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CITY OF BEND

Standards and Specifications

Cover Sheet

2026 EDITION Engineering Standards Amendment Approved by:

Director/City Engineer, Engineering: Signed by: Ryan Oster 8A9631979AE94D8... 5/1/2026

Ryan Oster, PE Date:

City Engineer, Private Development: Signed by: Benjamin T Berry 4A77455B06C9475... 5/1/2026

Ben Berry, PE Date:

Pursuant to City of Bend municipal code section 3.10.010 (B) the City Manager's designee, the City Engineer, has amended the technical provisions and standards of the City of Bend Standards and Specifications. Public notice of the amendments was posted in city hall for 30 days prior to the effective date of these amendments. This document is effective 30 days after the administrative adoption date.

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Getting paper copies

At any time, you may request from us a paper copy of any record provided or made available electronically to you by us. You will have the ability to download and print documents we send to you through the DocuSign system during and immediately after the signing session and, if you elect to create a DocuSign account, you may access the documents for a limited period of time (usually 30 days) after such documents are first sent to you. After such time, if you wish for us to send you paper copies of any such documents from our office to you, you may be charged a $0.00 per-page fee. You may request delivery of such paper copies from us by following the procedure described below. Paper copies may also be requested from City by contacting Procurement.

Withdrawing your consent

If you decide to receive notices and disclosures from us electronically, you may at any time change your mind and tell us that thereafter you want to receive required notices and disclosures only in paper format. How you must inform us of your decision to receive future notices and disclosure in paper format and withdraw your consent to receive notices and disclosures electronically is described below.

Consequences of changing your mind

If you elect to receive required notices and disclosures only in paper format, it will slow the speed at which we can complete certain steps in transactions with you and delivering services to you because we will need first to send the required notices or disclosures to you in paper format, and then wait until we receive back from you your acknowledgment of your receipt of such paper notices or disclosures. Further, you will no longer be able to use the DocuSign system to receive required notices and consents electronically from us or to sign electronically documents from us.

Notices and disclosures may be sent to you electronically

Unless you tell us otherwise in accordance with the procedures described herein, we may provide electronically to you through the DocuSign system required notices, disclosures, authorizations, acknowledgements, and other documents that are required to be provided or made available to you during the course of our relationship with you. You can receive all the disclosures and notices electronically or in paper format through the paper mail delivery system. If you do not agree with this process, please let us know as described below. Please also see the paragraph immediately above that describes the consequences of your electing not to receive delivery of the notices and disclosures electronically from us.

How to contact the City:

You may contact us to let us know of your changes as to how we may contact you electronically, to request paper copies of certain information from us, and to withdraw your prior consent to receive notices and disclosures electronically as follows:

To advise the City of your new email address

To let us know of a change in your email address where we should send notices and disclosures electronically to you, you must send an email message to us at dgalanaugh@bendoregon.gov and in the body of such request you must state: your previous email address, your new email address.

If you created a DocuSign account, you may update it with your new email address through your account preferences.

To request delivery from us of paper copies of the notices and disclosures previously provided by us to you electronically, you must send us an email to dgalanaugh@bendoregon.gov and in the body of such request you must state your email address, full name, mailing address, and telephone number.

To withdraw your consent with the City

To inform us that you no longer wish to receive future notices and disclosures in electronic format you may:

i. decline to sign a document from within your signing session, and on the subsequent page, select the check-box indicating you wish to withdraw your consent, or you may;

ii. send us an email to dgalanaugh@bendoregon.gov and in the body of such request you must state your email, full name, mailing address, and telephone number.

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The minimum system requirements for using the DocuSign system may change over time. The current system requirements are found here: https://support.docusign.com/guides/signer-guide-signing-system-requirements.

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To confirm to us that you can access this information electronically, which will be similar to other electronic notices and disclosures that we will provide to you, please confirm that you have read this ERSD, and (i) that you are able to print on paper or electronically save this ERSD for your future reference and access; or (ii) that you are able to email this ERSD to an email address where you will be able to print on paper or save it for your future reference and access. Further, if you consent to receiving notices and disclosures exclusively in electronic format as described herein, then select the check-box next to 'I agree to use electronic records and signatures' before clicking 'CONTINUE' within the DocuSign system.

By selecting the check-box next to 'I agree to use electronic records and signatures', you confirm that:

- **You can access and read this Electronic Record and Signature Disclosure; and**
- **You can print on paper this Electronic Record and Signature Disclosure, or save or send this Electronic Record and Disclosure to a location where you can print it, for future reference and access; and**
- **Until or unless you notify the City as described above, you consent to receive exclusively through electronic means all notices, disclosures, authorizations, acknowledgements, and other documents that are required to be provided or made available to you by the City during the course of your relationship with the City.**

CITY OF BEND

PART I

Intro, Processes, Special Provisions to the Oregon Standard Specifications for Construction General Conditions

1 INTRODUCTION STATEMENT

The purpose of this document is to provide the City of Bend community with a clear process for designing, bidding, and constructing City infrastructure for both public and private development.

This document is available on the City of Bend website and can be downloaded as a PDF file that can be printed if desired. The City will not provide printed versions of this document, but an electronic version on a CD can be purchased from the City Permit Counter. This document will be maintained and kept current on the City's website. Anyone using this document is encouraged to sign up for the email list so they can be notified of any changes or modifications. If users are working from a printed version they should check the City of Bend website for any revisions or changes prior to using. A table of revisions and revision dates, along with what was modified will be maintained on the City website.

The City Engineer is ultimately responsible for maintaining this document and implementation of it. Changes may be made by either City Engineer administrative approval or by City Council adoption per City of Bend Municipal Code Section 3.10.010

2 CHANGE PROCESS OVERVIEW

There are two types of changes to the Standards and Specifications

1) Standards Update – a change to the document applicable to all work or projects
2) Deviation Request – a one-time deviation for a specific project.

Standards Update

Generally on an annual basis, the City will review this document to maintain its consistency and ensure that best practices are being followed. This review will look at items including but not limited to consistency with industry design standards, city policies, issues specific to the City of Bend including impacts to operations, and changes necessary to maintain compliance with the Oregon Standard Specifications for Construction. These changes may occur on a less than annual basis if the City determines the change as significant and needed.

City led changes to this document are made with administrative approval or by council adoption. The type of public input may include notice, review, or solicitation of comments and will vary by the type of changes and if the change is an administrative approval or council adoption. The specific method and timing for public comment for changes to the document will be identified during each update. To request a change outside of an identified comment period complete the Change Request Form and submit it to **engineering@bendoregon.gov**. Generally, receipt of the request will be acknowledged with an initial screening for feasibility, and change requests will be reviewed with the next scheduled update.

The decision process for consideration of a change to the standards will follow the steps below:

1) The Assistant City Engineers (ACEs) along with the City Engineer(s), will determine if the City staff has the qualified expertise to make a decision on the request
    a. If it is determined that City staff lacks this expertise, City Engineering will retain the services of a qualified expert to review the change request
2) The ACEs, or the qualified expert, will develop a written response with recommendations on the decision
    a. If the decision is to not accept the change, the original requestor will be notified and the reason for not accepting the change will be provided. If the decision is to accept the change or accept the change with modifications, the written decision with the acceptance recommendation will be provided to affected divisions and staff to receive input with consideration of impact to city policy, operations,

finances, and legal. The feedback gathered will be documented in the written recommendations.

3) The ACEs, or the qualified expert, along with the City Engineer(s) will review all feedback and make a final recommendation for acceptance or rejection. This final recommendation will include consideration of cause and effect of accepting the change.
4) If the change is accepted it will be incorporated into the next Standards Update and the original requestor will be notified of the decision

Once reached, the City Engineer's decision will be final.

Standards and Specifications Deviation

A Deviation request is a one-time change to a specific standard or specification element for a specific project. These are limited cases, and the request must specify how it meets the criteria listed in this section.

To submit a Deviation request, complete the Deviation to Standards Request Form found on the City of Bend's Standards and Specifications webpage and either upload the form to the specific project permit location using the city's online permitting software or email it to **engineering@bendoregon.gov**. Requests for city projects may be submitted using the Deviation to Standards Request Form or via the construction drawings and specifications with findings and supporting technical information documented in the project records.

The criteria for a Deviation will be based on the following determination:

1) The Deviation will not harm, or will be beneficial to, the public in general
2) The Deviation is not inconsistent with the general purpose of ensuring adequate public facilities
3) One or more of the following conditions are met:
    a. The Deviation is necessary to eliminate or reduce impacts to existing drainage patterns or natural features such as riparian areas, significant trees, or steep slopes
    b. An existing structure, such as a substantial retaining wall, makes placement of utility lines, widening of a street, or widening of a right-of-way impractical or undesirable
    c. Vehicular or utility access to an existing lot would be eliminated without the Deviation
    d. Building on an existing lot would be infeasible without the Deviation

e. Existing structures make future widening of the remainder of a street or right-of-way unlikely and the additional width would not be beneficial for sidewalks or parking without the extension for the rest of the block

f. Needed to allow development of, or street access to, the property because of topographical constraints

g. The existing infrastructure:

    i. Does not meet current standards

    ii. Is and will remain functionally equivalent to current standards

    iii. There is little likelihood that current standards will be met in the area

h. The installation of the required improvements would likely cause unacceptable significant adverse environmental impacts and the Deviation would avoid such impacts

i. There is insufficient right-of-way to allow a full-width street cross section and additional right-of-way cannot be provided

j. There is no street or right-of-way adjacent to the property and easement access has been obtained across private property

k. Required street frontage improvements for individual single-family dwellings could best be accomplished by planned area-wide improvements at a future date

l. The City has conflicting or inconsistent standards and the proposal would comply with one set of adopted standards. Standards are conflicting or inconsistent only when it is not possible to comply with both. In most situations, the more recently adopted standard should be followed, and the older standard may be waived.

The process for review follows the same four-step process as outlined for a standards update in the previous section. All of the steps outlined will be followed. However, if the Deviation is approved it will not result in a Standards update or change to this document. Instead, it will result in a one-time change for that specific project. If a Deviation is not approved, the applicant must follow the Standards and Specifications. A Deviation will be processed as quickly as possible; however, the applicant should understand that this process could take several weeks depending on the amount of review required.

Once reached, the City Engineer’s decision will be final.

3 COMMUNITY DEVELOPMENT DEPARTMENT OVERVIEW

The City of Bend Permit Center is located within the Community Development Department (CDD) and provides a 'one-stop shop' for all private development-related permitting. Permit Center staff are dedicated to meeting the needs of new development interests while protecting the City's vital infrastructure. Permit processes are a coordinated effort between the developer, Private Development Engineering, Planning, Development Services, and Building Divisions, and other relevant parties.

Development permit applications are processed through the Online Permit Center including land use proposals, engineering construction plans, work in the public right-of- way and lane closures, clearing, grading, erosion control, drainage, revocable uses within public right-of-way, plats, and various development related dedications, releases, and agreements. Applications received at the Permit Center are routed to the appropriate departments and agencies for review and comment prior to final approval.

Additional information regarding application processes, responsibilities, and timelines as well as additional review and training materials may be found on the City of Bend's Online Permit Center webpage.

Private Development Engineering Permitting

Work subject to a right-of-way permit as described in the Bend Municipal Code Chapter 3.40, Right-of-Way Permits, is permitted through the Private Development Engineering Division (PDED) of the Community Development Department. This division reviews and approves work conducted within the existing and future/proposed right-of-way (ROW) and within public easements, which includes, but may not be limited to, public access easements, public utility easements (PUE), City sewer, City water and/or City storm easements. All work conducted within the ROW and public easements will be permitted through ROW permits, grading permits and/or traffic control permits depending on the work being performed. See, Chapter 3.40 and Title 16 of the Bend Municipal Code.

All applications are managed by a PDE reviewer (the "Reviewer"). More complex permits, specifically Tier 3 right-of-way permits, will be reviewed by the Planning Division, Addressing Team, Public Works (Water Services Department, Transportation & Mobility Department), and the Fire Department. Other City department reviewers may be added at the Reviewer's discretion.

An applicant for an infrastructure permit is the entity responsible for the development that requires the infrastructure improvement, a franchise utility performing work on their own infrastructure, or an agent authorized to act on either's behalf. If the applicant is different than the property owner, the owner must provide authorization to the City,

through the submittal of a signed Authorization Form, that the applicant is authorized to work on their behalf.

It is the applicant's responsibility to work with all applicable franchise utilities and regional authorities. The City will not perform coordination and review meetings on behalf of an applicant. Franchise utilities and regional authorities may include but are not limited to, depending on the location of the work to be performed:

- Water districts (Avion or Roats)
- Irrigation districts (Central Oregon Irrigation District, Swalley Irrigation District, Arnold Irrigation District, North Unit Irrigation District, etc.)
- Power companies (PacifiCorp or Central Electric Cooperative)
- Telecommunication companies (i.e., cable and internet providers)
- Natural gas (Cascade Natural)
- Transportation authorities (Deschutes County, Oregon Department of Transportation, Burlington Northern Santa Fe railroad, etc.).
- Public Transit Operators (Cascades East Transit)
- Bend Parks and Recreation District
- Bend-La Pine School District

The applicant is to have started communication with these entities and integrated their designs into the initial plan submittal to the City before submitting documents for Completeness Check.

Types of permits

1. **Right-of-Way Permits**

A Right-Of-Way permit is required for construction, demolition, or changes to the flow of traffic (vehicular, bike or pedestrian) in the public right-of-way. The permit tier, associated cost, and review time depends on the scale of construction or disruption. All fees are based on the Council-approved fee schedule applicable at the time of submittal.

The City defines three tiers of work to be performed in the right-of-way:

- **Tier 1 (No Street Cut) Permits** are for projects with low impact, where work is performed on utility lines, in the sidewalk, in the landscape strip, or in unimproved area behind the curb. Street cuts, curb cuts, and asphalt pavement restoration are not permitted under a Tier 1 permit. A Tier 1 ROW permit covers the following types of work, and other work of similar complexity, as determined by the City:
    - Installing, removing, or maintaining franchise utilities (e.g., natural gas lines, power lines, communication lines) underground or overhead in between the curb and private property that isn't in a private easement

    - Installing sidewalks in public right-of-way or public access easement
    - Installing driveways that do not require a new curb cut (curb cut is already existing)
    - Traffic Control for work in the right-of-way
- **Tier 2 (Street Cut) Permits** are for projects with medium impact, where work is planned for improved paved areas or where an existing sewer/water main is being tapped for services. This includes street cuts, curb cuts, pavement restoration, and any service taps from water or sewer mains. Most work under a Tier 2 permit doesn't need an engineered design, except for curb ramps and alley improvements. The City may require an engineering design depending on the complexity of the project. A Tier 2 ROW permit covers the following types of work, and other work of similar complexity, as determined by the City:
    - Installing franchise utilities within the right-of-way or a public easement where asphalt cutting and restoration is required
    - Street cuts and pavement restoration
    - Installing curb ramps
    - Driveways or alley approaches if they impact a curb
    - Paving streets or alleys without curbs or stormwater systems
    - Abandoning public infrastructure
    - Installing water services (2-inch diameter or less)
    - Installing sewer services (6-inch diameter or less)
    - Using boring or other trenchless technology for less than one city block or 350 feet, whichever is shorter (requires a boring profile)
- **Tier 3 (Infrastructure) Permits** are for projects with high impact. Typical Tier 3 (Infrastructure) permits involve construction of public infrastructure that will be accepted and maintained by the City of Bend as an asset. A Tier 3 (Infrastructure) permit covers the following types of work, and other work of similar complexity or greater, as determined by the City:
    - Grading of lots or streets within a development or site.
        - Does not include blasting work or rock crushing.
    - Public sewer or water main installations (any length) and related equipment (maintenance holes, valves, hydrants, manholes, etc.)
    - Installing water/fire sprinkler services 4 inches or larger
    - Storm infrastructure (e.g., catch basins, sedimentation manholes, drywells, storm pipes, swales, etc.)
    - Installing fire vaults in the right-of-way or within a public easement
    - Construction of new road sections, bridges, culverts, enhanced pedestrian crossings, medians, or intersection improvements, such as roundabouts, mini-roundabouts, traffic circles, etc.

- **Tier 3 (Franchise) Permits** are for projects with high impact and specifically for utilities that are licensed or have an agreement as a Franchise Utility to work and maintain facilities within the right-of-way. Bend Municipal Code 3.20. These permits are like the Tier 3 (Infrastructure) Permits with the exception that City assets are not being constructed outside of restoration and repair requirements. Typical Tier 3 (Franchise) permits involve multiple blocks where franchise utilities are being installed. A Tier 3 Infrastructure permit covers the following types of work, and other work of similar complexity or greater, as determined by the City:
    - Franchise utility installations over 350 feet, with more than 3 utility crossings, or infrastructure larger than 2 inches in diameter
    - Directional drilling, boring, or other trenchless technologies that:
        - Are longer than 350 feet
        - Cross 3 or more utilities (City and Franchise)
        - Cross under bridges or canals
        - Cross under high-pressure gas mains or other critical utilities
        - Cross under railroad tracks
        - Cross under rivers or streams

2. Traffic Control Plans

A Traffic Control Plan (TCP) is required for any work in the right-of-way or public easement that affects vehicle, bike, or pedestrian traffic (traffic/transportation system). This includes special events in the right-of-way that impact traffic. There are three levels of traffic control plans (TCP), assigned at the discretion of the City based on the level of impact of the proposed work:

- **Level 1 TCP:** For low impacts to the City transportation system, usually on a local road.
- **Level 2 TCP:** For medium impacts to the City system, typically on a collector or arterial road. This would not include any detours.
- **Level 3 TCP:** For high impacts to the City system, requiring a stamped, engineered plan. Typically, these are for collectors and/or arterials and includes traffic detours and/or closures of existing travelable roadway exceeding a week.

All Tier 1, Tier 2 and Tier 3 permits, where existing traffic systems are impacted, require a Traffic Control Plan and Level 1, 2 or 3 TCP permit.

The initially assigned permit level may change based on additional information that is provided during the application review process.

This document outlines the process required for Tier 3 permits. Traffic control plans and Tier 1 and Tier 2 permits shall be by process and on forms as required by the City Engineer, Community Development Department Director, or Private Development City Engineer.

3. Grading permits

Grading permits are required per Bend Municipal Code (BMC) Title 16. Applicability and exceptions are identified in BMC 16.10.010 and BMC 16.10.020. Types of grading permits include:

1. **General grading permit**. This includes the excavation or filling of a parcel and/or the removal of trees per BMC 16.10.020. Removal of trees will also require review by the Planning Division to ensure conformance with the City's tree code.
2. **Blasting permit.** Any blasting within the City must obtain a blasting permit per BMC 16.10.090. The City reviews blasting locations and performance standards, per Title 16 and applicable City standards, reducing the risk of damage to public or private property, but does not dictate methods of construction. The contractor, having applicable state and federal certifications, is responsible for damages and repairs caused by blasting.
3. **Rock crushing permits.** Rock crushing is permitted per BMC 16.10.075 where approved under a rock crushing permit.

Grading permits are not required where grading and erosion control is shown and reviewed by the City under a right-of-way permit or a building permit. General grading permits and right-of-way permits do not include blasting or rock crushing, requiring separate applications to perform this work. Blasting and rock crushing are temporary methods of construction, having limited durations of approval as listed under the permit conditions, that do not typically span the life of a project without City approved time extension. Extension to a permit will be based on compliance and verification that conditions haven't changed from when the permit was originally issued.

Grading, blasting, and excavating permits shall be by process and on forms as required by the City Engineer, Community Development Department Director, or Private Development City Engineer and are not governed by the process outlined for Tier 3 permits.

Permit submittal

City review of Tier 3 permits includes the following steps:

1. Completeness Check –PDED document, "Required Submittals for a Tier 3 Right-of-Way Permit", found on the City's website, lists documents and submittals needed for a complete initial application. Supplemental materials may be required at the request of the City.
2. Submittal Review
    a. Letter of Correction to the applicant with City comments, if applicable
    b. Applicant submits to begin 2nd Review Submittal.

    c. Repeat Letter of Correction and resubmittals until approval received from City
3. Submittal approval, Letter of Completion sent to the applicant
4. Pre-Construction (Pre-con) meeting
    a. Preconstruction meeting Acknowledgement. Confirmation of Pre-Construction Meeting Minutes from the applicant to the City
5. Notice to Proceed (NTP) issued by City and construction begins
6. Construction Substantial Completion
7. 1-year construction warranty period begins
8. Project Closeout, release warranty and Public Facilities Improvement Agreement (PFIA)

City review for Tier 1 and Tier 2 generally includes the following steps:

1. Completeness Check
2. Submittal Review
3. Submittal approval, Letter of Completion sent to the applicant
4. Issuance
5. Construction Substantial Completion / Project Closeout

Review Clock

Due to a State of Oregon legislation passed in 2025, Senate Bill 974 (SB 974), the City is adopting clear guidelines on submittal and approval requirements.

The City will review an application for submittal of all initial requirements during Completeness Check; under SB 974 this must be done within 30 days. Once the application has been reviewed for Completeness, either a Letter of Incomplete Application will be sent to the applicant, or the submittal will be identified as being complete and will move into the Submittal Review.

From the date the complete submittal has been uploaded to the City, the City will have 120 days to review and approve or deny the plans and issue a Notice to Proceed (NTP) to start construction for approved plans. The 120-day review (Review Clock) period is paused or tolled when the City is waiting for corrected or supplemental materials (including fees) to be submitted by the applicant.

For applications that require three or more reviews by the City resulting in additional submittals or corrections:

1. A mandatory meeting will be required between the City's reviewer and the applicant after the City's 3rd review comments and before the applicant may submit for the City's 4th review.

2. For the City's 4th and all subsequent reviews, the City will charge additional fees to the applicant for time spent on the additional reviews until permit approval, as provided in the Council-adopted Fee Schedule.
3. After the 3rd review or if the Review Clock is at or approaching 100 days, the City may take action it deems appropriate, including:
    a. Fail and close the application, if at the City's discretion, the application appears unlikely to meet approval criteria even with additional submittals within the mandatory 120-day review period or with applicant-requested extensions. If the applicant still wishes to complete the project, a new application would be necessary. Or,
    b. Inform the applicant the application will be denied unless the applicant requests in writing to extend the Review Clock up to 245 total days. The City will perform one additional review before denying and closing the application if not approvable, unless additional reviews are approved by the Community Development Director or Private Development City Engineer.

Denied or withdrawn permit applications will receive refunds as indicated by the City's adopted Fee Schedule, depending on when the application was withdrawn or denied.

When the City's review is complete and the plans can be approved, the City will issue a Notice of Approved Plans to the applicant, requesting the final additional materials and submittals necessary conduct the pre-construction meeting and issue site development permits for construction.

When all submittals from the Notice of Approved Plans have been provided, the Pre-Construction (Pre-Con) meeting is scheduled. The Pre-Con meeting is held and Meeting Minutes will be distributed to the applicant, typically within the same business day as the meeting. The Review clock is paused or tolled until all submittals, forms, and contracts have been supplied to the City and recorded with Deschutes County where applicable, and the Pre-Con meeting minutes have been approved by the applicant. A Notice to Proceed (NTP) may be issued after the applicant has reviewed the Meeting Minutes, signed them to indicate their agreement, and uploaded the signed minutes to the Pre-Con Meeting Acknowledgement Form condition in the permit portal. A NTP will only be issued upon receipt of the signed Pre-Con Meeting Acknowledgement Form document.

Issuance of the NTP constitutes the City's approval of site development permits for construction.

Completeness Check

All permits must be submitted to the City through the City's permitting software accessible on the City's website. Permits will not be reviewed through paper, email, etc.

The City's reviewer will verify the submittal. If it is deemed incomplete, a Notice of Incomplete Application will be sent to the applicant identified missing or incomplete submittals.

When the applicant resubmits, the City will again verify a complete application. When the application has been deemed complete, fees will be verified. If fees have not been paid or fees are added, a Fee Statement letter will be sent to the applicant. Upon having all fees paid, the first review will begin.

The applicant will have 60 days to resubmit materials or provide a statement that the applicant has provided all materials they intend to provide, and 60 days to pay the fees in full after issuance of a Notice of Incomplete Application and/or Statement of Fees Due. Non-response in this timeframe will result in the application becoming void.

A complete application requires everything listed in the Submittal Application check list. Refer to Submittal Application for submittal requirements for Permit Completeness Check. Submittal requirements for completeness must include, but are not limited to:

1. Authorization to act on behalf of property owner or developer, if applicable.
2. Land use decision(s) that required the infrastructure being constructed, where applicable.
3. Plan set must be on the City of Bend title blocks and follow the City's standards for page layout, numbering and drafting standards. On the City's website is an AutoCAD file.
4. Plans must be designed to a minimum ninety percent (90%) completeness. For purposes of a complete application, 90% plans have undergone a quality assurance/quality control (QA/QC) review and can be used to receive an accurate bid for construction costs. All information, including sheet notes and design, must be completed to City standards. All components of the sheets must be complete to the requirements of the Design standards Part II.
5. Utilities locate printout used for the topographic survey and project mapping.
6. Stormwater Drainage report is required when stormwater facilities are being constructed within public right of way or public easements or if facilities comply with COSM submittal requirements (if underground injection control facilities are proposed or if existing facilities will receive more stormwater), or if otherwise required by the City Engineer).
7. Deviation to Standards request applications, if applicable.
    a. Deviations that are known at the time of application submittal should be submitted for Completeness Check.

b. Deviations may be submitted at any time during the review process. Deviations are typically reviewed on a weekly basis and only after the fee is paid.

8. Fees for plan review, including deviations where applicable, must be paid for an application to be considered complete, and prior to the City starting review. The City will review that the fees were correctly accounted for in Completeness Check and fees added if not entered correctly at submittal.
    a. The applicant may choose not to pay the fees with the initial submittal and have the City send a Statement of Fees Due reflecting the calculated fee total.

City Review

When the application has been deemed complete, all requested materials have been provided, or the applicant states, in writing, that they have provided all materials they intend to provide, the review process will commence. The review will be conducted and comments provided on the submitted plans. Comments, including requested changes or corrections, will be made based on City Standards and Specifications, the Central Oregon Stormwater Manual (COSM), constructability, land use requirements, Bend Municipal Code, State, and/or Federal guidelines (PROWAG, AASHTO, DEQ, OARs, MUTCD, etc.). A compiled Notice of Required Revisions will be provided listing items that need correction, referencing the sheet number relating to the comment. A Design Revision Memo from the applicant is required as part of any resubmittal or when supplemental information is submitted. The Design Revision Memo must address each correction item in the most recent Notice of Required Revisions.

When the Notice of Required Revisions has been submitted to the applicant, the City will take no further action on the permit and the Review Clock is tolled. The Review Clock starts again when the applicant submits documents for a new round of review. The applicant must submit a complete set of construction drawings, calculations, and reports with every submittal, regardless of whether comments were made during the prior review, unless otherwise allowed by the City Engineer. Submittals that are not uploaded correctly or have missing documents will be returned without a review for further correction.

The review clock starts the date the City receives the submitted documents, not the date the City's reviewer documents the submittal verification. If the City's reviewer fails the Verify Submittal step because something is missing in the submittal or the design is not complete, the permit workflow goes back to the applicant and the Review Clock is paused or tolled until the missing or incomplete submittal is remedied and resubmitted to the City.

If an applicant chooses to submit a Deviation to Standards (Deviations) application because they believe that their design cannot be constructed to a City standards, the submittal must follow the process outlined in Part I – Section 2. All applicable fees must be paid before consideration. Criteria for approval of a deviation are included in Part I – Section 2. Deviation review will be conducted during the permit review period. Request for a Deviation will not stop or delay a submitted review. It is strongly recommended that the Deviation application be submitted with or before the Tier 3 Permit application to obtain an answer and avoid a Notice of Required Revisions requiring additional review submittals.

During review, submittals will not be accepted by email or other format, with the exception of Deviations applications can be emailed to the reviewer outside the Review Clock. All review documents must be submitted to the project through the permitting software, with no additional submittals permitted after the submittal has been verified complete and the review commences.

City approval during review does not ensure plans that are free from errors. The applicant is responsible for ensuring compliance with the land use and the requirements of the City Standards and Specifications. Error and omissions discovered during construction may require plans to be modified during construction through a plan modification review.

Approval Criteria

Pursuant to Bend Municipal Code Section 3.40.005, a right-of-way permit may be issued if the proposed improvement complies with the Bend Municipal Code, the Standards and Specifications, the Bend Development Code, and if the applicant is in compliance with all outstanding right-of-way permits. The City may deny an application for a right-of-way permit or impose conditions of approval to ensure compliance with applicable laws and regulations or to preserve infrastructure.

Permit Withdrawal or Voiding

The applicant may withdraw an application at any time and may receive a refund of fees paid as provided in the City's adopted Fee Schedule.

During the completeness check phase, the applicant will have 60 days to resubmit materials or provide a written statement that the applicant has provided all materials they intend to provide, and 60 days to pay the fees in full after receiving a Notice of

Incomplete Application and/or Statement of Fees Due. Non-response in this timeframe will result in the application becoming void, with fees refunded as provided in the City's adopted Fee Schedule.

After the application has passed completeness check and moved into the plans review phase, if the City has requested additional materials and an applicant has not responded for 90 days, the application will become void. Fees may be refunded depending on the level of work performed by the City, as provided in the City's adopted Fee Schedule.

Pre-Construction Requirements

Once the City determines the plans meet all required standards and can be approved for construction, a Notice of Approved Plans will be sent to the applicant stopping the Review Clock and requesting supplemental application material, forms, or bonds necessary for the City to issue permits for construction. The Notice of Approved Plans will identify all documents required for the applicant to submit prior to scheduling the Pre-Construction meeting. The items may include, but are not limited to:

- The Public Facilities Improvement Agreement (PFIA). The City will prepare this document for the Owner / Developer signature. This is the City's contract with the Owner / Developer.
- Recordable documents and/or agreements, if applicable for the project, e.g. utility easements or construction easements if work is to be performed on property not owned by the applicant/developer. All public easement and dedications will be prepared and recorded by the City. Private easements are typically, unless they need to be signed by the City, obtained and recorded by the applicant. Evidence of authority to construct improvements on land not owned by applicant/developer is required before a permit to construct will be issued.
- Proposed Construction schedule. Contractor will be held to the approved schedule during construction in existing travelable right of way unless otherwise approved by the Private Development City Engineer through a submitted schedule revision.
- Construction cut sheets and material/product specifications. These are to be reviewed by the Engineer of Record (EOR) and approved by them as conforming to City standards and specifications. Any requests to deviate must be submitted separately and identified as an exception so that the City reviewer can obtain the necessary review from the appropriate City department.
- Completion and submittal of the "Inspection Hours Calculation Worksheet"
- Payment for all inspection hours in the "Inspection Hours Calculation Worksheet"

- Submittal of a Contractor list. All contractors and subcontractors necessary to complete the permitted scope of work must be identified and verified to be on the City's Qualified Contractors List, including an excavator, concrete contractor, asphalt contractor, water works, testing/geotechnical, traffic control, etc.
- Approved plans submitted to the City for City Engineer and Fire Department signatures.
    - One complete construction plan set must be submitted on mylar; an additional cover sheet must be submitted on bond paper. No revision clouds or revision notes should be on the approved plan set, with revision clouds added only during construction with City reviewed revisions. The bond cover sheet must be wet signed by the City Engineer and Fire Marshal or designee; other signatories may submit an email approval of the plan set. After signature, the cover sheet will be returned to the applicant. A full set of bound PDF construction documents, with the scanned signed cover sheet, must be submitted to the permit.

Pre-Construction (Pre-con) meeting

Upon receiving all of the documents required by the Notice of Approved Plans, a Pre-Construction meeting is scheduled. The City typically schedules Pre-Construction meetings on Thursday mornings. Pre-construction meetings will not be scheduled unless all documents are submitted to the City two (2) days prior to the scheduled meeting, typically having all submittals by Tuesday at 5PM. The EOR, or their representative, and the Contractor are required to attend the Pre-Construction meeting. It is the EOR's or the Contractor's responsibility to forward the meeting request to any additional participants to the meeting, including the Developer and/or Owner, if they wish to attend. The City's reviewer will lead the meeting but will require participation from the EOR and Contractor. The purpose of this meeting is to answer any questions before construction.

Upon completion of the Pre-Construction meeting, the City's reviewer will prepare meeting minutes that will be distributed to the meeting's attendees. The applicant must review the meeting minutes and upload a signed Pre-Con Meeting Acknowledgement Form to show completion of the review and understanding of the Pre-construction meeting conditions. Typically, the City's reviewer will issue the Notice to Proceed upon receipt of the signed Pre-Con Meeting Acknowledgement Form unless other missing items are identified at the Pre-Con.

Notice to Proceed and Construction Begins

A Limited Notice to Proceed may be issued, at the City's discretion, if a portion of the project is ready for construction, but there is an issue with the plans or there is a constructability issue that prevents construction to begin on a specific section of the project. The Meeting Minutes and/or Limited Notice to Proceed will outline what items need correction before the full Notice to Proceed can be issued. The Meeting Minutes and/or Limited Notice to Proceed will clearly identify what work is authorized to begin. No other work can begin until the full Notice to Proceed is issued. The review clock is paused until the applicant provides all information requested. Upon receipt of the necessary information or updated construction documents, the Full Notice to Proceed will be issued.

Upon issuance of the Limited Notice to Proceed or Notice to Proceed, the permit will now allow for inspections to be requested by the contractor and/or anyone listed on the application as a contact. Any time that work is being performed, inspections must be requested for that day. Inspection requests must be made before 5pm, at the latest, the day before work is being performed.

It is expected that the EOR be involved in the project during construction per City Standard Section IV. If problems are identified during construction, the EOR should be coordinating between the City's reviewer, the City's inspector, and the contractor. If it is identified that a plan revision / modification is needed to document changes in the design, the plan revision will be submitted to the City's reviewer with the change in revision bubbles, submitted to the permit for review and approval. The Contractor will only be permitted to construct what is on approved construction documents. Working outside the approved plans may require removal and reconstruction of work conducted differing from the plans.

Substantial Completion - Construction

Substantial Completion is a milestone that is obtained when the following items are complete:

1. City Inspector has signed off on all improvements as being completed in conformance with the approved plans and City standards and specifications.
    a. For residential subdivisions, certain aspects of improvements can be deferred if part of the Residential Land Divisions Early Action (House Bill 2306) program or if permitted to bond for certain improvements at the City's discretion.
2. Conditions of land use have been met.
3. Submittal of a completed Bill of Sale Spreadsheet with Contractor invoices
    a. The City will prepare an Asset Transfer agreement that will be signed by the Owner/Developer. The signed Asset Transfer will be submitted back to the City.
    b. Construction Warranty. Warranty paperwork will be prepared by the City. The document will be signed by the applicant with all original documents

from the bank submitted to the City. Bonds, and other approved warranty agreements, typically have a 1-year duration. The City may require a longer warranty duration if workmanship quality is in question.

4. Performance bonds, if applicable. Performance bonds are typically only accepted for residential land divisions, as allowed by City standards, or as otherwise dictated by City agreement or land use.
5. Engineer of Record certified record drawings and CAD file representing what was constructed. The City's reviewer will conduct a site visit to visually check that drawings appear to match the finished construction.
6. Engineer of Record Certifications. The City will require certification for Accessible Curb ramps / ADA ramps and sidewalks, Stormwater facility performance, retaining walls, etc., where applicable to the project.
7. DEQ registration / rule authorization of private Underground Injection Controls (UICs) / drywells.
8. Stormwater Maintenance Agreements (SWMA) , if applicable.
9. Payment of any and all fees assessed during the construction period, including but not limited to revision fees, additional inspection fees, etc.
10. Other requirements stated in the project Conditions within the permit.

Upon receiving Substantial Completion, the Engineering Division will sign land division plats and/or approve occupancy of project sites. Substantial completion identifies a project as the time when the project begins their warranty period.

Project Completion

After Substantial Completion, the City inspector will conduct a warranty inspection at approximately 10 months. If items of concern are identified with workmanship, the contractor will be contacted to make repairs. If repairs are not repaired promptly, the City may contact the bank where the warranty agreement was issued to extend the warranty or to pull the warranty to have others complete the required work.

If repairs are completed or none are required within 12 months of Substantial Completion, the warranty will be released and the Public Facilities Improvement Agreement will be released from the project property's title. The project will be closed.

4 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ACE	Assistant City Engineer
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
AFD	Adjustable Frequency Drive
AI	Analog Input
AMR	Automatic Meter Reading
ANSI	American National Standards Institute
AO	Analog Output
APWA	American Public Works Association
AS	Adjustable Speed
ASAE	American Society of Agricultural Engineers
A.S.L.A	American Association of Landscape Architects
ASTM	American Society for Testing and Materials (ASTM International)
ATS	Automatic Transfer Switch
AWWA	American Water Works Association
AWG	American Wire Gauge
BMP	Best Management Practice
CAD	Computer-aided Design
CBR	California Bearing Ratio
CC&R	Conditions, Covenants and Restrictions
CDR	Concept Drainage Report
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CIP	Capital Improvement Project

CIS	Oregon Legislative Commission on Indian Services
CMP	Corrugated Metal Pipe
CN	Curve Number
COIC	Central Oregon Intergovernmental Council
COSM	Central Oregon Stormwater Manual
CS	Constant Speed
CT	Current Transformer
CTAPE	Chemical Technology Assessment Protocol
DBH	Diameter at Breast Height
DCCS	Deschutes County Coordinate System
DCP	Dynamic Cone Penetrometer
DEQ	Oregon Department of Environmental Quality
DI	Discrete Input
DI-120	Discrete Input, 120VAC
DI-24	Discrete Input, 24VDC
DO	Discrete Output
DO-120	Discrete Output, 120VAC
DO-24	Discrete Output, 24VDC
DSL	Oregon Division of State Lands
DTM	Digital Terrain Model
Ecology	Washington State Department of Ecology
ENT	Ethernet
EOR	Engineer of Record
EPA	U.S. Environmental Protection Agency
ESAL	Equivalent Single-axle Load
ESC	Erosion and Sediment Control
ET	Evapotranspiration
DTM	Digital Terrain Model
FEMA	Federal Emergency Management Agency

FERC	Federal Energy Regulatory Commission
fps	Feet per Second
ft2	Square Feet
ft/ft	Feet per Foot
FHWA	Federal Highway Administration
FPN	Fine Print Note
FROPT	Flow Restrictor Oil Pollution Control Tees
FRP	Fiberglass-Reinforced Plastic
FWD	Falling Weight Deflectometer
GFCI	Ground Fault Circuit Interrupter
gpad	Gallons per Acre Day
gpcd	Gallons per Capita per Day
GFI	Ground Fault Indicator
gpm	Gallons per Minute
GPS	Global Positioning System
GSC	Geotechnical Site Characterization
GUI	Graphical User Interface
HCl	Hydrochloric Acid
HGL	Hydraulic Grade Line
HMI	Human-Machine Interface
HPS	High-Pressure Sodium
HOA	Homeowner's Association
HVAC	Heating, Ventilating, and Air Conditioning
IBC	International Building Code
I/O	Input / Output
I&C	Instrumentation and Control
ICC	International Code Council
ICEA	Insulated Cable Engineers
I-D-R	Rainfall Intensity-Duration-Recurrence Interval

IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
ISA	Instrument Society of America
kcmil	1,000 Circular Mil
kW	Kilowatt
LCCA	Life-Cycle Cost Analysis
LDP	Local Datum Plane
mA	Milliampere
mgd	Million Gallons per Day
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MCC	Motor Control Center
MDFT	Minimum Dry Film Thickness, mils
MDFTPC	Minimum Dry Film Thickness per Coat, mils
mil	1/1,000 inch
NACE	National Association of Corrosion Engineers International
mph	Miles per Hour
MTS	Manual Transfer Switch
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

NPGS	Non-pollutant Generating Surface
NRCS	Natural Resource Conservation Service
O&M	Operations and Maintenance
O.A.L.A.	Oregon Association of Landscape Architects
OAR	Oregon Administrative Rules
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OISC	Oregon Invasive Species Council
OPRD	Oregon Parks and Recreation Department
OR-OSHA	Oregon Occupational Safety and Health Department
ORS	Oregon Revised Statutes
OSBEELS	Oregon Board of Examiners for Engineering & Land Surveying
OSS	Oregon Standard Specifications
OSHA	Occupational Safety and Health Act
OSU	Oregon State University
P&ID	Process and Instrumentation Diagram
PDS	Product Data Sheet
PE	Professional Engineer
PFCC	Power Factor Correction Capacitor
PFIA	Public Facilities Improvement Agreement
PGS	Pollutant-Generating Surface
PLC	Programmable Logic Controller
PLS	Professional Land Surveyor
P.O.C.	Point of Connection
PROWAG	Public Rights-of-Way Accessibility Guidelines
PSDS	Paint System Data Sheet
psi	Pounds per Square Inch
PUE	Public Utility Easement
PVC	Polyvinyl Chloride

ROW	Right(s)-of-Way
RPBA	Reduced Pressure Backflow Assembly
RPBD	Reduced Pressure Backflow Prevention Device
RTU	Remote Terminal Units
SBUH	Santa Barbara Unit Hydrograph
SCADA	Supervisory Control and Data Acquisition
SDA	Special Drainage Area
SFPG	Square Feet per Gallon
SFPGPC	Square Feet per Gallon per Coat
SHPO	State Historic Preservation Office
SP	Surface Preparation
SSPC	Steel Structures Painting Council; Society for Protective Coatings
SWAT	Smart Watering Advanced Technology
TAPE	Technology Assessment Protocol
TCP	Traffic Control Plan
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TVSS	Transient Voltage Surge Suppressor
UIC	Underground Injection Control
UL	Underwriters Laboratories, Inc.
ULC	Ultrasonic Controller
UPS	Uninterruptible Power Supply
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USGS	United States Geological Survey
V	Volt
VAC	Volt, Alternating Current
VDC	Volt, Direct Current

WQC	Water Quality Certification
WSDOT	Washington State Department of Transportation

5 SPECIAL PROVISIONS TO THE OSS GENERAL CONDITIONS

ORGANIZATION OF CONDITIONS AND SPECIFICATIONS

The 2024 Oregon Standard Specifications for Construction (OSS) form the basis for the Conditions and Specifications for this project.

https://www.oregon.gov/odot/business/pages/standard_specifications.aspx

The City of Bend Special Provisions to the OSS General Conditions modifies the 2024 Oregon Standard Specifications for Construction, (General Conditions).

Special Provisions to the OSS General Conditions

GENERAL CONDITIONS

Special Provisions to the 2024 Oregon Standard Specifications for Construction (OSS) General Conditions

00110 – Organization, Conventions, Abbreviations and Definitions
00120 – Bidding Requirements and Procedures
00130 – Award and Execution of Contract
00140 – Scope of Work
00150 – Control of Work
00160 – Source of Materials
00165 – Quality of Materials
00170 – Legal Relations and Responsibilities
00180 – Prosecution and Progress
00190 – Measurement of Pay Quantities
00195 – Payment
00196 – Payment for Extra Work
00197 – Payment for Force Account Work
00199 – Disagreements, Protests and Claims

PART 00100 – GENERAL CONDITIONS

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [normal - red text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all normal - red text before preparing the final document.)

Section 00110 – Organization, Conventions, Abbreviations and Definitions

Comply with Section 00100 of the Standard Specifications modified as follows:

00110.10 Abbreviations – Add the following:

NFPA - National Fire Protection Association
OSS - Currently City Adopted version of Oregon Standard Specifications for Construction
UIC - Underground Injection Control
WPCF- Water Pollution Control Facility

0110.20 Definitions - Modify as follows:

As Approved - Add the following:
The words "as approved", unless otherwise qualified, shall be understood to be followed by the words "by the City".

Agency - Replace with the following:
The City of Bend

City - Add the following:
The City of Bend, Oregon, including its duly authorized representatives. The City is described as the Agency in the OSS documents.

City Project Representative - Add the following:
The authorized representative of the City, with primary responsibility for administering the Public Improvement Contract.

Contract Documents - Delete in its entirety. Contract Documents are as defined in the CITY OF BEND PUBLIC IMPROVEMENT CONTRACT.

Design - perform architectural or engineering, or both, design professional services, including but not limited to planning, designing, observing, consulting, evaluating and other related services, for the construction of the Work.

Engineer - Replace with the following:
The City's project manager if the individual is registered as a professional engineer in the State of Oregon. If the City's project manager is not a professional engineer, the Engineer is the Engineering and Infrastructure Planning Department (EIPD) Director. In both cases, the City's project manager and EIPD Director may designate the Engineer.

Furnish - supply and deliver services, materials, or equipment to the Work site (or other specified location) ready for use or installation and in usable or operable condition.

Install - put into use or place in final position services, materials, or equipment complete and ready for intended use.

Laboratory - Add the following:
Any laboratory used or approved by the City. This may or may not be the same testing laboratory as designated in the OSS.

Legal Holiday - Add the following:
The following, subject to subsequent change by law, are legal holidays for the City /Agency: Sunday, New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Veteran's Day, Thanksgiving and the day after Thanksgiving, Christmas, and those days declared as holidays by the City. When a legal holiday falls on Saturday, the Friday preceding Saturday is a legal holiday. When a legal holiday falls on Sunday, the immediate following Monday is a legal holiday.

Other references to Legal Holidays in the OSS will comply with the modified definition of "Legal Holiday". Such as in Section 00170.65, 00180.41, 00220.60 and 00290.32.

Work on Saturdays, Sundays, and City's legal holidays will not be permitted unless written approval is granted by the City.

Perform or provide - when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

Plans - Delete and replace with the following:
The term "Plans" refers to the official plans, profiles, cross-sections, elevations, details, and other working drawings and supplementary drawings, or reproductions thereof, signed by the duly licensed design professional (Professional Engineer, Architect, or Landscape Architect), that show the location, character, dimensions and details for the work to be performed. Plans may either be bound in the same book as the balance of the Contract Documents, or bound in separate sets, and are a part of the Contract Documents regardless of the method of binding. Plans are Standard and Supplemental Drawings, and approved Unstamped and reviewed and accepted Stamped Working Drawings (see 00150.35 in the Special Provisions).

Private Development – Construction activities performed or contracted for by entities that are not the City of Bend, and which are permitted by the City of Bend's Community Development Department.

Quality Control Personnel - Add the following:
In addition to the ODOT technical certifications listed throughout the OSS, the following certifications are approved alternatives:

- ACI Concrete Field Testing Technician – Grade 1
- ACI Concrete Strength Testing Technician
- ICC Reinforced Concrete Special Inspector
- ICC Soils Special Inspector
- WAQTC certifications

Addition certifications may be submitted and approved on a case-by-case basis.

Right-of-Way Permit - City authorization for a person to install or construct anything within a right-of-way or property owned or controlled by the City, including public easements or infrastructure that will be owned and controlled by the City and located on lands intended to be dedicated as public easements or right-of-way, and includes permits identified in City Special Provisions to the Oregon State Standard Specifications for Construction Part 1, Section 3.

Working Day – Add the following:
The City working day is any and every calendar day excluding Saturdays, Sundays, and legal holidays. Unless otherwise permitted, a working day occurs between the hours of 7:00 a.m. and 6:30 p.m.

End of Section

Section 00120 – Bidding Requirements and Procedures

Comply with Section 00120 of the Standard Specifications modified as follows:

Section 00120 – Bidding Requirements and Procedures. Delete in its entirety Bidding Requirements are stated in the Bid/Contract Documents.

End of Section

Section 00130 – Award and Execution of Contract

Comply with Section 00130 of the Standard Specifications modified as follows:

Section 00130 Award and Execution of Contract - Delete in its entirety

End of Section

Section 00140 – Scope of Work

Comply with Section 00140 of the Standard Specifications modified as follows:

00140.00 Purpose of the Contract –-Add the following bullets:

- Contract Documents or Plans may be obtained upon request by paying the actual cost of reproducing the Contract Documents or Plans.
- Nothing in the Agreement shall be construed as vesting in the Contractor any right to the property or in the material used after acceptance by the City. All materials shall become the property of the City upon being accepted.
- City shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, access rights-of-way, and other lands that are designated for the use of Contractor. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the City, unless otherwise specified in the Contract Documents. The Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.
- The Contractor shall confine its equipment, the storage of materials, and the operation of its workmen to limits shown on the plans or indicated by law, ordinances, permits, or directions of the Engineer, and shall not unreasonably encumber the premises with its materials.

Add the following subsection:

00140.05 Cleaning and Site Maintenance - The Contractor shall at all times, at its own expense and without further order, keep property on which work is in progress free from accumulations of waste material or rubbish caused by employees or by the Work, and at all times during the construction period shall maintain structure sites, rights-of-way, adjacent property, and the surfaces of streets and roads on which work is being done in a safe condition for the Contractor's workers and the public. Accumulation of waste materials that might constitute a fire hazard will not be permitted. Spillage from the Contractor's hauling vehicles on public or private roads and parking areas shall be promptly cleaned up. Upon completion of the construction, the Contractor shall, at its own expense, remove all temporary structures, rubbish, and waste materials resulting from its operations.

Contractor shall keep the designated work site clear of noxious weeds and free of fire danger related to landscape material the enter length of the project.

Upon Contractor's failure to provide cleanup within 24 hours of receiving written direction to do so, the City may complete the cleanup by whatever means necessary, and the cost thereof, plus 10 percent for handling, shall be deducted from any payment due the Contractor. Should such amount exceed available funds, City may pursue compensation via a claim. Any such claim shall be in addition to liquidated damages.

Add the following subsection:

00140.06 Cutting and Patching - The Contractor shall provide all cutting, fitting, or patching of its work that may be required to make its several parts come together properly, and fit it to receive or be received by work of other contractors shown by the Plans.

Add the following subsection:

00140.07 Functional and Performance Testing - Operating equipment and systems shall be functional-tested and performance-tested in the presence of the Engineer to demonstrate compliance with the specified requirements. Performance testing shall be conducted under the specified design operating conditions or under simulated operating conditions recommended or approved by the Engineer. Unless timing is otherwise specified, testing shall be scheduled with the Engineer at least 1 week in advance of the planned date for testing and include a factory representative on site. Contractor shall provide written testing plans and all test results to City.

Add the following subsection:

00140.35 Subsurface and Physical Conditions - Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Except for such reliance on such "technical data," Contractor may not rely upon or make any Claim against Agency, Engineer, or any of Engineer's Consultants with respect to the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

Engineer's Review: After receipt of written notice as required, Engineer will promptly review the pertinent condition, determine the necessity of Agency's obtaining additional exploration or tests with respect thereto, and advise Agency in writing (with a copy to Contractor) of Engineer's findings and conclusions. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following: such condition must meet any one or more of the categories with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions stated in the General Conditions.

Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if the Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Agency in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or if the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or if the Contractor failed to give the written notice within the time and as required by the General Conditions.

If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Agency and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Agency or Contractor may make a Claim therefore as provided in the General Conditions.

End of Section

Section 00150 – Control of Work

Comply with Section 00150 of the Standard Specifications modified as follows:

(Consider if project would benefit from a Partnering arrangement and consider if this should be specified into the contract vs. offered informally after award. City has had experience with formal partnering, however, good value with low investment of time can be obtained in informal setting with a couple of the project management staff and the Contractor's leadership to discuss project challenges, concerns, solutions, etc.)

00150.05 Cooperative Arrangement - Delete in its entirety.

00150.10 Coordination of Contract Documents - Delete subparagraph (a) in its entirety. Coordination of Specifications and Plans (Order of Precedence) is stated in the Bid/contact Documents.

Add the following subsection:

00150.11 General Requirements for Sequence and Scheduling of Work -

- (Use the following subsections (a) through (h) to define the general requirements for sequencing and scheduling of work. Add, delete, or replace subsections as necessary to define the requirements of the work.)

- (Optional clause. Project Segments could be a useful way to divide linear projects with discrete constraints, or where work in one area must be complete prior to work in other areas. Item (a) only identifies the segments, and subsequent subsections describe how the work is constrained within the segments)

(a) Project Segments – The Project is divided into segments with the following limits:

- (Add project segments)

- (Optional clause. Construction limits could include items like requirements for franchise utility work, special timing or sequence constraints)

(b) Construction Limits – The Contractor shall limit active construction areas as described below:

(1) The following constraints are applicable to all Segments.

- (Add construction constraints)

(2) Segment 1

- (Add construction constraints)

(3) Segment 2

- (Add construction constraints)

(c) Temporary Pumping Plan – Temporary pumping plans are required for the following existing sewers:

- (Add temporary pumping plan)

(d) Gravity Sewers

(1) Existing Facilities - Existing gravity sewer facilities affected by construction shall remain operation at all times. Contractor shall plan and sequence all construction activities and provide all means and methods to maintain continuous operation of the existing gravity sewer facilities. The Contractor shall maintain continuous service to all customers connected to existing sewer facilities affected by construction and sequence the work to maintain uninterrupted service.

(2) New Facilities - (Add gravity sewer requirements)

(e) Temporary Water Service - (Add temporary water service requirements)

(f) Utilities – Contractor shall sequence all work activities with known utility conflicts and any unanticipated utility conflicts that are encountered during construction. The Contractor shall modify the schedule and sequencing for all work items including, but not limited to: traffic control, temporary utility re-routing and support, private residence access, maintenance of utility service to customers, and construction of the proposed improvements, as necessary to coordinate with existing and relocated utilities.

Contractor shall sequence and schedule the work to maintain the function of all utilities during construction and make accommodations as necessary to allow utilities to maintain services to all customers served by the affected utilities.

Contractor shall coordinate with utilities where relocation or modification of utilities is to be performed by the utility company during Contractor's work in the vicinity.

(g) Protection of Work – It is the Contractor's responsibility to adequately protect and barricade all elements of the work from potential accidents or injury to the public at all times during both working hours and shutdown periods such as overnights, weekends, and holidays.

(h) Landscape Restoration - (Add landscape restoration requirements)

(Optional clause. In some circumstances it may be appropriate to restrict blasting. The following clause may be used to do this. Note, other construction techniques can still cause significant vibration and could have higher risk of damage than allowing controlled blasting. Engineer of Record should carefully consider appropriate use of this clause.)

(i) Nonblasting Areas – Drawings may depict areas where nonblasting excavations methods may be required. Contractor shall comply with all such nonblasting requirements.

Specific nonblasting areas include, but are not necessarily limited to, the following station locations: A purpose for the nonblasting requirement is noted in parenthesis next to the station location(s):

EXAMPLE STA X+XX to Y+YY (gas)
EXAMPLE STA X+XX to Y+YY (water main)

(Include (j) when special utility potholes are identified in the plans and included in SP00498. Add time requirements for special utility potholes.)

(j) Special Utility Potholes – (Add special utility pothole time requirements)

Add the following subsection:

00150.12 General Requirements for Work Areas - (Add general work area requirements. This may include clause related to work within easements, protection of structures, property access for third parties adjacent to work areas, and other requirements.)

(See Section 00305 and the ODOT Survey Policy and Procedure manual (https://www.oregon.gov/ODOT/ETA/Documents_Geometronics/Survey-Policy-Procedure-Manual.pdf). The specifier must review 305 and understand the duties of City and Contractor with respect to surveying.)

00150.15 Construction Stakes, Lines and Grades - Delete and replace this section as follows:

Contractor shall perform all project surveying. See Section 00305.

Add the following subsection:

00150.19 Site Visits and Inspection - Engineer and/or Inspector will make periodic visits to the site to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. They will not be required to make exhaustive or continuous onsite inspections to check the quality or quantity of the Work. Their efforts are directed toward providing assurance for the City that the completed project will conform to the requirements of the Contract Documents. On the basis of their onsite observations, they will keep City informed on the progress of the Work and will endeavor to guard City against defects and deficiencies in the work of Contractors.

(Include the following sentence for Private Development Projects)

Contractor shall schedule daily inspections through City View Portal for Private Development projects and or work shall be “STOPPED” by direction of the City Engineer.

Add the following subsection:

00150.26 Right to Retain Imperfect Work - If any work done or material furnished under this Agreement shall prove defective and not in accordance with the Plans and Specifications, and if the imperfection is not of sufficient magnitude or importance to make the work dangerous or undesirable, or if the removal of the work will create conditions that are dangerous or undesirable, the City shall have the right and authority to retain the defective work and adjust the amount to be paid for the imperfect work. This section is intended to be complementary to, and does not alter or supersede, rights and responsibilities described in other sections of this Agreement, including 00170.80.

Add the following subsection:

00150.27 Use of Completed Portions - The City shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding the time for completing the entire Work or such portions that may not have expired. Such taking possession and use shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents.

Add the following subsection:

00150.34 Schedule of Working Drawings and Sample Submittals - Prepare and submit a schedule of all specified Working Drawings and Sample Submittals identifying Specification Section number, anticipated submittal date, proposed title of submittal, location or facility to which submittal applies, and subcontractor or supplier (if other than Contractor) that is responsible for preparing submittal for Contractor, and earliest date (per contractor's critical path schedule) by which products or materials that are subject of Working Drawings or Samples are required on-site for incorporation in the work.

00150.35 Plans, 3D Engineered Models, Working Drawings, and 3D Construction Models – Delete and replace this subsection as follows:

Contractor shall submit Working Drawings to Engineer for review and approval in accordance with the accepted schedule of Working Drawings and Sample submittals. All submittals will be identified as Engineer may require and in the number of copies specified in the General Requirements. The data shown on the Working Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information. The Agency will provide a web-based tool for handling submittals, Working Drawings, requests for information, and other communications. Contractor shall use this tool for communication on the project to maximum extent practicable.

Contractor shall also submit Samples to Engineer for review and approval in accordance with the accepted schedule of Working Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as Engineer may require to enable Engineer to review the submittal. The numbers of each Sample to be submitted will be as specified in the Specifications.

Where a Working Drawing or Sample is required by the Contract Documents or the schedule of Working Drawings and Sample submittals accepted by Engineer as required, any related Work performed prior to Engineer 's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

Before submitting each Working Drawing or Sample, Contractor shall have determined and verified: all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto; all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and Contractor shall also have reviewed and coordinated each Working Drawing or Sample with other Working Drawings and Samples and with the requirements of the Work and the Contract Documents.

Each submittal shall bear a stamp or specific written indication that Contractor has satisfied Contractor’s obligations under the Contract Documents with respect to Contractor’s review and approval of that submittal.

At the time of each submittal, Contractor shall give Engineer specific written notice of such variations, if any, that the Working Drawing or Sample submitted may have varied from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Working Drawing and Sample submitted to Engineer for review and approval of each such variation.

Engineer will timely review and approve Working Drawings and Samples in accordance with the schedule of Working Drawings and Sample submittals accepted by ENGINEER. Engineer’s review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

Engineer 's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

Engineer 's review and approval of Working Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer’s attention to each such variation at the time of each submittal as required and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Working Drawing or Sample approval; nor will any approval by Engineer relieve Contractor from responsibility for complying with the requirements.

Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Working Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

(a) Plans - The Agency-prepared Plans will show details of lines, grades, Cross Sections, and Typical Section of the Roadway, and locations and design details of Structures.

(b) Working Drawings - The Contractor shall supplement the Agency-prepared Plans with stamped Working Drawings, or unstamped Working Drawings that show all information necessary to complete the Work. The applicable Section or Subsection of the Standard Specifications will indicate the supplemental information required and whether the drawings are to be stamped or unstamped. Stamped Working Drawings, unstamped Working Drawings, are defined as follows:

(1) Stamped Working Drawings - Working Drawings, calculations, and other data which are prepared by or under the direction of a Professional Engineer licensed in the State of Oregon, and which bear the engineer's signature, seal, and expiration date.

(2) Unstamped Working Drawings - Working Drawings, calculations, and other data that do not bear an engineering seal.

(3) 3D Construction Models – (not used)

(c) Number, Size, and Format of Working Drawings - The Contractor shall submit Working Drawings according to one of the following methods:

(1) Paper Submittal - not permitted. If Special Provisions refer to paper submittals, Contractor shall substitute PDF, or other electronic media as directed by Engineer to satisfactorily depict the requirements of the submittal.

(2) Electronic Submittal - The Contractor shall submit electronic Working Drawings as required in 00170.08 and submit via electronic Project Document Tracking System Software.

(b) Processing Working Drawings - The Engineer will process Working Drawings as follows:

(1) Stamped Working Drawings - Stamped Working Drawings will be designated as "reviewed", "reviewed with comments", by the Engineer. If stamped Working Drawings are “reviewed with comments”, the Contractor shall address all comments and resubmit the stamped Working Drawings.

(2) Unstamped Working Drawings - Unstamped Working Drawings will be designated as "approved", "approved as noted", or "returned for correction" by the Engineer. If unstamped Working Drawings are returned for correction by the

Engineer, the Contractor shall address all comments and resubmit the unstamped Working Drawings.

(3) 3D Construction Models - not used.

The Contractor shall not fabricate or construct any structural components until the stamped or unstamped Working Drawings are returned by the Engineer with a written designation of "accepted", "accepted with comments", "approved", or "approved as noted", as applicable for the Working Drawings.

The Engineer's processing of the Working Drawings does not amend any contractual obligations of the parties.

The Engineer will process and return Working Drawings within 21 Calendar Days (65 Calendar Days if Railroad approval is required) after receipt by the Engineer. If the Engineer fails to return such drawings or models within this period of time, the Engineer will consider granting a Contract Time extension according to 00180.80. If the Contractor is required to resubmit Working Drawings to the Engineer, the Engineer will process and return the Working Drawings within 21 Calendar Days (65 Calendar Days if Railroad approval is required) after receipt of the resubmitted Working Drawings by the Engineer.

00150.40 Cooperation and Superintendence by the Contractor- Add the following bullet after the fourth bullet within this section:

- Maintain on the job site, and make available to the Engineer upon request, one current marked-up set of the Design Drawings that accurately indicate all approved variations in the completed Work that differ from the original design information shown on the Drawings.

Add the following bullet after the final bullet in this section:

- Contractor shall reasonably provide access for City staff and City representatives to City facilities and the Work at all times, shall not unreasonably restrict access upon request.

Add the following subsection:

00150.41 Construction Management Forms and Communication

CONSTRUCTION PROJECT MANAGEMENT DOCUMENTATION

This item covers all project management and documentation efforts.

Project Document Tracking System Software:

All correspondence, including but not limited to meeting minutes, RFIs, Field orders, Work Change Directives, Contract Modifications, Submittals, manufacturer’s catalog cuts and materials information, data sheets, and similar required informational or documentary submittals,

shall be provided in either 8-1/2 inch by 11 inch or 11 inch by 17 inch PDF format, and shall be provided to the Engineer and Agency's Representative electronically using the City's project management application software rather than in paper form. All documents referencing financial requirements can be processed through the City's project document tracking system. The Software and Training shall be paid for by the Agency.

The following forms shall be used to administer the Work.

Construction forms:

(a) Request for Information (RFI)

This form is to be used to ask questions as to the design intent or make clarification of the design by the Contractor. This form can also be used by the Engineer to clarify the design intent.

(b) Work Change Directive (WCD)

It is understood that this work change directive will not change the contract price or schedule, but is evidence that the parties expect a change order to be subsequently issued reflecting any changes.

(c) Field Order

The intent of this Field Order is to authorize minor variations to the contract documents not involving a change in contract price or contract schedule and which are compatible with the design concept of the completed project. This Field Order is binding upon Agency and upon Contractor who will perform the work promptly. If Agency or Contractor believes an adjustment to the contract price or contract schedule is necessary, the party may make a claim therefore in accordance with the general conditions.

(d) Removal From Service (RFS) Request Form

This form shall be used for requesting and documenting significant operations interruptions or requests from the Contractor to make modifications to existing infrastructure that is in operation.

(e) Request for Quotation

Requests contractor's proposal of cost and times to perform Agency's contemplated changes in the work.

Formally issued by the Agency; may be prepared by the engineer as the agent of the City of Bend.

NOT to be utilized for authorization to proceed with the change. Scope of work must be complete with all sketches, specifications, etc. required for contractor to estimate fully the work required. Lower portion of form to be completed and returned by contractor.

(f) Substitution Request: See section 00180.31(b)

This form shall be used for requesting substitutions to the specified products. All requests shall provide data which includes product description, specifications, drawings, photographs, performance and test adequate for evaluation of the request. Applicable portions of the data shall clearly identified.

(g) Submittal Transmittal Form

This form shall be used for submitting Construction submittal information, Project submittal according to the project specification and for submittal tracking purposes.

(Use the following subsection .50(f) when listing utility information.)

Add the following subsection:

00150.50 Cooperation with Utilities

(Add the following subsections.)

(f) Utility Information:

(Use the following paragraph when no anticipated utility conflicts exist.)

There are no anticipated conflicts with the Utilities listed below. Contact those Utilities having buried facilities and request that they locate and mark them for protection prior to construction.

	Utility	**Contact Person's Name and Phone Number**
1.		
2.		
3.		
4.		

(Use the following paragraph when utility adjustments are the responsibility of the City.)

Arrangements for removing, relocating, or adjusting Utilities on the Project are the responsibility of the City. Contact the City for information regarding these arrangements.

(Use the following paragraph on projects with organizations that may be adjusting utilities.)

The following organizations may be adjusting Utilities within the limits of the Project during the period of the Contract, with relocation work estimated to be completed by the following dates (times):

Utility	Estimated Completion Date (Time)
(Utility company – "Gas Company") (Contact person's name and (Phone number)	

(Use the following paragraph when high-pressure gas lines exist on site.)

In the immediate area of the high-pressure gas lines, when moving any Equipment, excavating, driving piles, pounding guardrail posts, boring, or other road construction activities, the Contractor shall increase the tolerance zone from 24 inches, as defined in OAR 952-001-0010, to 10 feet. Exceptions require written approval from the Gas Utility. The Contractor shall provide the Engineer a copy of the written approval of the exception before beginning Work.

(Repeat as needed – "Power Company")

(Use the following paragraph when power lines overhang work areas.)

Energized power lines overhang portions of the Work with a minimum vertical clearance of 18 feet. Contractor shall maintain at least 10 feet of safety clearance.

This Project is located within the Oregon Utility Notification Center area, which is a Utilities notification system for notifying owners of Utilities about work being performed in the vicinity of their facilities. The Utilities notification system telephone number is 811 (or use the old number, which is 1-800-332-2344).

(Use the following subsection .55 when there is an existing specific City contract that will be performed within the project site and the Contractor is required to cooperate with the other City contractor. List the contract name, the contractor's name and on-site contact number, and the estimated time the other specific contract work will be taking place within the project limits. Delete the example.)

00150.55 Cooperation with Other Contractors – Add the following paragraph at the end of the subsection:

The following contract work will be ongoing within the Project site during the following times:

Contract Name (Contractor's Name)	Estimated Times (From – To)
(For example – Your project's bid opening is July 5, 2021, so:	
OR99E Howell Prairie Rd-Wauconda Rd. Dewey Cheatum Construction Inc. 541.123.4567 (On-Site))	Aug 2021 to Oct 31, 2021

00150.55 Cooperation with Other Contractors - Add the following paragraph at the end of the subsection:

If any part of the Contractor's work depends, for proper execution or results, upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in the other work that render it unsuitable for proper execution and results. The Contractor's failure to so inspect and report shall constitute an acceptance of the other contractor's Work as fit and proper for the reception of its work, except as to defects that may develop in the other contractor's work after execution of its work.

Add the following subsection:

00150.76 Protection of Property - The Contractor shall adopt every practical means and comply with all laws, ordinances, and regulations in order to minimize interference to traffic and inconveniences, discomfort, and damage to the public, including the provision of adequate dust control measures. All obstructions to traffic shall be guarded in accordance with the "Manual on Uniform Traffic Control Devices."

The Contractor shall not trespass upon private property and shall be responsible for all injury or damage to persons or property, directly or indirectly, resulting from its operations in completing this Work. They shall comply with the laws and regulations of the City, county and state, relating to the safety of persons and property, and will be held responsible and required to make good any injury or damage to persons or property caused by carelessness or neglect on the part of the Contractor or Subcontractor(s), or any agent or employee of either during the progress of the Work and until its final acceptance.

The Contractor shall protect property, public and/or private, encountered in this Work except as stipulated elsewhere herein. The Contractor shall be responsible and liable for any damage. The Contractor shall protect its work and materials from damage or the elements, until the completion and acceptance of the Work. All loss or damages arising under the terms of these Contract Documents, or from any unforeseen obstruction or defects that may be encountered in the prosecution of the Work, or from the action of the elements, shall be sustained by the Contractor.

In an emergency affecting human health or safety, the Contractor shall act to prevent or mitigate the risk or threat. Any compensation claimed by the Contractor on account of emergency work shall be determined by agreement or as covered under the Section "Change Orders".

Add the following subsection:

00150.77 Unforeseen Difficulties - The Contractor shall protect its work and materials from damage resulting from the nature of the work, the elements, carelessness of other contractors, or from any cause whatever until the completion and acceptance of the Work. All loss or damage arising out of the nature of the work to be done under these Contract Documents, or from any unseen obstruction or defects that may be encountered in the prosecution of the Work, or from the action of the elements, shall be sustained by the Contractor.

This clause is complementary to Section 00170.80 and excludes repairs necessitated by damaged caused by

- Acts of God or Nature, as defined in Section 00110; or
- Actions of governmental authorities.

Add the following subsection:

00150.99 Public Safety and Convenience - The Contractor shall conduct the project with proper regard for the safety and convenience of the public. When the project involves use of public ways, the Contractor shall provide certified Flaggers when directed, a temporary traffic

control plan approved by the Engineer, and shall install and maintain means of free access to all property. Private residential driveways shall be closed only with approval of the Engineer or specific permission of the property owner. The Contractor shall not interfere with normal operation of public transit vehicles unless otherwise authorized. The Contractor shall not obstruct or interfere with travel over any public street or sidewalk without approval. Where detours are necessary, they shall be maintained with good surface and shall be clearly marked. The Contractor shall provide open trenches and excavations with adequate barricades of an approved type that can be seen from a reasonable distance.

(Note requirement to backfill all open trenches at night, which may be unreasonable and costly for very deep excavations. Review end-of-shift backfill requirements. If night work is expected and trenches would be backfilled during the day time, update text as required to indicate “end of daily work shift” or similar)

At night, the Contractor shall backfill all open trenches, unless otherwise specified, and mark all construction areas with signs and lighted barricades (Type A Low Intensity Flashing Warning Light on a Type I or II barricade, typical) in accordance with the Manual of Uniform Traffic Control Devices (MUTCD). Steel plates will not be permitted within the travel way between November 1st and March 1st. The Contractor shall install and maintain all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges, and facilities. The Contractor shall observe all safety instructions received from the Engineer or governmental authorities, but following of instructions shall not relieve the Contractor from the responsibility or liability for accidents to workers or damage or injury to persons or property.

Emergency traffic such as police, fire, and disaster units shall be provided reasonable access to the work area at all times.

The Contractor shall be liable for any damages that may result from failure to provide reasonable access or failure to notify the appropriate authority.

Request for Information

PROJECT__REQUEST NO. ___ CONTRACTOR___DATE _____ PROJECT NO.

Clarification/Interpretation Requested by _____

Regarding: Plan sheet_____of _____ Spec. Section _____

DESCRIPTION:

_____
_____
_____
_____
_____
_____

_____
Prepared by

_____
Date

RESPONSE ASSIGNED TO:

☐ Project Manager
☐ Project Design
☐ Manager Other_____

_____
Signed

_____
Date

CITY OF BEND PUBLIC WORKS
WORK CHANGE DIRECTIVE

CONTRACTOR: _____ **WCD NO.:** _____

PROJECT: _____ **PROJECT NO.** _

AGENCY: _____

ENGINEER: _____

The following additions, deletions or revisions to the work have been ordered and authorized:

Description of Work:

Reason for change(s):

Attachments (List supporting documents):

It is understood that this work change directive will not change the contract price or schedule, but is evidence that the parties expect a change order to be subsequently issued reflecting any changes.

ORDERED BY: _____ **DATE:** _____

RECOMMENEDED BY: _____ **DATE:** _____

FIELD ORDER

CONTRACTOR _____ **FIELD ORDER NO.** _____

PROJECT _____ **PROJECT NO.** ___

AGENCY _____ **ENGINEER** _____

The following minor changes in the work have been ordered and authorized:

Description of Changes:

Reason for field order:

Reference Drawing sheets and section(s) or detail(s): Reference Specification section(s) /paragraph(s):

The intent of this Field Order is to authorize minor variations to the contract documents not involving a change in contract price or contract schedule and which are compatible with the design concept of the completed project. This Field Order is binding upon AGENCY and upon CONTRACTOR who will perform the work promptly. If AGENCY or CONTRACTOR believes an adjustment to the contract price or contract schedule is necessary, the party may make a claim therefore in accordance with the general conditions.

Issued by Engineer	**Contractor Receipt Acknowledgement**
By:	**By:**
Title:	**Title:**
Date:	**Date:**

REMOVAL FROM SERVICE (RFS) REQUEST FORM

PROJECT: DATE:_____
PROJECT NUMBER:

BUILDING/AREA AFFECTED _____

SYSTEMS/EQUIPMENT AFFECTED _____

DAY OF SHUTDOWN_____TIME_____DURATION_____

WORK TO BE ACCOMPLISHED_____

_____

_____

_____

FOREMAN IN CHARGE_____CREW SIZE_____

SHUTDOWN ACTIVITIES	START TIME	SPECIAL REQUIREMENTS
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

WORK THAT REQUIRES CITY STAFF PARTICIPATION

_____

PROBLEMS THAT MAY BE ENCOUNTERED AND CORRECTIVE ACTION

_____

_____

_____

_____

_____

Initial

Contractor Superintendent _____ Inspector COB _____

Operations COB _____

☐

REQUEST FOR QUOTATION

QUOTATION NO. _____

TO:_____DATE

_____ FROM:__PROJECT:

_____

KEYWORD DESCRIPTION:

_____

_____

DATE QUOTATION REQUIRED

_____

The following modification to the contract has been identified. Pursuant to the General Conditions, following the order of precedence, please provide a quotation for the alteration as described in Item 1. The quotation should include an itemized breakdown of contractor and subcontractor costs, including labor, materials, rentals, approved services, overhead, and profit. This request shall not be considered authorization to proceed with the work herein described.

TO BE COMPLETED BY INITIATOR OF REQUEST

1. Scope of Work: (include list of attachments)
2. Reason(s) for Modification:
3. Approval of Request:

City of Bend _____ Date _____

Engineer _____ Date _____

TO BE COMPLETED BY CONTRACTOR

1. Total cost of modification (attach detailed breakdown) $ _____
2. Will a modification to the contract time be requires☐ Yes ☐ No
   a. If so, trade(s) _____
   b. Number of personnel _____
   c. Duration_____(calendar days)
3. Attachment identification: (list) _____
4. Quotation is in effect until: (date) _____
5. Approval of Quotation _____

Contractor Date

SUBSTITUTION REQUEST (SR)

PROJECT: _____ **SR NO.**_____

CONTRACTOR: _____ **CONTRACT NO.**___

ORIGINATOR: _____ **SPEC. SECTION:** __

DATE SUBMITTED: _____ **DRAWING NO**_____ **SHEET:** _____ **OF** _

SPECIFIED ITEM:

SECTION	**PAGE**	**PARAGRAPH**	**DESCRIPTION**

The undersigned requests consideration for the following:

PROPOSED SUBSTITUTION:

Attached data includes product description, specifications, drawings, photographs, performance and test adequate for evaluation of the request. Applicable portions of the data are clearly identified.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings and will not require any change in any of the contract documents.

2. The undersigned will pay for changes to the design, including engineering design, detailing and construction costs caused by the requested substitution, estimated to be $ _____.

3. The proposed substitution will have no adverse effect on other contractors, the construction schedule (specifically the date of substantial completion), or specified warrantyrequirements.

4. Maintenance and service parts will be locally available for the proposed substitution.

5. The incorporation or use of the substitution in connection with the work is not subject to payment of any license fee or royalty.

The undersigned further states that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by CONTRACTOR	**Reviewed by ENGINEER**

Signature: _____

Firm: _____

Date: _____

Telephone: _____

By: _____

Attachments: _____

☐ **Accepted**
☐ **Accepted as Noted**
☐ **Not accepted**
☐ **Received too Late**

Title: _____

_____ **Date:** _____

_____ **Remarks:** _____

SUBMITTAL – TRANSMITTAL FORMS (Need to attach to each submittal) DATE _____	
City of Bend Project Name: _____ Project Number: _____ ☐ New Submittal ☐ Re-submittal Submittal No: _____ Specification Section No.: _____ (One transmittal per section) Schedule Date of Submittal _____	Design Engineer: _____ Contractor: _____ _____
Submittal Type ☐ Shop Drawing ☐ Sample ☐ Informational ☐ Deferred	

The following items are hereby submitted:

No. of Copies	Description (Type, Size, Model No., Etc.)	Spec. & Para No.	Drawing No.	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that Contractor has complied with the requirements of Contact Documents in preparation, review, and submission of designated Submittal and the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By:_____ Contractor (Authorized Signature)

Section 00160 – Source of Materials

Comply with Section 00160 of the Standard Specifications modified as follows:

00160.05 Qualified Products List (QPL) - Add the following paragraph:

Products, materials, and equipment listed in the Technical Specifications, Special Provisions or Supplemental Specifications shall be provided in lieu of a similar product on the Qualified Products List. Where no specific product, material, or equipment is specified in the Special Provisions or Supplemental Specifications an item from the QPL may be furnished. Contractor shall submit to the Engineer, a list of any product from the QPL proposed to be included in the work.

ODOT Internet Address: **http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/**

00160.20 Preferences for Materials - Add the following paragraph:

All materials shall be new of U.S.A. domestic manufacture that meet all AWWA, APWA, Federal and, State code requirements, as well as local City and County code requirements. Additionally, strict attention shall be given to workmanship, and materials shall be of good quality.

(Use the following subsection .30 when the City will furnish items or materials other than material from a borrow source; for example, poles, timbers, guardrail, etc. Give the location where the items/materials may be picked up. Delete the words in parenthesis and parentheses as needed. For aggregates and other similar materials, use 00160.40.)

(Use the following subsection .40 on projects for City-furnished material sources. Include ODOT SP235 (for City-furnished material/aggregate sources) or Supplementary Specification Agency Furnished Products 04020 when using this subsection. Prepare Supplemental Specification 04020, edit and include when Agency Furnished Materials are used on project.)

00160.30 Agency-Furnished Materials - The City will furnish the listed items at the (Project Site:) (following locations:)

End of Section

Section 00165– Quality of Materials

Comply with Section 00165 of the Standard Specifications modified as follows:

00165.00 General – Add the following after the sentence “Materials or manufactured…”:

All materials to be incorporated in the Work shall be subject to sampling, testing, and approval. Samples furnished by the Contractor shall be representative of the materials to be used. The Engineer may select samples or may require that samples be delivered to and tested as required by the Specifications at the laboratory of the Engineer, at no additional cost to the City.

All sampling and testing of materials shall be done in accordance with the current designated standard methods of the American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials (ASTM), etc., or in accordance with special methods designated in the Specifications.

The Contractor shall furnish, without additional charges, the necessary test pieces and samples, including facilities and labor for obtaining the same, as requested by the Engineer. When required, the Contractor shall furnish test certificates of materials and equipment made at the point of manufacture by a recognized testing laboratory.

The Engineer shall have access to the Work wherever it is in preparation or progress, and the Contractor shall provide facilities for the access, including maintenance of temporary and permanent access routes.

If the Specifications, laws, ordinances, or public authority requires the Work to be tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection. If the inspection is by authority other than the Engineer, the Engineer shall be given timely notice of the date fixed for the inspection. Inspections by the Engineer will be promptly made and, where practicable, at the source of supply. If work should be covered without approval or consent of the Engineer, it shall, if required by the Engineer, be uncovered for examination at the Contractor’s expense.

Re-examination of questioned work may be ordered by the Engineer and, if so ordered, the work shall be uncovered by the Contractor. If the work is found not in accordance with the Contract Documents, the Contractor shall correct the defective work at no additional cost to the City.

Observations by Engineer, inspections, tests, or approvals by persons other than the Contractor shall not relieve the Contractor from the obligation to perform work in accordance with requirements of the Contract Documents.

End of Section

Section 00170 – Legal Relations and Responsibilities

Comply with Section 00170 of the Standard Specifications modified as follows: 00170.01 Other Agencies Affecting Agency Contracts - Add the following:

(For projects involving railroad, review available ODOT boilerplates, and determine what else may be required. The clause below is generally satisfactory to require Contractor to comply with railroad requirements.)

(e) Railways - The Contractor shall comply with any Contractor railway requirements and agreements that are in effect for this Project as applicable. City shall provide permit and permit fee relative to this project.

(Consider and use available ODOT boilerplates for 00170.06 Federal-Aid Participation. These boilerplates are not included herein.)

00170.08 Electronic Document Management – Delete and replace this section with the following:

00170.08 Project Document Tracking System Software -

(a) The City and Contractor shall utilize City of Bend's Online Permit Center Portal (the CityView Portal) system for electronic submittal of all data and documents throughout the duration of the Contract. The CityView Portal is a web-based electronic media site that is hosted by the City of Bend utilizing CityView software. The CityView Portal will be made available to all Contractors' Project personnel, subcontractor personnel, suppliers, consultants and the Designer of Record. The joint use of this system is to facilitate; electronic exchange of information, automation of key processes, and overall management of the Contract. The CityView Portal shall be the primary means of Project information submission and management. When required by the City's representative, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents the paper documents will govern.

(b) User Access Limitations:

a. The City will control the Contractor's access to the CityView Portal by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system, determine assigned function-based authorizations (determines what can be seen), and user privileges (determines what they can do). Subcontractors will be given access to the CityView Portal through the Contractor's request to the City. Entry of information exchanged and transferred between the Contractor and its subcontractors and suppliers on the CityView Portal shall be the responsibility of the Contractor.

b. Joint Ownership of Data: Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within the CityView system) by the City and the Contractor will be jointly owned.

(c) Automated System Notification and Audit Log Tracking: Review comments made (or lack thereof) by the City on Contractor submitted documentation shall not relieve the

Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. City's acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

Contractor Responsibility: The Contractor is responsible for the validity of their information uploaded to the CityView Portal and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet browsers, email programs, CAD drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The Contractor shall utilize the links on the CityView Portal to the maximum extent possible. If a link does not exist on the CityView Portal, the Contractor must include a form of their own or provided by the City as an attachment to a submittal. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use

(d) User Access Administration: Provide a list of Contractor's key CityView personnel and subcontractors for the City's acceptance. Contractor shall notify the City of any addition or removal of personnel or subcontractors. The City reserves the right to perform a security check on all potential users.

(e) Connectivity Problems: The CityView Portal is a web-based environment and therefore subject to the inherent speed and connectivity problems of the Internet. The Contractor is responsible for its own connectivity to the Internet. The CityView Portal response time is dependent on the Contractor's equipment, including processor speed, Internet access speed, etc., and current traffic on the Internet. The City will not be liable for any delays associated from the usage of the CityView Portal including, but not limited to slow response time, downtime periods, connectivity problems, or loss of information. The Contractor can view any scheduled outages on the Portal homepage and shall plan accordingly. The Contractor will ensure that connectivity to the CityView Portal (whether at the home office or jobsite) is accomplished through high-speed broadband communication systems. Under no circumstances shall the usage, of the CityView Portal be grounds for a time extension or cost adjustment to the Contract.

00170.60 Safety, Health, and Sanitation Provisions – Add the following after the sentence "According to ORS 468A.715…":

As required by law or administrative regulation, the necessary sanitary conveniences, properly secluded from public observation, shall be erected and maintained by the Contractor at all times while people are employed on the Work, and use of the sanitary conveniences shall be strictly enforced. The location of the conveniences shall be approved by the Engineer.

(The following subsection .65(e) is required only on Federal-Aid projects that do not require Davis-Bacon prevailing wages. Use according to the following:

- Do not use this subsection on projects that are funded by the Safe Routes to School Program.
- Do not use this subsection on projects that are required by an environmental document, even if the project is away from the Federal-aid highway right-of- way. Example: wetland mitigation. (This type of project is linked to, or dependent upon, the Federal aid highway project.)
- Use this subsection on projects that have a Functional Classification of 08 rural minor collector, 09 rural local, or 19 urban local. (Obtain the Functional Classification from the project Insurance Risk Assessment.)
- Use this subsection on projects that are not located within the Federal-Aid highway right-of-way, and are not linked to, nor dependent upon, the Federal- Aid highway. Examples:
- Restoration of a historic railroad station
- Construction of an independent bike path
- A landscaping or scenic beautification project that is not on the Federal- Aid highway right-of-way and is not required because of a Federal-aid highway project

For questions about application of this section contact the ODOT State Specifications Engineer.)

00170.65(e) Additional Requirements When Federal Funds are Involved - Replace this subsection, except for the subsection number and title, with the following:

For this Federal-Aid Project, the Contractor shall comply with 00170.65(a) through 00170.65(d) and the provisions of FHWA Form 1273, Required Contract Provisions Federal-Aid Construction Contracts, except Section IV of FHWA Form 1273 does not apply.

Add the following subsection:

00170.66 Contractor's and Manufacturer's Compliance with State, OSHA, and Other Applicable Code Requirements - The completed Work shall include all necessary permanent safety devices such as machinery guards and similar ordinary safety items required by the state and federal Occupational Safety and Health Administration (OSHA) industrial authorities and applicable local and national codes. Further, any features of the Work (including City selected equipment) subject to the safety regulations shall be fabricated, furnished, and installed in compliance with these requirements. Contractors and manufacturers of equipment shall be held responsible for compliance with the requirements included herein.

(Contact Issuing Officer to provide input for insurance coverages consistent with project requirements, which will be in the contract not the Part 100's)

00170.70 Delete this section in its entirety and replace as follows:

0170.70 Insurance Coverages – See Public Improvement Contract for insurance amounts and coverages required.

00170.72 Indemnity/Hold Harmless - Add the following after the paragraph that begins with "In claims against…":

Extend indemnity and hold harmless to the Agency and the following:

The City of Bend and its officers, agents, and employees

(Note – City Project Manager may choose to add additional entities, such as outside engineering consultants, third party construction manager consultants, suppliers of Agency-furnished equipment, or Agency representatives in some cases.)

00170.85.b.2 General Warranty for Local Agency Project - Delete this section in its entirety. See Public Improvement Contract for warranty requirements.

00170.85 Responsibility for Defective Work - Add the following:

(d) Remedies Cumulative - Nothing in this Section 00170.85 precludes the City from asserting any other remedy or theory of recovery, including breach of contract and negligence for defects in the Work.

Add the following subsection:

00170.95 Ownership of Drawings - All Plans, Drawings, Specifications and copies furnished by the City are the City's property and are not to be used on other work and, with the exception of the signed contract set, are to be returned on request at completion of the work. Any reuse of these materials without written authorization by the City will be at the risk of the user and without any liability or legal expense to the City. All models are the property of the City.

End of Section

Section 00180 – Prosecution and Progress

Comply with Section 00180 of the Standard Specifications modified as follows:

00180.05 Assignment/Delegation of Contract - Delete and replace first sentence of this paragraph as follows:

Unless the Agency gives prior written consent, which may be withheld in the City's sole, discretion, the Contractor shall not assign, delegate, sell, or otherwise transfer or dispose of any rights or obligations under the Contract, whether voluntarily or involuntarily, and whether by merger, consolidation, dissolution, operation of law, or any other manner, including, without limitation:

- The power to execute or duty to perform the Contract; or
- Any of its right, title or interest in the Contract.

00180.30 Materials, Equipment, and Work Force - Add the following above the paragraph starting with "The work force shall…":

The Contractor at all times shall enforce strict discipline and good order among its employees. The Contractor shall comply with all applicable labor rules, wage scales, and regulations, including nondiscriminatory laws, of the Government of the United States, the State, County, and City or Town in which the Work is performed.

00180.31 Required Materials, Equipment, and Methods - Delete (b) and (c) and replace with the following:

00180.31(b) Substitution and "Or-Equal" Products - The Agency will not consider substitute or "or-equal" products during the bid period, but only after Contract award. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a particular manufacturer or supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal", indicating that substitution is permitted, materials or equipment of alternate manufacturers or suppliers may be accepted by the Engineer if sufficient information is provided by the Contractor to allow the Engineer to determine that the material or equipment proposed is equivalent or equal to the named manufacturer's material or equipment. The proposed substitutes or "or equal" submittal procedure also applies to Equipment Manufacturers/Suppliers originally listed by the Contractor in the Bid Proposal Attachment that are not named in the specifications. Submittals are subject to the following requirements:

> The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the Contractor.
>
> The Engineer shall be the sole judge as to the type, function, and quality of any such substitute material or equipment, and the Engineer's decision shall be final.

The Engineer may require the Contractor to furnish, at the Contractor's sole expense, additional data about the proposed substitute.

The Agency may require the Contractor to furnish, at the Contractor's sole expense, a special five-year performance guarantee or other surety with respect to the substitute material or equipment.

Acceptance by the Engineer of a substitute item proposed by the Contractor shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents and the adequacy of the substitute item.

The Contractor shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the Contractor's work, the work of the Contractor's Subcontractors, and all other Contractor's; and the Contractor shall accomplish such changes without cost to the Agency or Engineer.

Procedure for review by the Engineer will include the following:

If the Contractor proposes to furnish or use a substitute item of material or equipment, the Contractor shall make written application to the Engineer on the "Substitution Request Form" included in these Supplementary Conditions for acceptance thereof.

Unless otherwise provided by law or authorized in writing by the Engineer, the "Substitution Request Form" shall be submitted within the 35-day period after Award of the Contract.

Whenever a proposed substitute material or equipment has not been submitted within the said 35-day period, or whatever submission of a proposed substitute material or equipment has been judged to be unacceptable by the Engineer, the Contractor shall provide the material or equipment named in the Contract Documents.

The Contractor shall certify that the proposed substitute shall perform adequately the function and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.

The Engineer shall be allowed a reasonable time within which to evaluate each proposed substitute.

As applicable, no shop drawing submittals shall be made for a substitute item, nor will any substitute item be ordered, installed, or used without the Engineer's prior acceptance of the Contractor's "Substitution Request Form" (00150.40(2)), which will be evidenced by a change order.

The Contractor's Application using the "Substitution Request Form" shall contain the following statements and/or information which shall be considered by the Engineer in evaluating the proposed substitution:

The evaluation and acceptance of the proposed substitute shall not prejudice the Contractor's achievement of substantial completion on time.

Whether or not acceptance of the substitute for use in the work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.

Whether or not incorporation or use of the substitute item in connection with the work is subject to payment of any license fee or royalty

All variations of the proposed substitute for that specified shall be identified.

Available maintenance, repair and replacement costs and services shall be included. Itemized estimate of all costs that may result directly or indirectly from the acceptance of such substitute, including costs of redesign and claims from other Contractors affected by the resulting change.

Within 35 calendar days following the Contract Date, the Contractor shall furnish to the Engineer, a complete list of proposed substitutions together with shop drawings and/or such technical data as is defined in the Contract Documents, submittal procedures.

(Use the following subsection .40(b) when limitations prevent all contractor work before a specified date. Fill in the specific date.)

00180.40(b) On-Site Work - Add the following after the bullet that begins with "Assembled all Materials":

The Contractor shall not begin On-Site Work before __(Date)__, unless approved by the Engineer.

(Use the following lead in sentence and subsection .40(c) when limitations are included in the Special Provisions. Delete the limitations that do not apply.)

Add the following subsection:

00180.40(c) Specific Limitations - Limitations of operations specified in these Special Provisions include, but are not limited to, the following:

Limitations	Subsection
Cooperation with Utilities	00150.50
Cooperation with Other Contractors	00150.55
Railways	00170.01(e)
Contract Time	00180.50(h)

Right-of-Way and Access Delays 00180.65

Closed Lanes .....00220.40(e)(1)

Special Events..... 00220.40(e)(2)(b)

Limited Duration Road Closure ..... 00220.40(f)

Road Closure Using Rolling Slowdown Method ..... 00220.40(g)

Regulated Work Areas ..... 00290.34(a)

Noise Control.....00290.32

Maintenance Under Traffic 00620.43

Opening Sections to Traffic 00744.51

Opening Sections to Traffic 00745.51

(Use the following paragraphs when the project is within irrigation districts. Obtain information from the relevant irrigation district.)

[Begin irrigation paragraphs]

When submitting the supplemental "look ahead" Project Work schedule, the Contractor shall show all Work that impacts the (insert irrigation district name) canals and channels.

Irrigators have legal rights to use irrigation water from the canals and channels of the (insert irrigation district name) in (insert contact office location of the irrigation district for the project).

During the irrigation season of (insert date: example April 1) through (insert date: example October 31), the Contractor shall not restrict the flow of water or contaminate the water of the (insert irrigation district name).

During the non-irrigation season of (insert date: example November 1) through (insert date: example May 31), the Contractor shall allow a (insert number of days) day stock water run approximately every 30 Days. The Contractor shall contact the (insert irrigation district name) for the stock water run times.

[End irrigation paragraphs]

(Use the following paragraph when limitations prevent contractor work within the limits of the project, before a specified date, or for a duration. Fill in the specific dates.)

Be aware of the schedule limitations in the Standard Specifications that are not listed in this subsection.

00180.41 Project Work Schedules - After the paragraph that begins "Contractor's activity…" Add the following paragraph:

(City Project Manager shall determine the type of schedule ("A," "B", or "C") from the project Scheduler. Insert the type in the blank.)

In addition to the "look ahead" Project Work schedule, a Type_____schedule as detailed in the Standard Specifications is required on this Contract.

(For most projects, use the following subsections .41(b-2) when a Type "B" Schedule is required. For complex multidisciplinary projects use of Primavera P6 high performance scheduling software is appropriate and could be considered the industry standard scheduling software for these large/complex projects. Certain consulting and construction management firms have expertise in evaluation of various schedule submissions (in Primavera P6) and are capable of supporting the City identifying changes, and schedule characteristics (like float suppression) that should be carefully evaluated and responded to in the course of construction administration. Consider retaining Primavera P6, as per OSS, for these complex projects.)

After the paragraph that begin "The Contractor shall submit…" Add the following new paragraph:

(For Private Development projects, all Work shall be performed in accordance with the approved Type "B" Schedule for the Work set forth in the Right-of-Way Permit or Contract, as the schedule may be updated and reviewed by the City in accordance with the requirements of the Right-of-Way Permit or Contract ("Project Work Schedule"). Compliance with the approved Project Work Schedule and applicable permit conditions is a condition of authorization to perform Work. Work performed outside the approved Project Work Schedule durations constitutes noncompliance with the City's authorization and may result in Civil Penalties pursuant to Bend Municipal Code 3.40.100. For Private Development projects, "Work" as used in this Section means the construction activities authorized and approved by the City under an issued right-of-way permit or other City approval.)

00180.41(b)(2) Detailed Schedule - Delete "the current version of Primavera P6 by Oracle,"

(Use the following subsections .41(c-1) .41(c-2) when a Type "C" Schedule is required.)

00180.41(c)(1) Detailed Schedule - Delete "the current version of Primavera P6 by Oracle,"

00180.41(c) (2) Detailed Schedule - Delete "the current version of Primavera P6 by Oracle,"

(Specification Sections 00150.50 an 00150.55 contemplate work of other utilities in coordination with the Work. this clause below is intended to require contractor to invite

said utilities to the Preconstruction Conference and to show/incorporate their work in the schedule presented at the Preconstruction Conference.)

00180.42 Preconstruction Conference - Add the following to the end of this subsection as follows:

If Utility work is part of the Contract, Contractor shall contact representatives from the utility companies involved with this project. Contractor shall incorporate the utility's work into the Contractor's schedule prior to the preconstruction conference.

00180.50(c)(2) Calendar Day Calculation - Delete and replace as follows:

When the Contract Time is stated in Calendar Days, counting of Contract Calendar Days will begin on the day stated in the Notice to Proceed.

00180.50(d) Recording Contract time - Delete and replace as follows:

All Contract time will be recorded and charged to the nearest one-half day.

(Use one of the following .50(h) lead-in sentence options, according to the number of completion times to be used. NOTE: contract times are detailed in the Contract. Use caution in this sentence when re-stating any contract times.)

Note: If either durable pavement markings (00865) or high performance pavement markings (00866) are required, and the completion date is after September 15, check with the Scheduler and request multiple completion times.

Note: If permanent seeding (01030) or planting (01040) is required, and the completion date is outside the planting seasons (see 01030.43(b) or 01040.41 and.42), check with the Scheduler and request multiple completion times.)

[Begin lead-in sentence options]

[Option 1 - Use to specify one completion time.]

00180.50(h) Contract Time - There is one Contract Time on this Project as follows:

[Option 2 - Use to specify two completion times.]

00180.50(h) Contract Time - There are two Contract Times on this Project as follows:

[Option 3 - Use to specify three completion times.]

00180.50(h) Contract Time - There are three Contract Times on this Project as follows:

[End lead-in sentence Options]

(Use one or more of the following paragraphs as needed to specify one or more INTERIM completion dates. Fill in the blanks. Copy one of the paragraphs if needed for projects with two interim completion times. Delete paragraphs that do not apply. Replace "X" with a sequential number, starting with "1" for the first paragraph used.)

[Begin interim completion date options.]

(X) The Contractor shall complete all Work to be done under the Contract, except for

_____, not later than _____.

(X) The Contractor shall complete all Work to be done under the Contract required to

_____ not later than _____.

(X) The Contractor shall complete all Work to be done under the Contract, except for

_____, before the elapse of ____Calendar Days, or not later than _____ _____, whichever occurs first.

(X) The Contractor shall complete all Work to be done under the Contract required to _____ _____before the elapse of _____Calendar Days, or not later than_____ _____, whichever occurs first.

[Example: "The Contractor shall complete all Work to be done under the Contract required to remove and replace Span 5 of Bridge No. 02025, including reinstalled end panel, final ACP wearing course, and permanent bridge rails; and reopen the Santiam Highway (US20) to two traffic lanes, before the elapse of 110 Calendar Days, or not later than July 31, 2016, whichever occurs first."]

[End interim completion date options.]

(Use ONE of the following paragraphs to specify a single completion time, or as the FINAL paragraph for projects with multiple completion times. Fill in the blanks. Delete paragraphs that do not apply. Remove parentheses. Replace "X" with a sequential number when there are multiple completion times, or delete "(X)" entirely when there is only one completion time.)

[Begin final completion date options.]

(X) The Contractor shall complete all Work to be done under the Contract, except for (seeding establishment) (and) (plant establishment), before the elapse of Calendar Days, or not later than _____, whichever occurs first.

(X) The Contractor shall complete all Work to be done under the Contract before the elapse of _____ Calendar Days, or not later than _____, whichever occurs first.

(X) The Contractor shall complete all Work to be done under the Contract, except for (seeding establishment) (and) (plant establishment), not later than _____.

(X) The Contractor shall complete all Work to be done under the Contract not later than ____ _____.

[End final completion date options.]

00180.65 Right-of-Way and Access Delays - Add the following paragraphs:

- Temporary or Permanent easements that are the City's responsibility to obtain under the Contract Documents.

It is anticipated that the ending date of an anticipated delay for the following properties will be as shown:

File ___(R/W file number) (Stations right and left) ____not later than_____(Date) _____.

Add the following subsection:

00180.66 Delays and Extension of Time

If the Contractor shall be delayed at any time in the progress of the Work by any act or neglect of the City; or of any employee of the City; or by any separate contractor employed by the City; or by changes ordered in the Work; or by strikes, lockouts, fire, unavoidable casualties, or any cause beyond the Contractor's control that justified the delay, or by any delay authorized in writing by the Engineer; then the date for completion of the Work shall be extended. Within 14 days after the Contractor submits to the Engineer a written request for an extension of time, the Engineer will determine the number of days extension due to the Contractor. The City will make the final decision on all requests for extension of time.

No extension shall be made for delays occurring more than 7 days before claim is made in writing to the Engineer. In case of a continuing cause of delay, only one claim is necessary.

No extension of time will be granted to the Contractor for delays occurring to parts of the Work that have no measurable impact on the completion of the total Work under this Agreement

No extension of time will be considered for weather conditions normal to the area in which the work is being performed. Unusual weather conditions, if determined by the Engineer to be of a severity that would stop all progress of the work, may be considered as cause for an extension of Agreement completion time.

Delays in delivery of equipment or material purchased by the Contractor or its Subcontractors shall not be considered as a just cause for delay. The Contractor shall be fully responsible for the timely ordering, scheduling, expediting, delivery, and installation of all equipment and materials.

The contract time may only be changed by a Change Order.

****

(City Project Manager shall prepare computation of liquidated damages for projects exceeding $1,000,000 and have this on-file prior to bid.)

****

00180.85(b)(1) Single Contract Time - Replace this subsection, except for the subsection number and title, with the following:

The Liquidated Damages per Calendar Day* are 15.0 percent of C divided by T as defined in this Section.

C = The Contractor's Bid amount for the Contract.

T = The total Calendar Days between the latest completion date or time listed under 00180.50(h) in the Solicitation Documents and the Bid Opening that will result in the greatest value for T.

* Calendar Day amounts are applicable when the Contract time is expressed on the Calendar Day or fixed date basis.

00180.90 Termination of Contract and Substituted Performance - Delete this Section in its entirety. See Public Improvement Contract for termination provisions.

End of Section

Section 00195 – Payment

Comply with Section 00195 of the Standard Specification modified as follows:

00195.10 Payment for Changes in Materials Costs - Delete and replace with following: No material price escalation/de-escalation is allowed on City projects unless specifically identified and defined in the Contract Documents. All OSS clauses relating to this matter are not applicable on City projects.

(The Specifier shall delete or include as applicable to the project work. Use of escalation clauses is appropriate for certain projects, but requires subjective decision making regarding inclusion in Contract Documents. It is most appropriate for projects with "significant" quantities of oil or asphalt, and in multi-year or long duration contracts, or in periods of significant oil price volatility. It may be appropriate to contact paving contractors or asphalt suppliers prior to bid to characterize current market conditions to determine if escalation clause is warranted. City Project Manager is encouraged to consider actual quantities of asphalt binder or oil in the project, and determine sensitivity of oil prices changes to actual escalation gross value. It has difficult to make generalizations, but if effort to manage the escalation exceeds the potential value of the escalation differential, then it is not worth adding this clause.

If needing Escalation and De-escalation for oil. Add this section.)

00195.10 Payment for Changes in Materials Costs - Replace this subsection with the following subsection:

00195.10 Asphalt Cement Material Price Escalation/De-escalation - An asphalt cement escalation/de-escalation clause will be in effect during the life of the Contract.

The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this escalation/de-escalation provision shall not limit those rights.

(a) Monthly Asphalt Cement Material Price (MACMP) - The Monthly Asphalt Cement Material Price (MACMP) will be established by the Agency each month and will be based on the published prices of PG 64-22 asphalt cement furnished by Poten & Partners, Inc. Portland, Oregon area prices will be used as the basis of the MACMP and is the sole area to be used as the basis for all asphalt cement used on the Project. Each MACMP for a given month will be the average of the published prices for that MACMP for each Friday in that month.

For information regarding the calculation of the MACMP, and for the actual MACMP, go to the Agency website at:

https://www.oregon.gov/ODOT/Business/Pages/Asphalt-Fuel-Price.aspx

If the Agency-selected index ceases to be available for any reason, the Agency in its discretion will select and begin using a substitute price source or index to establish the MACMP each month. The MACMP will apply to all asphalt cement including but not limited to paving grade, polymer modified, and emulsified asphalts, and recycling agents. The Agency does not guarantee that asphalt cement will be available at the MACMP.

(b) Base Asphalt Cement Material Price (Base) - The base asphalt cement material price for this Project is the MACMP published on the Agency website for the month immediately preceding the Bid Opening date.

(c) Monthly Asphalt Cement Adjustment Factor - The monthly asphalt cement adjustment factor will be determined each month as follows:

- If the MACMP is within ± 5% of the Base, there will be no adjustment.
- If the MACMP is more than 105% of the Base, then:

  Adjustment Factor = (MACMP) - (1.05 x Base)

- If the MACMP is less than 95% of the Base, then:

  Adjustment Factor = (MACMP) - (0.95 x Base)

(d) Asphalt Cement Price Adjustment - A price adjustment will be made for the items containing asphalt cement listed below. The price adjustment as calculated in (c) above will use the MACMP for the month the asphalt is incorporated into the Project. The price adjustment will be determined by multiplying the asphalt incorporated during the month for subject Pay Items by the Adjustment Factor.

The Pay Items for which price adjustments will be made are:

Pay Item(s)

- (List all Pay Items in which price adjustments apply. Use complete and accurate Pay Item names. Add or delete Pay Items as appropriate.)

_____ Asphalt in _____ACP
Emulsified Asphalt in Fog Coat
Emulsified Asphalt for Tack Coat
Asphalt in Emulsified Asphalt Chip Seal
Asphalt in Multiple Application Emulsified Asphalt Surface Treatment
Emulsified Asphalt in Mixture
Recycling Agent

[End subsection .10]

- (Use the following lead-in paragraph and subsection .11 on projects with estimated fuel usage in excess of 25,100 gallons. The estimated fuel usage is for the major Pay Items or specific Structure Numbers that are listed for coverage under this specification.
    - *[Begin subsection .11]*

Add the following subsection:

Delete the following Sections: 00195.12 and 00195.80

00195.20(a) Insignificant Changed Work - Delete and replace with the following.

(a) Change Orders - Payment or credit for any alterations covered by a Change Order shall be determined by one or a combination of methods below.

- **Unit Prices -** If applicable, the unit prices stated in the Proposal or unit prices negotiated and mutually acceptable to the Contractor and City.
- **Lump Sum -** A total sum for the Work negotiated and mutually acceptable to the Contractor and City.

The Contractor's quotations for Change Orders shall be in writing and firm for a period of 45 days. Any compensation agreed upon, and subsequently paid by the City for work defined in a Change Order, shall be deemed to include all costs and expenses related to the work, including the costs and expenses to a direct, indirect, and consequential nature, or otherwise, and it is specifically understood and agreed that no additional compensation may be subsequently sought or charged by the Contractor for the work covered by the applicable Change Order.

The City's request for quotations on alterations to the work shall not be considered authorization to proceed with the work prior to the issuance of a formal Change Order, nor shall the request justify any delay in existing work.

00195.50(b) Retainage: Delete the paragraph beginning : "The agency reserves…" with the following:

The amount to be retained from progress payments shall be 5% of the value of the Work accomplished.

00195.50(c) Forms of Retainage: Delete in its entirety.

00195.80 Allowance for Materials Left on Hand - Delete and replace section with the following:

00195.80 Materials delivered to the work site but not used - Final payment will be made only for materials actually incorporated in the work. Upon acceptance of the work, all materials stored on the site, unless otherwise agreed upon in writing, shall revert to the Contractor.

Add the following subsection:

00195.89 Release of Liens - Except for payments to Subcontractors, neither the final payment nor any part of the retained percentage shall become due until the Contractor submits to the City a signed affidavit, satisfactory to the City, stating that so far as the Contractor has knowledge or information, all accounts for materials, labor, and incidentals in connection with the Work have been paid in full.

00195.90 Final Payment - Delete and replace with the following:

To receive final payment, the Contractor must do the following:

1. Notify the Engineer, in writing, that the Work has been completed in accordance with the Contract Documents, and request final payment.

2. Submit to the City appropriate waivers of lien for itself and all Subcontractors.

3. Furnish to the City a completed wage certification as required by ORS 279, as amended. Within 15 days of these documents, the Engineer shall conduct a final inspection of the Work. If the Work, including all required inspection by City and other government agencies, and documentation has been completed to the satisfaction of the Engineer, the City shall accept the Work and make final payment to Contractor within 30 days of the final inspection.

Add the following subsection:

00195.92 Acceptance of Final Payment Constitutes Release - The acceptance by the Contractor of the final payment shall release the City and the Engineer as agent of the City from all claims and all liability to the Contractor for all things done or furnished in connection with the Work, and every act of the City and others relating to or arising out of the Work. No payment, however, final or otherwise, shall operate to release the Contractor from obligations under these Contract Documents, including obligations to repair or compensate City for work later determined to be defective.

Add the following subsection:

00195.93 No Waiver of Rights - Neither the inspection by the City, through the Engineer or any of its employees, nor any payment for or acceptance of any part of the Work by the City Engineer, nor any extension of time, nor any possession taken by the City, shall operate as a waiver of any provision of these Contract Documents, or any power reserved to the City, or any right to damages. A waiver of any breach of this Agreement is not a waiver of any other or subsequent breach.

End of Section

Section 00197 – Force Account Work

Comply with Section 00197 of the Standard Specifications modified as follows:

00197.80 Percentage Allowance - Delete table and percent columns and replace with the following:

Subsection	Percent
00197.10 Materials	15
00197.20 Equipment	15
00197.30(b) Labor	20
00197.40 Special Services	15

00197.90 Billings - Add the following paragraph to the end of the section:

To receive partial payments and the final payment for force account work, the Contractor shall submit in a manner approved by the Engineer, detailed and complete documented verification of the Contractor's and any of his/her Subcontractor's actual current cost involved in the force account work pursuant to the issuance of an approved Change Order. Costs shall be submitted within 30 days after the work has been performed.

No payment will be made for work billed and submitted to the City after the 30 day period has expired. No extra or additional work shall be performed by the Contractor, except in an emergency endangering life or property, unless included in a written Change Order.

End of Section

Section 00199 – Disagreements, Protests and Claims

Comply with Section 00199 of the Standard Specifications modified as follows:

Add the following subsection:

00199.01 Inconsistencies and Omissions - Any inconsistency, error or omission found in the Contract Documents shall be reported to the City in writing immediately and before proceeding with the work affected by the inconsistency, error or omission. Contractor shall not be liable to City for failure to discover any inconsistency, error or omission. City will clarify inconsistencies, errors or omissions in writing within a reasonable time. The City's decision shall be final. Inconsistencies shall be resolved according to the priority stated in the Agreement.

00199.40 – Replace the paragraph that begins "The Engineer may determine…." With

The Engineer may determine to skip the Step 1: Project Principal Review, in which case the claim or claims will advance to Step 2: City of Bend Engineer Review.

00199.40(b) Step 1: Region Level Review - Replace the title with the following:

00199.40(b) Step 1 Project Principal Review:

Add the following sentence prior to the first sentence.

The Project Principal Reviewer is the responsible Principal Engineer, Assistant City Engineer or other individual as identified by the City Engineer.

Throughout the subsection replace "Region-level reviewer" with "Principal Reviewer".

00199.40(c) Step 2: Agency Level Review – Replace the title with the following:

00199.40(c) Step 2 City of Bend City Engineer Review:

Throughout the subsection replace "Contract Administration Engineer" with "City Engineer".

00199.40(d) Step 3: Arbitration; Claims Review Board: Delete in its entirety and replace with the following:

At this step, the parties agree to submit the dispute to non-binding arbitration before an arbitrator selected by mutual agreement of the parties. If the parties are unable to agree to an arbitrator, they shall ask the Presiding Judge of the Circuit Court of the State of Oregon for Deschutes County to appoint an arbitrator.

Add the following subsection:

00199.61 Remedies Cumulative - The remedies provided for in the contract documents are cumulative, and in addition to other remedies available at law. Contractor agrees that, due to the health, safety and welfare issues that relate to timely and acceptable completion of the facilities to be constructed under this contract, the City may not have an adequate remedy at law in the event of a breach of this contract by Contractor, and that the City may obtain injunctive relief at the sole election of the City.

End of Section

PART II

City of Bend Design Standards

Part II – Design Standards

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1 Use of These Design Standards

These Design Standards provide required design constraints, methodologies, features, and practices that shall be implemented in all designs of Public Works facilities in the City of Bend. If, in practice, a designer encounters a design feature for which a Design Standard does not exist, the responsible designer shall use best professional judgment for completing the design. The City Engineer retains the right to establish requirements for design of public works features for which a Design Standard does not exist and the designer shall modify designs to reflect all requirements of the City Engineer. To avoid re-work, the responsible designer should seek approval from the City Engineer, early in the design process when it becomes apparent to the responsible designer that a project requires design of features for which a Design Standard does not exist.

These Design Standards provide some guidance regarding permitting that may be required for some projects, but this document is not intended to identify the permitting requirements. The City of Bend Community Development Department and other agencies should be consulted for permits that will be required for projects. Prior to design, the designer should consider proximity to all private utilities, canals, or railways that may exist and understand their permitting and approval requirements. Their requirements are likely different than these design standards but could impact overall design and layout of public infrastructure.

These design standards are intended to complement the City of Bend's standard construction specifications, which are based on the Oregon Standard Specifications for construction as supplemented and/or modified by the City of Bend Special Provisions.

1.1 Authority

These Public Works Design Standards have been adopted by the City Council and minor amendments may be made by the City Engineer. Bend Development Code Chapter 3 also contains applicable land use design standards.

Throughout these design standards references are made to City Engineer approval. The City Engineer has the authority to delegate this approval, with the exception being to deviations, waivers, or modifications. Users are encouraged to work through the permit center at CDD to seek the lowest level of approval needed to prevent bottlenecks and time delays. City staff at the permit center will seek additional approval or input as needed. Users are discouraged from contacting various divisions, and division staff for additional information. Doing so will likely slow approval and provide misinformation.

1.2 Deviations, Waivers, or Modifications

Any deviations, waivers, or modifications from the City design standards must comply with the process identified in Part I - Section 2. The City Engineer will make a final determination on the request. Note approved deviations, waivers, or modifications on all applicable construction drawings.

1.3 References to Other Standards

The City of Bend intends to align its public works design and construction practices with public works industry standards. The Bend Design Standards and Construction Specifications refer to the latest version of various third party standards that contain design or construction elements required for compliance with the Bend Design Standards and Construction Specifications. Where third party standards are referenced, the responsible designer shall obtain copies of these public domain and/or copyrighted standards as required to understand and prepare designs in compliance with these standards. In no case shall the City of Bend be responsible for providing access to, or copies of, any referenced standard to a Consultant, Contractor, Developer, legal counsel or other party unless this standard is a unique standard published by the City of Bend.

1.4 Compliance with Americans with Disabilities Act

Design engineers are responsible for implementing appropriate sections of the latest versions of the “Americans with Disabilities Act Accessibility Guidelines (ADAAG)” for private property and buildings and the “Public Rights-of-Way Accessibility Guidelines (PROWAG)" for public rights-of-ways and private rights-of-ways with public access easements. Both documents are published by the United States Access Board to ensure access compliance for people with disabilities to buildings, properties and roadway facilities. The engineer should recognize that field conditions vary greatly and must be thoroughly investigated to ensure applicable criteria are met or exceeded. In addition, the City of Bend has specific design standards that supplement and work as a companion to the ADAAG and PROWAG requirements. The design engineer must also ensure these City standards are met.

Every attempt has been made to provide files in accessible formats. If you need to request an alternative version of a file posted on this site, please contact the permit center at CEDD (541-388-5580) and provide as much information as you can about the document, its location, and your specific needs.

1.5 Roadside Safety

Roadside is defined as the area between the edge of the traveled way and the right-of-way. Roadside crashes account for 30 percent of the total fatal crashes nationally. The roadside environment plays a significant role in the injury or fatality outcome of leave the road events.

There are numerous reasons that can cause a driver to leave the road, from crash avoidance, to driver distraction. Regardless of the reason for a vehicle leaving the roadway, a roadside environment free of fixed objects with stable, flattened slopes reduces crash severity. These standards and specifications strive to reduce the likelihood of vehicles leaving the pavement; to create designs that do not include obstacles; and to reduce the impact severity by using an appropriate breakaway device. Within this document, the term 'obstacles' covers a variety of right-of-way design elements. The engineer is responsible for designing facilities; structures, signage, and landscape that ensure applicable criteria are met or exceeded.

1.6 Airport Design

The City of Bend owns, operates, and maintains the City of Bend Airport. This facility is designed to the Federal Aviation Administration's (FAA) requirements. Nothing in these design standards is intended to supersede or replace the FAA requirements. Where the FAA is silent, or has no design requirements, the City of Bend Design Standards shall be used.

Design Submittal Requirements

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2 Design Submittal Requirements

The purpose of this section is to clearly identify the requirements for design submittal of proposed plans for approval by the City. The City of Bend's Online Permit Center webpage contains information regarding the application process, responsibilities, and timelines, as well as additional review and training materials. It is highly recommended that the designer review the land use decision that is tied to the property they are designing for regarding public facilities. Often times the land use decision has specific requirements of sizing, placement, or other requirements that must be satisfied. The design of those requirements relies on this document. The designer is responsible for ensuring all required elements that are contained in a land use decision are shown on plan submittals.

The requirements for site plan submittal are identified within the Bend Development Code and Bend Municipal Code. The Bend Code specifies what is required to be shown on any site plan submitted, which typically has significantly less detail than construction plans. The site plan review process is similar to construction plans, however the comments provided by the City are only to the level of detail that was provided on the plans and required by the City Development Code. Construction plans typically have far more detail and therefore City comments will also be more detailed during the construction plan review.

Plans and specifications for construction of any City utility that includes water, sewer, stormwater, streets (including alleys) and any other city infrastructure must be submitted to the City Engineer, or designee, for approval prior to construction.

Applicants shall submit complete electronic sets of plans and technical specifications for review by the City Engineer, or designee. A complete set of plans will show all the required elements as identified in this section. All plans must meet the City of Bend CAD Drafting Standards, which are outlined below in 2.4 - CAD Drafting Standards. Submittals shall include a copy of the Administrative Review and Decision and be accompanied by a transmittal letter with all pertinent materials attached, including a copy of the approved site plan. All designs shall conform to the current City of Bend Standards and Specifications.

Any project work on the proposed site conducted prior to approval of plans by the City Engineer and/or prior to Notice to Proceed by the City of Bend is not allowed. All grading and clearing shall be subject to the provisions of the most recently adopted City of Bend Municipal Code Title 16 for Grading, Excavation, and Stormwater Management. In addition, 7 - Grading and Erosion Control of these design standards contains specific requirements to address grading and drainage. A grading plan and an erosion and sediment control plan, including tree preservation/removal, must be submitted for approval. Only those grading activities approved on the tentative site plan or plat under the applicability standards of the ordinance are allowed to be conducted prior to the approval of the engineered plan set.

An AutoCAD format template drawing for use by designers is available from the City of Bend Permit Counter. The drawing contains the City's required layer naming convention, standard blocks and symbols, and other information related to drafting standards. Designers are required to use the template for all City infrastructures projects.. Additional information regarding the use of the template drawing is identified below 2.4 - CAD Drafting Standards.

2.1 Initial Plan Submittal and Comments

Depending on the size and complexity of the project, the City Engineer or designee shall require that construction plans be submitted at different phases of design. This requirement will expedite review and approval overall and prevent major changes being required by the City late in the design process that can be both costly and timely. As an example of things that may require early design review could be but are not limited to: an entire development that has multiple streets with all related infrastructure, a street connecting to an arterial, pressure sewer system, large stormwater elements, connecting water mains of various sizes, multiple sewer laterals, or complex ADA access. The designer must check with the City Engineer or designee to determine if early design submittals will be required. Projects that are identified as part of a master plan require 30, 60, and 90 percent construction plan submittals. Private Development project submittals, not part of a master plan require 90 percent plans with the first submittal. 90-percent plans are defined by a stage of plan preparation where design documents are almost entirely complete and the project is to the point where the contents can accurately be bid for construction costs and are near ready for construction, meeting all applicable City of Bend standard design requirements. Submittals will be reviewed for completeness, with substandard or missing documents rejected and reviews deferred until a complete application can be provided. City Capital improvement projects generally follow the 30,60, and 90 percent construction plan submittals.

For projects requiring a land use decision, land use actions must be complete and a land use decision available prior to construction document submittal. The Private Development City Engineer may grant approval to proceed with the initial construction document review with the applicant tolling the review clock, in writing, for a period of 14 days (2 weeks), with the second review not to be submitted for another review until the land use decision is available.

Plans will be reviewed in a timely manner through an internal process that ensures a complete and consistent review by all affected departments. At each review comments will be recorded by City staff and provided to the designer/applicant. Comments will be consistent with the requirements specified in this document and City of Bend standards and Development Code. Every comment must be addressed prior to resubmittal. The plans shall be returned electronically with required modifications clearly noted and identified thereon. All comments need to be satisfied and include written responses to all comments prior to final approval.

In addition to the plan submittal, any technical specifications that are appropriate for any portion of the project must also be submitted with the plans. These include pumps, motors, controllers, communication/telemetry systems, special valves, or other items that will ultimately need to be owned and operated by the City.

2.2 Survey Plat

The following sample language shall be incorporated into the plat declaration when right-of-way dedication or public utility easements are being provided:

- Does hereby dedicate to the public forever, for road and utility purposes, the public street right-of-way, as shown hereon. (Street names may be included on the dedication at the discretion of the project surveyor and the county surveyor).

- And further dedicates to the public forever, the public utility easements (P.U.E.) shown hereon, as easement areas for the installation and maintenance of underground utility services and their above ground appurtenance. Utilities shall have the right to install, maintain and operate their equipment and all other related facilities above and below ground within the Public Utility Easements identified on this plat map as may be necessary or desirable in providing utility services within and without the lots identified herein, including the right of access to such facilities and the right to require removal of any obstructions including structures, trees and vegetation that may be placed within the PUE.. The utility may require the lot owner to remove all obstructions at the owner's expense, or the utility may remove such obstructions at the lot owner's expense. At no time may any permanent structures be placed within the PUE or any other obstruction which interferes with the use of the PUE without the prior written approval of the utilities within facilities in the PUE and the City Engineer.

- Where required also dedicate public access easement. This may be separate or coincident with a utility easement. Also identify who is responsible for maintenance (ex. adjacent property owners, HOA, etc.)

- When Bend Parks and Recreation District has agreed to maintain a trail outside of the City right-of-way, the land or public access easement shall be dedicated to the District. This may be done on the plat or by separate document.

- Where right-of-way dedication is required for public purposes and a mortgage or deed of trust encumbrance is shown on a title report, the plat must include a reference to a recorded affidavit consenting to the declaration of the property being subdivided or partitioned and to any dedication or donation of property for public purposes in compliance with ORS 92.075(4).

2.2.1 Shadow Plat

When a shadow plat is required by the City during review of a land division, the applicant shall provide a potential plat that illustrates how future land divisions, right-of-way dedications and/or street connections and utilities can be completed in accordance with City Standards and the Bend Development Code. The purpose of the shadow plat is to facilitate review of the impact on future development by the applicants proposed land division; showing how orderly development can be provided in the future to the adjacent lands.

2.3 Information Required on Plans

In addition to specific information required in 2.4 - CAD Drafting Standards, the following shall be included on all plans:

- Identify the location of all public and private utilities, both existing and proposed

- Street names including area quadrant (i.e. N.E., N.W., S.E., or S.W.)

- Special details for items not shown on Standard Drawings

- Show existing and proposed ROW, property lines, survey monuments and label assessor’s parcel numbers

- City standard title block on all Tier 3 (Infrastructure) right of way permits, having the permit number in the title block on every applicable sheet in the permit set.
- Refer to 10.5 - Survey Data Required on Plans for survey data required on Plans
- Any existing or proposed easements
- North arrow and scale bar

Plan sheets shall be laid out and organized in a fashion that facilitates easy plan reading and interpretation. Typical plan sheets must be laid out to include all storm, water, sewer, roadway, and franchise utilities, where applicable, on the same plan and profile sheet. Scale of the sheet will be determined to maximize readability. If needed due to complexity the utility improvements may be shown on a separate plan sheet than the roadway and storm improvements.

2.3.1 Cover Sheet

All projects shall include a cover sheet. One cover sheet may be used when constructing more than one facility (sewer, storm drain, etc.); however, all requirements for the title sheet must be met. The following information shall be included on all cover sheets:

- Title to include project name, project number, and land use / planning number (when applicable); developers name, address and phone.
- Schedule of Improvements – list of City and water improvements and quantities
- Site plan of the entire project, showing street right-of-way and/or subdivision layout to a scale (typical scale of 1 inch=100 feet). The site plan shall be a composite plan showing the complete site with all applicable street names, existing and proposed utilities, lot numbers and adjacent properties within 100 feet.
- North arrow and scale bar
- Size of the total project area
- Vicinity map providing location of the project (typical scale of 1 inch=800 feet)
- Permanent Survey Bench Marks
- Sheet Index
- Symbol legend. This can be moved to the notes sheet as needed.
- Approval signatures, including but not limited to:
  - City of Bend Engineer
  - Bend Fire Department
  - Franchise utilities

        - PacifiCorp or Central Electric Cooperative
        - Lumin and other applicable telecommunication companies
        - TDS and other applicable TV/internet companies
        - Cascade Natural Gas
    - Applicable Irrigation District (if the site is adjacent to these facilities): Central Oregon Irrigation District / Swalley Irrigation District / Arnold Irrigation District (if the site is adjacent to facilities)
    - Transportation Authorities, when applicable: Deschutes County Road Department / Oregon Department of Transportation / Burlington Northern SantaFe (if detours impact County/State Roads or if the project is directly adjacent to County/State Facilities)
    - Appliable Water Districts (if adjacent to or constructing): Avion Water District, Roats Water District
    - Others

2.3.2 Construction Notes

General construction notes are included within the standard template drawing. Any design engineering notes shall not conflict with City general construction notes unless approved by the City Engineer.

2.3.3 Streets – Plan and Profile Views

- Plan and Profile shall be included on the same sheet and drawn to the same scale
- Vertical and horizontal curve data. Grade breaks must be identified.
- Horizontal curve data must include stationing for start / end and curve radius
- Vertical curve data must include start/end station and elevation, length, k-valve and high/low point station and elevation
- Roadway centerline and stationing along centerline to a minimum of 100 feet beyond proposed project limits or as required due to topography and/or existing utilities
- Slopes of centerline, sidewalk/shared-use paths, and gutter lines, and running slope of roadway
- On profiles, existing and finished grade labeled every 50 feet on straight roadway sections, labeled every 25 feet on curves.
- Match lines and references to continuation sheets
- Continuous stopping sight distance along roadway

- Intersection sight distance and decision sight distance at intersections
- Luminaire quantity table, including alignment station and offset of any luminaire bases. Plan to show bases and yard arm direction. Use of back shields. Luminaire design may be requested on a case by case basis.
- Radii and grades at the ends, midpoint, and 1/4 points of curb returns
- Typical street cross-section location
- Sight distance measurements and protections
- Enhanced crossing design, where required including adequate information for ADA compliance checks including a detailed grading plan
- Bicycle treatments including adequate information for vehicle and bicycle turning movements
- Spot elevations sufficient to demonstrate accessible ramps at all sidewalk/shared-use path intersections
- Counter slope of roadway at ramp
- Slope, utility, and other existing and proposed easements
- Clear vision area at intersections
- Grade of all sidewalk/shared-use paths shall be shown on the profile when deviated from road centerline grade
- Proposed or conceptual locations of driveway approaches. Identify construction of driveways or curb cuts.
- Identify sidewalk/shared-use paths to be bonded, when applicable
- Conceptual trees, placement as required by the Development Code, to identify conflicts
- References to applicable standard drawings
- Existing and proposed access and utility easements
- Approved design deviations, waivers, or modifications
- Dimension strings or callouts for street width, sidewalk/path width, ROW width, etc.

2.3.3.1 Streets - Roundabouts

In addition to specific information required in 2.3.1 - Cover Sheet and in the City's Roundabout Evaluation and Design Guidelines, 2010, (Update Pending), the following shall also be included on all plans when applicable.

- Roundabout inscribed circular diameter labeled
- Approach and Exit alignment and design shown for each leg (include stationing and profiles)
- Centerline stationing and profiles for circulatory roadway
- Concrete Joint Detail Plan
- Speed checks (in design report is ok)
- Site lines based on speed analysis (in design report is ok)
- Design vehicle identified (in design report is ok)
- Turning movement analysis for design vehicle (in design report is ok)
- Vehicle path alignments and path overlap checks (in design report is ok)
- Sidewalks/shared-use paths and crossings including any enhancements (such as RRFBs on multi-lane approaches)
- Bicycle treatments including ramp details
- Splitter island details and curb types, elevations
- Approach and circulatory roadway widths
- Truck apron design details including reveal curb and interior curb details
- Cross-slopes labeled and identified for all roadways including truck apron
- Illumination including pole type and location, wattage, fixture type, horizontal and vertical luminance and uniformity
- Pavement markings and striping
- Signing
- Sight distance measurements and protections
- Grading, drainage, and landscaping

2.3.3.2 Streets - Traffic Signals

In addition to specific information required in 2.3.1 - Cover Sheet, the following shall also be included on all plans when applicable.

- Provide traffic signal removal or reconstruction plan
- Signal quantity table, including location, direction, size and type of MUTCD number of all permanent street signing

- Show location, wiring, and mast arm for intersection street lighting

- Provide traffic and pedestrian signal design showing relationships between signal head placement and lane striping, lines of sight, and pedestrian movements. (Also include bike signal design where applicable.)

- Show signal poles, pedestrian poles, and controller cabinet foundation locations with relationship to sidewalk/shared-use paths and rights-of-way.

- Provide conduit design and location

- Include wiring diagram

- Include phasing and timing diagram addressing vehicle, pedestrian, and bicycle modes as applicable.

- Include detection plan. For loop detectors, show wiring diagram and layout plan. For video or radar detection, include camera/radar placement and detector zone setup and logic.

- Include ITS plan showing how signal and any ITS elements will be connected to the signal system.

2.3.4 Sewer – Plan and Profile Views

- Plan and Profile shall be included on the same sheet and drawn to the same scale (typically on the same sheet as Streets – Plan and Profile)

- Alignment station and offset location of existing and proposed manholes, sewer line, and services in plan and profile

- Stationing along sewer line. Applicable when sewer is deviating from the roadway centerline alignment.

- Alignment station, offset, invert and rim elevations at existing and proposed manholes on profile

- On all manholes with multiple inverts into/out of manholes, clearly identify with directional designation (N,S,E,W, etc.) and notation of direction of flow (in or out)

- Sewer extended to provide service to adjacent properties

- A profile showing sufficient cover and finished street grade and crossing locations showing potential conflicts

- All conflicting public and private utilities indicated up to 100 feet outside of the proposed development or as needed due to topography or existing utility constraints.

- Sewer service provided to each lot with station and offset at end of service line

- Pipe material identified (i.e., AWWA C900 or ASTM D3034)

- Slopes, distances, and diameter of main runs
- Alignment station and offset, slope and invert elevation shown on proposed sewer lines stub-outs for future extension
- Where a line is to be connected to an existing system, the following NOTE should be placed on the final plans: “Contractor shall verify the location of the existing sanitary sewer line before proceeding with trenching. If the location differs from the location shown on the plans, immediately notify the EOR.”
- Include all underground utility (water, sewer, storm, and dry utilities) linework on each plan and profile sheet unless otherwise approved by the City Engineer. For example, when water and sewer sheets are separate from roadway and storm sheets, storm linework should appear on the water and sewer sheets with crossing pipes shown in profile view even if the notes for that facility are on a different sheet.
- References to applicable standard drawings
- Existing and proposed utility easements
- Approved design deviations, waivers, or modifications
- Where applicable, a NOTE stating, “Sewer taps to be performed by City-approved Contractor.”

2.3.5 Water – Plan and Profile Views (typically on the that same sheet as Streets – Plan and Profile)

- Plan and Profile shall be included on the same sheet and drawn to the same scale
- Alignment station and offset location of fittings, fire hydrants and services
- Stationing along waterline. Applicable when water is deviating from the roadway centerline alignment.
- A profile showing sufficient minimum cover and finished street grade and crossing locations showing potential conflicts
- Fire flow requirements
- Utility conflicts
- Service to each lot with station and offset at end of service line
- Pipe curvature radius and/or joint deflection angle
- Fittings specified with alignment stations and offsets
- All fire service lines plan and profile

- Thrust block details, where applicable, including hot tap thrust blocks
- Restrained joint pipe table showing restrained joint lengths for all restrained pipe
- Include all underground utility (water, sewer, storm, and dry utilities) linework on each plan and profile sheet unless otherwise approved by the City Engineer. For example, when water and sewer sheets are separate from roadway and storm sheets, storm linework should appear on the water and sewer sheets with crossing pipes shown in profile view even if the notes for that facility are on a different sheet.
- References to applicable standard drawings
- Existing and proposed utility easements
- Approved design deviations, waivers, or modifications

2.3.6 Stormwater – Plan and Profile Views (typically on the that same sheet as Streets – Plan and Profile)

- Alignment station and offset location of manholes, storm lines, service lines, catch basins, treatment controls, and other appurtenances
- Stationing along main storm line. Applicable when sewer is deviating from the roadway centerline alignment.
- Alignment station, offset, and rim and invert elevations shown at manholes, catch basins, and inlets
- Profile of storm pipe showing cover and finished street grade and crossing locations showing potential conflicts
- All utilities and services with conflicts indicated on profiles
- Pipe material identified
- Slopes, distances, pipe material and diameter of main runs
- Permanent drainage plan, including drainage basin boundaries and areas
- Existing or natural drainage courses, canals, rivers and ponds
- Curb inlet basins on all arterial and collector streets unless otherwise approved by the City Engineer
- Drainage control at low spots and storm sewers at sag curves
- Slope and utility easements
- Utility pole and fire hydrant locations

- Storm facility testing requirements and storm design assumptions (infiltration rates, etc.)

- Storm facility size (amount of drain rock, cubic feet of storage, depth of facility, etc.)

- Storm water information should be on the same plan sheet as street improvements unless otherwise approved by the City Engineer.

- Include all underground utility (water, sewer, storm, and dry utilities) linework on each plan and profile sheet unless otherwise approved by the City Engineer. For example, when water and sewer sheets are separate from roadway and storm sheets, storm linework should appear on the water and sewer sheets with crossing pipes shown in profile view even if the notes for that facility are on a different sheet.

- References to applicable standard drawings

- Approved design deviations, waivers, or modifications

2.3.7 Landscaping and Irrigation Plans

Landscape and irrigation plans are required for any installation that is located within City right-of-way (ROW), except for applications reviewed under the Minimum Development Standards Review (MDS) process in the Bend Development Code or plans submitted with the current Pre-Approved ROW Templates. Required landscape and/or irrigation plans for work within the public ROW must be stamped and signed by a licensed landscape architect defined by the Oregon Revised Statutes. Minimum general specifications for construction must be set forth in the Oregon Standard Specifications (OSS) for Construction and these City of Bend Standards and Specifications.

1. **Landscape Plan** Landscape plans must include the following:

    a. Identify limits of City maintained landscaping and privately maintained landscaping.

    b. Existing and proposed structures, streets, driveways, walkways and other hard surfaces.

    c. Existing and proposed terraces and retaining walls.

    d. Existing and proposed utilities. Tree and utility separation requirements must comply with City standards.

    e. Existing Regulated Trees (six inches or larger in diameter measured at four and one-half feet above the ground known as DBH, for “diameter at breast height”). Include tree type and size. Show all existing trees proposed for removal or relocation.

    f. Existing vegetation areas that will remain as-is including existing turf areas.

g. Proposed protection fencing locations and type of protective measures in compliance with Standard Drawing E-3, Tree/Vegetation Protection Fencing.

h. Existing and proposed signs to prevent conflict with trees and sign visibility. Signs locations must also comply with the separation requirements per City standards.

i. Clear vision areas, intersection sign triangles and sight distance areas. See 12.2.4.5, Street Tree Location and Spacing for clearance requirements.

j. Proposed plant and non-plant materials. Include a planting schedule containing the location, size, species, and quantity of proposed plant materials (at time of planting) and include plant installation timeline.

k. Existing and proposed grading and drainage systems.

2. **Irrigation Plan** Irrigation plans must include the following:

- Specify hydrozones and landscaping features.
- Schematic piping layout and size to water source.
- Location of sleeves under all hard surfaces or construction obstructions.
- Location, type, and coverage of each irrigation zone.
- Location of irrigation controller, flow sensor and master valve by note (if remote-offsite) or symbol.
- Location of backflow device and 'blowout' for winterization.
- Location of all points of connection (POC) and location of irrigation service and meter.
- Table of hydraulic calculations showing all zones and their overall application rate (in/hr) and flow (GPM). Site structures and obstacles that interfere with the coverage and performance of the irrigation system.
- Schedule of heads and/or drip type, numbers of circuits, and sizes of piping.
- References to applicable standard drawings.

3. Specify soil specifications at time of planting.

4. Specify mulch types, applied depth, and location.

5. Include approved design deviations, waivers, or modifications.

2.3.8 Signing and Marking

- Signing Quantity Table, including onsite and offsite signing including MUTCD sign type or legend, size of sign, type of post.
- Existing signing, including MUTCD sign type or legend, to a minimum 300 feet beyond the proposed project limits including size of sign, and condition.
- Proposed signing with MUTCD sign types or legends
- Show any required Type III barricades or road end signage on the plan sheets
- Stations or distances to proposed signing
- Existing signing to be removed or replaced
- Schematics or legends of nonstandard signs
- Existing striping, transitions, and tapers, including lane widths,
- Proposed striping with match points identified
- Proposed lane width and turn bay storage lengths dimensioned
- Line and symbol types and colors identified
- Beginning and end points of tapers, per AASHTO and City of Bend standards, identified with stations
- Removal of existing striping identified
- Striping Quantity Table, including total linear feet of 4-inch line, 8-inch line, 12-inch thermoplastic, and number of symbols by type
- References to applicable standard drawings
- Approved design deviations, waivers, or modifications

2.3.9 Grading, Erosion, and Sediment Control

The following items must be shown on all plans, as applicable.

- Construction entrance(s) / Wheel washes
- Storm Inlet protection
- Tree protection in compliance with Standard Drawing E-3, Tree/Vegetation Protection Fencing / removal
- 1 foot contours for existing and proposed grades. Where steep terrain exists, existing grade contours can be shown at 2-foot intervals.

Contours must be labeled to provide clear understanding of slope direction and grade.

- Slope mitigation (during construction and post construction)
- Concrete washout
- Stock pile areas
- Stream / Waterway protection
- Sediment control
- Indicate whether land is a cut or a fill. Lots in land division must be shown as fill lots when fill exceeds 2 feet over any portion of the buildable lot.
- Show site plan and identify all drainage basins within the area.
- Show erosion control methods.
- Provide cross-sections or profile plans to show existing and final grading where terrain is steep and incurring large cuts and fills.
- Temporary erosion control methods and permanent site stabilization plan
- References to applicable standard drawings
- Approved design deviations, waivers, or modifications

2.3.10 Calculations

The following calculations shall be shown on all plans or separate report as approved by the City Engineer:

Stormwater table in plan set must have the following information:

- Basin title/name and basin size (square foot of impervious and pervious)
- Flow rate (cfs) and volume (gallons and cubic feet) of 25 year and 100-year storm events.
- Drywell capacity and /testing volume in gallons and cubic feet.
- Design infiltration rate.
- Identify the sag low point
- Add label to denote Public vs Private facilities
- Testing volumes

- Amount of drain rock and depth of drywell perforations. Dimensions of swale / drywell.

- Storm runoff hydrograph and drainage system sizing for 25- and 100-year storm events. See COSM for stormwater submittal requirements.

- Calculations for both offsite drainage and existing site drainage

- Pump station and wetwell sizing, including pump station operating parameters (pump curves, etc.)

2.3.11 Traffic Control

Traffic control must be provided with all right-of-way permits where typical travel conditions are altered by the project requirements. The following items must be included:

- Identification of vehicle, bicycle, and pedestrian detours , where applicable. Higher classification streets cannot be detoured onto lower classification streets without City Engineer approval.

    - Detours onto private streets without public access easements from public streets will not be permitted

- Identify the level of traffic stress for existing and proposed bicycle and pedestrian detours including crossings.

2.3.12 City Standard Drawings

The final page(s) within the plan set must include the City standard details that are applicable to that project. This is to ensure the project is constructed and inspected under the standards in which it was designed and ensures contractors are aware of the construction requirements during construction. No more than 8-drawings per sheet will be permitted to ensure they are readable in print.

2.3.13 Design Deviations, Waivers, or Modifications

Note approved design deviations, waivers, or modifications on all applicable sheets.

2.4 CAD Drafting Standards

These drafting standards have been established to facilitate producing drawings that are consistent in appearance and present sufficient information to allow the construction contractor, inspection staff, and City reviewers to know both the broad scope and the details necessary to complete a successful project. Adherence to these standards will:

- Aid in the efficient review and response to of construction plan submittals

- Aid the City in maintaining a complete facilities record of its assets

- Provide an accurate post-construction record of the work

These drafting standards are to be followed by all designers, public and private, who are preparing drawings for the City of Bend. If a project extends, replaces, or calls for

construction of infrastructure or utilities that will become the responsibility of the City, these drafting standards will apply. This applies to all infrastructure projects regardless of the initial funding source.

Questions regarding use of these guidelines should be directed to the City of Bend Utility Division CAD/GIS Group.

2.4.1 National CAD Standards

The National CAD Standards (NCS) were used as the basis for development of the Bend CAD standards. As much as possible of the NCS guidance was used in developing the Bend drafting standards. Use of the NCS modules varies depending on the content and applicability. Much of the NCS guidance is directed at building design and construction and only a small portion is focused on utilities and civil design.

Although the City of Bend templates, standard details, and drafting standards are broadly applicable to utility projects, the information and guidance provided herein is not all-encompassing. When a designer finds a need to add or create a feature not contained or addressed in these standards, their first resource should be the NCS guidance.

2.4.2 Drawing Creation and Layout

The City of Bend has created and provides a standard template drawing to designers. This template is populated with the layers to be used.

Drawings will be available to the public, therefore individual company or engineering firm copyrights will not be permitted to be included on plans.

2.4.2.1 Layer System

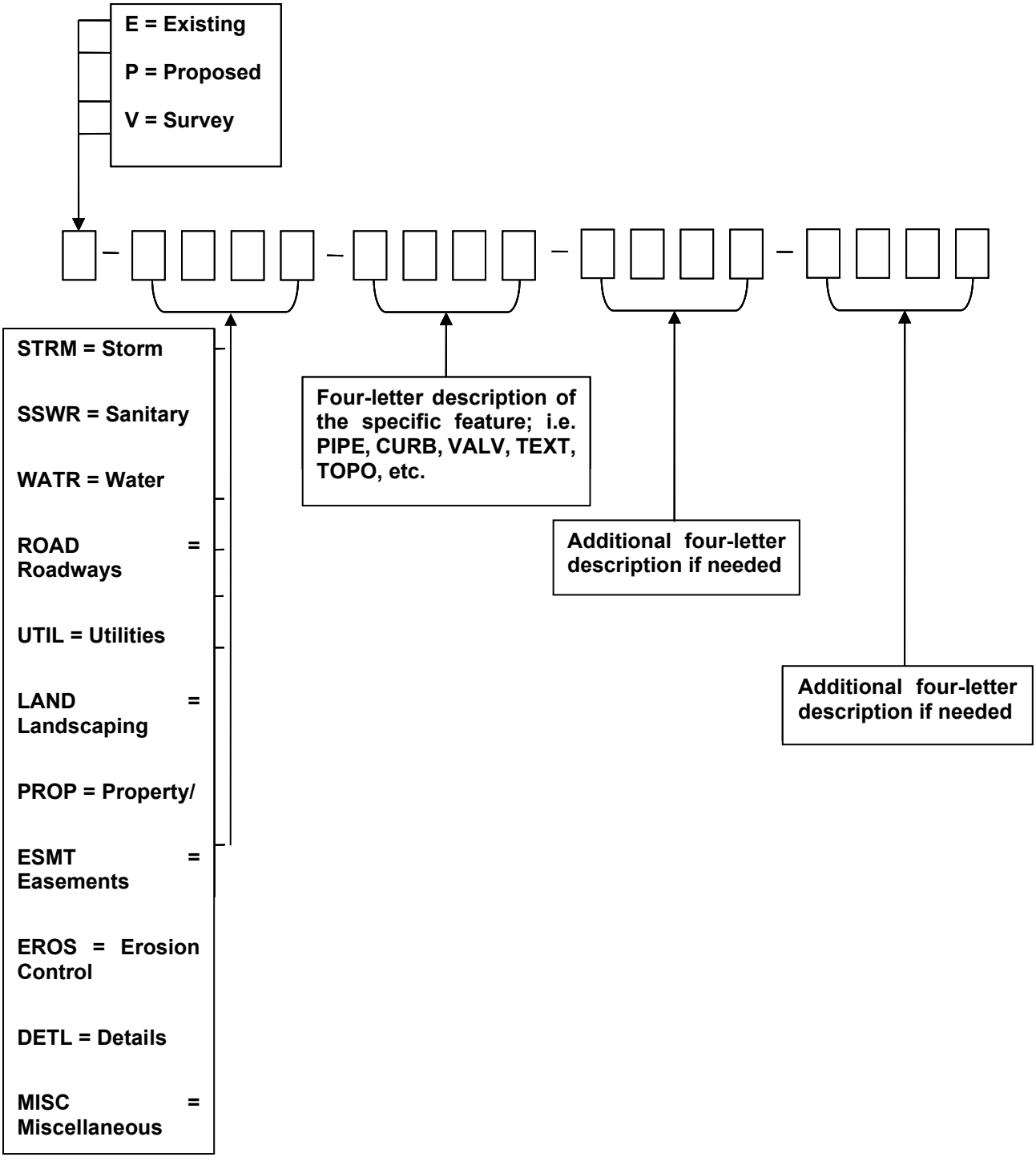
The City of Bend adheres for the most part (but not totally) to the NCS major and minor group layer name format. See Figure 2-1, City of Bend CAD Standard Layer Naming Convention, for a graphic representation of the layer naming format.

If there is an object for which there is no layer name, the designer shall provide a proposed layer name based on the NCS major and minor group layer name format. At the earliest opportunity, the designer will submit new layer name(s) including the layer/object description to the City for approval. The City will either approve the new layer name or may require the designer to modify the layer name. Once approved by the City, that layer name may become part of the City's list of layer names for all subsequent projects.

No layer names, other than those in the City's layer name list or those having received City approval prior to completion of the design, will be present in drawing files. Exceptions are those layer names automatically created by AutoCAD: "0", "DEFPOINTS".

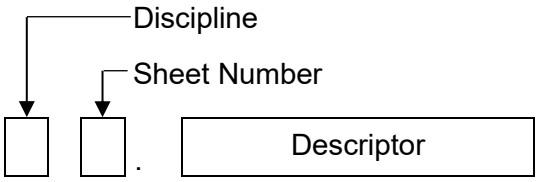
Layer names created by third party software or add-ons, including Autodesk add-ons, will **Not Be Accepted**.

FIGURE 2-1
City of Bend CAD Standard Layer Naming Convention
City of Bend: CAD Drafting Standards and Guidelines



2.4.2.2 Sheet/File Naming Convention

All sheets uploaded to be reviewed must follow the naming convention described below. All file names must be CAPITILIZED.



Discipline	Designation
Architectural	A
Civil	C
Franchise Utilities	F
Geotechnical	G
Landscape	L
Signs/Striping	N
Structural	S
Survey/Mapping	V
Other Disciplines	X

Examples
C1.Utilities
C2.Row
C10.Details

Common Descriptors	Designation
Architectural Site	Site Plan
Architectural Other	Other
Civil Demolition Structure Removal and Site Clearing	Demo
Civil Grading Excavation, Grading, Drainage, Retention Ponds	Grading
Civil Improvements Pavers, Flagstone, Exterior Tile, Furnishings, Retaining Walls, and Water Features	Improvements
Civil Private Streets, Bridges, and Parking Lots	Private
Civil Survey (Site) Plats, Topographic, Dimension Control	Site Plan
Civil Transportation Waterway Construction, Streets and People Movers	Transport
Civil Utilities Water, Sanitary Sewer, Storm Sewer, Franchise Utilities	Utilities
General Cover Sheet	Cover
General Notes	Notes
General Details	Details
General Contractual Phasing	Phasing
Landscape Demolition Protection and Removal of Existing Landscaping	Demo
Landscape Irrigation	Irrigation
Landscape Planting	Planting
Structural Demolition Protection and Removal	Demo
Structural Site	Site Plan
Structural Substructure Foundations, Piers, Slabs, and Retaining Walls	Structure

Where there are mixed Descriptors (example: road and utilities), the submitter may choose one or the other descriptor, but will be consistent throughout the submittal. All files must

be named the same with each subsequent submittal during the review process. If there is not a descriptor listed in the provided table, the submitter can choose a single work descriptor that is obvious to the reviewer.

2.4.2.3 Borders and Title Blocks

Standard City of Bend borders and title blocks will be used on all drawings unless otherwise allowed. The City's standard template drawing provides the borders and title blocks for all users. Upon creation or revision of a drawing, the information/attributes inserted into the title block of the drawing shall be revised. All information relevant to finding the file, plotting the file, and dating the plot shall be listed in the appropriate area of the title block. Regardless of the title block location or size, the title block shall contain the following:

1. Project name
2. City's project/permit number
3. Firm/Agency name and/or logo and designer's name
4. Drafter's name
5. Plan checker's name
6. Date of last edit
7. Engineer's stamp
8. CAD file name
9. Other plotting codes
10. List of revisions during construction, if applicable. Date and description.
11. "Asbuilt" identifier at the end of the project's construction

2.4.2.4 Coordinate System

To allow for easy integration of existing and new data, as well as updates of City maps and City geographic information system (GIS) databases, all plans, maps, and exhibits shall be prepared in Model Space using the Deschutes County Coordinate System (DCCS). The DCCS is a commonly used coordinate system, well-monumented within the City and available to all designers. It is also referred to as the "Central Oregon Coordinate System" and the "Deschutes County Grid". In any case, the basis for the coordinates is common to each. Topographic map information and DCCS data are available from the City of Bend Public Works Department. Specific information regarding the basis for, development, and use of the DCCS is also available from the Deschutes County Surveyor's Office:

Deschutes County Surveyor's Office
61150 SE 27th St.
Bend, Oregon 97702
Phone 541-322-7145 Fax 541-388-2719

2.4.2.5 Text

The City of Bend standard text styles named "_ _ SCALE TEXT" are stored in the template drawing, where _ _ is the scale of the drawing.

(Text styles were created using SanSerif at .1 minimum height in paper space)

Open style (_style) and select the proper "_ _ SCALE TEXT".

All text shall be entered using the multiline text (_mtext) feature.

2.4.2.6 Dimension Style

The City of Bend standard dimension styles named "_ _ SCALE DIM" are stored in the template drawing, where _ _ is the scale of the drawing. Open the dimension style manager (_dimstyle) and select the proper "_ _ SCALE DIM".

(Line type scale (_lts) shall be set to "1" for dimensions to display correctly).

2.4.2.7 Leader Lines

The City of Bend standard multileader styles named "_ _ SCALE MLEADER" are stored in the template drawing, where _ _ is the scale of the drawing. Open the multileader style manager (_mleaderstyle) and select the proper "_ _ SCALE MLEADER".

Leader lines are commonly used to identify specific objects or to point out features that may otherwise be overlooked by the plan reader. All leader lines shall terminate with an arrowhead indicating the object of the reference. Good drafting practice avoids leader lines that are:

- Horizontal or vertical
- At the same angle as cross-hatching
- At very small angles to the terminating surface
- Parallel to extension or dimension lines
- Curved
- Crossed
- Too long

Crossing dimensions and leaders are generally to be avoided. When necessary, the leader lines are to be broken so that the lines will not physically cross on the paper.

Multileader lines (_mleader) shall be used for all leader lines.

(Line type scale (_lts) shall be set to "1" for leader lines to display correctly).

2.4.2.8 Blocks

Title blocks, scale blocks, detail titles, detail call-outs and north arrow blocks are pre-populated within the standard template drawing.

2.4.2.9 Symbols

Most commonly used symbols are embedded and pre-populated within the standard template drawing at 1″=20′. The drafter shall scale symbols appropriately for other drawing scales.

For example:

- For 1″=10′ insert or scale symbols by 0.5
- For 1″=30′ insert or scale symbols by 1.5
- For 1″=40′ insert or scale symbols by 2
- For 1″=50′ insert or scale symbols by 2.5
- For 1″=100′ insert or scale symbols by 5

Many design symbols contain attributes to be populated with data specific to that asset. All data acquired during the design process shall be attached to the appropriate symbol using the 'existing' facilities layer.

Table 2-1 provides a listing of project symbols for which attributes are required as part of the new design. These attributes should be shown on the 'proposed' features layer.

TABLE 2-1
Attributed Symbols
City of Bend: CAD Drafting Standards and Guidelines

Topographic Features		
Benchmark	Irrigation Controller	Telephone Riser
Coniferous Tree	Mailbox	Utility Vault w/Manhole or Hatch
Control Monument	Monument (found)	
Deciduous Tree	Monument (set)	
Gas Meter	Railroad Crossing Arm	
Gas Valve	Telephone Manhole	
Sanitary/Storm Sewer Systems		
Catch Basin	Culvert	Drywell
Cleanout	Ditch Inlet	Manhole
Potable Water System		
Air Release Valve	Fire Department Connection	Pressure Regulator Valve
Blow off Valve	Fire Hydrant	Pressure Relief Valve
Butterfly Valve	Flanged Gate Valve	Single Detection Check Valve
Check Valve	FL x MJ Gate Valve	Utility Vault
Combination ARV	Gate Valve	Water Meter

TABLE 2-1
Attributed Symbols
City of Bend: CAD Drafting Standards and Guidelines

Double Detection Check Valve	Pressure Reducing Valve	
Transportation System		
Bridge	Striping (Incl. Bike Lane and buffer, marked, Crosswalk)	Traffic Signal Control Box
Curb (Incl. Curb Cut, Paint, Ramp)	Traffic Calming (Incl. Chicane, Diverter, Median Island, Splitter Island, Mini Traffic Circle, Speed Hump)	Traffic Signal (with mast arm)
Guard Rail		Utility Pole
Retaining Wall		Utility Pole with Light
Sidewalk/shared-use path		City owned street light
Sign		

Should the designer require use of a symbol not found in the standard template drawing, the NCS library of symbols (Module 6) is the first resource. At the earliest opportunity, the designer will submit new symbol(s) including the symbol description to the City for approval. The City will either approve the new symbol or may require the designer to modify the symbol. Once approved by the City, the symbol may become part of the City's list of symbols for all subsequent projects.

2.4.3 Electronic Drawing Format/Naming convention

All drawings shall be produced, saved and submitted in full compliance with the most recent or prior version of AutoCAD® software at the time of submission (file extension = .DWG). Current file save AutoCAD 2018 or newer format. Drawing will be named as CAD-<Project #>.dwg.

2.4.4 Units

Drawing setup/units shall be set to the following:

- Linear units = feet
- Angular units = degrees
- Angle display style = bearings

Display precision settings shall be as follows:

- Linear = 2
- Elevation = 2
- Coordinate = 2
- Angular = 4

Drawing units (units) shall be set to the following:

- Length Type = Decimal
- Length Precision = 0.00
- Insertion Scale = Feet
- Angle Type = Deg/Min/Sec
- Angle Precision = 0d00′00″

(Calculate to the fourth decimal place but label to the second decimal place).

2.4.5 Scale

For line types to display correctly, drawing scale must be set to appropriate scale of drawing. Whenever drawing scale is changed, line type scale (_lts) shall be set back to “1” for line types, leader lines, and dimensions to display correctly.

Graphic scales are embedded and pre-populated within the template drawing and are required on all maps and graphics.

All plan views and horizontal scale of profiles and cross-sections will be drawn in scale 1:1 in model space. Vertical profile scales will vary from project to project and may be selected by the designer. Vertical scales should be selected to minimize the number of view breaks on a sheet.

Certain details may need to be drawn with different horizontal and vertical scales. Horizontal work must be proportional to itself and vertical work must be proportional to itself.

There are a very few instances where it is not practical to draw details to any scale; Where drawings are intended to be diagrammatic or schematic, and for those instances only, a scale will not be required. Such drawings will be noted “NOT TO SCALE”.

Plots for projects will be produced at a scale commonly used by the engineering profession (that is, 1″=10′, 1 =20′, 1″=30′, 1″=40′, 1″=50′, 1″=100′).

Vertical scale for cross-sections and profiles will be drawn to a scale in the same ratio as the final plotted product. For example, if the final plot is horizontal 1″=20′, and the vertical 1″=2′, then the vertical scale is 10 times that of the horizontal so it will be drawn 10 times larger than 1:1.

The practice of drawing at a scale different than 1:1, then making a block with the parts and inserting the block to represent a 1:1 scale, **will not be permitted**.

Drawing sheets that are not scale relevant, such as construction notes, shall fill the scale attribute box on the title block with the notation “N/A”. The notation “NTS” or “NOT TO SCALE” shall be left to those drawing files that are scalable, but are shown in a scale not measurable with a typical engineering scale, such as details, schematics, etc.

2.4.6 GIS Interface

The City intends, where applicable, to standardize how asset information is captured, stored, and presented in design drawings, with an emphasis on improving the quality and condition of the City's geodatabase and improving staff efficiencies. This goal is reached through an exchange of the information found on design drawings created by a CAD drafter and used by a GIS technician. Together this creates a system allowing electronic transfer of a subset of asset information embedded through the use of attributes in CAD drawings.

The effort to develop a standard for attributed features in the CAD standard template drawing, is currently in development. Many of the more common symbols provide the opportunity to include this attribute information. Once the standard is developed, City staff will provide a list of features that will require attributes as part of the design, along with detailed instructions regarding the process for attaching attributes describing these individual assets.

2.4.7 Line Types, Weights, and Colors

Line types, weights, and colors have been predefined and associated with the appropriate layer within the standard template drawing.

Line type scale (_lts) shall be set to "1" for line types, leader lines and dimensions to display correctly.

2.4.8 Sheet Layout

All sheets shall include the City of Bend's title block, which is included within the standard template drawing. All appropriate information shall be filled in.

2.4.9 Model Space and Paper Space

All line work shall be in model space.

Standard details and special details shall be in paper space.

Title blocks shall remain in paper space with the use of a viewport for appropriate scaling of the drawing. The viewport shall be on layers:

"G-MISC-VPRT" for a viewport border that will plot, or "G-MISC-VPRT-NPLT" for a viewport border that will not plot.

2.4.10 Drawing Orientation

North arrows are embedded and pre-populated within the template drawing and are required on all drawings where applicable.

Drawings should be typically oriented so that north is the top or right on all sheets. In general the north arrow shall be oriented to allow project stationing to increase from left to right.

North arrows will be inserted in the upper right corner of the sheet. Exceptions may be made, but consistency should be maintained throughout the drawing set.

2.4.11 Standard Details

Standard details are available in PDF format and shall not be altered. If a designer wishes to use portions of a City of Bend standard detail, redrafting is allowed; however, this will create a “special detail” (see below) with a unique assigned number. All City of Bend standard details used on a project must be inserted on a detail sheet(s) in the plan set.

Standard details shall be inserted on the “G -DETL-STND” layer on the detail sheet(s) in paper space at a 1:1 scale.

2.4.12 Special Details

Special details may be created specifically for the project by the designer when standard details are not suitable. Special details will be drawn in paper space on the following layers:

- G-DETL-BOLD
- G-DETL-BOLD-DASH
- G-DETL-DIMS
- G-DETL-FINE
- G-DETL-FINE-DASH
- G-DETL-MEDM
- G-DETL-MEDM-DASH
- G-DETL-PATT
- G-DETL-STND
- G-DETL-TEXT
- G-DETL-TITL
- G-DETL-TTLB

Special details will be called out numerically, with the detail number used only once. Special details will be called out on the plan sheet with an embedded and pre-populated detail call-out block within the template drawing, where the top number is the detail number and the bottom number is the sheet on which the detail is found.

2.4.13 Terms and Abbreviations

Abbreviations shall be used only when enough room is not available to spell out the word. If there is any question as to the meaning of an abbreviation, spell out the entire word. Refer to Part I Section 4 of the standard and the NCS terms and abbreviations for all terms and abbreviations.

2.4.14 External Reference (Xref)

Any external reference that was used to create a drawing shall be bound to the drawing and all objects will be transferred to the appropriate layers.

External References Shall Not Be Accepted.

2.4.15 Professional Stamps

Use of professional stamps or seals shall follow the Oregon Revised Statutes (ORS) Chapter 672 regulations. Professional stamps shall be included on all final drawings and plan sets submitted for review for the discipline represented by the work. The placement of the stamp will be within the title block. Professional stamps may be either electronic or manually applied at the licensee's discretion.

2.4.16 Plot Styles

Autodesk-Mono.stb has been set in the plot style table within the standard template drawing and shall not be altered.

Plot styles have been set to proper screening within the template drawing and shall not be altered.

2.4.17 Drawing Submittal

Complete drawing set (DWG) shall be submitted fully compliant with the City's CAD Drafting Standards and Guidelines.

All drawing files shall have all layout tabs zoomed to extents (z) (e), prior to any submittal to the City. All drawing files shall be saved with the first layout tab active.

All final drawing files shall be fully purged (purge) prior to final submittal.

All final drawing files shall be saved and submitted with the current layer set to "0".

Consultants shall obtain a file number for the project and make sure that the appropriate information is completed in the title block. File numbers can be obtained from the Project Engineer.

Standard drawing size shall be 22" x 34"

At the conclusion of the project, the designer shall submit a hard copy (minimum of 20 lb., ultra-bright bond paper, 22″ x 34″), a DWG and corresponding image (PDF Format) file of the project drawings in electronic format (CD, DVD, USB). PDFs shall be combined into a single file. Every sheet in the record set of construction drawings needs to have a corresponding (1:1) image file. The image may be produced directly from the CAD application or scanned from the hard copy. Regardless of production method, **the image file must match the content of the CAD file and hard copy for each sheet submitted**. Sheets shall be in landscape orientation with the title block to the right of the sheet, arranged in the order that they are to be printed, and the set assembled matching the drawing index order.

When a project is designed by a consultant who uses the collaboration of sub-consultants, the prime consultant shall be responsible for all submittals of electronic and paper drawing

files. Electronic submittals shall be in the form of a single media (1 CD/DVD/USB) and shall include the entire project. All electronic media shall be labeled, including the project name, City's project number, design firm name and submittal date.

2.4.18 City Standard Template

An example cover sheet and required construction notes for Tier III ROW permits is provided as Part VI – Appendix A – Example Tier III ROW Plan Set.

2.5 Final Plan Submittal

The final plan, with all required signatures, is to be submitted to the City of Bend Permit Center or designated Division/Department office for approval. Submittal will include one full mylar plan set and one additional coversheet. The additional cover sheet may be bond or mylar, being returned to the engineer after being signed by the City Engineer and Bend Fire Department. The engineer submitting the plans is required to determine the appropriate signatures of all private utilities and/or agencies being affected by this project. The cover sheet must be signed prior to delivery to the City for signature. Final mylar documents must not be in color to ensure easy document reproduction and scanning, with line types, line weights, and text legible and sufficient for archiving. With submittal of the final mylars, an electronic (see 2.4.17 - Drawing Submittal) copy of the entire plan set must be provided to the City, uploaded to the City's permitting software. The electronic copy may be requested on CD, DVD, or USB depending on the file size or project manager. All files necessary to reproduce the complete set of construction documents must be included on the upload/disc. Drawing files must conform to the City of Bend CAD Standards, text files in MS Word, and spreadsheet files in MS Excel. All final plans must have the Professional Engineering stamp wet signed or digitally signed in accordance with ORS 672 and OAR 820.

2.6 Revised Plan Submittal

If any revision is needed to the approved plans during construction, the Engineer of Record must sign and date each revision. A revision cloud must be placed on the plan set where changes are required from the approved construction document. All revisions to the approved plans must be approved by the City prior to construction. Revision clouds are not to be on final approved documents or as-builts. A revised CAD file will be provided when requested by the City.

At the completion of the project, a completed Record Drawing, or As-built, will be provided to the City in a .pdf format, incorporating all revisions. When required by the City or Project Manager, the designer is responsible for submitting one complete mylar plan sets, consistent with the Record Drawing Plan Submittal requirement in 2.7, that reflect all revisions or changes made to the drawings. Such a revision shall also require that a new set of electronic drawings with the revisions be submitted to the City. Failure to submit final Mylar's and pdf files(s) will result in the performance and/or warranty bond on the project not being released until this requirement is met.

2.7 Record Drawing Plan Submittal

Prior to recording a plat or providing certificate of occupancy, record drawings (pdf and CAD files) for public infrastructure improvements shall be submitted to the City of Bend

along with completed inspection forms and warranty documents. The record drawings shall include the full set of approved construction documents approved by the City under the Final Plan Submittal with all changes applied to the drawings from approved plan modifications and/or engineer of record (EOR) observed changes that have occurred during construction. Field notes shall be provided as a separate document, if applicable. Refer to Part IV - Construction Observation and Inspection Requirements. The record drawings shall show the following:

- Have all modification clouds removed. These are records of what was constructed, not what was changed from the original approved construction set
- All construction plan sheets signed and stamped by the EOR
- Each sheet's title block containing the permit number and "Record Drawings"
- The cover sheet shall contain the following language in a box:

I certify that this project has been constructed in substantial compliance with the City approved plans and the City of Bend Public Improvement Construction Procedure Standards and Specifications date (XXXX edition). This certification is based on periodic inspections performed by me or by representatives under my direct supervision and information provided by the Construction Contractor and other independent testing and inspection agencies. The information provided by other has been assumed to be correct and has not been verified by the Engineer. This certification indicates that I have reviewed this information and verified that any revision(s) or change(s) as defined by the record do not appear to be adverse to the planned use and/or intent of the original design.

_____

Engineer of Record Signature *Date*

- The City's review staff may conduct site visits with the application of the record drawings to verify conditions and identify the need for additional easements. Part of this review is verifying sidewalk/shared-use path and curb cut installations as this may affect the submittal requirements and permits needed during a lot's development. This does not remove the requirement for all permittees to provide picture submittals of the lot frontage to show existing conditions at the time of lot development. The City may require additional fees be paid to the City if the record drawings are not correct.

2.8 Notice to Proceed

Before construction is started or resumed, final approval of the documents by the City Engineer, or designee, must be obtained, approval by any other affected agencies must be obtained, amended Agreements with the City of Bend must be obtained, and any required fees must be paid. Upon receiving approval of the Construction plans, the City will provide a Notice of Completion that indicates remaining items needed by the City for the project to proceed into construction.

A pre-construction meeting shall be held prior to the issuance of a Notice to Proceed (NTP). Prior to a pre-construction meeting being scheduled all required permit plans must

be approved, all required fees have been paid and all paperwork, such as Public Improvement Facilities Agreements (PFIA), are complete. In addition, proof of all bonding required, proof of insurance, any relevant certifications will be presented and copies of signed contracts related to the project must be shown. During the pre-construction meeting inspection requirements for the project will be reviewed that are relevant to the project. Inspection requirements are spelled out in Part IV - Construction Inspection Requirements. These requirements should be considered from the beginning of design. Notes during the pre-construction meeting will be taken by the City's review engineer and/or inspector. The notes from the pre-construction meeting will include all in attendance, contact information including emergency contacts, and identify all key points discussed in the meeting. The notes will be signed by the project's applicant City, contractor, and/or owner. A copy of the notes with signatures will be provided to the contractor, the engineer of record, project manager (if different than the engineer of record), with the pre-construction meeting minutes maintained within the project files and the inspector will retain the originals in their files for that project. Once all preconstruction requirements are met, a Notice to Proceed will be provided. See Part IV - Construction Inspection Requirements, for an example template for preconstruction meeting that will be used on all projects.

2.9 Right-of-Way Permit Expiration

After any Engineering Permit (i.e., Right-of-Way Permits, Grading Permits, Rock Crushing Permits, Sewer Water Analyses, Traffic Analyses, etc.) has been submitted to the City for review but prior to issuance, the permit will expire after 180 days of inactivity. After a permit is issued, an inspection must be called in within 180 days from the date of issuance and construction must be completed within 365 days from the date of issuance or the permit will expire. Permit extensions requests must be submitted in writing for City Engineer approval prior to the permit expiration.

Streets and Temporary Traffic

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3 Streets

The City of Bend plans and implements an interconnected network of complete streets and trails that provide safe, optimized travel for all modes. The system is intended to increase connectivity, safety, and travel time reliability while encouraging walking, biking, and opportunities for using transit. All new and reconstructed streets in the City of Bend, public or private, will be complete streets.

Complete Streets allow the City of Bend to meet its transportation goals by providing safe and efficient spaces for different travel modes. As transportation technology evolves there is an increase in people choosing to use a wider variety of human, electric, and other powered devices to travel. Additionally, automated vehicles are developing at an accelerated pace. Designers are challenged to categorize the various nuances of each of the travel options and incorporate them into designs for today while providing infrastructure resiliency for the future. For the purpose of these standards and to simplify references to all the different travel modes, the following three mode types are referenced:

- Drivers - people driving or riding in motor vehicles, electric cars, automated vehicles, delivery vehicles, transit, trucks, emergency vehicles, and other vehicles operating at a motor vehicle speed and scale

- Pedestrians – people walking, using mobility devices, or using other devices (such as skateboard, manual scooter, etc.) that operate at a pedestrian speed and scale

- Bicyclists – people riding bicycles or using other devices (electric scooter, one-wheel, etc.) that operate at a bicycle speed and scale

Transit users are not listed as a separate category; they are typically a combination of one or more other modes: drivers, pedestrians, and/or bicyclists.

A complete street in the City of Bend is a street that serves people of all ages and abilities traveling safely using a variety of modes. It is a street designed and operated to prioritize safety, comfort, and access to destinations for people walking, biking, driving, and taking transit. A key element of complete street design is creating travel routes that are more comfortable for people walking and biking, including easier ways to cross the street.

While it is the intent that every street serve all modes (driving, walking, biking, and transit), the priority and range of modes served will vary by classification, location, and other factors. Some streets may be more oriented toward the pedestrian with slower and fewer vehicles, and others may provide enhanced bike lanes and shared use paths with higher vehicle volumes and speeds. Trucks, buses, and emergency vehicles are accommodated in different ways depending on the context and need.

The following street standards are required to be used when planning, designing and constructing public and private street facilities in right-of-way and public access facilities within the City of Bend. The City may require limited conceptual design to extend beyond a project's scope (a shadow plan) to determine if the installation of proposed infrastructure (streets, drainage facilities, etc.) have the potential to conflict with future improvements or access to another adjacent property. Proposed improvements must be designed to

accommodate and not impede future utility, driveway, or pedestrian access to another property and other property's ability to develop.

These street standards shall be used to support the design and construction of land use requirements, exactions and mitigations within the City of Bend as well as public works projects implemented outside of the land use process.

3.1 References

Designs shall conform to the City of Bend Standards and Specifications, as well as current versions of additional references specified in various subsections. Roadway design shall comply with minimum design standards as shown in the standard drawings. Additional references include, but are not limited to:

- City Development Code and Ordinances of the City of Bend
- A Policy on Geometric Design of Highways and Streets (AASHTO)
- Manual of Uniform Traffic Control Devices (MUTCD)
- Oregon Supplements to the MUTCD
- Highway Capacity Manual (TRB)
- Roadside Design Guide (AASHTO)
- Public Right-of-way Accessible Guidelines (U.S. Access Board)
- City of Bend Roundabout Design Manual
- City of Bend Signing and Marking Manual
- City of Bend Complete Streets Guide
- Oregon Standard Specifications
- Oregon Traffic Line Manual
- Oregon Signal Design Manual
- Oregon Bridge Design Manual
- Oregon Sign Design Manual
- ODOT Analysis and Procedures Manual Chapter 14 Multimodal Analysis,
- Low Stress Bicycle Network (Transportation System Plan Figure 5-1),
- Pedestrian Connector Routes and Crossings Map (Part VI – Appendix C)
- Guide for the Development of Bicycle Facilities, AASHTO

- Urban Bikeway Design Guide, NACTO
- All other referenced documents cited herein

3.2 Deviation from Streets Standards

The City of Bend provides for roadway designs that are flexible and reflective of their context while meeting current safety and operations standards. There may be times when compliance with the City of Bend Standards and Specifications is not possible and the City's design standard deviation process shall be followed to receive approval from the City Engineer. The City Engineer may delegate review authority.

This standards deviation process shall not be used to override a requirement of a land use decision once finalized. The City's Bend Development Code has provisions for requesting modifications to land use requirements. Except as provided elsewhere in other City codes, resolutions and land use actions, written requests for deviations from these streets standards shall be reviewed and may be granted by the City Engineer according to the criteria outlined in Part I - Section 2 as well as the following additional review criteria for Streets Standards:

- The deviation is required due to extreme topography or natural resource constraints
- The deviation is required due to inconsistencies with the function of the street and the adjoining land uses
- The proposed alternate provides a complete street and meets low stress network requirements or includes appropriate mitigation
- The request specifically addresses the deviation review criteria found in 1.2 - Deviations, Waivers, or Modifications and those review criteria for the subject standard as provided within this section.

3.3 Design Considerations

3.3.1 Traffic Studies

The City requires two types of traffic studies:

- Land use traffic studies
    - Transportation Facilities Report (TFR) – study required with development applications per the Bend Development Code Chapter 4.7.4
    - Transportation Impact Analysis (TIA) – study required with development applications per the Bend Development Code Chapter 4.7.5
- Design Traffic Study
    - Design Traffic Study – study required to support street and intersection design per this section

This section defines Design Traffic Study requirements for public and private roadway and intersection projects. The Design Traffic Study, as opposed to a Traffic Impact Analysis Study provided within a land use action, is used to guide all design and construction aspects of the project. The Design Traffic Study will be used to identify concept designs, intersection control type, lane configurations, queue storage, access management needs and pedestrian crossing needs, pavement design, roadway geometrics, drainage methodology and right-of-way needs, etc. The Design Traffic Study shall identify a need for higher order intersection control and as provided for herein, shall identify and study control warrants. The Traffic Study will identify the type and location of any required low traffic stress route or crossing along with any connector routes or crossings.

The Traffic Study will identify and evaluate the following elements as part of the complete street network design:

- Safety
- Existing volumes
- Forecast volumes
- System context (relationship of land uses with transportation system)
- Local context (ROW, design vehicle)
- Anticipated users of various modes including passenger vehicles, trucks, bicyclists, pedestrians, and transit
- Operations
- Corridor influences (upstream and downstream controls, railroad crossings, etc.).
- Any design elements or mitigation measures identified in the TFR/ TIA
- Connectivity to adjacent streets, sidewalks/shared-use paths, bike facilities, and transit routes including low stress routes and connector routes

These should be identified and evaluated in order to facilitate a context sensitive design that implements current design standards, safety features, and efficient operations to serve all road users including drivers, pedestrians, bicyclists, and transit users.

Operational analysis shall be provided for the existing traffic conditions, as well as the design year of the project, which is typically based upon the City's current twenty year planning model. Lane configurations, vehicle delays, queuing, and level of service results should be provided to support concept development as well as for the final chosen configuration.

Turn lane storage length shall be separately accounted for when providing the tapers and shall be based on the analysis of the design year's 95^{th} percentile queuing.

Operational analysis for traffic control other than roundabouts (i.e. traffic signals, stop signs) shall be performed using Highway Capacity Manual methodologies except as otherwise allowed by the City Engineer.

Operational analysis for roundabouts shall be performed using methodologies in the City's Roundabout Evaluation and Design Guidelines, 2010, (Update Pending) except as otherwise allowed by the City Engineer.

Complete the Intersection Form Evaluation in the Roundabout Evaluation and Design Guidelines, 2010, (Update Pending) and submit for City Engineer approval of the traffic control as part of the operational analysis for roundabouts, traffic signals, and all way stops on collector and arterial streets.

Where traffic signals are the recommended form of traffic control, optimized signal phasing shall be developed as part of the operational analysis and incorporated into the design. Impacts to system performance shall also be evaluated for traffic signals proposed within signalized corridors.

3.3.2 Intersection Controls

Intersection controls provide right-of-way guidance to street users at intersections. Traffic control shall be provided per the most recently approved guidelines of the MUTCD, these standards, the Roundabout Evaluation and Design Guidelines, (Update Pending), and the approved intersection Form Evaluation. Additional information on stop control is provided in the Signing and Marking manual.

Roundabouts are the preferred intersection form over a traffic signal for safety benefits (fewer and less severe crashes). The intersection Form Evaluation is required to confirm the capacity, traffic flow, and overall benefits between a roundabout and a signal and to present a recommendation for City Engineer approval.

Traffic signals will be considered only where shown to meet MUTCD warrants, and where overall intersection safety and operation will be improved, as indicated by the traffic study and approved Intersection Form Evaluation. Emphasis is placed on the satisfaction of Warrant 1, Eight-Hour Vehicular Volume, and Warrant 7, Crash Experience (using the three most recent years for which crash data is available). Warrant analysis should be performed using 14-hour traffic volumes based on actual counts.

3.3.3 Design Speed

Design speeds are established based on the context and road classification to serve the differing mobility needs for all user types. Slower speeds improve safety for all users and are a significant factor in reducing crash severity and number.

Standard design speeds are provided below for each of the City's roadway classification designations.

Context	Arterial*	Collector*	Local*#
Downtown, Core Area or Business District	30 mph	25 mph	25 mph
Other Areas	35 mph	30 mph	25 mph

- # The design speed for constructed greenways is 20 mph.
- * The design speed of 20 mph may be used for multi- block segments (3 blocks minimum) that meet the ORS requirements for business districts and are or will be posted as statutory 20 mph speed zones.

The design speed for alleys and woonerf/ plaza streets is 15 mph.

Design speeds shall be consistent throughout a cohesive segment of a roadway corridor. Changes in design speeds from one segment to another shall be strongly identified through design feature changes to encourage compliance with posted speeds and to model the street form after the abutting land use form. Where the existing designated speed is lower, or where higher and the context has not change sufficiently for a lower speed limit to be issued; that speed limit is used. A standards deviation to utilize lower speeds may be requested of the City Engineer to reflect existing speeds on a corridor or changes in context (abutting land use, multi-modal use and crossings, etc.).

A standards deviation to utilize lower speeds may be requested of the City Engineer to reflect existing speeds on a corridor or changes in context (abutting land use, multi-modal use and crossings, etc.) following the general criteria in the Oregon Department of Transportation (ODOT) Speed Zone Manual for setting speed limits. A street may be posted for a lower speed limit via the official speed order issued by ODOT, but horizontal, vertical, and sight distance is to be based on the speed design table above unless otherwise approved by the City Engineer.

While the local street design speed is 25 mph, a local street being modified as a Greenway may add traffic calming elements based on a 20 mph design speed where the greenway meets the criteria and a 20 mph speed sign will be posted.

See the Signing and Marking manual for posting speed limits (statutory limits and requests for new limits or changes to existing limits). Speed limits are set following the general criteria in the Oregon Administrative Rule, Revised Statutes, and the Oregon Department of Transportation (ODOT) Speed Zone Manual.

3.3.4 Sight Distance

A driver's ability to see ahead is of the utmost importance in the safe and efficient operation of a vehicle on a roadway. Designers should provide sight distance of sufficient length, as determined by AASHTO, for a driver to control the operation of a vehicle to avoid striking an unexpected object in the traveled way.

3.3.4.1 Stopping Sight Distance, Decision Sight Distance

All streets shall be designed to provide adequate Stopping Sight Distance (SSD) continuously along the roadway, based on the design speed and in accordance with the Table 3-1 and 3-2, AASHTO "A Policy on Geometric Design for Highways and Streets", 7th Edition (2018).

Design Speed (mph)	Brake reaction distance (ft)	Braking distance on level (ft)	Stopping sight distance – level		Stopping sight distance on Grades					
			Calculated (ft)	Design (ft)	Downgrades			Upgrades		
					3%	6%	9%	3%	6%	9%
15	55.1	21.6	76.7	80	80	82	85	75	74	73
20	73.5	38.4	111.9	115	116	120	126	109	107	104
25	91.9	60.0	151.9	155	158	165	173	147	143	140
30	110.3	86.4	196.7	200	205	215	227	200	184	179

35	128.6	117.6	246.2	250	257	271	287	237	229	222
40	147.0	153.6	300.6	305	315	333	354	289	279	269
45	165.4	194.4	359.8	360	378	400	427	344	331	320

Adjustments for grade and truck traffic shall be made when pertinent. Longer sight distances are desirable, particularly at locations where unexpected, complex, or cluttered conditions exist. AASHTO Table 3-3 provides Decision Sight Distances (DSD), which offer drivers additional margin for error and afford them sufficient length to maneuver their vehicles at the same or reduced speed. The Engineer of Record shall make the determination if SSD is sufficient for design criteria or if DSD should be used, dependent on the complexity of the corridor and typical traffic types/flow.

Both sight distances are based on a height of driver's eye equal to 3.5 feet, and an object height of 2.0 feet, equivalent to the taillight height of a passenger car.

Designers should coordinate with other disciplines as necessary to ensure that other roadway elements such as median or planter strip landscaping, do not obstruct the required sight lines.

3.3.4.2 Intersection Sight Distance

Sight distance at intersections is provided to allow drivers to perceive the presence of potentially conflicting vehicles, and to allow drivers of stopped vehicles a sufficient view of the intersecting roadway to determine whether to enter or cross it. Although Stopping Sight Distance allows drivers to anticipate and avoid collisions, drivers of major road vehicles may be required to stop or slow to avoid a collision with a minor road vehicle. Designing for longer Intersection Sight Distance enhances traffic operations and is required for all new intersections and driveways. Adjustments for design vehicles and grades shall be made as appropriate.

To provide adequate intersection sight distance, specified areas along intersection approach legs and across their included corners should be clear of obstructions. The dimensions of the legs of these "Intersection Sight Triangles" are dependent on design speeds and type of intersection control. Refer to the 2018 AASHTO "A Policy on Geometric Design of Highways and Streets", Chapter 9, and Figures 9-16 and 9-17 for information on these areas, (called Clear Sight Triangles in the manual).

3.3.4.3 Intersection Sight Distance vs. Clear Vision Area

Similar to Intersection Sight Triangles, Clear Vision Areas are triangular areas adjacent to intersections intended to provide sight distance for conflicting traffic movements by establishing a prescribed area in which to prohibit sight obstructions. Note that Clear Vision Areas are a planning level tool and are described by fixed dimensions based on road type and land use zones. Clear Vision Areas do not take into account vehicular speeds or intersection control, as do Intersection Sight Triangles. Intersection Clear Vision area is dictated by the Bend Development Code and City of Bend standard drawing R-2.

3.3.4.4 Sight Distance Obstructions

Intersection Sight Triangles and Clear Vision Areas should be identified early in the design process and shown on the plans. Sight obstructions between sight lines two (2) and eight (8) feet above curb grades are not permitted within these areas. Existing obstructions shall be shown on the plans and identified for removal or relocation. Designers may be required

to provide sight distance profiles, if deemed necessary by the engineer, to demonstrate that AASHTO requirements are met.

Where sight triangles extend across private property, acquisition and execution of a recorded “Intersection Sight Triangle” easement is required. Such easements shall be granted to the City of Bend and limit the height of vertical features, including but not limited to utility infrastructure, buildings, walls, fences, berms, signs, roadside terrain and trees/vegetation. Where intersection sight distance cannot be provided, alternative roadway alignments may be necessary.

3.3.5 Level of Traffic Stress

3.3.5.1 Definition and Level of Traffic Stress Calculation

Level of traffic stress (LTS) is a qualitative measure of the discomfort people feel when they bike or walk close to vehicle traffic. Separate walking and/or biking facilities farther away from traffic are low stress and facilities adjacent to higher speed and volume travel lanes are high stress. LTS is more specifically referred to as Bicycle Low Traff Stress (BLTS) and Pedestrian Low Traffic Stress (PLTS) when designing for specific users within a corridor.

The City follows the methodology listed in the ODOT Analysis and Procedures Manual Chapter 14 to determine the bike and walking LTS for routes and crossings. The LTS evaluation provides a quick way to quantify, compare, and select facilities that provide the target LTS. The different LTS levels include:

- LTS 1 (the lowest) represents little traffic stress and requires less attention so it is suitable for all users including children that are safely trained to travel along streets and cross intersections as well as people using wheeled mobility devices. LTS 1 facilities are most often separate and detached.

- LTS 2 represents low traffic stress but requires more attention than young children would be expected to deal with and is more suitable for teen and adults with moderate biking skills or conditions may limit some people from walking. This may include a buffered bike lane or a greenway

- LTS 3 represents moderate stress and is a bike facility suitable for most adult observant cyclists or a sidewalk/shared use path that pedestrians may feel uncomfortable but safe using. This may be an attached shared-use path or an on-street bike lane that is not buffered.

- LTS 4 represents high stress and is a bike facility suitable for experienced and skilled cyclists or a sidewalk/shared use path that people with limited other choices tend to use. This is a bike lane on a multi-lane road or a higher volume shared street.

Bicycle LTS (BLTS) for segments, intersection approaches, and intersection crossings by using the look up tables and the proposed conditions. The lookup tables are available in ODOT’s Analysis and Procedures Manual, Version 2, Chapter 14.4. Then determine the route LTS by using the highest number rating of the three elements. That is if the segment is LTS 1 but the crossing is LTS 4, most people still will not find the route low stress, and the overall rating is considered LTS 4.

Pedestrian LTS (PLTS) for segments using the look up tables and the proposed conditions. The lookup tables are available in ODOT's Analysis and Procedures Manual, Version 2, Chapter 14.5. Determine the PLTS based on sidewalk/shared use path condition, physical buffer, and total buffer width. Determine the PLTS of the crossings. Then determine the route LTS by using the highest number rating of the elements. That is if the segment is LTS 1 but the crossing or condition is LTS 4, most people still will not find the route low stress, and the overall rating is considered LTS 4.

The City's standards, requiring property tight and wider sidewalk/path construction, require PLTS 1 guidelines to be met for full integration into a corridor. Allowance to a lesser standard, when approved by the City Engineer, will be granted when impediments exist such as terrain, right-of-way constraints, trees or unmovable utility conflicts.

3.3.5.2 Low Stress, Key, and Connector Routes

A low stress route is a street, bikeway, and/or access corridor alignment identified in the TSP (Figure 5-1) designed to meets the requirements in these standards for providing bicycle LTS 1 or LTS 2, including any required arterial or collector street crossings. Low stress routes are located approximately every 1/2 mile north-south and east-west to provide continuous route for people to access homes, work, parks, schools, and major destinations.

The Key Routes are a subset of the low stress bicycle routes shown on TSP Figure 5-3b that provide cross-town bicycle connections, complete missing pedestrian facilities, extend the reach of existing trails and greenways, and form a backbone for the overall low stress bicycle network. There are twelve key routes identified across the City that provide both east-west and north-south connections. The key routes were identified in the TSP as priority segments to complete, and were highlighted to target TSP capital project funding. From a design standards perspective they fall under the same requirements as the overall low stress network for bicycle LTS, except they also require meeting pedestrian LTS 1 or 2 and as noted in 3.6.1.1 - Low Stress Routes regarding have a preference for higher levels of separated design for walking and biking from vehicle traffic.

A connector route is a priority low stress pedestrian routes as shown on the Connector Routes and Crossings Map (Part VI – Appendix C). This map identifies:

- Connections to and across arterial or collector streets along primary routes to school
- Primary connections and arterial or collector crossings from neighborhoods to area parks
- More direct connections from subdivisions to the low stress networks such as connector trails from the back of cul-de-sacs

Where feasible the map combined connections to schools and parks with transit stops, and may include additional crossings at other high use transit stop locations. This map includes routes and crossings that are not part of the bicycle network, and may also include some portions of the bicycle network that are priority links for the pedestrian network. While not specifically listed on the connector map, depending on the type of bicycle facility many of the low stress bicycle facilities also serve as low stress pedestrian routes.

3.6.1 - Sidewalks, Shared-Use Paths, Trails, and Low Stress Routes provides more detail on the design of the low stress bicycle and pedestrian networks.

3.3.5.3 Target LTS

The City of Bend targets LTS 1 on bicycle low stress routes and connector routes adjacent to, and within ¼ mile of, schools and parks and key routes. LTS 2 is targeted on other low stress and connector routes. To serve the full spectrum of bicyclist skill levels, the City of Bend requires both buffered bike lanes and shared-use paths on arterial and collector streets. If the target LTS is met by a shared use path, the buffered bike lane is still required. In that case, the buffered bike lane is preferred to, but is not required to also meet the target LTS.

3.4 Roadway Design Elements

3.4.1 Right-of-way

Rights-of-way shall be dedicated to the public and are utilized for transportation, transit, and bike and pedestrian facilities as well as for above and underground City and franchise utilities.

Standard right-of-way widths for the roadway classifications are contained in the Bend Development Code through the approved Transportation System Plan (TSP), and by reference incorporated as the City of Bend's standards. They are also shown on the standard street cross-sections in the Standard Drawings. Rights-of-way are established to provide paved street width, sidewalk/shared use path and bike facilities, planter strips, drainage facilities, and other street elements as noted in the following sections.

In addition to right-of-way for the standard street cross-sections, dedication of right-of-way is required for widening at intersections to support intersection traffic control, roundabouts, and low-stress multi-modal crossings. This includes dedication of right-of-way for roundabouts at every arterial-arterial, arterial–collector, and collector-collector intersection.

In limited cases where the standard right-of-way cannot be accommodated due to unique site constraints, deviations from right-of-way standards shall proceed through a standards deviation review process with the City Engineer as identified in 3.2 – Deviation from Streets Standards and the following additional specific right-of-way considerations:

- Safety and operations
- Accommodation of complete streets elements and all modes including the Low stress network, connector routes, or other required pedestrian and bicycle facilities, stormwater, and landscaping
- Abutting land use

3.4.2 Paved Street Widths and Lane Widths

Lane configurations shall incorporate complete street design principles and provide for vehicle, pedestrian, bicycle, and transit, and include pedestrian and bicycle crossing facilities. Standard Street cross-sections for the various street types are shown in the Standard Drawings. The pavement design shall comply with 11.4 – Pavement Design.

Where design standards and standard drawings are in conflict with the Bend Development Code, the Bend Development Code will mandate the design unless a Waiver to Public Improvement Standards is approved per Bend Development Code Chapter 3.4. Where existing ground cross slopes exceed 12 percent, see 3.4.7 - Hillside.

3.4.2.1 Arterial and Collector Roadways

Arterial and collector roadway locations are identified in the TSP, the Bend Development Code, and these standards. The standard cross-sections for all new and reconstructed arterial and collector roadways are shown in the Standard Drawings. Arterials and collectors with raised medians shall be designed to accommodate a curb-to-curb clear width of 20 feet minimum for Oregon Fire Code fire lane requirements. See 3.4.5 – Medians for raised median requirements. Sidewalks/shared-use paths shall be located property-line-tight, on both sides and permitted to meander to avoid barriers (utilities, trees, etc.). There is a minimum one-half foot construction tolerance to the right-of-way line. Sidewalks/shared-use paths and bike lanes are required on all arterial and collector streets, additional detail provided in 3.6.1 – Sidewalks, Shared-Use Paths, Trails, and Low Stress Routes.

The planter strip or landscape strip is the area located between a sidewalk/shared-use path and the curb. Planter strips vary per the standard drawings but shall never be less than 5 feet, as required for tree planting unless otherwise approved. Planter strips shall contain street trees or other approved vegetation when required by the Bend Development Code and the City's landscaping requirements found in 12 – Landscape Architecture and Irrigation Systems.

Shy distance is measured from the face of raised-median-curb to the center of the abutting yellow stripe, where applicable. The standard, and minimum, shy distance is 1.5 feet; maximum is 2 feet. The standard drawings include the following arterial and collector cross-sections:

Cross Section	Right-of-Way Width	Curb-to-Curb Width
5 Lane Arterial – No Parking	100'	72'
3 Lane Arterial – Parking Both Sides	100'	72'
3 Lane Arterial – No Parking	100'	56'
2 Lane Major Collector – Parking Both Sides	80'	62'
2 Lane Major Collector – No Parking	80'	48'
2 Lane Minor Collector – Parking Both Sides	80'	62'
2 Lane Minor Collector – No Parking	80'	46'

Cross sections with parking on one side are allowed by combining the applicable half street sections of the No Parking and Parking Both Sides from the same classification. Parking is not permitted in areas where the median is needed to provide an enhanced crossing. See section 3.6.10 – On-Street Parking for on-street parking requirements.

The collector roadways shown on the TSP are major collectors, designated streets required by OAR 660-012-0020(b). Minor collectors are identified through site planning and design based on the street layout and adjacent land use. It typically has more access points, lower volumes, and serves less through traffic than a major collector. Minor collector traffic volumes do not warrant turn lanes.

3.4.2.1.1 Standard Deviation Request – Raised Median

Designers may request a standards deviation review by the City Engineer to eliminate the raised median portion of the arterial or collector roadway while still maintaining the required standard street width. The deviation request to convert the raised median area to a striped median (double yellow, two-way-left-turn lane, or turn bay) is reviewed under the review criteria of 3.2 – Deviation from Streets Standards and the following specific review criteria:

- Driveway spacing less than 10 driveways per mile
- Left turn demand is less than 50 trips per hour at each driveway
- Road is a 3-lane road
- Raised median is not required to provide enhanced crossing refuge island as required per the crosswalk design standards (to serve a low stress route, to serve a non-low stress enhanced crossing, or as directed by the City Engineer)
- Sight lines meeting AASHTO for the design speed are available for driveways and access roads

3.4.2.1.2 Standards Deviation – Elimination of Median

Designers may request a standards deviation review to eliminate the entire median width on arterial and collector streets under the review criteria of 3.2 – Deviation from Streets Standards. The following specific review criteria shall also be utilized:

- There is one, and not more than one, through travel lane in each direction
- Left turn volumes are below the threshold for a separate left turn lane and turn volumes can be accommodated from the through travel lane
- A raised median enhanced crossing refuge island is not required per the crosswalk design standards (to serve a low stress route, to serve a non-low stress route enhanced crossing, or as required by the City Engineer), or, if required, an island will be provided at the identified crossing locations
- The arterial or roadway intersection that would remain open due to the elimination of the raised median does not experience significant crashes due to turning movements that would be eliminated by the installation of the median
- The horizontal and vertical roadway alignment is adequate to create adequate left-turn intersection sight distance along the roadway segment
- Adequate distance is provided for the transition taper where matching existing median sections

3.4.2.1.3 Standards Deviation – Additional Travel Lanes

Designers may request a standards deviation review for additional travel lanes to accommodate existing or projected vehicle demand on arterial and collector streets under

the review criteria of 3.2 – Deviation from Streets Standards. The City's policy is to manage congestion/corridor demand before adding motor vehicle lanes (not including center turn lanes). Adding travel lanes for motor vehicles will be considered only after the City has evaluated:

a. The safety effects for all users and modes of travel

b. The potential to add capacity through intersection improvements

c. The potential to add capacity through increasing system connectivity with parallel routes

d. Whether appropriate transit, bicycle and pedestrian facilities, including safe crossings can be provided as part of a travel lane project

e. The effect of transportation demand management or other tools

f. The full cost of property acquisition in monetary and social terms

g. The potential to add capacity through technologies such as upgraded traffic control devices and other intelligent transportation system applications.

Additionally Bend Development Code Chapter 3.4.200(F)(3)(b) identifies certain road segments that are not eligible for travel lane expansion. The alternate cross-section shall be in accordance with a standard cross-section.

New four-lane roadways are not allowed because they don't provide the target LTS for crossings and the inefficiency of the inside travel lanes to accommodate both through traffic and left turning traffic.

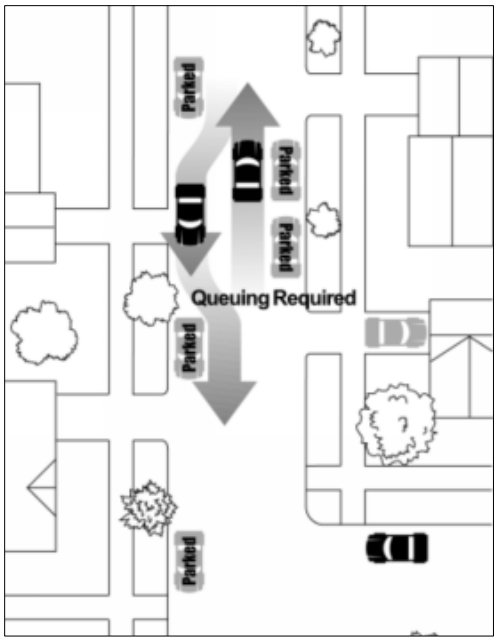
3.4.2.2 Local Streets

The Bend Development Code requires fully-gridded local street systems with short block lengths. Block access may also be provided by alleys. The City recognizes that increasing grid and connectivity optimizes emergency vehicle routing, enhances walkability and bikeability and reduces traffic volumes on any one local street. The local street layout design seeks to minimize concentrating neighborhood traffic on one street and to minimize through traffic from arterial and collector streets, especially if the local street is a designated low stress route (TSP Figure 5-1). Local streets are identified during site development or construction plan preparation to continue the existing grid and to serve new development per the provisions in the Bend Development Code.

The standard drawings include the local street cross-sections and the Standard Curb-to-Curb Width shown in the following table:

Cross Section	Right-of-Way Width	Curb-to-Curb Width
Local Road – No Parking	60'	24'
Local Road 28 ft – Parking Both Sides*	60'	28'
Local Road 32 ft – Parking Both Sides*	60'	32'
Local Road 36 ft – Parking Both Sides	60'	36'
Industrial Local – No Parking	60'	36'
Industrial Local – Parking Both Sides	60'	44'

* Indicates a queuing street
** No parking 100 ft from intersections and other locations where required to facilitate truck turning movements to/from driveways of sites that accommodate trucks



In most cases, parking is required on both sides of the street. Alternate sections with no parking, or parking on one side, may be approved through land use planning where adjacent and immediate vicinity land use or other unique factors demonstrate the reduced need for parking. A cross-section with parking on one-side should be determined by adding half of the 24 foot no parking street section to half of the applicable street section with parking. For example, a section with parking on one side, based on the 36 foot street section, would include 12 feet (from ½ of the 24 foot street) plus 18 feet (half of the 36 foot street) for a total 30 foot street. The street would be built so the two half-street sections meet at the right-of-way centerline. In the example above, the right-of-way centerline would be 12 feet from curb on the no parking side and 18 feet from the curb on the side with parking. Where parking is restricted, "No Parking" signs shall be posted per the Signing and Marking Manual.

The cross-sections were developed to reduce vehicle speed, avoid construction of excessive pavement and create livable neighborhoods. In general, these standards provide for a hierarchy of narrower streets, on-street parking, and sidewalks/shared-use paths. The selection of street cross-sections will be determined during land use, or site design (in the absence of land use), and will be based on "right sizing" the street for the context. Generally wider local streets are used to serve higher densities with higher traffic volumes and as the primary residential or commercial connection to arterial and collector streets. The narrower 28 foot and 32 foot street sections are typically used on one to two block segments that don't connect to an arterial or collector street and have very low traffic volumes. More detail on the different sections follows:

The queuing streets listed in the table above provide travel ways less than 10 feet wide in each direction. In these instances, the cross section may not meet minimum requirements of the Oregon Fire Code. When a proposed design does not meet the minimum requirements of the currently adopted *Oregon Fire Code*, the *fire code official* shall determine the adequacy of the proposed fire apparatus access. When the *fire code official* determines the proposed design to be inadequate, Uniform Alternate Construction Standards (UACS) shall apply as outlined in ORS 455.610 and detailed Oregon Administrative Rules (OAR) 918-480-0125 to remedy the inadequacy of the proposed fire apparatus access.

The 28 foot local road cross-section provides for parking on both sides with one lane of travel that serves very low traffic volumes. Two way traffic is served by vehicles waiting at the upstream approach, pulling over in a parking space or driveway area to let an oncoming vehicle or bicycle pass. This type of street is called a queuing street. People riding bicycles ride in line with vehicles in the travel lane. To allow space for

queuing, these streets are used in short segments, where parking demand is lower, or where driveways allow spaces for queuing as shown in the figure to the right[1].

The 32 foot local road cross-section has a 16 foot travel way that provides two narrow, eight foot travel lanes or one wider lane used as a queuing street, depending on the speed and confidence level of the drivers. This street section is typically used within single family residential areas on shorter block segments (less than three to five blocks long), on streets that are not continuous between arterial and/or collector streets, street sections with multiple curves or shorter horizontal radii, and streets not adjacent to high density developments such as apartment buildings

The 24 foot local road with no parking is used where there is no on-street or adjacent area need for parking and may be approved through a land use decision. The 24 foot local road may be used where the road is confined by steep terrain, an Area of Special Interest (ASI), or other unique site barrier that prevents wider road construction.

Where the 36 foot local road cross-section is used, curb extensions may be used at intersections except where left turn lanes are required with the development or may be required in the future to serve projected traffic volumes.

Local street extensions must match the existing street width. An exception may be granted if 1) the street is identified as a low stress route, transit route, is adjacent to a mobility hub or is identified in the Transportation System Plan (TSP) as requiring a wider cross-section to provide new transportation features (shared use paths, bike lanes, etc.) or 2) street widths are either increased or decreased to service the needs of the development's use (fire code requirements, access, larger trucks, etc.). Street width transitions are to occur at an intersection instead of at mid block, with transitions occurring with curb extensions or other design features to create aligned travel lane transitions meeting taper requirements.

Where City standard street cross-sections are not used, such as for certain private streets, lanes, t-courts, or internal commercial access drives, the Fire Code requires 26 feet road width around hydrants.

The Industrial local road cross-section is used in industrial zones.

Bike lanes are generally not provided on local streets.

A minimum 6-foot detached, property-tight sidewalk is required on both sides of all local streets except where waived per the Bend Development Code. Where a local street serves as a low stress route, but does not meet the criteria for a greenway, an 8-foot sidewalk or shared-use path may be required on one side. The path must be constructed on the north or west side of the street, unless an alternative location is determined to better align with schools or parks in the area. Sidewalks/shared-use paths are permitted to meander to avoid barriers (utilities, trees, etc.). Sidewalks/shared-use paths are permitted to be placed curb-tight when a site can meet one of the following criteria:

- The existing ground cross slopes exceed 12 percent, see 3.4.7 - Hillside.
- Placement around cul-de-sac bulb

[1] Neighborhood Street Design Guidelines, TGM/ ODOT, June 2001.

- As determined by the City Engineer during permit or land use review

Curb-tight sidewalks/shared use paths must not be less than 6 feet wide to allow for a minimum 2-foot door swing, or street sign installation, while still meeting the 4-foot minimum ADA width requirement.

Additional sidewalk/shared use path width may be required based on mailbox, signs or other obstacles to obtain accessible widths. All sidewalks/shared use paths must conform to accessibility standards within the right-of-way or under a public access easement.

The planter strip width will vary depending on the street width. Planter strips shall contain street trees when required by the Bend Development Code. Where sidewalks/shared-use paths are curb-tight, street trees will be placed behind the sidewalk/shared-use path or on private property as determined during land use and/or permit review. Street trees shall conform to 12.2.3 – Street Trees and Plants. Planter strip design standards are contained in 3.6.2.12 – Planter Strip.

3.4.2.3 Alleys

Alleys are built to serve rear loaded properties. Alleys shall be built per the Standard Drawing R-1G.

Where existing alleys are being paved or reconstructed, pavement width can be reduced by 12 inches on each side of the property line/right-of-way (24 inches narrower) to aid in matching existing grade during construction. The alley is not to be less than 14 feet wide. No parking is allowed within alleys. The City may require that alleys be designed and stamped by a professional engineer as part of any right-of-way permit application.

3.4.2.4 Cul-de-Sacs and Turnarounds

The standard cul-de-sac design does not include a center island. Landscaped center islands may be approved by the City Engineer where designed to accommodate snow storage. Parking is prohibited in all cul-de-sacs and tee turnarounds. Attached sidewalks are permitted around the bulb of the cul-de-sac. Tee turn arounds are only permissible as a temporary turn around, see Standard Drawing R-1H.

Where cul-de-sacs are proposed to be installed with mountable curbs, the curb-tight sidewalk shall be 6 feet wide around the entire bulb. Mountable curbs will not be permitted on streets at low points unless additional stormwater infrastructure and catchment can be provided.

3.4.3 Roundabout Design

See City of Bend Roundabout Design Manual.

3.4.4 Traffic Signal Design

3.3.2 – Intersection Controls identifies selection parameters for traffic signals. Traffic signal locations are approved by the City Engineer. Traffic signals will be considered only where a traffic study documents that a signal is warranted in conformance with the Manual on Uniform Traffic Control Devices (MUTCD), and that a traffic signal is recommended over the City's preferred roundabout intersection control.

Traffic signal installations shall conform to the current edition of the MUTCD with Oregon Supplements and City Standards and Specifications. ODOT approval is required for traffic signal installations on state highways within City limits.

All traffic signal plans shall be prepared in substantial conformance with the ODOT Traffic Signal Design Manual. For road improvement projects with existing traffic signals, temporary signals or temporary relocation of existing signal heads may be required to maintain proper signal head alignment during construction.

Unless otherwise directed by the City Engineer, all new or reconstructed traffic signals shall include the following:

- Mast arm type signal poles
- ODOT Type 6L – vertical four section head with left turn arrows for dedicated left turn lanes with protected and protected/ permitted phasing
- Illumination with luminaires mounted for each approach on signal pole luminaire arms at standard orientation over the mast arms
- Vehicle and bicycle detection system (radar detection unless otherwise directed)
- Pedestrian crosswalks and curb ramps at all corners
- Bike crossing features (separate bike crosswalks or other bike crossing enhancements and associated bike features such as ramps, two-stage bike box, raised islands, etc.) unless otherwise approved by the City Engineer
- Accessible Pedestrian Signals (APS) with pushbuttons which provide audio and vibrotactile walk indications.
- Countdown Pedestrian Signals
- Emergency vehicle preemption system
- ITS components including communications structure and interconnect to the signal system and to adjacent signals on a signalized corridor. Confirm available communications infrastructure (fiber optic, wireless, etc.) with Engineer
- Mast-arm-mounted street name signs
- Controller cabinet prints and optimized traffic signal timing shall be prepared for all new traffic signal or signal modification designs.

Separated traffic signal designs are encouraged on designated low-stress routes and may be considered with City Engineer approval.

3.4.5 Medians

A median is defined as the area between opposing traffic lanes. A median may be raised or striped (two way left turn lane, painted median, or turn bay). The median includes both the shy line distances as well as raised medians. Medians are installed as required by the standard cross-sections, to provide an enhanced crossing refuge in accordance with the

crosswalk marking standard (to serve a low stress route or to serve a non-low stress route enhanced crossing), at a location required to enforce access management and turn restrictions, or as required by the City Engineer. Medians only at the intersection are considered islands per 3.4.6 – Raised Islands.

Raised medians implement access management by reducing conflicting turning movements to improve traffic safety and roadway capacity, however, they should be designed utilizing a system approach in coordination with the affected properties on a corridor segment basis.

Medians can also improve traffic safety by restricting turns from driveways or intersecting roadways that have inadequate sight lines. Medians can also serve as refuges for pedestrians, facilitate roadway aesthetics and provide space to accommodate left turn lanes. Medians can also be used for storm retention and roadway drainage facilities. Medians also serve to reduce the heat island effect of large expanses of asphalt pavement. Medians can be planted or installed as an impervious surface, typically as stamped concrete. The median landscape design parameters are determined during land use and/or construction plan review.

Median end treatments shall have offsets and gradual approach tapers as shown in the Standard Details. The design reduces the possibility of vehicles striking the leading edge of the median.

Crosswalks through medians shall have a minimum curb-to-curb length of travel of 6 feet as described in 3.4.6 - Raised Islands. The width shall match the width of the standard approach sidewalk/shared-use path. Median pedestrian island refuges shall meet accessibility and PROWAG standards.

3.4.6 Raised Islands

Within the intersection area, the raised element separating traffic movements is considered an island.

Island end treatments shall have offsets and gradual approach tapers as shown in the Standard Drawings. The design reduces the possibility of vehicles striking the leading edge of the island.

Islands are installed as required by the standard cross-sections; to provide a pedestrian refuge in accordance with the crosswalk design guide (low stress route or a non-low stress route enhanced crossing) or as required by the City Engineer. On existing streets with constrained right-of-way, width shall not be less than 6 feet curb-to-curb to allow for two sets of detectable warning surfaces (each 2 feet wide) plus a 2-foot clear distance between the domes meeting ADA requirements. If the cut through is flush (no ramping up and down), the entire edge of the detectable warning surfaces must be placed at the face of curb, not at the back of curb as is typical at curb ramps. The island opening shall match the width of the design standard width of the approach sidewalk/shared-use path. All islands must be installed with standard curb construction – no doweling into pavement unless otherwise approved by the City Engineer.

Islands may be permitted on a local street approach to an arterial or collector as a traffic calming tool.

3.4.7 Hillside

Where existing ground cross slopes exceed 12 percent, sidewalk/shared use path installation may be placed curb-tight. Planter strips are not required on those portions of the street that qualify as hillside.

3.5 Roadway Geometry

Roadways including the travel lanes, sidewalks and paths, and bike facilities shall be designed to extend to and through adjoining properties. Designers shall demonstrate with centerline profiles for horizontal and vertical geometry that the roadway can be extended while meeting the City's standards or shall adjust the design to allow for the continuation of the roadway.

3.5.1 Intersections

3.5.1.1 Geometry

Street intersections shall be as near right angles as possible except where topography or existing geometric constraints requires a lesser angle. In no case shall the acute angle be less than 80 degrees.

All intersections shall be designed to provide the required AASHTO intersection sight distance for all movements. At complex intersections, or where unusual or unexpected maneuvers are likely, decision sight distance as shown in AASHTO 2018 Exhibit 3-3 is required. Design shall take into consideration the back of the planning year's 95th percentile queues.

Intersection sight triangles shall be provided at all approaches and necessary grading and clearing performed. At times this will require a sight line easement to be created and purchased. Traffic control devices shall not eliminate the need for the appropriate sight lines without first receiving a design standards deviation from the City Engineer. The design deviation review for intersection sight distances shall include the following criteria:

- Ability to design intersection at a different location that provides adequate sight distance
- Ability to provide sight triangles across adjacent property
- Complexity and level of uniqueness of proposed intersection
- Extent of access control, number of accesses within functional area of intersection
- Concentration of travel demand in area
- Amount of visual clutter or distractions
- Crash history in the vicinity of the proposed intersection
- Prevailing speeds on all uncontrolled approaches
- Traffic volumes and truck percentages

- Tangent approaches shall be required at all intersections

Cross streets that intersect arterial or collector roadways shall have their centerlines aligned, with no off-sets allowed unless there is a median on the arterial or collector roadway that creates two tee-intersections. Tee intersections may also be allowed in order to construct a refuge island to serve a low stress route, non-low stress route network crossing, or as required by the City Engineer. Tee intersections must meet intersection offset requirements.

Curb returns and corresponding grades and transitions shall be designed to meet curb ramp requirements and ensure drainage of the intersection, with no standing water. Grades shall be noted on each quarter delta of the curb return.

Dedicated right turn lanes on approaches to signalized and roundabout intersections shall be designed to incorporate pedestrian islands to minimize the impact of the additional crossing width of the roadway and intersection. Dedicated right turn lanes are not permitted for driveways and any unsignalized intersection.

Turn lanes are not easily navigated by pedestrians with total blindness. Adequate way-finding, orienteering, and reduced speed approach speeds must be provided in order to be fully accessible. Gap identification supplements may be necessary.

3.5.1.2 Curb Radius and Curb Returns

The minimum curb radius shall be as follows:

Curb Return Type	Minimum Curb Radius
Local-Local	15 feet
Local-Collector	20 feet
Local-Arterial	20 feet
Collector-Collector	25 feet
Collector-Arterial	35 feet
Arterial–Arterial	55 feet

Where a radius larger than 35 feet is desired, or where site constraints warrant, a 3-centered symmetric compound curve shall be used. Three-centered symmetric compound curves shall be designed only on right-of-way sufficiently large to accommodate 12 feet minimum between curb face and the property line. The radii of the 3-centered symmetric compound curve shall be 120-feet, 40-feet, and 120-feet. The offset of the 40-foot radius shall be determined by the design vehicle as follows:

Design Vehicle	Offset
SU	2 feet

BUS	3 feet
WB-40	4 feet
WB-50	5 feet
WB-67	6 feet

Where fire access is required, the City shall receive a design from a registered engineer showing turning templates. Turning templates shall have a fire truck movement having a 25-foot interior radius with an exterior 45-foot radius, or as otherwise directed by the City Fire Marshall.

Curb returns must be designed and installed with slopes meeting the requirements for curb ramp construction. The curb ramp construction may not be required by a particular project, but slopes must be considered to avoid the regrading of an intersection during a future development. Refer to 3.6.2 – Curb Ramps and Crosswalks.

3.5.2 Horizontal Alignment

3.5.2.1 Cross slope

Standard normal cross slope is 2-percent straight line with a crown in the center of the roadway. Unless approved by the City Engineer, cross slopes shall not exceed 4 percent. Standard roadway alignment shall place the centerline of the roadway at the centerline of the right-of-way. This may lead to a negative superelevation for some relatively flat curves. Particular attention shall be paid to the design of downhill left turns and downhill left turns on rightward turning curves to ensure overturning hazards are eliminated.

3.5.2.2 Superelevation

Superelevation is to be used only as a design element to enhance drivability of horizontal curves on arterial and collector roadways. Superelevation design is typically around the road centerline in conformance with Section 3.3 of the 2018 AASHTO “A Policy on Geometric Design of Highways and Streets”. The use of superelevation for other purposes, or on local streets, shall require a design deviation from the City Engineer.

The maximum design superelevation shall be 0.060 ft/ft, however in conditions where traffic operations frequently limit travel speeds to below the design speed, the maximum design superelevation shall be 0.040 ft/ft (4.0%) to reduce the possibility of sliding during snow and ice conditions. Minimum design superelevation shall be 0.020 ft/ft (2.0%).

3.5.2.3 Horizontal Curves

The minimum radius of curvature for a particular superelevation rate shall be calculated using AASHTO’s 2018 Equation 3-7 and those values presented in AASHTO’s 2018 Table 3-13.

Street Class	Design Speed (mph)	Friction Factor (f)	Super Elevation, e (%)						
			-2.0	0.0	2.0	3.0	4.0	5.0	6.0
Local	15	0.38	50	47	44	43	42		

	20	0.27	107	99	92	89	86	Not Recommended	
	25	0.25	198	181	167	160	154		
Collector	30	0.20	333	300	273	261	250		
	35	0.18	510	454	408	389	371		
Arterial	40	0.16	762	667	593	561	533	508	485
	45	0.15	1039	900	794	750	711	675	643

Compound horizontal curves should be avoided on streets having a design speed of greater than 30 mph. If a compound curve is necessary, the ratio of the flatter radius to the sharper radius should not exceed the following:

- 31 – 49 mph design speed 2 : 1
- 50+ mph design speed 1.5 : 1

Where the ratio exceeds these limits, a suitable length of spiral or a circular arc of intermediate radius shall be inserted between the two curves.

Adjustments for traveled way widths shall be provided based on AASHTO's 2018 Table 3-24a and 3-25 in order to reduce the amount of off-lane tracking on horizontal curves for the design vehicles ranging from bus to semi-tractor trailer combinations.

On all streets having a design speed greater than 30 mph there shall be a minimum 100-foot tangent section between reverse horizontal curves.

3.5.2.4 Pavement Width Transitions

At times there are transitions that need to be accommodated to widen or reduce pavement widths. These transitions shall utilize the recommended MUTCD taper length formulas as follows:

For speeds 45 mph or greater; L=WS and

For speeds less than 45 mph; $L=WS^2/60$

Where:

L = length of the taper (in feet)

W = off-set distance of the travel lane (in feet)

S = design speed of the roadway (in mph)

Reviews shall include identification and mitigation for downstream roadside obstacles when pavement widths are narrowing.

3.5.2.5 Deceleration Tapers for Auxiliary lanes

AASHTO's 2018 Figure 9-34a (L=149 feet or L=102 when approved by City Engineer) is the City's standard to provide for entry into left turn lanes and right turn lanes on curbed

urban streets. This asymmetrical reverse curve system provides for urban speeds, reduces the possibility for snow plow damage, and reduces the possibility that drivers can hit the leading edge of the taper resulting in loss of control of the vehicle.

Turn lane storage length shall be separately accounted for when providing the deceleration tapers and shall be based on the analysis of the design year's 95th percentile queuing.

3.5.2.6 Sight Distance

Standard AASHTO 2018 Table 3-1 stopping sight distances for the design speed shall be provided continuously along a roadway including provision of stopping sight distance sight lines through medians and park strips around horizontal curves.

3.5.3 Vertical Alignment

3.5.3.1 Sight Distance

Vertical curves shall conform to the AASHTO design criteria and be designed to provide at least the stopping sight distance shown in AASHTO 2018 Table 3-2. These distances are considered minimums; additional sight distance is recommended to provide drivers with additional margin for error. Longer decision sight distance is needed at critical locations such as those with concentrated demand that are visually cluttered, at changes in cross-section, or at intersections where unexpected or unusual maneuvers are required. AASHTO 2018 Table 3-3 provides decision sight distances for various maneuver types.

3.5.3.2 Minimum Grades

To allow for adequate drainage, the minimum longitudinal tangent grade is 1.0 percent for all roadways. Where the 1.0 percent minimum cannot be met, the grade may be reduced to a minimum of 0.5 percent and requires curb and gutter in place of standard curb.

3.5.3.3 Maximum Grades

Street grades shall be determined with consideration of topographical conditions and relation to existing and planned streets. Where intersections occur on roadway sections with moderate to steep grades, grades shall be reduced through the intersection wherever practical to facilitate vehicular turning movements and reduce the potential for crashes.

Roadway Classification	Maximum Permissible Grade
Local Streets and Alleys	10%*
Collectors	8%*
Arterials	6%*

*Exceptions:
1. Grade breaks – Grade breaks are permitted within a corridor, but are not to exceed 1.0% every 100-feet.
2. Hillsides – Street grades on hillsides exceeding 12% slope may exceed maximum street grades, subject to Fire Department approval.

Where grades exceed 6%, use combination catch basin inlets (Standard Drawing STRM-13B).

3.5.3.4 Sag Vertical Curves

Minimum lengths of sag vertical curves shall be determined in accordance with AASHTO 2018 requirements, using equations 3-48 and 3-50 and Figure 3-37, using stopping sight distances as the value of S. These minimum lengths provide for headlight sight distance.

Design controls in terms of (K), rate of curvature, for each design speed and corresponding stopping sight distance, are shown in AASHTO Table 3-37. To provide for adequate drainage, K values for sag curves shall not exceed K = 167.

Design Speed (mph)	Stopping sight distance (ft)	Rate of vertical curvature, K
15	80	10
20	115	17
25	155	26
30	200	37
35	250	49
40	305	64
45	360	79

3.5.3.5 Crest Vertical Curves

Crest vertical curves shall be designed to provide at least the stopping sight distance for the design speed of the road. Equations to calculate these minimum lengths, based on differential in grade for a given design speed are shown in AASHTO 2018 Equations 3-42 through 3-45. Figure 3-36 provides a graphical representation of minimum curve lengths based on rounded values determined from these equations. Design controls for stopping sight distance and crest vertical curves expressed in terms of terms rates of curvature (K) are provided in Table 3-35.

Design Speed (mph)	Stopping sight distance (ft)	Rate of vertical curvature, K
15	80	3
20	115	7
25	155	12
30	200	19
35	250	29
40	305	44
45	360	61

3.5.3.6 Intersections

At intersections, the grade break permitted at the gutter line is not to exceed 4 percent. This allows for a -2 percent standard crown thru-street to grade break and max slope up at +2 percent for an accessible crossing between curb ramps. Thru streets (nonstop-controlled) cannot exceed 4.5 percent, unless otherwise approved, in order to conform to the maximum street grades required for accessible crossing between curb ramps.

Only at stop controlled intersections can the vertical curve “K” be less than AASHTO standards dictated in 3.5.3.4 – Sag Vertical Curves and 3.5.3.5 – Crest Vertical Curves.

The vertical curve at the intersection must have a minimum 50-foot length and not be less than the 15 mph “K” value.

3.6 Other Right-of-Way Design Elements

3.6.1 Sidewalks, Shared-Use Paths, Trails, and Low Stress Routes

The City developed the following design guidelines and policy in association with the United States Code of Federal Regulations (CFR) (See 28 CFR 35). The City has adopted PROWAG for all accessible routes within the public right-of-way and public access easements. The City may adopt standards that are more strict than guidelines of PROWAG (for example, PROWAG is silent on the requirement for ramps to align, whereas the City requires that ramps project users to the receiving ramp). However, where conflicts between PROWAG and City standards conflict, PROWAG will be the measure for compliance where specially addressed by PROWAG code. Maintenance operations or approved privately funded (public) improvements may require upgrades, roadway surface alterations or addition of ADA facilities.

For the purpose of this document and the requirements for accessibility, shared use paths and sidewalks may be used interchangeably.

The width, details, and construction location of the various types of pedestrian and shared-use facilities identified in the Bend Development Code (sidewalks, primary shared-use paths, connector shared-use paths, primary trails, connector trails, and single track trails) are shown in the standard cross-sections and standard details. Trails are a type of shared-use path that may be owned and maintained by the Bend Parks and Recreation District, or another agency, or by a private party (the city typically does not build trails). Private trails with a public access easement should be designed to one of the standard trail sections.

Sidewalks and shared-use paths shall be designed to meet the following:

a. Surfaces – Sidewalks and curb-tight shared-use paths must be concrete. Separated shared-use paths may be asphalt or concrete, primary and connector trails are asphalt unless approved by the Bend Park and Recreation District or City Engineer as soft surface. Where a street is adjacent to a park or an area with a trail, it is not desirable to have two parallel facilities (sidewalk and trail) therefore, when eliminating the sidewalk to serve the street with a trail, the trail shall conform and meet all sidewalk requirements as outlined herein.

b. Placement of surface utilities or barriers (poles, drywells, sedimentation manholes, valves, etc.) must be considered to allow for future extension of sidewalk.

c. Location – Sidewalks and shared-use paths shall be located within the right-of-way unless approved by the City Engineer to meander in a dedicated public access easement. Trails shall be located in land or easements dedicated to the Bend Park and Recreation District unless otherwise approved by the City Engineer. If design deviations to this location are desired then a request shall be made of the City Engineer. Deviation considerations shall include the review

criteria from 1.2 – Deviations, Waivers, or Modifications as well as these specific criteria:

- The centerline of the sidewalk shall not meander more than 35 feet from the street curb line.
- Where topographical or vegetation limitations require, 15-foot public access easements (7.5 feet each side of centerline) shall be provided
- Shared-use paths shall not be narrower than 8 feet
- Sidewalks shall not be narrower than 6 feet
    - Where existing sidewalks are being repaired, the sidewalk may be replaced to match the adjacent connecting sidewalk width provided the width is not less than 5 feet.
    - If sidewalk installation is more than 40 feet or the full frontage of a lot, the sidewalk must be constructed to comply to current City standard width

Sidewalks and shared-use paths are the responsibility of the property owner fronting them per Bend Code 3.30.020 to maintain in working order and unobstructed. They can be repaired/maintained in the right-of-way either by replacement of full sidewalk panels or by grinding under a City right-of-way permit. In all situations where a curb ramp or refuge panels is damaged, the entire curb ramp is required to be replaced. Refer to 3.6.2 – Curb Ramps and Crosswalks.

Grinding sidewalk or concrete shared-use path or trail is only permitted where repairs do not exceed 1 inch of concrete removal, the lifted sidewalk is perpendicular to the flow of pedestrian traffic, and the sidewalk has not been previously ground. A 3-inch minimum concrete thickness shall remain after the grinding. The edge of the grinding must meet the requirements of PROWAG R302.7.2: maximum 0.5-inch vertical discontinuity and a beveled slope not steeper than 50 percent. Grinding within a driveway apron or in a curb ramp or refuge panel shall not exceed 3/16 inch. If during grinding aggregate becomes dis-lodged, edges spall, or sidewalk falls out of conformance with PROWAG or concrete thickness requirements, the full sidewalk panel removal will be required.

Sidewalk, shared-use path, trail, driveway aprons, or accessible curb ramps and other elements within the right-of-way that are damaged during construction must be repaired to City standards.

3.6.1.1 Low Stress Routes Design

Low stress bicycle routes are required per TSP Figure 5-1, and are approximately every ½ mile north-south and east-west to provide continuous route for people to access homes, work, parks, schools, and major destinations. Where a new or reconstructed street is shown in the TSP as a low stress route, or for larger undeveloped areas or future expansion areas where the TSP does not show a preferred low stress route and there is not a route within ½ mile serving north-south, and east-west travel, the adjacent development is required to provide a connected low stress facility.

Low stress bicycle route types shall not vary indiscriminately and shall change at logical transition points. Types of low stress bicycle facilities are generally shown in the standard drawings and may include:

- 8-foot to 10-foot shared-use path/shared use trail (trail is typically outside of the right of way and managed privately or by another agency)
- lane only bike lane
- buffered bike lane/painted buffer
- separated bike lane
  - parking separated bike lane
  - device separated bike lane (curb sections, “armadillo”, bollard, delineator, or planter)
- raised bike lane (designs case-by-case; no standard drawing shown)
- shared use street
  - basic shared use street
  - greenway
- enhanced crossing (designs vary; see Signing and Marking manual)
- separated intersection (designs vary by intersection; no standard drawing shown

Select the type of facility based on the design parameters required to meet LTS 1 or LTS 2 for the speed, volume, condition, and configuration of the street cross-section. In most cases, the standard cross-section should meet the requirements. If the standard cross-section does not meet the target LTS, modify the design to meet the target. In some locations on the map the low stress routes are not in alignment with a street, but instead are required as an off-street multi-use path. For existing streets, City staff can provide the initial type of low stress facility identified with the TSP as a starting point for the reconstruction/ modification design.

On key routes, in addition to meeting the LTS, new and reconstructed bike lanes shall target providing the highest level of separation feasible.

3.6.1.2 Connector Routes

Connector routes are required per the Connector Routes and Crossings Map (Part VI – Appendix C), the Bend Development Code Chapter 3.1.300, and as identified by the City Engineer. These are generally infill sidewalks, multi-use paths, or trails. The type of facility is determined from the applicable standard cross-section, modified as needed to meet the target LTS.

The connector route map is established to work with the low stress route map and to coordinate systematic implementation of arterial and collector crossings at ½ to ¼ mile spacing where they serve the most users and destinations. Connector routes are required

as identified in the Bend Development Code for larger undeveloped areas or future expansion areas.

3.6.1.3 Low Stress and Enhanced Crossings

Where a low stress route crosses an arterial or collector intersection, or a crossing is identified on the Connector Routes and Crossings map, enhanced crossings may be required to provide the target LTS 1 or LTS 2 crossing.

Enhanced crossings may also be required at crossing that serve higher volumes of pedestrians as identified in the standard for marking crosswalks or per the City Engineer. See the Signing and Marking manual for Enhanced Crossing Design.

New intersections and intersection approaches must be designed to achieve the target LTS. For existing intersections, the reconfiguration of intersection lanes, addition of full width medians, reduction of speeds, or modification of traffic control required to modify an existing intersection or crossing to achieve an LTS 1 or 2 may not be feasible within existing off site right of way, within the scope of a city project, or within the nexus of a development. In those cases, designers must work with the City Engineer to identify alternative mitigation. One example is providing a bike exit ramp for bicyclists at an LTS 3 or 4 intersection approach to have the option to access an LTS 1/2 multi-use path to travel through the intersection.

3.6.1.4 Obstructions

Structures and obstructions including but not limited to fire hydrants, street signs, utilities, utility poles, signal poles, central delivery mailboxes, and individual mailboxes shall not be located in the accessible path of travel portion of the sidewalk. Sidewalks, multi-use paths, and trails having obstructions shall either be made wider to allow for accessible travel widths defined by PROWAG or have the obstruction removed.

3.6.1.5 Horizontal Alignment

Sidewalks/shared-use paths shall be constructed abutting the property line (back of walk at 6 inches from property line). Designers may meander the sidewalk/shared-use path from the property line when necessary due to topographical or vegetation issues, rather than economical or other design issues.

The sidewalk/shared-use path shall generally follow a smooth and gradual alignment free of sharp angles or bends; horizontal curves shall not be less than 20’ radius.

3.6.1.6 Vertical Alignment

Sidewalk/shared-use path grades shall comply with PROWAG guidelines. Changes in vertical elevation of the sidewalk with respect to the roadway’s running curb elevation can lead to difficulties in achieving ADA compliance with running slopes and ramp slopes.

For separated sidewalks/shared-use paths, the total vertical separation between the top of curb and the top of the sidewalk/shared-use path may vary based on the allowable planter strip slope per 3.6.2.12 – Planter Strip, however the running slope must not exceed the general grade of the road per PROWAG R302.5.

For curb-tight sidewalks/shared-use paths, the total vertical separation between the top of curb and the top of sidewalk shall be zero feet – the sidewalk shall be flush with the curb.

Where sidewalk/shared use path is installed curb tight, the curb must be in good shape to support the sidewalk. Where curb is heaved or sections are missing or chipped, the curb must be removed and replaced to support the sidewalk and prevent uneven gaps between the sidewalk and curb interface. Sidewalk/shared use path is not permitted adjacent to the street's surface without being vertically separated from the asphalt edge by curb.

3.6.1.7 Surface Alterations

A roadway alteration includes activities such as reconstruction, rehabilitation, resurfacing, widening, and projects of similar scale and effect (See 2010 ADA Accessibility Standards, section 106.5). Maintenance activities such as filling potholes, minor pavement patching, and limited trench cuts for utilities are not typically considered alterations. However, any of these activities that occur within a street level pedestrian walkway (a marked or unmarked crosswalk) may not reduce the path's accessibility (See 28 CFR 35.133(a). A street level pedestrian walkway (e.g., marked or unmarked crosswalk) is where the pedestrian would cross an intersecting road, regardless if curb ramps are currently present.

3.6.1.8 Sidewalks/Shared-Use Paths Through Driveways

Sidewalks/shared-use paths shall travel through City standard driveway aprons at sidewalk/shared-use path grade, with the driveway being segmented by the sidewalk/shared-use path. To maintain their effectiveness, detectable warning surfaces should not typically be used where an accessible route of travel intersects a residential or commercial driveway entrance or within a parking lot. However, where commercial driveways are provided with yield or stop control, detectable warning surfaces should be provided at the junction between the pedestrian route and the vehicular route per PROWAG 208.1. The typical sidewalk width is 6 feet (8 feet or wider for shared-use paths), having the width maintained through the driveway apron unless otherwise approved due to topography, but never permitted to be less than 4 feet..

3.6.2 Curb Ramps and Crosswalks

All required curb ramps must meet the requirements of PROWAG published by the U.S. Access Board. The City, by this reference, adopts PROWAG into its standards.

Curb ramps shall be as wide as the sidewalk or shared-use path they serve.

Curb ramps are only required where there is a pedestrian walkway (e.g., a sidewalk or trail/path) with a prepared surface that intersects a roadway. Prepared surfaces may include concrete, asphalt, or other compacted materials such as soil and granite. Concrete and asphalt are the two most common prepared surfaces found in Bend.

Conditions for curb ramp construction:

- If any work (new construction or reconstruction) impacts a curb where there is a pedestrian walkway (e.g., a sidewalk or trail/path) intersecting a roadway then a new ramp or replacement of an existing non-compliant curb ramp must be constructed.

- If any work includes resurfacing through a street level pedestrian walkway (e.g., marked or unmarked crosswalk), even if the work is not the full width of the

roadway, curb ramps must be built or reconstructed on both ends of the crosswalk.

- If any sidewalk work connecting to an existing non-compliant ramp that requires any modification to any portion of the ramp to meet current sidewalk design standards, then the entire ramp shall be reconstructed to current standards.

- If any utility trench work impacts a curb at a cross walk, with or without a ramp, the replacement of an existing non-compliant curb ramp must be constructed.

- If utility trench work does not impact a curb ramp but is "limited to a portion of the pavement, including a portion of the cross walk" replacement of an existing non-compliant curb ramp may not be required (dependent on overall project scope and required pavement restoration limits).

- Any Land Use application for new development that includes requirements for sidewalk/shared use path construction or frontage improvements meeting current City Standards, all curb ramps along the property frontages shall be reviewed for compliance with current standards. Any non-compliant curb ramps or sidewalks/shared use paths along the property frontage must be brought into compliance. This requirement must be included as a Condition of Approval in the Land Use Decision.

- If constructing a new ramp, any existing receiving ramp, if applicable, must align. The construction of a new ramp must not make an existing ramp, either along a project site or directly across the street, non-compliant.

3.6.2.1 Marked and Enhanced Crosswalks

See the Signing and Marking Manual for crosswalk marking and enhancing requirements.

3.6.2.2 Number and Direction of Curb Ramps

The City requires each new intersection to be designed with two (paired) curb ramps per corner allowing for all directions of travel, unless site conditions require modification. These are often referred to as **directional** ramps. If site conditions prevent the use of directional ramps, the design engineer must provide documentation to the City Engineer for review and approval as described in 3.6.2.3 - Type of Ramps Preferred and Documentation.

An example of "all directions of travel" in this case means six curb ramps at a T or three legged intersection. This would be two curb ramps at each corner (one per crosswalk) and two on the "top of the T" allowing for crossing of both roadways.

At a four legged intersection this would be eight curb ramps (two at each corner, one per crosswalk). Each ramp shall run parallel to (in line with) each crosswalk (regardless of if the crossing is marked or unmarked).

On collector and arterial streets, where pedestrians are crossing un-signalized intersections, having two pedestrian crossings across the higher classification street can be waived by the City Engineer to reduce the conflict points or sight distance concerns. Where this occurs, pedestrian closure signs/barriers must be installed on the intersection leg where the crossing is not proposed, and the sidewalk/shared use path is curb-tight.

Where a development/project installs a curb ramp along a site frontage, a receiving ramp must be constructed to current standards where there is an existing sidewalk/shared-use path to connect to on the receiving side. If no sidewalk/shared-use path exists at the receiving side, the receiving curb ramp need not be installed.

3.6.2.3 Type of Ramps Preferred and Documentation

A perpendicular curb ramp for each crosswalk is the City's most preferred design because it does not present unnecessary grade changes in the path of travel for pedestrians that are not crossing the roadway.

If existing site constraints such as the required use of a curb-tight sidewalk/shared-use path prevent the use of perpendicular curb ramps, the next most preferred and allowable design options include parallel or combined perpendicular/parallel curb ramps which still provide a separate and distinct curb ramp for each crosswalk. Documentation in writing of existing site constraints preventing the use of a perpendicular curb ramp and instead utilizing parallel or combined perpendicular/parallel curb ramp design must be provided to and approved by the City prior to construction.

A single diagonal curb ramp or sidewalk/shared-use path depressed corner may only be used when significant existing site constraints do not allow two ramps to be installed (one per crosswalk). Documentation in writing of these significant existing site constraints must be provided to and approved by the City prior to construction. To summarize the City's requirements for selecting an appropriate curb ramp design, the following flow chart shows ramps in order of preference:

1) Required: **Perpendicular** curb ramp for each crosswalk (two per corner)
2) **Parallel** curb ramp for each crosswalk (two per corner)*
3) **Combined** perpendicular/parallel curb ramp (this provides a separate and distinct curb ramp for each crosswalk)*
4) Least preferred: **Diagonal** curb ramps or blended transitions shared by two crosswalks (only allowed with significant existing site constraints that shall be fully documented, provided in writing to and approved by the City prior to construction)*

*Allowable only if constraints dictate, such as the required use of curb-tight sidewalk/shared-use path. Documentation in writing shall be submitted to and must be approved by the City prior to design and construction.

3.6.2.4 Existing Physical Constraints

Where existing physical constraints make it impracticable for altered elements, spaces, or facilities to fully comply with the requirements for new construction, compliance is required to the extent practical within the scope of the project. If the engineer of record deems the work is not practical due to existing constraints, the City Engineer will decide whether any deviation or claim of impracticality is justified. (For more information on existing physical constraints, see below).

A common example of "within the scope of the project" would be when all work related to a project is restricted to one corner of an intersection. In this case the project would only be responsible for providing two accessible curb ramps at this location (regardless of what was present in the existing conditions). The project would not be responsible for

constructing new or altering existing curb ramps on the other corners of the intersection outside of the project limits.

Existing physical constraints can include, but are not limited to, underlying terrain and topography, right-of-way availability, underground structures, adjacent developed facilities, drainage, or the presence of a notable natural or historic feature. Right of way that is controlled / owned by a developer is not considered a constraint when a public access easement can be dedicated to meander sidewalks or ramps onto private property to comply standards.

3.6.2.5 Design Details

Curb ramps must be designed to fit the site and must be detailed on construction plans. The design must provide sufficient horizontal and vertical control and the drawings annotated to ensure that ramp conforms to federal, state, and local accessibility standards. Curb ramps with corresponding grades and transitions must be designed to ensure proper drainage of the intersection. The design and construction of the ramp must prevent stormwater ponding in the ramp and curb returns.. Grades including running slopes and cross slopes must be noted on each quarter delta of the curb return. The City may require that curb ramps be designed and stamped by a professional engineer as part of any permit application.

To assist in the City's review of plans and for contractors and inspection staff to ensure compliant and quality ramp construction, the following information is required to be shown in plans:

- **Running slope** (parallel to path of travel) percentage and direction
- **Cross slope** (perpendicular to path of travel) percentage and direction
- **Control points** with finished grade and top of curb (where applicable) elevation information*
- **Dimensions** of features (e.g., length and widths of ramps and landings)
- **Curb slope** must be maintained at 1-percent slope from beginning for curb return to end of curb return to prevent water and sediment / puddling in ramps. High points and low points must be outside the curb return. Slopes less than 1-percent and greater than 0.5-percent, specifically where constructing against existing conditions that might prevent steeper slopes, must have a concrete curb and gutter constructed around the entire curb return to convey water.

*Control points may include throats of ramps, top and bottom of ramps and landings, tie-in points to match existing or other proposed features, and any wings or curb returns.

Per PROWAG, the absolute legal maximum constructed slopes allowed are:

- 8.3%* (or 12:1 run/rise) for a **running slope** (parallel to the direction of travel); and
- 2.1% (or 48:1 run/rise) for **cross slope** (perpendicular to the direction of travel).

- 5.0% (or 1:20 run/rise) for **clear area slope** (running slope between bottom grade break and curb)

Since the City recognizes that when curb ramps are constructed in the field some tolerances from the design may occur, designers are directed to use the following maximum design values to ensure the constructed ramps and sidewalk/shared-use paths will be below the following PROWAG required absolute legal maximum slopes:

- For **running slope** (parallel to direction of travel) the maximum design value should be 7.5%*
- For **cross slope** (perpendicular to direction of travel) the maximum design value should be 1.5%
- For **clear area** slope (running slope between bottom grade break and curb) the maximum design value should be 4.5%

*Per PROWAG, curb ramps and transition ramps are not required to be longer than 15 feet.

3.6.2.6 Perpendicular Curb Ramps

Perpendicular curb ramps have a running slope that cuts through a curb along the direction of the pedestrian access route. A landing is required at the top of a perpendicular ramp per PROWAG. The term perpendicular does not differentiate between directional or diagonal ramps. A single perpendicular curb ramp could be used at an intersection corner as a diagonal ramp, but only where there are documented constraints and with the approval of the City.

Ramps must utilize wings, with vertical curb installation only permitted when approved due to conflicts (trees, driveways, utilities, etc.) or topography that prohibit wing construction.

3.6.2.6.1 Ramp Running Slope

Perpendicular curb ramps have running slopes of 5 percent or greater and 8.3 percent or less but shall not require the ramp length to exceed 15.0 feet. If a ramp's running slope will be less than 5 percent, it is considered a blended transition instead of a perpendicular curb ramp and therefore a top landing is not required unless there are intersecting sidewalks/shared-use paths and/or ramps sharing a common area, in which case a landing is required where they intersect. For additional discussion on blended transitions, see PROWAG. Grade breaks are not permitted within the ramp.

Ramp slopes shall have a minimum 2 percent slope back to the street to direct stormwater to the street and along the curb for conveyance to the storm facilities. Where physical constraints require the ramp to slope down from the road, place a catch basin, or inlet, just upstream of the ramp to limit the amount of water entering the ramp throat. Additional swales or measures may be required to prevent stormwater runoff into lots.

3.6.2.6.2 Ramp Cross Slope

Ramp cross slopes shall typically not exceed the 2.1 percent maximum required for a pedestrian access route. Where ramps lead to a pedestrian street crossing without yield or stop control, or a mid-block pedestrian street crossing, the cross slope may transition

along the length of the ramp from 2.1 percent maximum at the landing to the maximum slope allowed per 3.6.2.9 - Pedestrian Street Crossings at the curb.

3.6.2.6.3 Ramp Width

No changes in width are allowed through perpendicular curb ramps, between the top and bottom. The widest dimension shall be held the entire way through the ramp. Again, the mistake that is often made is attempting to align with joints previously made in curbs or sidewalks/landings that were poured separately. This is not required.

All ramps shall have the same width as the sidewalk or shared-use path that they are serving or intersecting (e.g., if the sidewalk is 6 feet wide, the ramp shall be 6 feet wide). See exception in 3.6.2.8 – Ramp/Landing Width Exception. Where ramps are being constructed with a new sidewalk or pathway, the ramps must match in width of the abutting sidewalk or path, matching the width per standards or as approved through a deviation to standards (example - an 8 foot ramp must have an 8 foot receiving ramp). Where ramps are being rebuilt to PROWAG standards on both sides of a crossing but one side of the crossing connects to narrower non-standard sidewalk/shared use path widths, the new ramp(s) shall be built to the current standard width unless otherwise approved in the right of way permit because of limited space and/or unsupporting grades. If a widened path is only required on one side of the street, that the path crosses the street to be continued on the opposite side, ramps must be constructed to the width of the path to convey a continuous widened access through the intersection or crossing.

3.6.2.6.4 Direction of Ramp

No changes in direction are allowed through perpendicular ramps, between the top and bottom. This means that the edges of the ramp shall be aligned with the detectable warning surface tile and the direction of travel from the top landing and crosswalk direction to the receiving ramp on the other side of the intersection. The mistake that is often made is attempting to align with joints previously made in curbs or sidewalks/landings that were poured separately. This is not required. Design and construct the ramp throat so that the running slope joints (longitudinal joints from landing to curb) project and align with the same joints in the receiving ramp. Slight misalignments of 2 degrees to 5 degrees will be permitted when existing conflicts or constraints are identified that prevent alignment.

3.6.2.6.5 Flared Sides and Returned Curbs

Flared sides (commonly referred to as wings) are preferred on the sides of perpendicular ramps wherever possible to reduce the likelihood of damage from snowplows, minimize tripping hazards, and make maintenance of surrounding landscaping easier (e.g., allow for passage of mowing equipment over the ramps and flared sides). Try to locate features such as hydrant pads, catch basins, drywells, meter boxes, etc. at a distance such that a flared side between the ramp and these features is still possible and a returned curb is not needed. If a flared side is possible on only one side of the ramp, the run-off side is the most important to try and achieve this on since this is the side most likely to be struck by a snowplow blade. When flared sides are within the pedestrian circulation path, the maximum slope shall be 10 percent. When flared sides are adjacent to a non-traversable area, such as landscaping, the slope may exceed 10 percent. When this is the case, a typical 3-foot wide flared side should be utilized for consistency. Flared sides should extend up the entire length of a ramp to add strength, especially at intersection corner locations where ramps are exposed to over-tracking from turning vehicles and can crack.

3.6.2.6.6 Landing

Perpendicular ramps shall have landings at the top of the ramp. Landings shall be squared off to the ramp and direction of travel through it. While the jointing may be different and the ramp dimensions may be wider/longer than the ramp width itself (this is often the case with landings shared by more than one ramp at an intersection corner), it must not be on an angle or curve that is not perpendicular to the intersecting ramp. For additional discussion on landings see PROWAG. The landing's finished surface slope shall not exceed 2.1 percent in the direction of travel or the cross slope.

3.6.2.6.7 Detectable Warning Surface

In the case of perpendicular ramps located along a street edge/curb line that is angled or changing due to an intersection/corner radius, typically the detectable warning surface should be installed perpendicular to the edges of the ramp and direction of travel through the ramp. In this case a grade break shall be provided along the bottom edge of the detectable warning surface. Everything above this grade break is considered the curb ramp and shall be a continuous slope with no grade breaks until the top landing is reached from where the tie in with the sidewalk/shared-use path will occur. Everything below the bottom edge of the detectable warning surface is considered the pedestrian access route (see PROWAG R302, clear area) and therefore shall have a running slope of less than 5 percent. Further, the detectable warning surface shall be located so that one corner is no more than a 2-inch distance from the back of the adjacent street curb and the other edge is no more than a 5-foot distance.

3.6.2.6.8 Transition to Sidewalk

From the landing to the adjacent connecting sidewalk/shared-use path, transition the sidewalk/shared-use path to the requirements of 3.6.1.5 - Horizontal Alignment and 3.6.1.6 - Vertical Alignment over as long a distances as necessary to meet the requirements of a pedestrian access route. If the running slope exceeds 5 percent, the path is considered a ramp and landings are required after every 15 feet of ramp.

Where connecting to an existing sidewalk/shared-use path with a cross slope greater than 2.1 percent, construct a cross slope transition panel where new meets existing. The length of the cross slope transition panel shall be as necessary, minimum 5 feet, to transition to the existing cross slope at a warp rate of not more the 0.5 percent per foot.

3.6.2.7 Parallel Curb Ramps

Parallel curb ramps have a running slope that is in line with the direction of sidewalk travel and lower the sidewalk to a landing where a turn is made to enter the pedestrian street crossing. A landing area is required at the bottom of the ramp per PROWAG. The term parallel does not differentiate between directional or diagonal ramps. A single parallel curb ramp could be used at an intersection corner as a diagonal ramp, but only where there are documented constraints and with the approval of the City.

3.6.2.7.1 Ramp Running Slope

Parallel curb ramps have running slopes of 5 percent or greater and 8.3 percent or less but shall not require the ramp length to exceed 15.0 feet. If the ramp's running slope will be less than 5 percent, it is considered a blended transition instead of a parallel curb ramp and therefore a landing is not required unless there is a change in direction of travel at the

bottom of the ramps to enter the street and crossing. Note there typically is a change of direction in travel in the case of parallel curb ramps because of the nature of their design and use, therefore bottom landings are almost always required. For additional discussion on blended transitions, see PROWAG. Grade breaks are not permitted within the ramp.

3.6.2.7.2 Ramp Cross Slope

The cross slope for parallel ramps shall not exceed 2.1 percent.

3.6.2.7.3 Ramp Width

All parallel ramps shall have the same width as the sidewalk or shared-use path that they are serving (e.g., if the sidewalk is 6 feet wide, the ramp shall be 6 feet wide). See section 3.6.2.6.3.

3.6.2.7.4 Back of Walk Curb

Back of walk curbs are typically utilized in the design/construction of parallel curb ramps. It is best practice to always include a back of walk curb along the ramp(s) and landing even if located in a fill section - over time adjacent ground and landscaping can erode onto the ramp(s) and landing and property owners may also modify or add landscaping that may encroach. The back of walk curb shall be installed entirely outside of the ramp and landing so not to reduce width of the pedestrian access route (e.g., if the sidewalk is 6' wide, the curb should be installed beyond the back of walk to maintain the 6-foot width through the ramp and landing). Exposure of the back of walk curb shall vary with the largest exposure at the landing to zero where the top of ramp meetings the adjacent sidewalk/shared-use path. If unable to transition to zero exposure due to constraints, the curb can be transitioned on the end to taper over a 1-foot distance to avoid creating a tripping hazard or blunt end.

3.6.2.7.5 Landing

The bottom landing on parallel curb ramps will sometimes be located on intersection/corner radii which will cause them to change dimensions from the back to the front of the landing as they radiate out. The narrowest dimension, at the back of the landing, shall match the width of the sidewalk/shared-use path the ramp is located along and in no cases be less than 5 feet unless there are constraints that have been documented by the designer and approved by the City. See exception in 3.6.2.8 – Ramp/Landing Width Exception.

The landing's finished surface slope shall typically not exceed 2.1 percent in any direction. Where a landing abuts a pedestrian street crossing without yield or stop control, or a mid-block pedestrian street crossing, the slope parallel to the curb may match the maximum slope allowed per 3.6.2.9 – Pedestrian Street Crossings.

3.6.2.7.6 Transition to Sidewalk/Shared Use Path

Transitions from the top of parallel ramps to the adjacent connecting sidewalk/shared-use path shall follow the same requirements outlined in 3.6.2.6.8 – Transition to Sidewalk beyond the top landing.

3.6.2.8 Ramp/Landing Width Exception

At pedestrian street crossings where the sidewalk/shared-use path width differs on each side of the road, the ramp and landing width must be constructed to match the City standard width. Ramps widths are to match the width of sidewalk running into the ramp landing. Narrower ramps on the opposite side of the street do not make them non-compliant based on width alone..

3.6.2.9 Pedestrian Street Crossings

The cross slope of pedestrian street crossings shall be per PROWAG R302.6 which is summarized in the following table:

Crossing Type	Maximum Cross Slope
Intersection **WITH** Yield or Stop Control	2%
Intersection **WITHOUT** Yield or Stop Control	5%
Mid-block Crossings *	Road Grade (not exceeding 5%)

* Mid-block crossings are not permitted unless otherwise approved by the City Engineer. Where approved, additional mitigations might be required, based on the corridor and location of the crossing, to make the mid-block crossings safe, including by not limited to: curb extensions, enhanced crossings/island, lighting, striping, and/or signage.

3.6.2.10 Miscellaneous/Special Cases

The designer/Engineer of Record shall provide written documentation for why a particular design (e.g., curb ramp, sidewalk/shared-use path, etc.) cannot meet the requirements of PROWAG, City Design Standards, City standard drawings etc.) that will be reviewed by the City and if approved will be included with the curb ramp inspection forms that will be uploaded and stored in the City's asset management system.

Combination curb ramps are often utilized in many designs. They are called this because they include elements of both perpendicular and parallel curb ramps. An example includes ramping down sidewalk/shared-use path to a landing (e.g., parallel design element) before coming off of the landing with an intersecting curb ramp down to street level (e.g., perpendicular design element). When designing or constructing combination ramps, follow the relevant requirements for both types (e.g., utilize a back of walk curb behind the landing elements, meet the running slope requirements on all ramp elements, square off all grade breaks, utilize flared sides where possible on ramps that intersect the street with adjacent landscaping buffers, etc.)

If a project is only replacing curb ramps and is tying into existing sidewalk/shared-use path that is not being replaced and this sidewalk/shared-use path is currently narrower than the City's standard/requirement for the street's classification or zoning for the area the street is within, the curb ramps should be designed/constructed as the width that would be required for new construction if adequate right-of-way is available or can be obtained within the scope of the project. Transition panels back to the width of the remaining narrower existing sidewalk/shared-use path should then be provided.

In certain situations, the City will allow a depressed corner with one combined landing and two separate detectable warning surfaces to orient the directions of crossing at an intersection. In order to provide separation between them, a vertical curb should be installed along the street corner. Where possible this curb should have a 6-inch exposure

and be 12 inches wide for strength since it will likely be driven over by over tracking vehicles. Additionally, painting the inside and top of this curb yellow can minimize the possibility of this non-standard feature on a corner becoming a tripping hazard since it might otherwise visually blend in with all of the other surrounding gray concrete.

When a sidewalk/shared-use path has been constructed as part of a City project, private development, etc. but does not end at an intersection, provide an end of walk curb ramp per ODOT standard drawing RD952 for street level access. Detectable warning surfaces are typically not required but the grades of the transition must meet curb ramp slope requirements for accessibility. The City may waive the requirement for this transition in some instances with an appropriate submittal and approval.

With new and retrofit roundabout projects, extending the sidewalk/shared-use path to a point beyond the bike ramp before terminating the sidewalk/shared-use path with an end of walk curb ramp is preferred over utilizing the bike ramps for pedestrian access to the roadway. If it is necessary to utilize the bike ramps for pedestrian access until a future time when a sidewalk/shared-use path is extended beyond the roundabout, bike ramps must be designed to meet accessible grades for curb ramps.

3.6.2.11 Additional Definitions and Requirements

ORS 801.220 defines crosswalks as any portion of a roadway at an intersection or elsewhere that is distinctly indicated for pedestrian crossing by lines or other markings on the surface of the roadway. Where no marked crosswalk exists, a crosswalk is every crossing of an intersection.

In general, when a feature in the public right-of-way is altered, the requirements for new construction must be applied to the maximum extent feasible. Any design that does not meet the accessibility requirements for new construction must be documented in writing, submitted to, and approved by the City prior to construction. Note approved deviations on the appropriate construction drawing.

Detectable warning surfaces are required on all accessible curb ramps, and where the pedestrian paths of travel cross intersecting roadways, such as a paved trail intersecting a roadway with no curb. PROWAG refers to this as a blended transition. Detectable warning surfaces must extend for the full width of the curb ramp or blended transition.

3.6.2.12 Planter Strip

The planter strip is the portion of the roadside that is located between the curb and the sidewalk/shared-use path. Planter strips are required to conform to roadside safety requirements in terms of slope, landscaping, appurtenances, utilities, etc.

The landscaped portion of the planter strip must be a minimum of 5 feet wide, unless otherwise approved by the City Engineer, except where the sidewalk/shared-use path meanders to be adjacent to the curb. In order to prevent sharp re-entrant angles in the landscaped portion of the planter strip, an edge not less than 8 inches long and squared to the curb must be constructed at the juncture of the sidewalk/shared-use path to the curb.

Planter strips must contain street trees when required by the Bend Development Code. Street trees shall conform to the City's landscaping requirements found in 12 - Landscape Architecture and Irrigation Systems and sight distance requirements found in 3.3 - Design

Considerations. Planter strips may be utilized for swales or landscaping and shall conform to the applicable Bend Development Code provision. When used for landscaping, the landscaping shall conform to the City's landscape provisions found in 12 - Landscape Architecture and Irrigation Systems.

The cross-slope of the planting strip between the curb and the right-of-way must not be steeper than 4H:1V to provide a recoverable roadside slope. All appurtenances, utilities and structures located within the planter strip that are roadside safety obstacles must comply with roadside safety principles of 1.5 - Roadside Safety. Obstacles must be located as far from the roadway as possible and be designed with recoverable slopes or breakaway foundations complying with AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, with interim revisions."

The planter strip must not contain stairs. Stairs are not allowed to be located within the public way. Deviations to this standard may be submitted to the City Engineer for design standard deviation review per the requirements of 3.2 - Deviation from Streets Standards.

Where existing ground cross slopes exceed 12 percent, see 3.4.7 - Hillside.

3.6.2.13 Exceptions

This section identifies exceptions to the ADA requirements. The City's Transition plan outlines requirements for operation of the ADA program. This design guideline does not set direction of maintenance activities or operational goals outlined in the transition plan. However, when a ramp upgrade or installation is required, it must meet these requirements unless otherwise stated in a project scope or contract.

3.6.3 Transit Facilities

Bus stop locations, bus pull-out locations and transit facilities located within the public right-of-way shall be approved by the City Engineer.

When evaluating bus stop locations or a corridor of stops, the impact on roadway operations and safety shall also be considered. Analysis inputs should include: dwell time; bike lane and travel lane blockage effects; transit vehicles ability to enter and exit the flow of traffic; convenience and safety of passengers; and convenience and safety of pedestrians accessing the bus stop.

Transit facilities shall be designed to incorporate roadside safety features by locating benches and shelters far away from the traveled edge of the roadway, as close to the right-of-way line as possible. Deviations in sidewalk/shared-use path alignment to facilitate the installation of transit facilities shall be designed to comply with the horizontal alignment requirements of this chapter. Consideration should be given to using breakaway support features to reduce the crash severity of vehicle run off the road events when elements cannot be located with adequate clearance to the traveled way.

3.6.3.1 Bus Stop Locations

A tTransit or bus stop is a designated place along a transit route typically in the street right-of-way where a public transit vehicle stops to load and unload passengers. The following are design guidelines for the locations of bus stops:

- Distance between stops is typically 800 feet

- Stops are located in areas where passengers have a safe and direct access to sidewalk/shared-use paths, walkways and waiting areas
- Passengers have access to an accessible route to and from the bus stop and onto the bus
- Convenient access for pedestrians
- Stops are located in proximity to marked crosswalks and low stress routes or in locations that are consistent with systematic crossing spacing on the roadways;
- A properly developed and located bus stop allows for safe movement by the bus in to and out of the main traffic flow and minimize conflicts with the bike lane
- Stop locations are coordinated with the transit agency

3.6.3.2 Types of bus stop locations

3.6.3.2.1 Far-side

A far-side bus stop is a stop that is located immediately following an intersection and is recommended for all traffic signals and when:

- Traffic in the direction the bus is traveling is heavier approaching the intersection than leaving the intersection
- There is high demand for right turns in the direction the bus is traveling
- The crossing street is a one-way street where traffic flows from left to right
- The location is one that offers a clear advantage for transit riders by providing improved access to a major destination or to other intersecting bus routes
- Priority control at the traffic signal is utilized to maintain bus schedules

3.6.3.2.2 Near-side

A near-side bus stop is a stop that is located immediately before an intersection and is recommended for all roundabouts and when:

- Traffic in the direction the bus is traveling is heavier leaving the intersection than approaching the intersection
- The cross street is one-way where traffic flows from the right to left
- The location is one that offers a clear advantage for transit riders by providing improved access to a major destination or to other intersecting bus routes

3.6.3.2.3 Mid-block

A mid-block bus stop is a stop that is generally located 100 feet or more before or beyond an intersection and is generally not recommended. Mid-block locations may be considered when:

- The distance between intersections far exceed the standard for bus stop spacing
- Traffic or physical street characteristics prevent siting a stop close to an intersection
- The bus stop serves large businesses, housing developments, or other significant trip generators
- An analysis is conducted to determine if additional crosswalk enhancements or sidewalk/ shared-use path connectivity is required to provide access to a safe crossing location so that riders do not cross mid-block in an unmarked location

3.6.3.3 Bus Stop Turnouts

Bus stop turnouts are not standard for arterial and collector roadways. Design standard deviations review shall consider the following criteria:

- Bus dwell time
- Dwell time impact on bicyclists
- Width of roadway and impact of following vehicles passing bus during dwell time on arterial or collector roadway operations and safety

When approved, bus turnouts shall be designed in accordance with the current standards set forth in AASHTO.

3.6.3.4 Mobility Hubs

Mobility hubs are physical centers that connect transportation modes and may provide an integrated suite of services, information, and amenities. The Bend development code defines mobility hubs, and TSP Figure 5-2 identifies target mobility hub locations. Mobility hubs are established in conjunction with Cascades East Transit. In addition to the mobility hub, a larger center that connects multiple transportation modes and may provide mobility services and information; there is neighborhood mobility points. Neighborhood mobility points are smaller scale than a mobility hub with less services and fewer amenities. Neighborhood mobility points are typically located along transit and/ or low stress routes at locations with higher density or at intersections where higher volumes of people may change modes. They range in size (small, medium, large) based on the space used and number of services provided and can be all in the public right-of-way, all on private property with a public access easement or a combination. Mobility points are small facilities, typically the size of one or a few parking spaces that may provide micromobility services, electric vehicle charging, and car share loading/unloading. All types of mobility hubs generally include some type of kiosk providing information about the services at the hub.

The design of each mobility hub will be site-specific, and determined by the City Engineer. Example layouts for mobility points is provided in Standard Drawings R-50A and R-50B. The standards for neighborhood mobility points are shown in the following table:

Type	Urban Context	Size	Shared Mobility Elements	Future Transit Elements	Other Elements /Amenities
Small	Neighborhood commercial centers, parks, commercial destinations	1 parallel parking space	- Bikeshare and dockless parking zone	- Microtransit stop	- Bench - Info Kiosk and wayfinding
Medium	Neighborhood commercial centers, midsize to larger parks, commercial destinations	2 parallel parking space	- Bikeshare and dockless parking zone - Carsharing: 1 space for TNC/paxi pickup	- Microtransit stop	- Bench - Info Kiosk and wayfinding
Medium+	Neighborhood commercial centers, midsize to larger parks, commercial destinations	3 parallel /angled parking space – or 2 parallel spaces plus end of block	- Bikeshare and dockless parking zone - Carsharing: 1 space for TNC/paxi pickup	- Microtransit stop - Shuttle Stop	- Bench - Info Kiosk and wayfinding - Covered Shelter - EV Charging space
Large	Off street parking on Commercial Centers. (High density: outlying city neighborhoods, suburban transit centers, shopping/ commercial areas (parking away from destinations), destination centers)	Min of 6 parking spaces in an off-street location	- Bikeshare and dockless parking zone - Carsharing: 2 space for TNC/paxi pickup - 2 Carpool parking spaces	- Microtransit stop - Shuttle Stop	- Bench - Info Kiosk and wayfinding - Covered Shelter - EV Charging space - Placemaking element such as food truck w/ outdoor seating,

3.6.4 Driveways

The locations of new driveways shall be approved through land use (e.g., part of a master plan, subdivision, or site plan) and through a right-of-way permitting process. Driveways shall be reviewed with the following considerations:

- There is a valid land use approval for the driveway (or is confirmed that no land use approval is necessary for the driveway in question);
- There is only a single access point to the property unless:
    - The lot is on a corner lot
    - Higher density developments (multi-family, industrial, commercial) require additional access points for onsite large truck circulation. Access approved by the City Engineer.
    - Duplexes are allowed up to two aprons with an aggregate maximum width of 32 feet
    - Triplexes are allowed up to three aprons with an aggregate maximum width of 32 feet
    - Quadplexes are allowed up to four aprons with an aggregate maximum width of 32 feet
    - The residential lot has a wide street frontage per the Bend Development Code Chapter 3.1.400
- The access is to the lowest classified roadway facility abutting the property (order of classification (lowest to highest): alley, local, collector, arterial)
    - New residential developments will be required to abandon existing driveway access from local streets if they have access to an alley access unless:
        - Access to an existing permanent garage structure would be removed
        - Removal of the access would make the site non-conforming – removing parking requirements for the existing site use
        - The alley is not accessible
    - Where adjacent to two streets and one street is designated as a low stress route as shown on Figure 5-1 of the TSP, access shall typically be from the street that is not a low stress route
- Adequate intersection sight distance for all turning movements in and out of the proposed driveway are provided
- The driveway meets the following minimum spacing (10 feet apart (bottom of curb drop to bottom of curb drop)), unless otherwise approved by the City Engineer where sufficient separation from utilities (existing or proposed) exists

- Maximum distance to an intersection is provided given the lot configuration and site layout

- Driveways shall not compromise safety and operations.

- Where a driveway is proposed across the street from another driveway, alley, or street, the path of travel should be aligned or sufficiently offset, where possible

- No drywells, sedimentation manholes, water meters, valves, manholes or pressure sewer valves/pits or any other utility structures will be permitted within the driveway apron or driveway landing unless otherwise approved by the City Engineer. No utility structures will be permitted in sidewalks/shared us paths or applicable path of accessible travel.

Concrete driveway approaches are required on all new construction or reconstruction where sidewalk/shared-use path and/or curb is existing or proposed. The driveway apron aids in retention of stormwater within the right of way, conveying flows along the curb, and delineates private vs. public property/ownership. Asphalt driveways are permitted where sidewalk/shared-use path or curb is not existing or proposed. New alleys or reconstructed alleys must have a driveway approach at the intersection of the alley and roadway. Where private streets or private accesses intersect with the right of way, a driveway apron must be constructed to delineate the separation between the public and private roadway sections. Site drainage will be permitted into the right of way for the first 20 feet, inclusive of the driveway approach landing. All other private site drainage to be captured and contained on the private site in conformance to City Code Title 16." Design standards deviation requests to consider a curb return rather than a driveway approach may be considered by the City Engineer in accordance with 1.2 - Deviations, Waivers, or Modifications and the following specific driveway review criteria:

- The design vehicle for the site is too large to accommodate turns within the standard driveway apron

- A pork-chop or other traffic mitigation measure is to be installed at the site entrance

The minimum sidewalk width is 4 feet through driveways and 8 feet for shared-use paths. The design shall provide sufficient horizontal and vertical control and the drawings annotated to ensure that driveway conforms to federal, state, and local accessibility standards.

Driveways and/or mountable curbs must be avoided at low points whenever possible. Where driveways are located at the bottom of a cul-de-sac or other dead end roadway, driveways shall be relocated outside the low point to prevent stormwater flowing from the street down into a private property. Additional catch basins or other infrastructure may be required at these areas to further protect the private properties.

3.6.5 Signing

No sign shall be designed for, or installed, within public right-of-way unless it has first been reviewed and approved by the City Engineer or designee.

Street signs and barricades shall be designed per the City of Bend Signing and Marking Manual. Street signs and barricades shall be designed and installed according to City of

Bend Standards and Specifications, and meet the requirements of the most current edition of the MUTCD as well as the Oregon Supplements to the MUTCD. This applies to signs and traffic control devices on all streets open to public travel, whether publicly or privately owned or maintained.

To provide appropriate roadside safety, ground-mounted signposts shall be breakaway in compliance with the current AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, with interim revisions."

New signs shall be installed, and existing signs modified, to reflect new lane configurations and in coordination with existing or revised pavement markings. Remove and replace signs beyond the project limits as necessary to reflect changes implemented with the project.

Existing signs within project limits that are not in compliance with these requirements in terms of offsets, siting, physical condition, and applicability shall be updated to bring them into compliance.

Plans shall reference signs by MUTCD type, and include designs for all non-standard signs. Designs for standard signs are provided in FHWA's Standard Highway Signs manual; ODOT's Sign Policy and Guidelines and the City's Standard Details include designs for Oregon- and City-specific sign designs not found in the federal manual.

Before any new highway, detour, or temporary route is opened to traffic, all necessary signs and barricades shall be in place. Signs necessitated by road conditions or restrictions shall be removed when those conditions cease to exist or the restrictions are withdrawn. Temporary TRAFFIC CONTROL CHANGE AHEAD signs, installed on wood posts, shall be installed on any project that changes traffic control type.

3.6.6 Pavement Marking/Striping

Pavement marking and striping, including curb paint, information is provided in the Signing and Marking Manual. Plans shall show and identify a minimum of 300 feet of existing striping beyond the project limits, to ensure proper tie-in to existing striping. Where project limits occur within 500 feet of existing pavement or striping tapers, limits of striping plans shall be extended to include the full taper. Plans shall show and identify all existing striping and include all striping removal necessary to implement new striping as shown.

Turn lane storage shall reflect 95th percentile queues as determined in a queuing analysis, which shall be submitted with the striping plan.

3.6.7 Mailboxes

Mailboxes located within roadway right-of-way must obtain a right-of-way permit prior to installation. The City reviews the location to confirm clear vision does not conflict with bike facilities, vision, accessibility requirements, and utility avoidance. A developer and homeowner must work with the United States Postal System for location and installation specifications. New subdivision developments must not install individual mail boxes but rather cluster box units.

Foundations and support structures of individual and cluster postal delivery boxes shall meet the current requirements of PROWAG and USPS or manufacturer's recommendations.

The mailbox shall be firmly secured to the post to ensure that the impact of a vehicle does not loosen the box which could then become a flying object hazard.

Mailboxes shall not require that users cross an arterial or collector roadway. Mailboxes shall be located on the users side of arterial and collector roadways. Where feasible locate mailboxes near fire hydrants, where parking is already limited, to reduce the conflict between parked vehicles and mail pick up. (There is no state law or city code that prohibits parking in front of mail boxes.)

For all new and reconstructed roadway projects, rural delivery mailbox styles shall be considered for consolidation into cluster postal delivery boxes.

The location of cluster postal delivery boxes shall be shown on the engineered plan submittal drawings for review and approval. The United States Postal Service will approve the location of cluster postal delivery boxes.

An accessible pedestrian path of travel must be designed and constructed to the mailbox per PROWAG and USPS requirements.

An accessible pedestrian path of travel must be maintained on sidewalk/shared-use paths adjacent to cluster boxes per PROWAG standards.

Cluster postal delivery boxes shall not be located on arterial and collector streets, unless otherwise approved by the City Engineer. Their location shall be shifted to nearby and convenient local streets. When locating the cluster postal deliver box care should be taken to locate it in an area that minimizes impact on abutting properties.

The back edge of the sidewalk/shared-use path shall smoothly meander back from the central delivery mailbox station to provide a minimum 5-foot wide unobstructed pathway. The edge of the mailbox shall comply with Clear Zone requirements.

3.6.8 Illumination

Street lights (luminaires) are required at all street intersections with collectors and arterials, including local and private street intersections with collectors and arterials. Lights must be placed to illuminate the arterial/collector crossing, not the local street. This requirement does not extend to alley intersections. Enhanced crosswalks (marked, signed at a minimum) including mid-block crosswalks shall be illuminated on both approaches

At crossings, a luminaire will be installed a half to one luminaire pole height distance before the crossing. Typical luminaire mounting height is 28 feet. Luminaires should not be placed directly over the crossing, rather, before the crossing to provide front lighting unless otherwise approved.

Luminaire shields are not typically installed on City street lights. A shield may be required to cut-off light where a residence in close proximity may be impacted. .

Requests for street lights at other locations shall be reviewed in conformance with the Transportation Division’s Standard Operating Procedure and installed only with City Engineer approval.

Separate street lighting plans are not required for most projects although proposed street lights shall be shown on plan and profile or utility sheets. Plans must include the following:

- Proposed pole locations shall comply with the City's Roadside Safety requirements
- Power supply shall be provided via underground wiring and conduit systems conforming to power company requirements
- Fixtures shall be cut-off fixtures to minimize light pollution and up-lighting
- Light poles and fixtures shall be approved and maintained by the power company

Street lights in the City of Bend are operated and maintained by either Pacific Power Corp or Central Electric Cooperative in accordance with the City's franchise agreements. Lighting infrastructure shall be per the appropriate agencies requirements. While there are some existing street lights operated and maintained by the City of Bend, all new lights must be owned and maintained by one of the power companies.

On private development projects, all costs of installation shall be borne by the developer for installation. The City will pay for ongoing power and maintenance expenses for public street lighting. Ongoing expenses for private street lighting (including power costs) shall be borne by the developer or homeowner's association.

Decorative lighting and solar lighting within City right-of-way will not be permitted without special approval and maintenance agreements signed by the City Engineer and approved by the Transportation and Mobility Department (TMD) Director.

See standards section 13.6.20 for additional information on the electrical and lighting requirements.

3.6.9 Drainage

Roadways shall comply with the storm drainage requirements of 6 - Stormwater.

The standard drainage inlet feature for arterials and collectors shall be curb inlet when bike lanes are present.

Where roadway grades exceed 6%, drainage systems must be reviewed to ensure stormwater is not bypassing catch basins.

3.6.10 On-Street Parking

On-street parking shall be designed to accommodate parking parallel to the curb. There may be instances when head in or back in angle parking is desirable. The City will consider these instances on a case-by-case basis, usually only permitted at locations to service a park or trail head where traffic volumes are low. Backing into traffic should be avoided whenever possible to avoid vehicular conflicts with multi-modal and other vehicles using the street corridor. Where on-street parking is striped, accessible parking must be considered and accounted for within the right-of-way.

Where parking is permitted on arterial or collector streets, as classified by the City's TSP, per the Bend Development Code, parking permitted must be located outside of permitted clear vision areas or where intersection sight distance is provided for the design speed limit. Curb extensions are required at intersections to create parking bays, maintaining

vehicles out of the clear vision and sight distance constrained areas, and improve visibility of pedestrians.

Parking bays on arterial and collector streets are limited to a maximum length of 220 feet as required to provide curb extensions at the end of the block and mid-block (depending on block length) to help define parking lane and to allow space for landscaping and utilities.

Where parking is adjacent to a bike lane, a parking separated bike lane configuration may be used. While supported, there is no standard detail for a parking separated bike lane since the design parameters vary based on location. Parking separated bike lane design will be reviewed on a case-by case basis by the City Engineer with consideration for the location (number of driveways, length and continuity of parking, etc.), the transition of the bike lane through the intersection, and other applicable factors.

3.6.11 Traffic Calming Devices

Traffic calming devices in the context of the standards, means specific traffic calming devices designed to restrict travel speeds over, or through, a specific location and reduce volumes. Traffic calming devices include neighborhood traffic circles (which are very specifically not roundabouts), speed humps, raised pedestrian crossings, curb extensions, and other items noted in the following tables. Within the context of this document, traffic calming devices are not medians, roundabouts, signals, stop signs or crosswalks as these are typical operational or cross-sectional elements of roadway design.

City standards provide for arterial and collector roadway designs that are reflective of their abutting land use zoning and are designed to serve their surrounding context. The installation of traffic calming devices, other than those listed in Table 1 below, are not allowed on arterial and collector roadways due to their negative impacts on emergency vehicle routing, maintenance issues, and truck circulation issues.

The standard local street cross sections provide a hierarchy of local streets with narrower widths to encourage travel at slower speeds. New local street systems shall be designed to provide connectivity without creating long straight streets that facilitate higher speeds or direct short-cut connections between arterial and collector streets. Where geometric and site design constraints limit alternate options on new designs or reconstructions, traffic calming may be approved by the City Engineer. Traffic calming devices should not be used on local industrial streets.

1 – the following traffic calming tools may be used on all streets except local industrial:

1) Curb extensions – may be used on streets with parking or wider travel lane sections to narrow the travel width, reduce the crossing distance, and increase pedestrian visibility. Curb extensions must provide a minimum 22-foot travel width on local streets and the minimum standard cross-section width including bike lanes and buffer on arterial and collector streets. Curb extensions must be designed to provide the required curb radius and serve the specified design vehicles.

2) On-street parking modifications – parking bays or lanes may be added to wide streets per the dimensions on the standard street sections. Where one-sided parking exists on local streets, alternate parking layouts can be used.

3) Additional landscaping or vertical elements to narrow the field of vision – except where restricted for clear vision, sight distance, sign visibility, additional street side

vertical elements may be added to narrow the view corridor such as landscaping, fencing or other treatments approved by the City Engineer. This may include landscaping or art in traffic circles and roundabouts.

4) Narrowing wider travel lanes to standard widths - 11-foot minimum travel lanes on arterial or collector streets, local street widths may be narrower per standard cross-sections (note that 10-foot minimum travel lanes may be used for short segments, typically less than 100 feet, on arterial or collector streets to accommodate an enhanced crossing island on an existing street that includes a one and a one half foot shy line on each side).

5) Centerline treatments – islands/medians, traffic circles, mini/urban roundabouts or roundabout. See design criteria for each element in other sections of these standards.

The following traffic calming elements may only be considered on local street sections that are part of the low stress network, have an uncontrolled length in excess of three blocks, vehicle volumes over 400 Average Daily Traffic (ADT), and 85th percentile speeds more than 5 mph over the posted speed limit.

2 – traffic calming on certain local streets

1) Travel path narrowing (chicanes) - raised curb islands or center medians may be used to narrow travel path widths to standard widths for the local street type; parking may be removed for short segments on one or both sides in order to create travel path narrowing using raised islands or medians

2) Speed humps (Standard Drawing R-32) - speed humps are one tool that may be used on designated greenways to reduce vehicle speed and volumes as part of the greenway corridor construction. Speed humps may be considered on existing streets designated as greenways where volume counts are more than 1,000 vehicles per day and 85th percentile speeds less than 30 miles per hour (greenways are typically posted with 20 mph speed limits). Speed hump design shall include:

   400-foot spacing along all or target portions of the route.

   Locate speed humps more than 50 feet away from an intersection and 10 feet minimum to either side of a driveway or alley

   Speed hump design must accommodate and not adversely impact storm water drainage

   Where installed on a street with no sidewalk/shared use path, speed humps extents must be designed to allow a minimum 4-foot accessible passage on each side of the street. In this case, parking must also be restricted for 10 feet on either side of the speed hump to allow access to the accessible way.

3) Alternating parking – where parking is provided on one side, it may be alternated to create a chicane effect. The side selected for parking should favor the side with more curb line (i.e., fewer driveways and more parking spaces) as feasible.

3 – the following traffic calming tools may be used on all local streets

Raised crosswalk (Standard Drawing R-33) - raised crosswalks may be constructed a) on a local street adjacent to a school at the marked crossing that provides a direct route to the school entrance designated by the school for students walking and biking to access the school, or b) on a local street adjacent to a marked crossing that provides the primary access to a BPRD park.

Traffic calming can be an effective tool when an area has only one longer and/or wider street with higher speeds and volumes. Where more than one street in an area has been identified with speeding issues or serves the same through route, a traffic evaluation is required to develop a systematic installation such that construction of traffic calming on one street does not push the issue to an adjacent street. A traffic evaluation may be required in other areas where there is potential for shifting traffic to create similar impacts on adjacent local streets. The traffic evaluation scope will be confirmed by the City Engineer and will include pre and post traffic and speed counts, estimated traffic on adjacent routes, and a systematic traffic calming design recommendation.

All traffic calming devices require fire department review and approval of the City Engineer. Traffic calming will generally not be permitted on primary access routes to hospital or medical facilities.

3.6.12 Railroad Crossings

All new or reconstructed rail crossings shall be built to Federal Rail Administration standards and approved as quiet zones.

3.7 Temporary Traffic Control

The primary function of temporary traffic control is to provide safe and efficient movement of all road users through or around work zones while protecting those within the work zone. The City requires temporary traffic control, based on a City-approved Traffic Control Plan, for all improvement projects, public or private, performed within, or impacting travel on, public right-of-way.

Traffic Control Plans (TCP’s) shall be provided for review with the ROW permit submittal.

All traffic control shall comply with the current edition of the Oregon Temporary Traffic Control Handbook (OTTCH), where traffic control is being implemented for three or fewer days. All traffic control that extends beyond three days must comply with requirements set forth by MUTCD.

Sidewalk/shared-use path and bikeways shall be made accessible at all times during construction. When the traffic control exceeds the "temporary traffic control" of three or fewer days, a pedestrian path or approved detour shall be implemented. Sidewalk/shared-use paths may be detoured around the construction site if the detour route exists in complains with ADA/PROWAG requirements. Pedestrian and bike detours should be at the same level of traffic stress or better than the existing route without creating excessive out of direction travel.

Traffic control from higher order streets, collectors and arterials, shall not be detoured onto local streets unless otherwise approved by the City Engineer and speed mitigation is provided.

Where onsite construction occurs adjacent to the right of way line, and work poses a safety concern to the public's use of the adjacent public sidewalk/shared use path, the contractor must construct barriers and/or overhead protections, not blocking right of way but rather separating them from the private property hazards, to allow safe pedestrian access through the right of way. Detours across arterials and collectors will not be permitted unless approved by the City Engineer. Accessibility must be maintained through the construction site frontage. Where temporary structures and/or fencing are required and approved by the City Engineer, such as scaffold, it must be designed by an engineer and may require revokable agreements.

Closures of the right of way for pedestrian, bicycle, or vehicular travel is authorized through a City approved construction schedule for a specific period of time. The contractor will be required to vacate the right of way or remove closures based on the approved construction schedule unless written schedule extensions are approved by the City Engineer.

Traffic Control Plans shall be developed according to the following:

TCP's must be in substantial compliance with:

- The Manual on Uniform Traffic Control Devices (MUTCD), current edition; Chapter 6

The Oregon Supplements to the MUTCD

- The Oregon Temporary Traffic Control Handbook for Operations of Three Days or Less (OTTCH), when applicable

Additional Resources:

- ODOT Standard Drawings, TM 800 series – contains additional information and details for traffic control scenarios not found in the OTTCH

Non-project related TCP's need not be CAD-drawn, but must be legible and scaled or dimensioned to clearly indicate relevant spacings and distances. Figures from the references listed in this section may be utilized whenever applicable, and customized as necessary. At a minimum, TCP's must show the following:

- Existing features within 300 feet of the work area (# of lanes, turn lanes or medians, bike lanes, sidewalk/shared-use paths, stop signs, traffic signals). (Extend to 500 feet if work area is within 500 feet of a traffic signal.)

- All proposed Traffic Control Devices, including signs, cones/tubular markers, barrels, barricades, etc. Identify devices by MUTCD types or Legends/Colors, and size.

- Posted speed. Work zone area component lengths and device spacings are dependent upon prevailing speeds of area traffic. Speed signs for speeds less than the permanently posted or statutory speeds may only be implemented with a Temporary Speed Zone Reduction approved by the City Engineer.

- Spacing of all Traffic Control Devices. See Chapter 2.3 of the Oregon Temporary Traffic Control Handbook

- Lengths of the Temporary Traffic Control Zone Area components, including the Advance Warning Area, Transition Area, Activity Area (Buffer Zone + Work Zone), and Termination Area. See Chapter 2.1 of the Oregon Temporary Traffic Control Handbook or Section 6C of the MUTCD for required lengths

- Proximity to nearest intersection. Site specific drawings are required for all work zones within 500 feet of a signalized intersection. Note that Oregon law prohibits flagging through an operating traffic signal (except for uniformed traffic control officers). Lane reductions through an operational, signalized intersection may be permitted on multi-lane facilities.

- Work zones must accommodate people walking and biking – see Chapter 1.6 of the OTTCH. Use the shortest detour route and the same level of stress as the existing facility. A minimum of 4 ft for one-way and 6 ft for two-way pedestrian travel, and 5 ft for one-way and 8 ft for two-way bicycle travel must be maintained. Signs shall be installed so they do not encroach on the walking and biking route widths. Bicycle route alignment shall be such that people can maneuver along the route without having to get off their bike to negotiate (ie not sharp turn angles). Closures of facilities for people walking and biking must be clearly indicated, and users diverted upstream at appropriate locations. If needed to provide a similar level of traffic stress, temporary crossing enhancements may be required. Signs used shall be MUTCD compliant.

- Existing traffic control devices, including stop signs and traffic signals, within 300 feet of the work area. Detour signing must show each proposed sign, and include signing adequate to direct motorists through the complete detour route and back to the original roadway. Detours shall be used only with an approved Street Closure Permit approved by the City Manager.

Modifications to approved traffic control shall be made during construction, if deemed necessary and directed by the City Engineer.

Temporary Traffic Signals - Plans for temporary traffic signals shall include the same information required for permanent installations.

Traffic Signal Removal Plan/Traffic Signal Staging Plan – such plans, when deemed necessary by the City, shall be prepared in the same format and including the same information referenced above.

3.8 Pavement Restoration Requirements

3.8.1 Grades

The City of Bend establishes a “Grade” based pavement cut standards system developed on the date of construction, the last qualifying pavement treatment applied and the Pavement Condition Index (PCI) rating of a pavement. These standards will be in effect for any City roadway from initial construction or from the time the most recent qualifying pavement treatment was applied. The PCI and road classification (Arterial, Collector or Local road) will determine which Grade must be used.

Qualifying pavement treatments include the following but are not limited to: mill and overlay, removal and replacement, thin lift overlay, large area patches half a block in length, and half a lane in width or full street reconstruction. Slurry seals, chip seals, and fog seals are not considered qualifying pavement treatments; they are considered a maintenance treatment.

Grade 1 - Pavement Cut Restriction Standard (PCI 100-60, qualifying pavement treatments < 5 years): Pavement cuts will only be allowed on an emergency basis or through the waiver process defined in Part I - Section 2. No planned or permitted cuts will be allowed when these standards apply. If pavement cutting is necessary for emergencies, pavement restoration will be curb-to-curb for 30 feet centered over improvements.

Grade 2 – Full Standard (PCI 100-60, qualifying pavement treatments > 5 years): Pavement cuts must be full depth and extend 12 inches beyond the nominal trench edge longitudinally and transversely (Standard Drawing R-11) and be the width of the roller plus two inches, four-foot minimum width. Pavement cuts must be at lane or skip line. Transverse trenches (perpendicular to the centerline) constructed with less than 10-foot separation between cut lines shall be patched as one patch incorporating both trenches. If three or more transverse trenches are within one pavement section or block, all three trenches shall be patched as one patch.

Restoration must extend from one of the following depending on how far the trench extends into the roadway:

- Curb-to-fog/bike lane line (5-7 feet from curb)
- Curb-to-centerline (if cut is past fog/bike lane line)
- Curb-to-curb (if past centerline)

Grade 3 - Modified Standard (PCI 59-40): Pavement cuts must be full depth and extend 12 inches beyond the nominal trench edge longitudinally and transversely (Standard Drawing R-11) and be the width of the roller plus two inches, four-foot minimum width. Pavement cuts must be at the lane line, skip line, or center of travel lane. Transverse trenches (perpendicular to the centerline) constructed with less than 10-foot separation between cut lines shall be patched as one patch incorporating both trenches.

Restoration must extend from one of the following depending on how far the trench extends into the roadway:

- Curb-to-fog/bike lane line (5-7 feet from curb);

- Fog/bike lane line to center of travel lane
- Center of travel lane to centerline
- Fog/bike lane line to centerline
- Curb-to-curb (if past centerline)

All pavement restoration must be shown on the permit plans and approved prior to construction. Half lane improvement are on a case-by-case basis and as approved.

T-Cut Standard (PCI 39-0): Pavement cuts must be full depth and extend 12 inches beyond the nominal trench edge longitudinally and transversely (Standard Drawing R-11 and be the width of the roller plus two inches, four-foot minimum width.

Applicable standards based on Grade (number of years since last qualifying pavement treatment) and City Street Classification is established in the following table:

TABLE 1- RESTORATION REQUIREMENTS BY CLASSIFICATION AND TIER

Classification	PCI 100 - 60 < 5 years	PCI 100-60	PCI 60-40	PCI 40 - 0
Local	Grade 1	Grade 2	Grade 3	T - Cut
Collector	Grade 1	Grade 2	Grade 3	Grade 3
Arterial	Grade 1	Grade 2	Grade 2	Grade 3

Grade 1 - Pavement Cut Restriction Standard

Grade 2 - Full Standard

Grade 3 - Modified Standard; T - Cut Standard (ACP Only)

Note: Proposals to deviate from the standards described above may be allowed at the discretion of the City Engineer and will require approval in advance by the City Engineer. See 3.8.8 - Pavement Cut Restriction (Exception Process) for the exemption process. During the permit review process, the City Engineer will determine the applicable standard based on the above table.

3.8.2 Permits

As part of obtaining a Right-of-Way permit per Bend Code Chapter 3.40, Permittee must submit a complete application to Community Development Department for review and approval. A Right-of-Way application is available on the City website. The City Engineer will determine the restoration requirements in accordance with these Standards. The Permittee must provide the City Engineer at least 24 hours' notice prior to completing final restoration to allow for inspection. The Permittee shall notify the City within 48 hours after completion of the work (Bend Code Chapter 3.40.025). Warranty period will not begin

unless the final inspection has been completed. Permittee is responsible for all work until the permit is closed and the warranty period begins.

If the City Engineer determines, in the City Engineer's discretion, that previous violations of these Standards exist, future construction work may be disallowed until the Permittee has fulfilled all obligations. Written notification by the City Engineer will be sent prior to this action.

3.8.3 Responsible Party

The Permittee shall be responsible for all construction and warranty requirements of these standards even when the work is done by a Permittee-retained contractor.

3.8.4 General Requirements

Materials must comply with the City of Bend Standards and Specifications.

a. All patching materials and construction requirements not addressed in this document must conform to the Specification Section 00744 – Asphalt Concrete Pavement.

b. To the extent Controlled Low Strength Material (CLSM aka CDF) is required for a particular repair, the Permittee must follow Specification Section 00442 – Controlled Low Strength Materials.

3.8.5 Pavement Sections

Pavement sections must meet the pavement design standards in 11.4 - Pavement Design and comply with the cross sections in the Standard Drawings, or as specified in a stamped geotechnical report as approved by the City Engineer.

3.8.6 Full, Modified, and T-Cut Patching Standards

Patching must comply with the following standards:

a. Longitudinal cuts that extend through multiple grade classifications require discussion with the City Engineer to determine the appropriate patching approach. In principle, each road section will be patched according to the applicable standard and grade in which it is ranked, however, the City retains the right to require a higher level grade at its discretion.

b. For all full depth asphalt repairs on local roads, the minimum asphalt thickness shall be 4 inches, or match the existing depth of asphalt, whichever is greater

c. Existing base rock disturbed within full depth asphalt repairs must be re-compacted prior to paving. For trench backfill requirements, see Standard Drawing R-10

d. All cold-planed surfaces must be swept and kept clean at all times. All cold-planed materials must be removed and disposed off-site at the cost of the Permittee.

e. If a new patch adjoins an existing patch, the existing patch will need to be replaced up to 20 feet from the edge of the new patch. This will be on a case-by-case basis and will be at the discretion of the City Engineer.

f. If any part of the excavation, patch or damaged area intrudes into an adjacent lane, that lane must also be replaced

g. New patches adjacent to any existing patch must be combined into one patch if there is less than 4 feet separation

h. When two or more patches on the same project are constructed with less than 10-foot separation between cut lines shall be patched as one patch incorporating both trenches at the expense of the Permittee. The total number of street cuts should be kept to a minimum. If there are three or more street cuts within a block, the patches must be combined or a single grind and inlay must be performed over to the entire saw cut area. It is at the discretion of the City Engineer to determine the final pavement restoration limits of a project.

i. All restoration shall be shown on approved permit plans, otherwise the grade standards apply in full

j. Pavement cuts must be straight and clean and must be either parallel or perpendicular with respect to the travel lane. No jagged, broken or undermined edges will be allowed unless otherwise approved by the City Engineer.

k. Where saw cutting into concrete roadways, the entire concrete panel disturbed by the excavation must be removed and replaced to conform with original design specifications for the road. The City will refer to the design/asbuilt drawings to determine the concrete's structural section for replacement, including doweling and reinforcement requirements, where applicable, or as determined by the City Engineer.

l. All joints where new pavement meets existing pavement shall be sealed per Specification Section 00746 - Crack Sealing Flexible Pavements

m. Contractors must use ODOT approved release agents and tack when placing multiple lifts of ACP unless placing during the same shift

n. The top lift of asphalt for all longitudinal repairs with a length that exceeds 30 feet must be placed using a paving machine with a screed or an asphalt spreader box

o. The completed surface of all courses must be of uniform texture; smooth, uniform as to crown and grade and free from defects. Tolerance exceptions and corrective measures due to existing roadway conditions or other reasons must be approved by the City Engineer.

p. All areas outside of the travel lanes or shoulders that are affected by the work must be restored to their original condition

3.8.7 Pot Holing

Potholing to find utilities shall be exempt from patching requirements of these standards. To be exempt, it is preferred that all potholes are cut with a core/hole saw. If a larger

asphalt pothole is required, the pavement cuts must be less than two (2) feet square with no joints in the wheel path, bike lane or sidewalk/shared use path. Aggregate backfill and compaction, per the City's trenching standards, is preferred for larger potholes and excavations, with application of CLSM fill in small potholes where compaction cannot be performed. CLSM fill shall be placed twelve (12) inches above the utility to bottom of asphalt. Core coupons (removed asphalt or concrete circles), if not damaged, maybe grouted/epoxied back into the existing pavement with an approved method and material. Only core/hole saw pot holing is permitted in concrete roadways. Where potholes occur within concrete streets, the coupon must not exceed 8-inch diameter. The concrete core coupon must be retained and epoxied into the pothole. If the hole exceeds 8-inches or the coupon is damaged or disposed of, the entire concrete panel will be removed and replaced. Cuts or potholes within concrete sidewalks/shared use paths must have the damaged sidewalk/shared us path panel removed and replaced. Pot holing outside of paved surfaces must conform to the City's trenching standards for backfill and compaction.

3.8.8 Traffic Control

Permittee must follow 3.7 - Temporary Traffic Control for all temporary traffic control.

3.8.9 Pavement Cut Restriction (Exception Process)

After any street has been constructed, reconstructed, paved or overlaid by the City, the pavement surface must not thereafter be cut or opened for a period of 5 years or as directed by the City Engineer or Director of Streets & Operations. It is understood that field conditions or emergencies may warrant an exception to this Policy. However, the exception process in NO WAY obligates the City to allow cutting or opening the Street Cut Restriction Street, and any such decisions are at the City's discretion.

A utility desiring to perform work in Street Cut Restriction streets must schedule a meeting with City staff prior to submittal of a permit application. If an exception is granted, the Private Development Engineering Department will make a concerted effort to protect the integrity of the pavement structure, and to ensure a high quality replacement patch or overlay. Additional restoration requirements and extended limits will apply.

When granting exceptions to this policy, the Streets Director or City Engineer may impose conditions determined appropriate to insure the rapid and complete restoration of the street and the surface paving.

Valve and manhole repairs are exempt from the patching requirements of these standards. Valve and manhole patching requirements are in accordance with City Standards. All warranty and construction requirements must be met. No longitudinal construction joints must be allowed in the wheel path.

Potholing to find utilities must be exempt from patching requirements of these standards. To be exempt, it is preferred that all potholes are cut with a core/hole saw. If a larger pot hole is required the pavement cuts must be less than 2-feet square with no joints in the wheel path and must be backfilled with CLSM or other City approved fill from 12 inches above the utility to bottom of asphalt. Core holes must be hot patched in the existing pavement.

City capital improvement projects will be subject to testing and warranty requirements that are established under the applicable public procurement contracts.

An exception from the street cut restrictions standards may be granted if the City Engineer determines that impacts to vehicle, bicycle, and/or pedestrian traffic would negate the public benefit of this standard.

3.8.9.1 Deviation Request

Permittee may seek an deviation of these Standards as follows. Refer to City standards Part I section 2.

Permittee must submit an deviation request to the City Engineer identifying the proposed project, the impact the project will have on the roadway, the timeline for completion and explaining how all alternative solutions including avoidance have been exhausted

The City Engineer must accept or deny any such request. If a request is accepted, the City Engineer may attach conditions of approval that require additional restoration of the area affected and/or special inspections, the cost of which shall be borne by the Permittee.

3.8.10 Permits for Non-Street Cut Restriction Streets and Street Cut Restriction Streets with Approved Exception

No excavation or tunneling may be performed under any area within public rights-of-way prior to first obtaining the applicable permit from the City (permits for emergency work may be issued after the fact per this policy).

Applications for utility permits must be made on forms provided by the City. The applicant must describe the purpose, location, and size of the anticipated construction project (work), the name of the person/firm performing the actual work, and the name of the person/firm for whom the utility work is being performed. The application must be endorsed by the person/firm for whom the work is being performed or the person's/firm's agent. By signing the application, it is understood that the person/firm performing the utility work will comply with the requirements of this policy and any conditions imposed upon the work.

Depending on the impact to traffic, pedestrians, businesses or residents, public notification plans (signs, advertisements, flyers, public service announcement, etc.) may be necessary and submitted as part of the permit application. It is the responsibility of the permit applicant or the duly authorized representative to coordinate with all affected neighbors. A pedestrian detour route shall be clearly delineated whenever sidewalk/shared-use paths are obstructed.

Emergency utility or service lateral repair work necessary for the immediate preservation of life or property is acceptable; provided that any person making such emergency repair work they call for emergency locates. Permittee must notify the City Engineer of emergency repairs not later than the next business day. The ROW restoration for such emergency repairs must be in conformance with the criteria stated in this policy. Note, work necessary to locate faulting utilities, conduits or pipes during the emergency situation is considered part of the emergency repairs. Permittee must make every reasonable effort to restore the roadway quickly.

When the City Engineer determines that traffic conditions, safety or convenience of the public necessitates ROW utility or service lateral construction and repair be performed as quickly as possible, the City Engineer will require the Permittee to provide adequate

personnel, equipment, and facilities on a 24-hour basis such that the utility or service lateral work be completed as soon as practicable. This may include, but is not limited to, flaggers, temporary traffic control signs and devices, lighting, etc. The Permittee must be responsible for the cost of providing the necessary personnel, equipment, and facilities.

If work is being performed within Highway 20 & 97 (including Parkway 3rd St and Greenwood), coordination with ODOT may be necessary and the applicant must comply with their requirements for all work solely in the ODOT jurisdiction. For any work in that is jointly permitted, the Utility/Permittee must provide a copy of the ODOT permit to in conjunction with the City's permit application.

3.8.11 Special Requirements for Concrete Roads

All concrete road cuts must be pre-approved before beginning work (except in the case of an emergency situation). Concrete roads must require full panel replacement unless approved otherwise by the City Engineer. All concrete joints must require an approved tie bar and dowel retrofit. Depth of concrete replacement must match the existing thickness or as directed by the City. Care must be made not to undermine the existing panels. If the adjacent panels are disturbed or damaged, they also must be replaced at the City Engineer's direction. All joints must be sealed with material approved by the City Engineer. Where concrete roads are overlaid with asphalt, the concrete must be replaced as described above and the asphalt portion of the cut must be constructed according to the pavement standard.

3.8.12 New Development

These standards are minimum standards applicable to all cuts made in existing roadways. For new development, additional requirements may apply. Contact the Community Development Department for specific additional requirements.

3.8.13 Temporary Pavement Restoration

Pavement must be restored with temporary patches before the road is reopened to traffic as defined below. The Permittee must maintain the temporary patch until the patch has been permanently restored. Gravel surfacing is not acceptable as a temporary patch.

An immediate patch may be used to open the roadway to traffic. Immediate patches may include the use of steel plates with signs or be a minimum of 2 inches thick cold mix asphalt on 2 inches thick crushed surfacing. Immediate patches will only be allowed while work is being completed and must be replaced with an interim or permanent patch within 7 days after placement. Steel plates must be pinned and ramped with cold mix asphalt. At the direction of the City staff or City Engineer, Steel plates may not be used from November 1st to March 10th. Higher classification roads are on a case-by-case basis. Steel plates may only be used for less than 5 working days.

When a permanent patch cannot be completed within 7 days of an immediate patch, an interim patch must be used to keep the roadway open to traffic. Interim patches must be a minimum of 2 inches thick ACP on 2 inches thick crushed surfacing. Interim patches must be replaced with a final patch within 30 days after placement.

Material exceptions may be requested in the event that the ACP Plants have shut down for the season or at the discretion of the City Engineer. Material exception forms must be submitted with the final inspection. Permittee is responsible for making final restoration

within 45 days of the ACP plants opening for the season or as directed by the City. Permittee must submit photo documentation, and street location of all street cuts with material exceptions 5 days prior to completing the work

3.8.14 Testing and Warranty Requirements

ACP testing must be in accordance with Bend Standards and Specifications. Patches greater than 8 feet in width will require density testing per the Bend Standards and Specifications. The City reserves the right to require density testing on a case-by-case basis if field observations indicate minimum compactive efforts are not being achieved as required in the Bend Standards and Specifications.

Pavement restoration on roadways under all pavement cut standards will have a minimum warranty period of one year and up to 2 years. The patch must be repaired if necessary until the warranty has passed.

All warranties will become void if the road receives a qualifying pavement treatment within the patching limits.

All warranty work requires that a City inspector be on site. The Permittee must be required to coordinate inspection with the City Engineer.

The following minimum defects identified by the City Engineer must be covered by warranty (but not limited to):

Sunken pavement patches greater than or equal to 1/4 inch (measured by a 12-foot straight edge)

Surface raveling or oxidation due to deficiencies with the asphalt material

Poor workmanship

Inadequate compaction per Bend Standards and Specifications

Notice of Repairs

If emergency repairs are needed due to safety concerns, the Permittee must immediately make such repairs and give notice to the City Engineer

For non-emergency repairs on arterial or collector streets, the Permittee has 48 hours in which to make such repairs from time of verbal notice by the City Engineer. For residential streets, the Permittee has up to 7 days to make such repairs.

The City may undertake the repairs if not completed within the specified timeframes above. The City Engineer must notify Permittee of non-compliance and Permittee must make all identified repairs within 2 business days of notification of noncompliance. Repairs involving public safety maybe made by the City without notice. Permittee will be assessed all costs associated with the City performed repairs, plus 15 percent overhead fees.

If repairs are made other than seam sealing to the warranted patch, a new warranty will be implemented for the new patch

3.8.15 No Dig/Trenchless Technology

To minimize damage to road surfaces and other surface infrastructure, implementation of no dig/trenchless technology is the preferred method for most utility work.

3.8.15.1 Trenchless Technology Plan Requirements

Applicants for work in the ROW planning to use trenchless technology must submit plans prepared by a qualified professional. Any qualified professional, as defined in this policy, experienced in trenchless utility installation may prepare plans for simple work. Typical "simple work" includes borings of 100 feet or less perpendicular to street alignment and borings of 200 feet or less parallel to road and sidewalk/shared-use path surfaces. For longer distances, the applicant must meet with Department staff to discuss the proposed operations. The City Engineer may require the plan to be prepared by a qualified registered civil engineer, geotechnical engineer or geological engineer licensed in the State of Oregon and require additional studies or information than those required for "simple work". The plans for "simple work", at a minimum, must address/consider the following:

The proposed bore path (bore plan and profile must be provided) should be planned to allow sufficient room from other utilities or structures for workers to perform maintenance or operations on adjacent utilities. There must be a 5-foot minimum horizontal and 18-inch vertical separation between the proposed utility and City sewers or as otherwise directed. However, additional separation may be required depending upon depth of new utility installation, environmental factors, and engineering conditions.

The locations of other utilities within or adjacent to the proposed bore path (within 5 feet) must be shown. Include proposed potholing locations

In preparing the plan, location of other structures such as manhole covers, valve box covers, meter boxes, telephone and cable television boxes, electrical transformers, conduit, or droplines from utility poles, pavement patches, previous locator markers, heating oil tanks, utility vaults, and sewer lateral cleanouts must be considered.

Include pavement restoration details (as needed) according to this policy. This includes repair of borehole entry pits and potholes.

3.8.15.2 Drilling Fluid Handling

The trenchless technology contractor must contain, handle, and dispose of drilling fluids in accordance with industry and Oregon Department of Environmental Quality standards. Excess drilling fluid must be confined in a containment pit at the entry and exit locations until recycled or removed from the site. Precautions must be taken to insure that drilling fluid does not enter roadways, streams, municipal storm or sanitary sewer lines, and/or any other drainage system or body of water. Unintended surfacing of drilling fluid must be contained at the point of discharge and recycled or removed from the site. Drilling fluids that are not recycled and reused must be removed from the site and disposed at an approved disposal site. Any damage as a result of using trenchless technologies is the sole responsibility of the Permittee.

3.8.15.3 Settlement/Heaving Monitoring

Trenchless technologies must be performed in a manner that will minimize the movement of the ground in front of, above, and surrounding the boring operation; and will minimize disturbance of the surface above and in the vicinity of the boring. The applicant must be responsible for the repair to City infrastructure resulting from heave or settlement caused by the use of the trenchless technology. All operations must stop immediately whenever a vertical change in elevation of ½ inch or more, or any surface disruption is observed. The Permittee must then immediately report the amount of settlement to the Engineering Inspector, Street Department or Utility Department.

3.8.15.4 Trenchless Technology Operations Guidelines

All construction work must be performed in accordance with City requirements and industry standards. The Permittee must ensure that all cleanup and restoration is in compliance with the City requirements for right-of-way restoration. In some cases determined by the Department, the Permittee will televise, in the presence of Department staff, the City stormwater and wastewater components within five feet parallel to boring activity or crossed by the boring activity.

3.8.15.5 Compliance

As part of the notice of noncompliance, the City Engineer will include a notice to comply within 5 working days or all future permits may be denied until the problems have been corrected. A meeting must be arranged with the City Engineer and a plan of action to prevent future noncompliance must be presented before issuance of any new permits.

Noncompliance Activities include:

Failure to obtain a permit

Failure to maintain temporary patches

Failure to make permanent repairs

Failure to make emergency repairs

Failure to make warranty repairs

Failure to inform the City of asphalt completion date

Failure to follow traffic control measures, as required

Failure to meet specified timeline for any repairs

3.9 Performance Bonding

Under the Bend Development Code Chapter 4.3.400.J, bonding/financial security is permitted in lieu of construction when approved by the City Engineer or as approved by a land use decision for a development. Performance bonding of residential developments is also permitted under the Oregon House Bill 2306 process, with certain bonding limitations. House Bill 2306, or the “Residential Land Division Early Action Program”, is not discussed in depth within this document and defers to the City’s website for bonding allowances under this program. Performance bonding is typically allowed under the following situations:

1) Prior to occupancy/project completion of a right of way permit, the following items can have a performance bond posted in lieu of construction before plat or occupancy (Performance bonds, with conditions as to when the improvements need to be completed in the future:

   a) Commercial and Industrial. All infrastructure (water, sewer, sidewalk/shared-use paths, streets, etc.) must be complete. During winter conditions, if approved by the City Engineer, must abide by the cold weather concrete standards and material exception processes apply. Bonding may be considered on a case-by-case basis for asphalt paving.

   b) Residential:

      i) Sidewalk/shared-use paths. Bonding will not be permitted for sidewalk/shared-use paths for the following situations:

         (1) Along arterials or collectors frontages

         (2) Sidewalks/shared-use paths that abut mountable curb. ADA accessibility challenges usually exist at the transition between mountable curb and standard raised curb and because of the thickened sidewalk/shared-use path section requirements.

         (3) Accessible curb ramps are to be installed and are not permitted to be bonded

         (4) Sidewalk/shared use path where no driveway approach is proposed or permitted by code. Corner lots will choose one frontage where they will take access, with the other frontage requiring the build out of the sidewalk/shared use path.

         (5) Lots that front an alley.

         (6) Fronting along tracts of land (open space tracts or other land parcels that are not planned for development or housing)

         (7) Utilities unless otherwise approved through a City approved Development Agreement

      ii) Bonding will be permitted for sidewalk/shared-use paths for the following situations:

         (1) Sidewalks/shared use paths along the local street frontages of for residential lots where driveway access is proposed.

         (2) Residential projects approved under the Oregon House Bill 2306 process. Bonding limitations exist within that process as documented on the City's website, outside of these standard documents, as the "Residential Land Divisions Early Action Program"

Bonding is typically not permitted for commercial, industrial or mixed-use developments.

Bonding will not be permitted for utility installation unless otherwise approved through a City initiated and approved development agreement.

During the winter construction season, performance bonds may be permitted when:

1) A Material Exception is granted and approved with a right of way permit where asphalt plant closures and/or when construction materials are not available to comply with City standards and specifications. Material Exceptions are not typically approved for concrete or utility work. In situations where work included under the Material Exception is significant (paving an alley/street or improvements greater than just a utility patch), the City may require a performance bond that will be released upon completion of the work and closure of the Material Exception.

2) Street trees. Bonding for street trees is at the Planning Department's discretion. Unless otherwise approved by the Planning Department Manager, trees are only to be bonded when ground is frozen.

iii) Driveway aprons. Driveway aprons must be constructed prior to occupancy of a residential dwellings. Bonding for driveway aprons will not be permitted unless approved by the City Engineer under a material exception due to extreme weather conditions.

c) Work within an arterial or/ collector street corridor may require a performance bond At time of land use prior to Notice to Proceed for construction as determined during aor right-of-way permit review. City Engineer may determine bonding be required for work being performed within an existing arterial / collector street. In these situations, a full notice to proceed will not be issued until the bond is placed with the City. This bond is not for in lieu of construction, but rather to protect the public's interest to ensure work performed on an existing arterial/collector street is completed in a timely manner.

Construction documents and record asbuilt drawings must clearly identify which sidewalks/shared-use paths are being installed and which are being bonded. The City, not the applicant or owner, will make the determination as to what can and will be bonded based on this review and what must be constructed.

3.10 Easements

All public easements must be recorded either under a survey plat or by separate recordable document prepared and recorded by the City of Bend. All easements must have a surveyor's legal description and exhibit map, prepared on letter sized paper, stamped by a professional land surveyor, to accompany the easement document. The legal description and exhibit map will be titled as identified in the City prepared documents.

The following are the most common easements used during development:

Public access easement (PAE): A public access easement will be required where the full roadway or sidewalk/path cannot be constructed within right of way and the property owner does not elect to dedicate additional right of way. The public access must extend a minimum 12-inches beyond all roadway and/or sidewalk/path improvements that encroach within private property.

Slope easement (SE): Where roadway or sidewalk is constructed on a steep slope, the City may require a slope easement. Slope easements are used to protect slopes supporting street and/or pedestrian facilities. Where a slope easement is required, the slope easement must extend at a flat slope a minimum 5 feet from the back of sidewalk at

a 2H:1V slope to catch existing grade. Minimum 5 feet is provided to allow for sidewalk maintenance without compromising the slope. No footings, structure, or excavation work is permitted in any slope easement without approval from the City Engineer. Where driveway access is needed within the slope easement, either fill material can be placed with in a slope easement, which will not impact the streets structural stability, or a bridge deck can be constructed on private property and outside the slope easement.

Public Utility Easement (PUE): These easements are for franchise utilities. Location and width of PUEs are determined by the franchise utilities but are to be no less than 5 feet where they are required. Private utilities are not permitted with PUE's except where water and sewer crossings are made coming for the City mains perpendicular to the easement.

City utility easements: City water, City sewer, or City storm easements are required to be a minimum 20 feet wide, centered on the pipe. Easements widths may be wider depending on the depth of the utility, typically widened when the City utility exceeds 10 feet depth. Water meters are to be recorded within 5-foot easements, centered on the meter, and hydrants within 10 feet easements, centered on the hydrant. Water easements around larger meter vaults may require larger easements. City utility easements should be recorded under separate easements from Public Utility Easements.

Private easements are not typically prepared by the City. The City may require that it be a signatory on the easement to prevent its release in the future without City approval.

Sanitary Sewer Systems

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4 Sanitary Sewer Systems

Minimum design standards for sewer facilities are defined by the Oregon Department of Environmental Quality (DEQ) regulations as detailed in the appropriate OAR, Division 52. City of Bend Design Standards may be more stringent. In cases where the City of Bend Standards are different from the requirements specified by DEQ, the City of Bend Design Standards will be used. In cases where the City of Bend lacks a design standard, designers shall refer to OAR Division 52, Appendix A – Sewer Pipelines, and OAR Division 52, Appendix B – Raw Sewage Lift Stations, for detailed criteria.

The City of Bend requires gravity sewers. The City has made this requirement due to the expense of long term operational and maintenance costs associated with non-gravity sewer systems. This has been evaluated in the City's Collection System Master Plan (CSMP) and will continue to be evaluated in future updates of the CSMP. In places where a gravity solution is not possible, two solutions exist, pressure sewers, and a regional pump station with force main. Regional pump stations will be determined through the City's CSMP. Where a regional pump station is defined in the CSMP, all sewer flowing to the wet well will be by gravity. No pumping from one pump station to another pump station will be allowed. In addition, no lines or pump stations will be allowed to connect to the discharge line (force main) of any City owned pump station, until the first manhole at which force main line becomes a gravity flow line.

Pressure sewers may be proposed as an alternative. Pressure sewers are defined as an area where each lot is served with a privately owned, operated, and maintained sewer pump that feeds to a pressure line in the public right-of-way. No City-owned or operated pump stations will be connected to a pressure sewer system. Each pressure sewer will be evaluated on a case-by-case basis by the City Engineer or designee. Pressure sewers are not allowed to connect to the discharge line of any City-owned pump station and the City is only responsible for the main line that individual pressure pumps connect to. Multiple lots are not allowed to be served by a single pump station on a pressure sewer system, therefore each lot is required to have its own privately owned and operated pressure pump. The City is not responsible for any maintenance or operation of any privately owned pump station. When determining if a gravity system is not possible, the City will consider the long term operational and maintenance costs associated with any pressure sewer solution.

Additional flow into the City sewer system is not permitted where the system has no capacity. Capacity is defined as having the ability to adequately convey additional sewer flow during peak flow periods without violating criteria for surcharge, wet well capacity, or velocity. Distance from a municipal sewer line that has capacity is not a limitation on providing service. If, and only if, the City lacks capacity to provide sewer service to any development, the property owner can elect to consider on-site treatment and disposal for interim sewer needs until city sewer capacity is available. On-site treatment includes, but is not necessarily limited to, traditional septic tanks and leach fields or advanced treatment systems such as membrane technology. The process selected for treatment must be approved by the City of Bend, Deschutes County and DEQ, and shall comply with local, state, and federal laws and regulations. On-site treatment is allowed only after the City Engineer determines in writing that the City's sewer system lacks capacity to provide sewer when the property owner needs the service.

Any system that is designed to treat and dispose of sewer on-site must be designed to be connected to City sewer at a later date. In addition, any on-site treatment system owner will be required to enter into an agreement with the City that clearly identifies the owner's responsibility to maintain and operate the facility. The agreement will also provide that the City is not required to maintain or operate these systems and that should they fail, the land owner is responsible for any necessary repairs or requirements to satisfy State and Federal law even if the laws have been amended since contract initiation with the City. Any federal and/or state permits to operate an on-site system shall be included as an attachment to the agreement. The agreement shall be recorded against the subject property and shall remain in effect even if the property is transferred. The City may elect that a trust, contract to operate the system, or similar permanent financial mechanism, be established to cover repair and maintenance costs for the system to remain in compliance for perpetuity.

Approval for use of any alternative to gravity sewer shall be requested through the waiver process identified in Part I - Section 2 - Change Process.

All design calculations and studies of wastewater conveyance systems shall be submitted in an organized, legible, and professional form for review. These calculations, bearing the signature and stamp of a registered professional engineer, shall also include a thorough list of assumptions used in making the calculations. Submittals that are not legible, poorly organized, are inaccurate in the assumptions for the calculations, or are otherwise not in accordance with submittal requirements will be returned to the applicant for correction and re-submittal. Any work done on City sewer lines requires a Right-of-Way (ROW) permit.

4.1 Sewer Main

Sewer facilities shall be designed using alignments in public rights-of-way. Sanitary sewer mains shall be located within frontage streets rather than alleys unless approved by the City Engineer. Sewer mains shall be located as close to the roadway centerline as possible or centered within the right-of-way when no roadway exists. Sewers on curved roadways may vary from the centerline to minimize the use of manholes; however, the manholes themselves shall be located as close to the roadway centerline as possible. On narrow streets, 32-foot curb-to-curb width or narrower, locate the manholes in the center of the travel lane, typically 5 to 6 feet from the roadway centerline.

Casings must be placed on all sewer main crossings at irrigation pipes, within ODOT right of way, or as otherwise required by the City Engineer where access to public mains are may be limited. Where casings are on mainlines that are identified as having the potential for upsizing in the future (where mains are not on dead end streets or where gravity mains are at minimum cover that prevents main extensions), casing must be upsized to 2 to 4 nominal pipe sizes from the needed main size to allow for potential future main upsizing. Casing pipe and pipe spacers to be determined during development of the construction documents. All pipes are to be restrained within the casing.

All sewer improvements shall terminate at a sewer manhole. Stubbing sewer pipe for future extension will be permitted for approved multi-phased, master planned developments only where approved by the City Engineer.

Sewers shall maintain a minimum 10-foot horizontal separation from all water mains and water services.

Franchise utilities shall maintain a 10-foot horizontal separation, and 12-inch vertical separation from sewer mains. For sewer services, the horizontal separation may be reduced to 2 feet. 6-inch vertical separation from franchise utilities may be granted on a case-by-case basis.

Ninety degree fittings for sewer mains are not permitted, unless otherwise specified.

No bends or deflection are permitted within gravity sewer mains. Where change of direction is required, construction of manholes will be required.

Public sewer mains shall not be extended onto private property, even within an easement, unless it is done to serve multiple properties. Where sewer needs to be extended onto private property to service a single property or use, a private service will be extended in accordance with all applicable state building/plumbing codes.

Sewer mains within private property, outside City of Bend right-of-way, shall be within a recorded sewer easement not less than 20 feet wide, with the pipe centered in the easement. Additional easement width may be required as determined by sewer depth and topographic conditions, as determined by the City Engineer.

If a sewer extension is required for a single service connection to a property, the property owner shall be required to extend the City sewer main a distance sufficient to establish a standard perpendicular service connection into the property, or 20 feet, whichever is greater. For all other development where the street construction is required, the sewer mains shall be required to be extended to and through the length of the property frontage unless otherwise determined by the City Engineer.

Sewer mains that are unused and that have no approved current or future anticipated use shall be removed from the right of way or abandoned in place per Section 4.1.18. Sewer mains within City sewer easement, on private property, are preferred to be removed but can be abandoned in place, with approval from the City Engineer, provided the sewer easement is extinguished.

4.1.1 Depth

Minimum cover from finished grade to the outside top of the pipe for all sewer lines, except sewer services, shall be 36 inches. If conditions do not allow for a 36-inch depth consideration will be given from the City of Bend on a case-by-case basis.

4.1.2 Minimum Diameter

For gravity sewer mains, the minimum inside diameter shall be 8 inches, unless otherwise approved by the City Engineer. Minimum size for pressure collection system lines shall be 4 inches, unless otherwise approved by the City Engineer.

4.1.3 Flow Calculation

Average sanitary sewage flows shall be calculated using the most current land use zoning, and applying the unit rates shown in Table 4-1.

Flows generated by unusual land uses such as institutional or heavy industrial shall be based on actual (preferred) or estimated water consumption records. Estimates must be based on either an industry standard, or water consumption from a similar use.

Projected flows for a development are based on the Collection Sewer Master Plan (CSMP) and Equivalent Dwelling Units (EDUs). Any subdivision building or proposing a community swimming pool that is connected to a sewer lift station shall be required to provide flow calculations and general information pertaining to volumes being discharged into the City's collection system for cleaning purposes. Additionally, there shall be a requirement to mandate this procedure being done during off peak hours. Furthermore, the pool maintenance staff shall be required to notify the City Collections staff prior to performing this work.

TABLE 4-1

Basis for Sanitary Sewage Flow Estimation

Land Use	Average Daily Flow
Residential	130 Gallons / Unit / Day
Non-Residential	427 Gallons / Acre / Day
School	347 Gallons / Acre / Day
Medical District Overlay	490 Gallons / Acre / Day
OSU-Cascades	490 Gallons / Acres / Day
Central Business District	185 Gallons / Unit / Day

Equivalent Dwelling Unit Calculations for known site conditions
130 Gallons / EDU / Day

Residential Use	
Single Family Dwelling	1 EDU
Two Family or Duplex Unit	2 EDU
Multi-Family	0.8 EDU / unit

Institutional Use	
Schools	
Kindergarten	0.05 EDU / person
Elementary	0.08 EDU / person
Junior & Senior	0.10 EDU / person
College	0.15 EDU / student
Nursing Home	0.65 EDU / bed
Hospital	0.75 EDU / bed
Library	1 EDU

Commercial Use	
Retail	1.0 EDU for first 2,000 SF floor area 0.5 EDU / Each additional 2,000 SF
Service & Repair Shop	1.0 EDU for first 1,800 SF floor area 0.5 EDU / Each additional 18,000 SF
Bank & Office	1 EDU / 2,000 SF
Medical, Dental, Veterinary	1.0 EDU / 1,000 SF floor area
Restaurant	1.0 EDU / 600 SF
Automobile service station	2 EDU
Barber Shop	0.30 EDU / Chair
Beauty Shop	0.38 EDU / Chair
Industrial, Manufacturing, Beverage Processor & Commercial Warehouse	0.09 EDU / person
Commercial laundry	2.58 EDU / 1000 Gallons of water use
Laundromat	1 EDU / machine
Theater	0.009 EDU / seat
Parks with restroom	1 EDU
Stadium	2 EDU
Swimming Pool	6 EDU
Dry Cleaners	3.10 EDU / 1,000 SF floor area
Recreational Roller Rink, Dance Hall	0.27 EDU / 1,000 SF floor area
Spa & Athletic facilities	6.67 EDU / 1,000 SF floor area
Armory	1 EDU
Carwash	1.17 EDU / wash stall
Pet Grooming	0.67 EDU / 1,000 SF floor area
Motel, Dormitories	0.40 EDU / room

4.1.4 Peak Factor (Domestic Flows Only)

Sanitary sewage design flows are calculated by applying a peaking factor to the average daily flow. This is done by accumulating flows from the upper reaches of the system and multiplying the accumulated average daily flow at specific nodes.

Apply the following peaking factors to obtain the design peak flow at that point:

Average Domestic Flow	Peaking Factor
< 1.0 mgd	3.0
1.0 – 2.5 mgd	2.5
2.5 – 5.0 mgd	2.25
> 5.0 mgd	2.0

Peaking flows for large institutional, commercial, or heavy industrial point sources shall be determined by analysis by a qualified professional engineer and require approval by the City Engineer, or designee.

Flow calculations shall be based on Manning's equation using the following values for n:

Pipe Material	Mannings 'n'
PVC pipe	0.011
HDPE pipe	0.015

4.1.5 Line Diameter and Velocity

Line diameters shall be computed using the procedures above to calculate the peak flow and selecting a diameter that will flow eighty percent full at that peak design flow [sewage depth/inside diameter (d/D >= 0.8)]. For example:

- A 6-inch line @ 0.006 ft/ft minimum grade flowing half full = 115.3 gpm
- An 8-inch line @ 0.004 ft/ft minimum grade flowing half full = 202.7 gpm

Slopes and diameters for gravity sewers shall be designed to maintain a minimum velocity of 2 feet per second (fps) at the average daily flow rate. However, no design shall ever exceed 8 fps, to ensure the liquids do not surpass the solids.

4.1.6 Minimum Grade (Gravity)

Designers shall use the following minimum grades (based on PVC Manning's n=0.011, velocity 2 fps at 50 percent flowing full). Reference OAR 340 Division 52 for additional information:

Pipe Inner Diameter (inches)	Slope (feet per 100 feet)
4	1.5 min, 2 typ
6	0.75
8	0.40
10	0.25
12	0.19
16	0.14
18	0.11
21	0.09
24	0.08
30	0.06

4.1.7 Inverted Siphons

Inverted siphons shall not be permitted. If there are no practical alternatives for gravity sewer service without a siphon the designer may request a waiver using the process described in Part I - Section 2 - Change Process.

4.1.8 Flows in Pressure Sewers

Flow calculations for pressure systems shall be based on the Hazen and William's equation using the following value for *C*:

Material	C Value
PVC	135

4.1.9 Minimum Velocity

Line diameters for pressure sewers and force mains shall be selected to maintain a minimum velocity of 3 fps at the minimum pumping flow rate for variable flow pumps.

4.1.10 Maximum Velocity

Maximum velocity along any point in pressure sewers, including force mains, shall be 8 fps.

4.1.11 Pressure Sewer Appurtenances

Pressure sewers and force mains shall be designed with a constant downstream elevation rise, with the discharge being the highest point in the line. Pumping downhill (the discharge elevation being lower than the pump elevation) is not allowed. Variable grades shall require a waiver as described in Part I - Section 2 - Change Process for any pressure sewer of force main that is unable to achieve a constant downstream rise. In cases where a waiver is granted for maintaining a constant downstream rise, designers shall include

air release/vacuum relief devices at high points and cleanout facilities on pressure sewer or force mains over 500 feet long.

All air or air/vacuum relief valves shall be provided with freeze protection including insulated enclosures and designed by a professional engineer. Designers shall assume -10 °F sustained outside temperature. Design calculations for air release valves shall be submitted with the plans.

4.1.12 Waterline Crossings

Sanitary sewer line and water line crossings shall be designed per OAR 333-061-0050 and/or AWWA standards, whichever is most stringent.

In situations involving a water and non-potable water or lateral crossings, the separation between the two shall be as follows (all non-potable lines shall be treated as “sewer” lines as described in OAR 333-061-0050):

- A water and non-potable water crossing shall always be perpendicular unless otherwise approved by the City Engineer.

- Whenever possible, the bottom of the water lines shall be 1.5 feet or more above the top of the non-potable line. Where the crossing occurs, the non-potable line water shall have one full length stick of AWWA C-900 pipe water pipe centered at the water non-potable crossing.

- Where the water line crosses over the non-potable line but with a clearance less than 1.5 feet, the non-potable line shall be exposed to the non-potable pipe joints on both sides of the crossing to permit examination of the non-potable pipe. The examination shall be conducted by the City’s Inspector/Public Works and the project’s Engineer of Record to verify the condition of the non-potable pipe. If the non-potable pipe is in good condition and there is no evidence of leakage, the 1.5-foot separation may be reduced to not less than 6 inches. However, in this situation, the contractor must center one full stick of water pipe at the crossing. The Engineer of Record must prepare a written report of the findings and indicate the reasons for reducing the separation. If the contractor and Engineer of Record determines that the conditions are not favorable or finds evidence of leakage from the non-potable line, the non-potable line shall be replaced with a full length of pipe centered at the crossing point. The pipe shall be AWWA C900 or other pipe material as approved by the City Engineer. As approved by public works and the City Engineer, under the OAR’s the non-potable pipe can be encased in a reinforced concrete jacket for a distance of 10 feet on both sides of the crossing. This is not a permitted practice unless there are no other options and is approved by the City Engineer.

- Where the water line crosses under the non-potable line, the contractor shall expose the non-potable line to the nearest joints on both sides of the crossing to permit examination of the non-potable pipe. The examination shall be conducted by the City’s Inspector/Public Works and the project’s Engineer of Record to verify the condition of the non-potable pipe. If conditions are favorable and there is no evidence of leakage from the non-potable line, the non-potable line may be left in place, but special precautions must be taken to assure that the backfill material over the water line in the vicinity of the crossing is thoroughly tamped in

order to prevent settlement which could result in the leakage of non-potable water. In this situation, the contractor must center one length of the water line at the crossing and the Engineer of Record must prepare a written report recording the manner in which the non-potable line was supported at the crossing and the material and methods used in backfilling and tamping to prevent settlement of the non-potable line. If the contractor and Engineer of Record determines that the conditions are not favorable or finds evidence of leakage from the non-potable line, the non-potable pipe shall be replaced with a full length of pipe centered at the crossing point. The pipe shall be AWWA C900 or other pipe material as approved by the City Engineer; or the non-potable shall be encased in a reinforced concrete jacket for a distance of 10 feet on both sides of the crossing, the latter being the least desirable and requiring City Engineer approval.

The City considers a non-potable line favorable if the following conditions are met:

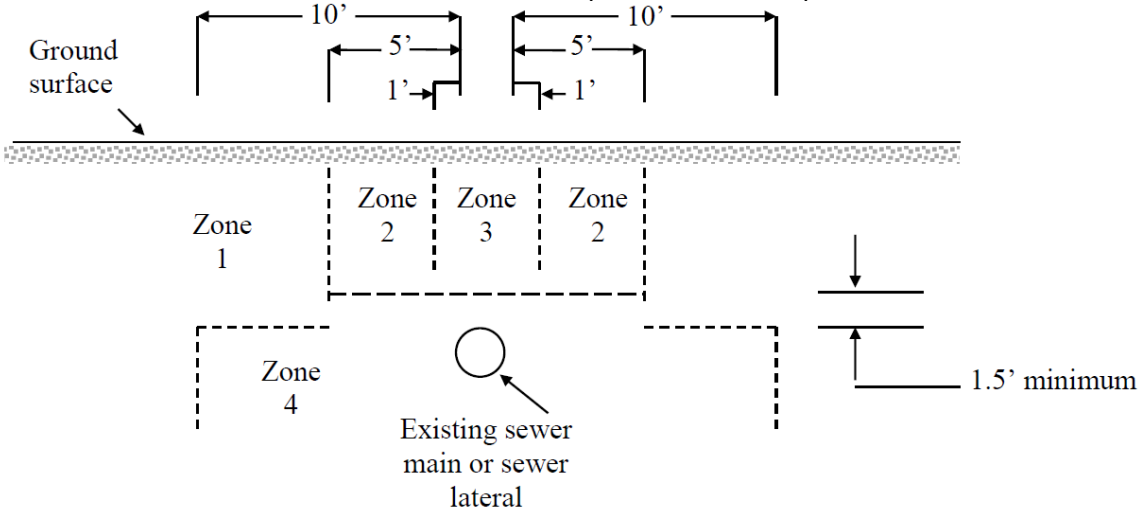
- No signs of non-potable leakage for the joints. This may be determined from visual drips, smell, or contaminated soils in the vicinity of the pipe (discoloration, mold, etc.)

- The non-potable pipe is not cracked, broken or otherwise damaged. The City may elect to review the inside of the pipe with a camera to verify pipe integrity.

Where separation is compromised, the City may request that a CCTV inspection be performed on existing non-potable pipe prior to work at the crossing and again after the work is complete to ensure the pipe condition was not compromised during compaction and final trench restoration within the crossing vicinity.

Minimum vertical pipe separation shall be 12 inches, with reduction to 6 inches vertical separation with approval from the City Engineer.

WATER LINE – SEWER LINE SEPARATION FIGURE (OAR 333-061-0050)



Zone 1: Only crossing restrictions apply

Zone 2: Case-by-case determination

Zone 3: Parallel water line prohibited

Zone 4: Parallel water line prohibited

4.1.13 Marking Tape and Locate Wire

Marking tape will be minimum 2-inches wide, APWA green and stretchable to a minimum of five times its original size.

Marking tape is required on all mains and laterals. The marking tape shall be installed 12 inches above the pipe.

In addition to the marking tape requirement described above, pressure and vacuum sewer mains shall be wrapped with marking tape a minimum of 4 wraps per 20 lineal feet of main.

A #10 minimum tracer locate wire shall be centered on the top of vacuum and pressure sewer mains. Tracer wire is not required on gravity main installations. Tracer wire shall be installed directly above all sewer services (gravity, vacuum, and pressure) per Specification Section 00445. Tracer locate wire shall be tested for continuity prior to pipe burial.

Sewer Type	Marking Tape	Tracer Wire
Gravity Main	12 inches above	None
Gravity Service	12 inches above	Centered on top of pipe
Pressure Main	12 inches above and 4 wraps per 20 LF of main	Centered on top of pipe
Pressure Service	12 inches above	Centered on top of pipe
Vacuum Main	12 inches above and 4 wraps per 20 LF of main	Centered on top of pipe
Vacuum Service	12 inches above	Centered on top of pipe

4.1.14 Materials

Gravity sewer mains and services shall be constructed of ASTM D3034, dimension ratio not to exceed 35, or ASTM F679, minimum pipe stiffness 46, sewer pipe. Where minimum cover cannot be maintained, or where directed by the Engineer, pipe shall be AWWA C900 Specifications. Where rigid PVC pipe is to be used, gravity sewer pipe shall conform to ASTM D1784.

Pressure main lines and force mains shall be Schedule 40 (under 4-inch pipe) or AWWA C900 pipe and have a minimum DR of 18 (4-inch and larger pipe). Vacuum mains shall be constructed of SDR 21 PVC.

4.1.15 Construction

Construction of a sewer in an unimproved street shall include bringing the street to subgrade elevation to ensure that adequate bury, depth of cover, and utility separation is acquired. The street must be fully improved within six months after sewer is installed. If the street cannot be improved within the six months after sewer is installed, a 14-foot wide 2 inch thick paved all weather access road, with a 6-inch base, or as approved by the City Engineer, shall be installed centered over the sewer line with a 6-foot square asphalt or concrete pad around manholes. If the access road requires a vehicle turn around, adequate space shall be included for an all-weather access road.

If the street is to be improved more than six months after construction approval, the designer shall require that the street be properly staked to the approved design prior to the commencement of sewer line construction.

4.1.16 Septic System and Municipal Sewer Extensions

All sewer connection and/or septic use in the City of Bend must be in accordance with Bend Code Title 15. In most cases, the City will permit existing septic systems to be maintained if they are functioning and no development is proposed on the lot. In the event of minor additions to a residential lot, the City will defer to Deschutes County for connection requirements, if not adjacent to a functioning and available City main, based on the existing septic size and capacity and Oregon State and DEQ requirements.

Deschutes County, when reviewing permits for conformance and the ability to maintain their existing system, will review each situation individually in accordance with OAR 340-071-0160, requiring denial of a Construction, Installation, Alteration, and Repair Permit for a septic system serving:

- A single family dwelling or other establishment with a maximum daily sewage flow not exceeding 899 gallons if the nearest municipal sewer connection point is within 300 feet of the closest property line to be served

- A proposed subdivision or group of two to five single family dwellings or other establishment with the equivalent projected daily sewage flow if the nearest municipal sewer connection point from the closest property line to be served is not further than 200 feet multiplied by the number of dwellings or dwelling equivalents

- For proposed subdivisions or other developments with more than five single-family dwellings or equivalent flows, the City Engineer will determine municipal sewer availability

Any sewer extension required to bring a lot off septic will require installed to the property and a minimum one stick of sewer pipe, or 20 feet, into beyond the property line.

The property owner will be required to incur all costs to design, permit and construct an extension of the public sewer system to serve the property unless other agreements and/or funding arrangements have been approved by the City.

4.1.17 Sewer System Extension Requirements

If a sewer extension is required to service a lot, the property owner shall be required to extend the City sewer main a distance sufficient to establish a standard perpendicular service connection into the property, requiring a minimum 20-foot installation beyond the private property line.

For all other developments (partitions, subdivisions, etc.), sewer mains shall be required to be extended to, and through, the length of the property frontage.

4.1.18 Sewer System Abandonment

No unused existing utility system elements may be abandoned in place within the City right of way or City controlled easements unless a waiver to allow

abandonment is approved by the City Engineer. A waiver may be granted for the instances that meet all of the following criteria;

- System elements with more than six feet of bury depth.
- System elements located at least four feet (outside of pipe to outside of pipe) apart from any project proposed systems regardless of depth, located within the City of Bend ROWs.
    - For system elements within City of Bend controlled easement(s), that remain active, the measurement shall be increased to ten feet of any proposed utilities.

The City Engineer may also approve systems elements to be abandoned in place, at their discretion.

When a system element is to be abandoned in place the following requirements must be followed;

- The City of Bend shall be notified whenever a system element is abandoned and shall be inspected to ensure conformance with the City of Bend Standards and Specifications.
- Submit full surveyed as-built plans in accordance with Part V of the City of Bend Standards and Specifications and comply with ORS dig law requirements for all abandoned underground, out of service and un-locatable facilities within the project limits.
- System elements with no approved future anticipated use, fill abandoned pipes completely with approved non-shrinking grout to prevent future loss of pipe integrity and roadway damage.
- Standard manhole structures will be removed to a minimum depth of six feet. Below a depth of six feet, the structures will be filled with approved road base rock material.

4.2 Manholes (Gravity)

Manholes shall be located in a manner to provide unobstructed access for maintenance and inspection, to prevent stormwater infiltration, and to minimize the possibility of damage from vehicles or injury to pedestrians. Sewer mains shall be extended as necessary to place new manholes at street intersections. Manhole location with regard to centerline shall be per 4.1 - Sewer Main. Manholes shall be placed at intersections and spaced no more than 500 feet apart.

Manholes shall not be located within 25 feet of street sag low points. At the end of cul-de-sacs, storm drainage is to be designed to prevent manhole placement adjacent to catch basins.

Manholes located on mains larger than 12 inches in diameter, or at a pressure/gravity sewer intersection, may be required to be corrosion resistant manholes. Types of corrosion resistant manholes include, but are not limited to, polymer concrete, crystalline waterproofing additive, and thermoplastic lined manholes.

Manholes for all piping in excess of 12-inch diameter, or manholes that have three or more inverts must be 60-inch in diameter and use an eccentric cone configuration with the manhole opening located over a point opposite the outlet pipe. All other manholes shall be a minimum of 48-inch-diameter and use an eccentric cone configuration with the manhole opening located over a point opposite the outlet pipe.

Existing 48-inch-diameter manholes are not required to be replaced with 60-inch-diameter manholes when additional invert(s) are added. The existing and new inverts shall be separated by a minimum of 12 inches in all directions.

Each manhole shall be designed with a minimum fall through the invert of not less than 0.1 feet. Invert fall through manholes that divert flow more than 45 degrees or are 60-inch diameter shall have a fall through the invert of not less than 0.2 feet. At no time shall manholes direct flow more than 90 degrees unless approved by the City Engineer.

Manhole channels must be reviewed by the Engineer of Record during design to meet the following requirements. Where inverts cannot meet the conditions below, a detail of the manhole channels may be requested by the City at time of permit review.

1) The flow channel shall be made to conform to the slope and shape of the sewer pipe entering and exiting the manhole.
2) The channel shall be formed from cast-in-place concrete to a cross-section matching the circular pipes.
3) The channel shall be constructed with vertical walls from a point one half the pipe diameter above the channel flow line as shown in the standard drawing.
4) At intersections with other lines, channels shall be formed with a curve to minimize turbulence.
5) The flow channel shall be constructed to have a minimum depth equal to the pipe diameter.

All manhole channels must be detailed where new sewer is connecting into existing manholes. The design must incorporate how the channels will be formed in the existing manhole and how the existing flow within the manhole will not surcharge into the new pipe. The City will require that all new connections have an invert into the manhole located half the outlet pipe diameter higher than the outlet invert elevation (e.g., 8-inch pipe invert out at 3630.30 feet – new pipe invert 4 inches higher at 3630.63 feet) or that field investigation be conducted to determine the peak flow depths to set the invert. Inverts installed too low in the manhole, incurring surcharge into the new pipe, will not be accepted.

At no time, unless otherwise approved by the City Engineer, will the invert into the manhole be installed higher than the outflow pipe's crown.

For pipes that are larger than 8-inch diameter, internal invert drops are limited to not more than 2.0-foot differential between the invert-in and the invert-out without installation of a

drop manhole. For pipes that are 8-inch diameter and smaller the internal invert drop is limited to 1.0-foot differential between the invert-in and the invert-out without installation of a drop manhole. These are maximum inverts through the manholes and must have manhole channel design by the project Engineer of Record where the inverts fall outside the channel requirements above. The City encourages designs that avoid the use of external drops through the adjustment of the grade of the pipe entering the manhole.

4.2.1 Drop Manholes

For sewer mains larger than 12-inches in diameter with invert differentials large enough to require a drop manhole, an outside drop will be installed per Standard Drawing S-4. For sewer mains 12-inches in diameter and smaller with invert differentials large enough to require a drop manhole, an inside drop will be installed per Standard Drawing S-4A. Inside drop manholes are required to have a minimum diameter of 60 inches to allow sufficient room for maintenance. The manhole opening shall be positioned directly over the top of the inside drop structure.

4.2.2 Manhole Placement

Where manholes are adjacent to but outside paved right-of-way, a paved access pad sufficient for service equipment to operate without blocking the traveled way shall be constructed. Where manholes are away from paved right-of-way, a 14-foot wide 2 inch thick paved all weather access road, with a 6-inch base shall be installed centered over the sewer line with 6-foot square asphalt or concrete pad around manholes. This paved access road shall be a minimum of 14 feet wide. Support facilities such as, but not limited to, vehicle turnaround or fencing with a lockable gate, may be required at certain manhole locations. These requirements will be at the determination of the City Engineer or designee.

Location of manhole frame and covers in a vehicle wheel track is not acceptable. Location of the center of manholes within 5 feet of the curb line is not acceptable. Location of manholes outside of paved areas is not acceptable.

Composite frames and covers are permitted in non-traffic areas only.

4.2.3 Manholes (Pressure to Gravity Sewer)

Manholes shall be placed where pressure sewers connect to gravity main lines after the point at which the pressure line is in laminar non-pressurized flow. A minimum of one joint of gravity pipe shall be installed prior to the manhole. The joint of gravity pipe shall be installed at minimum grade, as practical.

4.2.4 Pressure Sewer Manholes

Manholes are required in all pressure sewers where cleanouts, air release, or vacuum relief devices are placed. Cleanout manholes shall not be more than 500 feet apart. As with gravity manholes, manholes shall be located on or near to pavement centerline.

Valves shall be located outside the normal path of wheel travel, bike lanes, and accessible travel path. No valve shall be located within a sidewalk/shared-use path/path or within 3 feet of an existing or proposed street gutter line and shall fall a minimum 12 inches beyond the gutter pan where curb and gutter exists. All valves shall have a minimum distance of 18 inches measured from the top of the valve body to the top of the road surface. Where

valves fall outside paved roadways, a concrete collar pad a minimum 4 inches thick and 2 feet by 2 feet centered on the valve shall be constructed.

4.3 Sewer Services

Sewer services shall be placed perpendicular to the main sewer whenever possible and shall not be connected into any manhole. All sewer services shall have tracer wire and marking tape per 4.1.13 - Marking Tape and Locate Wire.

Sewer services shall be installed in conformance to City standard drawings. For new sewer mains 12-inch diameter and smaller, services shall be installed using wye fittings. For new sewer mains larger than 12-inch diameter, services shall be installed using tee fittings. Where new sewer mains are installed within a cul-de-sac or dead-end mains with low flow, service wye fittings must be used regardless of the main size.

Services from existing mains smaller than 12-inch diameter may be cut-in fittings or saddle connections. Services from existing mains 12-inch diameter and larger must be cut-in fittings.

Service lines 8-in diameter or larger shall connect to the main line using a standard manhole per 4.2 Manholes (Gravity).

Size-on-size hots taps are not permitted.

Gravity sewer services are not to be less than 4-inches in diameter. All new commercial/industrial properties must have a minimum 6-inch gravity sewer service installed. Where an existing site is serviced by a 4-inch sewer service, upsizing the sewer lateral is not required unless sewer discharge, determined by the plumbing code, requires a larger service. All gravity sewer services and all pressure sewer services shall be design for the appropriate diameter for the application as specified by the designer and approved by the City Engineer.

Sewer services shall have not less than 24-inches of cover at the property line. If the service crosses a roadside ditch, or any low area, 24-inches of clearance must be obtained at the crossing, measured for where solid compacted backfill was placed.

Except for middle housing land division applications as provided below, all residential, commercial, industrial, or institutional properties is permitted a single service. On a lot with multiple buildings, each building is required to have at least one service, but those services can only feed to a single service connected to a sewer main.

For properties on which the development of middle housing land division is allowed under ORS 197.758(2) or (3), additional separate services may be provided from the main to each dwelling unit if the owner or developer of such lot or parcel completes or intends to complete a middle housing land division of the parent site. Intention is defined by the submittal of applications to pursue the land division.

Private sewer services shall not be constructed to service multiple properties per OAR 340-052 unless otherwise approved by land use and the City Engineer. The standard of having every lot serviced by their own service should be maintained whenever possible. Where approved for multiple properties serviced off a common private sewer service, an agreement with the City and all properties being serviced from the common private lateral

must be recorded with the County indicating private ownership and maintenance responsibilities of the private lateral to the main. Where a common sewer is being installed servicing multiple properties, the lateral from the main to the property line must be reviewed for conformance with Plumbing Code to confirm the size is adequate to service the multiple residence. The individual private laterals branching from the common sewer must occur on private property outside the right of way, with the private laterals recorded under private sewer easements to the benefit of the property(ies) they service.

Sewer services that cross property lines are discouraged and require approval from the City of Bend Building official and City Engineer. Private sewer service lines shall not be installed across multiple property lines unless approved through land use or all of the following can be shown to exist:

1) The service line is located outside the building envelope (placed within building setbacks as defined by the Development Code's zoned property line setbacks)

2) There is no "practical means" of bringing a lateral service from the property's right-of-way frontage

3) A 10-foot private utility easement can be secured and recorded with Deschutes County, by plat or other recordable document, prior to any plumbing permit acceptance to the City. The easement width of the private service can be reduced as approved by the City's Building official – width dependent on depth and size of service line being installed.

"Practical means" is defined by the inability to provide a main/service installation to City standards because existing utility conflicts or creating a non-conforming installation that contradicts City standards, not having sufficient City of Bend right-of-way to perform the work, or known existing/future conflicts within the right-of-way that prevent the work (bridges or other geographical barriers that cannot be crossed/removed by general construction means – excavation within wetlands/fragile ecosystems, City ASI's, etc.). A property that is in conformance, with no existing utilities crossing property lines, cannot be made non-conforming through any lot line adjustment, partition or subdivision land use process unless an exception can be made by the City Engineer, allowing private utilities to cross multiple property lines. Where an existing private sewer is already crossing property lines, and there is a recorded easement around the service, the property owner can continue to utilize that existing right.

All unused or abandoned service pipes within the right-of-way shall be cut and capped at the main. The unused service pipe shall be completely removed within the right-of-way. The pipe that remains on private property may remain or be removed at the property owner's discretion.

Sewer services are the ownership of the property owner they service. The property owner is responsible for the maintenance of the sewer service from the main into the property, including any private pumps required for pressure sewer systems.

Where properties have sewer service provided from a pressure sewer system, a check valve shall be installed on private property at the right-of-way line. Beyond the check valve an individual pump with sump shall be installed in conformance to the Oregon State Plumbing Code under a City plumbing permit. All private pumps are owned and maintained by the homeowner or homeowner group. No lots shall pump into a force main (a sewer main with a City pump station) without the approval from the City Engineer.

When services are installed for future use, install cleanout and tail at property line per Standard Drawing S-2C. If a PUE exists, install the cleanout at the property line and extend the tail to the back of the PUE.

4.3.1 Cleanouts

Permanent cleanouts within the right-of-way are not acceptable on gravity mains unless approved by the City Engineer. Cleanouts are permitted on private property per the Oregon Specialty Plumbing Code.

Where a sewer main is stubbed to an approved multi-phase master plan development, with the sewer anticipated to be extended, the sewer main stub must terminate with a manhole or cleanout. Sewer mains cannot terminate with a cap. If a the cleanout is constructed, it must be a minimum 8-inch pipe, extended to the finished surface being within the street asphalt surface or having a concrete collar around the cast iron lid. The cleanout will be removed with the extension of the main. No sewer services will be permitted within this sewer main ending in the cleanout stub unless the main terminates in a permanent manhole.

4.3.2 Sample Manhole

Sample manholes must be located on private property, unless otherwise approved by the City Engineer. Sample manholes shall be located in a manner to provide complete accessibility, to prevent stormwater infiltration and to minimize the possibility of damage from vehicles or injury to pedestrians. Sample manholes shall be located away from traffic and parking. Sample manhole placement shall allow easy access 24 hours per day. Fences or walls shall never be erected around the manhole blocking access. Where sample manholes are constructed in unpaved areas, a 6-foot square concrete pad shall be constructed around the rim.

Sample manholes, regardless of the proposed use, shall be constructed on all new commercial and industrial use properties. Because of the needed sewer depth and sewer lateral size, installation with new projects is easier and less expensive that attempting future installations with building or sire retrofits. With site or building retrofits, where a sample manhole was not installed prior, a sample manhole must be placed on all properties that have uses identified in the US Environmental Protection Agency document “Introduction to the National Pretreatment Program”, with the list of uses specifically provided in the documents Appendix G. The list of these site uses are listed below. Where there are multiple buildings on a site, the City Engineer may require each building’s service lateral to have a sample manhole. Sample manholes shall always be installed downstream of a grease trap or oil water separators, when applicable. Sample manholes do not require sulfide-resistant material. Drops between the inlet and outlet invert shall be 5% minimum or match the existing pipe slope where installed on an existing service line. When sample manholes are located on private property, the Building Department will inspect the sample manhole. The sample manhole will be inspected per the City’s Standard Drawing and Oregon Specialty Plumbing Code.

Sample tees will never be permitted on new construction sites. Sample tees will be permitted only where approved by the City Engineer and where the following conditions apply.

1) Retrofits
2) Where the user is not fabricating or potentially discharging high-strength chemicals into the system

Appendix G of the Introduction to the Nation Pretreatment Program: Aluminum Forming, Battery Manufacturing, Carbon Black Manufacturing, Centralized Waste Treatment, Coil Coating, Concentrated Animal Feeding Operations (CAFO), Copper Forming, Electrical and Electric Components, Electroplating, Fertilizer, Glass Manufacturing, Inorganic Chemical Manufacturing, Iron and Steel Manufacturing, Leather Tanning and Finishing, Metal Finishing, Metal Molding and Casting, Nonferrous Metals Manufacturing, Oil and Gas Extraction, Original Chemicals, Plastics and Synthetic Fibers, Paint Formulating, Paving and Roofing materials (tars and asphalts), Pesticide Chemicals, Petroleum Refining, Pharmaceutical Manufacturing, Porcelain Enameling, Pump, Paper and Paperboard, Rubber Manufacturing, Soap and Detergent Manufacturing, Steam Electric Power Generation, Timber Products Processing, Transportation Equipment Cleaning, and Waste Combustors.

4.3.3 Sample Manholes on Pressure Sewer Systems

Sample manholes connected to the site's gravity sewer discharge, prior to pressure sewer system's to the on-site pressure sewer manhole/sump.

4.4 Sewage Pump Station Design

The City's policy is to install gravity sewer in all situations unless it can be demonstrated to the City that gravity cannot service an area. The City of Bend recognizes that there may be cases where a sewer pump station will be required due to topography or other reasons. In any case where a sewer pump station is being proposed, it needs to be verified in the most currently adopted Collections System Master Plan (CSMP) that it is also showing the need for a pump station in the proposed location. There may be times where the CSMP does not reflect the desired location of a pump station in which case a waiver must be requested through the waiver process in Part I - Section 2 - Change Process. In such cases where a sewer pump station is being requested through a waiver process, the designer should allow additional time for review. In no case will a pump station be allowed to connect to another force main, another pressure sewer or another pump station. Any pump station must have a dedicated force main that flows to a gravity manhole.

The City of Bend requires strict compliance with Oregon Revised Statute 672 for Professional Engineers. The professional design engineer must have had prior experience in designing similar systems. Unless otherwise indicated by the City, prior to the initiation of a study for any new pump station and/or sewer project, the Design Engineer shall submit qualifications for review, and approval by the City.

Design of pressure sewer facilities and sewage pumping stations shall conform to the City of Bend Standards and Specifications and the Oregon Department of Environmental Quality (DEQ) regulations as detailed in the appropriate Oregon Administrative Rules (OAR), Division 52. Designers shall refer OAR Appendix B – Raw Sewage Lift Stations, for detailed criteria.

All raw sewage pump stations shall use submersible pumps in the wet well. In some cases, immersible pumps designed in a wet/dry well configuration will be allowed. This will be determined at pre-design.

All pump station mechanical equipment shall be provided by a single provider, including the pumps, base, guide rails, etc. All electrical devices must be UL or CSA approved, and meet all NFPA and NEC codes and NFPA codes regarding classified areas. All pump stations are subject to submittal to DEQ for approval.

City maintained pump stations shall be located in dedicated tracts of land owned by the City or, when approved by the City Engineer, in a City of Bend easement. A hydrant shall be located at the frontage of the tracts/easement for cleaning the pump station wet well.

The Design Engineer shall provide pump operating data, including pump curve, total dynamic head and calculations used to derive peak flow rate.

A pre-design meeting shall be scheduled with the City. At the pre-design meeting the City will provide a list of requirements for the pump station improvements. The Design Engineer shall come to the meeting with the design service area and anticipated flow rate information development by the service area. Prior to beginning the final design, the Design Engineer shall submit a pre-design report to the City for review, covering all aspects of the Pump Station Design, as described in the pre-design meeting and herein.

The following additional guidelines supplement the Oregon Standards.

Pump stations often require Building permits where electrical, gas or other utility is necessary to supplement the City's pump station facility. The applicant must coordinate those efforts during design to ensure compliance with Oregon plumbing and mechanical codes. If a structure is constructed with the pump station, all required property line setback and building code reviews apply.

4.4.1 Wetwells

All wetwells, shall be concrete epoxy lined self-cleaning design per ASTM standards. A precast, circular wetwell design is required unless otherwise approved by the City Engineer. Pre-packaged pump stations with fiber glass wet wells will be reviewed on a case-by-case basis, complying with Flygt standards or approved equal. Joints shall be keyed rubber ring per ASTM 443 with mastic gaskets and be water proof. A leak test shall be conducted by the Design Engineer and witnessed by the City Inspectors with written documentation of the test provided.

Floors shall be sloped to drain to pump at a minimum of 45 degrees.

The top of the wetwell and associated valve pit shall be flush with the surrounding pavement. Top deck and lid of wetwell and valve pit shall be flush with the surrounding pavement/grade with properly sized 316 Stainless Steel gooseneck vent installed in top of wetwell.

The invert of the lowest influent pipe to the wetwell will enter no more than 1-foot above the lead pump's on setting, to reduce the turbulence in the wetwell. This may require the pipe be sloped outside the wetwell from the normal pipe depth with maximum slope of 22.5 percent. The emergency storage time in the wetwell may be calculated to the invert elevation of the influent pipe in the last manhole prior to the sloped section.

The Design Engineer shall calculate the buoyancy potential for the wetwell assuming ground water level at the ground surface and an empty wetwell. A factor of safety of a

minimum of 1.25 shall be used in the calculation and as deemed appropriate by the Design Engineer and approved by the City. Invert of inlet above operating flow level and designed to reduce turbulence.

4.4.1.1 Working Capacity

The minimum working capacity of the wetwell, from pump off to pumps on, shall be determined at pre-design based upon estimated peak inflow rates and pump manufacturers recommendations.

4.4.1.2 Emergency Capacity

The emergency capacity of a wet well may be required under certain circumstances and shall be reviewed and approved by the City on a case-by-case basis and the City shall provide design criteria that must be met. This will be determined at pre-design.

4.4.1.3 Design Flow

Pumping stations and related components shall be designed to discharge Peak Hourly Flow (PHF), Final design PHF shall be reviewed and approved by the City. The PHF shall be calculated using a combination of the following parameters:

- Average Residential Per Capita Flow per the City of Bend Collection System Master Plan.
- Infiltration and Inflow Allowance per the City of Bend Collection System Master Plan.
- Peak Hour (Diurnal) Flow Peaking Factor per the City of Bend Collection System Master Plan.
- Non-Residential Flow Factors per the City of Bend Collection System Master Plan.
- Seasonal Peaking Factors shall be applied per the City of Bend Collection System Master Plan.

The Design Engineer shall review the City's Collection System Master Plan and DEQ guidelines for pump stations and develop the flow calculations for review and approval by the City of Bend in the Preliminary Design Report.

4.4.1.4 Design Life

Wetwells shall be designed and sized to accommodate for the build-out within the identified basin(s) contributing to the pump station, unless otherwise approved by the City. Pumps, motors, electrical systems and related components shall be designed and sized for a minimum 20-year service life, unless otherwise approved or required by the City. Structures shall be capable of a minimum 75-year design life.

4.4.1.5 Wetwell Wiring

Submersible pump power and control cables shall be continuous from pump to termination in panel, and penetrations into the panel shall be made with a cable gland sized to the as-furnished cables (Crouse Hinds CGB Cord Grip, or equal). Confirm number of power and control cables per pump. (Larger horsepower pumps may have more than a single cable.)

Provide an open penetration (core drill or precast) through the precast concrete wet well wall near the wet well top. The hole must be large enough to accommodate the pump cables and instrumentation cables and provide a minimum of 2 inches of separation between the pump and instrumentation cables. Pump and instrumentation cables shall exit through the open penetration near the top of the concrete wet well wall and travel through an aluminum cable tray with a hinged, locking lid to an electrical isolation pedestal or to the control panel. The cable tray shall include a 20-gauge (minimum) aluminum barrier between the wet well and the electrical isolation pedestal (or control panel). The aluminum barrier in the cable tray shall be grounded. Pump and instrumentation cables shall be separated by a minimum of 2 inches as they enter and exit the cable tray and shall be located on opposite sides of the cable tray barrier from one another.

4.4.1.6 Level Control

Level control shall be provided by the use of a submersible level transducer or radar sensor located inside the wet well. A redundant level sensor shall be provided.

One High-High level sensing float-switch type alarm shall be provided in the wetwell to provide backup pump start control and alarming in the event the primary level sensors become inoperable. This float switch will start the lead pump to insure the contents of the wetwell are pumped out in the event of a primary level control failure.

Float controls shall be utilized as a redundant high and low alarm device and pump control capable of by-passing the control circuit, unless as determined by the City of Bend. The high level PLC and redundant float set point shall initiate the operation of the standby pump along with the high level alarm. Separate contacts shall be used for the alarm and operational points. Float controls shall be intrinsically safe and motor starters shall be NEMA rated. Float switches shall be of a weighted design, which do not require tying off in order to tip and operate properly. Floats shall be individually hung, at a distance no less than 8 inches apart from each other, from stainless steel uni-strut fastened to the concrete with stainless steel hardware and installed in such a manner as not to interfere with pulling pumps for maintenance and free of water turbulence. Floats and other level control shall be intrinsically safe, run in their own conduit system, and terminate in their own explosion proof J-box. All clamps, straps, fasteners and other hardware shall be stainless steel.

All applicable NEC and NFPA 820 requirements for explosive environments must be utilized.

4.4.1.7 Hardware

All hardware and fasteners inside the wetwell shall be stainless steel. Hatch assembly shall align with the slide rail system for pump removal. Rails shall be one piece, solid stainless steel construction of a two rail design. Wetwell and valve pit access lid shall be as manufactured by Utility Vault 4872AL 4 feet x 6 feet Double Door Aluminum suitable for H20 loading with no cross bar (no manhole lids).

All wet well hatches will include an OSHA approved fall protection grating. It will be a minimum of T-316 stainless steel, two piece, with a latch to hold it in the open position. Suggested manufacturers are Flygt and Halliday Products. All hatches shall be full traffic rated suitable for H20 loading.

4.4.2 Pumps

All pump stations that are to be owned and maintained by the City of Bend shall be of immersible motor construction, unless otherwise determined by the City of Bend. Pumps shall be explosion proof and designed for continuous operating service for pumping raw, unscreened sewage, constructed to meet the intended service.

The pumps shall be mounted on a 316 stainless steel guide rail lift out system provided by the manufacturer. The pump shall meet NFPA 820 and NEC requirements, be explosion proof, and shall be capable of passing a minimum 3inch solid diameter sphere. Three phase services are to be specified. Single phase power may only be specified for pumps with a maximum power of 5 horsepower only as explicitly approved by the City.

The pumps shall be supplied by a distributor authorized to service them throughout warranty period and afterwards. The pumps shall be warranted by the manufacturer for a minimum period of two years after the City has accepted them into service. Certified pump tests shall be provided by the manufacturer for each pump provided.

All wetted parts shall be compatible and suitable for application with municipal raw wastewater and the corrosive environment associated with a typical municipal pump station, in addition to the specific materials requirements specified herein.

Each pump shall be provided with a stainless steel, stamped nameplate indicating the serial number, rated head and flow, impellor size, pump speed and manufacturer's name and model number.

Compatibility-Pumps and pump station equipment shall be selected considering compatibility with other City Pump Stations and final selections shall meet the approval of the City of Bend.

The Design Engineer shall provide system curves that indicate the required pump operating conditions. System curves shall be developed for static head and dynamic losses due to suction and discharge piping, valving, and other sources of head loss.

The Design Engineer shall select pump(s) that operate under the determined system curve conditions with the highest efficiency possible. Pumps selected shall operate under the manufacturer's recommended operating conditions and limitations. All system and pump curve information shall be submitted for approval by the City Engineer.

4.4.2.1 Pump Types

Immersible pumps shall be supplied by one of the following approved manufacturers:

1) Flygt (N-type impellor)
2) Approved equal

Self-priming pump stations are not permitted.

4.4.3 Reliability and Redundancy

All pump stations shall be designed to meet the EPA Class I reliability requirements, which includes pump redundancy, standby power provisions, and a telemetry/SCADA system.

Pump redundancy shall mean adequate pump capacity to discharge the PHF with one unit out of service. All pump stations shall be constructed with a three pump system (minimum 2 pumps operating alternately and an additional pump as an installed backup) unless otherwise determined by the City of Bend. All installed pumps shall be capable of assuming a lead, lag, or standby role.

Pumping facilities shall be equipped with a backup control system, which shall operate the pumps in the event the primary power and/or control system fails.

Standby power and telemetry systems shall be provided per these standards.

All new, expanded, or upgraded pump stations shall be supplied with a permanently installed onsite generator with a functional automatic transfer switch with the capacity to operate all pumps, controls, lights and any other necessary equipment to operate the station simultaneously. The backup generator shall automatically transfer during loss of power and automatically re-transfer upon resumption of electrical utility power. The generator set shall be equipped with outputs capable of integrating pertinent information via the City of Bend SCADA system. Those outputs shall be, but are not limited to: generator run, generator low temperature, generator low oil pressure, generator failed to start, amperage, and voltage. The backup generators shall be fueled by natural gas unless otherwise approved by the City of Bend.

Allowable Generator Manufacturers:

1) Katolight
2) Kohler
3) Or approved equal

4.4.4 Telemetry and SCADA

The telemetry system shall be designed, installed and approved by the City of Bend. Ancillary telemetry systems may be required in addition to the standard data transmission telemetry. Additional hardware and software may be required as determined by the City.

Supervisory Control And Data Acquisition (SCADA) software may be required as determined by the City of Bend. The software shall be installed in a panel mounted Human Machine Interface (HMI). The HMI shall be industrial quality with a touchscreen view panel as approved by the City of Bend. Allen Bradley is currently the only HMI allowed in the City of Bend.

4.4.5 Pump Control Panels

Pump panel shall be manufactured using discrete components by a nationally recognized manufacturer. Pump operation shall be controlled by an Allen Bradley Programmable Logic Controller (PLC) unless otherwise determined by the City of Bend. The PLC shall be programmed for alternating pumping sequences and utilizing the Lead, Lag, Standby concept. The PLC shall be capable of integration with the current City of Bend Utility SCADA system. The PLC shall interface with an intrinsically safe level sensor that produces an isolated 4-20 mA signal for pump control. In all selected applications, redundant level controllers will be required with PLC programming to include operator selection and differential alarm settings.

Panels shall include hand, off, auto selector switches, alternating switch with lead selection capability, if applicable, phase failure/reversal relay, starter auxiliary contacts for telemetry use, elapsed time meters, and high level alarm contacts for telemetry. HOA switches, alternating switches, handles for pump breakers, branch and control circuit breaker, reset buttons, overtemp and seal lights and resets shall be operable from the exterior of the control panel door. All electrical power transfer switches shall be mounted externally to the control panel and inside the pump station enclosure. All wires shall be properly labeled; tie wrapped, and laid in wire way as to maintain a professional installation. Cut sheet for products along with computer generated wiring schematics, and equipment layout diagrams all properly labeled showing the entire system shall be approved through the permit process and submitted to Public Works prior to startup of the system. In addition, all operational, maintenance, warranty, and informational documentation including pump curve, electrical schematics, and pump information plate as provided by the manufacturer shall be supplied at start-up to the City.

All pump stations shall be designed for 3 phase power. All stations receiving 240 volt 3 phase line power will be wired so the high leg is on B phase at the first connection after the utility company connection, with clockwise rotation, wired and labeled according to the NEC. If the pumps require counterclockwise rotation, the change will be made at the pump starter. All 460 volt stations will be wired according to the NEC with clockwise rotation. If the rotation must be changed for the pumps, it will be changed at the pump starter.

Allowed Panel Manufacturers: Powers of Automation, Renco, Pump Tech.

Circuit breaker and contactor permitted: Cutler Hammer, Square ”D”, General Electric.

4.4.6 Electrical Enclosure

All electrical devices must be UL or CSA approved, meet NEC codes and NFPA codes regarding classified areas. All pump stations are subject to submittal to D.E.Q. for approval. All electrical components (Pump panel, telemetry, circuit breaker panel, transfer switches, etc.) shall be installed in a free standing, floor mounted, 2 door, and Nema 12 enclosure. The size shall be a minimum of 72 inches x 72 inches x 20 inches deep and shall include a back panel to mount equipment on. A paddle lockable hasp shall be mounted above the exterior handle. The panel shall be on 12-inch high floor stands and securely mounted to a poured concrete base, which extends at least 12 inches past the edge of the panel on all sides.

The panel shall be located outside of the Class 1 Division 2 area as defined by NFPA 820. In no case shall the panel be less than 60 inches from any wetwell hatch or electrical hatch opening and 60 inches from any wetwell vent.

Acceptable Products:

1) Hoffman A-727220ULP Enclosure
2) Hoffman A-72P72 Back Panel
3) Or approved equal

The enclosure shall contain a 200 cfm; thermostatically controlled cooling fan located in the lower right or left hand sidewall. A seven-inch by seven-inch louvered plate with filter shall be located on the upper wall opposite the cooling fan. There shall also be an 800-

watt, 120-volt electric fan forced heater with separate thermostat. Baseboard and residential can type heaters shall not be acceptable, nor shall open unguarded axial type cooling fans. A toggle switch controlled porcelain keyless fixture with 100-watt bulb installed on the upper back wall shall be included along with a 15-amp GFI receptacle. Next to the outlet box shall be a 4-Square steel box with raised steel switch cover for use as a telemetry power switch. The power source for the telemetry switch shall be fed from the pump panel control circuit.

All this and other utilization and distribution equipment including air compressors, light and heat shall be wired from or to a source other than the pump control panel, control circuit and/or control transformer. This will require adding a small 6 or 8 circuit panel tapped off the load side of the pump control panel disconnecting. In the case of a 480-volt pump station a properly sized step down transformer with disconnects shall be required.

All these components shall be wired in EMT conduit, rigid steel conduit, or liquid tight metallic flex.

Acceptable Products:

1) Cooling fan Hoffman A-PA6AXFN
2) Louver / filter Hoffman A-VX66, AFLT66
3) Heater Hoffman D-AH8001B
4) Light Lithonia 9875
5) Electrical panels may be required to be enclosed in a pump station building as determined by the type and quantity of the equipment used.

4.4.6.1 Standby Generator Receptacle

The pump station panel enclosure shall include a Crouse Hinds reverse contact (S22) generator receptacle with back box. Sized appropriately for the pumps and station and wired through a manual transfer switch in such a manner as to back up power to the entire station using the City of Bend standard generator set. The receptacle shall be mounted no less than 36 inches above grade and shall be securely fastened to the enclosure using minimum 5/16-inch diameter bolts. The wiring configuration must conform to the City standard.

The receptacle shall be installed as an additional electrical backup system and shall be installed in accordance with all applicable codes.

Acceptable products:

1) 240 Volt Crouse Hinds, reverse service, 200 Amp AREA 204126S22
2) Appleton AR 200 44 RS
3) lt; Appleton 200 Amp 22 Deg. Turn, Reverse Service, AP 200 44 P4RS

4.4.7 Hydrogen Sulfide Protection

Each station may require a chemical treatment basin per City specification, the odor/ corrosion control system will be identified and approved for each individual station as directed by the City. Odor containment systems may include valves, tanks, pumps, piping,

containment, secondary containment, and other pertinent appurtenances as required by the City of Bend.

4.4.8 Station Access

All pump stations shall be designed to allow for ease of access for equipment and operation of equipment.

4.4.8.1 Equipment Access

Design drawings and specifications shall incorporate all applicable and reasonable provisions to maximize efficient removal, replacement and maintenance of all equipment. This includes but is not limited to adequate clearances, sufficient anchorage, hoists, hatches and platforms as necessary.

4.4.8.2 Site Access

Site Access shall be provided such that a maintenance vehicle and/or vactor truck may be parked off-road and on the pump station site without hindering area traffic. Paved access shall be provided to the station at all times. The access shall allow a vehicle, including the City's Jet Rodder Combination Truck (20-foot W.B. 10-foot overhang, front/back) to park over the wetwell without blocking any traffic lanes or pedestrian walkways. Access shall be as level as possible, but shaped to drain away from wetwell. All paving shall be shown on construction plans and approved by the Engineering Division prior to construction. A 10-foot clear space shall be required between existing, proposed, or future equipment (including 12-foot by 20-foot designated generator area) and fencing on all sides of the pump station.

4.4.9 Station Fencing

The stations shall be enclosed with a chain link fence with 16-foot wide sliding gate with sight screening vinyl slats. Where the sliding gate has wheels for sliding along the ground, a concrete or asphalt path or run shall be constructed to allow for the sliding gate's wheels to run unimpeded. A man gate, installed adjacent to the sliding gate, should be constructed. Where a community determines that a more decretive fence or gate is desirable, it will be the requirement of that community's HOA for the repair and maintenance of the fence and/or gate. There shall be sufficient room inside the fence for a concrete pad 6 feet wide and 9 feet long next to the wetwell and electrical panel. Each installation shall be reviewed and approved on an individual basis. All gates shall be supported by wheels; alternate fencing materials will be considered on an individual basis. Fencing shall be at the tract property line and there shall be a minimum 10-foot clear space between the fence line and any existing, proposed or future pump station equipment/structures. Alternate fences shall be considered if maintained by adjacent HOA.

4.4.10 Force Main Cleanout

Each station shall have a pig launch with a 1-inch ball valve with a brass swivel fitting with brass plug mounted in the center of the flange to permit the attachment of jet rodder hose. There shall be a plug valve on the discharge side of the pig launch.

4.4.11 Flow Metering

Each sewer pump station will have an inline-electromagnetic flowmeter installed on the station discharge main in the vault. There must be no moving parts, or obstruction in the flow. The flowmeter can be used A.C. or D.C. model signal, using a 120-volt A.C. power source. The meter must be designed for and approved for wastewater use with an accuracy of 1 percent. The meter must be programmable with a built-in keypad, with data storage. The transmitter is to be mounted in the station enclosure. There must be 4-20 mA inputs and outputs, with an interface capable of communicating with the City's RTUs and/or SCADA system. The meter must be installed according to the manufacturers specifications with the O and M manual supplied to the City. All necessary conduit and wires for electrical power and communications must be installed and connected. A downstream plug valve must be installed downstream from the meter at a distance required by the manufacturer of the meter for accurate operation and a properly sized spool piece of the same piping material must be provided to facilitate removal of the flow meter.

Acceptable manufacturers are: Krohne, Endress & Hauser, Yokogawa, or approved equal

4.4.12 Bypass System

Each pumping station shall be equipped with a sewage bypass system unless otherwise determined by the City. The Bypass System shall consist of a manhole prior to the pumping station wet well and a discharge port located on the discharge pressure pipe. The manhole shall be readily accessible and located on the site of the pumping station. No manhole will be allowed under cover or inside any of the on-site buildings. The discharge port shall be installed on the discharge pipe immediately after exiting the pumping station. The discharge port shall be readily accessible and on the same site as the pumping station. It shall be constructed of 6-inch ductile iron and extended vertically 12 inches above grade. A 6-inch plug valve shall be installed with a 4-inch by 6-inch cast iron, flanged concentric reducer and a 4-inch aluminum camlock fitting with a lockable cover.

4.4.13 Safety Systems

Each pumping station must conform to all applicable OSHA safety regulations. Additional safety devices such as fall protection and atmosphere monitoring devices may be required as determined by the City of Bend.

4.4.14 Lift Station Standards

An example plan set for lift station design is provided as Part VI – Appendix B – Example Lift Station Plan Set.

4.5 Vacuum Sewer

Vacuum Sewer is currently only within the City's Wood River Village subdivision, located south of Reed Market Road, west of Brookswood Boulevard and east of the Deschutes River. No additional vacuum systems, or extensions of the existing system, will be permitted in the City of Bend unless otherwise approved by the City Engineer. The vacuum sewer system, manufactured by AirVac, functions on vacuum instead of a standard gravity or pressure system - it utilizes vacuum to pull sewer from each induvial lot to a centralized pump station. Each lot uses a gravity service that follows into a vacuum

pit. The pit contains a valve that opens when the pit fills. When the valve opens, because of the system has a vacuum, it sucks everything out of the pit and into the main. Eventually the vacuum will pull everything down to the pump station and pump it to a gravity main elsewhere in the City's system. If you have too many connections to a valve pit or have too much sewer flow to a valve pit, the valve pit is opening more often, reducing the vacuum in the mainline system. With reduced vacuum, you reduce the system's ability to move the sewer to the station and cause the pumps in the pump station to run more frequently. The system was installed initially for the single family and mobile home development densities that existed with the systems construction. Because the AirVac system is designed for these relatively small flows into the pits, additional density in the area requires additional pit installations, often reducing the number of connections to pits that are permitted by the manufacturer.

4.5.1 Valve Pit Design

When a lot is being developed and/or divided, valve pits must be reviewed for capacity. Each valve pit will be permitted only 2.5 sewer lateral connections (average) per single pit.

Connection options – based on averages:
1 valve pit can serve two single family homes
1 valve pit can serve a single triplex
2 valve pits are required for a single four plex.

An Accessory Dwelling Unit (ADU) can be considered ½ a connection, but generally a new valve pit is not required for construction of an ADU.

With any development, the City Engineer has the discretion to require a new valve pit based on review of fixture units that would discharge to the valve pit. AirVac recommends a discharge flow that does not exceed approximately 3 gallons per minute (gpm) into the valve pit, providing approximately 22 minutes of storage in the pit.

Unless approved by the City Engineer, lots should not use pressure systems to discharge into the valve pit.

4.5.2 Valve Pit Construction

Installation of all valve pits must be to the specifications of the manufacturer. The contractor must work with the City during the installation of a new pit, requiring the City to turn off the pump station temporarily to have the wye installation on the mainline. Connection of a service lateral to the valve pit must be conducted under a right of way permit. Construction of the private discharge service on private property must be conducted under a plumbing permit and installed in conformance to Oregon Plumbing Code or applicable building code. An air intake assembly must be installed. The vacuum system relies on the air intake pipe to function, siphoning air into the system to maintain vacuum when the valve in the pit opens. Removal of the air intake pipe can result in a system that fails to discharge sewer or can cause damage to the private property piping systems.

Valve pits must be constructed outside of driveways, sidewalks/shared use paths and roadways, and must be located so that they are accessible by City maintenance personnel. Unless otherwise approved by the City Engineer during right of way permit review, the valve pipe should be located to allow from construction of property tight sidewalks/shared use paths, locating the rim so that is 7 feet from the property line, falling within a landscape strip. Installation of valve pits on private property will require the recording of City sewer easements around the pit. The sewer easement could potentially extend along the frontage of the lot to allow for connection by adjacent lots if the valve pit is identified as having additional capacity for future connections.

Water

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5 Water

Materials and procedures for water facilities shall conform to the most current Oregon Standard Specifications for Construction as supplemented and/or modified by the City of Bend's Special Provisions. The Oregon Health Division Administrative Rules, and American Water Works Association (AWWA) standards, may also be referenced.

Designers shall note that some areas within the City limits are served by private water utilities (Roats and Avion). The private water utilities shall be shown on the infrastructure plans. The design standards require these private utilities apply for a right-of-way permit (Tier II or Tier III/Infrastructure depending on work being performed) when water infrastructure is being installed for ultimate ownership by the private utility and requires their approval.

All design elements below are minimum requirements. Any exception will require a waiver request as outlined in Part I - Section 2 - Change Process.

5.1 Main Line

The City's water distribution system is designed to meet peak hour demands and all fire flow requirements with minimal impacts to City of Bend water customers. All new elements added to the existing system need to be designed with these requirements in mind. Where new water infrastructure is being constructed, water systems shall be looped into existing water pipes in the project vicinity or as directed by the City Engineer.

City of Bend water mains and services in the City's right-of-way that are not in use and that have no approved current or future anticipated use shall be removed completely unless a waiver to allow abandonment is approved by the City Engineer per Section 5.1.10. Where water mains and services within a City utility easement (outside of public right-of-way) on private property is to be decommissioned, it is preferred to have all pipes removed, however with the City Engineer's approval, they can be abandoned in place when the easement is extinguished and the City releases liability of the abandoned pipeline to the property owner. Existing water services to be abandoned must be cut at the corporation stop and removed from the right of way. Place a watertight cap on the existing corporation stop. Corporation stops on services larger than 1 inch shall be removed and replaced with a plug at the water main. Fittings and valves shall be removed from the right of way.

City of Bend water pipe shall be constructed in a trench with Class B compacted backfill within the pipe zone in conformance with the standard drawings. Water mains shall not be constructed on blocks.

Continuous casings must be placed on all water main crossings at irrigation pipes, within ODOT, railroad or other jurisdictions right of way, or as otherwise required by the City Engineer where access to public mains are may be limited. Casing must be upsized to minimum 2 nominal pipe sizes. Casing pipe and pipe spacers to be determined during development of the construction documents. All pipes are to be restrained within the casing.

Public water mains will not be permitted onto private property unless the following is applicable and approved by the City Engineer:

- 1) The main is within an unencumbered City water easement. Private easements are not to cross and run within the City water easement unless approved by the City Engineer through a Deviation to standards
- 2) The main is installed within a paved drive isle, providing access to the main and preventing planting of trees
- 3) The main is looped, preventing a dead end system, stagnation and providing redundancy
- 4) The site is large in size, servicing multiple buildings or lots and requires the main for fire hydrant and fire sprinkler protection

In all other cases, the water service onto the site will be constructed as private in conformance with all applicable building/plumbing codes and state/federal regulations, with the installation of premise isolation at the property line. Private domestic and private fire water systems must be separate taps from the right of way.

If a water extension is required for fire service or domestic service, the property owner shall be required to extend the City water main a distance sufficient to establish a standard perpendicular service connection into the property or 20 feet, whichever is greater. For all other development, water mains shall be required to be extended to and through the length of the property frontage unless otherwise determined by the City Engineer. Exceptions may exist due to pressure zone or service area boundary constraints.

5.1.1 Minimum Size

The minimum pipeline diameter for distribution mainlines shall be 8 inches. Distribution mains shall be either 8 inches or 12 inches in diameter. New 10-inch diameter mains will not be permitted unless otherwise approved by the City Engineer. Transmission mains shall be minimum 16 inches in diameter. Fire hydrant lines shall be 6 inches in diameter and have a 400-foot maximum running length. All mainline extensions and system designs shall meet required minimum fire flow for that zoning, see 5.6.1 - Fire Flow Requirements.

5.1.2 Marking Tape

Marking tape is required on all mains. Marking tape must be minimum 2 inches wide, APWA blue, and stretchable to a minimum of five times its original size. The marking tape must be installed at the top of the pipe zone material, 12 inches minimum above the main, centered on the main. Refer to Standard Drawing W-1.

5.1.3 Materials

Ductile iron is the only material approved for construction of water lines and fittings in the City of Bend system. Adequate controls and protective equipment shall be provided so that the level of pressure rise resulting from surges and other variations from normal operations shall not exceed the internal design pressure at any point in the piping system and equipment by more than ten percent. Surge analysis calculations shall be provided on request for City review and shall be included with any design submittals.

Minimum class requirements:

Pipe Diameter (I.D.)	Class
4-inch to 12-inch	52
14-inch and larger	50

5.1.4 Location

All water lines must be located in public right-of-way, unless otherwise approved by the City Engineer. Public easements for water mains and hydrants across private property will not be allowed unless approved by the City Engineer. Any public water lines (domestic water services, fire services, or private water mains) entering into private property requires premise isolation (backflow devices) at the right-of-way. The location of the premise isolation shall be on private property directly adjacent to the right-of-way or easement line, unless otherwise approved by the City Engineer. Backflow devices will be permitted within a building on a case-by-case basis, but shall not be permitted if the premise isolation is located more than 20 feet from the right-of-way without City Engineer approval (i.e. installation of the premise isolation 20 feet from the right-of-way within the building immediately adjacent to the building's pipe penetration may be permitted on a case-by-case basis).

Water mains shall be located 10 feet from roadway centerline. Water mains shall be offset a minimum 6 feet from the centerline where located on streets 32 feet or less in width (curb-to-curb). Water mains shall be constructed a minimum 3 feet from the curb.

A 10-foot separation between water and franchise utilities must be maintained. At non-potable crossings, the bottom of the water line shall be 1.5 feet or more above the top of the non-potable utility. Where a 1.5-foot vertical separation cannot be obtained at the crossing, the non-potable utility pipe at the crossing shall be constructed such that one full 20-foot stick of water pipe is centered at the crossing. Separation from sanitary sewer lines is established by Oregon Administrative Rule (OAR) 333-061-0050. All non-potable lines shall be treated as "sewer" lines as described in OAR 333-061-0050. Dry utility crossings are to maintain a typical 12-inch vertical separation from all water crossings, with minimum 6-inch vertical separation permitted with City approval.

All water lines shall have a minimum of 36 inches of cover measured from the top of the outside pipe to the top of the roadway surface. Maximum depth of a water main shall not exceed 6 feet. If greater depth is needed the Design Engineer shall provide vertical deflection up to establish a 6-foot depth maximum at all branch and hydrant valves.

5.1.5 Velocities

Normal working velocities (Average Day Demand) shall not exceed 5 feet per second. In no case will velocities exceed 12 feet per second. Consideration for surges from higher velocities must be considered in the design.

5.1.6 Pressures and Flow Calculations

The City of Bend has numerous pressure zones around the City, each with unique pressures. The City strongly recommends that the designer understand the pressure zone they are in and the specific requirements associated with that zone.

The following table identifies the City of Bend requirements for pressures:

Condition	Pressure (PSI)
Minimum Service Pressure Under Fire Flow	20
Maximum Service Pressure without PRV	80
Maximum Service Pressure with PRV	120

The City of Bend is required to ensure required fire flows can be obtained at 20 psi. Pressures higher than 20 psi are not guaranteed, and the designer should consider how pressures may change over time as additional development is added beyond any proposed tie in or extension of the existing water distribution system.

Normal service pressures are defined as static pressures on peak day demand. Pressures below 40 psi typically generate complaints. To avoid complaints, the designer is required to design facilities to provide a minimum pressure of 40 psi. If normal service pressures cannot be met, each service line will require an individual and private pressure pump located a minimum of six feet past the City premise isolation and shall not be located on City Right-Of-Way, and/or the title to the property that the service line is serving shall be modified to state:

> *"Known low water pressure area. The City of Bend is not responsible for inadequate service pressures associated with this property. If pressures are unsatisfactory to the property owner, the property owner at their discretion can install a pressure pump on the downstream side of the City Meter at the owner's expense. The pump shall be located at a minimum of six feet past the premise isolation and shall not be located on City Right-Of-Way. In no situation is the City responsible for maintenance, service, or replacement of this pump."*

Maximum service pressures that are at, or exceed, 80 psi on City owned mainlines will require a pressure reducing valve and vault. The designer will need to meet with the City to determine exact location, orientation, size, and type to be installed. Water service lines past the City owned meter must meet plumbing code requirements for maximum pressure. It is strongly suggested that service lines that are within 10 percent of maximum pressure as determined by plumbing code install individual pressure reducing valves.

5.1.7 Bends and Joint Deflection

All bends shall be called out on the plan and profile by station and offsets, including size, number, and designation (90°, 45°, 22-1/2°, 11-1/4°) of each. When applicable, joint deflection shall be called out in the number of degrees per joint and radius of curvature when several joints in succession are to be deflected.

5.1.8 Thrust and Restrained Joints

The City requires mechanical restrained joints. Concrete thrust blocks are required behind hot taps 4-inch and larger on existing watermains, sized appropriately on the construction documents by the engineer of record. Thrust blocks will not be used when a mechanical restrained design can be implemented unless otherwise approved by the City Engineer, Any other thrust restraints require a waiver request as specified above. All restrained systems shall be in conformance with Specification Section 01140.

The Engineer shall provide calculated restrained lengths for all bends, tees and appurtenances requiring thrust restraint. Calculations shall be run under the following minimum requirements, as per AWWA standard: 2:1 safety factor, type 5 trench, 3-foot bury, 150 psi test pressure (or higher as needed) and soils consistent with the site geology (typically a GM – Silty gravel, or as determined by the engineer of record). All improvement plans shall have a restraint table stating the applicable restrain lengths for pipe size and fittings used, calculation inputs and installation notes.

5.1.9 Pressure Reducing Vaults

Pressure reducing vault designs shall be coordinated with the City on a case-by-case basis.

5.1.10 Water System Abandonment

No unused existing utility system elements may be abandoned in place within the City right of way or City controlled easements unless a waiver to allow abandonment is approved by the City Engineer.

When a system element is to be abandoned in place the following requirements must be followed;

The City of Bend shall be notified whenever a system element is abandoned and shall be inspected to ensure conformance with the City of Bend Standards and Specifications.

Submit full surveyed as-built plans in accordance with Part V of the City of Bend Standards and Specifications and comply with ORS dig law requirements for all abandoned underground, out of service and un-locatable facilities within the project limits.

System elements with no approved future anticipated use, fill abandoned pipes completely with approved non-shrinking grout to prevent future loss of pipe integrity and roadway damage.

All water valves boxes will be removed to a minimum depth of six feet. Below a depth of six feet, valve boxes will be filled with approved road base rock material.

5.2 Service Lines

The minimum water service line size is 1-inch diameter to the meter. This line size may be reduced through the meter as required for domestic service in conformance with the Oregon Plumbing code and any other applicable state building codes. The water meter shall be the same size or one size smaller than the water service line. No more than one service line per property is permitted unless otherwise approved by the City Engineer; provided, however, that for properties on which the development of middle housing is allowed under ORS 197.758(2) or (3), additional separate lines may be provided for each dwelling unit if the owner or developer of such lot or parcel completed or intends to complete a middle housing land division of the parent site.

An existing water service must be brought into conformance with City standards when 1) plumbing fixtures require an upsize of the service line/meter (as determined by the plumbing code) or 2) where the water meter is larger than the service line from the main (example ¾ inch service lateral to a 1 inch meter). All water services for commercial or

industrial use, including residential projects that have three dwelling units or more, must be brought into conformance with the City's commercial standards (and OAR 333-061-0070), having a minimum 1-inch premise isolation installed outside the meter box on private property directly adjacent the right of way line. For existing site's undergoing renovation, the existing meter size and/or service lateral size may be retained if the additional plumbing fixtures do not require a meter upsize as determined by the plumbing code or the required flow to the buildings fixtures do not exceed the manufacturers' meter service flow capacity. All new services must be constructed to current City standards.

Service lines shall be installed as shown on the Standard Drawings. All service runs shall be one continuous run of copper within the City's right-of-way. All service lines shall have a minimum of 3 feet of cover. When services are installed for future use, extend the tail to the property line, or back of the Public Utility Easement (PUE), if a PUE exists.

Marking tape shall be installed a minimum of 12 inches above the service line at the top of the pipe zone material, centered on the service line.

Service taps at the main shall not exceed one tap every 2 feet and be a minimum 2 feet from bends or bells on the mainline. Water services are to maintain 10 feet separation from franchise utilities and non-potable water when within the right-of-way or in a utility easement.

Services 2-inches and larger shall be hot tapped with a minimum 2-inch corporation stop, using the appropriate tapping saddle and appurtenances as called out by the Engineer of Record. Service connections to existing pipe may utilize a saddle tap and valve. All water service lines shall be placed perpendicular to the water main.

New service connections greater than 2 inches shall be designed by a Professional Engineer. 3-inch service lines are not permitted, requiring 4-inch ductile iron water lines with the ability to reduce to 3-inch service lines at the meter.

All irrigation water services used specifically for irrigation will be constructed to commercial water service standards. Irrigation services will only be permitted for the irrigation of 1) HOA tracts or 2) frontages along arterials and collectors where an HOA maintains landscaping for the subdivision. All other lots, subdivision or commercial/industrial properties, will use the domestic water service for the irrigation of the property. Use of the irrigation service within medians and/or roundabouts will be determined on a case-by-case basis, with the City's preference to have drought tolerate vegetation that does not require irrigation once established.

Connections to transmission lines are not permitted. A separate distribution line shall be required to provide single services unless otherwise approved by the City Engineer. Where water services are permitted off of transmission mains, the taps must be performed by tapping sleeves and not corporation stops due to the thinner walled pipe. Additional tapping requirements may be required by the City with tapping of transmission mains dependent on the situation and location of the tap.

City standard is that services are to be provided directly to property with meters and premise isolation installed within the right-of-way for residential application. Reference Standard Drawings W-4, W-4A, and W-4B for residential service installation. Service connections beyond the premise isolation, installed within the property shall be considered private and will be reviewed in accordance to the Oregon Plumbing code and all other

applicable Oregon state building codes, installed under a City Building Department permit. The City is not responsible for maintenance beyond the meter. Reference Standard Drawings W-5 through W-5D for commercial service installation.

Private water service lines shall not be installed across multiple property lines unless approved under land use or approved by the City of Bend Building official and City Engineer when all of the following can be shown to exist:

1) The service line is located outside the building envelope (placed within building setbacks as defined by the Development Code's zoned property line setbacks)
2) There is no "practical means" of bringing a lateral service from the property's right-of-way frontage
3) A 10-foot private utility easement can be secured and recorded with Deschutes County, by plat or other recordable document, prior to any plumbing permit acceptance to the City. The easement width of the private service can be reduced as approved by the City's Building official – width is dependent on depth and size of service line being installed.

"Practical means" is defined by the inability to provide a main/service installation to City standards because of existing utility conflicts or creating a non-conforming installation that contradicts City standards, not having sufficient City of Bend right-of-way to perform the work, or known existing/future conflicts within the right-of-way that prevent the work (bridges or other geographical barriers that cannot be crossed/removed by general construction means – excavation within wetlands/fragile ecosystems, City ASI's, etc.). A property that is in conformance, with no existing utilities crossing property lines, cannot be made non-conforming through any lot line adjustment, partition or subdivision land use process unless an exception can be made by the City Engineer, allowing private utilities to cross multiple property lines. Where an existing private water service already crosses property lines, and there is a recorded easement around the service, the property owner can continue to utilize that existing right. Water services not in use, needing to be upsized or needing to be relocated within a parcel are required to be removed back to the main and the pipe removed from the right-of-way. The City requires that the corporation stop shall be removed from the main and the main be plugged, unless otherwise approved by the City Engineer or designee.

If the meter assembly/box or service line is damaged during construction/site improvement activities, during the warranty period, or if the existing meter box or service line does not meet current City Standards, the developer/property owner shall upgrade the components of the service that is out of conformance.

For all non-residential potable services a minimum of a D.C.V.A. (Double Check Valve Assembly) shall be required for Premise Isolation. The Premise Isolation Assembly shall be installed in accordance with O.A.R. (Oregon Administrative Rules) 333-061-0071, Oregon Plumbing Specialty Code Chapter 6, and City of Bend Standards and Specifications before a meter is set by City of Bend Utilities Personnel. The premise isolation shall be placed on private property directly behind the right-of-way line. The degree of hazard of each service connection shall be identified and verified by City of Bend Safe Drinking Water Program. Health Hazard connections shall be required to either utilize an approved In-Premise Backflow Prevention Assembly that is commensurate with the degree of hazard (Air Gap or Reduced Pressure Principle Backflow Prevention

Assembly) or install the Health Hazard Assembly as Premise Isolation. A Reduced Pressure Backflow Assembly will be required at the service connection when non-potable, non-domestic water services (i.e., COID/Swalley/Arnold/NUID irrigation) and City water services exist at the same project site, per ORS 33-061-0070 and all other applicable State regulations.

All residential water services shall have the backflow assembly/meter loop installed by City of Bend Utilities Personnel after construction and inspection approval of the service pipe and water meter box.

5.2.1 Services Off of Fire Lines

The City of Bend will not permit fire hydrant or fire sprinkler lines to be used as the domestic service line. Potable water services must be tapped from the main separate from the fire line. Fire sprinkler services shall not connect to fire hydrant lines unless approved by the City Engineer.

Fire sprinkler lines must have a Double Check Detector Assembly (DCDA) installed with leak detection meter. The City's ownership of the fire sprinkler lines terminate at the right-of-way line with the installation of a gate valve per Standard Drawing W-13B. All fire sprinkler lines and fire sprinkler vaults shall be reviewed by the Building Department when on private property to be in conformance with plumbing and fire code regulations. Fire sprinkler vaults are required on private property adjacent to the right-of-way when the building is located beyond 20 feet from the right-of-way line. In the instance where the building is within 20 feet of the right-of-way, the developer has the option of installing a fire sprinkler vault or installing the fire sprinkler plumbing (DCDA, Post Indicator Valves, and Fire Department Connections) within the building as approved by the Building Official and City Engineer and located directly behind the wall penetration and closest to the watermain tap.

Fire sprinkler services that use any chemical additions shall require an approved R.P.D.A. (Reduced Pressure Principle Detector Assembly). Fire services, vaults and backflow prevention assemblies shall be installed in accordance with O.A.R. (Oregon Administrative Rules) 333-061-0071, Oregon Plumbing Specialty Code and City of Bend Standards and Specifications.

Unless approved otherwise, fire hydrant lines on private property shall have premise isolation at the right-of-way. The hydrant main and hydrant is privately owned and maintained by the property owner beyond the premise isolation.

5.3 Valves

Main line valves shall be located in the public right-of-way. The maximum distance between valves is 1,000 feet on transmission mains and 500 feet on distribution mains. Valve locations to be determined by the City. Typically, transmission mains are defined as lines that have no other services or distribution connections to them and are typically coming from one of the sources of water. All other lines are distribution lines.

5.3.1 Valve Location

Valves shall be located outside the normal path of wheel travel, bike lanes, and accessible travel path. No valve shall be located within a sidewalk/shared-use path/path or within 3

feet of an existing or proposed street gutter line and shall fall a minimum 12 inches beyond the gutter pan where curb and gutter exists. All valves shall have a minimum distance of 18 inches measured from the top of the valve body to the top of the road surface. Where valves fall outside paved roadways, a concrete pad 4-inch thick and 2 foot by 2 foot centered on the valve shall be constructed. collar shall be constructed not less than 4 inches deep and centered in a 2-foot by 2-foot pad.

At all tee and cross fittings within an intersection, two valves shall be installed on tees and three valves installed on crosses. Valves on the main line at hydrant tees are only required where valve spacing requires the valve installation. At the direction of the City Engineer, additional valves may be required on at fittings where deemed necessary for maintenance of the system. In cases where the legs of the branches of the fitting are of different sizes, a valve shall be placed on the smaller diameter first. All valves shall be located within 5 feet of the cross or tee fitting unless on an arterial or collector street where valves may be required to be placed outside the intersection near the flow line of the local street intersection.

Valves should always be installed at valve clusters around a tee or cross and never in the middle of a corridor, unless otherwise approved by the City Engineer. All dead-end lines shall be terminated using a valve and blow off, except on mains 12-inches and larger, ending in a hydrant.

Hot taps to existing watermains shall be permitted depending on the location of existing valves in the vicinity. Where valves are not adequate to the existing system, a cut in tee will be required with valves installed on all branches, or as determined by the City Engineer. Size-on-size taps will not be permitted unless approved by the City Engineer. For cast iron, PVC, and steel mains, the tap size shall not be larger than half the diameter of the existing main.

5.3.2 Valve Types

Gate valves are required on all waterlines 8-inches and smaller. Butterfly valves shall be used on all waterlines of 10-inch diameter or larger; or on smaller diameter lines where 18 inches of cover to the top of a gate valve body cannot be obtained. Butterfly valves shall be mounted with the stem vertical and on the “curb” side of the main.

Air-Vac/Air Release valves shall be considered during design. Typically these will be located at all elevation rises and elevation high points. Typically, 1-inch Air-Vac valves shall be installed for water mains 12 inches and smaller and 2-inch Air-Vac/Air Release valves installed for water mains larger than 12 inches all larger water mains, however the sizing shall be verified against manufacturer’s recommendation. All Air-Vac/Air Release valves shall be designed to be insulated to protect against a sustained temperature of -10 °F. Hydrants are not considered Air-Vac or air release.

5.3.3 Pressure Reducing Valves

Projects requiring a PRV station shall set up a meeting with operations staff to discuss design requirements. The design must follow the standard drawing but may deviate depending on the system pressures, flows and location.

5.3.4 Blow-Offs

Blow off valves shall be located on all dead end lines. New lines that are connecting to existing lines at both ends will require a temporary blow-off for chlorination purposes. In no cases shall hydrant spacing be modified to use as a blow off. Design shall address how water from blow offs and flushing will be handled and disposed of to prevent any erosion or landscape damage.

Watermains must terminate with a blow off except where the following situations exist. Where these conditions exist, the watermain must terminate in a hydrant.

1. At cul-de-sacs or on dead end streets that will never be extended.

2. Where watermains terminate and will not be extended in the future (example, boundary of a pressure zone, jurisdictional boundary, etc.)

5.4 All-Weather Access

Where water facilities requiring maintenance access outside paved right-of-way, a paved access pad or road sufficient for service equipment to operate without blocking the traveled way shall be constructed. Where water facilities (such as fire hydrants and valves) are away from paved right-of-way, a 14-foot wide, 2-inch thick, paved all weather access road, with a 6-inch base, or as approved by the City Engineer, shall be installed to provide access. If the access road requires a vehicle turn around, adequate space shall be included for an all-weather access road.

Where water facilities not requiring maintenance access (such as transmission lines) lie away from paved right-of-way, an all-weather access road shall be constructed over the line. This all-weather access road shall be a minimum of 14 feet wide and shall be surfaced with a minimum of 6-inches of compacted aggregate base. The road shall be shaped to promote drainage and shall not cause the ponding of storm runoff.

5.5 Meters

All water service lines must have a meter box and assembly placed a minimum of 1 foot outside of hard surfaces (concrete and asphalt) unless approved by the City Engineer. Where meter boxes are unable to be located outside hardscape, an expansion joint shall be installed 12 inches around the entire perimeter of the meter box. When meter boxes are located in sidewalk/shared-use paths with tree wells, the meter box shall be located a minimum of 6 feet from the tree well. Fire lines no longer require meters but are required to have double detector check assemblies (DCDA) to detect low-flow events. Any service line that is providing water from the City of Bend distribution system for purposes other than fire flow must have the entire amount of water used measured. Water meters shall be sized to the water service line size or one size smaller.

New meters installed at commercial and industrial properties must be 1-inch minimum.

Commercial water meters shall be installed on residential projects that have three dwelling units or more.

Meters that are 3 inches or larger will be either a Sensus Omni or HbMag. All accessories, except the MTU, need to be included to ensure the meter functions properly.

For domestic water services, the City's ownership ends at the meter. City's ownership for fire services ends at the right-of-way.

5.5.1 Automatic Meter Reading Systems

The City requires the STAR Network AMI system as manufactured by Aclara on all metered services.

All meters shall include an Aclara/STAR meter transmission unit. The transmission unit shall be installed on the bottom of the meter box lid as shown in the Standard Details.

5.5.2 Standard Meters

All water meters 2-inch and smaller shall be installed by the City of Bend. Meters shall be approved by the City prior to installation.

5.5.3 Vaults and Meter Boxes, Including Insulation

Commercial vaults and meter boxes shall typically be installed 3 feet to 5 feet off of the corner property line in each direction. Residential meter boxes shall typically be installed 1.5 feet to 5 feet off of the corner property line in each direction. Vaults and meter boxes are to be installed outside of hard surfaces.

Meter banks, multiple meters placed in close proximity to one another to provide multiple lot services, are permitted with approval from the City Engineer. Water taps shall be spaced a minimum of 2-feet apart at the main. Stamped or engraved stainless steel or brass address tags shall be on each meter box in the meter bank to identify which meter services which address. Refer to Standard Drawing W-4.

The following, or an approved equal, are the only approved meter boxes for services for 2-inch and smaller. All meter boxes must be tier 8 or equal. Meter boxes shall not have mouseholes.

Brand	Box	Lid
Armorcast	BOX –17 x 30 x 18	LID-1730 Polymer with cast iron meter reader lid
Quazite	Polymer concrete; flared L 17 x 30 x 18	Quazite H20 17 x 30 with hinged cast iron reader door
Oldcastle	Polymer concrete Tapered 17 x 30 x 18	17 x 30 with hinged cast iron reader

For all meters larger than 2-inch, the designer will determine the appropriate meter box or vault. All meter boxes and vaults must be traffic rated. See Standard Details for 3-inch and larger meters.

All meter vaults and boxes must be installed to the correct finish grade. Any that do not meet this requirement, including requirements for correct depth of meter stops and service line, will not be activated and locked off with a City of Bend lock.

Closed cell foam insulation shall be installed with the meter stop as shown on the Standard Drawings.

5.6 Fire Services, Flows and Hydrants

The City of Bend requires all new developments or extension of existing facilities to have a fire flow analysis performed. This analysis must be performed by the City of Bend. All relevant information to the proposed development or extension of services must be provided. Forms and fees for this service are available from the permit center in the Community Development Department (CDD) or on the City's website.

The fire flow analysis uses a calibrated hydraulic model to determine available flow. The analysis uses the peak day demand in the distribution system with storage tanks at half full to determine the available flow, static pressures, and residual pressures.

No other analysis for fire flow can be substituted for the analysis performed by the City using its calibrated hydraulic model.

5.6.1 Fire Flow Requirements

The following table lists the required fire flows based on land use and development type:

Land Use Code	Development Type	Required Fire Flow (GPM)
AOD	Airport Operations District	2,500
ARID	Aviation Related Industrial District	2,500
ASD	Aviation Support District	2,500
ASDRA	Aviation Support District Reserve Area	2,500
CB	Central Business District (CBD)	3,500
CC	Convenience Commercial District	2,500
CG	General Commercial District	2,500
CL	Commercial Limited	2,500
CN	Commercial Neighborhood	2,500
EFUTRB	Exclusive Farm Use	1,500
IG	General Industrial District	2,500
IL	Light Industrial District	2,500
IP	Industrial Park	2,500
ME	Mixed Employment	2,500
MR	Mixed-use Riverfront	2,500
PF	Public Facilities	2,500
PO	Professional Office	2,500
PO/RM/RS	Mixed Use Office/Residential	2,500
RH	High Density Residential	1,500
RL	Low Density Residential	1,500
RM	Medium Density Residential	1,500
RR10	Medium-10 Density Residential	1,500
RS	Standard Density Residential	1,500
SM	Surface Mining District	2,500
SR2-1/2	Suburban Low Density Residential	1,500
UAR10	Area Reserve District	1,500

5.6.2 Fire Service Lines

The City of Bend requires all fire service lines be designed by a registered Professional Engineer up to the right-of-way and submitted through a right-of-way plan review and approval process. The fire service backflow/premise isolation device shall be designed in accordance to all applicable building/fire/plumbing codes under a building department permit. Where the building is located within 20 feet of the right-of-way line, the developer has the option of installing the premise isolation within the building, otherwise it shall be placed in a vault near the right-of-way line. All fire service lines will be installed from the nearest water main with a valve located adjacent to the tap/tee. Fire Department Connections (FDCs) and Indicator Valves (PIVs or WIVs) can be located on building walls with fire and building department approval. PIV's and FDC's must be located on private property, unless otherwise approved by the City Engineer. If approved by the City Engineer to be located within the right-of-way, the PIVs and FDCs shall be a minimum 5 feet from roadways/curb. Construction documents shall provide a plan and profile of the fire service installation up to the right-of-way line. Standard Drawing W-13B for fire lines is a minimum standard only.

All fire service lines will require a DCDA around the backflow preventer.

Backflow Assembly vaults shall comply with the Uniform Plumbing Code requirement for electrical and heat for freeze protection as determined by the Building Department.

5.6.3 Hydrants General

Each hydrant shall be connected to the main with a 6-inch-diameter ductile iron branch with a 6-inch shutoff gate valve using a restrained MJ x MJ connection. Breakaway flange shall be no higher than 3 inches above the surrounding surface for Roadside Design compliance. See Specification 01160.10(a) and Standard Drawing W-7. No valve shall be located closer than 48 inches to the hydrant. When the hydrant branch line exceeds 100 feet in length, the hydrant lateral pipe must increase to 8 inch diameter and two valves shall be required: one near the hydrant, and one at the main.

Hydrants shall comply with AWWA C502-64 with a dry top, left-hand opening, and have one 5 1/4-inch steamer nozzle and two 2 1/2-inch hose nozzles. The steamer nozzle should always face the street with the exception of parking lots.

Hydrant extensions are not allowed on new hydrants but can be utilized on existing hydrants at the discretion of the City Engineer and the City of Bend Utilities Department. Extensions shall be from the manufacturer or approved equal, with a maximum of one extension per hydrant. Hydrant extensions shall not exceed 12 inches. All hydrant extensions shall be inspected during installation and approved by a City inspector. Hydrant drains will be surrounded by a washed gravel pocket, wrapped with filter fabric or 12 millimeter plastic, to provide drainage. No hydrant drains will be connected to either the sanitary or storm sewer system.

Hydrants are not to be used in lieu if air release or air-vac valves.

5.6.4 Location

Fire hydrant placement shall be outside the pedestrian path of travel. Hydrants shall be spaced at no more than 400-foot intervals measured as the hose would lay within right-of-way. Any further spacing requires approval of the Bend Fire Department.

Hydrants shall be located such that maintenance staff has complete access. They shall also be located to minimize the possibility of damage from vehicles or injury to pedestrians, with location preferred near intersections not directly on the corner. Hydrants located in parking areas must be protected, preferably by placing hydrants in a curbed landscape median/island. Concrete filled steel bollards are not preferred. Unless otherwise approved by the City Engineer, hydrants placed onsite shall have a premise isolation valve installed at the right-of-way line. All plumbing onsite shall be privately owned and maintained by the property owner.

A hydrant shall be positioned within 100 feet of an FDC when required by the Fire Marshall.

Where a fire hydrant is located on a fire apparatus access road, the minimum road with shall be 26 feet, exclusive of shoulders.

5.6.5 Concrete Pad

Concrete hydrant pads shall be required around all hydrants (See Standard Drawings W-7 and W-8).

Stormwater

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6 Stormwater

To meet the City goals for stormwater management, stormwater drainage and stormwater quality as prescribed in the City of Bend Stormwater Master Plan, the City has adopted best management practices for addressing stormwater drainage in the City of Bend.

Designs of stormwater facilities and conveyance systems shall conform to the City of Bend Standards and Specifications and the applicable Oregon Department of Environmental Quality (DEQ) regulations. Where a conflict is discovered between City and DEQ requirements, the Design Engineer shall notify the City Engineer of the issue and the most stringent practice shall apply.

The City recognizes the current Central Oregon Stormwater Manual (COSM) as a standard design manual for stormwater and incorporates it into these Design Standards except as modified or otherwise prescribed herein. The following sections summarize key elements of the City design requirements. Stormwater design professionals are required to be familiar with the specific requirements and practices of the Manual and implement them fully into their designs for City approval.

6.1 Design Storm

All stormwater designs for new development or redevelopment projects shall address and comply with the eight basic requirements prescribed in the COSM. Any deviation from the Basic Requirements, or other provisions of the COSM must be fully demonstrated and documented in writing by the design professional through the drainage submittal process.

6.1.1 Water Quality Design Storm

The six-month National Resource Conservation Service (NRCS) Type I, 24-hour storm event is the designated water quality storm event to be utilized for both volume based and flow rate-based water quality best management practices (BMP's). The six-month design storm rainfall depth can be estimated as 2/3 of the 2-year, 24-hour storm depth. When 2/3 of the 2-year, 24-hour rainfall depth is less than 0.5 inches, the rainfall depth shall be set at 0.5 inches.

6.1.2 Water Quality Design Volume

Volume-based treatment BMPs are sized the same whether located upstream or downstream from detention facilities. The water quality design volume is defined as the volume of runoff predicted for the proposed conditions Pollutant Generating Surface (PGS) areas from the NRCS Type I, 24-hour storm with a 6-month return frequency.

6.1.3 Water Quality Design Flow

For runoff treatment facilities preceding detention facilities or when detention facilities are not used, the water quality design flow is defined as the peak flow rate predicted for the proposed conditions PGS areas from the NRCS Type I, 24-hour storm with a 6-month return frequency.

For runoff treatment facilities located downstream of detention facilities, the water quality design flow is defined as the full 2-year release rate of the detention facility.

6.1.4 Flow Control and Conveyance

At a minimum, the 25-year design storm shall be required. Additionally, safe passage shall be provided for the 100-year event storm via an overflow path that drains toward the natural discharge point of the contributing basin, away from adjacent buildings and residences.

High-risk areas, as defined by the City Engineer, with the potential for extensive flooding, safety, or other concern, the design capacity shall be provided for a 50-year storm with safe passage for a 100-year storm. Low/sag points within roadways shall be designed to a minimum 100-year storm event.

Flow control facilities must be sized based on the total developed site area (both impervious and pervious areas, regardless of pollution generation) and take into account the immediate drainage basin(s) wherein the site lies.

6.2 Hydrologic Basis of Design

The following methods shall be used for the design of flow control and conveyance systems, in compliance with the COSM. The Engineer shall take into account soil types and geotechnical conditions into the design.

- National Resource Conservation Service (NRCS) Urban Hydrograph Method (TR-55)
- Santa Barbara Urban Hydrograph Method
- Level Pool Routing Method
- Rational Method / Bowstring Method

Other testing methods shall not be used in calculating facility sizes unless approved by the City Engineer.

6.2.1 Hydrologic Design Criteria

The Engineer shall use the following information in performing storm water design, originating from the Central Oregon Storm Water Manual.

City of Bend 24-hour Storm Depths (inches)

6-Month	2-Year	10-Year	25-Year	50-Year	100-Year
1.0	1.5	2.0	2.5	2.8	3.0

The Rational and Bowstring Methods are not to be used for basins exceeding 10 acres. Rainfall intensities shall be based on the COSM's Appendix 5C Intensity-Duration-Frequency Curves, which have been tabulated from Bend in the following table.

City of Bend Rainfall Intensity (I, inches per hour)

Tc (min)	5	10	20	30	40	50	60	70	80	90	100
2 yr	1.30	1.05	0.78	0.60	0.49	0.42	0.37	0.34	0.30	0.28	0.26
10 yr	2.45	1.95	1.50	1.10	0.86	0.71	0.61	0.55	0.48	0.46	0.42
25 yr	3.25	2.65	1.90	1.50	1.25	0.95	0.82	0.71	0.65	0.60	0.55
100 yr	5.20	4.10	3.00	2.35	1.80	1.30	1.20	1.10	0.95	0.88	0.79

Time of Concentration (Tc) shall be no less than 5 minutes, with overland flow segments not exceeding 300 feet.

All applicable coefficients and design valves (Manning n, Time of Concentration value, etc.) are found in the COSM's Chapter 5.

Within the public right-of-way, storm delineation basins shall detain storm volumes no larger than 25,000 gallons (3,342 cubic feet) based on the 25-year storm event for drywells outside a sag low point. With the City Engineer's approval, storm facilities may be permitted to exceed the 25,000 gallon basin design size where the development can show that the design criteria cannot be met or if the basin size increase can be shown to reduce the number of facilities. Storm facilities in a sag low point cannot exceed 25,000 gallons. Where within a sag low point, the basin shall detain the 100-year storm event of not more than 25,000 gallons (3,342 cubic feet). Catch basins, curb cuts and all applicable storm detention infrastructure shall be designed to reduce the basin size, avoid sag low points, and connect basins with overflow piping when conditions allow.

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Public street design shall incorporate the storm water catchment basin to extend a minimum of 20 feet into the private lot. Calculations on the private lots must account for driveway impervious surface and possible reduced permeability. If topography is such that stormwater will never enter the right-of-way after the private lot's development, the Engineer of Record shall design the basin to the right-of-way. Calculations shall incorporate appropriate curve numbers or runoff coefficients for anticipated future impervious surface within the first 20 feet.

Where a regional storm basin (collecting private property into a public street) is to be employed in design or as determined necessary by the City Engineer, the larger basin design shall require geotechnical infiltration investigation specific for the drainage facility for use in design and have overflow structures installed to convey the 100-year storm event for the basin. The overflow is to be a separate structure from the 25-year containment facility, providing redundancy to the system. Regional systems are not permitted to flow and discharge stormwater outside the regional area / development limits.

Stormwater facilities (swales, UICs, etc.) within the public right-of-way cannot be designed or installed to be on top of franchise utilities. No stormwater facilities are permitted within PUEs unless otherwise approved. Swales will be required to have an overflow unless a 100-year storm event can be contained.

Private sites, that meet the COSM review requirements (COSM Chapter 2.1 criteria), will be reviewed by the City to ensure a 25-year, 24-hour storm event is contained onsite and will not flow into the public right-of-way or an adjacent property. The size of private drainage facilities (UICs or swales) do not have a maximum size unless there is the

potential of the drywell to flow into the public right-of-way or a neighboring private property. If said conditions exist, storm facilities shall not exceed 25,000 gallons (3,342 cubic feet) as determined by a 25-year, 24-hour storm event.

6.2.2 Drainage Facility Testing

Prior to approval of any private or public right-of-way project, the Engineer of Record (EOR) shall oversee the construction and testing of the drainage facilities on the approved construction documents.

Public Underground Injection Controls (UICs, including standard drywells (STD DWG STRM-10), modified drywells with storm injection well (STD DWG STRM-10A) and stormwater injection wells (STD DWG STRM-10B)) facilities shall conform to the following testing criteria:

1. Install the UIC per the approved plans, specifications and applicable construction guidelines. The EOR shall witness the construction of these facilities to ensure that the drain rock quantity is being placed, drain rock has sufficient voids, and the construction is per the City of Bend's standards and specifications. Pictures shall be taken and provided with the EOR's certification.
2. Inspect UIC prior to testing, making sure the UIC is clean and free of sediments. UIC will be tested prior to the construction of street sub-base and curb. If the UIC is disturbed through the excavation or is compromised through sediment introduction into the storm facility, the UIC will be tested again prior to acceptance.
3. Field check the accuracy of the flow meter by filling up a suitable container with known volume; for example a calibrated 55-gallon barrel.
4. Introduce clean water into the UIC and monitor using an in-line flow meter.
    a. If the UIC total inflow design volume is 10,000 gallons (1,336 CF) or less, place the design volume in the UIC within a 1-hour period and verify that the water either, disappears immediately or, if standing water exists after the test, document the depth and complete the test using the COSM Appendix 4B, Full Scale Drywell Test Method.
    b. If the UIC total inflow design volume is between 10,000-25,000 gallons (1,336-3,342 CF), place an initial 10,000 gallons (1,336 CF) into the UIC within 1 hour. If any standing water is present at the end of the 10,000-gallon test, then the City will require the full design inflow volume and/or a Full Scale 2-hour Drywell test per COSM Appendix 4B.
    c. If the UIC total inflow design volume is permitted to exceed 25,000 gallons (3,342 CF, the facility must be tested in conformance with COSM's Full Scale 2-hour Drywell test per COSM Appendix 4B.
    d. 25 percent of the UIC, or as otherwise determined by the City Engineer based on soil conditions, shall be tested to the COSM Full Scale drywell test. The UICs to be tested will be selected at random by the City inspector and tested by the EOR (or EOR representative).
5. Public and private swale facilities shall conform to the following testing criteria:

a. Install the swale per the approved plans, specifications and applicable construction guidelines. The EOR shall witness the construction of these facilities to ensure the drain rock quantity is being placed per the design, has sufficient void capacity, and is constructed per the City of Bend's standards and specifications, if applicable. Pictures shall be taken and provided with the EOR's certification.

b. Test the infiltration rate of the swale per Specification Section 01012.71.

6. Infiltration testing. Post-construction infiltration testing is required. Regardless of infiltration determination/testing, it is required that the EOR certify that all stormwater infiltrate from drywells/UICs/swales within 72 hours per COSM requirements.

    a. For drywells/UIC, draw down measurements shall be performed to determine infiltration rate and recorded during the drywell/UIC testing, tested in 5-minute increments for 20 minutes (obtaining 4 recorded draw down measurements). An average infiltration will be determined from the draw down measurements and compared to the design infiltration used in the calculations.

    b. For swales, infiltration shall be tested in conformance to the COSM Appendix 4D (Single-Ring Infiltrometer test), or other City approved method

        i. If design infiltration rates are not met during testing, the EOR shall determine how to 1) increase infiltration rates or 2) back calculate the facility design with the measured infiltration rate to determine if the facility has adequate capacity including a safety factor.

7. At the project closeout, private or public, the EOR will be required to certify the testing and construction of the drainage facilities, that they meet the performance standards under the stamped and approved design. Stormwater certification shall include

    a. All testing documents

        i. Recorded amount of water discharged into the facility, with start time and end time.

        ii. Draw down measurements. Depth of water at end of test with depth of water at 5-foot increments for 20 minutes duration, or until the facility is dry.

        iii. Construction inspection forms and pictures. Private and public project will not be approved by the City without this certification.

b. Certification letter. The letter shall be stamped by the project EOR on company letterhead as conforming to the approved construction document and identifying design assumptions are true in the completed facility.

Swale and drywell/UIC failure is determined if the facility cannot 1) contain volumes during the test, 2) if the facility is unable to infiltrate at the design infiltration rate (dictated in the construction documents or the storm water report) and 3) if the stormwater rises to the highest perforation in the drywell/UIC. In any case, the total volume and rate injected into the drywell/UIC or swale does not need to exceed the design storm volume. It is the burden of the EOR to have the drainage facilities perform in accordance to the design criteria approved on the construction documents.

Private and Public drainage facilities shall be tested for volume in conformance to a method determined by the EOR in conformance with the City of Bend standards and COSM and that all storm systems work in conformance to the engineer's design.

6.3 Water Quality Treatment

Water quality treatment design shall comply with Chapter 6 of the COSM with the following modifications:

The City of Bend is subject to Oregon Department of Environmental Quality (DEQ) regulations for piped discharges to surface water bodies and for underground injection control (UIC) systems. DEQ defines UICs as structures that are deeper than wide at the land surface and utilize infiltration by a perforated pipe or drain field. UIC regulations do not apply to swales, french drains, or footing drains. UIC systems that will be owned and operated by the City of Bend in City right-of-way or City owned property fall under the City's DEQ issued Water Pollution Control Facilities Permit for Underground Injection Control Systems. All UIC systems must have a pre-treatment barrier, or other appropriate control(s) in place to treat stormwater prior to discharge into the subsurface. Additionally, privately owned, DEQ rule authorized UIC systems shall not be installed within 500 feet of any water wells, within drinking water protection two year time of travel areas, or in locations where the injected stormwater could affect contaminated soils or DEQ cleanup sites. UIC separation from water wells must be maintained unless a more stringent guideline is imposed by DEQ.

All UIC's installed within the City of Bend shall meet the following siting requirements to protect groundwater quality and water wells:

Public or privately owned UIC facilities: For standard drywells (STD DWG STRM-10)

- UIC systems shall not be installed within 100 horizontal feet of water wells, within drinking water protection two-year time of travel areas if one has been established, or in locations where the injected stormwater could affect contaminated soils or DEQ cleanup sites.
- Must maintain a minimum of 53 feet of vertical separation from the bottom of the drywell and seasonal high groundwater.
- New standard drywells are not permitted in the Old Mill perched groundwater area. Surface infiltration systems must be used to manage stormwater.

Public facilities only: Modified UICs including modified drywells with storm injection well (STD DWG STRM-10A) and stormwater injection wells (STD DWG STRM-10B) will be permitted within the City of Bend Right of Way if all of the following conditions exist:

1. A geotechnical test must be conducted prior to allowance. One of two tests must be conducted, being performed by a registered geotechnical engineer/geologist. The test must be provided to the City in a stamped report with result figures:

    a. Geotechnical core samples. Welded tuff is discovered to extend deeper than 20 feet from finished grade

    b. Construction. Drywell is approved on plan set. A standard drywell excavation is hammered and/or blasted. An infiltration test is performed and infiltration is less than 75 gallons per minute.

2. The proposed UIC is to be located within a residential zone within the frontage of an alley, local, or collector street.

3. The proposed UIC is located outside of perched groundwater areas (Old Mill and North Bend).

4. The proposed UIC is located outside of the 1 and 2 year drinking water protection time of travel areas and 100 horizontal feet from private water wells.

5. The proposed UIC must maintain a minimum of 53 feet of vertical separation from the bottom of the UIC and seasonal high groundwater. Refer to the Bend Data Viewer for maps and information on water well setbacks, time of travel areas perched groundwater and groundwater depth at https://data.bendoregon.gov/

At no time can discharge from garbage containers/dumpsters/truck delivery berths or other polluting sources be discharged to a UIC. Proper containment of those systems and safe discharge must be designed by the project's engineer. Where permitted by applicable building and plumbing codes, private garbage containers, dumpsters, and truck berths may be discharged to the sanitary sewer provided these enclosures are covered and self-contained from stormwater flows. Stormwater is not permitted to discharge into a sanitary system.

6.3.1 Treatment Controls

The following treatment controls are required by the City, in descending order of preference. The treatment controls selected for a specific site shall address the pollutants expected for that site, along with the specific geotechnical conditions of the site. Projects within major drainage basins adjacent to the river or drainage basins containing MS4 system shall address pollutants of concerns for the river. Pollutants of concern in the river through the City of Bend related to stormwater include: sediment/turbidity, pH, and temperature. Pretreatment for Underground Injection Controls should focus on spill control. These controls shall be designed to the guidelines included in the standard drawings, and the COSM, with the City's standard drawings configurations and sizing taking precedence in case of a discrepancy. Treatment trains are encouraged as appropriate.

Given the importance of water quality, the City wishes to see preferred strategies in different areas of the City.

TABLE 6-1. PREFERRED STORMWATER STRATEGIES BY AREA

Area	Strategy	Types of Controls
Areas that drain to surface water	• Reduce flows to river/surface waters • Provide highest level treatment for remaining • Minimize sediment • Prevent facility clogging	• Drywells or infiltration trench with spill protection • Bioretention/Infiltration swale, pond, basin, planter box
Wellhead Protection Areas (One through 10 year Time of Travel)	• Spill Protection • Surface Infiltration Controls • Direct runoff to outside area if can for UIC use • Prevent facility clogging	• Water Quality Sediment Manholes, Oil/water separator TAPE approved manufactured spill control • Bioretention/ infiltration swale, pond, basin with treatment vegetation, planter boxes
Other Areas	• Dispersed System • UICs and regional controls • Prevent facility clogging	• Drywell or infiltration trench with spill protection (e.g., Water Quality Sediment Manholes) • Bioretention/infiltration, swale, pond, or basin • Planter boxes • Vegetated filter strip • Grassy swale

The City of Bend requires the installation of sedimentation manholes, per City of Bend standard drawing STRM-7, to be constructed prior to UIC's discharge unless otherwise approved by the City Engineer. Direct discharge from a swale into a drywell shall not be permitted without the installation of a sedimentation manhole upstream. STRM-7A provides for an optional deep sump catch basin special inlet that the City will accept only where conflicts do not allow for the installation of a standard sedimentation manhole. Sedimentation manholes provide for a convenient method to trap contaminated spills and to manage sediment loads prior to injection into the UIC.

Where development is occurring adjacent to an existing drywell, a sedimentation manhole may be required to be installed between the catch basin and the drywell unless otherwise approved by the City Engineer.

TABLE 6-2. PREFERRED TREATMENT CONTROLS

Treatment Type	UIC Pretreatment	Basic Treatment (TSS)	Oil Control (TPH)	Metals Treatment	Nitrogen[3]
Bioretention Systems—Storm Water Planters	X	X	X	X	X
Vegetated Infiltration Swales	X	X	X	X	X
Bioretention Systems—Landscape Detention	X	X	X	X	X
Extended Detention Dry Ponds	X	X	X	X	X
Grassy Swales	X	X		X	
Vegetated Filter Strips	X	X	X[1]	X[1]	
Sedimentation Manholes	X	X	X	X	

1) Vegetated filter strips are only applicable for oil control and metals when installed in series with an above ground flow control facility, such as a detention or evaporation pond. Such designs will be evaluated on a case-by-case basis.

2) Treatment controls for Nitrogen were determined using the International Stormwater BMP Database, 2014 BMP Performance Summaries.

6.4 Conveyance

A conveyance system includes all natural or constructed components of a storm drain system that collects stormwater runoff and conveys it in a manner that adequately drains areas, sites, structures, and roadways, minimizing the potential for flooding and erosion.

Stormwater conveyance systems that are unused and that have no approved current or future anticipated use shall be removed from the right of way or abandoned in place per Section 6.4.7. Stormwater mains within City stormwater easement, on private property, are preferred to be removed but can be abandoned in place, with approval from the City Engineer, provided the stormwater easement is extinguished.

No bends or deflection are permitted within piped stormwater conveyances. Flow through catch basins must be avoided, with no more than one connection to a catch basin permitted (no one catch basin is to have more than one invert in and one invert out). Stormwater conveyances must be constructed to sanitary sewer standards, meeting the same vertical and horizontal water separation requirements within the right of way.

Drillholes are not permitted within the City of Bend right-of-way. Projects that contribute to or front an existing drillhole will either be decommissioned in accordance to DEQ requirements or be upgraded to meet the City's Stormwater Injection Well standards, also having upstream infrastructure (sedimentation manholes and/or City of Bend catch basins with sumps, as approved by the City Engineer) constructed. Conveyance systems in the City of Bend shall be designed in accordance with COSM and the City standards, City standards taking precedence where in conflict.

6.4.1 Residential Conveyance to the Right-of-Way

Commercial and Industrial lots must not discharge to the right-of-way.

Residential subdivisions and lots have the ability to pipe private stormwater to the right way under the condition that:

1) The subdivision/lots were approved during land use for stormwater discharge to the right-of-way
2) The stormwater infrastructure was designed, constructed and tested to accommodate the additional storm capacity requirements

Stormwater conveyance shall be maintained within the subdivision tentative plan / masterplan area as approved during land use where private and public stormwater intermix. The stormwater for the development must be designed to be maintained within the development to a 100-year storm event – stormwater not flowing into adjacent, potentially undersized/under development, areas. Any agreements between the City and the development's Homeowners Associates, if applicable, and as required by land use, shall be recorded with Deschutes County prior to permitting storm discharge to the right-of-way.

Where permitted, stormwater from private property shall not discharge stormwater from overland flow to the right-of-way with the exception for the front yard's first 20 feet where it has been incorporated into the storm facility design basin. Private yard drains and catch basins shall be directed to onsite private storm facilities and not into the right-of-way. Direct surface runoff from the private site must be contained on the private property, with exception of runoff from driveways where the right-of-way storm facilities must be sized to accommodate the additional storm flow. This is to deter discharge of sediments, yard debris and fertilizers and other contaminants into the City's systems.

At no time will the City permit a direct residential storm pipe connection to a public storm facility (drywell, sedimentation manhole, etc.) unless approved by the City Engineer. Where storm is being directed to the street by a weep hole, the sidewalk/shared-use path and pipe must be installed within the right-of-way per the standard drawings; the sidewalk/shared-use path cannot be bonded due to the requirements to maintain the pipe out of the concrete pour and installed the drain pipe to private property.

Stormwater systems may be constructed with service laterals to each lot to a stormwater main. This system must be design and constructed to sanitary sewer standards, utilizing manholes and service laterals. No cleanouts will be permitted on public systems. Public storm systems are not permitted within private property unless otherwise approved by the City Engineer and the public system being under a City Stormwater easement, 20 feet wide centered on the pipe.

Where a private storm system (collecting discharge from multiple sources/lots – single lot storm lateral) enters into a public storm system, a sedimentation manhole must be installed, with the sump depth designed to meet COSM requirement for the flow.

6.4.2 Pipe Material

Storm pipe under roadways or in areas that have traffic loads shall be constructed of AWWA C900 PVC pipe. Outside of the roadway, the Engineer has the option of using

ASTM D3034 PVC sewer pipe. Storm pipe installed as part of a stormwater main and service pipe installation must be installed to sanitary sewer standards, following all depth of bury and water separation requirements, permitting the use of ASTM D3034 PVC pipe. All pipe installed shall conform to City of Bend specifications.

Where approved, residential storm pipe installed to curb weep holes shall be Schedule 40 PVC or approved equal.

6.4.3 Pipe Diameter and Length

The minimum pipe diameter shall be 8 inches. Pipe diameter shall be determined to ensure it is of proper size to convey a minimum 50-year storm event. When in the sag/low point, the pipe shall be sized to a 100-year storm event. The maximum length of pipe between junctions shall be no greater than 300 feet. Pipe diameters cannot be downsized for downstream runs.

Residential weep hole piping is to be minimum 3-inches. If it is determined that that the pipe running to the curb needs to be larger based on anticipate flows from the site, the City may require modifications to the curb exposure and height to accommodate the larger pipe size.

Where private water is being conveyed to a public storm sewer system to a swale or other storm facility within a subdivision, the storm sewer will be installed conforming to sanitary sewer design and construction standards, sizing the pipes to not less than a 50-year minimum storm basin size but not be less than 8-inch diameter.

6.4.4 Placement and Alignment

No storm drain pipe in a drainage easement shall have its centerline closer than 5 feet to a private rear or side property line or 10 feet from building foundations or other structures. For a storm drain located under the road, the storm drain shall be placed in accordance with the City of Bend standard detail. If it is anticipated that a storm drain system may be expanded in the future, provisions for the expansion shall be incorporated into the current design. Minimum depth of pipe is 12 inches below street base to top of pipe.

Drywell perforations shall be constructed in native soils, outside fill material. The drywell barrel foundation shall always be constructed on native ground.

Minimum spacing between drywell drainage rock galleries must be a minimum of 10 feet. Drywell rock galleries must be hydraulically separated.

Any UIC installation, private or public, must not be within 25 feet of a hydrant, measured from hydrant nut to edge of drainage gallery. Separation distance may be extended where drywells are located uphill from hydrant at the discretion of the City Engineer.

Storm service pipes, considered sewer pipes because they convey non-potable water, shall meet the separation requirements of a sewer pipe, maintaining a minimum 10 feet from water services, but will be permitted within 2 feet of franchise services and sanitary sewer services. Storm pipe vertical separation shall maintain the same separation requirements as required for sanitary sewer installations.

When a storm sewer system main is installed, the street section shall be no less than 32-feet paved width. Storm systems shall be constructed to sanitary sewer construction standards, maintaining 10 feet from sanitary sewer mains and water mains. Sanitary sewer mains shall be in the middle of the road, with water and storm sewer mains on either side. Storm sewer mains are not to be installed within landscape strips to allow for franchise utility installation/maintenance and to avoid conflicts with water and sewer services to each lot.

Where approved by the City Engineer, drywells can be installed within the roadway provided they are outside the wheel path and can maintain 10 feet from the stormwater rock gallery to public water and sewer mains. Acceptance of the drywell in the roadway will be considered only where the placement of the storm facility in the is impractical because of a constrained sidewalk/shared use path, significant tree or existing utility conflicts.

6.4.5 Outfalls

New outfalls to the Deschutes River or other water bodies designated as waters of the United States require regulatory agency approval.

Pipe or curb cut outfalls into swales must have rip-rap installation to protect against scouring, with swale side slopes not exceeding 3H:1V at the outfall. Refer to the COSM for further design criteria requirements.

6.4.6 Storm Drain Debris and Safety

Debris protection shall be provided for storm drain systems. Debris may consist of soil deposits (that is, silt, sand, gravel and boulders), limbs, sticks, trash, or other landscaping materials.

Safety bars shall be provided for outfalls with a diameter of 18 inches or greater to protect from unauthorized individuals entering the storm drain system. Outfalls within a fenced area are not required to have safety bars. The clear space between bars shall be less than 4 inches.

6.4.7 Stormwater System Abandonment

No unused existing utility system elements may be abandoned in place within the City right of way or City controlled easements unless a waiver to allow abandonment is approved by the City Engineer.

When a system element is to be abandoned in place the following requirements must be followed;

- The City of Bend shall be notified whenever a system element is abandoned and shall be inspected to ensure conformance with the City of Bend Standards and Specifications.
- Submit full surveyed as-built plans in accordance with Part V of the City of Bend Standards and Specifications and comply with ORS dig law requirements for all abandoned underground, out of service and un-locatable facilities within the project limits.

- System elements with no approved future anticipated use, fill abandoned pipes completely with approved non-shrinking grout to prevent future loss of pipe integrity and roadway damage.
- Standard manhole structures will be removed to a minimum depth of six feet. Below a depth of six feet, the structures will be filled with approved road base rock material.
- Stormwater sedimentation manhole structures will be removed to a minimum depth of six feet. Below a depth of six feet, the structures will be filled with approved road base rock material.
- Catch basins will be required to be completely removed.
- All stormwater treatment facilities and UICs will be abandoned in accordance with current DEQ rules and regulations.

When decommissioning a City owned UIC, the Engineer and/or contractor are required to follow City procedure for properly closing the storm facility with DEQ. The process with DEQ can take time, so the City encourages the Engineer/contractor to start the process early to avoid delays with right-of-way projects. Steps 1-9 describe the process for decommissioning City owned UICs.

Step 1 Prior to UIC decommissioning, develop and implement a plan to manage stormwater currently discharging into the UIC system.

Step 2 Conduct a site inspection of the UIC; note any contaminants or potential concern. The Project Manager/Engineer or their Designee shall inspect the site and identify any potential concerns with the UIC (unusual smells, staining or known spills/contamination concerns). If evidence of a chemical spill is found contact the Stormwater Program Manager.

Step 3 Sampling Requirements:

A. Sampling shall be conducted on all City-owned UIC closures. Collect water and/or sediment samples as required and submit for laboratory analysis
B. Analyze the sediment for RCRA-8 metals by the toxicity characteristic leaching procedure to determine if the sediment needs to be managed as a hazardous waste.
C. Options for conducting sampling:
   Option 1 City of Bend Field Sampling Team collects the sample and contracts out lab analysis. Notify the Utility Field Sampling Manager using the attached UIC Sampling Request Form. Note: All lab fees shall be paid out of the project budget.
   Option 2 Consultant Collected Samples and Analysis.
   The consultant shall provide a written plan, outlining the proposed sample collection methods and lab analysis to be performed.

Step 4 Review laboratory analysis.
If the results are above the applicable screening standards, contact the Stormwater Program Manager for guidance. Additional coordination with DEQ may be required. If results are within standards, move to step 5.

Step 5 The City of Bend Project Manger/Engineer shall prepare and sign a UIC Closure Plan. This applies to all projects closing a City-owned UIC (O&M, Capital, & Private Development).

Step 6 The City of Bend Project Manager/Engineer shall email the signed closure plan and lab report to the Stormwater Program Manager at least 30 days prior to decommissioning the UIC:

- The Stormwater Program Manager will notify the Department of Environmental Quality (DEQ) of the requested closure.

Step 7 Wait for DEQ to approve the closure.
The Stormwater Program Manager will notify City staff when DEQ has approved the closure and the UIC can be decommissioned.

Step 8 Decommission the UIC per approved plan.
All UIC closures must be overseen by a licensed geologist or engineer (City engineer or consultant), which is necessary to ensure that decommissioning meets the standards of OAR 340-044-0040.

Step 9 Update UIC Database.
Stormwater Program staff will submit changes to the UIC database using the Utility Department applications provided by the Office of Performance Management, Enterprise Asset Data Division: portal/apps/sites/#/utility.

6.5 Flow Control

Flow control facilities mitigate potential adverse impacts on downstream properties and natural resources resulting from the increase in stormwater runoff caused by land development.

Unless specifically approved by the City of Bend, stormwater runoff from any proposed land development to any natural or constructed point of discharge downstream shall not exceed the pre-development peak rate of runoff.

Flow control systems in the City of Bend shall be designed in accordance with COSM.

6.5.1 Sequential Implementation

In general, for any activity that creates, alters, or modifies a natural or man-made drainage system the following control measures are to be implemented sequentially:

1) Reduce runoff volumes and polluted runoff through Low Impact Development designs and source control measures
2) Address stormwater drainage with surface systems, such as above ground vegetated infiltration swales.
3) If surface control does not provide adequate capacity, treat the water quality storm in a surface facility and provide an overflow to an approved regional above ground retention facility or rule authorized UIC

6.5.2 Fencing

Fencing or other barriers shall be required to protect the health, welfare, and safety of the public under the following circumstances:

- Ponds with the first overflow at 3 or more feet above the pond bottom
- Ponds with side slopes in excess of 3H:1V
- Drainage facilities with retaining walls 2.5 feet high or taller. Walls within drainage facilities must be designed by a registered engineer for wall stability and hydraulic surcharge. Walls must be inspected by the EOR and certified, with a PE stamped letter of conformance, that they were constructed in accordance with the approved design plans.

The City of Bend reserves the right to require a fence around any drainage facility should there be a concern for safety.

The minimum fencing requirements are as follows:

- The fencing shall be at least 4 feet tall unless otherwise specified by the City of Bend, and provide visual access per the City of Bend building code requirements for fence height and openings
- Gates are to be provided where drainage facilities are fenced. The gates shall be a minimum of 12 feet wide with provisions for locks. Separate gates may need to be installed where the maintenance access drive connects to a public or private roadway.
- At the discretion of the City of Bend, marking fences (that is, vegetation, boulders, etc.), terraces, steeper side-slopes, egress bars, etc., may be allowed

6.5.3 Embankments

The height of an embankment is measured from the top of the bank to the catch point of the native soil at the lowest elevation. Embankments shall meet the following minimum requirements:

- Embankments, 4 feet in height or more, shall be constructed as directed by a Licensed Geotechnical Engineer
- Embankments shall be constructed on native consolidated soil, free of loose surface soil materials, roots, and other organic debris
- The embankment compaction shall be to 95 percent of the Modified Proctor Density, ASTM Procedure D698. Placement moisture content should lie within 1 percent dry to 3 percent wet of the optimum moisture content.

6.5.4 Access

Maintenance access roads shall be provided to control structures and other drainage structures associated with the stormwater facility (that is, inlet or bypass structures). Where storm infrastructure is away from paved right-of-way, a 14-foot wide, 2-inch thick

paved all weather access road, with a 6-inch base, or as approved by the City Engineer, shall be installed centered over the sewer line with 6-foot square asphalt or concrete pad around manholes.

In ponds and swales, an access ramp is required.

6.6 Drainage Submittals

This section provides a framework for uniformity in Drainage Submittal preparation. Properly drafted construction plans and supporting documents should also facilitate the operation and maintenance of the proposed drainage system long after design and construction.

The City of Bend reviews the Drainage Submittal for compliance with these Design Standards and other applicable standards. The Drainage Submittal includes the Construction Plans, Full Drainage Report, and, other documentation to support the proposed stormwater management methods for the project. Depending on the complexity of the project, the City of Bend may request that a Concept Drainage Report (CDR) be submitted for review with the planning application or during the preliminary design process. The submittal and/or approval of the CDR does not replace the Drainage Submittal requirements. State law requires that all engineering work be performed by, or under the direction of, a qualified Engineer. The final Drainage report will be signed and stamped by a registered Engineer.

The Drainage submittal shall include the following components:

- Narrative
    - Project Description
    - Summary of Basin Requirements and other conditions/permits
    - Summary of Geotechnical Site Characterization
    - Downstream/Down-gradient Analysis
    - Upstream drainage basin analysis which are not project related but may generate runoff which may infiltrate proposed project area.
    - Hydrology Assumptions
    - Storm water Facility Description, existing and proposed
    - Conveyance System Description
    - Erosion and Sediment Control (ESC) Measures Description
    - Long Term Maintenance
        - Inspection plan / agreement – Provide calendar of required inspections
        - Spill Prevention and Control Plan

        - ESC Plan
    - Discussion on UICs being within a 2-year time of travel, or within 500 feet, of a domestic well head. Identify the location of the nearest domestic well – and include within the report the well log.

- Storm Basin Map
- Soils Map
- Phasing Map (if applicable)
- Site Photos
- Hydrology Calculations – including assumed or tested infiltration rates and other design assumptions
- Facility Sizing Calculations
- Conveyance Calculations
- UIC / swale testing criteria
- UIC rule authorization / registration documents, if available at time of report submittal
- 1200C permit plans and application, if applicable
- Grading, drainage facility, and erosion control plans (11x17).

The Long Term Maintenance section of the report shall be on a separate page as it will be attached to a Storm Water Maintenance Agreement (SWMA), if applicable for the site work. Storm Water Agreements are not required for public facilities

Drainage submittal requirements in the City of Bend shall be in accordance with COSM with the following modifications.

After any UIC is decommissioned, the City shall be provided all paperwork submitted and responses/approvals from DEQ. With the installation of any stormwater facility (swales, drywells, etc. as approved), testing, installation reports and an engineer of record certification shall be provided prior to approval and acceptance of the facility into the City's assets.

6.6.1 Concept Drainage Report

Acceptance of a CDR does not relieve the project proponent from a Geotechnical Site Condition Report, a Downstream/Down-Gradient Analysis, or changes to the design that may be necessary in order to meet the criteria and standards found in these Standards and the City of Bend's guidelines.

6.6.2 Concept Drainage Report Applicability

The City of Bend also reserves the right to require a CDR for projects when any unspecified drainage conditions or extenuating circumstances are present.

6.6.3 Road and Drainage Plans

Construction drawings shall be submitted for review by the City of Bend. The submittal and acceptance process shall be in accordance with the current City of Bend Standards and Specifications. Road and drainage plans shall include the City of Bend standard notes for construction.

6.6.4 Minimum Plan Elements

The road and drainage plans shall provide enough detail for a third party to be able to construct the proposed facilities per the Engineer's design. At a minimum, the plans shall meet the City of Bend's Design Standards, and the minimum plan elements described in the COSM.

6.6.5 Maintenance Agreements

All private commercial and industrial properties will be required to obtain a Stormwater Maintenance Agreement (SWMA) at the construction conclusion of any new stormwater facility construction. Stormwater runoff from commercial and industrial sites must be maintained on private property, not permitted to flow into the right-of-way unless approved by the City Engineer in conformance with Bend Municipal Code Title 16.

All land divisions require a stormwater maintenance agreement before recording of the final plat.

A Stormwater Maintenance Agreement is required to address the following if these conditions exist:

1) Stormwater facilities are constructed within private streets or within private lots, making the stormwater facility private (not maintained by the City or included within the City's DEQ permits). Any private UICs must be registered and rule authorized with DEQ unless outright permitted without registration by DEQ (example: UIC to capture roof runoff).

2) Private stormwater runoff is permitted to flow into the public right-of-way stormwater facilities when approved through a land use decision. Stipulations on how private stormwater runoff is permitted to flow into public facilities are provided within these design standards. The Stormwater Maintenance Agreements will dictate the differentiation between what is public and private.

    a. Stormwater runoff from private lots into the public right-of-way is not permitted unless the initial subdivision was designed, constructed and tested by a registered engineer for the additional stormwater flows and volumes quantity.

All Stormwater Maintenance Agreements are to be prepared by the City and signed by the property owner. Refer to Bend Municipal Code Chapter 16.15.050.

SECTION 2-7

Grading and Erosion Control

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7 Grading and Erosion Control

Clearing, grading, and erosion control permit is required by the City of Bend Municipal Code Title 16, Grading, Erosion Control, Stormwater, illicit Discharge, Tree Protection, and Wells.

Soil conditions shall be addressed with the information gathered from the requirements of 1.2 - Geotechnical Recommendations Report where slopes greater than 2 horizontal to 1 vertical (2H:1V) exist, retaining walls greater than 48 inches in height or extensive areas of fill are proposed, where the wall is holding up City street or sidewalk/shared-use path, if unusual soil conditions are encountered or upon the request of the City Engineer.

Retaining walls or any other special structures shall be shown on the plans. Walls within 2 feet of a property line, having hydrologic, vehicular, or structural surcharge, or exceed 48 inches in height shall be designed by a registered Engineer and reviewed by the City of Bend for permitting.

Retaining walls are not permitted within the right-of-way or public/city easement without City Engineer approval through a deviation review. Retaining walls are defined by structures (concrete, rockery, etc.) constructed to retain or hold back soils in a vertical, or near vertical profile to prevent movement of material down slope or to prevent erosion on a site. Retaining walls are required on slopes exceeding 2H:1V and where steeper slopes have been verified by a geotechnical engineer to not be stable enough to stand on their own after grading. Where walls are approved on the right-of-way line, a slope easement shall be created on the adjacent private property being 1.5x the wall height, measured from finished grade at toe to top of wall cap. Where the wall exceeds or equals 4 feet tall, the slope easement shall be not less than 10 feet. To avoid undermining the wall, no structures, piping, or excavation shall be permitted within the slope easement unless approved by the City Engineer in writing.

Retaining walls shall be shown on the plans, whether in the right-of-way or private property development. Review of walls by the Engineering Division will occur when:

1. Walls are on private property and within 2 feet of any property line or a City easement,

2. Walls have been approved to be constructed within the right-of-way by the City Engineer,

3. Walls having hydrologic or vehicular surcharge (the wall is holding up a driveway or roadway),

4. Walls exceed 48 inches in height.

Walls that are impacted by structures, or will be impacted by future structures, will be reviewed and permitted by the Building Division (walls within subdivisions unless holding up right-of-way). Under these circumstances where the Engineering Division is reviewing walls, the walls must be designed by a registered Engineer and permitted by the City of Bend. Walls adjacent to property lines will be designed and reviewed for surcharge where they are within existing or future structure footprints (based on Development Code setback requirements and proposed wall height and assuming a

1H;1V angle of repose). Walls that are identified as having existing or the potential of future surcharge, or are approved within the right of way, will be inspected during construction by the Engineer of Record and certified by the stamping engineer as being constructed in conformance with their design. The certification must be accompanied by pictures of the wall being constructed taken during construction showing backfill, compaction and applicable drainpipe installation.

If a clearing, grading, and erosion control permit is required per Bend Municipal Code Title 16, no site work shall commence until a grading permit has been issued, and an initial erosion control and tree protection inspection has been approved. A preconstruction meeting may be required before issuance of the permit depending on the scope of the site grading . Prior to land disturbance, the contractor shall request an initial inspection via the Online Permit Center, All Best Management Practices (BMPs) and tree protection noted on the approved Erosion and Sediment Control Plan shall be installed prior to inspection.

All grading, erosion and drainage control plans submitted for review shall include the components required under the Central Oregon Stormwater Manual (COSM) and Bend Municipal Code Title 16.

Grading shall never exceed a 2H:1V cut/fill unless slope is verified by a geotechnical engineer and stabilized promptly after grading. 1.5H:1V cuts are permitted where excavation is within stable rock.

If a site exceeds 2 feet of fill, structural backfill shall be placed and tested in conformance to a geotechnical engineer's specifications. The City of Bend Building Department will require testing of this fill structure backfill before placement of structures on it.

When required for construction or road maintenance, the subdivision plan must establish an easement for a 2:1 slope along both sides of each public road right-of-way for public use. If a Public Utility Easement (PUE) is required along a road, that PUE is to be graded when the road is constructed on a side slope not to exceed 4:1; the 2:1 maximum side slope may commence outside the limit of the PUE. The Slope Easement must provide adequate room for proper transition grading at the toe or top of slope. The easement must be at the front setback line, or special setback line where applicable, per zoning, or as determined by a site-specific slope study in coordination with the road grade approved under this Chapter. A retaining wall instead of a slope easement may be allowed by the reviewing agency.

7.1 Erosion and Sediment Control

Erosion control best management practices shall be shown on all construction documents and grading and erosion sediment control plan submittals. Every plan shall include methods for:

1) Temporary erosion and sediment control best management practices – for applicable project phases.
2) Permanent erosion control methods for final stabilization of all disturbed areas including lay down yards and staging areas.

3) Erosion and sediment control inspection and maintenance.

Stormwater and sediments must be contained onsite, preventing the passage into right-of-way and/or adjacent private property.

All erosion controls must be installed before mobilization, grubbing and/or grading begins onsite. Water trucks or other means of controlling dust must be present on site and/or have a tackifier applied to disturbed soils.

7.1.1 Erosion and Sediment Control Plans

The minimum requirements for an erosion control plan are as follows:

- Include multiple sheets as necessary to capture unique project phases (I.e. Mass grading, Underground/Infrastructure, Vertical Construction, Final Stabilization, etc.)
- Drainage patterns, including existing and proposed topographic contours as well as directional arrows shall be shown so as to easily discern direction of slope on a site.
- Project boundaries and clearing limits. This includes perimeters for offsite and onsite work associated with the project, areas of disturbance, and areas to be protected (trees, utilities, infiltration features, Areas of Special Interest, etc.)
- Provide square footage estimates for onsite/offsite project boundary areas as well as total area to be disturbed.
- All required erosion and sediment control best management practices (BMPs). BMPs are required to address the following:
- Construction Entrance/Exit
- Dust Controls
- Runoff Control within perimeter control BMPs
- Storm Drain Inlet Protection for onsite and offsite inlets
- Surface Infiltration Facility Protection
- Concrete Washout
- Perimeter Control downslope of disturbance
- Stockpile Management
- Staging and Spill Prevention
- Tree/Vegetation Protection
- Dewatering

- In-water/Waterway Adjacent
- Temporary Stabilization
- Permanent Stabilization

For all selected BMPs, attach applicable City of Bend standard details and drawings. For BMPs selected where a drawing does not exist, provide manufacturer detail and/or notes.

Any existing or proposed permanent or temporary stormwater conveyance/infiltration system(s).

Any offsite inlet adjacent to or directly downslope of the project.

7.1.2 Erosion and Sediment Control Inspection and Maintenance

Erosion and sediment control best management practices shall be maintained on all projects. The minimum inspection and maintenance of the Best Management Practices (BMPs) are as follows:

- Inspect a minimum of once weekly, and daily during/after a runoff producing storm event). All erosion and sediment control BMPs are to be fixed, replaced, or additional BMPs added immediately upon finding they are out of conformance or not functioning.
- Inspection documentation shall be maintained onsite
- All BMPs shall be maintained in good working order per the details in the associated standard drawing or as documented by the manufacturer, EOR or City inspector.
- Remove temporary ESC BMPs within 30 days after the temporary BMPs are no longer needed.
- Permanently stabilize areas that are disturbed within 10 days of the project completion or when no work is being conducted
- When soils are tracked onto pavements, said pavements shall be immediately be swept and kept clean
- When the potential exists for sediment to impact adjacent property, or public and private storm drainage systems additional BMPs may be required.
- Contractors are expected to track weather conditions and forecasts and stabilize sites as needed to prevent erosion

7.1.3 Temporary and Permanent Stabilization

Temporary Stabilization:

All disturbed areas must be stabilized within 10 days of inactivity or as approved by the City. If no work occurs at a project site over 30 days period, the project may be required to be permanently stabilized. When the potential exists for sediment to impact adjacent property or public and private storm drainage additional BMPS may be required to supplement stabilization.

Temporary stabilization options include the following:

Option A: Seeding per **Seeding requirements** below

Option B: Other temporary cover measures as approved by the City in writing.

Permanent Stabilization:

Prior to a site's final approval and within 10 working days of project completion, all disturbed areas must achieve permanent stabilization. When the potential exists for sediment to impact adjacent property, or public and private storm drainage, additional BMPS may be required to supplement stabilization.

Disturbed ground, that includes steep slopes, shall be subject to additional stabilization measures per STD E-5

Permanent Stabilization options include the following:

Option A: Seeding per Seeding Requirement below. Germination must achieve uniform aerial plant coverage of 70% or greater of the seeded area prior to final approval.

Option B: 100% mulch cover of disturbed areas (2” minimum) followed by seed per Seeding Requirements below.

Option C: 100% mulch cover for disturbed areas 5% slope, cover includes a 2” thick rock or organic mulch blanket. Rock shall be open graded and free of lines.

Option D: For disturbed areas of residential development with <5% slope, where final lot grade is achieved but vertical construction is to occur as a separate phase, a soil stabilizer may be applied at a manufacturer’s recommended rate with an effective period of no less than 6 months.

Option E: Alternative stabilization methods as prescribed by the Engineer of Record and approved by the City in writing.

Seeding Requirement:

Prior to seeding the following must occur:

- Remove all course debris (trash, woody debris, loose rocks etc.)
- Soil test is recommended to determine soil amendments are necessary
- For steep slopes track-walk the full extent for the slope or prepare a uniform surface and install erosion control matting/blankets. Ensure all ridges and indents are parallel to the slope contours. In addition, install cross slope protection per City of Bend standard drawing E-4 and

manufacturer's recommendations.

Seed mix shall be applied with fertilizer and tracer followed by a Bonded Fiber Matrix (BFM) application or rolled matting installation to promote good seed to soil contact. BFM applications shall be long stand mulch including tackifier. Install to manufacturer's specifications or to a minimum of 3,000 pounds per acre on slopes flatter than 2H:1V and 3500-4000 pounds per acre on 2H:1V slopes or steeper. The BFM shall be applied from a minimum of two directions to avoid shadowing. See City of Bend Standard Drawing E-5 for rolled matting installation requirements.

To encourage successful germination, seed application shall occur from October 1 through February 1. Application shall occur when the ground is not frozen. Seeding should not occur outside of the approved time window or on snow unless approved by the City in writing.

Seed mix shall be free of noxious weed species, be native drought tolerant, and self-perpetuating. Alternative seed mixes may not be used unless approved by the City in writing.

The following seed mixes, or approved equal, shall be used

Grass seed mixture for areas "Disturbed by Construction":

Species	Common Name	Percent by Seed Count
Festuca ovina	Creeping Red Fescue	30%
Pesudoregneria spicata	Blue Bunch Wheatgrass	25%
Festuca idahoensis	Idaho Fescue	15%
Achnatherum hymenoides	Indian Ricegrass	10%
Poa secunda ssp. Canbyi	Canby, OR Sandburg Bluegrass	10%
Elymus elymoides	Bottlebrush Squirreltail	5%
Linum lewisii	Blue Flax	5%

Application rate: 4 lbs. /1,000 square feet or approved equal.

* Oregon Certified Seed

Seed Mix for Water Quality Swales:

Species	Common Name	Percent by Seed Count
Hordeum brachyantherum	Meadow Barley	25%
Danthonia callifornica	California Oatgrass	15%
Elymus glaucus	Blue Wildrye	10%
Bromus carinatus	California Brome	10%
Festuca roemeri	Roemer's Fescue	10%
Deschampsia cespitosa	Tufted Hairgrass	10%
Agrostis exarata	Spike Bentgrass	10%
Alopecurus geniculatus	Water Foxtail	5%
Deschamsia elongate	Sender Hairgrass	5%

Application rate: 4 lbs. /1,000 square feet or approved equal.

SECTION 2-8

Franchise Utilities

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8 Franchise Utilities

8.1 Franchise Utilities in Public Rights-of-way

8.1.1 General

Utility companies that have a current franchise agreement with the City may construct facilities in City of Bend public rights-of-way or publicly controlled easements in strict conformance with the City of Bend Standards and Specifications and the requirements stipulated in the Franchise Agreement. Prior to starting any construction, franchise utility companies shall obtain a City Excavation / Right-of-Way permit in an existing roadway or easement. Utility companies and their designers and agents shall cooperate with the City of Bend to allow for City inspection of utilities and the street restoration during construction. The intent of this requirement is to protect the interests of all utilities within City of Bend rights-of-way.

The City of Bend requires that franchise utilities including, but not limited to, those required for electric, communication, lighting and cable television services and related facilities be installed underground, where possible. New utility poles shall not be placed in the right-of-way or public utility easement, with an allowance made by the City Engineer for pole upgrades where existing poles are insufficient due to increase in pole use or increased capacity needs. Where upgrades are needed, the City may require that existing poles be removed and replaced, like for like, within the utility corridor. The developer shall make all necessary arrangements with the serving utility to provide the underground services. All above-ground equipment shall not obstruct clear vision areas and safe intersection sight distance for vehicular traffic.

Properties that are developing under an MDS permit and are currently serviced by overhead power can be serviced by overhead power. Any new land divisions or site plan reviews will be serviced by underground utilities.

Private utilities are not permitted within PUEs or right-of-way.

8.2 New Construction and Conduit Banks

When a private, underground utility is not completely installed by the time of road subgrade construction, appropriate utilities conduits (dry line) shall be placed in all areas to be paved to allow future completion of the utility. Conduit termini shall extend beyond the edge of pavement or curb a minimum of 5 feet. For wired utilities (cable, phone, electric, etc.), the ends of the conduit shall be sealed and marked in accordance with the requirements of the affected utility.

Franchise utilities shall be installed outside of the road pavement section, located within the road green strip / landscape strip or within a Public Utility Easement (PUE) on private property unless conducting perpendicular crossings. Only when approved by the City Engineer will franchise utilities be permitted within the road section of any new or existing development.

Private water utilities shall construct a dry line in an area to be improved with the line extending beyond the edge of pavement or curb a minimum of 5 feet. Any valves or thrust restraint for design conditions shall also be installed at the time the dry line is constructed.

All installations of private utilities shall be subject to the inspection of the affected utility and shall be acceptable to both the affected utility and the City of Bend.

8.3 Shared Trenches

Private underground utilities shall not be located within 10 feet horizontally of any water or sewer main line and shall be separated a minimum of 1-foot vertically. This requirement does not strictly apply to sewer service lines extending to individual properties.

All private utility crossings of public water or sewer mains shall be perpendicular to the roadway travel path.

Utilities may share the sewer service trench, 2-feet horizontally separated, in right-of-way areas in accordance with franchise utility agreements for shared trenches.

8.4 Trenching and Patching in Paved Right-of-Way Areas

Trench excavation and backfill shall conform to Standard Drawing R-10A and Specification Section 00405. Trench patching shall conform to Standard drawing R-11 and Specification Section 00495.

8.5 Small Wireless Facilities

Small Wireless Facility installations shall conform to the City of Bend Standards and Specifications, as well as the current version of additional references as specified and/or amended in the various subsections below. Small Wireless Facilities additional references include, but are not limited to:

- City of Bend Development Code and Ordinances of the City of Bend
- ORS 757.270 to 757.290
- Oregon Joint Use
- OPUC regulations
- NESC
- Applicable Building Codes
- Adopted joint use and co-locating requirements of all approved franchisees within the City of Bend
- All other referenced documents cited herein

8.5.1 Deviation from Small Wireless Facility Standards

The City of Bend provides for Small Wireless Facility installation designs that are flexible and reflective of their context while meeting current safety and operational standards. There may be times when compliance with the City of Bend Standards and Specifications

is not desired or possible and the City's design standard deviation process shall be followed to receive approval from the City Engineer. The City Engineer may delegate review authority.

This standard deviation process shall not be used to override a requirement of a land use decision once finalized. The Bend Development Code has provisions for requesting modification to land use requirements. Except as provided elsewhere, in other City codes, resolutions, and land use actions; written requests for deviations from these Small Wireless Facilities design standards shall be reviewed and may be granted by the City Engineer according to the criteria outlined in Part I - Section 2 of this document.

8.5.2 Co-Location

The City of Bend prefers all Small Wireless Facilities be co-located per Bend Development Code Chapter 3.7. If the facilities cannot be co-located and a Franchisee wishes to install its facilities in the ROW, the Franchisee shall use the *City and County of Denver – Small Cell Infrastructure Guidelines (April 2018)* Chapters 1, Chapter 4, Chapter 5, Appendix A and Appendix B. All attachments to existing or new utility poles will be permitted through the approved Joint Use process of the utility pole owner. Attachments to City owned street luminaires shall comply with Chapter 3. Attachment to City of Bend Traffic Signal arms and structures is prohibited unless otherwise approved by the City Engineer and ODOT.

All references in the *City and County of Denver – Small Cell Infrastructure Design Guidelines* to "Xcel Energy" will mean the applicable utility pole owner, i.e. Pacific Corp or Central Electric COOP or other owner. All references to "City" and "County of Denver" will mean the "City of Bend." All inconsistencies, conflicting standards, and final interpretations of this or any additional references are at the discretion or professional judgement of the City Engineer.

8.5.3 Location Guidelines

The following are guidelines for siting individual Small Wireless Facilities.

- Every effort should be made to install equipment in vaults underground or concealed as provided by the referenced design guidelines above

- Power connections to free standing facilities shall be buried underground in vaults unless otherwise approved

- All supporting equipment and connections to telecom facilities shall be installed in vaults underground, unless adequately shielded per the design guidelines or as approved otherwise

- New facilities linked together via fiber optics or other telecommunications infrastructure (other than wireless) will need to be designed as an Infrastructure/Tier Three ROW permit and shall be installed underground (connecting cables and power) unless they are co-located on existing power and telecom facilities

- Free standing facilities shall comply with Type 4 design specifications in Chapter 4 of the above referenced guidelines and shall be installed in all residential and business corridors as identified by the City during permitting

- An applicant wishing to attach to existing City of Bend facilities i.e., street luminaires, shall demonstrate that the pole(s) are appropriately sized, and have significant strength to support the additional equipment. Applicant shall provide an engineering analysis of the structure by an engineer professionally registered in the State of Oregon.

- Refer to sections 3.4, 4.5, and 5.5 of the *City and County of Denver – Small Cell Infrastructure Guidelines (April 2018)* for additional placement requirements as applicable

- The City will review ROW permits concurrently with Joint Use applications for co-location requests with the applicable utility. Approval of all permits is conditional on approval of the Joint Use application from the franchise utility.

- See Standard Drawing R-2 for clear vision requirements. Large transformers and other above ground infrastructure, other than utilities poles, should be located outside the clear vision area unless otherwise approved by the City Engineer.

- The location of all co-located facilities shall be provided to the City in the form of a record drawing per 2.7 - Record Drawing Plan Submittal. All installations in the City's ROW shall be permitted per Bend Code Chapter 3.40.

8.5.4 Franchise Fees, License Fees and Permit Fees

Small Wireless Franchise Utilities shall pay all applicable franchise fees, license fees and permit fees in an amount established by the Fee Resolution or applicable Franchise Ordinance or Franchise Agreement, subject to any limit imposed by federal law. Utilities that do not have franchises shall pay the Utility License Fee plus applicable permit fees as outlined in the City's Fee Resolution, subject to any limit imposed by federal law.

8.6 Removal of Abandoned Facilities

Franchise Utilities shall remove any and all facilities not limited to conduit, structures, piping, wiring, poles, or other materials that are in, on, upon, over, under or beneath the public right of way that become unused. Restoration of the right of way shall be in accordance with the applicable City, state, and federal requirements and subject to the City of Bend Design Standards.

SECTION 2-9

Canal and Irrigation Laterals

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9 Canal and Irrigation Laterals

This chapter applies to all Private Irrigation District Canal standards and lateral piping considerations, but is primarily intended to cover open channel and piped conveyance of Irrigation District water through and across public rights-of-way.

9.1 General

All new or replaced Irrigation District canals and laterals shall be installed in culverts to outside the limits of public and utilities infrastructure in rights-of-way. The construction and design shall conform to the requirements of the Irrigation District and the City of Bend. Where requirements may conflict or differ, the requirement providing the highest level of control, security, and/or integrity shall govern the construction.

9.2 Design

The design sizing requirements of Irrigation District canals and laterals shall be determined by the appropriate irrigation company or their agents.

9.3 Materials

The conduit used for Irrigation District culverts in the City right-of-way shall conform to the requirements of 6 - Stormwater. Where less than 36 inches of cover is provided, but not less than 18 inches, AWWA C900 or AWWA C905 pipe shall be used. Solid-wall HDPE pipe to meet or exceed ASTM F714

N-12 HDPE corrugated watertight (WT) pipe to meet or exceed ASTM 3212, ASTM C969 may be used only at the direction of the City Engineer and where the piping requirements necessitate arch culvert pipe. Piping shall be traffic-rated and shall be the heaviest gauge produced for the size specified. No joints shall be allowed under the pavement section of a city street unless noted on the plan and with an appropriate joint seal, and approved by the City Engineer.

9.4 Testing

Prior to testing any Irrigation District Standards, all other underground utilities shall be complete and in place. Pressure testing shall be performed for all irrigation pipe installations per the Standard Specifications as applicable to gravity or pressurized pipe systems.

9.5 Easements

Required easements shall be clearly depicted on plans and include a label and an easement statement. Easement widths shall be shown on the construction plans and plats. The full length of the easement shall be depicted where applicable. The smallest width for an irrigation lateral easement shall be 10 feet and requires City of Bend approval

SECTION 2-10

Surveying

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10 Surveying

10.1 Datum Requirements

10.1.1 Horizontal Datum

Horizontal datum shall be based on the Deschutes County Coordinate System. The DCCS is a commonly used coordinate system, well-monumented within the City and available to all designers. It is also referred to as the "Central Oregon Coordinate System" and the "Deschutes County Grid". In any case, the basis for the coordinates is common to each. When converting to a Local Datum Plane (LDP), in which distances represent true ground distances, the project combined scale factor shall be stated for converting distances and coordinates between ground and grid. The combined scale factor shall be the product of the project elevation factor and the project grid factor.

10.1.2 Vertical Datum

Vertical Datum shall be NGVD 29.

10.2 Aerial Photography and Photogrammetry

Accuracy – Photo mapping for the purpose of creating a detail (base) map and Digital Terrain Model (DTM) shall be conducted so as to achieve at least 0.10-foot accuracy on hard surfaces.

10.2.1 Photo Targets

Aerial photo targets set within the project limits shall be surveyed for elevation by one or more closed differential or trigonometric level loops. The error of closure of each loop shall not exceed 0.02 foot. The elevations of aerial targets lying outside the project limits may be determined by GPS or other methods.

10.2.2 Supplemental Ground Surveying

Areas obscured or otherwise not detected by aerial photography shall be surveyed using ground methods that achieve at least 0.10-foot accuracy on hard surfaces.

10.2.3 Confidence Points

Random confidence points shall be measured in the field to verify the accuracy of the DTM. Confidence points shall NOT be included in DTM computation. There are four types of confidence points:

- **Surfaced** – hard surfaces (asphaltic concrete or concrete pavement, bridge decks, and walks)
- **Graded** – graded and possible compacted surfaces but not intended to be the traveled way
- **Natural** – surfaces in their natural state
- **Rugged** – extremely irregular surfaces (large rock outcroppings, rocky river bottoms, etc.)

The minimum number of confidence points required is 10 per instrument setup or 2 percent of the total number of contourable points used for the DTM. Two-thirds of all errors must fall within the error tolerances and 100 percent of all errors must fall within three times the error tolerances according to Table 12-1.

TABLE 12-1
Error Tolerances

Type	Imperial (feet)	Metric (millimeters)
Surfaced	+/- 0.1	+/- 30
Graded	+/- 0.3	+/- 100
Natural	+/- 0.6	+/- 200
Rugged	+/- 1.5	+/- 500

Confidence points shall represent all surface types contained in the DTM, shall be proportional to the four surface types depicted in the DTM, shall provide a good sampling of the overall model, and shall be placed randomly.

10.3 Requirements for a Licensed Surveyor

Land surveying activities, per ORS 672, including, but not limited to, boundary, right-of-way, easement determination, topographic mapping for design, horizontal and vertical control, legal description writing, construction staking, and any other surveying services necessary to prepare construction plans shall be performed under the direct supervision of an Oregon Registered Professional Surveyor.

10.4 Use of Benchmarks

Where practical, two or more benchmarks shall be surveyed and the elevation differences compared with the published data. If an unacceptable discrepancy between two or more benchmarks is discovered, measures shall be taken to determine which elevation(s) is wrong, and the bad elevations shall be corrected and brought to the attention of the proper jurisdiction.

10.5 Survey Data Required on Plans

In addition to the requirements of 2.3 - Information Required on Plans, the following survey data shall be shown.

10.5.1 Control

Project control points shall be shown graphically on the corresponding plan sheets. Tables listing Point Number, Northing, Easting, Elevation, and Point Description shall be shown on all plan sheets on which control points appear. A statement describing the project Basis of Bearings and the horizontal datum shall be placed on the Horizontal Control Sheet.

The benchmark used for project vertical control shall be described on the Horizontal Control Sheet. The description shall include the location, type, size, and origin of monument, if known, and the elevation and vertical datum.

10.5.2 Monuments of Record

Monuments of record shall be shown graphically on the corresponding plan sheets. Preserve survey monuments according to ORS 209.140, ORS 209.150 and ORS 209.155. If such monuments are to be disturbed or destroyed, comply with requirements of these ORS for replacement or necessary actions.

10.6 Construction Phase Surveying

10.6.1 Supplemental Control

Any additional survey control point(s) needed for construction staking shall be established by one of three methods:

- The point(s) shall be double-tied from existing adjusted control by measuring from a minimum of two different existing control points and averaging the xyz coordinates, or the point(s) shall be measured twice from an existing control point using a different existing, adjusted backsight point for each measurement, and averaging the xyz coordinates

- The point(s) shall be included in a closed, adjusted traverse that begins and closes on two existing adjusted control points

- The point(s) shall be included in a network survey that is adjusted by the Method of Least Squares

10.6.2 Construction Staking

Construction staking shall be provided per Specification Section 00305 for all water, sewer, storm, roadway, irrigation, franchise, or other facilities as required for City inspectors to verify position of facilities within the public right of way or public easements.

10.6.3 Cutsheets

When requested, cut sheets for each phase of construction shall be prepared and forwarded to the Construction Inspector and to the Construction Supervisor on the next business day following the construction staking. A business day for purposes of this section is any day that construction work proceeds on a project. At minimum, cut sheet information shall include feature being staked, station, offset left or right, design elevation, offset hub elevation, and cut/fill.

10.7 Final Submittal of Electronic Files

10.7.1 CAD Files

All CAD files for final submittal to the City of Bend shall be prepared as specified in 2.4 - CAD Drafting Standards.

All electronic spreadsheet files for final submittal to the City of Bend shall be compatible with MS Excel.

10.7.2 Word Processing Documents

All electronic word processing documents for final submittal to the City of Bend shall be compatible with MS Word.

10.7.3 Image Files

All non-editable image files for final submittal to the City of Bend shall be submitted in PDF format.

Geotechnical Engineering

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11 Geotechnical Engineering

A geotechnical investigation is required by the City of Bend for all projects involving excavation within the public right-of-way unless a project-specific deviation request has been approved by the City Engineer. Because of the wide array of site conditions and project types within the public right-of-way, the Design Standards for geotechnical services contained herein are intended only to supplement the recognized design manuals and code documents listed in 11.8 - References, or the latest published edition of a reference as of the date of CIP contract execution or Initial Development Plan Submittal. The reference documents are listed in order of precedence, should a discrepancy be identified among the references. The City's Geotechnical Design Standards (presented below) and Construction Specifications shall take precedence over the reference documents.

The scope of the geotechnical investigation, typically including office studies, field and laboratory testing, engineering analyses, and recommendations for design and construction shall be developed by the Geotechnical Engineer based on engineering judgment and guidelines provided in applicable sections of the reference documents.

All public works and transportation infrastructure located within the public right-of-way shall be designed by a Professional Engineer registered in the State of Oregon. Copies of supporting design calculations shall be provided to the City Engineer upon request.

11.1 Geotechnical Data Report

Geotechnical Data Report (GDR). For development projects, a GDR is not required unless requested by the City following the Initial Submittal Plan. The purpose of this report is to summarize results of office studies and field and laboratory test results, as well as available information from previous projects. The GDR shall be submitted to the City prior to 30 percent completion of the design to allow the findings to be used in the design and for the development of the construction schedule and cost estimate. A report shall include:

- Description of the previous site uses, current site conditions, and proposed infrastructure
- Review of available subsurface information such as geology maps, seismic hazard maps, and geotechnical reports for previous nearby projects
- Reconnaissance of the surface conditions including topography, vegetation, exposed soils and/or rock outcrops, drainages, existing infrastructure, and any features that indicate geologic hazards such as subsidence, rapid erosion, or slope instability
- Results of subsurface explorations including geotechnical boreholes, test pits, and/or alternative methods approved by the City Engineer. Soil and rock shall be described according to the ODOT Soil and Rock Classification Manual (1987).
- Results of laboratory testing for soil and rock classification and the determination of engineering properties for design, including references to applicable testing standards
- Results of field instrumentation (for example, piezometers or slope inclinometers) or field testing (for example, infiltration testing)

11.2 Geotechnical Recommendations Report

For Capital Improvement Projects (CIPs), the responsible Engineer of Records shall be responsible for completing a Geotechnical Recommendations Report independent of the Geotechnical Data Report. A typical recommendations report shall include:

- Detailed descriptions of the proposed infrastructure and associated design criteria
- A brief summary of the subsurface condition and reference to the Geotechnical Data Report
- Discussion of analytical methods including technical references
- Summary and interpretation of analysis results
- Recommendations for design and construction

For new residential developments and fast-track CIPs, geotechnical data and recommendations may be provided in a single report with prior approval by the City Engineer.

11.3 Pipelines, Appurtenances, and Ancillary Structures

Potable water, stormwater, and sanitary sewer pipelines, and appurtenances, shall be designed according to the City's Construction Specifications and manufacturers' specifications. While it is recognized that these guidelines will provide adequate performance for typical projects, it remains the responsibility of the Design Engineer to ensure that the design satisfies the broader spectrum of criteria presented in the reference documents.

11.3.1 Excavation

All utility excavations shall satisfy the current requirements of the Oregon Administrative Rules (OAR), Division 3, Subdivision P, Excavations.

11.3.2 Thrust Restraint

Pipelines that convey fluid under pressure shall have thrust restraint measures at each bend and dead end run of pipe, designed according to Section M41 of the American Water Works Association (AWWA) 2009 Manual of Water Supply Practices. Joint restraints shall be used extending from the pipe bend to the point at which the friction along the pipe exceeds the thrust at that bend. Thrust blocks shall not be used without prior approval by the City Engineer.

11.3.3 Drywells

All drywells shall be designed in accordance with the current provisions of the Central Oregon Storm Water Manual, including completion of field and laboratory testing, where applicable.

11.3.4 Seismic Design

Buried pipelines shall be designed in accordance with the American Lifeline Alliance (ALA) 2005 publication "Seismic Guidelines for Water Pipelines," and above-grade piping shall be designed according to the 2002 ALA publication "Seismic Design and Retrofit of Piping Systems." The scope of the analysis will depend on the type and size of the utility, and its level of importance to the overall network. For example, even relatively small pipelines may

be deemed important if damage to those lines could threaten an adjacent mainline that serves lifeline facilities. Critical segments will require probabilistic seismic hazard analyses and a complete screening for seismic hazards including seismic wave propagation, seismic settlement, landslides, lateral spreading, liquefaction, and the presence of potentially active faults. For most residential applications, the design shall be completed according to the simplified design methods given in these publications.

11.3.5 Ancillary Structures

Public works structures such as pump stations, reservoirs, control buildings, and vaults shall be designed in accordance with Oregon Structural Specialty Code (2019), City of Bend Standard Construction Specifications, as well as applicable standards of the AWWA, and the American Concrete Institute (ACI). Seismic analysis of these structures shall include potential impacts to connections with buried and aboveground utilities and appurtenances.

11.4 Pavement Design

Pavements that will support a high volume of heavy vehicles and all streets included in the transit classifications (Expressways, Arterials, Major Collectors, Minor Collectors) shall be designed according to the ODOT Pavement Design Guide (2019), the American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures (1993), and the AASHTO supplement for Rigid Pavement Design & Rigid Pavement Joint Design (1998). Other recognized methods such as those developed by the Asphalt Institute, Portland Cement Association, Asphalt Pavement Association of Oregon, or the American Concrete Pavement Association may also be used with prior approval by the City Engineer. Local residential streets, including alleys, t-courts, and shared lanes, shall be designed using pavement sections equal to or greater than the minimum dimensions presented in 11.4.5 - Minimum AC Thickness and 11.4.6 - Minimum PCC Thickness and Joint Design.

11.4.1 Traffic Analysis

Pavement design will require an investigation of the traffic volumes, distribution of vehicle types, and traffic growth rates. The design traffic volume shall be calculated as the total number of equivalent, single, 18-kip axle load (ESAL) applications over the life of the pavement, based on the conversion factors for truck and non-truck traffic shown in Table 11-1.

TABLE 11-1
ESAL Annual Conversion Factors

Vehicle Type	ESAL Annual Conversion Factors			
	Flexible Pavement		Rigid Pavement	
	One-Way Traffic Data	Two-Way Traffic Data	One-Way Traffic Data	Two-Way Traffic Data
2-axle truck	100	50	100	50
3-axle-truck	220	110	270	135
4-axle truck	320	160	400	200
5-axle truck	650	325	950	475
6+ axle truck	650	325	950	475
Passenger cars	0.3	0.15	0.3	0.15
SUVs	1.9	0.95	1.9	0.95
Pickups	4.5	2.25	4.5	2.25

11.4.2 Subgrade Properties

Subgrade properties shall be determined for flexible pavements (resilient modulus) and rigid pavements (modulus of subgrade reaction) using methods appropriate to the proposed construction and design procedure. Back-calculation is the standard method for rehabilitation projects and may also be used for widening or the minor realignment of existing pavements. This method typically requires a condition survey, pavement cores, and falling weight deflectometer (FWD) testing to characterize the existing pavement section and subgrade.

For new pavement or full-depth reconstruction where back-calculation from FWD tests is not practical, the subgrade design parameters shall be determined using laboratory resilient modulus tests (flexible pavement), field plate load tests (rigid pavement), or correlations with the results of field dynamic cone penetrometer (DCP) tests. Subgrade parameters correlated from California Bearing Ratio (CBR) test results shall not be suitable for design. For roadways that will support less than 50,000 ESALs annually, the subgrade resilient modulus may be estimated based on the soils classification and prior experience with similar soils.

11.4.3 Inputs for 1993 AASHTO Pavement Design Procedure

Inputs for the 1993 AASHTO pavement design procedure shall be selected in accordance with the ODOT and AASHTO guidelines. For rehabilitation projects, selection of these design parameters shall be determined based on the condition of the existing pavement section and FWD test results. Structural coefficients used in the design of pervious pavements will need to be supported by field or laboratory test data, or recognized reference documents.

11.4.4 Minimum Design Life, and Life-cycle Cost Analysis

The minimum design life for new pavement sections shall be 20 years and 30 years for flexible and rigid pavements, respectively. Rehabilitated pavement sections shall have a design life of 15 years, or as determined by a life-cycle cost analysis (LCCA) according to AASHTO guidelines. LCCA shall be completed for new pavements and rehabilitation projects to evaluate the costs and benefits of the various pavement types or rehabilitation strategies.

11.4.5 Minimum AC Thickness

Refer to 3.8.5 - Pavement Sections for minimum AC thickness.

11.4.6 Minimum PCC Thickness and Joint Design

The minimum Portland cement concrete (PCC) thickness shall be determined according to the procedures of the AASHTO supplement for Rigid Pavement Design & Rigid Pavement Joint Design (1998), or approved equivalent, and rounded up to the nearest 0.5 inch. An increased PCC section may be required at bus stops or at other locations where heavy trucks regularly stop and start. In no case, shall the PCC thickness be less than 5 inches, and all PCC pavement sections should include a base rock section that will provide adequate drainage.

Proper joint design is critical to the performance of PCC pavements and the submitted pavement design shall include an explanation of the selected joint patterns, including applicable references and design criteria.

11.5 Sign, Luminaire, and Signal Pole Foundations in the Public Right-of-Way

For standard sign, luminaire, and signal poles, the ODOT standard foundation plans for standard sign, luminaire, and signal pole shall be used where the minimum geotechnical foundation requirements of the plans are met. Where nonstandard signs, luminaires, or signal poles are proposed, or where the geotechnical conditions do not meet the minimum requirements of the standard plans, foundations for the signs, luminaires, and signal poles within the public right-of-way shall be designed in accordance with the AASHTO (2001) Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

11.6 Other Transportation Design Elements

All other transportation design elements, including but not limited to bridges, culverts, embankments, retaining walls, and cut slopes, shall be designed in accordance with the ODOT (2018) Geotechnical Design Manual, the ODOT (2021) Bridge Design and Drafting Manual, and the AASHTO (2017) Load and Resistance Factor Design Bridge Design Specifications. Abbreviated design efforts may be acceptable for some applications if approved by the City Engineer.

11.7 Blasting

All transportation and utility design elements requiring blasting for the excavation of rock shall be designed to prevent damage to existing infrastructure, and avoid unnecessary overbreak of the rock. A precondition survey of nearby structures, private or public, shall be completed prior to the start of blasting, and the blasting program shall include provisions for monitoring of potential damage, dust/debris,, vibrations or noise in excess of permitted levels. Follow blasting requirements in OSS Section 00335, ORS 480 (and all other applicable code sections) and City Municipal Code.

A blasting plan must be provided during permitting Private Development Projects. Where there are existing public facilities, blasting of drywells and other deep installations must occur on the other side of the street to maintain maximum distance. Blasting should not occur within

20 feet of any existing utility unless otherwise approved by the City Engineer, and only then using small pounds of explosives to reduce possibility of damage. The City may require testing of existing assets (cc tv, etc.), at the contractors expense, to assess heaving or damage if blasting appears to have disturbed areas in the vicinity of the existing utilities.

11.8 References

Design of facilities for the City of Bend shall meet or exceed the requirements of the following references, or the latest published edition as of the date of CIP contract execution or Initial Development Plan submittal unless otherwise directed in writing by the City Engineer. The documents are listed in order of precedence, should a discrepancy between cited references be identified.

11.8.1 Utility Systems; Pipelines, Appurtenances, and Ancillary Structures

- Oregon Occupational Safety and Health Department (OR-OSHA). Oregon Administrative Rules, Division 3, Subdivision P, Excavations.
- Oregon Department of Transportation/Oregon Chapter of the American Public Works Association (ODOT/APWA). 2021. *Oregon Standard Specifications for Construction.*
- AWWA 2009. Manual of Water Supply Practices –M41: Ductile-Iron Pipe and Fittings. Third Edition.
- ALA. 2005. Seismic Guidelines for Water Pipelines. March.
- ALA. 2002. Seismic Design and Retrofit of Piping Systems. July.
- Central Oregon Intergovernmental Council (COIC). 2010. *Central Oregon Stormwater Manual.*
- International Code Council (ICC). 2018. *International Building Code.*
- ICC. Oregon Structural Specialty Code. 2019.

11.8.2 Transportation Structural Elements; Pavements, Bridges, Culverts, Embankments, Retaining Walls, and Cut Slopes

- ODOT. 2018. Geotechnical Design Manual.
- ODOT. 1987. Soil and Rock Classification Manual.
- ODOT. 2019. Pavement Design Guide.
- ODOT. 2019. Bridge Design & Drafting Manual.
- AASHTO. 1993. Guide for Design of Pavement Structures.
- AASHTO 2001. Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Fourth Edition.

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Landscape Architecture and Irrigation Systems

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12 Landscape and Irrigation Systems

The purpose of these standards is to promote community health, safety and welfare by protecting native vegetation and Regulated Trees (six inches or diameter measured at four and on-half feet above the ground known as DBH, for “diameter at breast height”), requiring landscaping and street trees in the right-of-way, and reducing water consumption through the use of appropriate site design, plant materials, and irrigation technologies.

These standards are in addition to the Bend Development Code Chapter 3.2, Landscaping, Street Trees, Fences and Walls.

12.1 Applicability

The standards in this Chapter apply to all landscaping and irrigation in the public right-of-way.

The standards include design parameters, tree preservation requirements, street tree and plant requirements, standard materials and requirements and irrigation plan submittals.

12.2 Landscape Plan Submittals

Landscape and irrigation plans are required in compliance with Chapter 2.3.7., Landscape and Irrigation Plans and this Chapter 12 and must be submitted for review with construction plans. Plans to include street trees and ROW landscape requirements.

12.2.1 Design Parameters

The design for public ROW must conform to the current City of Bend Standards and Specifications, codes and ordinances of the City of Bend. The following are the minimum design standards for the City of Bend. These standards apply to all public ROW unless a deviation to the City of Bend Standards and Specifications is approved from the City of Bend.

12.2.1.1 Stormwater Source Control Principles

The landscape plan must adhere to current stormwater quality source control principles for low impact development including but not limited to identifying the development/building envelope, designing with the natural topography, minimizing impervious areas, working to minimize the volume and velocity of stormwater runoff through features such as canopy coverage and infiltration, where appropriate, and incorporating treatment through soils.

12.2.1.2 Water Efficient Landscaping Principles

The landscape plan must adhere to current water conservation principles for water efficient landscape design, including, but not limited to, addressing microclimatic conditions in the site design process, grading, plant selection, soil amendments, irrigation design, and other material selection.

12.2.1.3 Hydrozoning

The landscape design must select and group plants by implementing principles of "matched hydrozones" that is, grouping and watering plants based on their water needs.

The City of Bend recognizes the following three hydrozone classifications

1) Very Low - Most natives / may require supplemental water for plant establishment during drought post establishment.

2) Low - Perennials and some shrubs / some supplemental water required during the growing season (Apr - Oct)

3) Moderate - Fruit trees, ornamental trees, and shrubs / regular amounts of supplemental water required during the growing season (Apr - Oct)

In addition, the following site-specific situations must be considered for separating zones:

- Separate zones for planting areas that have soil types that are significantly different as a result of being amended or disturbed
- Separate zones for plants in raised planters, containers, tree wells, tree pits, or other limited spaces because those spaces dry out faster
- Separate zones for plants on slopes, because they may require several short irrigation cycles to prevent runoff
- Separate zones for landscape areas separated by physical barriers such as walls, fences, roads, sidewalks and driveways
- Street trees in a planter strip must be irrigated on a dedicated irrigation zone, separate from other plant material, to allow for proper water allocation to trees and the remainder of the landscape plant species.

12.2.2 Tree Preservation

The following are the requirements for preserving Regulated Trees (six inches or larger in diameter measured at DBH) in the public right-of-way.

12.2.2.1 Tree Protection Plan

Trees in the public ROW must be retained unless approved by the City to be removed in compliance with 12.2.2.2, Tree Removal and Relocation.

Root Zone Protection Requirements.

Trees to be preserved must be protected from development impacts according to the following standards. Tree protection methods and specifications must be consistent with ISA best management practices.

1) **Establish a root protection zone.**

   Root protection zone means a circular area measured from the outside trunk of the tree equal to one foot in radius for every inch of tree at diameter at breast height. For offsite trees with root protection zones that extend into the site, the root protection zone may be estimated but no less than the extent of the dripline.

2) **Encroachments**

   a. **Existing encroachments**

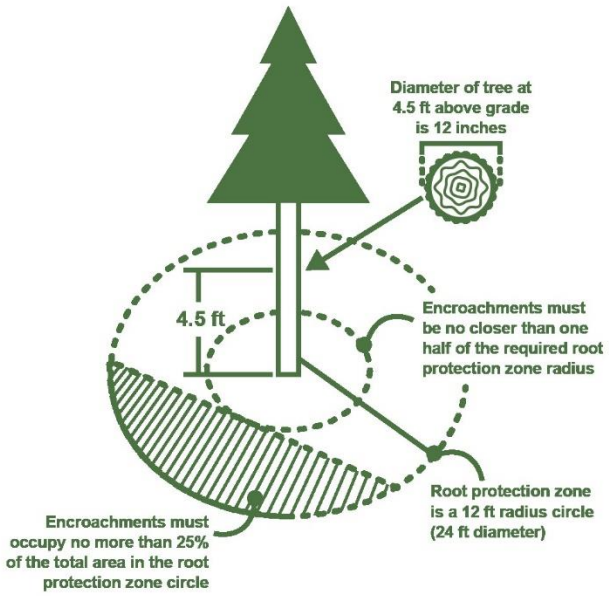
      Existing encroachments into the root protection zone may remain.

   b. **New Encroachments for Structures, Impervious Surfaces and Utilities**

i. New encroachments into the root protection zone are allowed provided the area of all new encroachments is less than 25 percent of the remaining root protection zone area when existing encroachments are subtracted; and

ii. New encroachments are no closer than one half of the required root protection zone radius.

Figure 12.2.2.1 – Permissible Encroachments



3. **Prohibited in Root Protection Zone.** The following is prohibited within the root protection zone of each tree:

   a. Clearing, grading and construction activity including vehicle or equipment access (but excluding access on existing streets or driveways), storage of equipment or materials including soil, temporary or permanent stockpiling, proposed buildings, impervious surfaces, underground utilities, excavation or fill, compaction, trenching or other work activities.

      i. Exception: Demolition of existing structures or other encroachments is permitted in the root protection zone. Trees damaged or destroyed must be replaced in compliance with BDC 3.200(EE), Mitigation Options.

   b. New structures, impervious surfaces and utilities unless approved to encroachment in compliance with subsection (2)(b) of this section.

4. **Protection fencing:**

   a. Required protection fencing must be installed before any construction

activities start; and may only be removed upon completion of final inspection.

b. Protection fencing must be installed in accordance with the City of Bend Standards and Specifications (See Standard Drawing E-3, Tree/Vegetation Protection Fencing). Existing structures and/or existing secured fencing at least 3.5 feet tall can serve as the required protective fencing.

c. When a root protection zone extends beyond the development site, protection fencing is not required to extend beyond the development site.

d. Signage designating the protection zone and penalties for violations must be secured in a prominent location on each protection fence.

5. **Landscaping and Irrigation.** Any landscaping or irrigation approved within the root protection zone may be installed before or after the removal of the protection fence and must not disturb existing trees including roots within the root protection zone.

Landscape plans or specifications must note a requirement for the City to be notified within 24 hours of any damage to existing trees within the project area that were not approved for removal or relocation. If damage occurs during construction, the contractor must employ an International Society of Arboriculture (ISA) Certified Arborist to determine whether the damage may be repaired or the tree must be replaced according to City mitigation procedures in BDC 1.3.300.C, Mitigation for the Removal of Landscaping and Regulated Trees.

12.2.2.2 Tree Removal and Relocation

Trees must not be removed or relocated within the public ROW without approval from the City Engineer. The applicant must submit a Tree Removal and Planting Permit application to the City of Bend that identifies number and type of trees to be removed, location of trees to be removed, reason for removal, and proposed planting mitigations. Approval for removal/relocation of the tree requires approval from the City Engineer based on the following criteria:

1) The site cannot feasibly be developed or accessed, either by alternative site design or construction methods without removing or relocating existing trees in the right-of-way

2) Trees left in their present location will be so undermined by construction that their viability is threatened to the extent they become a danger in the future

3) The existing location is determined to interfere with the clear vision standards, intersection sight triangles, and intersection sight distances (for traffic, bicycles, and/or pedestrians and causes a safety concern that may not be resolved by appropriate pruning or thinning).

Recommendations for removal, pruning or thinning must be made by a licensed landscape architect or certified arborist. Under no circumstances may a tree be “topped”.

Existing trees approved for removal or relocation must be clearly identified on the landscape plan. The City must be notified 48 hours in advance of any approved tree removal activity.

12.2.3 Street Trees and Plants

Street trees and planter strip landscaping must be planted consistent with BDC 3.2.400 Street Trees and Landscaping in Planter Strips.

All trees and plants considered must be hardy to USDA Zone 3 – 5 or 6b.

12.2.3.1 Approved Street Tree List and Plant List

Proposed plants must be selected from the City of Bend Approved Plant List (see Appendix E of the City of Bend Standards and Specifications) and/or the moderate to very low water need plants listed in the publication titled "Water-wise Gardening in Central Oregon" by the Oregon State University Extension Service. Copies are available at the City of Bend Utility Department and OSU Extension Service.

Proposed street trees must selected from the City of Bend Approved Street Tree List (see Appendix D of the City of Bend Standards and Specifications).

12.2.3.2 Non-approved Street Trees and Plants

The following species are prohibited from installation in the ROW:

- All species of warm and cool season turfgrass (grass lawn)
- Populus sp.
- Salix sp.
- Alianthus sp.
- Robina sp.

Synthetic turf is prohibited in the ROW.

12.2.3.3 Height Standards for Street Trees and Plants

Plants that will attain a mature height of two feet or more in height must not be planted in Clear Vision Areas, Intersection Sight Triangles, nor Sight Distance Areas. Refer to Standard Drawing R-2 and 3.3.4.3 - Intersection Sight Distance vs. Clear Vision Area. The height of the plant must include the abutting curb height and any earthwork or grading within the plant bed.

Existing trees must be limbed to a minimum of 8 feet above sidewalks, 12 feet above bike lanes, and 14 feet above vehicle travel lanes. This applies to center medians as well as roadside areas.

Only trees, 25 feet high or less, at maturity, can be considered for planting beneath or within 10 lateral feet of any overhead power lines. See the city's currently approved street tree list for planting beneath powerlines.

12.2.3.4 Size of Street Trees and Plants

Shrubs, Ornamental Grasses and Perennials and Groundcover Plants. Shrubs and ornamental grass must be a minimum of one-gallon containers, and perennials and groundcover plants must be a minimum of four-inch pots.

Deciduous Trees. The minimum caliper size of street trees at planting must be two inches measured at six inches above the soil or root ball for bare trees. If required caliper is not available as demonstrated by letters submitted by three different local nurseries, the Planning Director/Review Authority may accept a smaller caliper tree no less than one and one-half acres.

Conifer Trees. Conifer trees must be a minimum of six feet in height measured from the soil to the top of the tree.

12.2.3.5 Street Tree Location and Spacing

Location

Street trees must be planted within existing or proposed planting strips or in City-approved sidewalk/shared use path tree wells on streets without planting strips. Street trees must have a 2' radius of organic mulch around the root ball regardless of the surrounding groundcover material. Street trees planted within sidewalk/shared use path tree wells must be installed with a City-approved tree grate. Except where large trees (Bend Development Code 3.2.400B1) are required on arterial streets or collector streets in a tree grate suspended pavement, then silva cells, or structural soils are required to provide adequate area for root development.

Where the planter strip or the tree well is less than four feet wide (excluding curb dimensions) or adequate space is not available due to utility offsets, the street trees may be planted within five feet from the back of the sidewalk/shared use path or on private property. Trees placed behind the sidewalk will be columnar varieties (as listed in Appendix – D) to limit encroachment to adjacent structures. Root barriers are required with street tree planting to protect the City's curb and sidewalk/ shared use path. Existing trees located in the proposed planting strip, tree well, or whose canopy dripline is located within five feet from back of sidewalk/shared use path can count towards this requirement. For locations with curb tight sidewalks the ROW Landscape and Street tree plantings will be installed in the ROW area behind the sidewalk or outside of any utility easement on private property.

For public ROW landscape without existing sidewalks, trees must be located to accommodate future sidewalk/shared use path locations with consideration for existing and future utility corridors.

Spacing

The required spacing distance is based on the species of tree and describes in the city's currently approve street tree list except where planting a tree would conflict with existing trees, driveways, retaining walls, utilities and similar physical barriers. A random spacing of tress may be approved for the equivalent number of trees required for the length of the frontage.

Trees should be spaced no less than the following distances from existing or planned infrastructure:

- Stop signs: 35 feet
- Street lights: 25 feet
- Non-street light utility poles: 5 feet

- Property lines: 2 feet
- Fire hydrants: 10 feet
- Sewer laterals or sampling manholes: 5 feet
- Water meters 6 feet
- Driveways, or alleys: 5 feet
- Traffic signs: 20’
- Bus benches and shelters: 5’

Trees shall not be planted within the following areas:

- Clear vision areas except street trees may be planted a minimum of five feet from a driveway or an alley
- Intersection sign triangles
- Sight distance areas
- City water or sewer easements, unless approved by the City Engineer
- Over water or sewer mains, unless approved by the City Engineer.
- Public utility easements. All street trees must be placed outside utility easement. If the existing planter strip contains such easements and is not wide enough to also accommodate street trees, the street tree location requirements may be adjusted as approved by the Planning Manager.
- Medians tree wells and planter strips less than 4 feet wide (excluding curb dimensions)

12.2.3.6 Exemptions

Exceptions and/or exemptions to tree and plant location standards will be considered on a case-by-case basis, as approved by the City Engineer and/or Planning Manager.

12.2.4 Standard Materials and Equipment

Designs must incorporate materials and equipment that comply with the City of Bend Standards and Specifications. Alternative materials must only be used when an approved Deviation from Standards and Specifications request has been submitted and approved.

12.2.4.1 Tree Wells

Street trees planted within sidewalk/shared use path tree wells must be installed within a pedestrian rated tree grate or surrounded by permeable pavers or pavement appropriate for pedestrian circulation. The minimum tree pit dimensions must be a minimum of 108 cubic feet 4 ft. x 9 ft., minimum 3 feet deep, and a minimum surface dimension of 4 feet.

12.2.4.2 Soil Amendments

The City of Bend requires the use of organic soil amendments to improve soil structure and increase aeration, water penetration, and water retention for plant hydration when appropriate for the selected plant species. Soil amendment must be tilled into native topsoil to a depth of 6 inches across entire area for seeding or spot amended at individual planting holes at a ratio of 1/3 amendment to 2/3 native excavated soil. Topsoil with aggregate material in excess of 5 percent of composition is not acceptable amendment. Prior to amending soil, planting area must be cleared of construction debris, base rock and other to a depth of 12 inches for shrubs and groundcover and 24 inches at tree pits.

12.2.4.3 Mulches

Finished landscapes must include organic shredded bark or rock mulch to a depth of three inches and be even with finished hardscape grade. Mulch must be pulled back at 4”-6” radius from the tree and shrub root flare. A 2’ radius of organic mulch must be placed around each street tree regardless of surrounding groundcover materials

Weed barriers or impermeable plastic are prohibited under any mulches.

The landscape plan must identify the proposed type and recommended depth of installation for all proposed mulch materials.

12.2.4.4 Fertilizers

The landscape plan or specifications must specify any additional fertilization requirements that may be necessary for the establishment of new plant material.

The landscape plan must specify type and recommended application rate for each proposed use of any fertilizer recommendation that deviates from Specification Section 01030 - Seeding, and Specification Section 01040 - Planting, for approval by the City.

12.3 Irrigation Plan Submittals

Irrigation systems shall be designed to be efficient and to uniformly distribute water.

Specific criteria that must be considered in designs include soil type, slope, root depth, plant materials, hydrozones, microclimate conditions, water source, peak precipitation rate demand, and watering windows. To conserve and protect water resources, designs must utilize appropriate equipment and components that meet the City of Bend Codes, Standards and Specifications. Irrigation must be designed to operate at a level that conserves water resources and reduce required maintenance by City staff.

For capital improvement and development projects, the following design requirements must be implemented in all design deliverables and submittals presented to the City of Bend for review.

An irrigation plan must accompany the site/landscape plan and identify the location, type, and coverage of sprinklers, as well as drip lines, valves, zones, point(s) of connection and other equipment required to provide water as prescribed by the City of Bend as part of the submittal to the City for review and approval prior to installation. An irrigation plan is required for any public development where landscaping within the City of Bend right-of-way is part of the improvements, either new or existing. Irrigation plans must be in compliance with these standards and those set forth in OSS and in other Bend Codes, Standards, and Specifications.

See 2 - Design Submittal Requirements for plan submittal requirements and City of Bend CAD Standards.

12.3.1 Design Parameters

Irrigation systems must be designed to fully irrigate plant materials shown or specified on the site plan. System design should consider plant size and spacing at maturity to ensure long term effectiveness.

The minimum supply water pressure must be based on information supplied by the water utility, field-verified and noted on the drawings, and be incorporated in the irrigation design to ensure proper system performance.

Irrigation systems must be designed to maximize efficient water usage based on existing and proposed site– specific topography, soils, site orientation, prevailing wind conditions, and micro-climates to eliminate the possibility of run-off and overspray, minimize evaporation, and increase the rate of infiltration. Overhead irrigation sprinklers must be inset 12 inches from abutting hardscape, curbs and sidewalks/shared use paths to prevent irrigation overspray and runoff onto adjacent surfaces. Ensure the irrigation system adheres to Bend Code Chapter 14.20 and does not result in irrigation overspray or runoff onto adjacent hard surfaces.

Irrigation designs must not mix sprinkler types, i.e., rotary, bubblers, , drip, or subsurface irrigation on the same zone.

Provide separate irrigation zones for trees, shrubs and groundcovers. Trees may not be irrigated on the same zone as shrubs, groundcover or any other plant material. Tree irrigation must be a root watering system using either RainbirdRWS-M-B-1402 or Hunter RZWS- 18., per Standard Drawing L-18 Tree Root Watering System Detail with cans installed on each side of tree root ball and flush with finish grade. Bubblers placed at root flare of tree are not acceptable.

Where overhead irrigation is approved in widths >8 feet, high efficiency nozzles must be used and result in a net precipitation rate of 1 in/hr or less. Overhead spray nozzles are prohibited in the ROW. Irrigation utilizing high efficiency nozzles may be used for “temporary irrigation zones”. Temporary irrigation is required to establish areas being revegetated with drought-tolerant and native plant species. Temporary irrigation systems must be reviewed on a case-by-case basis and removed after the vegetation is established. Irrigation designs shall identify location, number of zones, and irrigation types proposed for any areas determined to be temporary irrigation zones.

Separate zones are required for permanent and temporary irrigation lines.

12.3.1.1 Safety

Run-off and/or over-spray from sprinkler heads must be eliminated from streets and sidewalks/ shared use paths by use of proper design principles and installation practices. Refer to Bend Code Chapter 14.20.030 for additional information about water waste.

To conserve and protect water quality, all landscapes and irrigation installations must consider the conservation of resources, and protect native habitats and watersheds.

Irrigation designs shall utilize products that require the least amount of service, repair, and replacement. Buried vaults and valves should be located near areas with low pedestrian and vehicular traffic.

12.3.1.2 Hydrozones

The irrigation plan, in conjunction with the landscape plan, must prevent over-watering and under-watering by implementing principles of "matched hydrozones." Refer to 12.2.1.3 - Hydrozoning for additional detail.

12.3.1.3 Hydraulic Calculations

Irrigation designs must supply complete calculations for all irrigation zones (drip zones and spray zones separately). Supply a table showing the total water required for each zone to ensure that the design has not exceeded the maximum for the meter, proposed pipe size, and zone watering times.

12.3.2 Drip Irrigation Design

Drip irrigation systems must be designed according to standards and engineering practices specified by the American Society of Agricultural and Biological Engineers or Irrigation Association. Systems should be designed to meet the changing water requirements of the landscape as it matures.

Drip irrigation/pressure compensating bubblers are required where dimensions are less than eight feet in any direction.

Subsurface drip irrigation systems must be buried to a depth of two inches below finished soil grade and include all required devices for successful long term maintenance and monitoring including, but no limited to, air relief valves, auto flush valves and drip zone indicators at each end of the drip header per zone. See Standard Drawing L-16 Dripline 2" Below Grade Potable System.

12.3.2.1 Irrigation Design Public ROW Multi-stream bubbler nozzles (MSBN) on a 1806 or 1812 pressure regulated stem (PRS) pop up, hard piped to a swing joint and set in no less than 12 inches from sidewalk and curb inside edge may be installed in widths <8 feet requiring drip irrigation. Stream bubblers should be oriented in cluster form with no more than 4ft spacing around groups of shrubs/grasses etc.. See Standard Detail for design layout. Bubblers must be installed on a 1806 or 1812 PRS pop up and be retractable staying flush with soil grade, bubblers may not be above ground installed on the end of a swing joint/funny pipe or riser.

12.3.3 Standard Materials and Equipment

Designs must incorporate materials and equipment that comply with Specification Section 01120. Alternative materials must only be used when an approved Deviation from Standards and Specifications request has been submitted and approved. Materials shall be designated by trade name as per City of Bend Special Provisions or an approved equal, as verified from information in the manufacturer's catalogue and shown to contain comparable components.

12.3.3.1 Irrigation Controllers

The City of Bend uses the current technology for programming and monitoring irrigation systems for landscape areas within the city to ensure the most efficient delivery of water to the public ROW. Irrigation controllers must be EPA WaterSense labeled smart irrigation controllers, programmed to automatically adjust irrigation run times in response to environmental conditions. A cellular network connection must be provided via manufacturer's recommendations with a minimum 1-year service connection following handover to City. Enclosures will require the installation of an external antenna to achieve the required

connectivity. An external wireless weather sensor shall also be provided with installation location approved by City, clear of obstructions per specifications. Some models may require an external weather sensor or accompanying module to access the weather data, freeze/rain clicks do not qualify.

At a minimum, a station list with plant type and area description map must be left in the controller. Each irrigation zone should be color coded on the map for easy identification. For public ROW projects, three waterproof copies of the irrigation map size 11 inches by 17 inches or larger shall be provided to the City Project Engineer for distribution to the landscaping supervisor along with a .pdf and .dwg via a secure USB thumb drive or secure shared file location. Multiple sheets may be necessary to ensure readability based on the extent of the work area. A pre and post grow in schedule must be calculated and left in the controller. If power is not available, a solar powered controller may be utilized with approval. Battery powered controllers may not be used in new construction.

12.3.3.2 Automatic Control Valves

Automatic electric solenoid remote control valves must be slow acting diaphragm-type, as per Specification Section 01120.17(h)(2) Automatic Control Valves.

12.3.3.3 Sprinkler Heads

Sprinkler heads must provide coverage as specified in the manufacturer's design literature. Where overhead type sprinklers are allowed, dimensions >8 feet, the use of high efficiency sprinklers or nozzles required in the ROW, zones must have a net precipitation rate of less than 1.0 inch per hour. Acceptable types of high efficiency nozzles include (Mp Rotators, R-Van, Precision) models. Fixed spray and VAN nozzles are prohibited from use in the ROW.

12.3.3.4 Pipe

ROW projects must be entirely furnished with one pipe class or schedule type as per the Bend Standards and Specifications, and conforming to all other national and local standards.

12.3.3.5 Blowouts

A blowout connection point must be installed to facilitate winterization by use of compressed air. Locate blowout connection immediately downstream of the backflow, master valve and flow sensor assembly.

SECTION 2-13

Electrical Systems

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13 Electrical Systems

General street lighting designs shall comply with City of Bend standards and the utility company providing the power guidelines. The designer shall coordinate the design with both entities prior to submission for plan approval.

NFPA 70 is the National Electrical Code (NEC) that has been adopted by the State of Oregon and the City of Bend. The State of Oregon Electrical Specialty Code is based on the NEC, with additions to and amendments of specific NEC Articles that are pertinent to the State of Oregon. Information on the Oregon Electrical Specialty Code and interpretations may be obtained from the Oregon Building Codes Division.

NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, includes the hazard classifications of specific areas and processes. The hazard classifications coincide with mandatory NEC requirements for the design of electrical systems, equipment, and materials in areas and for processes classified as hazardous.

13.1 Applicable Codes, Standards, and Regulations

Codes are legal documents whose use is determined by the Authority Having Jurisdiction (AHJ). Requirements of the current NEC as amended by the current State of Oregon Electrical Specialty Code are to be satisfied in all electrical designs. Additional codes, the current versions of which apply to all electrical designs, include:

- NFPA 70E, Standard for Electrical Safety in the Workplace
- NFPA 101, Life Safety Code
- ANSI C2, National Electrical Safety Code
- International Building Code (IBC)
- International Fire Code (IFC)

Standards are recommendations that form design guidelines that are not legal in nature, but are considered “standard practice.” Standards organizations, the applicable current versions of which apply to all electrical designs, include:

- American National Standards Institute (ANSI)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Instrument Society of America (ISA)
- Insulated Cable Engineers Association (ICEA)
- American Society for Testing and Materials (ASTM) International

- Underwriters Laboratories, Inc. (UL)
- Illuminating Engineering Society (IES)
- National Electrical Contractors Association (NECA)
- International Electrical Testing Association (NETA)

Regulations are legal design standards that must be incorporated into designs. Regulations, the applicable sections of which apply to all electrical designs, include:

- Occupational Safety and Health Act (OSHA)
- Americans with Disabilities Act (ADA)

13.2 Hazardous and Corrosive Areas

Hazardous areas and processes are classified in NFPA 820. The classification tables include a description of the location and function; the fire and explosion hazard; ventilation requirements if the initial classification is to be reduced; extent of the classified area; NEC area electrical classification (all Class I, Group D) with “Division 1”, “Division 2”, or “Unclassified” listed as applicable; materials of construction for buildings or structures; and fire protection measures. Hazardous area classifications (Class, Division, Group) are to be noted on applicable electrical drawings with the requirement to “furnish, install, and connect electrical devices and materials in these areas per NEC Article 501 (Class I locations) requirements.”

For all hazardous areas the designer shall specify type 316 stainless steel, NOT type 304 stainless steel, for all interior and exterior corrosive and/or wet areas. All hardware necessary to install electrical systems including supports and fasteners shall be 316 SST. Note on applicable electrical drawings those areas that are corrosive and/or wet with the requirement to “furnish, install, and connect electrical devices and materials in these areas per NEC Article 300.6 (protection against corrosion and deterioration) requirements.”

13.3 Design Approach and Guidelines

The electrical design shall satisfy all code requirements, and when codes, standards, or regulations conflict, the design is to comply with the more stringent requirements.

13.3.1 Distribution System

The facility power distribution system voltage shall be based on the connected load and what is available from the electric utility. Available electric service voltages are:

- 480Y/277 volts, 3-phase, 4-wire
- 480 volts, 3-phase, 3-wire
- 240/120 volts, 3-phase, 4-wire
- 240 volts, 3-phase, 3-wire

- 120/240 volts, 1-phase, 3-wire

The electric service up to 200 amps is required to be routed through a utility revenue meter box and socket. Above 200 amps, a separate electric utility current transformer (CT) cabinet is required with secondary conduit to the meter box and socket.

On the load side of the meter box or CT cabinet, provide a main circuit breaker located in either a separate enclosure or a motor control center (MCC) lineup. The main circuit breaker and its enclosure or MCC compartment are required to be UL labeled “suitable for use as service equipment.”

A standby power supply or provisions for standby power is required. Provide a transfer switch on the load side of the main circuit breaker, which is connected to the electric utility “normal” power source and when the “normal” power source is de-energized, can be switched to an “alternate” power source standby engine generator. The transfer switch enclosure shall be individually mounted or included in an MCC lineup.

On the load side of the transfer switch, provide the electric load power control equipment; for example, motor starters [and power factor correction capacitors (PFCCs) as applicable]; adjustable frequency drives (AFDs), power panelboards, feeder circuit breakers, etc. The power control equipment shall be either in individual enclosures or in a MCC lineup.

13.3.2 Standby Power

Provide standby power at all pump stations, reservoirs, etc., unless directed otherwise by the City Engineer in writing. The standby “alternate” power source shall be a stationary standby engine generator hardwired to an automatic transfer switch (ATS). An uninterruptible power supply (UPS) is another “alternate” power source, which relies on rechargeable batteries, to power critical panelboards for instrumentation, control, and supervisory control and data acquisition (SCADA) systems.

Standby engine generators shall be diesel-fueled with a subbase fuel tank under the engine generator skid inside an overall sound-attenuated, weatherproof enclosure. Natural gas or propane may also be used, depending on availability and Owner preference.

13.3.3 Fire Alarm

If directed by the Owner, provide a system with fire alarm control panel, addressable ionization smoke or infrared sensors, manual pull stations, and alarm strobe light/horns with provisions to activate an automatic telephone dialer to alert the local fire department.

13.3.4 Security System and Facility Access Control

Security systems shall consist of a door key pad, which activates the door lock. Magnetic door switches are provided in the door frame and door at the top of the door to alarm when the door is forced opened without key pad authorization. Doors shall also have a key lock.

13.4 Design Presentation

13.4.1 Legend

Provide an electrical legend and abbreviations drawing. If a standard legend and abbreviations are used, edit out all symbols and abbreviations that are not applicable to the design. If new symbols or abbreviations are used on the drawings, add them to the legend and abbreviations.

13.4.2 Site Plan

Provide an electrical site plan that locates the electric service entrance equipment and existing and/or new equipment provided by the electric utility to provide electric service to the facility. Show the routing of the electric utility service (overhead or underground) to the service entrance equipment. Show stationary standby engine generator or mobile standby engine generator receptacle, all exterior electrical loads (pumps, odor control equipment, etc.), control and/or instrumentation devices, site lighting, receptacles (remote from a building or outdoor control panel), etc., and the routing of underground conduits to them.

13.4.3 Process and Facility Plans

Provide building process and facility plan(s) and/or exterior pump wet well process and facility plans(s) with associated freestanding control panel(s). On process plans, show the location of the electric service entrance equipment (utility meter and main circuit breaker), automatic transfer switch, MCC and/or individually mounted motor starters (and PFCCs), AFDs, panelboards, transformers, etc. On facility plans, show the location of heating, ventilating, and air conditioning (HVAC) equipment, indoor and outdoor luminaires, light switches, telephone terminal cabinet or mounting panel, other non-process equipment, etc.

13.4.4 Single-Line Diagrams

Provide a single-line diagram that schematically shows power source(s) and electrical loads. Power source items include the normal (utility) power source and utility metering, service entrance main circuit breaker, standby power source engine generator or mobile standby engine generator receptacle, standby power source circuit breaker, ATS or MTS, surge arrester [transient voltage surge suppressor (TVSS)], and local metering. Electrical load items include motor starters (and PFCCs), AFDs, feeder circuit breakers, stepdown transformers, panelboards, etc.

Some ATSs are available with normal and standby molded case thermal magnetic circuit breakers, load-side metering, and have a UL “suitable for use as service equipment” label. These service entrance ATSs are acceptable instead of separate main and standby circuit breakers, ATS, and metering. All of the above items may be shown in individual enclosures or in a common MCC lineup.

Show all circuit breaker ratings and combination circuit breaker NEMA full-voltage starter sizes. Provide molded case motor circuit protector (instantaneous-trip) type circuit breakers shown “XX/M”, where “XX” is the current rating, for motor starters for motors up to 60 horsepower. Provide molded case thermal magnetic type circuit breakers for motor starters for motors larger than 60 horsepower and for all other circuit breakers. For metering, provide a switched voltmeter and ammeter or digital power meter.

13.4.5 Motor Control Schematic Diagrams

Provide motor control motor starter and/or AFD schematic control diagrams that include the motor starter/AFD circuit breaker; all control functions and interfaces, and the motor connection. Use the basic combination motor starter and/or AFD control diagram and add additional control features as required. Refer to Subsection “Design Criteria/Motor Control” for additional requirements.

Additional control features shall include interlocks between motor starters/AFDs to allow operation of less than the total number of pumps when the standby power source is powering the facility. Additional features may include a Flygt MiniCAS thermal/ moisture module or equivalent by other suppliers and motor connections, motor shutdown, reset, and alarm light for motor high temperature, and alarm light for motor moisture detection. Additional features may include an ON/OFF/AUTO selector switch with provisions for automatic operation from an ultrasonic (Siemens/Milltronics) level sensor. Additional features may also include a manual or automatic AFD bypass motor starter in case the AFD fails.

Motor starter/AFD status lights shall include a red “MOTOR RUNNING” and amber alarm lights. Status and alarm lights should be the push-to-test LED type. Motor starter/AFD output alarms to an automatic phone dialer or SCADA system should include “NOT IN AUTO,” “OVERLOAD SHUTDOWN”, “MOTOR HIGH TEMPERATURE SHUTDOWN”, “MOISTURE IN MOTOR,” and “AFD FAIL” alarms as applicable.

13.5 Schedules

Provide schedules for luminaires, manholes/handholes, and ultrasonic level sensor settings as required. Recommended luminaire schedule column headings include:

- Symbol and type number
- Input voltage (120V, 277V, etc.)
- Input Watts (includes ballast and luminaire)
- Description of luminaire
- Manufacturer and model number used as basis for design
- Lamp quantity, type (fluorescent, HPS, etc.), and color temperature or wattage
- Mounting (wall, ceiling, pendant, etc.)

Manhole/handhole column headings include:

- Manhole/handhole tag number
- Minimum inside dimensions (L, W, H)
- Drawing where manhole/handhole is located
- Manufacturer and catalog number

Ultrasonic controller (ULC) pump start/stop and alarm setpoint headings include:

- Pump/alarm identification (wetwell overflow, wetwell high level, lead pump on, lag pump on and alarm, etc.)
- ULC setpoint relay number
- Wet well elevation
- Remarks (pump start, alarm, etc.)

13.5.1 Details

Provide details as required to show underground conduit installation, conduit/cable penetration through the concrete slab, equipment pad (for MCC), pole-mounted site light, pedestal mounting frame for submersible pump disconnect receptacles, etc. Provide additional project-specific details as required.

13.5.2 Specifications

The City does not maintain standard electrical specifications for use on projects. The electrical design engineer shall provide the specifications required for a specific project that specify the requirements for equipment, materials, installation, etc. as required and incorporate applicable City Standards listed herein.

13.6 Design Criteria

13.6.1 Listed and Labeled Equipment

Materials and equipment shall be specified and installed in accordance NFPA 70, the NEC. Materials and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc., shall conform to those standards and shall have an applied UL listing mark or label.

13.6.2 Calculations

Calculations shall be made and documented for each project to establish electrical equipment current and circuit breaker ratings and conductor and conduit sizes. Based on full-load current ratings provided by process and facility equipment suppliers, calculate the size of power conductors and conduits to the equipment per the NEC Chapter 9 tables for the specified conductor and conduit types. Using NEC Article 430.24, calculate the size of the main power conductors and conduits to the electrical equipment that powers the process and facility equipment. Using NEC Article 430.62, calculate the current rating of the electrical equipment main service entrance circuit breaker and ATS or MTS.

13.6.3 Distribution Voltage

The project distribution voltage is established to some extent by the project equipment horsepower requirements and the voltage available at the project site by the local electrical utility. The utility may only have 120/240-volt, single-phase power available in residential or rural areas, and 3-phase power (480Y/277V or 240/120V) available in urban industrial

areas. Because it is desirable to keep equipment current requirements low to reduce wire sizes, a rule of thumb would be for a 120/240-volt single-phase 3-wire or 240/120-volt, 3-phase, 4-wire electric service to provide up to a service rating of 100 to 200 amps. Electric service ratings at 480Y/277 volts, 3-phase, 4-wire when available are satisfactory at any reasonable electric service current ratings. Although the utility service is listed at 480Y/277 volts, 3-phase, 4-wire with grounded neutral, the actual electric utility service voltage at the project electric service connection shall be 480 volts, 3-phase, 3-wire; neutral not required.

13.6.4 Utilization Voltage

The utilization voltage on pump station, reservoir, etc., projects is the same as the distribution voltage. For projects powered at 480 volts, 3-phase, 3-wire, low-voltage instrumentation and control, facility, lighting, and receptacle circuits should be powered from a 208Y/120 volt, 3-phase, 4-wire panelboard via a 480-208Y/120 volt transformer to minimize voltage unbalance.

13.6.5 Voltage Drop

Branch circuit voltage drop calculations, where required for heavily loaded and/or long feeder and/or branch circuit distances, shall comply with NEC Article 210.19(A)(1), Exception No. 2, Fine Print Note (FPN) No. 4, which states:

Conductors for branch circuits as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, provide reasonable efficiency of operation.

Make a voltage drop calculation for motor starting whenever an individual motor exceeds 20 percent of the serving transformer capacity.

13.6.6 Demand Factors

General guidelines for electrical load demand factors are as follows:

- Lighting 1.0 x connected load
- Emergency lighting 1.0 x connected load
- HVAC equipment 1.0 x connected load
- Sump pumps 0.5 x connected load
- Convenience receptacles 180 VA each
- Process loads 1 x full load amps of non-standby loads plus 25% of largest motor

Provide 10 to 20 percent spare capacity at MCCs and panelboards.

13.6.7 Metering

The electric utility revenue meter is provided by the electric utility for installation in a meter socket and box provided as part the project design. On the line side of the ATS or MTS, provide a voltmeter and 4- or 7-position selector switch with line-to-line, line-to-neutral, and OFF positions and an ammeter and 3- or 4-position selector switch with line and OFF positions. A digital power meter with the same measuring capabilities as the voltmeter and ammeter may be provided instead of the meters.

13.6.8 Branch Circuits

General guidelines for branch circuits are as follows:

- Use the connected load and NEC requirements for sizing branch circuit breakers, conductors, and conduits
- Use a minimum wire size of No. 12 American Wire Gauge (AWG) copper for lighting and receptacle branch circuits. Use No. 10 AWG wire when voltage drop requires a larger conductor on lighting circuits, and when receptacle circuits are longer than 75 feet.
- Where electronic ballasts are specified for fluorescent or high-intensity discharge lighting, provide a dedicated neutral for each lighting circuit; No common neutral for multiple lighting circuits.
- In general, lighting branch circuit loads shall be limited to 1,500 watts
- Light and receptacle branch circuits shall not be combined
- The number of convenience receptacles on any one branch circuit shall be limited to five duplex receptacles rated 120V, 20 amps. Where weatherproof, ground fault circuit interrupter (GFCI) duplex receptacles are required, each receptacle shall be a GFCI receptacle. GFCI feed through receptacles shall not be used.

13.6.9 Panelboards

General guidelines for panelboards are as follows:

- The panelboard and branch circuit breakers shall be identified by branch circuit or feeder homeruns shown on the drawings
- Each panelboard shall be equipped with a minimum of 20 percent spare branch circuit breakers with spaces, bus work, and terminations to complete the standard size panelboard
- Prepare panelboard schedules that include identification of the device powered by the branch circuit, protective device trip rating, number of poles (branch circuit breaker), load in volt-amps by phase, rating of main lugs or main circuit breaker, neutral bus size, ground bus size, and integrated short circuit rating of the panelboard
- Provide a separate panelboards for instrumentation and control (I&C) devices and field panels, if needed

13.6.10 Motor Control

Refer to 13.4.5 - Motor Control Schematic Diagrams for content, and prepare motor control diagrams per these requirements:

- Prepare elementary (ladder type) control diagrams for each motor showing wiring, pilot devices, auxiliary contacts and external connections. A single control diagram may be used for more than one motor having the same control.

- Use electrical symbols shown on the electrical legend sheet. Identify each component with a unique letter or name. Show wiring and devices inside the controller (motor starter or AFD MCC compartment or separate enclosure) with solid lines, and wiring and devices remote from the controller with dashed lines. Indicate the location of remote devices by symbol or description.

- Show remote control assemblies that have complex internal wiring as dashed rectangles. Identify only the interconnecting terminals or interface, and reference the location of the remote control assembly or who is responsible for the internal wiring.

13.6.11 Equipment Identification

Instrumentation and control (I&C) process and instrumentation diagrams (P&IDs) are required unless directed otherwise by the City. Use P&ID tag numbers for motors, I&C devices, and other process equipment shown on electrical drawings. Use this same numbering method to create unique tags for major electrical equipment.

If I&C P&IDs are not required, develop unique tag numbers for process, facility, and electrical equipment using abbreviations from the Abbreviations List on the Electrical Legend & Abbreviations Drawing and a unique number suffix as needed [for example, MCC, ATS or MTS, EF (exhaust fan), P1 (Pump No. 1), P2, etc.].

13.6.12 Raceways

Inside buildings and electrical control panels, route power, control, and instrumentation circuits in rigid galvanized steel conduits. Outdoors direct buried conduits, conduits under slabs, conduits concrete-encased in slabs, and conduits exposed in wetwells shall be:

- Schedule 40 PVC for power and 120-volt control circuits and fiber optic cables

- PVC-coated rigid steel for low control (less than 120V) and analog circuits

- Schedule 40 PVC for all exposed conduits in wetwells and channels

General guidelines for raceway sizing, selection, and installation are as follows:

- Base conduit sizing on THW insulated conductors

- Use these minimum conduit sizes:

    - 3/4-inch diameter for conduit installed exposed on walls and ceilings

- 3/4-inch diameter for conduit concealed in frame construction and finished ceilings
- 1-inch for conduit embedded in masonry, encased in concrete, and underground

- Route raceways exposed in process areas
- Use PVC-coated rigid galvanized steel conduit for the transition from underground direct burial PVC, underslab PVC, and concrete-encased PVC. The galvanized steel transition section shall extend from 1 foot below grade or top of floor slab or the last foot of conduit in the floor slab, to 6 inches out of the floor slab, concrete encasement, or above grade connection
- Limit the number of conduit bends to an equivalent of 270 degrees in long runs without pullboxes
- Identify underground conduit routes with nonmetallic warning tape underground above the direct buried conduits.

13.6.13 Wire and Cable

General guidelines for wire and cable are as follows:

- Use stranded copper conductors for all except lighting and receptacle wiring. Use solid copper conductors #10 AWG or #12 AWG for lighting and receptacle wiring.
- Use #14 AWG as the minimum conductor size for individual 120-volt control circuits.
- Use #12 AWG as the minimum conductor size for 120-volt control circuits routed in a common conduit with the power conductors to the motor circuit controls at the motor. Combine individual motor circuit power and control conductors in a common conduit up to a maximum power conductor size of #2 AWG.
- Under normal conditions, limit the maximum wire size to 500 kcmil. Use parallel conductors for circuits requiring greater capacity.
- Combine 120-volt control circuits in 600 volt multiconductor control cables containing multiple #14 AWG stranded copper conductors. Use control cables where grouping control circuits is practical and the number of individual wires exceeds six conductors. When selecting control cable size, provide 25 percent spare (plus or minus 10 percent) conductors.

13.6.14 Color Coding

Conductor insulation colors shall be as shown below:

System	Conductor	Color
All systems	Equipment grounding	Green
120/240 volts	Grounded neutral	White

Single-phase, 3-wire	One hot leg Other hot leg	Black Red
208Y/120 volts	Grounded neutral	White
3-phase, 4-wire	Phase A Phase B Phase C	Black Red Blue
240/120 volts	Grounded neutral	White
3-phase, 4-wire	Phase A	Black
Delta, center tap	High (wild) leg	Orange
Ground on single-phase	Phase C	Blue
480Y/277 volts	Grounded neutral	White
3-phase, 4-wire	Phase A Phase B Phase C	Brown Orange Yellow

13.6.15 Circuit Identification

Circuit names shall be based on the device or equipment at the load end of the circuit. The circuit shall be identified at each termination and in accessible manholes, handholes, and pull boxes. Use plastic sleeves for conductors #3 AWG and smaller, and plastic marker plates for larger conductors. For lighting and receptacle circuits, the panel and circuit number shall be identified at each luminaire and receptacle.

13.6.16 Enclosures

General guidelines for electrical equipment enclosure types are as follows:

- NEMA 1 – Equipment in electrical rooms and finished areas
- NEMA 12 – Equipment in dry industrial locations
- NEMA 4X (Type 316 Stainless Steel) – Equipment in wet and/or corrosive locations
- NEMA 7 –Equipment in Classified hazardous locations

13.6.17 Fiber-optic Cable

Where used, provide fiber optic cabling in 2-inch-diameter conduit, minimum, and provide large radius conduit bends to prevent breaking fibers in the fiber optic cable.

13.6.18 Grounding

Provide a ground ring around the building and stationary standby engine generator equipment pad or the electrical control panel equipment pad at the site. The ground ring shall consist of a #6 AWG bare copper ground wire and at least two ground rods. Connect conductors from the ground grid to each end of the MCC ground bus and the neutral of any 208Y/120-volt distribution transformer secondary. Ground rods shall be 3/4-inch in diameter by 10 feet long copper-clad steel installed 20 feet apart, minimum. If bedrock is

encountered, the ground rod must be installed by drilling a 4-inch-diameter hole and installing the ground rod in a graphite-based grout backfill material.

Provide a separate ground conductor sized in accordance with NEC requirements in raceways for power feeders and branch circuits for power, control, lighting and receptacle circuits.

13.6.19 Lighting

Provide interior and exterior areas with lighting. Interior lights shall include switched lights, emergency egress standby lights, and exit lights if required. Emergency standby and exit lights will each include a battery charger and battery. Exterior lighting shall include photocell-controlled or switched lights mounted on buildings near doors or on poles or structures. Design must comply with City standards and codes..

LED luminaires shall be used in all interior locations.Use“enclosed and gasketed” luminaires of non-metallic construction shall be used for applications in damp, wet, or corrosive locations or locations exposed to the weather and unprotected and shall be specified to be UL labeled “suitable for wet locations.”

LED luminaires shall be used for all exterior lighting. Luminaires shall be powered at 120 volts and controlled by a photocell. Exterior lighting shall have sharp cutoff shrouds to limit the migration of light. Exterior lighting shall be controlled by an ON/OFF/AUTO selector switch and roof- or wall-mounted photocell. In the AUTO mode, lights turn on at dusk and off at dawn via the photocell.

13.6.20 Street Lighting

13.6.20.1 General

As part of the public improvement process, a street illumination design shall be included with all project plans submitted to the City, as well as a power plan from the utility company providing the power. The street illumination design shall clearly show where the luminaires, conduit runs, junction boxes, service cabinets, and power sources will be located to provide the required illumination. Refer to ANSI/ IES RP-8 21/22 to determine lighting levels, fixture spacing, and uniformity based on road classification and pedestrian activity. th City of Bend dark sky standards. New streetlighting shall be correlated color temperature 3000 Kelvin,	**LED Watts**	**Pacific Power Level**

full cut off, backlight B1-2 depending on adjacent land use , uplight U0, Glare G2. If a design is not required the city standard is to use the Pacific Power or Central Electric standard luminaire for each street type as follows:**Street Type**		
Local	**25**	**Level 1**
Local Intersection	**36**	**Level 2**
Collector	**36**	**Level 2**
Collector Intersection	**71**	**Level 3**
Traffic Circle Small Radius	**99**	**Level 4**
Traffic Circle Large Radius	**126**	**Level 5**
Major 2 Lane	**71**	**Level 3**
Major-Major 2 Lane Intersection	**99**	**Level 4**
Major 4 Lane	**126**	**Level 5**
Major-Major 4 Lane Intersection	**165**	**Level 6**

13.6.20.2 Conduit Size

Conduits shall be sized according to the requirements of the NEC current edition.

All conduit runs shall be as direct from point to point as possible, shall remain within the rights-of-way, and maintain as straight an alignment as possible.

The minimum conduit size shall be one inch. All conduits under the roadway shall be a minimum of 2 inches in diameter. Conduits placed on Pacific Power utility poles will require ‘stand-off’ mountings and need to be specified in whole inch diameters. All conduit runs

shall be clearly indicated on the plans showing the route from the power source (typically a vault) to the street light.

A junction box shall be included at each end of roadway conduit crossings.

13.6.20.3 Conductor Size

A catalog cut sheet with maximum starting and operating amperages information shall be included in the plans submittal to verify the wire sizing calculations.

A circuit diagram and load calculations shall be included on the plan sheets at the end of the lighting construction drawings.

The maximum voltage drop shall be two percent from the utility to the service equipment and three percent from the service to the farthest load.

Any suitable method for calculating voltage drop and conductor sizes may be used. Provide reference to any source of information.

Junction boxes shall be placed near the base of each light pole. If the power source is within twenty feet of the street light, this junction box will not be required. All junction boxes used for the street lighting system shall have the words STREET LIGHTING displayed on the metal lid.

All electrical conductors shall be THWN with a minimum size of Number 12 AGW. A continuous, ground/bonding wire shall be used in all raceways (conduits) and sized according to the Code requirements.

SECTION 2-14

Instrumentation and Control Systems

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14 Instrumentation and Control Systems

14.1 Scope

This document is intended to provide guidance for pump stations, reservoirs, and other remote station facilities with process control functions. HVAC systems are exempt, except when required by the City Engineer.

14.2 Design Deliverables

14.2.1 Legend

Provide an I&C legend drawing to identify all P&ID symbols and abbreviations used on the project. The legend shall include at minimum all graphical symbols used for major equipment (pumps, motors, valves, instruments, vessels, etc.), a summary of flow streams used on P&ID process piping, a table to define the unit process numbers used on the project, a line legend to identify the uses of different line types on the P&IDs, and a table to identify all abbreviations used on the P&IDs (PLC, UPS, etc).

If a standard legend drawing is used, remove all symbols and abbreviations that are not applicable to the design. If new symbols or abbreviations are used on the drawings, add them to the legend and abbreviations.

14.2.2 Process and Instrumentation Diagrams

Provide complete P&IDs for the project. If multiple P&ID drawings are required, organize them by site, facility, or process. Show process flow from left to right.

P&IDs shall include the following minimum data:

- Major process components, vessels, and piping
- Equipment tags and descriptions for all major process components and vessels
- Flow stream identification on all process piping
- Flow directional arrows on all process piping
- Text next to each pump and motor to identify it as adjustable speed (AS) or constant speed (CS)
- Fail position of all valves (FO = fail open, FC = fail closed, FLP = fail last position)
- All major instruments identified by a tagname consisting of Instrument Society of America (ISA) instrument code, unit process number, and loop number (includes analytical, flow, level, pressure, and temperature instruments, as well as hand switches and indicating lights)
- Power supply voltage for all major process components, instruments, and panels
- Adjustable frequency drives

- All hand switches and indicating lights mounted on MCC bucket doors, control panels, and field control stations

- PLC I/O:

  - Use graphical symbols to differentiate between analog inputs, analog outputs, discrete inputs, and discrete outputs. Identify the I/O function with text (ON, FAIL, RUN, FLOW, PRESSURE, etc.)

  - Show signal lines between the I/O point graphical symbols and the interfacing field equipment. Use a different line type to differentiate between analog and discrete signals.

14.2.3 Process Control Functional Narratives

Provide written process control functional narratives to define all control system software functions to be programmed by the system integrator. Organize the process control functional narratives by site, facility, unit process and loop number. Include the following minimum information:

- Provide a written summary of the control loop operation, including field interlocks that affect software control of equipment

- Define all data to be displayed at the graphical interface, including but not limited to equipment status, alarms, and process variables

- Define all operator controls to be provided at the graphical interface, including user setpoints, selectors, and pushbuttons

- Define all calculations to be performed by the control system software

- Define all equipment software interlocks

- Define all alarms to be generated and displayed

- Identify the priority of all alarms generated by the system

- Define all data to be communicated between PLCs via networks or radio (peer data via message blocks)

14.2.4 PLC I/O List

Provide a list to summarize all PLC inputs and outputs associated with the project. For each control panel, summarize the quantity of each I/O type used on the project (# of analog inputs, # of analog outputs, # of 24VDC discrete inputs, etc). The list shall include the following minimum data:

- **Software tag –** Identify the software tag to be used in the graphical interface software. The software tag shall include the ISA component code or equipment abbreviation, unit process number, loop number and software function.

- I/O type

- AI for analog input
- AO for analog output
- DI-24 for discrete input, 24VDC
- DI-120 for discrete input, 120VAC
- DO–24 for discrete output, 24VDC
- DO-120 for discrete output, 120VAC
- ENT-AI for Ethernet-communicated analog input
- ENT-AO for Ethernet-communicated analog output
- ENT-DI for Ethernet-communicated discrete input
- ENT-DO for Ethernet-communicated discrete output

- **I/O module –** Identify the part number of the I/O module to which the point is wired
- **Description –** Provide a description of the equipment or system to which the I/O point is related. For example, “well pump 1,” “wetwell level,” or “pump 1 flow.”
- **ON state –** For discrete I/O points, provide a text description to identify the meaning of the point when it is energized in the software. For example, “RUN,” “HIGH,” “OPEN,” or “ON.”
- **OFF state –** For discrete I/O points, provide a text description to identify the meaning of the point when it is de-energized in the software. For example, “STOP,” “NOT HIGH,” “CLOSED,” or “OFF.”
- **Range –** For analog I/O points, provide the numerical range over which the value will change. For example, “0-100%,” “1-14 (pH)”, or “0-3000 gpm.”
- Physical location
  - **Rack –** The PLC rack in which the I/O module is located
  - **Slot –** The rack’s slot location of the module to which the I/O point is wired
  - **Point –** The point number on the module to which the I/O point is wired

14.2.5 Control System Block Diagram

If network or radio communications are used on the project, provide a control system block diagram to show connectivity of all communication system components, including network switches, media converters, communication modules, and terminating resistors. Identify the destination of communication lines that interface with the project components but are outside the project scope (for example, radio communications to an existing repeater). Distinguish between different types of communication media (fiber optic cable, CAT5 or

CAT6 copper, coaxial cable, etc.) using different line types or text. Identify all network addresses on the drawing, including station radio addresses and Ethernet network Internet Protocol (IP) addresses. Note that it may be necessary to coordinate with the City's IT staff for network address assignments.

14.2.6 Sample Loop Drawings

Detailed loop drawings shall be generated by the general contractor's system integrator based on samples provided in the design documents. Provide sample loop drawings to demonstrate City of Bend standard wiring concepts, drawing format, and level of detail. Major concepts to be included in the loop drawings include the following:

- I/O location, including PLC, rack, slot, point number, and I/O module part number
- Wire and cable tag
- Wire color
- I/O point software address, equipment description, and ON state description (for discrete I/O) or range (for analog I/O)
- Terminal block identifier and terminal number
- Associated circuit protection (circuit breakers and fuses)
- Analog signal cable shielding
- All associated terminations at PLC panel and field components

14.2.7 Instrument List

Provide an instrument list to identify the required parameters for all instruments associated with the project. Include the instrument type, instrument tag number, and loop description for all instruments, and organize the list by unit process and loop number. Provide the measurement range for all analog instruments. Provide initial setpoints or mounting elevations for all switches.

14.3 Design Criteria

14.3.1 Enclosures

14.3.1.1 General

Where enclosures contain voltages exceeding 120VAC, provide a main circuit breaker disconnect interlocked with the panel door. All enclosures shall be UL Listed.

14.3.1.2 Outdoor Application

Provide lockable stainless steel enclosures mounted on a shade structure for all outdoor applications. Include specification text requiring panel fabricators to provide enclosure temperature control for the following environmental conditions to protect temperature-sensitive components located inside the panel:

- Ambient temperature range: Minus 5-degrees F to 110-degrees F

- Protected from direct overhead mid-day sunlight and falling rain/snow by overhead shelter
- Exposed to wind, blowing rain, and blowing snow
- Exposed to morning and evening sun

Provide all operator indication and control devices on an inner door (behind the lockable door). At wastewater pump stations, a flashing alarm beacon shall be provided on top of the enclosure.

14.3.1.3 Indoor Application

Provide NEMA 12 enclosures in indoor dry locations. Provide NEMA 3R enclosures in normally dry indoor locations where pipe breakage could result in water spray onto the panel.

14.3.2 PLC I/O Special Requirements

14.3.2.1 Discrete Inputs

Use 24VDC for all discrete inputs.

14.3.2.2 Discrete Outputs

Use dry contact output modules dual rated for 24VDC and 120VAC. Use 24VDC for discrete outputs, where possible, but it is acceptable to use PLC discrete output module dry contacts in 120VAC motor control circuits.

14.3.2.3 Analog I/O

Use 4-20mA current signals for all PLC analog I/O.

14.3.2.4 Spares

Provide at least 25 percent spare points for each I/O type used. Provide a minimum of three spares for analog I/O types and eight spares for discrete I/O types.

14.3.3 Typical PLC I/O at Remote Station Facilities

14.3.3.1 Common I/O for All Remote Stations

Provide the following PLC I/O at all remote stations:

- DI: Utility Power FAILURE
- DI: 24VDC Power Supply FAILURE

14.3.3.2 Typical PLC I/O at Wastewater Lift Stations

Provide the following minimum PLC I/O at all wastewater lift stations:

- AI: Wetwell LEVEL
- AI: Lift Station Effluent FLOWRATE
- DI: Wetwell Level HIGH-HIGH

- DI: REMOTE control mode for each lift station pump
- DI: ON status for each lift station pump
- DI: FAIL status for each lift station pump

14.3.3.3 Typical PLC I/O at Freshwater Reservoirs

This shall include flow meters in and out. Provide the following minimum PLC I/O at all freshwater reservoirs:

- AI: Reservoir LEVEL

14.3.3.4 Typical PLC I/O at Freshwater Pump Stations

Provide the following minimum PLC I/O at all freshwater pump stations:

- AI: Pump Station Effluent FLOWRATE
- DI: REMOTE control mode for each lift station pump
- DI: ON status for each lift station pump
- DI: FAIL status for each lift station pump

14.3.3.5 Typical PLC I/O at Freshwater Wells

Provide the following minimum PLC I/O at all wastewater lift stations:

- AI: Well LEVEL
- AI: Well Effluent FLOW
- AI: Chlorine Residual
- DI: REMOTE control mode for each well pump
- DI: ON status for each well pump
- DI: FAIL status for each well pump

14.3.3.6 Typical PLC I/O at Pressure Monitoring Stations

Provide the following minimum PLC I/O at all pressure monitoring stations:

- AI: System PRESSURE

14.3.4 Tag Numbering

Provide tag numbers for all major process components and instruments. All tags shall include unit process number and loop number. Process component tags shall include a component code to identify the type of equipment (example: “P” for pump, “M” for motor). Instrument tags shall include the ISA code for the instrument type (“LSH” for high-level switch, “FIT” for flow indicating transmitter, etc.).

14.3.5 Network Communication

- **Variable frequency drives –** The City uses Ethernet for communication between variable frequency drives (VFDs) and PLC. Refer to the City's standard electrical specification for VFD requirements.

- **Media –** Use fiber optic cable where communication media is required to be routed outside a building or enclosure. Copper media (CAT6 cable, coax) is acceptable within a building or enclosure.

- **Radio –** The City uses radio for communication between remote sites and SCADA Central. Coordinate the approach for radio system design requirements, including radio pathway study, with the City's project manager.

14.3.6 Radio Pathway Study

Where not provided by the City, provide a radio pathway study to select and/or confirm a radio path for communication between the remote station and the central monitoring station or a repeater. The radio pathway study will confirm that radio communications can be successfully achieved with acceptable fade margin using the City's chosen frequency. The results of the pathway study will be used to determine radio system requirements including antenna height and signal routing (need for use of repeaters, etc.).

A radio pathway study is generally required only for remote stations with new radio links, unless the City is experiencing difficulty with existing radio communication or is planning to change radio frequency or signal routing.

14.3.7 Instruments and Components

14.3.7.1 Common Instrumentation for All Remote Stations

Use magnetic flowmeters for flow measurement.

14.3.7.2 Wastewater Lift Stations

Provide a submersible pressure transducer for wetwell level monitoring and control. Provide a float switch for high-high level alarming.

14.3.8 Testing Requirements

Testing of the instrumentation and controls for a project may include a factory demonstration test, functional testing, and performance testing.

The objective of the factory demonstration test is to confirm the process and instrumentation control system is operational before it is shipped to the project site. The scope of the factory demonstration test may include testing each control panel to confirm the fabricator's wiring and the panel functions; testing each control panel to confirm the fabricator's wiring between the panel's field terminals and the individual points on PLC I/O modules (for control panels with PLCs); testing the operation of communications between PLCs and remote I/O and between PLCs and computers (radio communication testing is not required). The testing shall be broken into two parts: unwitnessed factory testing and witnessed factory demonstration testing. The panel fabricator shall complete unwitnessed factory testing to find and correct problems before executing witnessed factory demonstration testing.

Functional and performance testing of the system will occur in the field. The objective of the field testing is to confirm that the entire process and instrumentation control system, operating with actual field equipment and final control system software configuration, provides the functions defined in the design documents. The scope of field testing may include testing of entire process and instrumentation control system, including but not limited to instruments, control panels, PLCs, computers (HMI workstations, servers, etc), control system software, networks, and radio communication.

The objective of functional testing includes checking installation of process and instrumentation control system components and systems to make sure they are ready for operation, calibration of instruments, adjustment of valves, testing of field wiring and software addressing for all PLC I/O, and testing the communication network functions.

The objective of performance testing is to test the control system software functions (perform testing to confirm that all automated monitoring and control functions operate as intended), tune loops, and make final adjustments to automated monitoring and control parameters.

The design engineer shall provide the specifications required for a project that specify the project-specific testing requirements.

PART III

Special Provisions to the Oregon Standard Specifications

CITY OF BEND

Project Name

City Project No.

Technical and Supplemental Specifications

City of Bend
710 NW Wall Street, Bend, Oregon 97703

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TECHNICAL SPECIFICATIONS

Boiler Plate changes from ODOT to 2021 Oregon Standard Specifications for construction are considered Special provisions when Added to Volume II Bidding and Contract Documents.

2021 Oregon Standard Specifications for Construction

Available from the ODOT website:

https://www.oregon.gov/odot/Business/Pages/Standard_Specifications.aspx

EXHIBIT A

Special Provisions for the Technical Specifications for the 2021 Oregon Standard Specifications for the Construction (OSS) – Technical Specifications

CITY OF BEND

SPECIAL PROVISIONS

FOR

(Fill in the blanks. Remove underlines, parentheses, and all instructions when finished.)

_____ (Project Name)_____
City Project No. (######)

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature	I certify the Special Provision Section(s) listed below are applicable to the design for the subject project for __(list specific design elements, i.e. "Bridge XYZ" or "Traffic Signals")__ . Modified Special Provisions were prepared by me or under my supervision. Section(s) ____(fill in section number(s) here)_____
Date Signed: _____	

(To add more POR signature sheets do the following:

1. ***Complete the project information above the Professional of Record Certification.***
2. ***Turn off Track Changes and turn on "Show/Hide" by selecting ¶ from the toolbar above.***
3. ***Highlight the entire text from the page, including the "Section Break" and the ¶ from the next page then select "copy".***
4. ***Go to the last POR page and place the cursor at the ¶ line then select "paste".***
5. ***Continue the paste process until you have enough POR signature sheets.***
6. ***Turn Track Changes back on then complete the signature page.)***

PART 00200 – TEMPORARY FEATURES AND APPURTENANCE

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00210 - Mobilization

Comply with Section 00210 of the Standard Specifications modified as follows:

00210.40 Mobilization DELETE the bullet item that begins "Obtaining and maintaining…" and REPLACE with the following bullet item:

Obtaining and maintaining access to the City of Bend's Online Permit Center Portal and using said portal to submit documents according to 00170.08.

00210.90 Payment DELETE the paragraph that begins "No separate or additional payment will…" and REPLACE with the following paragraph:

No separate or additional payment will be made for any costs associated with obtaining and maintaining access to the City of Bend's Online Permit Center Portal or the use of said portal.

End of Section

Section 00215 – Utility Conflict Resolution

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00215, which is not a Standard Specification, is included in the Project by Special Provision.

Description

00215.00 Scope – This work consists of extra work and delay caused by unanticipated utilities not shown in the plans and not marked through the Oregon Utility Notification Center that impacts construction progress. This section also covers extra work necessary to meet the requirements of OAR 333 where minimum water and sanitary sewer separation cannot be met. This work is to resolve unforeseen utility conflicts, including the removal, relocation, or mitigation of utility conflicts, manmade buried objects, or other unforeseen items, as approved by the Engineer.

Construction

00215.40 Utility Conflict Resolution – Notify the Engineer upon identification of any unanticipated utility conflicts prior to performing work requiring additional payment. Work performed prior to notifying the Engineer will not be subject to payment.

Measurement

00215.80 Measurement – No measurement of quantities will be made for Utility Conflict Resolution.

Payment

00215.90 Payment – The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Utility Conflict Resolution	Force Account

Item (a) will be paid on a Force Account basis in accordance with Section 00197 up to the contract allowance price and will include full compensation for furnishing all labor, materials, permits, tools and equipment required to complete the Work, as directed by the Engineer, and no additional compensation will be allowed therefor.

No separate or additional payment will be made for extra work for temporary facilities to meet the requirements of OAR 333.

End of Section

Section 00220 - Accommodations for Public Traffic

Comply with Section 00220 of the Standard Specifications modified as follows:

(Use the following subsection .02(a) when any of the following bullets are included in the project special provisions. Delete "(s)" or parentheses, as applicable.)

00220.02(a) General Requirements –

Replace the bullet that begins “Do not stop or hold vehicles…” with the following:

(The stop or hold duration may be increases up to 20 minutes with approval from the Engineer. 5 minutes is the default unless otherwise approved.)

- Do not stop or hold vehicles within the work zone for durations longer than allowed in the approved traffic control plan.

Add the following bullet(s) to the end of the bullet list:

- Notify the Engineer a minimum of 7 Calendar Days prior to activating any traffic control changes. Include contact information for the TCS and Site Manager in the notice.

- Temporary steel plating is not allowed between November 1st and March 1st. Removal all steel plates 24-hours prior to a forecasted snow event of greater than 1 inch.

(Use the following bullet when the pre-construction speed is greater than 35 mph and there is trench excavation or other excavation work to be performed.)

- When performing trench excavation or other excavation across or adjacent to a Traffic Lane on a roadway having a pre-construction posted speed greater than 35 mph, backfill the excavation, install surfacing, and open the roadway to traffic by the end of each work shift. Install a "BUMP" (W8-1-48) sign approximately 100 feet before the backfilled area and a "ROUGH ROAD" (W8-8-48) sign approximately 500 feet ahead of the "BUMP" sign. If this requirement is not met, maintain all necessary lane or shoulder closures and provide additional TCM, including flagging, at no additional cost to the Agency. Do not use temporary steel plating to reopen the roadway.

(Use the following bullet when any of the following apply:

- ***A new temporary or permanent STOP sign is installed at an intersection.***
- ***Modifications are made to lane configurations, lane assignments or roadway geometry that affects traffic patterns.***
- ***A permanent traffic signal is being installed or modified.***

- Before activating a modified traffic signal, revising lane usage, implementing new roadway geometry, or removing a "STOP" sign, protect traffic by installing "NEW TRAFFIC PATTERN AHEAD" (W23-2) signing according to 00222.40. Keep the signs in place for 30 Calendar Days after completing the modifications.

(Use the following bullet when excavation or paving creates an abrupt edge.)

- When excavation or paving operations create an abrupt edge, protect traffic by installing "ABRUPT EDGE" (CW21-7) signs every 500 feet.

(Use the following bullet any time traffic queues are expected to develop within proximity of a railroad crossing. Include Standard Drawing TM850.)

- When flagging operations may extend traffic queues onto the railroad crossing, protect traffic at the intersection of _____ and _____ by providing an additional flagger. Position additional flagger signs according to the "Advance Flagger for Extended Traffic Queues" configuration shown on the Standard Drawings. Do not allow traffic to stop on the railroad crossing.

00220.02(b) Temporary Pedestrian Accessible Route Plan – Delete the bullet that begins “For intersection Work…”

Replace the bullet that begins “Limit pedestrian detour…” with the following:

- Limit pedestrian detour lengths to the shortest available accessible route.

Add the following bullet:

- Limit closure of pedestrian facilities to the duration established in the pre con schedule.

(Use the following subsection .03(b) when public access(es) to a floatable natural waterway has been identified. Originated from HB2835 (2019). Delete "(s)" or parentheses, as applicable.)

00220.03(b) Closures - Add the following bullet*(*s*)* to the end of the bullet list:

- **Floatable Natural Waterway** - A minimum of 35 Calendar Days before restricting or closing the public access site(s), listed below:

(Fill in the blank with the appropriate public access location(s) information and include “as shown” if the access is shown on the Plans. Repeat the bullet as necessary to list all locations. Delete parentheses and the words in the parentheses as needed.)

- **Public Access Location** - _____ *(*as shown*)*.

Submit to the Engineer, in writing, when the closure(s) or restriction(s) have ended.

00220.03(b) Closures – Replace the bullet that begins "**Pedestrian Facilities –** A minimum of 14 Calendar Days…" with the following bullet:

- **Pedestrian Facilities** - A minimum of 72 hours before closing a sidewalk, Multi-Use Path, or other pedestrian facility. After receiving written approval, provide 48 hours' public notification before the closure.

Replace the bullet that begins "**Bicycle Facilities –** A minimum of 14 Calendar Days…" with the following bullet:

- **Bicycle Facilities** - A minimum of 72 hours before closing a bicycle lane. After receiving written approval, provide 48 hours' public notification before the closure.

Add the following paragraph to the end of the subsection:

Provide a minimum of 48 hours' notice to occupants of properties fronting a street where more than half the street will be closed to vehicular traffic. Coordinate street closure with all affected individuals and public agencies.

(Use the following subsection .40(e)(1) only when modifying closed lane restrictions. Fill in the blanks with the street name to be closed followed by the closure limits. Copy and paste the paragraph and bullet list as necessary for additional roads.)

00220.40(e)(1) Closed Lanes - Replace this subsection, except for the subsection number and title, with the following:

One or more Traffic Lanes may be closed on _____ between _____ and _____ when allowed, shown, or directed during the following periods of time except as specified in 00220.40(e)(2):

- _____

00220.40(e)(2) Opened Lanes – Replace the sentence that begins "Keep all Traffic…" with the following paragraph:

Maintain two-way traffic at all times unless otherwise allowed. Streets shall remain open for two-way traffic at all times when the Contractor is not performing work unless otherwise allowed. Maintain access to approaches to all properties except for short periods necessary for the progress of the construction. Keep all Traffic Lanes and pedestrian facilities open during the following periods:

(Use the following subsection .40(e)(2)(b) to list special events. List the names, times, and dates of the events.)

00220.40(e)(2)(b) Special Events - Add the following to the end of this subsection:

The following special events will occur during this Project:

- _____

(Use the following lead-in paragraph and subsection .40(f) when blasting, erecting bridge girders, erecting sign structures, or conducting other short duration work that can be done in periods not exceeding 20 minutes. Add applicable items and delete non-applicable items in the first sentence. Do not change the subsection alpha character (keep it "(f)".)

Add the following subsection:

00220.40(f) Limited Duration Road Closure - The Contractor will be permitted to close all Traffic Lanes for periods not to exceed 20 minutes in duration during blasting or erecting Bridge girders and sign structures over the Traffic Lanes or _____. This Work will only be permitted between the hours of _____ and _____ on ___(street name)___.

Succeeding roadway closures will not be allowed until traffic clears from a preceding closure.

(Use the following subsection .60(a)(1) when construction is anticipated in winter months)

00220.60(a)(1) Contractor Responsibility – Add the following paragraph and bullets to the end of the subsection:

Provide snow and ice removal for all streets with traffic control or channeling devices deployed within a travel lane and all streets where the existing pavement has been disturbed according to the following:

- Maintain a map showing snow removal boundaries and submit the map to the Engineer a minimum of 24-hours prior to a forecast showing snow accumulation exceeding 2 inches.
- When directed, provide snow and ice removal when accumulations exceed 2 inches on arterial and collector streets and 6 inches on local streets.
- Plow streets from curb to curb, or edge of pavement to edge of pavement where no curbs exist. Use equipment designed for such plowing including road graders, front end loaders, truck-mounted plows. Provide lights and beacons and appropriate signage for operating on public roads. Broadcast crushed basalt traction material on post-plowed surfaces in accordance with current City standards. Keep storm drains clear of snow and ice.
- Push the snow toward the side of the street. Minimize blocking of driveways and burying sidewalks. Do not push snow into natural surface bodies of water.
- Damage to public or private property caused by the Contractor's snow removal will be repaired at the Contractor's expense.

(Only use the following subsection 00220.90 modification and the added subsection 00220.91 below in conjunction with 00220.60(a)(1) above when construction is anticipated in winter months and the contractor will be responsible

for clearing of snow. To clarify, if there is no responsibility of the contractor to remove snow, do not modify 00220.90 as shown below nor add the 00220.91 section.)

00220.90 Payment – Replace the first sentence of this subsection, with the following:

No separate or additional payment will be made for Work performed under this Section, unless as identified in subsection 00220.91 or Pay Items are provided under other Sections.

Add the following subsection

00220.91 Payment Other Items

The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Snow Removal	Force Account

Item (a) will be paid on the Force Account basis in accordance with Section 00197 up to the contract allowance price and will include full compensation for furnishing all labor, materials, permits, tools and equipment required to complete the Work. Snow removal must be directed by the Engineer. Work performed without written authorization may not be subject to payment.

End of Section

Section 00221 - Common Provisions for Work Zone Traffic Control

Comply with Section 00221 of the Standard Specifications modified as follows:

(Use the following subsection .06 when traffic is anticipated to be stopped or held under flagging. Work with the City PM to determine the appropriate duration based on traffic volumes and site conditions. In no case shall the duration exceed 20 minutes.)

00221.06 Traffic Control Plan – Add the following sentences after the sentence that begins "The Contractor will…":

Traffic will be permitted to be stopped or held under flagging for ___ minutes within the work zone.

00221.40 General – Add the following paragraph to the end of the subsection:

In addition to the roles having authority per Section 00150, the City of Bend Street Maintenance Supervisor and uniformed police officers, have authority to orally temporarily suspend work for failure to maintain traffic control devices.

(Work with the City PM to determine the appropriate measurement and payment method for the project. Generally, Method "A" is best suited for projects with complex, multiphase, traffic control plans that are likely to require adjustment during construction. Method "B" is best suited for projects with well-defined traffic control plans at a single location. Method "C" is best suited for projects with minor traffic controls impacts not affecting lanes of travel or requiring pedestrian detours.)

End of Section

Section 00222 – Temporary Traffic Control Signs

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00222 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00222 of the Standard Specifications modified as follows:

(Use the following subsection .40(e) when adding any of the following temporary signs.)

00222.40(e) Temporary Sign Placement - Add the following to the end of the bullet list:

(Use the following bullet when it is necessary to reduce the overall roadway width between positive barriers [for example: concrete barrier, guardrail, and falsework] to less than 19 feet.)

- When the horizontal clearance for the Roadway is less than 19 feet, install horizontal clearance (CW21-12-48) signs, identifying the narrowest width of the Roadway. Locate these horizontal clearance signs as shown or as directed.

(Use the following bullet when it is necessary to reduce the overall vertical clearance to less than 15 feet 6 inches.)

- When the vertical clearance is less than 15 feet 6 inches, install low clearance (W12-2-48) and (OW12-2-36) signs. The clearance shown on the signs shall be 4 inches less than the shortest height of the opening. Locate these low clearance signs as shown or as directed.

(Use the following bullet on urban projects where there is an existing bike lane, designated "Bicycle Route", or when a significant volume of bicycle traffic can be expected and is required to use the travel lane.)

- When construction requires bicycles to use the Traffic Lanes, install a "Bicycle ON ROADWAY" (CW11-1) symbol sign on 1/2 mile spacing through the affected area. Keep the signs in place until completion of the Shoulder or bikeway final surface.

00222.41(e) Perforated Steel Square Tube Sign Supports – Replace the subsection except for the subsection number and title, with the following:

Perforated steel square tube sign supports may be used as a substitute for wood sign posts. Sign supports mounted on existing sidewalks, curbs, or other concrete surfaces are subject to approval by the engineer prior to installation. Surface mounted signs are not preferred. The engineer may evaluate surface mounted sign application on a location by location basis. If approved, the contractor shall repair the mounting location at the time of sign removal to the satisfaction of the engineer.

End of Section

Section 00223 - Work Zone Traffic Control Labor and Vehicles

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00223 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00223 of the Standard Specifications modified as follows:

00223.23 Automated Flagger Assistance Device - In the sentence that begins "Submit the following information…", replace the words "21 Calendar Days" with the words "14 Calendar Days ".

00223.80(b)(1) Flaggers – Add the following paragraph to the end of the subsection:

Flaggers not approved by the Engineer or included on the approved traffic control plan and schedule will not be measured for payment.

End of Section

Section 00224 - Temporary Traffic Channelizing Devices

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00224 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00224 of the Standard Specifications modified as follows:

(Use the following subsections, .47 and .80, when spare traffic channelizing devices are required to be kept on-hand for traffic control adjustments. Include quantity of spare items in the applicable bid item.)

Add the following subsection:

00224.47 Spare Devices – Stockpile the following quantity of spare temporary traffic channelizing devices on site to allow for quick traffic control adjustments:

(Add bullets as necessary to identify all spare devices.)

- *(*Insert device type*)* - *(*quantity*)*

Spare devices must remain on site for the entire project duration.

00224.80 Measurement – Add the following to the end of the bullet list:

- Spare devices identified in 00224.47 in addition to the bullets above. Spare device quantity will be measured upon delivery to the project site.

End of Section

Section 00225 - Temporary Pavement Markings

Comply with Section 00225 of the Standard Specifications.

End of Section

Section 00226 - Temporary Roadside Barriers and Impact Attenuators

Comply with Section 00226 of the Standard Specifications.

End of Section

Section 00228 - Temporary Pedestrian and Bicyclist Routing

Comply with Section 00228 of the Standard Specifications modified as follows:

00228.00 Scope - Replace this subsection, except subsection number and title, with the following:

In addition to the requirements of Section 00221, this Work consists of furnishing, installing, operating, maintaining, inspecting, and removing temporary devices for accommodating pedestrians and bicyclists through a work zone.

00228.80(a) Length Basis - Replace this subsection, except subsection number and title, with the following:

Pedestrian channelizing devices and bicycle channelizing devices will be measured on the length basis upon delivery to the Project. The quantities will be limited to those in the approved TCP.

End of Section

Section 00231 - Temporary Access Road

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general do not re-number or re-letter subsections when item(s) are deleted.)

Section 00231, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00231.00 Scope - This Work consists of constructing, maintaining, and removing temporary, unpaved access roads for the use of Contractor and Agency Equipment and personnel as needed, shown, or directed.

Materials

00231.11 Geotextile - Furnish subgrade geotextile, embankment geotextile, or riprap geotextile, at the Contractor's option. Geotextile shall meet the requirements of Section 02320, with documentation according to 02320.10(c).

00231.12 Road Material - Furnish crushed Aggregate Base, stone embankment, or other suitable granular material capable of supporting the weight of Equipment intended to use the temporary access road.

Construction

00231.41 Clearing - Clearing brush and vegetation for temporary access roads is allowed in the areas shown or where directed. Preserve and protect trees as shown or directed.

00231.42 Temporary Access Road - Construct temporary access roads to the width, grade, profile, and depth of base sufficient to support the weight of Equipment using the road.

00231.43 Not for Public Traffic - Do not direct or allow Public Traffic to use temporary access roads constructed according to this Section.

(Use the following subsection .44 when it is anticipated that the ground occupied by a temporary access road will later support permanent embankment. Check with the designer.)

00231.44 Verification of Subgrade - In areas where permanent earthwork construction is required on ground that has been occupied by a temporary access road, rework or replace unstable Materials to avoid and correct, according to 00330.40(c), excessive stress or strain that could be detrimental to the subgrade.

00231.45 Verification of Original Ground – Perform a proof roll on the original ground, in the presence of the Engineer, before beginning construction of the temporary access road and after removing it. If the post-removal proof roll indicates the original ground has been weakened by construction activities, or the presence or use of the temporary access road, correct the deficient condition in an approved manner and at no additional expense to the Agency.

Maintenance

00231.60 Surface Maintenance - Maintain temporary access roads so that the road surfaces remain firm, smooth, free of ruts or standing water, and are graded to prevent concentrations of runoff water. Promptly remove accumulations of mud or debris.

Finishing and Cleaning Up

00231.70 General - When a temporary access road is no longer needed, do the following:

- Remove all Materials.
- Restore areas occupied by the temporary access road to the original ground contours or as directed.
- Apply permanent seeding to the area occupied by the temporary access road according to Section 01030.
- Dispose of excess materials according to 00330.41(a)(5).

Measurement

00231.80 Measurement - Except for landscape restoration, no measurement of quantities will be made for Work performed under this Section.

Landscape restoration will be measured according to 01030.80 or 01040.80 as applicable.

Payment

00231.90 Payment - The accepted quantities of Work performed under this Section, except for permanent seeding work, will be paid for at the Contract Lump Sum amount for the item "Construct and Remove Temporary Access Road".

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for maintenance, removing and disposing of temporary access road materials, or for restoring the areas to original ground contours.

Landscape restoration Work will be paid for according to 01030.90 or 01040.90 as applicable.

End of Section

Section 00270 - Temporary Fences

00270.40 Construction - In addition to the requirements of Section 00270.40 and the Specifications, add the following:

No temporary fences or barriers are permitted within existing right-of-way or public access easement without proper permits or approval by the Private Development City Engineer. Where approved, a Revokable Agreement may be required.

Comply with Section 00270 of the Standard Specifications.

End of Section

Section 00280 - Erosion and Sediment Control

(This Section is not required for projects with no ground disturbance. Include this Section for all other projects.)

Comply with Section 00280 of the Standard Specifications modified as follows:

(Use the following subsection .00 on City projects that involve 5,000 square feet or more of land disturbance.)

00280.00 Scope - Add the following three paragraphs to the end of this subsection:

When applicable, obtain an NPDES 1200-C Permit from the Oregon Department of Environmental Quality for the Project or phase.

When applicable, comply with the WPCF UIC Permit or rule authorization requirements in its absence. Copies of any local or state agency/government permit(s) are available from the permitted agency/government and may be more stringent than these Specifications.

For projects disturbing 5,000 or more square feet of land, comply with erosion control requirements in the City of Bend's Municipal Separate Storm Sewer System Permit and Bend Municipal Code Title 16, including erosion control inspection and enforcement by City staff and obtain a grading permit when applicable.

00280.05 Erosion and Sediment Control Plan on Non-Agency Controlled Lands – Replace the bullet that begins "A Contractor-developed ESCP…" with the following bullet:

- A Contractor-developed ESCP for each unique site covered under applicable Federal, state, or local permits or regulations.

(Use the following subsection .15(f)(1) when compost filter socks are required. Fill in the blank with the diameter of the filter sock. Obtain information form the Erosion Control Designer.)

00280.15(f)(1) Filter Sock Material - Add the following sentence to the end of this subsection:

Furnish filter sock material with a diameter of ____ inches.

00280.30 Erosion and Sediment Control Manager –
Replace the paragraph that begins with "If the Agency's NPDES…" with the following paragraph:

If the project will have more than 5,000 sf of land disturbances, designate and provide an ESCM who possesses a valid DOT ESCM certificate or who has successfully completed a recognized erosion control certification in the State of Oregon such as Certified Erosion and Sediment Control Lead (CESCL).

Replace the bullet that begins “Monitor water quality…” bullet with the following bullet:

- Monitor water quality in receiving streams and UICs in the vicinity of the Project Site.

Add the following paragraph after the paragraph that begins “Provide the ESCM name…”:

The ESCM, or designee, must be able to respond to the site within 90 minutes of notification during storm events.

00280.41 (a) Disturbance Limits- Add the following sentence to the end of the subsection:

Protect post-construction stormwater facilities, unless used during construction as sediment trap, in which case repair according to 00280.46(h).

00280.41(c) Wet Season Work and Temporary Work Suspension – Add the following paragraph to the end of the subsection:

Wet season work is defined as work between October 1 and June 30.

00280.42(a) Soil Exposure Limitations – Replace this subsection, with the following:

Soil Exposure Limits: Stabilize all areas within 10 days of exposure.

00280.42(b) Temporary Stabilization –

Replace the first bullet with the following:

- Every 10 days, or more frequently as needed or directed.

Delete the bullet that begins “Upon approval, active…”.

00280.63(c) Paved Areas – Add the following sentence to the end of the subsection:

Street washing is not permitted.

00280.70 Removal – Add the following paragraph to the end of the subsection:

The cost of damage to public right-of-way or private property resulting from not removing erosion control materials will be at the Contractor’s expense.

End of Section

Section 00290 - Environmental Protection

(Modify these subsections only for site specific conditions.)

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00290 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00290 of the Standard Specifications modified as follows:

(Use the following subsection .20(c)(2) only when Section 00294 is included in the Special Provisions.)

00290.20(c)(2) Clean Fill - Add the following paragraph to the end of this subsection:

Manage all excavated soil that does not meet the definition of clean fill according to Section 00294.

00290.20(c)(3)(a) Burnable Materials – Delete this subsection.

00290.20(c)(3)(b) Woody Matter – Delete this subsection

00290.30(a)(1) General – Replace the bullet that begins "Comply with the…" with the following bullet:

- Comply with the erosion prevention and sediment control requirements of Section 00280, City of Bend, and all applicable DEQ NPDES 1200c Permit requirements.

(Use the following lead-in paragraph and subsection .30(a)(7) when there is work in, adjacent to, or over a Regulated waterway, even if there is no direct in-water work. Modify as needed for site-specific circumstances and project-specific permit conditions. Obtain information from the Environmental Coordinator.)

Add the following subsection:

00290.30(a)(7) Water Quality:

- Do not discharge contaminated or sediment-laden water, including drilling fluids and waste, or water contained within a work area isolation, directly into a drywell, drillhole, active storm drainage pipe, and/or any waters of the State or U.S..
- Do not use permanent stormwater quality treatment facilities to treat construction runoff unless prescribed by an ESCP approved under Section 00280.
- If construction discharge water is released using an outfall or diffuser port, do not exceed velocities more than 4 feet per second, and do not exceed an aperture size of 1 inch.

- Do not use explosives under water.
- Implement containment measures adequate to prevent pollutants or construction and demolition materials, such as waste spoils, fuel or petroleum products, concrete cure water, silt, welding slag and grindings, concrete saw cutting by-products and sandblasting abrasives, from entering a storm drainage system and/or waters of the State or U.S.
- Implement containment measures adequate to prevent flowing stream water from coming into contact with concrete or grout within the first 24 hours after placement.
- Do not end-dump riprap into the waters of the State or U.S. Place riprap from above the ordinary high water line.
- Cease Project operations under high flow conditions that may result in inundation of the Project area, except for efforts to avoid or minimize resource damage.
- The Engineer retains the authority to temporarily halt or modify the Work in case of excessive turbidity or damage to natural resources.
- If Work activities violate permit conditions or any requirement of this subsection, stop all in-water work activities and notify the Engineer.

(Add the following bullet if turbidity monitoring is not required.)

- Do not cause a visible sediment plume in waters of the State or U.S.

(Use the following lead-in paragraph and subsection .30(a)(8) when turbidity monitoring is required during in-water work. Use one of the following three options as instructed below. Delete the options that do not apply. This subsection must be modified for consistency with applicable regulatory approvals including but not limited to: Clean Water Act Section 401 water quality certification, a programmatic or individual biological opinion, and any applicable local approvals. If necessary, check with Regional Environmental Coordinator for correct one to use.)

Add the following subsection:

[Option 1 - Use the following subsection when visual turbidity monitoring is required during in-water work, but the project does not have a Clean Water Act 401 water quality certification.]

00290.30(a)(8) Visual Turbidity Monitoring - In addition to any turbidity monitoring required by 00280.62(c) to comply with NPDES 1200 series requirements, monitor turbidity visually during in-water work according to the following:

- Before beginning Work, make up-current and down-current in stream turbidity observations.
- Every four hours, make observations at an up-current location outside the influence of the Project, and at a down-current location that indicates any turbidity caused by the Project.
- Document all turbidity monitoring observations including date, time, and location on form 734-2755, “Turbidity Monitoring Form” or another form approved by the Agency. Submit reports to the Engineer weekly during in-water work and keep copies of the reports at the Project Site.

- If a down-current turbidity plume is observed, modify work procedures and repair or implement in-water best management practices (BMP). If a turbidity plume is still observed at the next four-hour observation, stop all in-water work and repair or implement additional BMP. Resume in-water work when there is no longer a visible turbidity plume.

[End Option 1]

[Option 2 - Use the following subsection when meter turbidity monitoring is required during in-water work by a Clean Water Act 401 water quality certification.]

00290.30(a)(8) Meter Turbidity Monitoring - In addition to any turbidity monitoring required by 00280.62(c) to comply with NPDES 1200 series requirements, monitor turbidity using a turbidity meter every two hours during in-water work according to the following:

- Use a turbidity meter that has been maintained and calibrated according to the manufacturer's specifications.
- Measure stream turbidity before beginning each day's in-water work to establish pre-construction turbidity levels.
- Measure up-current and down-current turbidity at two-hour intervals during in-water work and perform work based on turbidity measurements according to the following:
- Take up-current samples at a location representative of background turbidity approximately 100 feet from the in-water work area.
- Take down-current samples at a location approximately 100 feet from the in-water work area at approximately mid-depth of the water body and within any visible turbidity plume.
- If the down-current reading is less than 5 nephelometric turbidity units (NTU) higher than the up-current reading, continue to work and take readings every two hours.
- If the down-current reading is greater than or equal to 5 and less than 30 NTU higher than the up-current reading, modify work procedures and repair or implement best management practices (BMP), continue work, and continue to take readings every two hours. If after four hours the down-current reading is still greater than or equal to 5 NTU higher than the up-current reading, stop all in-water work and repair or implement additional BMP. Resume in-water work activities only after the down-current reading is less than 5 NTU above the up-current reading.
- If the down-current reading is greater than or equal to 30 and less than 50 NTU higher than the up-current reading, modify work procedures, repair or implement BMP and continue work. If, at the subsequent two-hour reading, the down-current reading is still more than 30 NTU higher than the up-current reading, stop all in-water work and repair or implement additional BMP. Resume in-water work activities only after the down-current reading is less than 5 NTU above the up-current NTU reading.
- If the down-current reading is 50 NTU or more higher than the up-current reading, stop all in-water work, repair or implement additional BMP, and inform the Agency. Resume in-water work activities only after the down-current reading is less than 5 NTU above the up-current NTU, as determined by continued readings made at least every two hours, or the next day's initial turbidity reading.
- Document all turbidity monitoring observations on form 734-2755, "Turbidity Monitoring Report", or another form approved by the Agency. Submit reports to the Engineer weekly during in-water work and keep copies of the reports at the Project Site.

[End Option 2]

[Option 3 - Use the following subsection when customized turbidity monitoring specifications are required that are not accommodated by the first two options, such as projects covered by a SLOPES or individual biological opinion, or an individual Clean Water Act 401 water quality certification with non-standard conditions.]

00290.30(a)(8) Turbidity Monitoring - In addition to any turbidity monitoring required by 00280.62(c) to comply with the NPDES 1200 series permit requirements, perform turbidity monitoring during in-water work according to the following:

(Insert permit turbidity monitoring frequency and requirements here. Only include project specific information. Use bullets to list information. Write in imperative mood and write in plain language.)

- _____
- _____

[End Option 3]

(Use the following subsection .34 when fish or fish habitat resources require protection. Modify as needed for site-specific conditions. Check to make sure applicable and consistent with project permit conditions. Obtain information from the Environmental Coordinator.)

00290.34 Protection of Fish and Fish Habitat - Add the following paragraph:

Meet with the Agency Biologist, Resource Representative, Engineer, and inspector on site, before moving equipment on-site or beginning any work, to ensure that all parties understand the locations of sensitive biological sites and the measures that are required to be taken to protect them.

(Use the following subsections .34(a) when regulated work areas are required. Fill in the blanks as necessary. Obtain information from the Environmental Coordinator.)

00290.34(a) Regulated Work Areas - Add the following to the end of this subsection:

(Use the following three options as instructed below. Delete any options that do not apply.)

[Option 1 - Use the following paragraph when the Agency will delineate the regulated work area on the plans]

The regulated work area is the area at or below the ordinary high water (OHW) elevation shown on the plans.

[Option 2 - Use the following paragraph when the Agency will identify and mark the regulated work area in the field.]

The regulated work area is defined as the area at or below the ordinary high water (OHW) elevation. The Engineer will identify and mark the regulated work area.

[Option 3 - Use the following paragraph when the Agency will NOT identify and mark the regulated work area in the field. Fill in the blanks. If the project has any gradient change through the project area, the elevation could be different from station to station. If gradient is significant this option should not be used.]

The regulated work area is the area at or below _____ feet elevation and between stations _____ and _____.

[End Options]

(Delete the following paragraph if it does not apply. Fill in the blanks with dates.)

Perform work within the regulated work area only during the in-water work period. The in-water work period is from ___(date)___ to ___(date)___.

(Delete the following paragraph if it does not apply. Fill in the blank.)

The total volume of material filled or discharged into waters of the State and waters of the U.S. shall not exceed ____ cubic yards.

(Delete the following paragraph if it does not apply. Fill in the blank.)

The total volume of material excavated from the waters of the State and waters of the U.S. shall not exceed _____ cubic yards.

Submit a schedule to complete all work within the regulated work area within the in-water work period at least 10 days prior to the preconstruction conference.

(Use the following subsection .34(b) when regulated work areas are required. Fill in the blanks as necessary. Delete what does not apply. Obtain information from the Environmental Coordinator.)

00290.34(b) Prohibited Operations - Add the following to the end of this subsection:

- Allow entry within the regulated work area or between stations _____ and _____.

(Use the following subsection .51 when there are known sensitive cultural sites on the project.)

00290.51 Protection of Sensitive Cultural Sites - Add the following to the end of this subsection:

(Fill in the blank with the number of sensitive cultural sites. Select either "sites were" or "site was" depending on the number of sites. Delete the language in orange parentheses that does not apply and delete all orange parentheses.)

There are sensitive cultural sites or areas of high probability for cultural resources on this Project. At the time of preparation of the Plans, _____ *(*sites were*) (*site was*)* identified.

(Use the following paragraph if an Inadvertent Discovery Plan is required for the project.)

An Inadvertent Discovery Plan (IDP) has been developed for this project. The IDP is available from the Engineer.

(Use the following paragraphs and bullet list when sensitive cultural sites require protection during construction.)

Meet with the Engineer at least 10 Calendar Days prior to beginning ground disturbing activities to discuss sensitive cultural sites on the Project. Required attendees include:

- The Contractor's supervisory personnel.
- Subcontractors, including contract archaeological monitors, and supervisory personnel who will be involved in ground disturbing activities.
- Engineer
- When applicable, tribal representative(s) or monitor(s).

Prior to beginning On-Site Work, install work zone fencing from section 00221.13 of the QPL, or lath and flagging, around no work zones, as shown or as directed.

(Use the following paragraph when Archaeological and/or Tribal Monitors are required during ground-disturbing activities. Delete the language in orange parentheses that does not apply and delete all parentheses.)

*(*Archaeological*)(*and *)(*Tribal*)* Monitors are required to be on-site during all ground-disturbing activities for this Project, unless otherwise notified. Notify the Engineer 10 Calendar Days before beginning ground-disturbing activities, or 14 Calendar Days if ground-disturbing activities are anticipated to occur simultaneously in more than two locations.

(Use the following six paragraphs when a monitoring report is required for the project)

Archaeological monitoring by a professional archaeologist will be provide by the Agency. Allow archaeologist access as necessary to perform monitoring requirements.

(Use the following subsection .90 when there are known sensitive cultural sites on the project, or when turbidity monitoring is required. Remove the parentheses in "paragraph(s)" when more than one paragraph below is used. Remove "(s)" when only the plastic mesh fencing paragraph is used.)

00290.90 Payment - Add the following paragraph(s) to the end of this subsection:

(Use the following paragraphs when turbidity monitoring is required.)

The accepted quantities of turbidity monitoring will be paid for at the Contract lump sum amount for the item "Turbidity Monitoring".

Payment for turbidity monitoring will be payment in full for furnishing and placing all Materials and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

(Use the following paragraph when there are known sensitive cultural sites on the project.)

No separate or additional payment will be made for work zone fencing.

End of Section

Section 00294 - Contaminated Media

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general do not re-number or re-letter subsections when item(s) are deleted.)

Section 00294, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00294.00 Scope - In addition to the requirements of Section 00290 and the Specifications, this Work consists of the following:

(Use the following bullet and table when disturbing contaminated soils.

Check with the geotechnical designer to evaluate slope stability before specifying that the Contractor can dispose of excess soil within the boundaries of the Project Site.

Include the pay item "Contaminated Soil Disposal" in the Schedule of Items, with a quantity matching the quantity entered in the table as "to be disposed of at landfill." In the table and in the Schedule of Items, exclude the quantity of contaminated soil that is expected to be reused on the project.)

- Excavate, segregate, stockpile, transport, and dispose of contaminated Soils, as defined by 00294.01, from the following locations:

(Fill in the table with the location, depth, quantity, and contents of soil contaminants.)

Contaminated Soil Location Table 00294-1

From Location/Station to Location/Station	Depth below grade (feet)	Approximate Quantity (cy)	Known Contaminants
Approximate Total Quantity		cy	
Quantity to be reused on Project		cy	
Quantity to be disposed at landfill		tons	

(Use the following bullet when removing contaminated soil.)

- In areas where excavation is not required, leave contaminated material and clearing and grubbing material in place.

(Use the following bullet and table when removing contaminated groundwater.)

- Pump, test, treat, and dispose of contaminated groundwater from the following locations in Table 00294-2:

(Fill in the table with the location, depth, and contents of groundwater contaminants.)

Table 00294-2

Location/Station	Depth below grade (feet)	Known Contaminants

(Use the following bullet when a HASP is required.)

- Prepare a Health and Safety Plan (HASP) for work within the contaminated areas of the Project.

(Fill in the blanks with the date and name of report that will be available from the Engineer.)

The _____ report, titled _____ documenting the contaminated media identified within the Project, is available from the Engineer.

(Use the following bullet when contaminated shoulder soil is the only material being excavated and lead is present in the shoulder soil.)

- Prepare a written lead compliance plan for work within contaminated areas of the Project.

00294.01 Definitions:

Contaminated Soil - Soil that does not meet the DEQ definition of "Clean Fill", as defined by OAR 340-093-0030(18). This contaminated Soil is a regulated waste, subject to OAR 340-093-0005 through OAR 340-093-0290. If the grubbing material has been determined to be contaminated, it will be considered and treated as contaminated Soil for the purposes of this Section.

00294.02 Testing of Contaminated Soil and Groundwater - When additional testing of contaminated Soil or groundwater is required to characterize the material for reuse, recycle, or disposal, conduct the tests according to 00290.20(c).

Use analytical methods meeting DEQ's Clean Fill Guidance Screening Levels for each analyte. Contaminated Soil and groundwater sampling must be conducted by an Oregon Registered Geologist or Professional Engineer who has experience characterizing contaminated media.

(Use the following paragraph and bullet list when contamination is known and additional sampling by the Contractor is required for making a waste management or disposal decision. Add or delete test methods that will be required for the project.)

Collect at least 3 composite Soil samples and submit for the following required testing:

- TPH-Gx and TPH-Dx by Northwest methods.
- The following volatile organic compounds (VOCs) by EPA Method 8260.
- Benzene, toluene, ethylbenzene, xylenes.
- Iso-propylbenzene and n-propylbenzene.
- 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene.
- Ethylene dibromide (EDB), ethylene dichloride (EDC), and Methyl tert-butyl ether MTBE.
- Polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270SIM.
- Total metals (RCRA 8) by EPA 6000 and 7000 series.
- One TCLP lead by using EPA Method 1311.

00294.03 Submittals - Submit the following documents:

(Use the following HASP language when a HASP is required.)

- A site specific HASP at least 10 Calendar Days before the pre-construction conference.

(Use the following two bullets when a qualified health and safety professional is required. A qualified health and safety professional is required when the contamination is something other than petroleum, is highly toxic, is a risk to workers, or is unusually complex.)

- The site specific HASP, completed and signed by a qualified health and safety professional meeting the requirements of 00294.30.
- The name and qualifications of the qualified health and safety professional.

Submit all modifications to the HASP that are requested by the Engineer or the qualified health and safety professional within 7 Calendar Days of the request.

[End HASP language]

- Current employee training certificates and medical surveillance information before beginning Work within the contaminated areas.

Submit the following documents within 48 hours of removal of contaminated media:

  - Permits, permit applications, and documentation of compliance.
  - All reuse, recycled, and disposal receipts.
- Final quantities of Soil *(*and groundwater*)* reused, recycled, and disposed and their final location.
- All analytical test results.

(Use the following bullet when contaminated soil will be used under the requirements of ODOT BUD No. BUD-20181204.)

- Documentation of final disposition of any reused Soil material that is reused under ODOT's Beneficial Use Determination.

(Use the following subsection .05 when contamination exceeds applicable DEQ cleanup levels or the site is listed by DEQ as a cleanup site or a leaking underground storage tank site.)

00294.05 Health and Safety Plan - Prepare a site-specific HASP that meets or exceeds the requirements of 29 CFR 1910.120 and include a personnel and equipment decontamination plan that details how decontamination media will be contained and disposed.

Maintain a copy of the HASP on site at all times and readily available to employees and inspectors during construction activities. If additional information becomes available regarding the site-specific conditions, revise the HASP and submit the revised version to the Engineer. Review or acknowledgment of the HASP by the Engineer is not an indication or representation that the HASP is fully compliant with State or federal requirements. Compliance is the responsibility of the Contractor. Review by the Engineer will not impose liability upon the Agency or relieve the Contractor of any responsibilities under the Contract.

Do not begin Work in contaminated areas until the Engineer provides written acknowledgement of the HASP.

All personnel entering contaminated areas shall follow the requirements of the HASP.

Labor

00294.30 Personnel Qualifications - Provide employees meeting the following requirements:

(Use the following HAZWOPER and Supervisor bullets and sub-bullets when the contamination is known to be greater than the applicable published DEQ RBC or the contaminated area is listed as (or is adjacent to) a cleanup site and encountering contamination is likely.]

- Hazardous Waste Operations and Emergency Response (HAZWOPER) trained workers (29 CFR 1910.120) that:
- Have completed a 40-hour HAZWOPER training course.

- Have completed an 8-hour HAZWOPER refresher training course within the last 12 months.
- Participates in the HAZWOPER Medical Surveillance Program.
    - A Supervisor that:
        - Has at least 2 years of experience cleaning up and managing contaminated Soil or groundwater in Oregon.
        - Meets the HAZWOPER training requirements plus completed an 8-hour HAZWOPER supervisor training course.

(Use the following bullet and sub-bullets when the contamination is something other than petroleum, is highly toxic, is a risk to workers, or is unusually complex.)

- A qualified health and safety professional that:
- Has at least 3 years' experience in hazardous waste site work.
- Meets the HAZWOPER training requirements.

(Use the following bullet when contaminated media requires segregation or field decision making,)

- An Oregon Registered Geologist or Professional Engineer who has experience handling contaminated media.

Construction

00294.40 Contaminated Soil Excavation - Excavate and handle contaminated Soil from Project excavations according to the following:

- Notify the Engineer at least 3 Calendar Days before beginning excavation activities within contaminated areas.
- Allow the Agency to collect Soil *(*and groundwater*)* samples during excavation activities.

(Use one of the following options as instructed. Delete the option that does not apply. Delete both if neither apply.)

[Option 1 - Use the following two bullets when the Contractor will field screen the soil.]

- Field screen Soil using instrumentation capable of detecting the contaminants identified for this Soil.
- Segregate non-contaminated Soil from contaminated Soil during excavation activities, based on the field screening and the provided contaminated Soil location information.

[Option 2 - Use the following two bullets when the Agency will field screen the soil.]

- Allow Agency access to field screen Soils for contaminants during excavation.

- Segregate non-contaminated Soil from contaminated Soil during excavation activities, as directed.

[End Option 2.]

- Load contaminated Soil directly into trucks and transport directly to the recycling or disposal facility, or on-site reuse areas or, when approved by the Engineer, temporarily store contaminated Soil on-site.

(Use the following bullet when temporary storage of contaminated soil may be allowed on-site. Fill in the blank with the contaminated soil location(s) where contamination is known to be greater that the applicable published DEQ RBC or the contaminated area is listed as (or is adjacent to) a cleanup site.)

- Store contaminated Soil from (site specific location) in covered watertight containers or place contaminated Soil on minimum 6 mil thick polyethylene sheeting that has an impermeable berm around the edge. Cover the contaminated Soil with minimum 6 mil thick polyethylene sheeting. Do not allow precipitation run-off to enter the excavated contaminated Soil. Label all stored material with the type of material, the contaminants, and the dates of accumulation.
- Remove contaminated media from the exterior of all vehicles before they leave the Project Site
- Cover trucks transporting contaminated materials to prevent spillage during transit to the disposal facility according to OAR 340-093-0220.
- Where over excavation is required, backfill the excavation according to 00330.42.

00294.41 Contaminated Soil Management - Reuse, recycle, or dispose of contaminated Soil according to any of the following:

(a) Landfill Disposal:

- Obtain the Engineer's approval of the disposal facility before disposing of the contaminated Soil.
- Transport the contaminated Soil to a DEQ permitted municipal solid waste landfill or a permitted construction and demolition landfill for disposal. Dispose of temporarily stored contaminated Soils within 30 Days of beginning excavation work or before Second Notification, whichever occurs first.
- Complete and sign all manifests and bill-of-lading forms for handling, loading, transporting, and disposing of the contaminated Soil.
- Pay all filing and permit fees.

(Use the following "recycling" bullets when recycling contaminated soil is allowed.)

(b) Recycling:

- Obtain the Engineer's approval of the recycling facility before disposing of the contaminated Soil.
- Transport contaminated Soil to a DEQ permitted recycling facility or asphalt batch plant. Recycle temporarily stored contaminated Soils within 30 days of beginning excavation or before Second Notification, whichever occurs first.
- Complete and sign all manifests and bill-of-Lading forms for handling, loading, transporting, and recycling the contaminated Soil.

Measurement

00294.80 Measurement - Work performed under this Section will be measured according to the following:

(Use the following paragraph when Pay Items (a), (b), (c), or (f) are included in the Pay Item list below.)

No measurement of quantities will be made for the following:

(Use the following bullet when Pay Item (a) is included in the Pay Item list below.)

- HASP.

(Use the following bullet when Pay Item (b) is included in the Pay Item list below.)

- Lead compliance plan.

(Use the following bullet when Pay Item (c) is included in the Pay Item list below.)

- Segregate and stockpile contaminated Soil.

(Use the following paragraph when Pay Item (d) is included in the Pay Item list below.)

Soil sample and analytical testing will be measured on the unit basis for each sample submitted and tested according to 00294.02 when test results are submitted according to 00294.03.

(Use the following paragraph when Pay Item (e) is included in the pay item list below.)

The quantities of contaminated Soil disposed will be measured on the weight basis, based on weigh tickets from the recycling or disposal facility.

Clearing and grubbing will be measured according to 00320.80.

Payment

00294.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

(Delete Pay Item (s) from the list that are not included in the Schedule of Items, but do not change the alpha characters next to the Pay Items.)

	Pay Item	Unit of Measurement
(a)	Health and Safety Plan	Lump Sum
(b)	Lead Compliance Plan	Lump Sum
(c)	Segregate and Stockpile Contaminated Soil	Lump Sum
(d)	Soil Sample Collection and Analytical Testing	Each
(e)	Contaminated Soil Disposal	Ton

(Use the following paragraph when item (c) is included in the Pay Item list above.)

Item (c) includes segregating, handling, and stockpiling contaminated Soil within the Project Site for the purpose of analytical testing, on-site reuse, or disposal.

(Use the following paragraph when item (d) is included in the Pay Item list above.)

Item (d) includes mobilization, Soil sampling, testing, analyses, and preparation of reports for tests required in 00294.02. Additional testing beyond that listed in 00294.02 will only be paid if authorized by the Engineer.

(Use the following paragraph when item (e) is included in the Pay Item list above.)

Item (e) includes all costs involved with the disposal of contaminated Soil at a recycling or disposal facility.

No separate or additional payment will be made for the excavation or reuse of contaminated Soil or contaminated shoulder soil. Payment will be included in payment made for the appropriate items under which the excavation or reuse of contaminated Soils or contaminated shoulder soil is required.

Clearing and grubbing will be paid for according to 00320.90.

Payment will be payment in full for removing and disposing of all Materials, and for furnishing all Equipment, labor, Plans, test results, and Incidentals necessary to complete the Work as specified.

End of Section

Section 00299 - Decommission Underground Injection Control Systems

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general do not re-number or re-letter subsections when item(s) are deleted. This Section requires SP00294 when contaminated soil will be encountered.)

Section 00299, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00299.00 Scope - In addition to the requirements of Section 00290, decommission underground injection control (UIC) systems according to the following Specifications.

Decommission the UIC systems indicated in Table 00299-1 below:

(Fill in the table with the required location, depth, width, description, and former use information.)

Table 00299-1

Location/Station	DEQ UIC #	Well ID #	Depth (feet)	Width (feet)	Description	Former Use

00299.03 Submittals - Provide the Engineer with the following information and documents for contaminated soil generated on this project, within 48 hours of completing or receiving them:

- DEQ notifications, correspondence, permits and reports.
- Reuse, recycling, and disposal receipts or other related documentation for the UIC systems.
- Sample data and analytical results.

Labor

00299.30 Personnel Qualifications - Provide contractors and workers meeting the following requirements:

- An Oregon Registered Geologist (RG) or Professional Engineer (PE) who has experience decommissioning UIC systems and handling contaminated media.

(Use this bullet when the UIC system contains contamination that is known or likely to exceed DEQ cleanup standards (for example: automotive UIC systems).)

- Workers meeting the HAZWOPER training requirements of 00294.30.

Construction

00299.40 Underground Injection Control System Decommissioning - Decommission UIC systems according to OAR 340-044-0040 and the following:

Decommissioning of UIC systems shall be done in accordance with Part II City of Bend Design Standards, Section 6.4.7 Stormwater System Abandonment:

(Use the following bullet when the UIC system is removed.)

- Remove the UIC by excavation and backfill according to 00330.42.

(Use the following two bullets when the UIC system is left in place.)

- Obtain approval and prepare closure report that follows Part II City of Bend Design Standards, Section 6.4.7 Stormwater System Abandonment.
- Backfill the excavation according to 00330.42.

Information for decommissioning underground injection control systems is available on DEQ's Fact Sheet titled *Closure of an Injection System*.

(Use the following subsection .43 when contaminated soil will be encountered.)

00299.43 Contaminated Media - Excavate, transport, and dispose of contaminated media according to Section 00294.

Measurement

00299.80 Measurement – No measurement of quantities will be made for Work performed under this Section.

(Use the following paragraph when contaminated soil or groundwater will be encountered.)

Excavating, transporting, and disposing of contaminated media will be measured according to 00294.80.

Payment

00299.90 Payment – No separate or additional payment will be made for Work performed under this Section. Work performed under this section is incidental to 00310.

(Use the following paragraph when contaminated soil or groundwater will be encountered.)

Excavating, transporting, and disposing of contaminated media will be paid for according to 00294.90.

End of Section

SP00300 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00300 – ROADWORK

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00305 - Construction Survey Work

Comply with Section 00305 of the Standard Specifications modified as follows:

00305.00 Scope – Replace this subsection, except for the subsection number and title, with the following:

Provide construction survey work according to the current edition on the date of Advertisement, of the ODOT *Construction Surveying Manual for Contractors* with the following exceptions:

(Review the ODOT Construction Surveying Manual for Contractors and modify the bullets below accordingly. Further, identify all survey monuments on the plans and indicate whether they are to be protected or if within in the construction area, who is responsible to replace)

1.5 Agency Responsibilities: delete the following bullets:

- Perform a Pre-Construction Survey in accordance with Chapter 7 of this manual.
- Perform measurements and calculations for pay quantities.
- Perform final "as constructed" measurements.

1.6 Contractor Responsibilities: add the following bullets:

- Perform a Pre-Construction Survey in accordance with Chapter 7 of this manual.
- Perform measurements and calculations for pay quantities.
- Perform final "as constructed" measurements.

Staking is required when using Automated Machine Guidance.

Add the following subsection:

00305.40 Construction Staking:

(a) General - All survey work shall be conducted by or under the supervision of a Registered Professional Land Surveyor, licensed in the State of Oregon. The Contractor will be responsible for providing all construction staking as required to complete the Work.

(b) Stakes – Conspicuously mark construction and reference point stakes for construction. Inform employees and subcontractors of the importance and the necessity to preserve and protect construction staking.

Provide the following information on construction stakes:

- Engineer's station (on back)
- Offset from line (underlined)
- Offset from control point (circled)
- Cut or fill to grade
- Distance right or left from centerline on curb stakes (on back)

(c) Flagging Code - A color code may be established during the course of the project indicating specific colors for the various kinds of stakes to be set.

(d) Staking Frequency:

(1) Street - Prior to commencing construction, clearing limits shall be established.

a. Provide staking for roadway centerline at 50-foot intervals on tangents and 25-foot intervals on curves.

b. Where a significant (greater than 3-foot) cut or fill is required for sub grade, provide slope stakes and construction staking for sub grade.

c. Stake curb line by means of an offset line no more than 6 feet from the face of curb, show the cut or fill to the finish grade. Protect and save curb stakes for a period of 5 working days after construction of curbs to allow Inspector to review alignment and grade. Provide additional stakes at catch basins, curb inlets, points of curvature and tangency, and ends of curb radii. Curb staking must be at 25-foot intervals within vertical curves. Staking must be at grade breaks, low/high points, and at the beginning and end of vertical curve locations.

(Delete (d) for projects where grade verifications points will be provided by the Contractor and reviewed by the Engineer.)

d. Stake base rock by painting an appropriate target on the curb and providing construction stakes (blue tops). On streets of 48 feet or greater width, provide blue tops at the quarter points as well as centerline. At intersections, provide blue tops along the centerline and gutter lines of the intersecting road.

(2) Sewer / Storm – Provide offset staking for line and pipe invert for gravity, storm and pressure sewer lines at 50-foot intervals.

a. Provide finish grade as required.

b. Stake manholes (sewer, storm, drywells, sedimentation manholes) with two reference points (swing-ties) indicating the center of the manhole, flow invert elevation, and finish grade. Upon the completion of sub grade, stake the top of the manhole with the finish grade and elevation by means of four offset stakes in a cross pattern so that the street slope and cross slope will be matched

c. Private Development Projects - Drywell drainage gallery excavations limits. Offset staking for bottom corners of gallery placed prior to excavation to ensure location does not encroach on private property or utilities trenches.

d. Sewer/Storm services must be staked by means of a 5-foot property line offset stake. Additional staking as required by the Engineer.

e. All tapping locations on existing mains must be staked.

f. Agency reserves the right to increase staking to 25-foot intervals if grades sewer grades are not being met.

(3) Water – Provide offset staking for waterline line and grade at 50-foot intervals.

a. Stake two reference points (swing-ties) for fire hydrants indicating the center of the fire hydrants. Stake finish grade is required.

b. Stake services as required by the Engineer.

c. All tapping locations on existing mains must be staked.

d. Stake services by means of a 5-foot property line offset stake. Additional staking as required by the Engineer.

(4) Structures – Stake line and grade for all structures as shown on the plans or as directed by the Engineer.

(5) Franchise Utilities – Provide offset staking with line and grade for franchise utility line installation at 50-foot intervals as shown on the plans.

Add the following subsection:

00305.41 Construction Stakes, Lines, and Grades:

(Use the following .41(a) for Private Development projects.)

(a) General – No work shall be performed until the Engineer inspects and approves stakes, lines, and grades. Work performed without field controls will be subject to removal at the contractor's expense.

(Use the following .41(a) for Capital Improvement projects.)

(a) General – No work shall be performed until stakes, lines, and grades have been established. Work performed without field controls will be subject to removal at the contractor's expense.

(b) Agency Responsibilities – The Engineer shall inspect Contractor's established lines, grades, Slopes, Cross Sections, and curve super-elevations for roadwork.

(c) Contractor Responsibilities – The Contractor shall:

- Lay out and set construction stakes and marks to establish the lines, grades, slopes, cross sections, and curve super-elevations for roadwork.
- Provide a set of construction stakes for line and grade for each phase of the Work.
- Set benchmarks and stakes for centerline of Bridges and bents.
- Calculate and provide finish deck grades.
- Inform the Engineer when stakes are available for inspection.
- Coordinate construction to provide sufficient area for performing surveying work efficiently and safely.
- Perform work in a manner as to preserve stakes and marks.
- Set any reference lines for automatic control from the control stakes.

End of Section

Section 00310 - Removal of Structures and Obstructions

(Note: Include Pay Item for "Removal of Concrete Barrier" when removal of concrete barrier work is included on the Project. Use either Lump Sum or Length unit of measurement. If Section 00820 "Remove and Reinstall Concrete Barrier" is also included in the project, do not include that quantity of barrier removal in this Section.)

Comply with Section 00310 of the Standard Specifications.

(Add the following subsection .45 when removal of underground injection control systems is required.)

Add the following subsection:

00310.45 Remove and Decommission Drywell and Drill Hole Remove and decommission existing drywells and drill holes in accordance with Section 00299.

(Add the following pay items and paragraphs when removal of underground injection control systems is required.)

00310.92 Separate Item Basis - Add the following Pay Items to the Pay Item list:

(i) Removal of Drywells……..Each
(j) Removal of Drill Holes……..Each

Items (i) and (j) include soil sampling and UIC decommissioning per DEQ requirements.

Contaminated soil removal will be paid for according to 00294.90.

Work completed according to Section 00299 shall be incidental to this Section.

End of Section

Section 00320 - Clearing and Grubbing

Comply with Section 00320 of the Standard Specifications modified as follows:

00320.40(b)(3) Vegetation and Materials to be Saved
Add the following to the end of this subsection:

Where the plans call for the preservation of trees, provide a tree preservation plan a minimum of 7 Calendar Days prior to beginning clearing and grubbing. Include, at a minimum, the following in the tree preservation plan:

- Method of protecting each tree
- Trimming procedure
- Watering schedule
- Root cutting procedure

The Contractor shall routinely water the preservation zone to keep the area moist

As soon as possible, but not more than two weeks prior to any required construction in a preservation zone per the exceptions above, thoroughly saturate the preservation zone with water.

When necessary to excavate or trench through a preservation zone, trim all roots exposed by the excavation. Do not tear or pull roots from the ground with construction equipment but cleanly saw them immediately when exposed by the equipment. An exception shall be rock saws. However; however, rock saws shall be operated to minimize the shattering of roots.

Backfill trenches in a preservation zone as soon as possible to minimize the drying of exposed roots. Where trenches need to be open longer than six hours, cover with burlap and keep moist exposed roots on the trench wall sides.

(Use the following subsection .42 when salvaging of vegetation or natural materials is required.)

00320.42 Disposal of Matter - Replace this subsection, except for the subsection number and title, with the following:

Dispose of all matter and debris according to 00290.20. Open burning of materials is prohibited within the City limits.

00320.42 Ownership and Disposal of Matter - Vegetation and natural material designated for preservation and salvage are the property of the Agency. All other matter and debris accumulated from clearing and grubbing operations become the Contractor's property at the place of origin. Dispose of all matter and debris according to 00290.20.

End of Section

Section 00330 - Earthwork

Comply with Section 00330 of the Standard Specifications modified as follows:

00330.14 Selected Granular Backfill - Delete the sentence that begins "Reclaimed glass meeting the requirements of Section 02695…"

00330.15 Selected Stone Backfill - Delete the sentence that begins "Reclaimed glass meeting the requirements of Section 02695…"

00330.41(a)(4) Excess Materials - Replace this subsection, except for the subsection number and title, with the following:

If the quantities of excavated materials are greater than required to construct embankments and to do all filling and backfilling, the Contractor may use the remaining materials to uniformly widen embankments or to flatten slopes in a manner satisfactory to the Engineer.

00330.43(b) Moisture-Density Testable Materials – Add the following to the end of the subsection:

> **(3)** Place moisture-density testable material in nearly horizontal layers with thickness as necessary to meet the requirements of Section 00330.43(b)(2)(b) but not more than 12 inches.

(Use the following subsection .80 when earthwork quantities are less than 100 cubic yards and payment will be on the lump sum basis. Insert approximate quantity of earthwork in the blank.)

00330.80 Measurement – Add the following bullet:

- Lump sum basis, no measurement of quantities will be made. Approximately ____ Cubic Yards of earthwork will be required on this project.

00330.92 Kinds of Incidental Earthwork - Add the following bullet*(*s*)* to the end of the bullet list:

- Excess material used to widen embankments or flatten slopes according to 00330.41(a)(4).

(Use the following bullet on projects with light grading, especially on urban projects, and when requested by the Project Leader, to eliminate separate measurement and payment for earthwork for driveways and road approaches. Do NOT use on projects involving driveways or road approaches with significant earthwork quantities.)

- Earthwork required for driveways and road approaches. Earthwork for driveways and road approaches will be that which is outside the Neat Line limits shown on the typical sections.

(Use the following subsection .95 when earthwork quantities are less than 100 cubic yards and payment will be on the lump sum basis.)

Add the following subsection:

00330.95 Earthwork Lump Sum Basis Payment – Earthwork will be paid for at the Contract lump sum amount for the item “Earthwork”.

End of Section

Section 00331 - Subgrade Stabilization

Comply with Section 00331 of the Standard Specifications.

End of Section

Section 00333 - Aggregate Ditch Lining

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00333, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00333.00 Scope - This Work consists of furnishing and placing aggregate ditch lining at locations shown or directed.

Materials

00333.10 Aggregate Ditch Lining - Provide hard durable rock or gravel with a moisture binder of clay material that provides a tight, erosion-resistant surface meeting the following grading requirements:

Sieve Size Passing	Percentages (by Weight)
6”	100
4"	30 - 50
2"	20 - 30
No. 200	15 - 25

Construction

00333.40 General - Place the aggregate material to the lines and grades established and as shown.

Measurement

00333.80 Measurement - The quantities of aggregate ditch lining will be measured on the area basis of the actual surface area of the wetted perimeter of the lined ditch.

Ditch excavation will be measured according to 00330.80 and 00330.81.

Payment

00333.90 Payment - The accepted quantities of aggregate ditch lining will be paid for at the Contract unit price, per square yard, for the item "Aggregate Ditch Lining".

Payment will be payment in full for furnishing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

Ditch excavation will be paid for according to 00330.90, 00330.91, and 00330.93.

End of Section

Section 00340 - Watering

Comply with Section 00340 of the Standard Specifications modified as follows:

00340.10 Water – Add the following to the end of this subsection:

For a charge, the City can provide water from a fire hydrant or similar source within the City's water service area. Application for a hydrant meter permit is available through the City Permit Center.

00340.80 Measurement – Replace this subsection title with the following:

Measurement, Method "A"

Add the following subsection:

00340.81 Measurement, Method "B" – Under this method, no measurement of quantities will be made.

00340.90 Payment – Replace this subsection title with the following:

Payment, Method "A"

Add the following subsection:

00340.92 Payment, Method "B" – Lump Sum Basis – Watering will be paid for at the Contract lump sum amount for the item "Watering".

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for obtaining permits, water rights, or any other costs related to complying with the "Oregon Water Laws".

When the Contract Schedule of Items does not indicate payment for Work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this Work is required.

End of Section

Section 00350 - Geosynthetic Installation

Comply with Section 00350 of the Standard Specifications.

End of Section

Section 00390 - Riprap Protection

Comply with Section 00390 of the Standard Specifications.

End of Section

SP00400 (Special Provisions for the 2021 Book) (Last updated: November 2024)

PART 00400 – DRAINAGE AND SEWERS

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00405 - Trench Excavation, Bedding, and Backfill

(This Section requires SP00330 when Trench Foundation is required.)

Comply with Section 00405 of the Standard Specifications modified as follows:

00405.02 Definitions –

Common Excavation - Replace the definition with the following definition:

The removal of all material including excavation of rock that may require removal drilling and blasting, wedging, sledging, barring or breaking up with power tools.

Rock Excavation – Delete this definition

(The Agency does not differentiate between Common Excavation and Rock Excavation)

00405.12 Bedding - Replace this subsection, except for the subsection number and title, with the following:

For all pipes, unless otherwise directed, furnish ¾" – 0 base Aggregate conforming to 02630.10.

00405.13 Pipe Zone Material - Replace this subsection, except for the subsection number and title, with the following:

For all pipes, unless otherwise directed, furnish ¾" – 0 base Aggregate conforming to 02630.10.

(Use the following subsection .14(a) when additional material sources may be available outside of the project limits. Material must be density testable, and the contractor must prove the material is appropriate for the anticipated loading.)

00405.14(a) Class A Backfill – Add the following sentence to the end of the paragraph:

Material must be moisture-density testable.

00405.14(b) Class B Backfill – Use crushed rock meeting the requirements for dense-graded base aggregate per section 02630.10. Designated size shall be ¾" minus**.**

00405.14(d) Class D Backfill – Replace this subsection, except for the subsection number and title, with the following:

Use native or common material that, in the opinion of the Engineer, meets the characteristics required for the specific loading or other criteria of the backfill zone. Material shall not exceed 3" in size with a minimum density of 90 pounds per cubic foot and must be moisture-density testable.

(Use the following subsection .41(a) when the open excavation method for installing pipes transversely is not permitted.)

00405.41(a) Within Paved Areas to be Preserved - Add the following to the end of this subsection:

Do not use the open excavation method for installing pipes transversely.

00405.42 Rock Excavation – Delete this subsection

(The Agency does not differentiate between Common Excavation and Rock Excavation)

00405.46(c)(2) Class A, B, C, or D Backfill – Add the following paragraphs to the end of the subsection:

Trench backfill shall be tested at one passing test for each 3 feet of fill and 100 LF of trench (e.g., 12-foot to 15-foot depth class shall require four to five tests per 100 LF or as directed by the Engineer). Passing test shall meet the requirements for trench compaction in that segment of trench backfill. Sampling locations shall be determined by the City of Bend. All results, including failing tests, shall be submitted to the City of Bend prior to any subgrade inspection.

All compaction testing shall be completed in the presence of a City of Bend representative. Where trench depths or conditions preclude density testing at deeper elevations because of worker safety concerns, the placement and compaction of backfill will be observed and documented on a full-time basis by contractor's qualified and approved personnel until backfill reaches an elevation at which density testing can commence. Establish compaction method and level of effort by compacting a test strip in an area that can be density tested.

Compaction testing shall remain current with the work being performed. Submit compaction reports within 7 Calendar Days of performing the test.

Compaction reports must be uploaded weekly or stop work order may be issued.

(The following paragraph may be deleted on projects that will have a full-time City of Bend Inspector)

All sampling and testing, including material certifying tests shall be performed by an independent testing laboratory.

00405.80 Measurement – Add the following paragraph to the end of the subsection:

No measurement will be made for rock or boulder excavation.

00405.81 Rock Excavation and Boulder Excavation – Delete this subsection

(The Agency does not differentiate between Common Excavation and Rock Excavation)

(Use the following subsection .90 when no Pay Items are included in the Schedule of Items for Section 00405.)

00405.90 Payment –

Delete pay items (a) and (b)

Add the following bullet to the list under the heading that begins “No separate or additional…”

- Rock or boulder excavation

Add the following paragraph to the end of this subsection:

When the Contract Schedule of Items does not indicate payment for Work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this Work is required.

End of Section

Section 00412 - Cured-In-Place Pipe Lining

Comply with Section 00412 of the Standard Specifications modified as follows:

00412.01 Submittals – Replace this subsection, except for the subsection number and title, with the following:

Submit the following at least 10 Calendar Days before the preconstruction conference:

(a) Certification - Certification by the lining system manufacturer that the installer is licensed and certified as competent to perform the Work.

(b) Documentation showing the installer meets the qualifications listed in 00412.30, and a list of the key qualified personnel who are assigned to Work on this Project.

(c) Test Reports - Certification of test results confirming that the exact CIPP liner system to be used for this project meets the requirements for initial structural properties (performed in accordance with ASTM F1216, ASTM D638, and ASTM D790 or equivalent as approved) and chemical resistance (per ASTM F1216-Appendix X2). Submit calculations that provide extrapolated long-term test results per ASTM D2990 to support long-term flexural modulus per the design parameters listed in 00412.03. The initial data between time “0” and “1,000” hours must be excluded. If the architecture of the CIPP is such that the physical properties vary depending on the direction of testing (i.e., axial versus circumferential), submit test data on both directions in accordance with the test methods listed above in this paragraph.

(d) Technical Data - Catalog data, and manufacturer's technical data showing complete information on material composition, chemical and physical properties, and dimensions of system components of the tube and resin system. Include manufacturer's recommendation for allowable mixing, impregnation, and handling times, transportation and storage, insertion pressures, curing, trimming, finishing, data on the maximum allowable stresses and elongation of the tube, and repair of damaged liner. Specify resin color to be used.

(e) Calculations - Stamped design of the proposed liner according to 00150.35 and 00412.02 identifying the design methodology, assumptions, design criteria, safety factor and material properties.

(f) Resin Volume - Calculations for the volume of resin to be used for each segment and detailed description of the wet-out process. Include the tube and resin manufacturer's wet-out recommendations including the roller gap, material feed speed and vacuum requirements for each liner size and thickness. The volume calculations must be based on required finished liner characteristics and should account for tube void space, the structural condition of the host pipe, and predicted changes in the resin’s physical and chemical characteristics due to polymerization.

(g) End Seals - End seal material to be used, and method of installation. If a grout sealing method is proposed or suggested, provide certification from the grout manufacturer or supplier that the grout material for sealing structures and service laterals

is compatible with the proposed resin and liner system and is suitable for use in aqueous environments.

(h) Sampling and Testing Plan – Provide a sampling and testing plan for physical properties according to ASTM F1216 and ASTM F1743, including name and location of independent third-party laboratory performing testing on installed liner system. Provide certification that the independent third-party laboratory has the appropriate accreditation for each specified tests to be performed. Include proposed methods, locations, and proposed chain-of-custody process for sample delivery to the City's Construction Manager. Refer to requirements in Specification Section 00412.72. Chain of Custody Form is provided at the end of this Specification Section.

(i) Installation Plan - Description of the pipe lining and curing process including staging and insertion locations (typically includes an incomplete cure log for each shot). The plan must also include specific curing times and pressure specific to each liner segment and address project design parameters and site conditions. If possible, include a contingency curing cycle in the event temperatures fall over or under the liner system manufacturer's recommendations. Identify in the description the type of temperature sensors that will be used, their proposed locations, and recording method and/or equipment. Include in the overall installation plan the method and sequence of lateral reinstatement, including the method for addressing lateral protrusion.

Include a control protocol for each installation. The control protocol must include certification of approval by the liner manufacturer, including the following minimum information:

(1) Date and time
(2) Length of liner
(3) Location of installation
(4) Curing Speed
(5) Inner air or water pressure
(6) Exothermic (curing) temperature

(j) Shot Schedule - Include a schedule detailing when the work is to begin and the order of locations to be completed.

(Use the following subsection .01(k) when allowing the use of resins containing styrene. Resins containing styrene are commonly used and less expensive, but styrene is regulated as a carcinogen. There are best management practices that can be used during installation to mitigate exposure. The other option is to require the use of styrene-free resins. Styrene-free resins tend to be more expensive, can increase installation costs, and are not as widely used. In most cases, resins containing styrene are recommended for use. However, when lining a pipe with sewer services connected to a hospital, healthcare facility, nursing home, or any location where you may have people with compromised respiratory systems, the use of styrene-free resin is recommended.)

(k) Styrene Control Plan – When resins containing styrene are proposed for use, include a detailed description of the styrene mitigation plan for reducing the styrene concentrations in all discharged process water to 2.5 mg/L or less. Plan shall also provide details for the water sampling methods and analytical analysis procedures to demonstrate

compliance with this requirement. In addition, provide a plan for controlling the airborne concentration of styrene to below OSHA and NIOSH limits.

(l) Pipe Access - Identify all required manhole, structure or pit access for CIPP installation. Identify required modifications to existing facilities and describe proposed preparation, modification, preservation, and restoration activities. Include sketches, shop drawings and/or engineered repair drawings as required. Include locations of intermediate pipe access and proposed repair plan that meets the requirements of the Contract.

(m) Lateral Reinstatement Plan - Include method, materials and personnel assigned to do the work.

(n) Liner Repair Plan - Contingency repair plan including methods and equipment to be used to repair or replace unacceptable liner defects identified in 00412.73. Liner Repair Plan approval is required prior to making each repair.

Submit the following for review, during construction:

(o) Wet Out Logs - Document resin volumes used and provide logs upon delivery of liner system to project site. Provide certification by the person responsible that the entire wet out process, including handling and delivery to the site, followed the defined procedures.

(p) Cure Logs – Record installation data and submit cure log upon completion of the installation.

(Use the following subsection .01(q) when allowing the use of resins containing styrene.)

(q) Air Test for Styrene Logs – When resins containing styrene are proposed for use, document gas levels as required in 00412.47 during the installation and curing process.

(Use the following subsection .02 to list the CIPP design parameters. Obtain the parameter information from the Designer. For pipe ovality, 2% is recommended for pipes less than 24-inches in diameter and 5% for pipes 24-inches or larger diameter. Designer to consider whether to represent Long-Term Flexural Strength and Modulus of Elasticity as shown below ([percent of ASTM D790] or in psi. For example, short-term flexural modulus and long-term modulus when tested in accordance with ASTM D790 for Standard Polyester would be specified as 250,000 psi and 125,000 psi, respectively. Short-term flexural modulus and long-term modulus when tested in accordance with ASTM D790 for Enhanced Polyester would be specified as 400,000 psi and 200,000 psi, respectively. Also note that this specification is specific to lining gravity sewer piping. Designer will need to reevaluate the liner material and strength being specified if CIPP lining methods are to be used for lining pressure piping [e.g. sewer forcemain, water].)

00412.02 Design Parameters – Replace the following parameters for the conditions in the table:

Condition	Parameter

Pipe Ovality……..…. 2%
Long-Term:
Flexural Strength ……..…… 90%* of Initial (ASTM D790)
Modulus of Elasticity…….. 50%* of Initial (ASTM D790)
Groundwater Elevation above invert……. _____

*Unless long-term test results are provided that substantiate a greater retainage.

Add the following to the end of this subsection:

Condition	Parameter
Poisson's Ratio ……	0.3
Service Temperature Range ……..……	140 degrees

00412.10 Tube – Add the following to the end of the bullet list:

- Before inversion, tubing is coated with an impermeable, flexible material on the outside layer of the tube.

Add the following paragraph to the end of the subsection:

Fabricate the tube to a size that when installed, conforms to the internal circumference and length of the host pipe. Make allowance for circumferential or longitudinal stretching during inversion.

(The OSSC specification allows the use of polyester, vinyl ester, or epoxy resin. Polyester is styrene-based, vinyl ester can be styrene-based or styrene-free, and epoxy is styrene-free. Additional edits to subsection .11 may be required by the Designer if a particular type of resin is specified for use [styrene vs. styrene-free].)

00412.11 Resin – Add the following paragraph to the end of the subsection:

The curing initiation temperature shall be as recommended by the resin manufacturer. No onsite or mobile impregnation is allowed.

Add the following subsection:

00412.13 Pipe Liner End Seals – The hydrophilic end seals completely seal the liner from any annular space leakage between the liner and the host pipe. Hydrophilic end seals must be one of the following:

(a) Bands that are 20 mm wide and 5 mm high, with a double bump on one side and flat on the other side. Product shall be Hydrotite Style DS-0520-3.51 or approved equal.

(b) Tubular hydrophilic sleeve, 2 mm in thickness and 3.5 inches in length, with a mechanical fastener with worm gear expander. Product shall be Insignia End Seal by LMK Technologies, or approved equal.

Add the following subsection:

00412.14 Temperature Monitoring Equipment - Provide full-length monitoring equipment that takes continuous temperature readings with sensors placed a minimum of 10 feet between sensors for the entire length of the pipe being lined for pipes 24-inches and larger. Use equipment that includes both the software and the hardware necessary to operate and monitor the system. Provide certified, hardcopy of temperature monitoring results to the Agency.

00412.30 Personnel Qualifications – Replace this subsection with the following:

(Designer shall discuss with City Procurement whether prequalification of Contractors is necessary for the Project or whether minimum qualifications shall be stated in the Qualifications section below (modify as needed). Prequalification is recommended in most cases unless due to pipe size, contract size (cost), and/or criticality of pipe(s) being lined are deemed to not be of high enough risk to the City to warrant prequalification. Note that there is a requirement for the Contractor to submit an Affidavit of Qualifications as a part of their bid forms certifying that they meet the minimum requirements listed in the specification. Coordinate with City Procurement to include the Affidavit of Qualifications form in the Bid Documents. If prequalification is desired in lieu of Affidavit of Qualifications, City Procurement can provide a template for prequalification.

For small diameter installations [less than 24-inches in diameter] consider removal of requirements for large diameter piping listed in sections (a), (b), and (c) below.)

00412.30 Qualifications – Contractor shall submit an Affidavit of Qualifications included in the Bid Submittal Forms at the time of bid certifying the following minimum qualifications are met:

(a) CIPP System Manufacturer: The CIPP system must have a minimum proven performance record of 1,000,000 linear feet installed of the exact name-brand product bid in the United States, with a minimum of 20,000 linear feet in diameters 24-inch or larger over the last five years. In addition, a minimum of 10,000 linear feet of 36-inch diameter or larger, of the exact name brand product must have been installed in the United States.

(b) Installer Experience: The Installing Contractor for the cured-in-place reconstruction of sewers must have a minimum of five years of experience using the exact named product proposed and have installed at least 300,000 linear feet of the exact named proposed product including at least 20,000 feet of 24-inch diameter or larger cured-in-place product. Documentation along with contact names and telephone numbers from the last ten projects shall be submitted.

(c) On-Site Field Superintendent: The Superintendent must have a minimum of five years of experience with cured-in-place pipe products. In addition, the Superintendent must have supervised jobs in which at least 20,000 feet of pipe has been reconstructed using the exact named product proposed including a minimum of 5,000 feet of 24-inch diameter or larger cured-in-place product. The Contractor shall submit information to document this requirement. The Superintendent for the Project shall be on-site during all phases of the work involving any pre- and post-installation video inspection, sewer cleaning or insertion and processing of the CIPP.

Add the following subsection:

00412.31 Labor Requirements – Crews and key personnel are not to work more than a maximum of 12 hours per 24-hour day, or as otherwise approved.

Staff the project with the key individuals as specified, and who will be available for the project duration.

00412.40 General – Add the following to the end of the subsection:

(a) Water and Electric Service - Furnish and supply generators or obtain temporary power to provide all electric power required for installation. Obtain a permit and pay all fees required for use of any hydrant per Specification Section 00340.

(b) Diversion of Flow - Furnish, install, maintain and operate a flow diversion system as needed, and in accordance with Section 00490.

(c) Receiving and Insertion Locations - Locate all manholes or pits to suit the pipe lining operation. Use existing manholes where practical. Remove manhole flattops and cones, inverts, benches, and channels to permit access for installation equipment, if required. Enlarge the incoming and outgoing pipe openings, if required, to accommodate the maximum outside diameter size of the insertion equipment. Do not put undue stress on existing structures. In areas where existing manholes are not available, intermediate access pits may be excavated and utilized at no additional cost to the City. Intermediate pipe repair and restoration must be done in accordance with the Drawings at no additional cost to the City. Manned entry in unlined pipe is not allowed. If manned intermediate access is required, an access pit must be dug at the required location.

(d) Customer Notifications

(1) The Contractor shall contact all residential and commercial customers whose service is to be interrupted by rehabilitation work or who may be affected by upstream or downstream rehabilitations. The customer shall be informed that they will be temporarily out of service. This notification shall be made a minimum of 48 hours prior to beginning rehabilitation work.

(2) For all residences the Contractor shall leave a door hanger detailing the service outage and providing contact information. Door hanger samples shall be submitted to the Engineer for review and approval. The Contractor shall also advise those customers against water usage until the mainline and lateral are back in service. After completing the necessary work on the main line and lateral to allow their reuse, the Contractor shall advise those customers that the sewer is back in service.

(3) All customer notification documentation and procedures shall meet the requirements of the Owner.

(e) Service Interruption Duration - Should a condition arise that the Contractor cannot restore service within 12 hours of service interruption; the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

00412.41 Pipe Cleaning – Replace this subsection, except for the subsection number and title, with the following:

Refer to Section 00415.40(c) for pipe cleaning requirements.

00412.43(a) General - Replace the sentence that begins “Do not allow…” with the following:

Do not allow the temperature of water discharged from processing liners to exceed 77 degrees Fahrenheit unless DEQ, upon the request of the City, approves alternate temperature limits not to exceed 125 degrees Fahrenheit.

00412.43(b) Pipe Liner End Seal - Replace the sentence that begins “Install an end seal…” and replace with the following:

Install a continuous or properly trimmed end seal between the ends of the new pipe liner and the host pipe connection. Insert end seals at each structure opening approximately 3 inches max, 2 inches min from inside of structure wall to the inside edge of the end seal. For bands, butt-up trimmed end seal edges against each other at the crown of the pipe using a miter cut. Seals that have any gap between the ends will be rejected and repaired with an internal joint seal, or as approved, at no additional cost to the City.

00412.43 Installation - Add the following to the end of the subsection:

(c) Wet Out - Impregnate ("wet out") the tube with resin using distribution rollers and vacuum, or other approved method, to thoroughly saturate the tube prior to its dispatch. Transport and store the impregnated liner in a refrigerated truck or container until installation in such a manner that it will not be damaged, exposed to direct sunlight, or result in any public safety hazard.

Use a sufficient quantity of resin to fill air voids and include additional allowance for polymerization and for any migration of resin into cracks and joints in the host pipe.

The City reserves the right to check, verify or inspect all phases of production including manufacturing, shipping, wet-out, installation, cure, and/or finished product. Any departure from the submitted procedures may be cause for rejection.

(d) Transport and Storage - Transport and store the impregnated tube at the site in such a manner that it will not be damaged, exposed to direct sunlight, or result in any public safety hazard. Inspection and review of all materials will be conducted prior to installation.

The City reserves the right to check, verify or inspect all phases of production and testing of materials from manufacturing, shipping, installation, cure, to finished product. Any departure from the submitted procedures will be cause for rejection.

(e) Insertion - Prior to insertion mark the exterior of the manufactured tube along its length at regular intervals not to exceed five (5) feet. Use the marks to measure elongation during insertion. The tube will be rejected and replacement required if the overall elongation of a tube reach exceeds five percent (5%), or as otherwise approved.

Maintain the pressure required to hold the flexible tube tight against the host pipe, per the manufacturer's recommendations, until curing is complete. No other depressurization outside of the range required by the manufacturer for curing is permitted until the tube is fully cured and cooled. Capture and clean up all escaped resin.

(f) Curing - Use a suitable source of hot water or steam and a recirculation system capable of delivering the required amount of heat uniformly throughout the segment for a complete cure of the resin.

Fit the heat source with monitors to gauge the temperature of the incoming and outgoing heat supply. Install full-length temperature monitors prior to installing the liner. Additionally, place remote sensing devices (such as thermocouples) between the impregnated tube and the invert and crown of the host pipe at each manhole to determine the temperatures during the resin cure process. Modify the curing process if curing temperatures are above or below the resin manufacturer's recommendations, as approved.

(g) Cool Down - Use a controlled cool-down process to cool the hardened pipe to a temperature in accordance with resin manufacturer's recommendation. Obtain the recommended cool temperature before relieving the static head or pressure in the lined pipe and returning normal flow back to the system. Take measures to release the pressure so that a vacuum will not develop and damage the newly installed CIPP system.

(h) Pollutant Control – Water, condensate, or any other material must not have a styrene concentration greater than 2.5 mg/L for discharge into downstream pipes that are carrying live sanitary flows. No water can be discharged until water chemistry compliance is met. Contractor can utilize available downstream sewer, prior to live waste streams, for short term (48 hour) storage of water utilized in CIPP installation. Water, condensate, or any other material that exceeds this concentration must be captured or treated prior to discharge into the City's sanitary sewer system. The use of styrene reducing agents will be allowed upon approval by the engineer. Styrene mitigation controls must be approved and fully operational prior to any lining work being completed.

Set up containment barrier to capture the release of any inversion, cure, steam condensate, cool-down, or flushing water. All inversion, cure, cool down, flush water and steam condensate that does not meet the requirements listed in the previous paragraph must be treated prior to discharge or contained and shipped off-site for disposal at an approved disposal facility.

Sample process water and submit to a third-party laboratory for analysis of VOCs. Submit all chain-of-custody forms to the Engineer. Analytical results demonstrating compliance with the maximum styrene concentrations must be provided within 24 hours following the initial installation and prior to the discharge of any additional process water.

00412.44 Service Line Reconnection - Replace this subsection with the following:

00412.44 Lateral Service Line Reconnection - Internal

(a) After the CIPP has been cured, the existing service connections and laterals shall be reinstated. In general, reinstatement of service connections and laterals shall be

accomplished internally, without surface excavation, using a remote control cutting device equipped with a television monitor. Reopened services shall be wire brushed to the satisfaction of the Engineer. In some cases, remote reinstatement may not be possible. In these instances, reconnection by excavation as specified below is acceptable. All connections must be reinstated by at least 95-percent of the original opening. Holes cut outside the lateral opening or oversized cutting (more than 100%) must be repaired at the Contractor's expense per Specification Section 00412.73. Particular attention shall be given to the lower quadrant of the opening to ensure that no accumulation of solids or debris will occur at the service tie-in.

(b) All capped or factory plugged service connections shall not be opened unless otherwise directed by the Engineer.

(While rare, if the Contractor is unable to find a lateral location with the internal robotic cutter after lining the mainline pipe, digging up the service lateral may be required. Section 00412.45 discusses the process of reconnecting a lateral via excavation.)

Add the following subsection:

00412.45 Lateral Service Line Reconnection – By Excavation

(a) General - Sewer lateral house connections accomplished by excavation shall be connected to the pipe by dual-strapped saddles. The Contractor shall connect existing sewer house lateral service pipe to the saddle using a flexible coupling. After connection to the saddle, the sewer house connection pipe shall have a slope toward the newly lined sewer equal to the pre-existing on the lateral pipe or a minimum of two percent.

(b) Execution

(1) The Contractor shall excavate the area of the lateral connection so that the host pipe and existing connection is exposed. The host pipe shall be broken back or removed in such a manner that the new CIPP liner is exposed without causing damage to the liner.

(2) An appropriately sized hole acceptable to the Engineer shall be cut into the CIPP using a circular hole cutter. Hanging or loose cuttings shall be removed so that the newly opened hole is smoothed around its edges.

(3) A sealant compatible with CIPP and acceptable to the Engineer shall be liberally applied around the newly cut hole to form a watertight seal between the CIPP liner and PVC pipe saddle used to make the connection.

(4) A dual-strap PVC pipe saddle acceptable to the Engineer shall be secured to the CIPP in accordance with the manufacturer's recommendations.

(5) Before the service lateral pipe is connected to the saddle, the Contractor shall hand wipe a hydrogen sulfide resistant composite epoxy resin mixture inside the saddle where the saddle and CIPP surfaces meet to ensure a watertight seal.

(6) The Contractor shall connect the lateral service pipe to the saddle according to the manufacturer's recommendations and in a manner acceptable to the Engineer.

Add the following subsection:

00412.46 Manhole Restoration and Structure Connections - After the cool down is complete, perform final trimming and sealing of the liner at access structures to provide watertight pipe and structure seals. Neatly and smoothly trim the finished ends of the liner to within one inch of access structure wall. Provide a smooth transition between the existing structure channel invert and the liner using cementitious or other approved material to prevent settling of sediments or debris from catching on the liner or ponding of any standing water in the access structure. Seal all holes and voids in manhole and structure walls immediately surrounding the new liner with a chemical grout, compatible with the resin mixture of the liner.

Reinstall manhole cones, slabs, grade rings, frames, covers, inverts, and reconstruct benches and channels after each pipe liner installation. Internal rehabilitation of manholes is not permitted until after the liner is installed and accepted.

Repair intermediate access points in accordance with the Drawings.

(Include Section 00412.47 if resin containing styrene is used. Designer to note required monitoring locations on the Plans or modify language in section below as needed.)

Add the following subsection:

00412.47 Styrene Gas Emission Monitoring - Styrene gas emissions inherent in the CIPP installation process shall be monitored at the specified locations by the Contractor as required. OSHA standards provide a guideline for Recommended and Regulatory Limits for Styrene PPM in the OSHA Z-2 Table.

Styrene gas emission monitoring shall be performed at the manhole locations identified on the Plans. Readings shall be taken directly at 5 ft downwind, 15 ft downwind, and 30 ft downwind from the outlet with the highest release of steam from the system during the installation and curing process. The styrene gas emissions shall be recorded on the Styrene Gas Emissions Monitoring Form included at the end of this Specification Section for each test conducted.

00412.71 Post Installation Video Inspection - Replace this subsection, except for the subsection number and title, with the following:

After completing each segment of pipe liner installation, reconnecting service laterals, and final cleaning, perform video inspection of the completed work according to 00415.

00412.72 Material Sampling and Testing - Replace this subsection, except for the subsection number and title, with the following:

(It is recommended samples be kept/stored for the duration of the warranty period. The samples would typically be stored by the City. Designer to discuss with City.)

(a) Sample Preparation and Collection – For each installation, prepare at least two samples. Immediately deliver to the City one sample of each completed liner segment. Any sample removed from the project site without approval will be rejected. Obtain

samples in accordance with ASTM 1216 and F1743. Send the second sample for testing per 00412.72(b).

Samples must large enough to provide five specimens for short-term flexural property tests. For flexural properties, the full wall thickness of the CIPP samples will be tested. Exterior film thickness will be subtracted from the measured thickness. The film will be physically removed from the specimen prior to testing. Determine sample size based on installed liner thickness, assuming a uniform non-reinforced felt tube, and ASTM D790 which requires use of a minimum 16:1 span-to-depth ratio plus 2 inches and a maximum 4:1 span-to-width ratio for each of the five specimens taken from the sample.

For each sample, individually label and fill out the Chain of Custody Form (provided at the end of this Specification Section) with the following information:

- Project number and name
- Name of contractor
- Name of person taking sample and their employer
- Sample number. Use a unique number for each sample.
- Manhole-to-Manhole segment number
- Initial cure start date and time, sampling date and time, and location of the sample within the manhole-to-manhole segment.
- Type of sample (restrained, plate or core)

Contractor shall provide the Chain of Custody Form to the Agency or City Project Representative along with sample.

(b) Plate Samples – Where creation of restrained samples are not possible, prepare plate samples from material taken from the same tube and resin/catalyst system used during the wet out. Cure plate samples in a clamped mold, placed either in the down tube when circulated heated water is used, or in the silencer when steam is used, and in accordance with the Inspection Practices section of ASTM F1216 or F1743.

(c) Testing – Send one sample per installation to a certified AL2A laboratory for testing according to ASTM D790. Submit signed, dated and timed copies of all test results to the City. Physical properties of the installed CIPP will be confirmed in accordance with ASTM F1216 and F1743 and pursuant to the following additional criteria:

(1) Thickness - Thickness will be measured in accordance with ASTM F1216, D5813, & D3567.

Ultrasonic pulse echo, per ASTM E797, may be used as an alternate method of measuring thickness, as approved and at no additional cost to the City. If ultrasonic pulse echo is used, use a minimum of 8 evenly spaced measurements around the internal circumference of the installed CIPP within the host pipe at a distance of 12 inches to 18 inches from the end of the pipe. Record a minimum of 16 evenly spaced measurements.

If the ultrasonic method is used, use the flaw detector with A-scan display and direct thickness readout, as defined in 6.1.2 of ASTM E797. Manufacture a calibration block from the identical materials used in the installed CIPP to calibrate sound velocity through the liner. Calibrate the transducer daily in accordance with the equipment

manufacturer's recommendations. Calculate the average thickness using all measured values and verify it meets or exceeds the minimum design thickness as agreed upon between purchaser and seller.

(2) Short-Term Flexural Properties – Submit test results for flexural strength and flexural modulus properties per ASTM D790.

If plate samples are used to determine initial flexural modulus according to 00412.72(a) then a reduction factor of 20% will be applied to the measured value (i.e. measured value x 0.80).

(d) Retesting – If any test fails, collect and deliver additional samples to the City's Construction Manager for re-testing. If the second samples fail, bring the liner into compliance by methods described in 00412.73.

00412.73 Repairs – Replace the bullet list with the following:

- Radially positioned (perpendicular to flow) wrinkles, fins or other discontinuities in the lower third of the pipe which exceed ½ inches in height.
- Radial wrinkles, fins or other discontinuities in the upper two-thirds of the pipe which exceed 1-inch in height, unless approved.
- Gouges, holes or tears.
- Areas of pin holes
- Soft spots
- Leakage through the liner.
- Separation of the liner from the existing pipe.
- Delamination of liner layers.

If an installed liner has unacceptable wrinkles, fins, discontinuities, leakage, delamination, pinholes, gouges, tears, soft spots, blisters, failed tests, or other defects, submit to the City's Construction Manager a repair plan to remedy the defect(s). The City reserves the right to require the installation of a second liner, removing and re-installing a full-thickness liner, constructing a full pipe replacement, or installing a liner repair, as approved. After remedial measures are performed to bring the liner system into compliance with conformance standards, conduct additional testing as required by the City per 00412.72.

00412.80 Measurement – Add the following at the end of the section:

Styrene gas emissions monitoring will be measured on a unit basis for each identified testing location.

00412.90 Payment –

Replace pay item "(b) Service Line Reconnections" with the following:

Pay Item	Unit of Measurement
(b) Service Line Reconnections - Internal	Each
(c) Service Line Reconnections - Excavation	Each
(d) Styrene Gas Emissions Monitoring	Each

Add the following to the end of the subsection:

Flow diversion will be paid for according to Section 00490.

No separate or additional payment will be made for:

- Temporary manhole modifications/repairs to provide access for performing the work.
- Installation of end seal material or addressing deficient end seals.
- Removal of protruding taps, tree roots, controlling leaks, and other cleaning activities during host pipe preparation process.
- Sampling and testing.
- Removal, repair, or replacement of CIPP liners the are determined to be noncompliant with 00412.73.
- Additional testing, cleaning, and video inspection required as a result of correction of unsatisfactory work.
- Internal reconnection of existing service laterals.
- Temporary manhole access ramp construction and removal.
- Intermediate pipe access and repair, backfill, and restoration.

Add the following subsection:

00412.91 Payment Deduction - Payment will be based upon the Contract Unit Price and test results acquired in accordance with 00412.72. Should test results fail to meet the specified design parameters for thickness and initial modulus of elasticity, yet comply with Conformance Standards in 00412.73, a payment deduction will be made according to the Payment Formula below.

Payment = Length Installed x Contract Unit Price x (Actual Safety Factor/Design Safety Factor)

The Actual Safety Factor will be calculated using the governing design equations (i.e. equations yielding the greatest minimum thickness) from ASTM F1216-Appendix X1. The measured thickness, measured flexural strength, and measured initial flexural modulus will be substituted for their respective design values while the remaining design parameters specified in 00412.03 are held constant. The Design Safety Factor is specified in 00412.03.

No additional payment is made for CIPP exceeding required design safety factor. The CIPP will be considered Defective Work if the actual safety factor is below 1.0. The City reserves the right to require the Contractor remove and replace Defective Work, at its sole discretion.

Styrene Gas Emissions Monitoring Form

Project: _____
COB#: _____

Styrene gas emission monitoring shall be performed at the manholes specified in the Plans. Contractor shall coordinate with the City of Bend to have a representative of the City or the Engineer present while the test is conducted.

Readings shall be taken directly at 5 ft downwind, 15 ft downwind, and 30 ft downwind from the outlet with the highest release of steam from the system during off-gassing.

Date of Test:	
Manhole No.:	
Name of Person Conducting the Test:	
Name of City Representative Present:	
Styrene Gas Emission Readings (PPM)	
5 ft Downwind	
15 ft Downwind	
30 ft Downwind	

The results of testing shall be submitted to the City as soon as they are available and not more than 3 days after the test is conducted.

Chain of Custody Form
CIPP Liner Test Samples

City Contract Number: Click here to enter text.

Project Name: _____

Client: _____

Sample ID: _____ (Must be a unique identification number.)

Sample Location: _____ (Manhole-to-Manhole Segment Number)

Sample Type: _____ (Restrained, flat plate)

Pipe Diameter (Inches): _____ Liner Thickness (mm): _____

Initial Cure Date and Time: Click here to enter a date. at _____ (AM/PM)

Date and Time Sample Taken: Click here to enter a date. at _____ (AM/PM)

Sample Taken by: _____ (Installer Signature)

Witnessed by: _____ (Inspector Signature)
Test results will not be accepted without inspector's signature.

Shipped By: _____ (Shipper Name) Shipment ID: _____

Testing Laboratory: _____ (Lab Name)
To be filled out by testing lab: (Or attach lab form)

Date Sample Received: Click here to enter a date.

Date Sample Tested: Click here to enter a date.

Tested By: _____ (Lab Technician Signature)

Comments: _____

_____

_____

Attach test results to this form and return to Owner at:

Test Results Received By: _____ (Owner Signature)

Date Results Received: Click here to enter a date.

End of Section

Section 00413 – GRP Cured-In-Place Pipe Lining & UV Care

Comply with Section 00413 of the Standard Specifications modified as follows:

00413.01 Submittals – Replace this subsection, except for the subsection number and title, with the following:

Submit the following at least 10 Calendar Days before the preconstruction conference:

(a) Certification - Certification by the lining system manufacturer that the installer is licensed and certified as competent to perform the Work.

(b) Documentation showing the installer meets the qualifications listed in 00413.30, and a list of the key qualified personnel who are assigned to Work on this Project.

(c) Technical Data - Manufacturer's technical data showing complete information on material composition, chemical and physical properties, and dimensions of system components of the tube and resin system. Include manufacturer's recommendation for allowable mixing, resin saturation, and handling times, transportation and storage times and storage requirements, insertion pressures, curing, trimming, finishing, and data on the maximum allowable stresses and elongation of the tube.

(d) Calculations - Stamped design of the proposed liner according to 00150.35 and 00413.02.

(e) Test Reports - Independent third-party certification of test results demonstrating that the exact resin/liner combination to be used for this project meets the requirements for initial structural properties (performed in accordance with ASTM F2019, ASTM F1216, ASTM D638, and ASTM D790 or equivalent as approved) and chemical resistance (per ASTM F1216-Appendix X2). Submit calculations that provide extrapolated long-term test results per ASTM D2990 to support long-term flexural modulus per the design parameters listed in 00413.03. The initial data between time “0” and “1,000” hours must be excluded. If the architecture of the UV-CIPP is such that the physical properties vary depending on the direction of testing (i.e., axial versus circumferential), submit test data on both directions in accordance with the test methods listed above in this paragraph.

(f) Resin Volume - Calculations for the volume of resin to be used for each segment including the calculated amount of excess resin necessary to achieve full saturation and detailed description of the resin impregnation (“wet out”) process. The volume calculations must be based on required finished liner characteristics and should account for tube void space, the structural condition of the host pipe, and predicted changes in the resin’s physical and chemical characteristics due to polymerization. Include the tube and manufacturer's resin impregnation (“wet out”) recommendations including the roller gap, material feed speed and vacuum requirements for each liner size and thickness. Upon liner system delivery, submit impregnation (“wet out”) logs documenting resin volumes used.

(g) Installation Plan - Detailed installation plan describing the pipe lining installation and curing process, project staging, insertion locations, liner shot plan and sequence, and

the manufacturer's standard procedures for liner installation. Include materials and equipment (e.g., UV light train) to be utilized and list of tasks associated with each installation. The description must include the resin manufacturer's curing cycle with temperatures and pressure requirements measured continuously and recorded at intervals no less frequently than every 5 minutes. The curing cycle must be specific to each liner segment and address project design parameters and site conditions. If possible, include a contingency curing cycle in the event temperatures fall over or under the liner system manufacturer's recommendations. Identify in the description the type of temperature sensors that will be used, their proposed locations, and recording method and/or equipment. Include in the overall installation plan the allowable pulling forces, temperature monitoring plan, speed of the UV light train for proper curing of the installed liner, and method and sequence of lateral reinstatement, including the method for addressing lateral protrusion.

Include a control protocol according to Section 6.7 of ASTM F2019 for each installation. The control protocol must include certification of approval by the liner manufacturer, including the following minimum information:

(1) Date and time
(2) Length of liner
(3) Location of installation
(4) Curing speed
(5) Light sources and wattage
(6) Inner air pressure
(7) Exothermic (curing) temperature

(h) Shot Schedule - Liner shot and curing schedule for each installation and the order of locations to be completed. Include curing log and pressures at the upstream and downstream end of the pipe during the curing process.

(i) End Seals - End seal material to be used, and method of installation. Hydraulic cements and quick-set cement products are not acceptable.

(j) Pipe Access - Identify all required manhole, structure or pit access for CIPP installation. Identify required modifications to existing facilities and describe proposed preparation, modification, preservation, and restoration activities. Include sketches, shop drawings and / or engineered repair drawings as required. Include locations of intermediate pipe access and proposed repair plan that meets the requirements of the Contract.

(k) Lateral Reinstatement Plan - Include method, materials and personnel assigned to do the work.

(l) Sampling Plan - Field sampling and testing plan for physical properties according to ASTM F2019. Include proposed methods, locations, and proposed chain-of-custody process for sample delivery to the City's Construction Manager. Include the name and location of independent third-party laboratory performing testing on the installed liner system. Provide certification that the independent third-party laboratory has the appropriate accreditation for each specified tests to be performed. Refer to requirements in Specification Section 00413.72. Chain of Custody Form is provided at the end of this Specification Section.

(m) Liner Repair Plan - Contingency repair plan including methods and equipment to be used to repair or replace unacceptable liner defects identified in 00413.72. Include a detailed description of methods and materials required to repair typical and isolated minor liner damage, such as: installation tears less than 4 inches in length and no more frequent than one in one-hundred linear feet, discrete blisters, areas of pinholes, areas of dry tube, and soft spots. Include proposed method for repairing trimmed wrinkles and fins. Provide the liner system manufacturer's recommendations for liner repairs. Liner Repair Plan approval is required prior to making each repair.

Submit the following for review, during construction:

(n) Cure Logs - Record installation data and submit cure log upon completion of the installation.

(Use the following subsection .02 to list the GRP CIPP design parameters. Obtain the parameter information from the Designer. For pipe ovality, 2% is recommended for pipes less than 24-inches in diameter and 5% for pipes 24-inches or larger diameter. Designer to consider whether to represent Long-Term Flexural Strength and Modulus of Elasticity as shown below ([percent of ASTM D790] or in psi. For example, short-term flexural modulus and long-term modulus when tested in accordance with ASTM D790 for Standard Polyester would be specified as 250,000 psi and 125,000 psi, respectively. Short-term flexural modulus and long-term modulus when tested in accordance with ASTM D790 for Enhanced Polyester would be specified as 400,000 psi and 200,000 psi, respectively. Also note that this specification is specific to lining gravity sewer piping. Designer will need to reevaluate the liner material and strength being specified if CIPP lining methods are to be used for lining pressure piping [e.g. sewer forcemain, water].)

00413.02 Design Parameters –

Delete the following conditions in the table:

Condition	**Parameter**
Height of fill from invert	_____

Replace the following parameters for the conditions in the table:

Condition	**Parameter**
Groundwater Elevation above invert…… .	_____
Pipe Ovality……..	2%
Long-Term:	
Flexural Strength ……..……	90%* of Initial (ASTM D790)
Modulus of Elasticity……..…	50%* of Initial (ASTM D790)

*Unless long-term test results are provided that substantiate a greater retainage.

Add the following to the end of this subsection:

Condition	**Parameter**
Service Temperature Range ……..……..	140 degrees

00413.11 Resin – Add the following to the end of this subsection:

The City's Construction Manager may inspect fabrication of the liner and resin impregnation at the manufacturer's facility to ensure compliance with these specifications.

Add the following subsection:

00413.14 Pipe Liner End Seal - The hydrophilic end seals completely seal the liner from any annular space leakage between the liner and the host pipe. Hydrophilic end seals must be one of the following:

(a) Bands that are 20 mm wide and 5 mm high, with a double bump on one side and flat on the other side. Product shall be Hydrotite Style DS-0520-3.51, or approved equal.

(b) Tubular hydrophilic sleeve, 2 mm in thickness and 3.5 inches in length, with a mechanical fastener with worm gear expander. Product shall be Insignia End Seal by LMK Technologies, or approved equal.

00413.30 Personnel Qualifications – Replace this subsection with the following:

(Designer shall discuss with City Procurement whether prequalification of Contractors is necessary for the Project or whether minimum qualifications shall be stated in the Qualifications section below (modify as needed). Prequalification is recommended in most cases unless due to pipe size, contract size (cost), and/or criticality of pipe(s) being lined are deemed to not be of high enough risk to the City to warrant prequalification. Note that there is a requirement for the Contractor to submit an Affidavit of Qualifications as a part of their bid forms certifying that they meet the minimum requirements listed in the specification. Coordinate with City Procurement to include the Affidavit of Qualifications form in the Bid Documents. If prequalification is desired in lieu of Affidavit of Qualifications, City Procurement can provide a template for prequalification.

For small diameter installations [less than 24-inches in diameter] consider removal of requirements for large diameter piping listed in sections (a), (b), and (c) below.)

00413.30 Qualifications - Contractor shall submit an Affidavit of Qualifications included in the Bid Submittal Forms at the time of bid certifying the following minimum qualifications are met:

(a) CIPP System Manufacturer: The CIPP system must have a minimum proven performance record of 1,000,000 linear feet installed of the exact name-brand product bid in the United States, with a minimum of 20,000 linear feet in diameters 24-inch or larger over the last five years. In addition, a minimum of 10,000 linear feet of 36-inch diameter or larger, of the exact name brand product must have been installed in the United States.

(b) Installer Experience: The Installing Contractor for the cured-in-place reconstruction of sewers must have a minimum of five years of experience using the exact named product proposed and, have installed at least 300,000 linear feet of the exact named

proposed product including at least 20,000 feet of 24-inch diameter or larger cured-in-place product. Documentation along with contact names and telephone numbers from the last ten projects shall be submitted.

(c) On-Site Field Superintendent: The Superintendent must have a minimum of five years of experience with cured-in-place pipe products. In addition, the Superintendent must have supervised jobs in which at least 20,000 feet of pipe has been reconstructed using the exact named product proposed including a minimum of 5,000 feet of 24-inch diameter or larger cured-in-place product. The Contractor shall submit information to document this requirement. The Superintendent for the Project shall be on-site during all phases of the work involving any pre- and post-installation video inspection, sewer cleaning or insertion and processing of the CIPP.

Add the following subsection:

00413.31 Labor Requirements – Crews and key personnel are not to work more than a maximum of 12 hours per 24-hour day, or as otherwise approved.

Staff the project with the key individuals as specified, and who will be available for the project duration.

00413.40 General – Add the following to the end of the subsection:

(a) Water and Electric Service - Furnish and supply generators or obtain temporary power to provide all electric power required for installation. Obtain a permit and pay all fees required for use of any hydrant, per Section 00340.

(b) Diversion of Flow - Furnish, install, maintain and operate a flow diversion system as needed, and in accordance with Section 00490.

(c) Receiving and Insertion Locations - Locate all manholes or pits to suit the pipe lining operation. Use existing manholes where practical. Remove manhole flattops and cones, inverts, benches, and channels if required to permit access for installation equipment. Enlarge the incoming and outgoing pipe openings, if required, to accommodate the maximum outside diameter size of the insertion equipment. Do not put undue stress on existing structures. In areas where existing manholes are not available, intermediate access pits may be excavated and utilized at no additional cost to the City. Intermediate pipe repair and restoration must be done in accordance with the Drawings at no additional cost to the City. Manned entry in unlined pipe is not allowed. If manned intermediate access is required, an access pit must be dug at the required location.

(d) Customer Notifications

(1) The Contractor shall contact all residential and commercial customers whose service is to be interrupted by rehabilitation work or who may be affected by upstream or downstream rehabilitations. The customer shall be informed that they will be temporarily out of service. This notification shall be made a minimum of 48 hours prior to beginning rehabilitation work.

(2) For all residences the Contractor shall leave a door hanger detailing the service outage and providing contact information. Door hanger samples shall be submitted to the Engineer for review and approval. The Contractor shall also advise those customers against water usage until the mainline and lateral are back in service. After completing the necessary work on the main line and lateral to allow their reuse, the Contractor shall advise those customers that the sewer is back in service.

(3) All customer notification documentation and procedures shall meet the requirements of the Owner.

(e) Service Interruption Duration - Should a condition arise that the Contractor cannot restore service within 12 hours of service interruption; the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

00413.41 Pipe Cleaning – Replace this subsection, except for the subsection number and title, with the following:

Refer to Section 00415.40(c) for pipe cleaning requirements.

00413.43(a) General – Add the following to the end of this subsection:

Where practicable, install liners in continuous runs through manholes where there are two or more continuous host pipe segments requiring lining. If manholes are lined through, remove crown of liner inside manhole flow channel.

00413.43(d) UV Curing Method – Replace this subsection with the following:

(d) Curing - Provide a UV light train that meets the following requirements:

- Minimum of one camera for UV-CCTV inspection of the liner,
- Size of the light train is appropriate for the pipe diameter,
- UV bulbs are in proper proximity to the liner wall all around the pipe circumference,
- Sensors to record the cure progress,
- Logged hours of individual UV Lights incorporated in the light train is less than 80% of the manufacturer's stated usage rate.

Maintain light train usage log on-site and submit to City's Construction Manager upon request.

Operate the ultraviolet curing lamps at a sufficient output and in a sufficient frequency range to ensure curing of the resin.

Optimize the multi-lamp ultraviolet curing lights and resin photo-initiator system for curing of the provided resin.

Assemble the UV light train according to the manufacturer's recommendations for the sewer pipe and liner diameter. Cure the liner according to the curing protocol, as approved. Maintain light train speed per the manufacturer's requirements, and to assure exothermic reaction has

completed. Do not pull the UV light train in a downhill direction during the curing process unless otherwise approved. Approval will not be given where pipe slopes are greater than or equal to 3.0%.

Collect curing data and UV-CCTV inspection records during the installation and curing process. Submit copies to the City for review. Where the curing data and the curing protocol differ, the City reserves the right to require additional "in pipe" sampling and testing at no additional cost.

00413.43 Installation – Add the following to the end of the subsection:

(e) Transport and Storage - Transport and store the impregnated tube at the site in such a manner that it will not be damaged, exposed to direct sunlight, or result in any public safety hazard. Inspection and review of all materials will be conducted prior to installation.

The City reserves the right to check, verify or inspect all phases of production and testing of materials from manufacturing, shipping, installation, cure, to finished product. Any departure from the submitted procedures will be cause for rejection.

Add the following subsection:

00413.44 Lateral Service Line Reconnection - Internal

(a) After the CIPP has been cured, the existing service connections and laterals shall be reinstated. In general, reinstatement of service connections and laterals shall be accomplished internally, without surface excavation, using a remote control cutting device equipped with a television monitor. Reopened services shall be wire brushed to the satisfaction of the Engineer. In some cases, remote reinstatement may not be possible. In these instances, reconnection by excavation as specified below is acceptable. All connections must be reinstated by at least 95-percent of the original opening. Holes cut outside the lateral opening or oversized cutting (more than 100%) must be repaired at the Contractor's expense. Particular attention shall be given to the lower quadrant of the opening to ensure that no accumulation of solids or debris will occur at the service tie-in.

(b) All capped or factory plugged service connections shall not be opened unless otherwise directed by the Engineer.

(While rare, if the Contractor is unable to find a lateral location with the internal robotic cutter after lining the mainline pipe, digging up the service lateral may be required. Section 00413.45 discusses the process of reconnecting a lateral via excavation.)

Add the following subsection:

00413.45 Lateral Service Line Reconnection – By Excavation

(a) General - Sewer lateral house connections accomplished by excavation shall be connected to the pipe by dual-strapped saddles. The Contractor shall connect existing sewer house lateral service pipe to the saddle using a flexible coupling. After connection to the saddle, the sewer house connection pipe shall have a slope toward the newly lined sewer equal to the pre-existing on the lateral pipe or a minimum of two percent.

(b) Execution

(1) The Contractor shall excavate the area of the lateral connection so that the host pipe and existing connection is exposed. The host pipe shall be broken back or removed in such a manner that the new CIPP liner is exposed without causing damage to the liner.

(2) An appropriately sized hole acceptable to the Engineer shall be cut into the CIPP using a circular hole cutter. Hanging or loose cuttings shall be removed so that the newly opened hole is smoothed around its edges.

(3) A sealant compatible with CIPP and acceptable to the Engineer shall be liberally applied around the newly cut hole to form a watertight seal between the CIPP liner and PVC pipe saddle used to make the connection.

(4) A dual-strap PVC pipe saddle acceptable to the Engineer shall be secured to the CIPP in accordance with the manufacturer's recommendations.

(5) Before the service lateral pipe is connected to the saddle, the Contractor shall hand wipe a hydrogen sulfide resistant composite epoxy resin mixture inside the saddle where the saddle and CIPP surfaces meet to ensure a watertight seal.

(6) The Contractor shall connect the lateral service pipe to the saddle according to the manufacturer's recommendations and in a manner acceptable to the Engineer.

Add the following subsection:

00413.46 Manhole Restoration and Structure Connections - After the installation is complete, perform final trimming and sealing of the liner at access structures to provide watertight pipe and structure seals. Neatly and smoothly trim the finished ends of the liner to within one inch of access structure wall. Provide a smooth transition between the existing structure channel invert and the liner using cementitious or other approved material to prevent settling of sediments or debris from catching on the liner or ponding of any standing water in the access structure. Seal all holes and voids in manhole and structure walls immediately surrounding the new liner with a chemical grout, compatible with the resin mixture of the liner.

Reinstall manhole cones, slabs, grade rings, frames, covers, inverts, and reconstruct benches and channels after each pipe liner installation. Internal rehabilitation of manholes is not permitted until after the liner is installed and accepted.

Remove temporary dams after work is complete and pipe is clean and restored according to 00490.

00413.72 Material Sampling and Testing –

Add the following before the sentence that begins "Obtain restrained samples…":

For all UV-CIPP installed from the same manufacturing process (i.e., same batch of resin, felt, and manufacturing process), prepare at least two above grade restrained samples for each diameter using the same material and the curing equipment as the original installation. Immediately deliver to the City one sample. Any sample removed from the project site without

approval will be rejected. For each sample, fill out the Chain of Custody Form (provided at the end of this Specification Section) and provide to the Agency or City Project Representative along with sample.

Add the following to the end of the subsection:

Samples for each type described below should be large enough to provide the recommended specimens for testing. For flexural properties, the full wall thickness of the liner samples will be tested. Sample size is based on installed liner thickness.

Plate samples will not be allowed.

(a) Testing – Send one sample per installation to a certified AL2A laboratory for testing according to ASTM D790 and ISO 178. Submit signed, dated and timed copies of all test results to the City. Physical properties of the installed CIPP will be confirmed in accordance with ASTM F1216 and D2019 and pursuant to the following additional criteria:

(1) Thickness - Thickness will be measured according to ASTM F2019, D5813, & D3567.

Ultrasonic pulse echo, per ASTM E797, may be used as an alternate method of measuring thickness, as approved and at no additional cost to the City. If ultrasonic pulse echo is used, use a minimum of 8 evenly spaced measurements around the internal circumference of the installed CIPP within the host pipe at a distance of 12 inches to 18 inches from the end of the pipe. Record a minimum of 16 evenly spaced measurements.

If the ultrasonic method is used, use the flaw detector with A-scan display and direct thickness readout, as defined in 6.1.2 of ASTM E797. Manufacture a calibration block from the identical materials used, to calibrate sound velocity through the installed liner. Calibrate the transducer daily in accordance with the equipment manufacturer's recommendations. The average thickness should be calculated using all measured values and shall meet or exceed minimum design thickness as agreed upon between purchaser and seller.

(2) Short-Term Flexural Properties – Submit test results for flexural properties per ASTM D790.

(b) Retesting - If any test fails, collect and deliver additional samples to the City's Construction Manager for re-testing. If the second samples fail, bring the liner into compliance by methods described in 00413.73.

00413.73 Repairs – Add the following to the end of the subsection:

If an installed liner has unacceptable wrinkles, fins, discontinuities, leakage, delamination, pinholes, gouges, tears, soft spots, blisters, failed tests, or other defects, submit to the City's Construction Manager a repair plan to remedy the defect(s). The City reserves the right to require the installation of a second liner, removing and re-installing a full-thickness liner, constructing a full pipe replacement, or installing a liner repair, as approved. After remedial

measures are performed to bring the liner system into compliance with conformance standards, conduct additional testing as required by the City per 00413.72.

00413.90 Payment–

Add the following pay items:

Pay Item	Unit of Measurement
(b) Service Line Reconnections - Internal	Each
(c) Service Line Reconnections - Excavation	Each

Add the following to the end of the subsection:

Spot repairs and flow diversion will be paid for according to Section 00490.

No separate or additional payment will be made for:

- Temporary manhole modifications/repairs to provide access for performing the work.
- Installation of end seal material or addressing deficient end seals
- Removal of protruding taps, tree roots, controlling leaks, and other cleaning activities during host pipe preparation process.
- Removal, repair, or replacement of liners that are determined to be noncompliant with 00413.72.
- Sampling and testing.
- Additional testing, cleaning, and video inspection required as a result of correction of unsatisfactory work.
- Internal reconnection of existing service laterals.
- Temporary manhole access ramp construction and removal.
- Intermediate pipe access and repair, backfill, and restoration.

Add the following subsection:

00413.91 Payment Deduction - Payment will be based upon the Contract Unit Price and test results acquired according to 00413.72. Should test results fail to meet the specified design parameters for thickness and initial physical properties, yet comply with Conformance Standards in 00413.73, a payment deduction will be made according to the Payment Formula below.

Payment = Length Installed x Contract Unit Price x (Actual Safety Factor/Design Safety Factor)

The Actual Safety Factor will be calculated using the governing design equations (i.e. equations yielding the greatest minimum thickness) from ASTM F1216-Appendix X1. The measured thickness, measured flexural strength, and measured initial flexural modulus will be substituted for their respective design values while the remaining design parameters specified in 00413.03 are held constant. The Design Safety Factor is specified in 00413.03.

No additional payment is made for liners exceeding required design safety factor. The UV-CIPP will be considered Defective Work if the actual safety factor is below 1.0. The City reserves the right to require removal and replacement of Defective Work, at its sole discretion.

Chain of Custody Form
CIPP Liner Test Samples

City Contract Number: Click here to enter text.

Project Name: _____

Client: _____

Sample ID: _____ (Must be a unique identification number.)

Sample Location: _____ (Manhole-to-Manhole Segment Number)

Sample Type: _____ (Restrained, flat plate)

Pipe Diameter (Inches): _____ Liner Thickness (mm): _____

Initial Cure Date and Time: Click here to enter a date. at _____ (AM/PM)

Date and Time Sample Taken: Click here to enter a date. at _____ (AM/PM)

Sample Taken by: _____ (Installer Signature)

Witnessed by: _____ (Inspector Signature)
Test results will not be accepted without inspector's signature.

Shipped By: _____ (Shipper Name) Shipment ID: _____

Testing Laboratory: _____ (Lab Name)
To be filled out by testing lab: (Or attach lab form)

Date Sample Received: Click here to enter a date.

Date Sample Tested: Click here to enter a date.

Tested By: _____ (Lab Technician Signature)

Comments: _____

Attach test results to this form and return to Owner at:

Test Results Received By: _____ (Owner Signature)

Date Results Received: Click here to enter a date.

End of Section

Section 00415 – Video Pipe Inspection

(Note: This specification is specific to Video Pipe Inspection for CIPP Lining and should only be included in the Special Provisions if CIPP Lining is being used on a project.)

Comply with Section 00415 of the Standard Specifications modified as follows:

Add the following subsection:

00415.01 Submittals – All the supplied data and information will become the property of the Owner. The following shall be submitted:

(a) Sample Submittal - An example of a typical CCTV Inspection final deliverable shall be submitted for approval by the Engineer prior to the start of work. The example deliverable shall contain the following:

(1) A sample NASSCO PACP Standard Exchange Database, version 6.0.2 or greater, in Microsoft Access file format (.mdb), as exported from the Contractor's data collection software.

(2) A proprietary database as generated by the Contractor's data collection software.

(3) Example media files, including observation photos, CCTV videos, and reports; with all files consistently utilizing the required file naming conventions and folder structures.

(4) The proposed viewing software to be used with the proprietary inspections database and related media.

(5) NASSCO PACP validation report in PDF format, demonstrating the sample is fully conforming to NASSCO PACP standards and conventions. Validation reports can be obtained by submitting a sample database to: http://www.nassco.org/training_edu/te_database_upload.aspx.

(6) Inspections database(s) shall be fully cross-referenced to the videos, images, and reports.

(7) Example reports will be presented in both hard copy and in PDF format, and all other sample data will be presented in digital format on an external hard drive.

The Engineer will review the video footage, inspection logs, and database file to determine if the quality of the video image is acceptable, if defects were properly identified and documented, and that the database is in PACP format. Samples shall be with the same camera and lighting equipment proposed for the work.

The Contractor shall be responsible for modifications to its equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior

to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

(b) Intermediate Inspection Submittal - No later than every fourteen (14) days following the completion of a pipeline inspection, the Contractor will submit the following:

(1) Two (2) hard copies of full details report for each inspection, showing the position and full text of each defect encountered and their grades.

(2) An overall summary report detailing major defects and inspections that require attention.

(3) A list of unmapped manholes and/or pipe segments that were identified during inspections but were not shown on field maps. This list shall include the field-assigned ID and a geographic reference or description (street address, intersection, etc.).

(4) A statistical report showing lengths of sewers inspected and a breakdown of sizes and lengths inspected.

(5) At regular agreed intervals, an external hard drive will be submitted to the Engineer containing a single NASSCO PACP Standard Exchange Database (version 6.0.2 or greater) containing all inspections to date, encoded videos, observation photos, inspection reports in PDF format, and support files. The supplied data and information will become the property of the Owner.

(c) Final Inspection Submittal - At the completion of all inspection work, the Contractor will supply the following to the Engineer to be delivered within ten (10) days of the inspection:

(1) A single, consolidated NASSCO PACP Standard Exchange Database (version 6.0.2 or greater) in Microsoft Access file format (.mdb) containing all inspections.

(2) NASSCO PACP validation report for the consolidated database (See Section 3.04.B.5.).

(3) All encoded inspection videos, observation photos, and inspection reports using required file naming formats.

(4) A single, consolidated proprietary database containing all inspections for the Contract, as generated by the Contractor's data collection software.

(5) Free-issue software to be used for the viewing of the proprietary inspections

(d) Calibration Data – Submit calibration data for recording device including the date on which it was last calibrated.

Equipment

00415.20(a) Video Camera – Replace this subsection, except for the subsection number and title, with the following:

(a) Video Camera - Use a digital color video camera capable of pan-and-tilt radial viewing that pans plus or minus 275 degrees and rotates 360 degrees and a zoom ratio of at least 40:1. Lighting intensity shall be remote-controlled and shall be adjusted to minimize reflective glare, providing a clear image of the full pipe circumference and all areas of concern. Provide a camera and lighting system capable of operating in 100% humidity conditions. Camera shall include "Data-View" displaying date, pipe number, and footage reading of distance traveled.

00415.20(b) Transporter – Add the following to the end of the subsection:

The transporter shall be capable of a minimum of 900 feet of continuous inspection.

00415.20(c) Recording Device – Replace this subsection, except for the subsection number and title, with the following:

Provide a device capable of recording video with "Data-View" displaying date, pipe number, and footage reading of distance traveled along the profile in tenths of feet and indicating the camera's position from the starting point. Calibrate the meter counter to be accurate within plus or minus 2 feet in 1,000 feet and measure the distance traveled by the camera in the sewer. The device must be capable of recording a digital video with a minimum resolution of 720 x 480.

Video equipment shall include genlocking capabilities to the extent that computer-generated data (e.g., footage, date, size, address and location), as determined by the Engineer, can be overlaid onto the video, and both indicated on the television monitor and permanently recorded on the inspection videotape.

Add the following subsection:

00415.24: Digital Video Format - Digital video files (Inspection Videos) shall be captured and/or recorded in the MPEG-2 format, minimum. The minimum resolution of videos shall be 720 pixels (x) by 480 pixels (y) and an encoded frame of 29.97 frames per second. The internal video capture files shall be linked to the database file(s) (Inspection Observations). The "link" of the video capture file to the database observation file is required and each observation shall record the name of the video file and the frame number referencing the time in the video when the inspection was made. The inspection observation(s) shall link to the video record in real time.

Add the following subsection:

00415.25: Image Format Requirements

(a) The inspection image files (pictures) shall have the ability to be exported to industry standard formats, including JPEG, BMP, and TIFF, and be transferable by disk, DVD, and/or external hard drive to an external personal computer utilizing standard viewers and printers. Digital pictures must have a minimum resolution of 1024 pixels (x) by 768 pixels (y).

(b) The video image capture module shall be capable of collecting multiple color video frames of the defects found during inspection and then linked to the inspection reports. There shall not be a limitation to the number of pictures allowed per observation.

Add the following subsection:

00415.26: Software

(a) The software shall be NASSCO PACP-certified (most recent release) and conform to its pipeline assessment procedures.

(b) Software shall export to a PACP (MDB) format (most recent release).

Add the following subsection:

00415.27: Database Requirements

(a) The Contractor must use the City's GIS pipe and manhole nomenclature. Each sewer segment, which extends from node to node, not necessarily from manhole to manhole, as identified on the contract drawings, shall have a separate video file. If field conditions result in multiple videos for a single sewer segment, the videos shall be combined into a single video file for the database.

(b) Each video file shall be named with the upstream and downstream manhole IDs and "WF" or "AF" to indicate whether the video is "with flow" or "against flow". For example, 10540_to_5890_AF.mpeg identifies the video for the pipe segment with upstream node 10540 and downstream node 5890 and the video was filmed from 5890 to 10540.

(c) These videos shall be linked to a single open-architecture database file. The database file must include fields as required by PACP.

(d) All video paths in the database file shall read as follows: "\Videos".

(e) Ensure that the database field titled "Sewer_Use" is populated as: "Sanitary"

(f) All videos linked to the database shall be saved in a subfolder named "Videos" (as opposed to a separate folder for each video).

Add the following subsection:

00415.30 Qualifications – The Contractor shall be qualified or shall have a qualified independent company specializing in video inspections to inspect the sewer interior using a color television camera, documentation of the inspection on video with audio location and date information, video title information, hard-copy inspection logs, and a Pipeline Assessment Certification Program (PACP) compliant database.

Internal video inspection shall be performed by a National Association of Sanitary Sewer Service Companies (NASSCO) PACP certified operator and shall meet the coding and reporting standards and guidelines as set by PACP. All report annotations, pipe conditions, and pipe defects shall be identified properly using PACP codes as defined by PACP, and severity ratings shall be calculated according to PACP.

00415.40 Video Inspection – Replace this subsection, except for the subsection number and title, with the following:

(a) General Video Inspection – The Contractor shall be responsible for properly inspecting the pipe and providing the finished inspection video and database file. Inspection shall consist of:

(1) Pre-Construction Video Inspection of the sewer prior to CIPP installation, following cleaning, root removal, intruding tap removal, and/or grouting.

(2) Final Acceptance Video Inspection of the sewer following CIPP installation and lateral reinstatement.

(b) Notice and Access - Notify the Engineer a minimum of 48 hours before beginning cleaning or video inspection. Allow the Engineer access at all times, to observe the video monitor and all other operations.

(c) Cleaning:

(1) The term "clean" as used in this Section, shall mean removing all sand, dirt, roots, grease and all other solid or semi-solid materials from the sewer pipelines, so that a closed circuit television camera can be used in the internal pipeline inspection for the purpose of discerning structural defects, misalignment and infiltration/inflow sources.

(2) The Contractor shall certify that sufficient cleaning units can be provided, including standby units in the event of breakdown, in order to complete the work within the contract period. Further, the Contractor shall certify that standby or back-up equipment can be delivered to the site within 24 hours in the event of equipment breakdown.

(3) Prior to the commencement of work, the Contractor shall coordinate access to water with the local water utility. Water will not be furnished by the Owner.

(4) All details of the point of water connection, backflow protection, conveyance methods, draw-off rates, times and all local conditions regarding the use of water shall be approved by the Engineer and the utility providing the water prior to commencement of work. All equipment, labor, and material required for obtaining water for the work shall be provided by the Contractor. The Contractor must ensure that a 6-inch minimum air gap is maintained at the water supply point on desilting/cleaning/jetting equipment or any other receiving apparatus used to obtain water from the utility's hydrants.

(5) Cleaning will be accomplished by utilizing a high pressure, hydraulic sewer pipeline cleaner. Pressure jetting equipment used shall be sufficient for the purposes of attaining the degree of cleanliness in sewers as specified.

(6) The cleaning unit(s) shall be capable of operating routinely, up to a minimum of 500 feet from the point of access to the sewer; minimum hose diameter shall be 1 inch.

(7) Successive passes using constantly moving pressure jetting techniques shall be applied to sewers until they are cleaned to the level specified. Nozzle hold-time

(stationary time), for any particular location, shall not be more than 60 seconds in order to forestall damage to the pipe being cleaned. Ideally nozzles shall have jet angles of between 30° to 45°. “High efficiency nozzles” (discharging “pencil jets”) with jet angles higher than this figure shall not be allowed to be stationary at any time.

(8) Cleaning shall be done immediately prior to the internal inspection to preclude the build-up of debris from infiltration/inflow sources and upstream manhole sections. Should television inspection reveal that a sewer pipeline is not clean; the cleaning operations shall be repeated until the sewer pipeline is clean. This additional cleaning shall be done at the expense of the Contractor, at no additional cost to the Owner.

(9) During preconditioning and cleaning work and all other associated Contract operations, sewer services shall be maintained at all times. This requirement may be relaxed only with the written approval of the Engineer.

(10) The manholes and sewers to be preconditioned and cleaned convey sanitary sewage or combined sewage. In many instances such sewers are subject to high flows, either continuously or in a periodically varying cycle, due to rainfall, infiltration, and/or pumping operations. The Contractor shall include in his proposal provisions for dealing with such variations, and where necessary, schedule the Work to accommodate such variation in flows.

(11) Cleaning shall include the trapping and removal of all sediments and residual wastes from successive manholes as the cleaning progresses. When hydraulic cleaning equipment is used, a suitable weir or dam shall be constructed in the downstream manhole, in such a manner, that the solids and water are trapped. Under no circumstances shall sewage or solids removed there from, be dumped onto streets, in catch basins or in storm drains. Material which could cause pipeline stoppages, accumulations of sand in wet wells, or damage to pumps, shall not be permitted to pass from manhole section to manhole section. The cost of trapping, removing, hauling and disposing of the residual wastes shall be included in the cost of cleaning. Disposal of residual wastes shall be in accordance with, and at a location approved by the Engineer and the Owner.

(12) The Contractor shall provide for the pumping down of any surcharged manhole section and provide all bypass pumping, if required, during the cleaning operation. All bypass pumping shall be approved by the Engineer.

(13) The Contractor shall submit a comprehensive equipment list to the Engineer before commencement of the Work. The complete list, which shall include all backup and standby equipment, shall be broken down into the following categories (at a minimum):

a. Safety equipment
b. Manhole preconditioning and cleaning equipment
c. Sewer preconditioning and cleaning equipment
d. Flow diversion and flow control equipment
e. Traffic control equipment
f. All other equipment necessary for the completion of the work.

(14) Blockages in the system shall be reported to the Engineer immediately.

(15) A responsible representative of the Contractor shall be present on the site of the work, or other location approved by the Engineer, to provide supervision of the work. At all times, and especially when a change of work location is underway, the Contractor's representative shall keep the Engineer continuously aware of the location, progress, planned execution of the work, and problems encountered.

(16) Remove and dispose of all debris according to 00290.20.

(17) Precautions

a. The Contractor shall take all necessary precautions to ensure that water used does not flood property or buildings served by the sewer pipeline being cleaned.

b. No fire hydrant shall be obstructed, in case of a fire in the area served by the hydrant.

c. The Contractor shall take all necessary precautions to protect the sewer pipelines from damage that might be inflicted by improper use of cleaning equipment and shall repair, at no cost to the Owner, any damage caused by the cleaning operation.

d. The Contractor shall furnish, to the Owner, certification of the accuracy of the automatic counter before any work shall begin on this Project. If, at any time, the Engineer has reason to believe that the counter is inaccurate, the calibration of the counter will be checked before any more work progresses.

e. The Contractor shall provide, operate, maintain and subsequently remove on completion, adequate ventilation apparatus in the form of blowers and/or fans. The ventilation apparatus shall introduce a fresh air supply to support a safe environment for Work in sewers, manholes and all other confined spaces, which shall be kept free from dangerous, toxic and/or explosive gases, whether generated from sewage, soil strata or other source.

f. The Contractor shall employ the "best practicable means" to minimize and mitigate noise as well as vibration resulting from operations. Mitigation measures shall include the utilization of sound suppression devices on all equipment and machinery particularly in residential areas and in the near vicinity of hospitals and schools, especially at night.

g. The Contractor shall inform the Engineer before the commencement of any portion of the work of any significant change in the methods of noise attenuation from those previously approved.

h. All pumps, generators, combination cleaners or other noise emitting equipment shall be suitably screened to minimize nuisance and noise pollution. This requirement shall not be taken as preventing or prohibiting the execution of work necessary for the saving of life, protection of property, or safety of the personnel and/or facilities. The Contractor shall notify the Engineer of such use of plant or equipment in an emergency situation as soon as practicable.

(18) Data Collection

a. The Contractor shall complete a cleaning report for each sewer segment cleaned. A hard copy of this report shall be furnished on a weekly basis to the Engineer. The information required on the cleaning report shall be as follows:

- Location, size and condition of sewer line. Location will be indicated by road name, intersection(s) and GPS coordinates. Size will be indicated by nominal internal diameter. Condition will be indicated by narrative describing visual observation and the items below, augmented by photos where needed.
- Degree and nature of deposits prior to cleaning.
- Length of sewer cleaned.
- Estimated amount and types of debris and sediment removed. Indicate approximate location.
- Grease build-ups - Indicate approximate location.
- Structural failures - Indicate approximate location.
- Blockages - Indicate percent blockage or free area.
- Method and man hours actually expended for cleaning.

(d) Flow Control – The Contractor shall conduct inspection work to achieve a view of at least 95 percent of the pipe diameter. This may require that the Contractor provide flow control or bypassing in accordance with Section 00490.

(e) Verbal Commentary – The Contractor shall record an audio narrative of the location, upstream and downstream control points, date, and time of the inspection.

(f) Access –The Engineer shall have access to observe the monitor and all other operations at all times. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

(g) Inspection – The Contractor shall observe the following requirements when conducting video inspections:

(1) The camera shall be pulled through the sewer in either direction, but all inspections at each location shall be in the same direction.

(2) Inspections shall be from the center of the starting manhole to the center of the ending manhole. Video inspections must begin prior to the camera head entering the pipeline. Camera counter shall start continuous recording upon entering the invert of the pipeline being inspected.

(3) Pan and tilt the entire circumference at the pipe-manhole interface, at any change in pipe material, and at other locations to ensure proper documentation of the pipeline's condition.

(4) Maximum rate of travel shall be 30 feet per minute when recording.

(5) Portions of the pipeline may be bowed or bellied and as a result the camera may encounter a submerged condition. Where the camera encounters a submerged condition, the Contractor shall reduce the flow depth to an acceptable level using a high-velocity jet nozzle or other acceptable dewatering device.

(6) Pan and tilt the camera in the invert of each manhole to give a full visual inspection of the starting, intermediate, and ending manholes.

(7) Each pipe segment video recording must have its own electronic file.

(8) Video inspection recordings must be continuous for each pipe segment. Video recording can be paused and then restarted without generating a new file.

(h) Image Perspective – The camera image shall be down the center axis of the pipe when the camera is in motion. The Contractor is required to provide a 360-degree view of the pipe interior. Points of interest shall also be videotaped and shall include, but not be limited to, defects, debris, and sediment. If, in the opinion of the Engineer, lighting is insufficient to gather the appropriate data, auxiliary lights will be required at no additional cost to the City.

(i) Sewer Identification – All inspection documentation shall include the sewer identification (at a minimum, the upstream and downstream manhole identification names, or numbers).

(j) Quality Assurance – The Engineer will review HDDs and logs to ensure compliance with the requirements listed in this section and the Contract documents. The Engineer will review the video footage to make sure that the required information is provided and the recording is of acceptable quality. If the sewer line is determined not to be adequately cleaned, it shall be re-cleaned and video-inspected by the Contractor at no additional cost to the City. If the Engineer determines that the video footage is defective or not of adequate quality, the Contractor shall conduct video inspection again at no additional cost to the City. Line segments that are not televised continuously from structure to structure will be re-inspected at no additional cost to the City.

(k) Video Record – The Contractor shall maintain an additional copy of all inspection documentation (HDDs, databases, and logs) for the duration of the work and guarantee period.

(l) Inspection Acceptance – Acceptance of the inspections shall be based on the Engineer's verification that the quality and format of the video and database meets the requirements of the specification and the successful upload of the database file and videos into the City's software.

00415.42(a) Remote Video Inspection with Laser Profiler - Replace the paragraph that begins "Use video inspection equipment meeting…" with the following paragraph:

Use video inspection equipment meeting the requirements of 00415.22. Calibrate the laser profiler according to the manufacturer's specifications and ASTM F3080 Section 9.

00415.90 Payment – Add the following to the bulleted list where no separate or additional payment will be made for:

- Cleaning

End of Section

Section 00440 - Commercial Grade Concrete

(This Section requires SP02030 and SP02050.)

Comply with Section 00440 of the Standard Specifications modified as follows:

00440.10 Materials – Add the following to the end of the material list:

Fiber …….02045

00440.11 Proportions – Add the following to the end of the bullet list:

- Fiber

00440.12 Properties of Commercial Grade Concrete –

In the bullet that begins **"Entrained Air…"** replace "4.0 to 7.0 percent" with "4.5 to 7.5 percent".

In the bullet that begins "**Slump**…" delete "5 inches…" and add the following subsections:

- Slip form curb – 3 inches or less
- Flat work and handset curb – 5.5 inches or less

In the bullet that begins "**Compressive Strength…**" replace "3,000 psi" with "3,500 psi".

Add a bullet, **fiber** – ½ bag per yard not to exceed manufacturer's recommendations

(Use the following subsection .40(b) when 00759 is used for Commercial Grade Concrete curbs, concrete curb ramps with curbs, islands, traffic separators, driveways, sidewalks, monolithic curb and sidewalks, miscellaneous surfaces, and stairs)

00440.40(b) Placing - Add the following bullet to the end of the bullet list:

- When haul time or placement conditions warrant exceeding the time of discharge, submit a detailed breakdown of the estimated time needed from batching to discharge of a load along with the measures that will be taken to ensure slump, temperature and uniformity will be maintained. Submit in advance to establish a new time limit at the Engineer's discretion.

00440.40(d) Weather - Replace this subsection, except for the subsection number and title, with the following:

Do not place CGC when the air temperature is below 35 °F or above 100 °F without approval.

Protect CGC from freezing if the air temperature is expected to drop below 35°F during the first 5 Calendar Days after placement.

All concrete placed below 35°F shall be approved under the following prescribed cold weather concrete plan:

- Concrete may be placed when the ambient air temperature is 25°F and rising, and the projected day time temperature high will be above 35°F for 2 days (unless otherwise approved by the City Engineer)
- Concrete shall not be poured below 25°F

- Concrete may not be poured on frozen ground
- If subgrade is frozen, all frozen material must be removed and new compacted base must be placed before concrete is poured
- Concrete subgrade must be inspected by the City prior to placing concrete
- At a minimum, when ambient air temperatures are between 30°F and 40°F, hot water will be used to maintain concrete temperatures not less than 55°F at placement
- At a minimum, when ambient air temperatures are between 25°F and 30°F, hot water will be used to maintain concrete temperatures not less than 55°F at placement and 1% non-Chloride accelerator
- Provide batch tickets to the Inspector
- The City may require the use of a hi/low thermometer to record the temperature of the placed concrete for 7 calendar days. Concrete must be maintained at 40°F minimum during this time
- If concrete temperature falls below 40°F, the City may choose to have the concrete removed and replaced at the contractors/permittee expense
- Prevent concrete from freezing for 7 calendar days after concrete is placed
- At a minimum, cover all concrete at night if the 7 day forecast shows a potential for freezing. It is up to the contractor to determine the best practice for protecting the concrete.
- Alternate cold weather concrete plans may be submitted for review but approval is at the City's discretion. All costs for these alternative plans to be reviewed by the City of Bend Quality Assurance representative will be borne by the contractor.

When the air temperature exceeds 90°F, place concrete in accordance with ACI 305R-10.

End of Section

Section 00442 - Controlled Low Strength Materials

(This Section requires SP02030.)

Comply with Section 00442 of the Standard Specifications.

End of Section

Section 00445 – Sanitary, Storm, Culvert, Siphon, and Irrigation Pipe

(This Section requires SP02415.)

Comply with Section 00445 of the Standard Specifications modified as follows:

00445.11 Materials –

Delete the reference to Polyvinyl Chloride Pipe in the material table

(e) Tracer Wire - Replace this subsection, except for the subsection number and title, with the following:

a. **Tracer Wire** - Furnish Copperhead Superflex 1045G-SF tracer wire, or approved equal.

b. **Connectors** - Furnish Copperhead SnakeBite LSC1030C locking connectors for terminals and connectors, or approved equal.

c. **Terminal Access Point** - Furnish Coperhead SnakePit CD14*2T-SW for installations in unimproved surfaces or SnakePit RB14*2T-SW for installations in hard surfaces

Add the following to the end of the subsection:

(i) Marking Tape - Marking tape shall be non-detectible marking tape for sewer that is 2 inches wide APWA green, stretchable to a minimum of five times its original size. Provide marking tape with the label that matched the utility. Marking tape shall meet all requirements of the owning utility and as approved by the Engineer.

(j) Gravity Sanitary and Storm Sewer Pipe

a. Rigid PVC pipe compounds used in gravity sewer pipe shall conform to ASTM D-1784, Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (PVC) Compounds.

b. PVC pipe shall conform to ASTM D-3034 standards dimensions ratio not to exceed 35 or to ASTM F679, minimum pipe stiffness of 46 psi. Provide manufacturer's certification, including test results, for all materials supplied under this specification.

c. Where minimum cover cannot be maintained, or where directed by the Engineer, pipe shall be C-900 water pipe meeting the requirements of AWWA C-900 Specifications, Polyvinyl Chloride (PVC) Pressure Pipe

d. Polyethylene ADS N-12 Dual Wall Flexible Water Tight Pipe used in gravity storm sewer pipe shall conform to ASTM F 2648 and shall have a smooth interior and annular exterior corrugations.

e. Solid-wall HDPE used in gravity irrigation pipe shall conform to Section 02415.20.

(k) Pressure Sewer Pipe

a. Pipe shall be C900 and have a minimum DR of 18 unless specified otherwise for pressure sewer pipe 4 inches in diameter and larger. Pipes 4 inches in diameter and larger shall be gasketed and shall use mechanical joints with the exception of service tees, which shall use glued joints.

b. Pipe and fittings smaller than 4 inches in diameter shall be Schedule 40 PVC assembled using glued joints.

c. Vacuum mains shall be constructed of SDR 21 PVC.

(l) Jointing Materials – Polyvinyl Chloride Pipe

a. **Gravity Sewer Pipe** – Joints shall be rubber gasketed and watertight conforming to ASTM D3212 for gravity sewers. Gaskets shall conform to ASTM F477. Lubricant jointing shall be as approved by the pipe manufacturer.

b. **Pressure Sewer Pipe** – Joints shall be rubber gasket or solvent welded depending on pipe size. Solvent welded joints shall conform to the applicable requirements of ASTM D2466 and ASTM D2467.

c. **Gravity Storm Sewer** – Joints shall be watertight per requirements of ASTM D3212. Gaskets shall conform to ASTM F477. Gaskets to be installed by pipe manufacturer and covered with removable protective wrap. Joint lubricant as approved by manufacturer.

(m) Fittings – Polyvinyl Chloride Pipe

a. Gravity Fittings

i. PVC pipefittings shall conform to ASTM D3034, standard dimensions ratio not to exceed 35 or to ASTM F679, minimum pipe stiffness of 46 psi. Provide manufacturer's certification, including test results, for all materials supplied under this specification.

ii. All fittings shall be the same as the joints used on the sewer pipe. Caps or plugs shall be furnished with each tee outlet or stub with the same type gasket and joint as furnished with the service connection pipe specified for future service connections. The plug or cap shall be banded or otherwise secured to withstand all test pressures involved without leakage.

iii. Each tee for future service connection shall be marked with detection tape and a new 2-inch x 4-inch utility grade wooden stake painted green all around. The face of the curb shall be marked with an "S" locating the service crossing. Where no curbs are being installed, the

end of service tee shall be marked with a #4 rebar set adjacent to the 2 x 4 stake and set to within 6-inch of the finished grade.

b. Pressure Sewer Fittings

i. **Plug Valves** – Type V405 Eccentric (Isolation Valves)

Plug valves shall be a non-lubricated type and rated at 175psig CWP drip-tight shutoff, with pressure from either direction, and shall have a cast iron body with flanged ends. The valve-closing member shall rotate 90° degrees to a full open or closed position with the plug rotating out of the sewage flow. The lug shall be cast iron with round or rectangular port of no less than 80 percent of the connecting pipe area. The plug shall be coated with Buna-N or Hycar elastomers with seats Type of 316 stainless steel or nickel. The valve stem bearing shall be self-lubricating stainless steel or reinforced Teflon, with the stem seal multiple V-rings (Chevron), U-cups, or O-ring of nitrile rubber, and shall include grit seals on the valve stem. Valves shall be polymer coated inside and out, and have a non-rising stem. Unless otherwise specified, plug valves shall be supplied with a 2" operating nut. In vault service boxes or above ground plug valves shall be supplied with hand wheels.

Approved manufactures:
1. Keysone; Ballcentric
2. Dezurik; Series 100
3. Victaulic; vic-Plug

ii. **Check Valves** – Check valves on pressure sewer mains shall be external lever and weight actuated, iron-body, flanged-end, resilient seat check valves equivalent to Kennedy model 106 ALS. APCO model 104P3 with backflow device may be used in lieu of the Kennedy check valve in certain applications.

iii. **Pressure Sewer MH and C.O**. – Cleanouts shall be constructed as indicated on the Standard Drawings. MH shall be a 48-inch manhole as illustrated in the Standard Drawings.

iv. **Pressure Pipe Air-release Valves** – Air-release valves shall be constructed as indicated on the Drawings, complete with 2-inch shut-off valve, 1-inch blow-off valve, and back flushing apparatus, APCO Model 400, Valmatic 302, or equal. Valve shall provide for an operating pressure range of 0-50 psi.

v. **Hot Tap Specifications** – 2-inch and 3-inch saddles shall be epoxy coated ductile iron body saddles with double stainless steel straps equivalent to type 202S as manufactured by Romac.

All taps larger than 2 inch shall be stainless steel sleeves equivalent to type SST service saddles as manufactured by Romac.

vi. **Valve Boxes** – Valve boxes subject to traffic loading shall be a two-piece grade adjustable box. The valve box shall have 7-inch I.D. with a slip top section without a dirt flange on the bottom as shown in the Standard Drawing. Valve boxes shall be cast iron East Jordan Iron Works #363912 or equal. The bottom extension piece shall be a single piece of 6" 3034 pipe of the proper length for to allow for 6"-12" inches of overlap. The word "SEWER" or letter "S" shall be cast into the top of the lid. Valve boxes shall not be located in driveways.

vii. **Restraining Device** – Restraining devices used on pressure sewer shall be a full-circumference wedge-type device as manufactured by Romac Industries. Restraining device shall be Grip Ring™ or approved equal.

c. Sewer Lateral fittings

i. Sewer Service Markers – Service connection markers shall be new, one-piece Douglas Fir or cedar, 2x4, utility grade or better. Rebar shall be #4, Class 40 or better.

ii. Service Saddles – Gravity line service saddles shall be Romac "CB" type saddles or equivalent with stainless steel strap. No other type shall be permitted. For all pipe materials EXCEPT PVC, furnish Predco PE44 Exothermic Epoxy Kit, 4 oz Resin and 4 oz Hardener In on 8 oz Jar, or approved equal, for application around gasket seals.

iii. Swing Check Valves – Swing valves shall be APCO series 100, Legend Model T451, or equivalent U.S. Brands. The check valve shall be capable of passing a 2-inch diameter solid.

iv. Plug Valves – Non-lubricated 175 psig rated type CWP drip-tight shutoff with pressure from either direction cast iron body with flanged ends. The valve-closing member shall rotate 90° degrees to a full open or closed position with the plug rotating out of the sewage flow. The lug shall be cast iron with round or rectangular port of no less than 80 percent of the connecting pipe area. The plug shall be coated with Buna-N or Hycar elastomers with seats Type of 316 stainless steel or nickel. The valve stem bearing shall be self-lubricating stainless steel or reinforced Teflon, with the stem seal multiple V-rings (Chevron), U-cups, or O-ring of nitrile rubber, and shall include grit seals on the valve stem. Valves shall be polymer coated inside and out, and have a non-rising stem. Unless otherwise specified, plug valves shall be supplied with a 2" operating nut. In vault service boxes or above ground plug valves shall be supplied with hand wheels.

Approved manufactures:
1. Keysone; Ballcentric
2. Dezurik; Series 100
3. Victaulic; vic-Plug

00445.40(b) Line and Grade - PRESERVE the subsection title and DELETE the remaining paragraph beginning “Centerline and grade control…”. REPLACE with the following:

Centerline and grade control shall be established by the contractor, per the contract documents, prior to start of construction.

Do not vary from established line and grade more than ½ inch for line and more than 1/32 inch per inch of pipe diameter. Variance shall not exceed 1 inch, subject to the following limitations:

00445.40(c) Pipe Distribution and Handling – Add the following paragraph to the end of the subsection:

Do not stage more pipe along an open trench, prior to installation, than can be installed in one work shift.

Add the following subsection:

00445.40(h) Sewer Taps – Sewer taps shall be performed only by competent personnel of companies’ pre certified for sewer taps by the City of Bend. Tapping equipment shall be used only for sewer taps. A representative of the City Engineer must witness every sewer tap. Provide a minimum of 5 calendar days’ notice prior to installing tap. Apply exothermic epoxy around gasket seals to adhere the gasket to the pipe.

Hot taps shall be scheduled only during the hours of 7:30 AM to 3:00 PM, Monday through Friday, including trench backfill.

00445.43(c) Polyvinyl Chloride Pipe – Add the following paragraphs to the end of the subsection:

For pressure sewer, wrap the pipe four (4) times per 20-foot section with detection tape to differentiate this pipe from the white or blue plastic pipe used in potable water applications.

Fittings, plugs, and caps shall be installed in pipe in the manner described within these specifications or by the approval of the City Engineer, or his/her representative. For dissimilar pipes, (e.g. AWWA C900 to ASTM D3034), a hard PVC transition type adapter coupling shall be used. Special conditions encountered for which suitable adapter couplings are not available, shall be referred to the City Engineer for consideration of an approved method. Fern-co and Calder Coupling type fitting will not be allowed.

(1) Solvent Welded Joints – After a length of Solvent Weld pipe is placed in the trench, both the spigot end and the receiving bell shall receive a thorough application of primer and glue as per the manufacturer’s specifications. The pipe shall be centered, seated, and rotated at least 90°. The pipe shall be brought to correct line and grade and secured in place with approved backfill material. Pipe and fittings which do not allow a sufficient and uniform space for jointing shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space. Precaution shall be taken to prevent dirt from entering the joint space.

(2) Number of Pipes Laid Before Jointing – Solvent Weld and Rubber gasket joint pipe shall be connected as hereinafter specified as soon as they are placed in the trench.

(a) Pressure Sewer Thrust Blocking – Place thrust blocks at all angle points on pressure sewer. Where approved by the City Engineer, restrained joints may be used on pressure sewer lines in lieu of thrust blocks or deadmen.

00445.48 Tracer Wire - Replace this subsection, except for the subsection number and title, with the following:

(a) General – Place tracer wire directly over the pipe centerline. Make tracer wire splices using a solderless connection kit that effectively moisture-seals two or more conductors for direct burial and securely join the wires both mechanically and electrically. Insulate splices to be moisture-proof and waterproof. Splices wrapped with tape will not be accepted as waterproof. Have all splice kits approved prior to installation. Test all tracer wire with locating Equipment prior to acceptance.

(b) Storm Sewer – Install tracer wire on all storm sewer pipes that do not terminate on both end at a structure. Tracer wire is not required on storm sewer pipes between structures.

(c) Sanitary Sewer

(1) Gravity Sanitary Sewer – Install tracer wire on all gravity sanitary sewer laterals from main to clean out. Tracer wire is not required on gravity sewer main between structures.

(2) Pressure Sanitary Sewer – Install tracer wire on all pressure sanitary sewer pipes.

(d) Terminal Access Point – Where terminating tracer wire at a location that does not have a cleanout, or other surface element, terminate tracer wire in a terminal access point set to finish grade.

Add the following subsection:

00445.49 Marking Tape - Replace this subsection, except for the subsection number and title, with the following:

Install one layer of marking tape 1 foot above the pipe in all sanitary and storm sewers trench and as needed for relocated utilities or marking tape that is disturbed or damaged during construction.

00445.70(a) Storm Sewer and Culvert Installations – Add the following sentence to the end of the subsection:

Perform low-pressure air testing on storm sewer mains.

00445.70(b) Siphon, Irrigation, and Sanitary Sewer Installations – Add the following paragraph to the end of the subsection:

No sewer line will be televised until all inverts and channels in manholes are grouted and the manholes and pipes have been flushed with water.

00445.71(a) General – Add the following paragraph to the end of the subsection:

All pressure sewer and sewer force mains shall successfully pass a hydrostatic test prior to acceptance.

00445.72(a) General – Replace the sentence that begins “After completing installation…”, with the following:

After completing installation of the system, including all service connections, installation of other facilities requiring excavation through the trench backfill, backfilling and compaction, receipt and review of compaction reports, and prior to wearing surface paving and curb placement, conduct sewer and storm pipe testing, including CCTV inspections a low-pressure air test or a hydrostatic test. For Private Development projects, curb placement and wearing surface paving

00445.72(c) Air Testing - Replace this subsection, except for the subsection number and title, with the following:

The pressure gauge used in air testing shall have minimum divisions of 0.1 psi and an accuracy of 0.0625 psi. All air testing shall be by the Time Pressure Drop Method. The test procedure is as follows:

(1) The Contractor may wet the lines prior to testing.

(2) Determine the average height of the groundwater over the line. The test pressures required shall be increased 0.433 psi for each foot of average water depth over the exterior crown of the pipe.

(3) Add air slowly to the section of system being tested until the internal air pressure is raised to 4 psi greater than the average back-pressure due to groundwater.

(4) After the test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.

(5) After the temperature stabilization period, disconnect the air supply.

(6) At any convenient observed pressure reading at 4.0 psig greater than the average external pressure of any groundwater above the pipe, begin timing the pressure loss. If the time shown in the table below for the designated pipe size and length elapses before the air pressure drops 0.5 psig, the section is considered to have passed the test. The test may be discontinued once the prescribed time has elapsed, even though the 0.5 psig loss has not occurred.

Pipe Dia. (in)	Min. Duration (min:sec)	Length for Min. Duration (ft)	Equation for Specific Length (sec)	Time (Minutes:Seconds)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
4	1:53	597	0.19*L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427*L	2:50	2:50	2:50	2:50	2:50	2:50	2:50	3:12	3:33
8	3:47	298	0.76*L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	6:20
10	4:43	239	1.187*L	4:43	4:43	4:43	4:56	5:56	6:55	7:54	8:54	9:53
12	5:40	199	1.709*L	5:40	5:40	5:41	7:07	8:32	9:58	11:23	12:49	14:14
15	7:05	159	2.671*L	7:05	7:05	8:54	11:07	13:21	15:34	17:48	20:01	22:15
18	8:30	133	3.846*L	8:30	9:36	12:49	16:01	19:13	22:26	25:38	28:50	32:03
21	9:55	114	5.235*L	9:55	13:05	17:27	21:48	26:10	30:32	34:54	39:15	43:37
24	11:20	99	6.837*L	11:23	17:05	22:47	28:29	34:11	39:52	45:34	51:16	56:58
27	12:45	88	8.653*L	14:25	21:37	28:50	36:03	43:15	50:28	57:41	64:53	72:06
30	14:10	80	10.683*L	17:48	26:42	35:36	44:30	53:24	62:19	71:13	80:07	89:01
33	15:35	72	12.926*L	21:32	32:18	43:05	53:51	64:37	75:24	86:10	96:56	107:43
36	17:00	66	15.384*L	25:38	38:27	51:16	64:06	76:55	89:44	102:33	115:22	128:12

Technica Data

a) Allowable Air Loss Rate (Q): The value for Q is 0.0015 cubic feet per minute per square foot of internal surface.

b) Testing Main Sewers with Services: If lateral sewers such as services are included in the test because of the difficulty in isolating such lateral sewer, their lengths may be ignored for computing test times. Ignoring the laterals results in a slightly more severe test.

c) Rounding Off Pipe Lengths: Rounding off pipe lengths shall always be to the next higher length value shown, i.e., the test time for 201 feet shall be the times shown for 250 feet. At the discretion of the Inspector, test times for a unique pipe length may be linearly interpolated from the next higher and lower times indicated.

Add the following subsection:

00445.72(e) Hydrostatic Pressure Testing of Pressure Sewer and Force Mains – Pressure sewer and force main shall be tested by hydrostatic methods. Furnish all necessary equipment and material and make all taps in the pipe as required for testing purposes. The test pressure shall be two times the calculated operating pressure, but not less than 50 psi for the low end of the pipe for a minimum duration of 2 hours. For high pressure lines, the test pressure shall not exceed the manufacturer's maximum operating pressure recommendation. Calculate allowable loss using the following:

Loss Formula - The quantity of water lost from the main must not exceed the number of gallons per hour determined by the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

L = allowable leakage in gallons per hour

S = length of pipeline tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in psi

Correct all visible leakage regardless of the allowable leakage specified. If the measured leakage exceeds the allowable amount specified, or if pressure cannot be maintained as specified, locate and repair the leaks and retest the pipeline until test requirements are met.

00445.74 Video Inspection of Sanitary and Storm Sewers - Replace this subsection, except for the subsection number and title, with the following:

After laying and joining sanitary and storm sewer pipe installations from 6 inches to 72 inches in diameter, including backfill and compaction of trenches, receipt and review of compaction reports, but before any finish surfacing or final paving, the Contractor shall coordinate with the City for the City to conduct a video inspection of all sanitary sewer pipes and storm sewer pipes.

Contractor shall introduce water flow of sufficient quantity at the upstream end of the pipe such that flow is observed to be exiting the downstream end of the pipe to be video inspected. Maximum allowable vertical pipe deflection shall not exceed the line and grade requirements of Section 00445.40(b) and will be determined by CCTV observation of standing water depth remaining in any section of the pipe after flow introduction.

Findings of the video inspection shall be recorded, provided to the Contractor, and the Contractor shall be required to correct all deficiencies at no expense to the City. Upon correction of deficiencies revealed by video inspection, the Contractor shall notify the City Engineer and a follow-up video inspection of the corrected areas will be done by the City. Costs for any follow-up video inspections will be borne by the Contractor.

The City will provide video inspection of all lines prior to completion of the one-year warranty and final acceptance of the work. This will be done at no cost to the Contractor.

Findings of the video inspection shall be recorded, provided to the Contractor, and the Contractor shall be required to correct all deficiencies at no expense to the City. Upon correction of deficiencies revealed by video inspection, the Contractor shall notify the City Engineer and a follow-up video inspection of the corrected areas will be done by the City. Costs for any follow-up video inspections will be borne by the Contractor.

If at any time during the one-year warranty period examination of the sewer line discloses a deficiency, that deficiency shall be corrected by the Contractor at no expense to the City.

Add the following subsection:

00445.80 Measurement – Delete the paragraph that begins “Video pipe inspection…”.

00445.80(k) Sewer Taps – The quantities for sewer taps will be measured on the unit basis.

00445.91 Payment –

Add the following Pay Items to the Pay Item list:

Pay Item	Unit of Measurement
(m) Sewer Service Pipe ____ Inch	Foot
(n) Sewer Taps	Each

In item (m), the nominal pipe size will be inserted in the blank.

Delete the paragraph that begins “Video pipe inspection…”.

End of Section

Section 00470 - Manholes, Catch Basins, and Inlets

Comply with Section 00470 of the Standard Specifications modified as follows:

Change Section title to:

Section 00470 – Manholes (including drywells), Catch Basins, and Inlets

(Use the following subsection .10 when composite frames and covers will be used. Composite frames and covers are only permitted for use in non-traffic areas.)

000470.10 Materials – Add the following to the materials list:

Composite Frames and Covers…….....2450.31

000470.13 Inside Drop Manhole Connectors – Replace this subsection with the following:

000470.13 Inside Drop – Furnish Reliner inside drop bowl or approved equal. Size drop bowl per the manufacturer's recommendation based on the inlet pipe size. Furnish silicone to be used as a seal between the bowl and the manhole wall. Furnish stainless steel anchor bolts and anchor straps for inside drop pipe connections.

000470.14 Pipe and Fittings – Add the following to the end of the subsection:

Furnish BMP 24R oil/water separator snout, or approved equal. Anchor bolts shall be stainless steel.

(Use the following subsection .16 when corrosion resistant manholes are required.)

000470.16 Sanitary Sewer Manhole Carry-Through – Replace this subsection with the following:

000470.16 Corrosion Resistant Manholes – Furnish corrosion resistant manholes per the following:

(a) Polymer Concrete Manholes – Furnish polymer concrete manholes per Section 02451.

(b) Crystalline Waterproofing Additive – Furnish precast manholes with crystalline waterproofing additive per Section 02452.

Add the following subsection:

00470.18 Drywell

(a) Drain Rock – Furnish commercially available clean 2" – 3" crushed or river run drain rock.

(b) Drywell Liner – Furnish Seattle Textile PVC Coated Polyester Mesh (STC Item #: VM-1000-XXX-99) or approved equal.

Add the following subsection:

00470.19 Resilient Connector – Furnish flexible rubber connector conforming to the requirements of ASTM C923. Use Series 304 stainless steel pipe clamps to secure the pipe to the connector.

00470.40(b) Pipe Connections – Replace the paragraph beginning "Grout concrete pipe connections" with the following:

Grout concrete pipe connections to manholes, catch basins, inlets and drywells so they are watertight, using non-shrink grout conforming to 02440.50. When grouted into the concrete structure, the pipe section shall not extend more than 18 inches outside the structure. If an approved flexible connection for concrete pipe is provided at the structure, full or partial pipe sections may be stubbed into the structure as required. Following the grout application, it should be carefully leveled to align flush with the catch basins interior wall. There should be no overlapping or extension of the grout on the internal surface area of the catch basin.

All grout shall be installed per manufacturer's recommendations.

00470.41(c) Grates, Frames, Covers and Fittings - Replace this subsection, except for the subsection number and title, with the following:

Set metal frames for manholes on full non-shrink grout beds to prevent infiltration of surface water or groundwater between the frame and the concrete of the manhole section. If concrete is to be poured around the frames, coat the portion of the frame that will contact the concrete with hot asphalt before placing the concrete. Set frames, covers and grates true to the locations and grades established. Clean bearing surfaces and provide uniform contact. The use of a bolt adjustment system for frames from the QPL is allowed. Secure all fastenings. Construct all mortared, sanitary sewer manhole necks and all riser ring joints made with non-shrink grout using an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted.

00470.42 Precast Concrete Catch Basins and Inlets - Add the following sentence to the end of this subsection:

Grade adjustments using concrete risers is allowed.

Grout riser base joints using non-shrink grout conforming to 02440.50, and do the following:

- Clean and wet the surfaces to be joined with water.
- Apply non-shrink grout to the lower portion of the bell or groove of the section already laid and to the upper portion of the spigot or tongue of the section being laid.
- Clean the joint recesses, fill completely with non-shrink grout and wipe to a smooth finish both inside and out.
- Do not allow free water to come in contact with grout joints within 24 hours after the mortared joints are finished.
- Protect the completed joints against rapid drying.
- Maintain minimum grout be thickness per manufacturer's recommendation.
- All gout shall be installed per manufacturer's recommendation.

00470.45 Steps – Delete this subsection

(The Agency does not allow steps or ladders in storm or sanitary structures)

Add the following subsection:

00470.48 Drywell Facility Construction – Install drywell structure per 00470.41. Place woven geofabric against undisturbed earth as shown in the standard drawing. Place drywell drain rock around the structure to the elevations of the concrete cap. Fold over the woven geofabric and place moisture barrier on top of the drain rock.

Pour the concrete cap directly on the moisture barrier – the concrete cap does not need to be formed. In earth or granular material, the outside two feet of the concrete cap shall be poured over undisturbed earth. In rock excavation, the cap may be poured directly to the rock wall, provided that the rock wall is stable.

The fabric liner specified for the inside of the drywell barrel shall have a smooth finish to promote cleaning by washing down. Felted materials are not acceptable. Fabric liner shall have sufficient tensile strength to be hung without undue sagging, and to resist tearing. It shall be resistant to raveling, and shall be anchored 18 inches back underneath the cone and at each dry well joint for the entire depth of the drywell.

The final elevation for each manhole shall conform exactly with the finished street. It is permissible to adjust the manhole frame to final grade after street paving provided the structure is low enough so as not to interfere with the street paving operation. Patching material shall be asphalt concrete with a maximum patch width of 6-inches.

For Private Development projects, the Engineer of Record shall inspect the drywell / underground injection controls daily during excavation and provide written reports weekly into the City permitting software. Inspections must confirm location of the excavation, being withing either the approved easement or within the right of way, and to the required dimensions to that meet the design capacity volumes.

Add the following subsection:

00470.71 (c) Testing Inspection - Add the following sentence to the end of this subsection: Hydrostatic testing and vacuum testing must be performed in the presence of a City inspector. Testing can be performed by a third party testing contractor, approved by the City inspector, in leu of the inspector being at the project site. Testing documentation must be provided to the City.

Add the following subsection:

00470.72 Drywell Facility Testing – Prior to acceptance, all Underground Injection Controls (UICs, including standard drywells (STD DWG STRM-10), modified drywells with storm injection well (STD DWG STRM-10A) and stormwater injection wells (STD DWG STRM 10-B)) shall pass a performance test under observation by a City or Engineer of Record representative. The test shall follow the following procedure:

1. Install the UIC per the approved plans, specifications, and applicable construction guidelines.

2. Inspect UIC prior to testing, making sure the UIC is clean and free of sediments. UICs will be tested prior to the construction of street sub-base and curb. If the UIC is disturbed through the excavation or is compromised through sediment introduction into the storm facility, the UIC will be tested again prior to acceptance.

3. Field check the accuracy of the flow meter by filling up a suitable container with known volume; for example a calibrated 55-gallon barrel.

4. Introduce clean water into the UIC and monitor using an in-line flow meter.

    a. If the UIC total inflow design volume is 10,000 gallons (1,336 CF) or less, place the design volume in the UIC within a 1 hour period and verify that the water either disappears immediately or document the standing water per the COSM Appendix 4B, Full Scale Drywell Test Method.

    b. If the UIC total inflow design volume is between 10,000-25,000 gallons (1,336-3,342 CF), place an initial 10,000 gallons (1,336 CF) into the UIC within 1 hour. If any standing water is present at the end of the 10,000-gallon test, then the City will require the full design inflow volume and/or a full-scale 2-hour drywell test per COSM Appendix 4B.

5. Infiltration Testing - Post-construction infiltration testing is required regardless of prior testing. Draw down measurements shall be performed to determine infiltration rate and recorded during the UIC testing, tested in 5-minute increments for 20 minutes (obtaining 4 recorded draw down measurements). An average infiltration will be determined from the draw down measurements and compared to the design infiltration used in the calculations.

Swale and UIC failure is determined if the facility cannot 1) contain volumes during the test, 2) if the facility is unable to infiltrate at the design infiltration rate (dictated in the construction documents or the storm water report) and 3) if the stormwater rises to the highest perforation in the UIC.

The standard testing form is provided on the next page.

UIC/Swale (Facility) Testing Report Form

Project: _____ Permit number: _____

Drywell ID: _____ Engineer of Record: _____

Date Tested: _____ Engineer Company:_____

Tester: _____ Testing Company:_____

Facility Dimensions:

Depth (*A*): _____feet Length:_____ feet Width:_____feet

Testing (Based on approved plans and COSM requirements)

Required quantity:_____gallons Required Testing time: _____ min

Assumed / Design Infiltration: _____ gal/min = _____ft/min

Test Time Start: _____

Depth of water at start: _____feet

Test Time End: _____

Depth of water at end: _____ feet (*B*)

Drawdown time – Infiltration Determination

Time (After test)	Depth, feet	Depth Change, feet, (*C*)	Infiltration (ft./min) I = *C* / 5
Test End	(*B*) =	0	
5 min			
10 min			
15 min			
20 min			
Infiltration Average =			

Passed: ☐ Failed: ☐

Tester Signature: _____ EOR signature: _____

00470.90 Payment –

Add the following Pay Item to the Pay Item list:

Pay Item	Unit of Measurement
(l) Drywell Facility ____ Cubic Yard	Each

In item (l), the drainage gallery size will be inserted in the blank.

End of Section

Section 00480 - Drainage Curbs

Comply with Section 00480 of the Standard Specifications.

End of Section

Section 00490 - Work on Existing Sewers and Structures

(This Section requires SP00470.)

Comply with Section 00490 of the Standard Specifications modified as follows:

Add the following subsection:

00490.12 Rubber Composite Grade Rings – Furnish rubber composite risers rings with a minimum tensile strength of 150 psi and a minimum density of 60 pcf.

Add the following subsection:

00490.40(a) Sanitary Sewer Bypass – Bypass sanitary sewer flows as needed to complete work shown. Bypassing system may be gravity or pumping. Submit a Bypass Plan for all anticipated sanitary sewer bypassing within 45 days of notice to proceed to the Engineer. The Plan shall include a narrative and diagram of the bypass, a detailed sequence of activities, a schedule, and a list of equipment and materials. See also requirements in Section 00150, Control of Work. The Contractor shall begin bypass facility construction only after the Plan is approved by the Engineer. Existing sanitary sewers and services must remain active at all times by either gravity flow, existing pressure system, or sewer bypass.

Provide vactor trucks, pumps, piping, sumps, electric power, and any other equipment, materials, and labor necessary to bypass flows as needed to maintain sewer service during construction. Pumping equipment, including all engines, motors, and generators, shall not exceed the City of Bend Municipal Code noise ordinance criteria of (60 dBA nighttime in residential areas as indicated in the code). Sound attenuating enclosures may be required to meet this criterion. Provide adequate capacity to handle existing flows and additional flow due to rain. Design bypass system capacity for peak flows indicated on Drawings. Do not discharge raw sewage onto private property or city streets, or into storm drain systems. The Contractor shall be responsible for any fines – local, state, or federal – resulting from a sanitary sewer spill.

If the bypass system includes pumps, provide a backup pump, generator, and vactor trucks as necessary, and a plan for switching over to the backup system in the event of power and/or equipment failure of the primary temporary pumping plan system. The backup system shall be capable of the same flow as the primary system, and the switch to the backup system shall prevent interruption of service. Switching to the redundant system shall not cause an interruption of sewer bypass or service to customers.

Place bypass piping in temporary trenches or provide ramps as necessary to provide uninterrupted access to businesses, residences, or any public access area. At locations where vehicles normally access, provide a surface suitable for all passenger cars that is smooth and has a maximum grade change that will not damage low clearance vehicles. Provide all measures necessary to protect the pipe from the heaviest expected load as approved by the Engineer. Restore the area disturbed for placement of temporary pipe to original or better condition. If the area is a paved roadway, restore the pavement to pre-construction condition. Prepare and submit temporary traffic control plans to facilitate bypass pumping.

Provide notice to all parties that may be affected by the placement of temporary piping 2 weeks in advance of any disruptions to access. Coordinate all activities with affected parties, and as approved by the Engineer.

Place bypass piping, pump stations, appurtenances, supplies, and any other items associated with temporary pumping within existing right-of-way and in areas approved by the City and the Engineer.

Restore all areas disturbed by pumping facilities or activities to the same or better than original condition, and as approved by the Engineer. All costs shall be incidental to bypass pumping.

00490.43 Abandoning Pipes in Place - Replace this subsection, except for the subsection number and title, with the following:

Abandoning pipe in place is not allowed. All abandoned utilities are required to be removed and disposed of properly, unless otherwise approved by the Engineer.

When pipe abandonment is approved, drain abandoned pipes and plug watertight. Plug abandoned pipes with gasketed mechanical plugs or grout seals, as directed. Where abandoned pipes connect to sewer manholes, install the plugs or seals from the inside of the manhole and reshape the channel to conform to the Standard Drawings.

Fill abandoned pipes greater than 12 inches diameter with sand, controlled low-strength material meeting the requirements of 00442, or other approved material.

00490.90 Payment –

Add the following Pay Item to the Pay Item list:

Pay Item	Unit of Measurement
(j) Sanitary Sewer Bypass Complete, ____ GPM.....	Lump Sum

In item (j) insert the maximum flow rate of the existing sewer in the blank.

End of Section

Section 00492 – Manhole Rehabilitation

Section 00492, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00492.00 Scope - This work consists of rehabilitating existing manholes using applied materials to restore or augment structural integrity, repair voids, and protect against corrosion and infiltration. Work also includes cleaning and surface preparation, removal of loose materials, stopping infiltration, manhole step removal, and manhole testing.

00492.01 Definitions - The following terms used in this Section are defined as follows:

(a) Structural Lining – A cementitious rehabilitation system that will provide a fully structural solution as well as provide some minor corrosion protection from bacteriological, chemical, gaseous (hydrogen sulfide), erosion and abrasion.

(b) Protective Coating – A coating system to provide continuous protection against corrosion from bacteriological, chemical, gaseous (hydrogen sulfide), erosion and abrasion, withstand hydrostatic pressures, and provide some structural enhancement to the existing structure.

(c) Rehabilitation System –A lining, coating, or combination of the two as called out in this Section or on the Plans. In addition, materials used to repair or prepare the existing surface is considered a part of the rehabilitation system.

(d) The terms "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

(e) DFT – Minimum dry film thickness, without any negative tolerance.

(f) Key – Groove of certain depth and width for the purpose of mechanical locking. Approximate depth and width of a quarter (¼) inch by a quarter (¼) inch.

(g) Holiday Testing – Holiday testing is a non-destructive test method to check protective coatings for discontinuities including voids and pinholes. This testing is used to find coating film discontinuities that are not clearly visible.

00492.02 Submittals - Provide the following for review in a single package, following the requirements of subsection 00150.35 at least 30 days prior to commencing rehabilitation Work:

(a) Manhole Rehabilitation Work Plan, including:

(1) Product documentation, including:

a. Materials List: A coating materials list showing the manufacturer and the product number, keyed to the coating systems herein. The list shall be submitted prior to or at the time of submitting samples.

b. Manufacturer's Information: For each coating system to be used, the following data:

- Manufacturer's data sheet for each product proposed, including:
  - Statements on the suitability of the material for the intended use.
  - Application, substrate and air temperatures necessary for application
  - Acceptable humidity and surface temperature ranges for application
  - Cure time
- Technical and performance information that demonstrates compliance with the system performance and material requirements.
- Manufacturer's instructions and methodology for rehabilitation system installation including surface preparation, application, and finish work for manholes and connected pipes.
- Colors available for each product (where applicable).
- Compatibility of shop and field applied coatings (where applicable).
- Material Safety Data Sheet for each product proposed.
- Written certification by the manhole rehabilitation system manufacturer stating that the Supervisor and installers meet minimum experience requirements depicted in 00492.30.
- Manufacturer approval of rehabilitation system components and application equipment.

(2) Protective Coating Samples

a. Standard manufacturer colors shall be used unless otherwise stated by the Agency and only if available by the manufacturer. If custom mixed colors are indicated by the Agency and are available, the color samples shall be made using color formulations prepared to match the color samples furnished by the Engineer. The color formula shall be shown on the back of each color sample (if applicable). A step sample of the protective coating shall be provided and furnished at the Engineer's request.

(3) Experience Requirements of the Protective Coating Field Application Contractor

a. Three references which verify that the Field Application Contractor has demonstrated successful application of the specified coating system in the past 3 years. Provide the size (area of coating), time of completion, name, the owner's address and telephone number for each installation referenced.

b. A written statement from the Field Application Contractor or Manufacturer stating that they are qualified and experienced in the application of the specified coating/ lining systems. The letter shall state the manufacturer and model number of mixing, heating, and pumping equipment to be used to apply the specified coating systems.

c. A written statement from the Manufacturer certifying that the Field Application Contractor's onsite foreman and each applicator performing Work on the project has been trained and approved to apply the selected coating system.

d. A written warranty from the Contractor and coatings manufacturer providing protection from defects in material or workmanship. See Section 00492.75.

e. The Field Application Contractor shall provide SSPC QP 1 Certification or the manufacturer's certification of the applicator for the specified coating system.

(4) Manhole preparation plan, including:

a. Proposed methods and procedures for surface preparation, which must meet the minimum guidelines indicated in the lining manufacturer's application instructions.

b. Proposed methods for sealing leaks to allow for optimum bond strength conditions for the approved rehabilitation system.

(5) Description of rehabilitation system and equipment components, including certification that the equipment to be used for applying the products has been manufactured or approved by the manhole rehabilitation system manufacturer(s).

(5) Detailed instruction and methodology for rehabilitation system application, including how finish work for all pipe and manhole connections to rehabilitated manholes will be completed to prevent infiltration and exfiltration.

(**6)** Description, layout, and application sequencing plan.

(7) Wastewater Flow Control/Bypassing Plan (if required to conduct the Work).

(8) Plan for capturing extraneous debris during rehabilitation processes and debris disposal.

(9) Temporary Traffic Control Plan (if required to conduct the Work).

(b) Submit the following during construction, within 10 days of completion of tests:

(1) Pull test records that include, at a minimum: manhole identification number, test pressure, repeat test number, repairs (if any) made, and actual loading fixture (dolly) used in each test.

Materials

00492.10 Materials - Furnish materials that will meet the following requirements:

Grout	02080
Repair, Resurfacing, and Lining Materials for Manhole Rehabilitation	02221

00492.11 Protective Coatings - General

(a) Protective Coating Suitability - The Contractor shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.

(b) Protective Coating Material Sources - Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply with VOC limits in effect at the time of Bid opening, that product will not be accepted, and the Contractor shall propose a substitution product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating / lining materials shall be materials that have a record of satisfactory performance in wastewater treatment facilities or manholes.

(c) Protective Coating Compatibility - In any coating / lining system, only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

(e) Containers - Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.

(f) Colors - For primers and other coatings which will not be visible after the finish coat is applied, standard manufacturer colors shall be selected by the Engineer unless specified by the Agency, in the case where additional colors are available by the manufacturer. Finish (or outermost) coat colors shall be standard manufacturer colors selected by the Engineer unless otherwise specified by the Agency and if available by the manufacturer.

(1) Protective coating / lining materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. When requested, the Contractor shall provide the Engineer with the names of not less than 10 successful applications of the proposed manufacturer's products that comply with these requirements.

(2) If a proposed substitution requires changes in the Work, the Contractor shall bear such costs involved as part of the Work.

Equipment

00492.20 Equipment- Provide equipment constructed or certified by the lining manufacturer.

Labor

00492.30 Personnel:

(a) Installers shall be trained and certified by the manufacturer in handling, applying and finishing manhole rehabilitation materials.

(b) Installers shall have completed successful rehabilitation of at least 250 sanitary sewer manholes in the last 10 years using the proposed method and materials.

(c) For each material and method, work must be supervised by a foreman trained and certified by the manufacturer with a minimum of two (2) years of experience and successful completion of thirty (30) manhole rehabilitations.

(d) Protective Coatings

(1) Installers shall possess valid Oregon state license(s) required for performance of the painting and coating Work called for in this Specification.

(2) Contractor shall provide 5 references which show that the Field Application Contractor has previous successful experience with the indicated or comparable coating / lining systems. Include the name, address, and the telephone number for the owner of each installation for which the Contractor provided the protective coating.

00492.35 Protective Coating Manufacturer's Services

(a) The Field Application Contractor shall require the protective coating manufacturer to furnish a qualified technical representative to visit the Site for technical support as may be necessary to resolve field problems.

(b) For submerged and severe service coating systems, the Contractor shall require the paint manufacturer to furnish the following services:

(1) The manufacturer's representative shall provide at least 6 hours of on-Site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.

(2) The manufacturer's representative shall observe the start of surface preparation, mixing, and application of the coating materials for each coating system.

(c) For Lining Systems, the Manufacturer shall provide a letter certifying that the application contractor has been trained in the application of the Lining System.

Construction

(Design Note: The table below is an example of what information should be included on the Plans. Modify as appropriate. For example, consider adding existing manhole diameter, material, depth. Include "Structural Lining", "Protective Coating", or "Structural Lining + Protective Coating" to the Scope column with required thicknesses. If Table 1 in section 00492.42 is used, then minimum design thickness column would not be needed on Plans.

	Existing Manhole Data				
Manhole ID	*Diameter*	*Material*	*Depth*	*Rehabilitation Scope*	*Minimum Design Thickness (mils)*
SS-1	*48-inches*	*Concrete*	*15 ft*	*Structural Lining and Protective Coating for X vertical feet measured*	*1000 mils*

	Existing Manhole Data				
Manhole ID	*Diameter*	*Material*	*Depth*	*Rehabilitation Scope*	*Minimum Design Thickness (mils)*
				from manhole base	
SS-2	*48-inches*	*Concrete*	*10 ft*	*Protective Coating*	*150 mils*

Delete this note and table from the specifications.)

00492.40 Material Handling

(a) Material Delivery - Deliver materials to the job site in original, unopened containers, each bearing the manufacturer's name, installation method, batch number, date of manufacture, storage life, and special handling directions. Remove from the site any uncured compound determined to be more than six months old. Do not use uncured product or grout if container has been open for more than 24 hours or per the manufacturer's instructions, whichever is less.

Materials may be rejected and removed from the site if they exceed the manufacturer's recommended storage life. Provide replacement materials at no additional cost. Coating materials shall be used within the manufacturer's recommended shelf life.

(b) Material Storage - Store materials in enclosed structures, protected from weather and excessive heat or cold. Store flammable materials according to state and local codes. Coating / lining materials shall be stored under the conditions recommended by the Product Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings from different manufacturers shall not be mixed together.

Store flammable materials according to state and local codes.

(c) Mixing and Thinning of Materials - Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed.

00492.41 Manhole Preparation

(a) Diversion of Flow – When required to complete the Work, provide and maintain a flow diversion system in accordance with Section 00490. Dam, plug or divert all active flows, including leaks, to ensure all flow is maintained at an elevation lower than the manhole surfaces requiring rehabilitation during preparation, application and curing process. Put plywood mats or sheeting over the existing flow channel and bench to prevent debris from falling into the sewer. Collect debris from manhole bench at the end of each workday.

(b) Manhole Steps - Prior to cleaning, cut off manhole steps flush with manhole wall and grind back remaining steel to ½-inch below existing concrete surface, according to 00490 and as approved.

(c) Cleaning and Surface Preparation – Prepare surface per Manufacturers' recommendations.

(1) Remove all brick, concrete or mortar that is loose, protruding, unsound or is damaged by chemical exposure, corrosion or other means of degradation, leaving a sound surface. Fill all voids, seal all leaks and exposed rebar. All surfaces shall be clean and free of laitance or loose material.

(2) Prepare areas of exposed rebar by abrasive-blasting all exposed reinforcing steel surfaces to remove all contaminants and corrosion products. Reinforcing steel, exposed by corrosion or during surface preparation operations, shall be treated with a water-based epoxy resin, anti-corrosion coating and bonding agent such as Armatec 110 EpoCem, manufactured by the Sika Corporation, or approved equal.

(3) Clean and abrade all surfaces that are to be rehabilitated in order to produce a sound surface with adequate profile and porosity, and to provide a strong bond between the rehabilitation product and the substrate. All surface preparation methods shall be performed in a manner that produces a uniform, sound, clean, neutralized surface that is not excessively damaged and is suitable for the specified rehabilitation product(s) and adhere to the manufacturer's recommendations.

(4) Seal all infiltration leaks per manufacturer's instructions. Use grout and sealing materials recommended by the manufacturer and as approved. Repair material that is not verified by the manufacturer at the time of construction will not be allowed.

(5) Surfaces to receive rehabilitation shall be prepared with a series of grooves (key ways) cut into the substrate prior to the structural liner and cut into the structural liner prior to the protective coating at a spacing and depth as per manufacturer recommendation but no less than above and below each horizontal manhole joint, above the manhole bench, and at the top of the flow channel. The grooves shall be angled into the substrate at a 60 degree angle with a width and depth no less than 1/4 inch. At no time shall the existing reinforcement be cut or damaged during installation of the key ways.

(6) Pack annular spaces between the manhole cone or chimney and the bottom of the manhole frame with approved repair material. Where incoming laterals are to be abandoned, block laterals and build surface to be flush with manhole walls with approved repair material. Use resurfacing materials to fill large voids, lost mortar in masonry structures, smooth deteriorated surfaces and rebuild severely deteriorated structures so the profile of the prepared concrete surface does not have any pits or holes exceeding ¼-inch in depth. Trowel repair material to provide a smooth surface with an average profile equivalent to

coarse 60 grit sandpaper to optimally receive the rehabilitation system products.

(d) Inspect Manhole - Prior to surface restoration, inspect all surfaces receiving rehabilitation. Provide notice of any obvious defects interfering with the proper surface preparation or application of proposed products. Inspection by the Agency or Engineer is required during and after surface preparation is complete. Manhole must pass visual inspection by the Engineer prior to application of rehabilitation products/materials.

Test prepared surfaces after cleaning, but prior to application of the rehabilitation products/materials, to determine if pH, profile and moisture content of the concrete meet the manufacturer's recommendations.

00492.42 Structural Lining - Do not begin installation until the concrete substrate is properly cured according to the manufacturer's recommendations, and as approved. Use application procedures according to the lining manufacturer recommendations and specifications, including material handling, mixing, environmental controls during application, safety, and spray equipment.

Confirm that the ambient temperature and humidity, the prepared surface temperature and moisture content, and the temperature of the lining material to be applied are within the manufacturer's allowable ranges. Shield surfaces receiving linings to avoid direct sunlight exposure or other intense heat source.

Properly match pump, hoses, gun, tip, and pressures to the specific lining application used. The equipment must be properly cleaned before work starts. Test spray pattern for uniformity of distribution.

Thoroughly mix all lining materials to ensure all agglomerated particles are reduced to original size or removed prior to placement into the application equipment (i.e. the hopper). Each batch of material should be entirely discharged before recharging with fresh material. Clean mixing equipment at regular intervals to remove all adherent materials. Add water to the mix according to the manufacturer's recommendations. Re-mixing or tempering isn't permitted. Do not reuse rebound materials.

Apply lining product to all exposed concrete surfaces, including bench, pipe penetrations, interior structure walls, ceilings, and chimney. Do not apply to flow channel. Application must consistently achieve uniform compaction with low percentage of rebound and no visible sag.

Lining shall be terminated by keying into the concrete per 00492.41(c). Prior to application of lining, the saw cut shall be dried and vacuumed to remove all dust and residue. During lining application, a liberal amount of material shall be applied to the saw cut area and smoothed level.

For pipes protruding from the manhole wall, manhole lining shall overlap the pipe by 3 inches along the outside surface of the protruding pipe. For pipes terminating flush with the existing manhole wall, cut a circular groove around the existing pipe penetration and extend lining to the edge of the circumference of the pipe. Do not extend lining into the pipe.

Install lining to the thickness necessary to qualify as a monolithic (void free) liner. Finish horizontal surfaces with wood float, sponge float, broom, or brush to produce a textured surface, or as recommended by the manufacturer.

Table 1: Liner Thickness in mils based on Manhole Depth and Diameter

	Liner Thickness (mils)		
Depth	**48-inch**	**60-inch**	**72-inch**
<5 feet	750	950	1100
5 feet to 10 feet	800	1000	1200
10 feet to 15 feet	1000	1250	1500
15 feet to 20 feet	1100	1375	1650
20 feet to 25 feet	1200	1500	1800
25 feet to 30 feet	1300	1625	1950

Required Thickness: As called out in Table 1 (minimum 750 mils).

Do not add hot air to the manhole to accelerate set time of the lining.

00492.43 Preparation for Protective Coating

(a) General - Surfaces to receive protective coatings shall be prepared as indicated prior to application of coatings. The Contractor shall examine surfaces to be coated and shall correct surface defects before application of any coating material. Marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any field coating application. Surfaces to be coated shall be dry and free of visible dust.

(b) Protection of Surfaces Not to be Coated - Surfaces that are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. The following surfaces shall not be coated:

(1) Stainless steel

(2) Machined surfaces

(3) Grease fittings

(4) Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

(c) Care shall be exercised not to damage adjacent Work during blasting operations. Spraying shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent Work or adjoining property occurring from blasting or coating operations.

(d) Protection of Painted Surfaces - Cleaning and coating shall be coordinated so that dust and other contaminants from the preparation process will not fall on wet, newly-coated surfaces.

00492.44 Concrete Surface Preparation for Protective Coating

(a) Surface preparation shall not begin until at least 30 Days after the concrete or masonry has been placed.

(b) At the discretion of the Inspector, the Contractor shall test the surfaces for soluble salts with the use of Chlor*Test as manufactured by Chlor*Rid International or approved equivalent. Any surfaces shall be tested and shall have a maximum concentration of 5 micrograms per square centimeter (µg/cm2). A test shall be conducted for every 100 square feet (ft2) of surface area to be coated at locations determined by the Inspector.

(c) If the soluble salt test indicates chloride concentrations greater than those outlined in these Specifications, the Contractor shall use Chlor*Rid, as manufactured by Chlor*Rid International, in the water source during Water Cleaning to remove the salts from the substrate. A substrate's surface preparation will be accepted once the soluble salt concentration is below the amounts outlined in these Specifications.

(d) In accordance with ASTM D4262, test to determine the pH of the concrete surface after the surface has been thoroughly blasted and cleaned. If the pH is outside the range recommended by the coating manufacturer, then the surface must be neutralized by removing concrete until the surface pH of 7 or greater is obtained prior to any coating application. One pH test shall be performed every 200 square feet, or less, and at locations determined by the Inspector.

(e) The Contractor shall test for capillary moisture in accordance with ASTM D4263. Moisture tests shall be taken every 200 square feet or less and at locations determined by the Inspector. If capillary moisture is present, the coating manufacturer shall be consulted to determine primer requirements and special coating application criteria.

(f) Surface Voids - Bugholes, honeycomb, or other surface voids greater than 1/4 inch in depth or 1/4 inch in diameter shall be filled in with a resurfacing mortar prior to the application of any primer or finish coat.

(g) Holes or other joint defects in masonry shall be filled with mortar and repainted. All voids and cracks shall be repaired as specified. Loose or spatter mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.

(h) Coating Floor/Wall Joints - A 1/4-inch wide by 3/8-inch deep saw cut shall be made on the vertical and horizontal concrete surfaces around the perimeter of the floor. The saw cut shall be 2 inches from the joint on both sides. Prior to the coating application, the saw cut shall be dried and vacuumed to remove all dust and residue.

(i) All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC-SP 1 before abrasive blast cleaning.

(j) New concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned, per SSPC-SP 13/NACE No. 6, to remove existing

coatings, laitance, and deteriorated concrete, and to roughen the surface equivalent of ICRI Concrete Surface Profile (CSP) No. 4-6.

(k) Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

00492.45 Application of Protective Coatings

(a) Cleaned surfaces and each coat shall be inspected prior to applying each succeeding coat. The Contractor shall schedule such inspection with the Engineer in advance.

(b) Coatings shall be applied in accordance with the manufacturer's instructions and recommendations and this Section, whichever has the most stringent requirements.

(c) Special attention shall be given to materials that will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

(d) Finish coats, including touch-up and damage repair coats shall be applied in a manner that will present a uniform texture and color matched appearance.

(e) Coatings shall not be applied under the following conditions:

(1) Temperatures exceeding the manufacturer's recommended maximum and minimum allowable.

(2) Concrete surfaces will be in direct sunlight during application or within 3 hours after application.

(3) Dust or smoke laden atmosphere.

(4) Damp or humid weather.

(5) Substrate or air temperature is less than 5 degrees F above the dew point.

(6) Air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dew point within 8 hours after application of coating.

(7) Wind conditions or gusts which may bring substantial dust or airborne particles towards the site during coatings application where wind abatement cannot be achieved.

(f) Dew point shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables or instruments approved prior to the project start-up.

(g) Workmanship

(1) Skilled craftsmen and experienced supervision shall be used on coating Work.

(2) Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure thorough surface preparation.

(3) Lining Systems shall be applied in accordance with the Manufacturer's instructions.

(4) Damage to other surfaces resulting from the Work shall be cleaned, repaired, and refinished to original condition.

00492.46 Curing of Coatings

(a) The Contractor shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.

(b) In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

00492.47 Manhole Steps – New manhole steps shall be installed according to Specification Section 00490. Ensure that there are no gaps exposing concrete at the wall penetration of the new steps. Do not install manhole steps in brick manholes.

00492.50 Visual Inspection - At certain hold points in the rehabilitation process, request approval to proceed with the next stage of the application process. The designated inspection hold points for each installation are:

- Completion of surface repairs, re-profiling, and preparation.
- Completion of each application of cementitious lining (if used).

Provide 24-hour notice that approval of an inspection hold point is needed. The Owner's Representative will respond to the request within 24 hours. Visual inspection includes:

- Zero groundwater infiltration.
-
- All pipe connections are open and clear.
-
- No cracks, voids, dry spots, delamination or other types of defects of the newly applied material are visible.

Finishing and Clean Up

00492.70 Cleanup - Remove surplus materials, protective coverings, accumulated rubbish, and thoroughly clean all surfaces. Repair any overspray, splashes, splatters or other rehabilitation-related damage after approval of the work. Surfaces damaged from this clean up shall also be cleaned, repaired and refinished to the original condition or as approved.

00492.71 Field Inspection and Testing

(a) General - The Contractor shall give the Engineer a minimum of 3 Days' advance notice of the start of any field surface preparation or coating application.

(b) Inspection by the Engineer, or the waiver of inspection of any particular portion of the Work, shall not relieve the Contractor of its responsibility to perform the Work in accordance with these Specifications.

(c) Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be furnished on areas to be inspected.

(d) Inspection Devices - The Contractor shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for the Engineer's use while coating is being done, until final acceptance of such coatings. The Contractor shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the Engineer.

(e) Tests shall be conducted by a NACE certified inspector.

(f) Film Thickness Testing - Coating thicknesses shall be measured at the time of application using a wet film gauge per ASTM D4414: Standard Practice for Measurement of Wet Film Thickness. Dry film coating thickness shall be measured in accordance with ASTM D6132. Use a PosiTector 200 or equal. Repair all verification points upon acceptance of the thickness tests.

(1) For structural lining, test a minimum of four equally spaced points around the circumference of the manhole wall. Conduct tests every 10 vertical feet, starting at a point 1 foot above the manhole bench or base in the absence of a bench. For manholes less than 11 feet deep, conduct thickness tests at a point equidistant from the bench / base of the manhole and the top of the applied liner.

(g) Adhesion Testing of Structural Liner to Substrate – Conduct one test every 5 vertical feet in accordance with ASTM C109. For structural liners less than 5 feet deep, conduct adhesion tests at a point equidistant from the bottom of the structural liner and the top of the applied liner. Remove and replace areas not meeting required 150 psi at 28 days minimum adhesion requirement (or resulting in substrate failure).

(h) Adhesion Testing of Protective Coating to Substrate - Conduct one test every 5 vertical feet in accordance with ASTM 7234. For coatings less than 5 feet deep, conduct adhesion tests at a point equidistant from the bottom of the structural liner and the top of the applied liner. Remove and replace areas not meeting required 150 psi at 28 days minimum adhesion requirement (or resulting in substrate failure).

(i) Holiday Testing - If applicable for the selected coating material(s) and manhole type, the Contractor shall test for continuity per ASTM D4787 for all coated or lined surfaces that will be submerged in water or other liquids, surfaces that are enclosed in a vapor space in such structures, and surfaces coated with any of the submerged and severe service coating systems. Areas that contain discontinuities shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then be retested.

(1) Coatings with thickness exceeding 20-mils total DFT: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be

used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.

(2) Coatings with thickness of 20-mils or less total DFT: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10- and 20-mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo or equal, shall be added to the water prior to wetting the detector sponge.

(j) Surface Preparation - Confirm proper surface profile with ICRI Concrete Surface Profile
Chips.

00492.75 Warranty – The Contractor unconditionally warrants to the Agency the product and installation under this Section against failure, according to this Subsection and 00170.85(b)(1).

"Unconditionally warrant" means that the warranty covers all failures, regardless of the source or cause of the failure, including, without limitation, whether the source or cause is or may be related to workmanship, inspection, or choice of materials.

The Agency inspection of any portion of the Work during the Contract and during the product installation, the Agency acceptance of the Work, corrections under the warranty, or expiration of the warranty shall not relieve the obligations under this warranty.

(a) Warranty Period - The warranty period shall extend for 10 years from the date of product installation and Agency acceptance. During the warranty period the Contractor or coatings manufacturer will repair or replace coating at no charge to the Owner.

(b) Inspection - An inspection may be conducted during the twelfth month following completion of coating Work. The Contractor and a representative of the coating manufacturer shall attend this inspection. Defective Work shall be repaired in accordance with these specifications and to the satisfaction of the Agency. The Contractor is not relieved of its responsibilities to correct defects, whether or not the inspection is conducted.

Measurement

(Design Note: Consider using a per vertical foot for measurement and payment if Contract Documents should have the flexibility to add/delete manholes that are of unusual depth (e.g., very shallow, very deep) or size (e.g., oval, etc.). If scope is clear/set, recommend bidding the work on an "EACH" basis, especially if manholes are standard depth.)

00492.80 Measurement – The quantities of manhole rehabilitation will be measured on the unit basis for each manhole rehabilitated.

Payment

00492.90 Payment – The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement for the following items:

Pay Item	Unit of Measurement
(a) Rehabilitate Manhole	Each

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, tools, labor, and incidentals necessary to complete full structural lining and protective coating of the manholes as specified. Manhole steps will not be installed or replaced post manhole rehabilitation.

Flow diversion will be paid for according to 00490.

End of Section

Section 00495 - Trench Resurfacing

Comply with Section 00495 of the Standard Specifications modified as follows:

00495.40 General – Add the following paragraph after the paragraph that begins “The following construction…”:

Transverse trenches in the paved ROW shall be constructed so that the termination point complies with 00745.47(a) in the travel way. Transverse trenches constructed with less than 10-foot separation between cut lines shall be surface patched as one patch incorporating both trenches per COB Standard Drawing R-11. Three or more transverse trench cuts within one pavement section or block if placed from curb to center line require a full patch from curb to center line incorporating all trench cuts as one surface patch. Three or more transverse trench cuts that cross the travel way from curb to curb within a pavement section or block require a full patch from curb to curb incorporating all trench cuts as one surface patch. The surface finish of trench patches shall comply with 00745.70(b). All longitudinal trench cuts in the paved way shall comply with 00745.47(a)(2).

Add the following subsection:

00495.41 Crack Sealing – Provide crack sealing in accordance with Section 00746 at all joints where new pavement meets existing pavement.

00495.90 Payment – Add the following paragraph to the end of the subsection:

Crack sealing will be paid for according to 00746.90.

End of Section

Section 00498 – Utility Field Explorations

Section 00498, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00498.00 Scope – This work consists of exposing existing utilities as identified on the Plans. Information gathered from Utility Field Exploration regarding utility location, configuration, dimensions, and elevations shall be added to Record Drawings.

(Use the following paragraph when Special Utility Potholes are identified in the plans. Update SP00150.11 accordingly with time requirements for completion of Special Utility Potholes)

Special Utility Potholes are identified in the plans at critical locations which may require design revisions. See Section 00150.11 for Special Utility Pothole time requirements.

Construction

00498.40 Utility Field Exploration – The subsurface conditions for existing utilities including, but not limited to, water, gas, sewer, CATV, fiber optic, power, telephone, pipe fittings, steel casing pipe, valves, duct banks, and appurtenances shown on the drawings are estimates based on surface locates and survey information. In areas of new pipeline construction, verify the existing conditions where crossings, connections to, or modifications of the existing utility are shown on the drawings. Excavate at these locations to verify existing conditions and obtain information necessary to perform required pipeline construction and connections to existing utilities.

Submit a plan to the City of the anticipated exploratory activities including the proposed schedule, local traffic control plan necessary for the exploratory work, areas of excavation, proposed extent of excavation and pavement repair.

Receive approval for the plan from the City before scheduling or starting the work. Coordinate all exploratory activities with the City to allow City observation of activities if they desire.

For each exploration, submit to the Engineer all documentation including photographs and a schematic of the actual conditions, including depths, pipe size, material, locations of joints, thrust blocks, valves, fittings, and other appurtenances, and measurements between all features.

Contractor shall be responsible to locate the exact invert of each pipe or conduit shown on the plans or as identified in the field. Invert elevations and horizontal location based upon layout of the new pipe will immediately be provided to the Engineer/Owner to allow grade comparisons of the design. Contractor shall locate the utility and provide the information to the Engineer/Owner prior to construction activity coming within a minimum of 500-feet of the locate to allow field adjustment of pipe grades as necessary.

Complete field exploration activities at each location and submit documentation a minimum of 1 week prior to construction in that area. If the actual conditions require changes to the work shown on the drawings, immediately notify the Engineer.

Measurement

00498.80 Measurement – The quantities for utility field exploration shall be measured on a per each basis for all investigative efforts regardless of the type, size or location of the utility below existing ground.

Payment

00498.90 Payment – The accepted quantities for work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

(Delete the pay item(s) from the list that are not included in the Schedule of items, but do not change the alpha characters next to the pay item.)

Pay Item	Unit of Measurement
(a) Field Explorations	Lump Sum
(b) Special Utility Pothole	Each

The unit price paid for Field Explorations (Potholing) shall include all compensation for coordination activities, documentation, traffic control, excavation and replacement of materials in each utility field exploration areas, surface restoration, and associated activities not covered under other bid items.

End of Section

Section 00499 – As-Built Drawings

Section 00499, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00499.00 Scope – This work consists of providing as-built drawings showing all aspects of construction as required by Section 00150.40.

00499.15 General – Prepare and maintain as-built drawings in accordance with the procedures set forth in this section. When applicable, prepare as-built drawings in accordance with regulations as set forth by the State of Oregon Department of Environmental Quality for both wastewater and/or water systems and State of Oregon Department of Health Services. Submitted as-built drawings not meeting ODEQ and DHS regulations shall not be considered approved.

As-built drawing information required in the submittal for acceptance includes a complete set of red-lined drawings, construction contractor's field installation notes of the facilities as-constructed, and original construction field survey notes.

(a) During Construction - Maintain a working set of red-lined drawings on site and available for viewing by the Engineer upon requests.

(b) Following Construction - Submit a red-lined copy of the original Plans noting all changes made. The information furnished shall include all modifications made and shall represent the material installed and in operation. The as-built drawings shall contain the same data shown on the construction contractor's field installation notes and provide enough information for the Engineering of Record to prepare Record Drawings..

(c) Field Installation Notes – Provide field installation notes containing the horizontal and vertical location information as constructed including, but not limited to:

- Manhole and cleanout horizontal station and vertical elevations
- Valves, fire hydrants, valve boxes, PRV's and mechanical joint fittings
- Make, model and location of all thrust restraint fittings and total footage of pipe restrained
- Service connections at the mains and stationing
- Special fittings
- All encountered utilities
- Changes in pipe size, slope, or type
- Service locations at property lines swing-tied to above-ground facilities, such as fire hydrants, houses, light poles, or water valve boxes. For sanitary sewer, provide the invert elevation of the connection at the property line or easement line.

Irrigation system

Measurement

00499.80 Measurement – No measurement of quantities will be made for Work performed under this Section.

Payment

00499.90 Payment – The accepted quantities for Work performed under this Section will be paid for at the Contract lump sum amount for the item “As-Built Drawings”.

Partial payments will be made as follows:

- When 30 percent of the Contract is complete 30%
- When 60 percent of the Contract is complete 30%
- At completion of the Contract once As-Built drawings are accepted 40%
-

Contractor must demonstrate as-built drawings are being adequately maintained to receive partial payment.

End of Section

SP00500 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00500 – BRIDGES

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00510 – Structure Excavation and Backfill

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00510 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00510 of the Standard Specifications modified as follows:

(Use the following subsection .04(a) when shoring is required.)

00510.04(a) Defined Shoring Systems - Add the following to the end of this subsection:

Construct shoring at the location(s) listed below:

(Use the following table to indicate the shoring location and the defined system(s) allowed. Include the beginning and ending stations, use either "Lt." or "Rt.", or a separate shoring alignment as required, to locate and provide minimum shoring length, and include the defined type of shoring system type(s) allowed from the list: All, 5A, 5B, 5C, 5D, 5E, 5F, 6A, 6B, 7A. Add or delete rows in the table as necessary to list additional locations and list all applicable defined shoring systems.

Example:

Beginning Station	*Ending Station*	*Shoring System Type(s) Allowed*
Station 1+55 Rt.	*Station 2+45 Rt.*	*All*
Station 4+00 Lt	*Station 4+40 Lt.*	*5A*

)

Beginning Station	Ending Station	Shoring System Type(s) Allowed
Station _____(Lt.)(Rt.)	Station _____(Lt.)(Rt.)	

(Use the following subsection .80(b)(1) when structure excavation is paid for on the lump sum basis.)

00510.80(b)(1) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of structure excavation is:

Location	Structure Excavation (Cubic Yard)

(Use the following subsections .80(d) when granular wall backfill and/or granular structure backfill will be measured and paid for on the lump sum basis.)

00510.80(d)(1) Lump Sum - Add the following to the end of this subsection::

The estimated *(*quantity*)(*quantities*)* of *(* granular wall backfill*) (*and*) (*granular structure backfill*) (*is*)(*are*)* :

(Delete headings that do not apply. Obtain quantities from the designer.)

Location	Granular Wall Backfill (Cubic Yard)	Granular Structure Backfill (Cubic Yard)

(Include the following cofferdam design checklist when required by the Bridge Designer.)

COFFERDAM DESIGN CHECKLIST

Instructions - This cofferdam design checklist was developed to facilitate the design, review, and erection of cofferdams to be used for ODOT bridge construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed and signed by the cofferdam design engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit the Checklist according to 00510.03.

	YES	NO	N/A
A. Contract Plans, Specifications, Permits, etc.			
1. Are the cofferdam Working Drawings prepared, stamped and signed by an engineer registered to practice in Oregon?	____	____	____
2. Have three copies (five copies if railroad approval is required) of the complete design calculations accompanied the cofferdam drawings submittal?	____	____	____
3. Are cofferdam Working Drawings in compliance with the requirements of the construction plans general notes?	____	____	____
4. Are cofferdam Working Drawings in compliance with contract plan structural details?	____	____	____
5. Are cofferdam Working Drawings in compliance with the requirements of the Oregon Standard Specifications for Construction, subsection 00150.35?	____	____	____
6. Are all existing, adjusted or new utilities in proximity with the proposed cofferdam shown on the cofferdam Working Drawings and is projection of these utilities addressed?	____	____	____
7. Are clearance requirements satisfied and shown on the cofferdam Working Drawings?	____	____	____
B. Loads			
1. Are the magnitude and location of all loads, equipment and personnel that will be supported by the cofferdam shown noted on the cofferdam Working Drawings?	____	____	____
2. Are design loads and material properties used to determine design stresses shown for each different cofferdam member shown on the cofferdam Working Drawings?	____	____	____

3. Is the assumed water elevation for seal design shown on the Working Drawings? ____ ____ ____

4. Does the cofferdam design assume water pressure acts on the full height of the cofferdam (from the vent to the bottom of the excavation?) ____ ____ ____

5. Has percolation into the excavation been addressed? ____ ____ ____

C. Allowable Stresses

1. Have the design loads used for cofferdam design of all members been noted in the design calculations? ____ ____ ____

2. Are the allowable stress and the calculated stress listed in the summary for each different cofferdam member? ____ ____ ____

D. Timber Construction

1. Are timber grades consistent with material to be delivered to the construction site, noted on the cofferdam drawings, and in accompanying calculations for all timber cofferdam material? ____ ____ ____

2. If "rough" lumber is specified for the cofferdam, are the actual lumber dimensions used in the calculations shown? ____ ____ ____

E. Steel Construction

1. Are steel structural shapes and plates identified by ASTM number on the cofferdam Working Drawings and in the calculations? ____ ____ ____

2. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? ____ ____ ____

F. Compression Members, Bracing Members and Connections

1. Has general buckling been evaluated for all compression members? ____ ____ ____

2. Has bracing been provided at all points of assumed support for compression members? ____ ____ ____

3. Is bracing strength and stiffness sufficient for the intended purpose? ____ ____ ____

4. Have all connections been designed and detailed? ____ ____ ____

_____ _____
Designer Engineer of Record Signature Date

(Include the following shoring design checklist when required by the Bridge Designer.)

SHORING DESIGN CHECKLIST

Instructions - This shoring design checklist was developed to facilitate the design, review, and erection of shoring to be used for ODOT construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed by the shoring design engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit this Shoring Design Checklist for each stage and phase of the project, along with the shoring design summary, Working Drawings and calculations according to 00510.04.

		YES	NO	N/A
A.	**General**			
1.	Are the shoring Working Drawings and supporting calculations prepared, stamped, and signed by an engineer registered to practice in the state of Oregon?	____	____	____
2.	Are the temporary shoring installation plans, construction sequence, and removal plan compatible with the project construction staging/phasing?	____	____	____
B.	**Design Standards**			
1.	Does the shoring design comply with standards identified in ODOT GDM 15.3.26.3 and related sections?	____	____	____
2.	Is the design standard and edition identified in the shoring design calculations?	____	____	____
C.	**Loading**			
1.	Have the design loads, including special loading conditions (e.g. cranes, stockpiles, etc.), used for shoring design of all members been noted in the design calculations?	____	____	____
2.	Have the appropriate load and resistance factors or factors of safety on the shoring system been identified, for all applicable load combinations or load cases?	____	____	____
3.	If public traffic is near or directly above the shoring system, has a minimum traffic live load surcharge of 250 psf been applied?	____	____	____

4. Have the loads from actual construction equipment and not less than 250 psf been included in the shoring system design? ____ ____ ____

5. Have the construction loads for different stages of construction been considered and included in the calculations? ____ ____ ____

6. Have the effects of any construction activities adjacent to the shoring system on the stability/performance of the shoring system been addressed in the shoring design (e.g., excavation or soil disturbance in front of the wall or slope, excavation dewatering, vibrations and soil loosening due to soil modification/construction activities)? ____ ____ ____

7. Have earth pressure diagrams been included? ____ ____ ____

8. Does the shoring design consider the effect of water saturated soil pressure acting on the full height of the shoring? ____ ____ ____

D. Geotechnical and Structural Analysis

1. Has internal stability been evaluated? ____ ____ ____

2. Has eccentricity/overturning stability been evaluated? ____ ____ ____

3. Has sliding been evaluated? ____ ____ ____

4. Has overall/global stability been evaluated? ____ ____ ____

5. Has bearing capacity been evaluated? ____ ____ ____

6. Have displacement constraints or other performance objectives of the shoring system been identified and evaluated? ____ ____ ____

7. Has each stage of the shoring system construction been evaluated to carry traffic and construction loads and ensure internal and external stability through the construction and loading sequence? ____ ____ ____

8. Are the allowable stress and the calculated stress listed in the summary for each different shoring member? ____ ____ ____

9. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? ____ ____ ____

10. Have connections for all phases of construction and removal been designed for all interim loading? ____ ____ ____

11. Has buckling, bracing strength, and stiffness been evaluated for all compression members? ____ ____ ____

E. Materials

1. Are all soil, rock, and other material properties used for the design of the shoring system provided and consistent with GDM and the subsurface field and lab data? ____ ____ ____

2. Are timber grades noted on shoring drawings and in accompanying calculations? ____ ____ ____

3. Are the minimum lumber dimensions shown in the calculations and noted on the Working Drawings? ____ ____ ____

4. Are steel structural shapes, bolts, connections, and plates identified by ASTM number on the shoring Working Drawings and in the calculations? ____ ____ ____

F. Shoring Working Drawings

1. Is the field verified ground topography above and below the shoring wall shown? ____ ____ ____

2. Are all existing, adjusted or new utilities, structures, and “no work zones” in proximity to the proposed shoring shown on the shoring Working Drawings and is protection of these items addressed? ____ ____ ____

3. Are horizontal and vertical clearance requirements identified and shown on the shoring Working Drawings? ____ ____ ____

4. Are plan view, elevation and cross sections drawn to scale, with dimensions defining location and size of the temporary shoring, components, and excavation limits? ____ ____ ____

5. Are the magnitude and location of all loads, equipment and personnel that will be supported by the shoring shown or noted on the shoring Working Drawings? ____ ____ ____

6. Has a dewatering plan been shown? ____ ____ ____

7. Have all connections been detailed? ____ ____ ____

8. Has bracing been detailed? ____ ____ ____

G. Testing and Monitoring

1. If a “yes” response to No. D-6, is a monitoring plan provided to verify adequate performance of the shoring system throughout the design life of the system? ____ ____ ____

2. Has a load testing program been provided for soil nails, tiebacks, or other applicable elements of the shoring system ____ ____ ____

_____ _____
Design Engineer of Record Signature Date

End of Section

Section 00530 - Steel Reinforcement for Concrete

(This Section requires SP02510 if epoxy coated reinforcement is required.)

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00530 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00530 of the Standard Specifications modified as follows:

(Use the following subsection .80(a) when reinforcement is paid for on the lump sum basis. Remove the coated reinforcement table if coated rebar is not required. Delete the "Stainless Steel" column when stainless steel reinforcement is not required. When stainless steel rebar is used, fill stainless steel grade in the blank. Add additional rows as necessary. Obtain information from the Bridge Designer.)

00530.80(a) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of reinforcement is:

Structure Number	Uncoated Reinforcement Quantity (Pound)			
	Grade 60	Grade 80	Grade 100	Stainless Steel Grade ____ ____

Structure Number	Coated Reinforcement Quantity (Pound)		
	Grade 60	Grade 80	Grade 100

The weight of miscellaneous metal, based on weights listed in 00530.80(b) and Project quantities, is included in the estimated quantity of uncoated reinforcement.

End of Section

Section 00540 - Structural Concrete

(This Section requires SP02001 and SP02050.)

Comply with Section 00540 of the Standard Specifications modified as follows:

00540.41 Design of Falsework for Vertical Pressures - Replace the title of this subsection with "**Design of Falsework"**

00540.41(e) Additional Requirements at Railroad Traffic Openings - Replace the bullet that begins "Design bracing so that the bent…" with the following bullet:

- Design bracing so that the bent will resist the required horizontal load or 5000 pounds, whichever is greater.

Add the following subsection:

00540.41(f) Concrete Forms on Steel Structures - Provide sufficient temporary bracing or temporary struts and ties to minimize lateral deflection and rotation of the exterior steel girder. Calculate exterior girder rotation according to the Oregon Bridge Design Manual section 1.38.4. Limit deck deflection at the edge of deck due to girder rotation to no more than 1/4 inch.

Support compression member or bottom connection of cantilever formwork support brackets either within 6 inches maximum vertically of the bottom flange or within 6 inches maximum horizontally of a vertical web stiffener.

If partial depth cantilever formwork support brackets are permitted, submit Working Drawings showing the additional formwork struts and ties used to brace the steel girder against web distortion.

(Use the following paragraph if bolt holes are allowed in the exterior girder web to support form brackets.)

Shop drill bolt holes in the exterior girder web to support form brackets. Fill the holes with fully torqued ASTM F3125 Grade A325 or button-head twist-off bolts ASTM F1852 or F2280 bolts according to Section 02560. Place each bolt head on the exterior side of the web. No holes are to be made in the flanges.

00540.45 Construction of Forms - Add the following sentences to the end of the paragraph that begins "Permanent stay-in-place bridge":

Use removable concrete forms on all steel Structures. Do not weld any part of the form to any steel girder.

(Use the following subsection .80(a)(1) when concrete is paid for on the lump sum basis. List by bridge number then by bid item name. Add items as appropriate. Delete what does not apply. Obtain information from the Bridge Designer.)

00540.80(a)(1) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of concrete is:

Bridge No. _____

Type and Class	**Quantity (Cu. Yd.)**
Foundation Concrete, Class _____	_____
Deck Concrete, Class _____	_____
General Structural Concrete, Class _____	_____

Bridge No. _____

Type and Class	**Quantity (Cu. Yd.)**
Foundation Concrete, Class _____	_____
Deck Concrete, Class _____	_____
General Structural Concrete, Class _____	_____

(Include the following falsework design checklist when required by the Bridge Designer.)

FALSEWORK DESIGN CHECKLIST

Instructions - This checklist was developed to facilitate the design, review, and erection of falsework to be used for Oregon Department of Transportation bridge construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed and signed by the Falsework Design Engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit the Checklist according to 00540.41(a).

	YES	NO	N/A
A. Contract Plans, Specifications, Permits, Etc.			
1. Are the falsework plans prepared, stamped and signed by an engineer registered to practice in Oregon?	____	____	____
2. Have three complete sets (five if railroad approval is required) of the design calculations been included with the falsework drawings submittal?	____	____	____
3. Are falsework plans in compliance with the requirements of the construction plans general notes?	____	____	____
4. Are falsework plans in compliance with contract plan structural details?	____	____	____
5. Are falsework plans in compliance with the requirements of the Oregon Standard Specifications for Construction, subsection 00150.35?	____	____	____
6. Are all existing, adjusted or new utilities in proximity with the proposed falsework shown on the falsework plans and is protection of these utilities addressed?	____	____	____
7. Are clearance requirements satisfied and shown on the falsework plans?	____	____	____
8. For construction in or over navigable waters have all requirements for construction of falsework that are called for in the Coast Guard Permit been incorporated in the falsework design?	____	____	____

9. Has possible damage from traffic been considered in the falsework design? ____ ____ ____

10. Has damage from stream drift been considered in the falsework design? ____ ____ ____

11. Is the concrete placing sequence shown and is it consistent with the contract plans? ____ ____ ____

B. Foundation Requirements

1. Are driven falsework piling provided as called for on the contract plans? ____ ____ ____

   a. Is a minimum pile tip elevation or penetration indicated on the drawings? ____ ____ ____

   b. If timber falsework piles are specified, are the recommended order lengths sufficient to virtually eliminate the possibility of pile splices? ____ ____ ____

   c. Is a detailed static pile capacity analysis included in the calculations? ____ ____ ____

   d. If lateral loads are applied to the piling by equipment, dead loads, flowing water, or drift, is a detailed lateral load analysis included in the calculations? ____ ____ ____

   e. When piling are in an active waterway, have the potential effects of scour on axial and lateral pile support been addressed in the calculations? ____ ____ ____

   f. Does the proposed falsework pile hammer meet the minimum field energy requirements as listed in 00520.20(d)(2)? ____ ____ ____

   g. Will a driving criteria graph [FHWA Gates Equation, in 00520.42(b)] plotting blow count versus stroke for an acceptable pile hammer be provided for the project inspector? ____ ____ ____

2. Is falsework supported on spread footings or mud sills? ____ ____ ____

   a. Are the spread footing elevations shown on the drawings? ____ ____ ____

   b. Has a rational method for determining the ultimate bearing capacity of the foundation materials been presented and described in the calculations? ____ ____ ____

c. Have the soil parameters used in calculating the ultimate bearing capacity been listed and confirmed by the designer? ____ ____ ____

d. Has an appropriate Factor of Safety been used for calculating the allowable bearing capacity of the foundation materials? ____ ____ ____

e. Are spread footing settlement estimates included in the calculations? ____ ____ ____

f. Have effective stresses been used in the calculations, when applicable? ____ ____ ____

g. When spread footings are founded near the top of a slope or in a slope, have the ultimate bearing capacity calculations been modified accordingly? ____ ____ ____

h. When spread footings may be subjected to flowing water, have the potential effects of scour on ultimate bearing capacity been addressed in the calculations? ____ ____ ____

C. Loads

1. Are the magnitude and location of all loads, equipment and personnel that will be supported by the falsework shown and noted on the falsework plans? ____ ____ ____

2. Has the mass of specific equipment units to be supported by the falsework been included in the calculations or on the falsework plans? ____ ____ ____

3. Is the deck finishing machine supported in a manner that will not impose load on concrete forms except deck overhang brackets? ____ ____ ____

4. Are design loads and material properties used to determine design stresses for each different falsework member shown on the falsework plans? ____ ____ ____

5. Is the worst loading and member property condition, rather than the average condition, used to obtain design loads? ____ ____ ____

6. Are deck forms for concrete box girders supported from the girder stem and not from the bottom slab? ____ ____ ____

7. Are diaphragm loads or other concentrated loads included in the analysis of supporting beams? ____ ____ ____

8. If sloping structural members exert horizontal forces on the falsework, is bracing or ties used to resist these loads? ____ ____ ____

D. Allowable Stresses

1. Has the method used for falsework design of all members except for manufactured assemblies been noted in the design calculations? ____ ____ ____

2. Are manufactured assemblies identified as to manufacturer, model, rated working capacity and ultimate capacity? ____ ____ ____

3. Is the allowable stress and the calculated stress listed in the summary for each different falsework member, except for manufactured assemblies? ____ ____ ____

E. Timber Falsework Construction

1. Are timber grades consistent with material to be delivered to the construction site, and noted on falsework drawings, and in accompanying calculations for all timber falsework material? ____ ____ ____

2. If "rough" lumber is specified for falsework by the falsework designer are the actual lumber dimensions used in calculations shown? ____ ____ ____

3. If plywood spans are governed by the strength of the plywood, are the allowable stress and the calculated stress shown on the submitted calculations? ____ ____ ____

4. If plywood spans are governed by the allowable spacing of supporting joists, are the allowable and the proposed spacing shown on the falsework plans? ____ ____ ____

5. Have timber stringers been checked for bending, shear, bearing stresses, and 1/240 of the span length deflection? ____ ____ ____

6. Are joists identified as being continuous over 3 or more spans when they are not analyzed as simple spans? ____ ____ ____

7. Have stringers and cap beams been checked for bearing stresses perpendicular to the grain as well as for bending and shear stresses? ____ ____ ____

8. Have posts been checked as columns as well as for compression parallel to the grain? ____ ____ ____

F. Steel Falsework Construction

1. Are steel structural shapes and plates identified by ASTM number on the falsework plans and in the calculations? ____ ____ ____

2. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? ____ ____ ____

3. Has horizontal plane bracing been shown where required to limit compression flange buckling? ____ ____ ____

G. Deflections and Settlement

1. Is falsework deflection for concrete dead load shown on the plans for all falsework spans? ____ ____ ____

2. Is falsework deflection from concrete dead load limited to 1/240 of the span length for all falsework spans? ____ ____ ____

3. Do stringers supporting cast-in-place concrete compensate for estimated camber? ____ ____ ____

4. For beam spans with cantilevers, has the upward deflection of the cantilevers due to load placed on the main spans been investigated? ____ ____ ____

5. Are provisions shown for taking up falsework settlement? ____ ____ ____

H. Compression Members, Connections and Bracing

1. Has general buckling been evaluated for all compression members? ____ ____ ____

2. Has bracing been provided at all points of assumed support for compression members? ____ ____ ____

3. Was bracing in each direction considered in establishing the effective length used to check post capacity? ____ ____ ____

4. Is bracing strength and stiffness sufficient for the intended purpose? ____ ____ ____

5. If temporary bracing is required during intermediate stages of falsework erection, is it shown on the falsework plans? ____ ____ ____

6. Have all connections been designed and detailed? ____ ____ ____

7. Are web stiffeners required on steel cap beams to resist eccentric loads? ____ ____ ____

8. Are wedges required between longitudinal beams and cap beams to accommodate longitudinal slope or to reduce eccentric loading? ____ ____ ____

9. Has the width to height ratio of wedge packs been verified to fall within the limits given in the special provisions? ____ ____ ____

10. If overhang brackets are attached to unstiffened girder webs, has the need for temporary bracing to prevent longitudinal girder distortion been investigated? ____ ____ ____

11. Have beams and stringers with height/width ratios greater than 2.5:1 been checked for stability? ____ ____ ____

12. Have sloping falsework members that exert horizontal forces on the falsework been braced or tied to resist these loads? ____ ____ ____

13. If beams supporting cast-in-place concrete have cantilever spans, have the falsework plans been noted to require the main spans be loaded before loading the cantilever spans? ____ ____ ____

14. Have timber headers set on shoring towers been checked for eccentric loads, and for shear and bending stresses produced by the eccentricity? ____ ____ ____

I. Highway and Railroad Traffic Openings (For falsework over or adjacent to highway or railroad traffic openings.)

1. Do falsework plans satisfy construction clearances shown on the contract plans? ____ ____ ____

2. Are posts designed for 150% of the calculated vertical loading and increased or readjusted for loads caused by prestressing forces? ____ ____ ____

3. Are mechanical connections 2,000 pounds minimum capacity shown at the bottom of posts to footing connections? ____ ____ ____

4. Are mechanical connections 1,000 pounds minimum capacity shown at the top of the post to cap connections? ____ ____ ____

5. Are beam tie downs 500 pounds minimum capacity shown for all beams? ____ ____ ____

6, Are 5/8 inch or larger diameter bolts used at connections for timber bracing? ____ ____ ____

7. Are temporary erection and removal bracing shown? ____ ____ ____

J. Additional Requirements for Railroad Traffic Openings

1.	Do falsework plans show collision posts as shown on the contract plans?	____	____	____
2.	Do posts adjacent to the openings have a minimum section modulus of?			
	a. steel - 9.5 cubic inches	____	____	____
	b. timber - 250 cubic inches	____	____	____
3.	Are soffit and deck overhang forming details shown?	____	____	____
4.	Are falsework bents within 20 feet of centerline of the track sheathed solid between 3 feet and 17 feet above top of rail with 5/8 inch thick minimum plywood and properly blocked at the edges?	____	____	____
5.	Is bracing on the bents within 20 feet of the centerline of the track adequate to resist the required assumed horizontal load or minimum 5,000 pounds, whichever is greater?	____	____	____

_____ _____
Designer's Signature Date

End of Section

Section 00543 - Architectural Treatment

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00543, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00543.00 Scope - This Work consists of applying concrete surface texture, color, and anti-graffiti coating to the indicated concrete faces, as shown in the Plans.

00543.02 Required Submittals - Submit the following at least 10 Calendar Days before the preconstruction conference:

- Electronic submittal of the form liner manufacturer's pattern details;
- Electronic submittal of manufacturer's instructions for handling, cutting, assembling, and finishing form liners;
- Electronic submittal of the stain manufacturer's written application instructions;
- One color sample for each proposed stain to be used;
- A description of proposed containment methods and plan for disposal of chemical or other residues; and
- Documentation showing that the firm performing the Work of this Section has successfully completed a minimum of 5 projects involving comparable textured and colored concrete construction within the previous 5 years. Include the name, location, and approximate completion date for each previous project, and the name and phone number of an owner's representative who can attest to the success of the project.

Materials

00543.10 Form Liners - Furnish form lining Materials and patterns according to the Specifications and as approved by the Engineer.

(a) General - All form liners used for a particular pattern shall be from the same manufacturer.

00543.11 Form Liners - Furnish a high-quality form liner product that attaches easily to the forms. Form liners shall be:

- Capable of withstanding anticipated concrete pour pressures without compressing more than 1/4 inch or leaking concrete so as to cause physical or visual defects in the finished Work; and
- Removable without causing damage to the concrete surface or the substrate.

00543.12 Colored Stain - Furnish a semi-opaque, solvent-based or water-based, colored stain that penetrates the surface of the concrete. The stain shall allow moisture and vapor transmission, and shall not alter the textured surface or its resistance to attack by moisture, alkali, acid, mildew, mold, or fungus.

Furnish concrete surface stain color that conforms to the following colors:

(In the following list, replace the color and color number if necessary. Delete all orange parentheses.)

- Brown, conforming to SAE AMS-STD-595C color #(31090).

Furnish one of the following stains or approved equal:

(In the following list, add, delete, or replace options as necessary. Obtain the approval of Technical Resource for this Section.)

- Canyon Tone Stain, by United Coating
  8001 N Bruce Road
  Spokane, WA 99217
  Telephone: (509) 998-6270

- Chemprobe Conformal Stain, by Tnemec Corporation
  7929 Second Ave. S.
  Seattle, WA 98108
  Telephone: (206) 661-2086

- H&C Colortop Water-Based Solid Color Concrete Stain by H&C Products Group
  101 W. Prospect Avenue
  Cleveland, OH 44115
  Telephone: (800) 867-8246

Submit color chip to the Engineer for approval before ordering stain.

00543.13 Anti-Graffiti Coating – Furnish the following sacrificial graffiti control system or approved equal:

- Monochem Permashield Sacrificial Graffiti Control System by Monopole, Inc.
  4661 Alger Street
  Los Angeles, CA 90039
  Telephone: (818) 500-8585

00543.14 Form Release Agents and Patching Materials - Furnish form release agents and patching Materials that are compatible with the form liner system and stain.

00543.15 Form Ties - Furnish form ties with set break-backs at least 1 inch below the finished concrete surface (bottom of rustication groove), so designed that the device can be disengaged and removed without spalling or damaging the concrete.

00543.16 Quality Control - Provide quality control according to Section 00165.

Construction

00543.40 Pre-Production Tests:

(a) Form Liner Test Panels - Construct vertical, unreinforced test panels for each form liner type specified, to demonstrate the surface texture produced by the form liner. The minimum size for the test panel shall be 8 inches thick by 8 feet wide by 6 feet high.

The test panel shall include one vertical and one horizontal joint between adjacent sections of form liner to demonstrate that the finished pattern meets the appearance requirement of 00543.41.

Construct test panels in a location designated by the Engineer, using the same concrete class and finishing procedures as proposed for the finished Structure.

The Engineer will examine the surface of the resulting test panel. Remove and dispose of unsatisfactory test panels according to 00290.20(c) and repeat test as required. Do not proceed with the Work prior to receiving the Engineer’s approval.

Retain the approved test panel to serve as the standard for accepting subsequent texturing Work.

(b) Coloring Test - Perform one or more color application tests prior to applying stain to the finished Work. Perform test(s) on cured form liner test panel(s) constructed according to 00543.40(a), or other area(s) where directed. If results do not meet Specifications, repeat the test on new test panel(s) until the Engineer approves the results.

The approved test area will serve as the standard for accepting subsequent stain application, and may be incorporated into the finished work if approved.

00543.41 Form Liner Installation - Ensure that form liners are clean and free of concrete build-up, blemishes, tears, or other damage prior to each use.

Attach liner to forms following manufacturer's recommendations. Butt adjoining liners with less than 1/4-inch seams. Fill open cracks prior to placing concrete. Assemble and join form liner panels so that the finished pattern has a continuous appearance, and is not interrupted by visible vertical or horizontal joints between panels.

Coordinate form tie locations with the form liner pattern. Locate form tie holes in the high point of the rustication groove between stone patterns.

00543.42 Coloring - After the textured concrete has cured as recommended by the stain manufacturer, but not less than 28 Days after concrete placement unless approved by the Engineer, stain the textured surfaces where shown, following the manufacturer’s instructions.

Ensure the concrete surface is free of all laitance, dirt, dust, grease, efflorescence, curing agents, form release agents, paint, or other foreign material before applying stain.

Sand blasting or other methods that reduce the approved surface texture will not be allowed for cleaning concrete surfaces. If using pressure washing, manage wash water according to Section 00290.

The stained surface shall be free of blemishes, discoloration, surface voids, and conspicuous form marks.

Measurement

00543.80 Measurement - The quantities of Architectural Treatment will be measured on the area basis and will be the area of treatment on the indicated concrete faces, including faces of approved test panels incorporated into the main concrete surface.

No measurement of quantities will be made for test panels, including architectural treatment of test panels not included in the main concrete surface.

Payment

00543.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Architectural Treatment	Square Yard
(b) Test Panels	Lump Sum

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for:

- furnishing and placing formliners
- release agents
- patch mix
- finishing
- caulking compounds
- concrete surface colorant
- concrete sealers
- anti-graffiti coating

End of Section

Section 00545 - Reinforced Concrete Bridge End Panels

(This Section requires SP02001.)

Comply with Section 00545 of the Standard Specifications modified as follows:

Add the following subsection:

00545.01 Terminology - For the purposes of this Section, the terms “end panel” and “end panels” shall respectively refer to and shall be read to mean “approach slab” and “approach slabs”.

End of Section

Section 00550 - Precast Prestressed Concrete Members

(This Section requires SP00530, SP02001, and SP02560. This Section required SP02510 if epoxy coated reinforcement if required.)

Comply with Section 00550 of the Standard Specifications modified as follows:

00550.80 Measurement - Add the following paragraph to the end of this subsection:

Stirrup extension reinforcement will be measured according to 00530.80. Estimated quantities of reinforcement for the lump sum method will be listed in 00530.80(a).

00550.90 Payment - Add the following paragraph to the end of this subsection:

Stirrup extension reinforcement, as shown, will be paid for according to 00530.90.

End of Section

Section 00582 - Bridge Bearings

Comply with Section 00582 of the Standard Specifications.

End of Section

Section 00585 - Expansion Joints

(This Section requires SP02530.)

Comply with Section 00585 of the Standard Specifications modified as follows:

00585.01 Definitions -

Replace the sentence that begins "**Asphaltic Plug Joint Seal -** A sealed joint composed of Aggregate**.**…" with the following sentence:

Asphaltic Plug Joint Seal - A closed joint composed of Aggregate and flexible binder material placed over a steel bridging plate.

Replace the sentence that begins "**Closed Joint** - A sealed or filled joint designed…" with the following sentence:

Closed Joint - A sealed joint designed to prevent water and debris from passing through the joint.

Add the following definition:

Control Joint - A joint created by sawing a groove in a surface to create a weakened vertical plane and filled with a poured material.

Replace the sentence that begins "**Filled Joint** - A joint using a preformed …" with the following sentence:

Filled Joint - A joint using a preformed joint filler placed prior to concrete pour.

Delete the definition for **Sealed Joint**

Replace the sentence that begins "**Strip Seal** - A sealed joint with an extruded**.**…" with the following sentence:

Strip Seal - A closed joint with an extruded elastomeric seal retained by edgebeams that are anchored to the structural elements.

Add the following subsection:

00585.02 Submittals:

(a) Materials - At least 21 Calendar Days before starting Work, submit QPL listed products to the Engineer for approval.

(b) Personnel Qualifications - At the pre-construction conference, submit joint installer personnel certifications(s) from the manufacturer affirming that the installers have been trained in application methods of materials and health and safety to install Closed Joints as detailed.

(c) Working Drawings - At least 21 Calendar Days before starting Work, submit unstamped Working Drawings from the manufacturer for each Closed Joint according to 00150.35. Include the following:

- Plan, elevation and section of the joint system with dimensions and tolerances.
- Complete details of all joint materials with all ASTM, AASHTO or other material designations.
- Method of installation including sequence and installation details at traffic barriers, roadway surfaces, curbs and sidewalks.
- Joint details to include the following:
  - Prevent the entrance of water and debris into the joint.
  - Accommodate the required structure movements shown.

00585.11 Approval of Materials - Delete this subsection.

00585.12 Concrete for Blockout Opening - Replace the sentence that begins “Fill blockout openings with the …” with the following sentence:

Fill blockout openings with the same class and type of concrete used in the deck, unless otherwise shown.

00585.30 Closed Joint Installers - Replace this subsection with the following subsection:

00585.30 Joint Installers - Provide trained personnel to install the Closed Joints.

00585.31 Sealed Joint Manufacturer's Representative - Replace this subsection with the following subsection:

00585.31 Expansion Joint Seal Manufacturer's Representative - Provide a manufacturer's representative on-site during the installation of expansion joint device. Discuss with the representative regarding the Work to be done, the methods of installation, installation procedures, and the required Equipment to assure correct installation of expansion joints

00585.42(a) Submittals - Replace this subsection with the following subsection:

00585.42(a) Notification - Notify the Engineer in writing at least 7 Calendar Days before installing the Closed Joint. Include the Contract number, bridge number, joint seal material, product name, and the approximate date of installation.

00585.42(c) Joint Preparation - Replace the sentence that begins “Prepare the joint surfaces as directed…” with the following sentence:

Prepare the joint surfaces as shown or directed in this Section and according to the joint material manufacturer's recommendations.

00585.42(d) Weather Conditions at Time of Installation - Replace this subsection, except for the subsection number and title, with the following:

Install joint seals when the weather conditions are suitable for joint installation according to the manufacturer's recommendations.

00585.42(e) Leakage Check - Replace this subsection, except for the subsection number and title, with the following:

After joint installation is complete, check joints for leakage by flooding the joint with water. Maintain ponding of water in the roadway shoulders or 3 feet from the gutter line, whichever is greater, for 2 hours. Use an unnozzled water hose delivering one gallon of water per minute to the inside face of railing. Verify no leaking of joints. If leakage is observed, repair the joints using a method recommended by the manufacturer and approved by the Engineer prior to starting Work at no additional cost to the Agency. Perform additional leakage check at no additional cost to the Agency. Additional leakage checks have the same requirements.

Add the following subsection:

00585.50 Control Joint - Construct Control Joints as shown. If details of the control joint are not shown, sawcut the surface 1 1/2 inches deep and 1/2 inch wide and fill it with hot applied joint sealant.

00585.80 Measurement - Add the following to the end of the subsection:

The estimated quantities of joints are:

(List all applicable joint types, e.g. expansion joints, control joints, or hot applied joint sealant, as the pay item name. Obtain information from the Bridge Designer.)

Structure	Joint Type	Quantity (Foot)
Bridge No. _____		
Bridge No. _____		

00585.90 Payment - Add the following to the pay item list:

(Add the following pay item to the pay item list when a control joint is specified and not paid with paving Work.)

(g) Control Joint ..... Lump Sum

(Add the following pay item to the pay item list when removing and replacing hot applied joint sealant in an existing joint are specified and not paid with paving Work.)

(h) Hot Applied Joint Sealant ..... Lump Sum

Replace the bullet that begins “preformed expansion joint filler…” with the following bullet:

- preformed joint filler, hot applied joint sealant, or sawcutting to construct Filled Joint

Replace the bullet that begins “providing the manufacturer's…” with the following bullet:

- providing the expansion joint seal manufacturer's representative

Add the following to the end of this subsection:

When the Contract Schedule of Items does not indicate payment for control joints performed under this Section, no separate or additional payment will be made for the control joint. Payment will be included in payment made for the appropriate items under which the control joint is required.

End of Section

Section 00587 - Bridge Rails

(This Section requires SP02001.)

Comply with Section 00587 of the Standard Specifications modified as follows:

00587.80 Measurement - Add the following to the end of this subsection:

The estimated quantity of bridge rail is:

(List rail type as the pay item name. Obtain information from the Bridge Designer.)

Structure	Rail Type	Quantity (Foot)
Bridge No. _____		
Bridge No. _____		

End of Section

Section 00589 - Utility Attachments on Structures

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00589, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00589.00 Scope - This Work consists of providing for attachment or installation of utilities on new and existing Structures as shown or as directed.

(Use the following two paragraphs when structures have been designated "Special Structures" by Bridge Engineering Section. List the designated Special Structures by bridge number.)

The following Structures are designated "Special Structures":

- Bridge No. _____
- Bridge No. _____

Utility attachments to Special Structures shall not alter the appearance of the Structure. Make attachments only inside the girder line, as close as possible to the soffit, or as required to make the installation as inconspicuous as practicable.

Materials

00589.10 General - Furnish utility attachment systems using Materials from the QPL and meeting the following requirements:

Structural Steel	02530
Forgings, Shafting, Castings, and Nonferrous Materials	02540
Fasteners	02560
Reflective Sheeting	02910.20(a)
Resin Bonded Anchor System	00535.10

Furnish brackets constructed of hot-dip galvanized structural steel.

Construction

00589.40 General - Provide sufficient space around utilities for maintenance activities.

Avoid drilling through reinforcing steel. If reinforcing steel is hit, move the anchor location and patch the hole with an approved patching material from the QPL.

Attach conduits or brackets to concrete Structures galvanized concrete inserts, unless otherwise shown or approved.

00589.41 Natural Gas Lines - Conform to the portions of CFR 49 Part 192 that are applicable to the Work. Provide isolation valves 200 feet from each end of the Bridge as shown.

(Include the following subsection .42 when a casing is requested by the Utility Coordinator. Delete the item from the subsection that does not apply, but do not change the alpha characters next to the title. Fill in the blank with the appropriate information.)

00589.42 Casing –

(a) Natural Gas Casing - Install steel pipe casing for natural gas lines below bridge deck as shown. Natural gas line will be installed within casing by others.

(b) Communication Casing - Install (insert the type of casing as discussed with the Utility Owner) casings for communications lines below bridge deck as shown. Communication lines will be installed within casings by others.

(Include the following Subsection .43 when a waterline will be attached to a bridge)

00589.43 Water Line Attachment - Install ductile iron pipe and fittings with restrained joints according to 01140.00 through 01140.52 below the bridge deck as shown and specified.

00589.48 Labeling - Clearly label all piping or conduit systems according to the following APWA color code:

Table 00589-1

Material	Marker Background Color
Electrical Power Lines, Cables, Conduits, Lighting Cables	Red
Gas, Oil, Steam, Petroleum, Gaseous Materials	Yellow
Communications, Alarm, Signal Lines, Cables, or Conduits	Orange
Potable Water	Blue
Reclaimed Water, Irrigation, Slurry Lines	Purple
Sewers, and Drain Lines	Green

Generate purple by placing purple transparent film over white reflective sheeting. The purple tint of the transparent film shall match Federal Standard Color 595B No. 37100.

Minimum length of label shall be as shown in Table 00589-2.

Table 00589-2

Pipe O.D. Min.	Pipe O.D. Max.	Length of Label	Width of Label
3/4"	1 1/4"	8"	3/4"
1 1/2"	2"	8"	1"
2 1/2"	6"	12"	2"
8"	10"	12"	2"
10"	—	12"	2"

Place labels on each pipe or conduit, on each side of every bent, and at each entrance to a box girder.

Where piping is above or below normal line of sight, place pipe labels so that label may be seen from normal eye height.

Measurement

00589.80 Measurement - No measurement of quantities will be made for Work performed under this Section.

Payment

00589.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract lump sum amount for the item "Utility Attachment on Structures".

The type of utility attachment on structures will be inserted in the blank.

Payment will payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

Section 00593 - Powder Coating Metal Structures

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00593 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00593 of the Standard Specifications modified as follows:

(Use the following subsection .10(b) to list topcoat colors that aren't identified in the Standard Specifications. Fill in the blanks as instructed and obtain information from the Designer. Copy and repeat the paragraph as needed. For color number, only use numbers 14159 to 28915 from the SAE AMS-STD-595 color index.

For metal handrail and pedestrian, the standard color to be used is SAE AMS-STD-595 color #20140.

Example:

For the combination rail on Bridge No. 12345A, provide a topcoat color of High Gloss Black that conforms to SAE AMS-STD-595 color # 17038.)

00593.10(b) Color - Add the following to the end of this subsection:

For __*(Structure number or item description)*__, provide a topcoat color of __*(Color Name)*__ that matches SAE AMS-STD-595 color # __*(Color Number)*__.

End of Section

Section 00595 - Reinforced Concrete Box Culverts

(This Section requires SP02001. This Section requires SP00591 when spray waterproofing membrane is required.)

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00595 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00595 of the Standard Specifications modified as follows:

(Include the following bullet if welding is to be performed. Select the appropriate 00560.26(a) for bridge size culverts or 00560.26(b) for non-bridge culverts. Check with the designer.)

00595.44 Precast Installation – Add the following to the end of this subsection:

- Perform structural steel welding according to *(*00560.26(a) or 00560.26(b)*)*.

(Use the following .80 for estimated quantities for wing walls and aprons.)

00595.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of reinforcement and concrete for wing walls and aprons are:

(Fill in the appropriate amount of wing wall and apron reinforcement and concrete. Obtain information from the Bridge Designer.)

	Reinforcement (Pound)	**Concrete (Cubic Yard)**
Wing Walls		
Aprons		

End of Section

Section 00596A - Mechanically Stabilized Earth Retaining Walls

(This Section requires SP02001 and SP02690.)

Comply with Section 00596A of the Standard Specifications modified as follows:

(Use the following subsection .01 and bullets when the contractor will be required to select a permanent proprietary MSE wall system. For "Bridge" retaining walls and "Highway" retaining walls, fill in the blank with the structure number. If the retaining wall does not have a structure number, delete the phrase ", structure no. ____ ,".)

00596A.01 Proprietary MSE Walls - Add the following to the end of this subsection:

Select one of the following preapproved proprietary MSE retaining wall systems for the wall, structure no. ____, as shown:

(Fill in the blanks with the proprietary retaining wall system name (including the "™" symbol), company name and telephone number from the ODOT Geotechnical Design Manual, appendix 15-D.)

- ARES® MSE Retaining Wall System, provided by Tensar®, telephone: (360) 779-5555.
- LANDMARK® MSE Retaining Wall System, provided by Anchor® Wall Systems, telephone: (949 363-6663.
- Reinforced Earth® MSE Retaining Wall System, provided by The Reinforced Earth® Company, telephone: (303) 790-1481.

(Use the following subsection .04(b) to list proprietary wall geotechnical and seismic design parameters. Obtain information from the designer. Delete what does not apply. Delete the language in orange parentheses that does not apply and delete all orange parentheses. Copy and paste the structure number, station limits, and associated bullets for each separate retaining wall.)

00596A.04(b) Design Calculations - Add the following to the end of this subsection:

The following retaining wall design parameters have been established for this Project:

Structure No. _____ : Sta. _____ to Sta. _____*(*Lt.*)(*Rt.*)*

- Foundation soil unit density _____ lbs./cu. ft.
- Foundation soil angle of internal friction _____ degrees
- Foundation soil nominal (unfactored)
- bearing resistance _____ lbs./sq. ft.
- Retained soil unit density _____ lbs./cu. ft.
- Retained soil angle of internal friction _____ degrees
- Reinforced soil unit density _____ lbs./cu. ft.
- Reinforced soil angle of internal friction _____ degrees

- Peak ground acceleration coefficient (*PGA*) _____
- Short period spectral acceleration coefficient (S_S). _____
- Long period spectral acceleration coefficient (S_1) _____
- Site class _____
- Peak seismic ground acceleration coefficient
- modified by zero period site factor (A_s) _____
- Horizontal seismic acceleration coefficient (k_h) _____

(Use the following bullet and sub-bullet when the Mononabe-Okabe method is <u>not</u> required. Repeat as necessary for variations in wall height and backslope along the wall.).

- Between Station _____ and Station _____ ***(*****Lt.*****)(*****Rt.*****)***
  - Total (static plus seismic) external seismic thrust (P_{AE}) _____ lbs./ft.

(Use the following bullet and sub-bullets to specify minimum length of soil reinforcement. Repeat as necessary for variations in wall height, backslope, bearing resistance and other parameters which can change along the wall.)

- Between Station _____ and Station _____ ***(*****Lt.*****)(*****Rt.*****)***:
- Minimum length of soil reinforcement for overall stability _____ft.
  - Minimum length of soil reinforcement for external stability _____ft.

00596A.11(c) Modular Block Core and Drainage Backfill - Replace this subsection, except for the subsection number and title, with the following:

Furnish 3/4" - No. 4 PCC Aggregate Material meeting the requirements of 02690.20(a) through (e).

(Use the following subsection .12(e)(1) when precast concrete panel facing is required. Use one of the following options as instructed below. Delete the option that does not apply.)

00596A.12(e)(1) Portland Cement Concrete - Add the following paragraph to the end of this subsection:

[Option 1 - Use the following paragraph when an ARES™ wall system is <u>not</u> specified.]

Furnish Class 4000 structural concrete meeting the requirements of Section 02001.

[Option 2 - Use the following paragraph when an ARES™ wall system is specified.]

For ARES™ retaining wall systems, furnish Class 4500 structural concrete meeting the requirements of Section 02001, except the maximum water-cementitious material ratio shall

not exceed 0.44. For all other retaining wall systems use Class 4000 structural concrete meeting the requirements of Section 02001.

00596A.15 Elastomeric Bearing Pads for Precast Concrete Facing Panels - Replace this subsection, except for the subsection number and title, with the following:

In horizontal and diagonal joints between precast concrete panels, furnish the grade, size, number and type of bearing pads shown in the stamped Working Drawings and design calculations prepared by the manufacturer. Determine the stiffness, size, and number of bearing pads so that the final joint opening is 3/4 inch ± 1/8 inch or as shown.

(Use the following subsection .16 when KeySystem I™, LANDMARK™, or MESA™ wall systems are specified in 00596A.01.)

00596A.16 Concrete Modular Block Facing Connection Devices - Add the following to the end of this subsection:

(Use the following paragraph and table when the LANDMARK™ wall system is specified.)

For LANDMARK™ wall systems, furnish lock bars that are made of a rigid, polyvinyl chloride polymer conforming to the following requirements:

Property	Limits	Specification
Specific Gravity	1.4 (min.)	ASTM D792
Tensile Strength (at yield)	2,700 psi (min.)	ASTM D638

(NOTES to Specification Writer:

(1) The bid item quantity for MSE retaining walls is "Lump Sum," and includes all labor, materials, and inclusive items necessary to complete the work. Items such as excavation, shoring, reinforced backfill, and standard copings are considered inclusive items to the wall pay item, but items such as sidewalk copings, traffic barrier, moment slabs, guardrail and fencing are considered appurtenances along with the following items and should be included as separate bid items:

Items associated with referenced standard drawings and details such as architectural treatments, geomembrane barriers, drainage pipes and geocomposite drainage panels.
Items associated with incidental work, such as scour protection, dewatering, or foundation improvement.
Larger structures such as culverts.
Items that cost more than 5 percent of the lump sum cost.

(2) For proprietary retaining wall systems, where details of wall construction are generally not known until after the construction contract is awarded, do not include estimated quantities for inclusive items.)

00596A.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of retaining walls are:

(Provide wall area below. The wall area is bounded by the beginning and end of the wall, top of the wall (excluding wall coping), and top of the footing or leveling pad. If no footing or leveling pad exists, the bottom of the wall is used. Copy and paste more lines, as necessary, to list estimated areas for each retaining wall.)

Structure Number _____ :

Station Limits	**Area**
Sta. _____ to Sta. _____ *(*Lt.*)(*Rt.*)*:	___(Wall area here)___ sq. ft.

(Use the following paragraph to list estimated quantities for nonproprietary retaining wall systems only. Ensure that the Wall (Bridge) Designer provides estimated quantities for all-inclusive items such as excavation, shoring, reinforced backfill, leveling pads, wall drainage backfill/geotextile, and standard coping. Copy and paste more lines, as needed, to list estimated quantities for each nonproprietary retaining wall.)

The estimated quantities of listed Materials are:

Structure No. _____: Sta. _____ to Sta. _____ _____ *(*Lt.*)(*Rt.*)*::

Material	**Estimated Quantities**
_____	____ cu. yd.
_____	____ foot
_____	____ lb.

End of Section

Section 00596B - Prefabricated Modular Retaining Walls

(This Section requires SP02690.)

Comply with Section 00596B of the Standard Specifications modified as follows:

(Use the following subsection .01 and bullets when the contractor will be required to select a permanent proprietary Prefabricated Modular wall system. For "Bridge" retaining walls and "Highway" retaining walls, fill in the blank with the structure number. If the retaining wall does not have a structure number, delete the phrase ", structure no. ____ ,".)

00596B.01 Proprietary Prefabricated Modular Walls - Add the following paragraph and bullet list to the end of this subsection:

Select one of the following preapproved Prefabricated Modular proprietary retaining wall systems for the wall, structure no. ____ , as shown:

(Fill in the blanks with the proprietary retaining wall system name (including the "™" symbol), company name and telephone number from the ODOT Geotechnical Design Manual, appendix 15-D.)

- Allan Block AB Classic Retaining Wall System, provided by Allan Block Corporation, telephone: (952) 835-5309.
- Ultrablock™ Retaining Wall System, provided by Ultrablock, Inc., telephone: (800) 377-3877.

(Use the following subsection .04(b) to list proprietary wall design parameters. Obtain information from the designer. Delete what does not apply. Copy and paste the structure number and bullets for each separate retaining wall.)

00596B.04(b) Design Calculations - Add the following to the end of this subsection:

The following retaining wall design parameters have been established for this Project:

Structure Number _____

- Foundation soil unit density _____ kips/cu. ft.
- Foundation soil angle of internal friction _____ degrees
- Foundation soil nominal (unfactored)
- bearing resistance _____ kips/sq. ft.
- Retained soil unit density _____ kips/cu. ft.
- Retained soil angle of internal friction _____ degrees
- Peak ground acceleration coefficient (PGA) _____
- Long period spectral acceleration coefficient (S1) _____
- Site class _____

(Use the following two bullets when the Mononabe-Okabe method is required.)

- Peak seismic ground acceleration coefficient modified by short period site factor (A_s) _____
- Horizontal seismic acceleration coefficient (K_h) _____

Use the following bullet and sub-bullet when the Mononabe-Okabe method is <u>not</u> required. Repeat as necessary for variations in wall height and backslope along the wall.)

Between Station _____ and Station _____ (Lt.)(Rt.):

- Total (static plus seismic) external seismic thrust (P_{AE}) _____ kip/ft.

(Use the following bullet and sub-bullets to specify minimum base width for external and overall stability. Repeat as necessary for variations in wall height and backslope along the wall.)

Between Station _____ and Station _____ (Lt.)(Rt.):

- Minimum base width for overall stability _____ ft.
- Minimum base width for external stability _____ ft.

00596B.11(b) Modular Block Core and Drainage Backfill - Replace this subsection, except for the subsection number and title, with the following:

Furnish 3/4" - No. 4 PCC Aggregate Material meeting the requirements of 02690.20(a) through (e).

00596B.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of retaining walls are:

(Provide wall area below. Copy as necessary.)

Station Limits	Area
Sta. _____ to Sta. _____ (Lt.)(Rt.)	___ <u>(Wall area here)</u> ___ sq. ft.

(Use the following paragraph to list estimated quantities for <u>nonproprietary retaining wall systems only</u>. Ensure that the Wall (Bridge) Designer addresses quantities for excavation, shoring (if needed), and leveling pad concrete and rebar, and backfill. Copy and paste more lines to address the estimated quantities for nonproprietary retaining wall systems.)

The estimated quantities, for estimating purposes only, of excavation, shoring, leveling pads, and specified backfill for nonproprietary retaining wall systems are:

Structure Number	Material	Estimated Quantities
_#_	_____	____ cu yd.
_#_	_____	____ foot
_#_	_____	____ lb.

End of Section

Section 00596C - Cast-In-Place Concrete Retaining Walls

Comply with Section 00596C of the Standard Specifications modified as follows:

00596C.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of retaining walls are:

(Provide wall area below. Copy as necessary.)

Station Limits	Area
Sta. _____ to Sta. _____ *(*Lt.*)(*Rt.*)*	___ (Wall area here) ___ sq. ft.

(Use the following paragraph to list estimated quantities. Ensure that the Wall (Bridge) Designer addresses quantities for concrete, reinforcement, excavation, shoring (if needed), and backfill. Copy and paste more lines to address the estimated quantities for retaining wall systems.)

The estimated quantities, for estimating purposes only, of concrete, steel reinforcement, excavation, shoring, and specified backfill for retaining wall systems are:

Structure Number	Material	Estimated Quantities
_#_	_____	____ cu yd.
_#_	_____	____ foot
_#_	_____	____ lb.

End of Section

SP00600 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00600 – BASES

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00620 - Cold Plane Pavement Removal

(This Section requires SP00744 or SP00745 when traffic is not allowed on the cold planed surface.)

Comply with Section 00620 of the Standard Specifications modified as follows:

00620.40(e) Warning Signs - Replace this subsection, except for the subsection number and title, with the following:

Provide warning signs as required where abrupt or sloped drop-offs occur at the edge of the existing or new surface according to Sections 00221 and 00222.

(Use the following subsection .43 when traffic restrictions are required on cold planed areas. Delete what does not apply.)

00620.43 Maintenance Under Traffic - Replace this subsection, except for the subsection number and title, with the following:

(Use these three paragraphs when traffic is allowed on cold planed areas for a limited duration. Obtain time limit from the pavement designer. Time limit should not exceed 7 Calendar Days. Verify time limit aligns with sequencing requirements in Section 00150.11. Designer to consider traffic control and drainage impacts with allowing traffic on a cold planed surface.)

Traffic will be allowed on the cold planed surface up to ___ Calendar Days after removing the existing surface. Sweep and clean the cold planed surface before opening to traffic.

Submit a plan describing how drainage will be maintained while traffic is on the cold planed surface at least 7 Calendar Days prior to cold planning.

Before beginning paving operations, make repairs to the existing cold planed surface as directed. Payment for the repairs will be made according to 00195.20.

(Use this paragraph when cold planed areas are required to be paved before opening to traffic. Delete subsection number in parentheses that does not apply. Delete all orange parentheses. Be sure to include 00744.51 or 00745.51 in the special provisions, as appropriate.)

Traffic is not allowed on the cold planed surface. Before opening the area to traffic, pave the surface according to (00744.51) (00745.51).

End of Section

Section 00640 - Aggregate Base and Shoulders

(Use Section 00640 when the project does not meet the minimum criteria to use Section 00641)

Comply with Section 00640 of the Standard Specifications modified as follows:

00640.80 Measurement - Replace this subsection, except for the subsection number and title, with the following:

The quantities of Aggregates will be measured on the weight basis or on the area basis according to the following:

(a) Weight Basis – When measurement is by weight, quantities will be measured in the hauling vehicle.

(b) Area Basis – When measurement is by area, the quantity will be the number of square yards of Aggregate Base constructed to the full thickness. The surface area will be limited to the neat lines shown in the plans or as directed in the field. Each area constructed with varying thicknesses, as directed or shown, will be adjusted by converting it to an equivalent area at the Pay Item thickness on a proportionate volume basis.

00640.90 Payment – Replace this subsection, except for the subsection number and title, with the following:

The accepted quantities of Aggregates will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Aggregate Base	Ton
(b) Aggregate Shoulders	Ton
(c) Aggregate Base, ____ Inches Thick	Square Yard

In item (c), the depth of Aggregate Base will be inserted in the blank.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for water used to obtain proper compaction and in the care of the Work.

When the Contract Schedule of Items does not indicate payment for Work performed under this Section, no separate or additional payment will be made. Payment will be included in payment made for the appropriate items under which this Work is required.

End of Section

Section 00641 - Aggregate Subbase, Base, and Shoulders

(Use Section 00641 for road base for all classification of roadways in the City of Bend.))

Comply with Section 00641 of the Standard Specifications modified as follows:

00641.10(a) Base and Shoulder Aggregate - In the paragraph that begins "Aggregate for bases…", add the following sentence after the first sentence:

Base aggregate shall be either 1” - 0 or ¾” - 0 size.

00641.80(c) Area Basis - Replace the sentence that begins “The surface area will be…” with the following:

The surface area will be limited to the neat lines shown in the plans or as directed in the field.

End of Section

Section 00645 - Recycled Asphalt Products in Base

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00645, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00645.00 Scope - This Work consists of hauling recycled asphalt products from Agency provided stockpiles specified in Section 00160 and placing one or more layers of recycled asphalt products, mixed with water, on a prepared surface to the lines, grades, thicknesses, and Cross Sections shown or established.

Materials

00645.10 Materials - Furnish recycled asphalt products of the designated sizes from the stockpiles except discard hardened lumps exceeding 2 inches on any measured face at the stockpile site in a separate new stockpile or reprocess to achieve the desired maximum size limit.

Acceptance of the recycled asphalt products will be by visual inspection.

00645.12 Limits of Mixture - Provide a mixture of recycled asphalt products and water having a uniform moisture content sufficient to obtain the required compaction. Water may be introduced in a mixing plant, or on the grade.

00645.15 Quality Control - Provide quality control according to Section 00165.

Equipment

00645.21 Hauling Equipment - Provide recycled asphalt products hauling vehicles capable of hauling and depositing the recycled asphalt products material with a minimum of material segregation.

00645.22 Watering and Spreading Equipment - Provide Equipment to add water to the recycled asphalt products and spread to the lines and grades shown or directed.

00645.23 Compacting Equipment - Provide self-propelled rollers and compactors capable of reversing without backlash and meeting the following requirements:

- A gross static weight of at least 10 Tons.
- Adequate to compact to specified density while the recycled asphalt products is still moist.

Labor

00645.30 Quality Control Personnel - Provide a technician having a CDT technical certification.

Construction

00645.40 Preparation of Foundation - Provide a firm surface or material on which recycled asphalt products is to be placed, according to Sections 00330 or 00610 as applicable.

00645.41 Mixing, Hauling, and Placing - Load the recycled asphalt products into the hauling vehicle without compacting material remaining in the stockpile.

Add water to recycled asphalt products while mixing to provide moisture content according to 00645.12.

Thoroughly mix the combined recycled asphalt products and water for as long as necessary to produce a homogeneous mixture. Mix, haul, and place the material by one of the following methods:

(a) Stationary Mixing Plant - Combine materials in a pug mill or rotary mixer.

Deliver and deposit the mixture without delay. Deliver the mixture to the spreading Equipment by direct deposit into its receiving device, or by placing in uniform windrows in front of the Equipment.

(b) Road Mix - Place materials for each layer, add water, and mix with a motor grader until a homogeneous mixture is achieve.

00645.43 Thickness and Number of Layers - If the required compacted depth of the Course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches unless approved by the Engineer.

Place each layer in spreads as wide as practical and to the full width of the Course before a succeeding layer is placed.

00645.44 Shaping and Compacting - Begin compaction of each layer immediately after the material is spread. Determine optimum roller pattern according to ODOT TM 306 C *Control Strip Method of Compaction*. Maintain optimum roller pattern throughout.

Shape and maintain the surface of each layer, during the compaction operations, to produce a uniform texture, and to meet the requirements of 00645.45.

Apply additional water over the materials for proper compaction.

00645.45 Surface Tolerance - The finished surface of the recycled asphalt products and the surface of each underlying layer shall parallel the established grade and Cross Section for the finished surface within 5/8 inch.

The finished surface of the compacted recycled asphalt products, when tested with a 12 foot straightedge, shall not vary from the testing edge by more than 5/8 inch at any point. Furnish and operate the straightedge as directed.

Maintenance

00645.60 Care of the Work - After construction of each layer and completion of recycled asphalt products Course, maintain the layer to specified conditions, and prevent or repair segregation, raveling, or rutting until it is covered with a following layer or until all work is completed.

Measurement

00645.80 Measurement - The quantities of recycled asphalt products will be measured on the area basis, of recycled asphalt products constructed to the full nominal thickness. In areas and where the thickness is other than the full nominal thickness, the areas will be adjusted by converting it to an equivalent number of square yards at the full nominal thickness on a proportionate volume basis.

Payment

00645.90 Payment - The accepted quantities of recycled asphalt products will be paid for at the Contract unit price, per square yard, for the item "Recycled Asphalt Products in Base, _____ Inches Thick".

The thickness of the recycled asphalt products will be inserted in the blank.

Payment will be payment in full for hauling and placing the Agency provided Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for water used to obtain compaction or in care of the work.

End of Section

SP00700 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00700 – WEARING SURFACES

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00705 - Emulsified Asphalt Prime Coat and Emulsified Asphalt Fog Coat

Comply with Section 00705 of the Standard Specifications modified as follows:

00705.11(a) General - In the paragraph that begins "Obtain samples of Emulsified Asphalt according to AASHTO T 40…" replace the words "AASHTO T 40" with the words "AASHTO R 66".

00705.11(c) Fog Coat - Replace the paragraph that begins "Provide CSS-1…" with the following paragraph:

Provide CRS-2P or HFRS-P1 Emulsified Asphalt for the fog coat.

Add.
00705.50 Quality Control – Upon completion of paving and when requested by the City inspector or City Engineer, the Contractor shall conduct a water test to ensure proper drainage grades along curblines. A City inspector must be present during the test. Contractor shall discharge a minimum of 500 gallons of water on to paved area. Puddles resulting to a depth of ¼ inch or any water flowing on to private property shall be repaired.

End of Section

Section 00706 - Emulsified Asphalt Slurry Seal Surfacing

Comply with Section 00706 of the Standard Specifications modified as follows:

00706.23 Rollers – Delete this subsection

00706.48 Rolling – Delete this subsection

End of Section

Section 00715 - Multiple Application Emulsified Asphalt Surface Treatment

Comply with to Section 00715 of the Standard Specifications modified as follows:

(Use the following subsection .00 when surface treatment is NOT designated on the plans. Delete those that do not apply. Remove "(s)" or parentheses as appropriate.)

00715.00 Scope - Add the following to the end of this subsection:

Provide the following surface treatment(s) on this Project:

Fine Double Chip Seal
Medium Double Chip Seal
Type E-9 Oil Mat
Type E-11 Oil Mat

00715.11 Emulsified Asphalt - Add the following paragraph to this subsection:

(Choose the correct Polymer-Modified or Non-Polymer-Modified emulsified asphalt. It will be specified in the pavement design report. Delete the one that does not apply. Remove the parentheses.)

Provide *(*Polymer-Modified*)(*Non-Polymer-Modified*)* Emulsified Asphalt for this Project.

00715.11(c) Acceptance of Emulsified Asphalt - In the paragraph that begins "Obtain Emulsified Asphalt samples according to AASHTO T 40…" replace the words “AASHTO T 40” with the words “AASHTO R 66”.

(Use the following subsection .40 to change hours. Check with the Project Manager for the number of hours that emulsified asphalt and aggregate can be placed before sunset. It may range from 2 - 4 hours, depending on elevation, work in shaded areas, and other conditions.)

00715.40 Season and Weather Limitations - In the sentence that begins "Complete the application of…", replace the words "3 hours" with the words "_____ hours".

In the sentence that begins "The placing of multiple…", replace "July 1" with "June 1".

(Use the following subsections .42(a) and .43 to change hours. Check with the Project Manager for the number of hours that courses can be squared up before sunset. It may range from 2 - 4 hours, depending on elevation, work in shaded areas, and other conditions.)

00715.42(a) Type E-9 and E-11 Oil Mats - Throughout this subsection, replace the words "3 hours" with the words " _____ hours".

00715.43 Applying Emulsified Asphalt - In the third bullet, replace the words "3 hours" with the words " _____ hours".

End of Section

Section 00730 - Emulsified Asphalt Tack Coat

Comply with Section 00730 of the Standard Specifications modified as follows:

00730.11 Emulsified Asphalt – Add “Areas that are less than 600 square feet or irregular areas of less than 8 feet wide can have tack applied using a tack wagon and wand with inspector or Engineer of Record on site to witness application.”

00730.11 Emulsified Asphalt - In the paragraph that begins "Obtain samples according to AASHTO T 40…" replace the words “AASHTO T 40” with the words “AASHTO R 66”.

(Use the following subsection .90 on projects that have less than 10 tons of tack coat. Obtain quantity from the Designer.)

00730.90 Payment - Replace this subsection, except for the subsection number and title, with the following:

No separate or additional payment will be made for Emulsified Asphalt tack coat. Approximately _____ Tons of Emulsified Asphalt in tack coat will be required on this Project.

End of Section

Section 00740 - Commercial Asphalt Concrete Pavement (CACP)

(Use Section 00740 when the project requires minor asphalt in areas outside of the typical vehicular travel path such as patching around curb ramps and asphalt paths. Do not include this section when Section 00744 or 00745 are included in the project.)

(This Section requires SP00730.)

Comply with Section 00740 of the Standard Specifications.

End of Section

Section 00744 - Asphalt Concrete Pavement

(Use Section 00744 when the project does not meet the minimum criteria to use Section 00745. This Section requires SP00730.)

Comply with Section 00744 of the Standard Specifications modified as follows:

(Fill in the blank with the required grade of asphalt used on the project.)

00744.40 Season and Temperature Limitations – In the table, under the row labeled "Greater than 2 ½ inches" replaced the surface temperature from 50° to 40°. DELETE the two asterixis (**) from "All Year" under the "**All Courses**" column and the "**All Other Courses**" column.

00744.11(a) Asphalt Cement - Add the following to the end of this subsection:

Provide PG 64-28 or PG 70-28 grade asphalt cement for this Project.

(Use the following subsection .42 when tack coat is not required between lifts placed during the same shift.)

00744.42 Tack Coat - Add the following sentence after the sentence that begins "Construct a tack coat…":

A tack coat is not required between lifts placed during the same shift provided the bottom lift is kept clean and free of dirt or debris.

Treat all paved surfaces on and against which ACP is to be placed and where paving abuts curb with an asphalt tack coat.

00744.44(b) Drop-Offs - Replace the bullet that begins "Provide warning signs and markings…" with the following bullet:

- Provide warning signs and markings according to Sections 00221, 00222, 00224 and 00225 where abrupt or sloped edge drop-offs greater than 1 inch in height occur.

Add the following subsection:

00744.46 Crack Sealing – Provide crack sealing in accordance with Section 00746 at all joints where new pavement meets existing pavement.

(Use the following lead-in paragraph and one of the following two options when traffic restrictions are required. Obtain information from the pavement designer. Delete the option that does not apply.)

Add the following subsection:

[Option 1 - Use this .51 when paving through the top base course is required.]

00744.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the top Base Course before opening to traffic. Traffic will be allowed on the top Base Course up to ____ Calendar Days.

Before beginning wearing Course paving operations, make repairs to the existing surface as directed. Payment for the repairs will be made according to 00195.20.

[Option 2 - Use this .51 when paving through the wearing course is required.]

00744.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the wearing Course before opening to traffic.

00744.90 Payment – Add the following paragraph to the end of the subsection:

Crack sealing will be paid for according to 00746.90.

End of Section

Section 00745 - Asphalt Concrete Pavement - Statistical Acceptance

(Use Section 00745 when any of the following apply, otherwise, use Section 00744:

- ***Project includes any quantity of Level 4 paving***
- ***Project includes more than 2,500 tons of Level 2 or Level 3 paving***

This Section requires SP00730.)

Comply with Section 00745 of the Standard Specifications modified as follows:

00745.40 Season and Temperature Limitations – In the table, under the row labeled "2 inches – 2 ½ inches" and the row labeled "Greater than 2 ½ inches" DELETE the two asterixis (**) from "All Year" under the "**All Courses**" column and the "**All Other Courses**" column.

(Use the following subsection .42 when tack coat is not required between lifts placed during the same shift.)

00745.42 Preparation of Underlying Surfaces - Add the following sentence to the end of the paragraph that begins "Treat all paved surfaces…":

A tack coat is not required between lifts placed during the same shift provided the bottom lift is kept clean and free of dirt or debris.

Add: Treat all paved surfaces on and against which ACP is to be placed and where paving abuts curb with an asphalt tack coat.

00745.46(c) Placing –

In the paragraph that begins "When Leveling irregular surfaces…", replace the words "4 inches" with the words "3 inches".

In the paragraph that begins "Place the mixture in…", replace the words "4 inches" with the words "3 inches".

00745.47(b) Drop-Offs - Replace the bullet that begins "Provide warning signs and markings…" with the following bullet:

- Provide warning signs and markings according to Sections 00221, 00222, 00224 and 00225 where abrupt or sloped edge drop-offs greater than 1 inch in height occur.

Add the following subsection:

00745.47(d) Crack Sealing – Provide crack sealing in accordance with Section 00746 at all joints where new pavement meets existing pavement.

Add the following subsection:

00745.48(d) Crack Sealing – Provide crack sealing in accordance with Section 00746 at all joints where new pavement meets existing pavement.

(Use the following lead-in paragraph and one of the following two options when traffic restrictions are required. Obtain information from the pavement designer. Delete the option that does not apply.)

Add the following subsection:

[Option 1 - Use this .51 when paving through the top base course is required.]

00745.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the top Base Course before opening to traffic. Traffic will be allowed on the top Base Course up to ____ Calendar Days.

Before beginning wearing Course paving operations, make repairs to the existing surface as directed. Payment for the repairs will be made according to 00195.20.

[Option 2 Use this .51 when paving through the wearing course is required.]

00745.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the wearing Course before opening to traffic.

(Obtain the specific gravity for the project from the Designer and fill in the blank.)

00745.80 Measurement - Add the following paragraph to the beginning of this subsection:

The quantities of ACP shown in the Contract Schedule of Items were computed on the basis of Aggregates having a specific gravity of _____.

(Use the following two paragraphs when no separate measurement will be made for the liquid asphalt. Do NOT use on projects that have more than 100 tons of liquid asphalt. When used, be sure to also include the boilerplate language under subsection .90.)

Replace the paragraph that begins "The quantities of ACP..." with the following paragraph:

The quantities of ACP will be measured on the weight basis. No separate measurement will be made for asphalt cement used in the mixture. No deduction will be made for lime or any other additive used in the mixture.

(Use the following subsection .90 when no separate payment will be made for the liquid asphalt. Do NOT use on projects that have more than 100 tons of liquid asphalt. When used, be sure to also include the boilerplate language under subsection .80.)

00745.90 Payment - Add the following paragraphs to the end of this subsection:

No separate or additional payment will be made for asphalt cement used in the mixture.

Crack sealing will be paid for according to 00746.90.

End of Section

Section 00746 - Crack Sealing Flexible Pavements

Comply with Section 00746 of the Standard Specifications modified as follows:

00746.42 Installation Procedure - Add the following paragraphs to the end of this subsection:

Place crack sealing consistently along the length of the joint at a width of 4 to 6 inches.

End of Section

Section 00749 - Miscellaneous Asphalt Concrete Structures

(This Section requires SP00730.)

Comply with Section 00749 of the Standard Specifications.

End of Section

Section 00754 - Plain Concrete Pavement Repair

(This Section requires SP02001 and SP02050. This Section requires SP02510 if epoxy coated reinforcement is required.)

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00754, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00754.00 Scope - This Work consists of saw cutting and removing existing concrete pavement and constructing new plain portland concrete pavement repairs as shown and specified.

00754.01 Abbreviations:

SSD - Saturated Surface-Dry
SSFC - Stationary Side Form Construction

00754.02 Areas of Work - Locations of the areas for repair are as shown. Additional areas of repair may be required as determined by the Engineer.

00754.04 Prepaving Conference - Supervisory personnel of the Contractor and any Subcontractors who are to be involved in the concrete paving work shall meet with the Engineer, at a mutually agreed time, to discuss methods of accomplishing all phases of the paving work.

Materials

00754.10 Materials - Furnish Materials meeting the following requirements:

Resin Bonded Anchors	00535
Bar Reinforcement	02510
Concrete Materials	02001
Curing Materials	02050
Epoxy and Nonepoxy Bonding Agents	02070
Epoxy and Nonepoxy Grouts	02080
Galvanizing	02530.70
Portland Cement Concrete Repair Materials	02015
Poured Joint Fillers	02440.30
Preformed Expansion Joint Filler	02440.10

00754.11 Classes of Concrete - If the time frame designated for opening traffic is less than 72 hours after concrete placement, provide Class HES4000 - 1 1/2 concrete designed to

attain a minimum average compressive strength of 3,000 psi prior to allowing traffic on the concrete. Otherwise furnish Class 4000 - 1 1/2 paving concrete.

00754.13 Concrete Mix Designs - Prepare and submit either new mix designs or current mix designs for each class of concrete required according to Section 02001.

00754.15 Quality Control - Provide quality control according to Section 00165, Section 02001, and the following:

(a) Concrete Mixture - If the results of any test are outside of the specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the specification limits. If the load cannot be corrected, reject it and do not incorporate it into the work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the specification limits.

(b) Records - Deliver all batch tickets, water-cement ration calculations, and all other records required to the Engineer upon availability but no later than the morning of the next Day.

00754.16 Acceptance of Concrete:

(a) General - Acceptance of concrete will be based on the results of the Contractor's quality control testing according to Section 00165 and the MFTP.

(b) Aggregate - Acceptance will be based on the Contractor's quality control testing, if verified by the Agency according to Section 00165 and the MFTP.

(1) Aggregate Gradation - A stockpile contains Specification aggregate gradation when the quality level for each sieve size calculated according to 00165.40 is equal to or greater than the quality level in Table 00165-2 for a PF of 1.00. Each required sample represents a sublot. When the quality level in Table 00165 2 yields a PF of less than 1.00 for any constituent, the material is non specification.

(2) Non-specification Aggregate Gradation - Stockpiled aggregates that contain non-specification aggregate gradation will be rejected by the Engineer unless non-specification material is removed from the stockpile. Do not add additional material to the stockpile until enough non-specification material is removed so that the quality level for each constituent is equal to or greater than the quality level in Table 00165 2 for a 1.00 PF.

(c) Plastic Concrete - Acceptance of the plastic concrete will be based on the tests performed by the Contractor's QCT, according to the tolerances and limits of Section 02001.

(d) Hardened Concrete - Cast and cure the test cylinders according to AASHTO T 23 in single use plastic molds and test at 28 Days according to AASHTO T 22.

(1) General - For all classes of concrete, acceptance of hardened concrete will be based on an analysis of compressive strength tests of cylinders cast by the QCT. Test cylinders at an ODOT certified laboratory.

(2) Actual Strength Test Value - The ASTV at 28 Days is the average compressive strength of the three cylinders tested.

(3) Sampling and Testing - Sample and test according to Section 00165 and the MFTP.

(4) Acceptance - The ASTV shall exceed the $f'c$ (specified strength) for the mix design. If a set of cylinders has an ASTV less than $f'c$, the Engineer will review the results to determine if the concrete represented by the cylinders shall be removed. In any case, concrete that has an ASTV of less than 85 percent of the specified strength shall be removed unless otherwise authorized, in writing, by the Engineer. The cost of removal, replacement, and all related work shall be the Contractor's responsibility, subject, if the concrete is allowed to remain in place, to a price adjustment according to 00150.25.

If an ASTV falls below the $f'c$, the Contractor may submit a written plan within 3 Days of the test for review by the Engineer. The plan shall outline a proposed alternate method of evaluating compressive strength. The plan shall provide evidence that a reasonable $f'cr$ (over design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. If the Engineer determines that the compressive strength test results are suspect from definable external factors, the Engineer may allow an alternate method of acceptance.

00754.17 Spall Repair Material - For spall repair, furnish a PCC repair material meeting the requirements of Section 02015 except do not use products that contain magnesium phosphate. Use either "Rapid Setting" or "Very Rapid Setting" material.

00754.18 Bond Breaker - Bond breaker must be one of the following:

- Non-woven geotextile meeting the property requirements listed in Table 02320-4.
- Liquid curing compound evenly applied as a bond breaker in two applications, at a rate of 1 gallon per 130 to 165 square feet for each application, over the entire surface area.

Equipment

00754.20 Batch Plant - Provide batch plants according to 02001.40.

00754.21 Mixers - Provide mixers according to 02001.40.

For Projects requiring Class HES concrete, mobile mixers may be used if the mixers conform to the following:

- The mixer is self-propelled and carries sufficient unmixed dry bulk cement, sand, coarse aggregate, admixtures, and water to produce a minimum of 6 cubic yards of concrete on site.
- The mixer provides positive measurement of cement being introduced into the mix by meter or counter.

- The mixer provides positive control of the flow of water into the mixing chamber. Water flow is readily adjustable to provide for minor variations in aggregate moisture.
- Each mixer is calibrated to automatically proportion and blend all components according to the mix design on a continuous or intermittent basis as required by the placing operation.

Perform a calibration and yield test on each mixer prior to the first placement to accurately proportion the specified mix. Use a written calibration procedure from the mixer manufacturer, a procedure provided by the agency or other written procedure acceptable to the agency. The calibration process may be witnessed by the Engineer. Provide the Engineer with information about the scheduled date, time and place for the calibration. Perform a new calibration when the source of materials changes, when the mixer undergoes a major repair, or when requested by the Engineer.

00754.22 Hauling Equipment - Use truck mixers to transport concrete. Provide hauling Equipment conforming to AASHTO M 157.12 or AASHTO M 157.11.6.

00754.23 Paving Equipment - Provide paving Equipment conforming to the following:

- Able to vibrate, consolidate, and finish the slab to proper grade and Cross Section for the full width and depth of the concrete being placed.
- Capable of meeting the smoothness requirements.
- Approved by the Engineer.

00754.24 Concrete Saws - Provide power driven concrete saws for sawing joints, adequate in number of units and power to complete the sawing at the required rate. Also provide a standby saw on the Project Site.

00754.25 Smoothness Testing Equipment - Provide one 12-foot straightedge.

00754.26 Concrete Drills - Provide a drilling system consisting of drilling Equipment and drilling supports that:

- Is capable of drilling holes of the required diameter and depth.
- Can produce holes parallel to the pavement surface and parallel to each other within a tolerance of ± 1/8 inch.
- Can provide hole alignments at mid-depth of PCC pavement.

Labor

00754.30 Quality Control Personnel - In addition to the certified technicians required in 02001.50 provide and designate an individual to be present at the placement site at all times during concrete placements and who is authorized and responsible for acceptance and rejection of materials.

Construction

00754.40 Weather Limitations - Coordinate all operations involved in repairing the pavement so the Work will result in a finished pavement conforming to the Specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is permitted to proceed.

Do not place PCC during periods of rain. Do not place PCC on frozen bases. Stop placement when descending air temperature falls below 35 °F. Do not begin placement until the air temperature is 35 °F in the shade and rising and is forecast to remain above 35 °F.

Protect the pavement from weather damage. Protect unhardened PCC from precipitation with protective material. When PCC is placed during cold weather and the air temperature is forecast to drop below 33 °F, prevent the concrete from freezing for a minimum of 7 Days after placement.

Remove and replace weather-damaged pavement at no additional cost to the Agency.

00754.41 Preparation:

(a) Removal of Existing Pavement - Remove full panels of existing concrete pavement full depth as shown or directed. A vertical full depth saw cut is required along all longitudinal joints and at transverse locations. Cut concrete through tie bars and dowels. Remove concrete pavement with Equipment approved by the Engineer in a manner that does not damage remaining pavement or connections and allows for specified connections. Repair damage to the existing pavement due to the Contractor's operations, at no additional cost to the Agency, by extending the full depth repair to the satisfaction of the Engineer.

(b) Concrete Pavement Base Repair - Use material similar to existing base material or use commercial concrete. If concrete is used, place a bond breaker between the new concrete Base and the new concrete pavement. If the repair is a nominal 2 inches deep or less, the repair may be accomplished by pouring the patch monolithically with the new concrete pavement, without a bond breaker. PCC repair material may be substituted for Commercial Grade Concrete.

Compact unbound granular materials used in the Base repair as directed. Allow concrete or substitutes to cure sufficiently to support necessary construction activities without yielding prior to continuing those activities. No further testing of pavement Base material is required.

(c) Spall Repair Area - Saw cut the existing concrete pavement to a nominal depth of 2 inches. Remove existing concrete within the perimeter of the saw cut to a depth of 2.0 inches, or to sound concrete as determined by the Engineer. If jack hammers are used for removing pavement, they shall not weigh more than 30 pounds, and chipping hammers shall not weigh more than 15 pounds. Do not operate hammers at an angle greater than 45 degrees measured from the surface of the pavement. Any existing pavement that is to remain that has been damaged shall be repaired at no additional cost to the Agency.

(d) Preparation of Existing Concrete - Before placement of concrete, blow clean the existing concrete surfaces within the pour area with compressed air and dampen the area to be paved with a light application of water. If the area becomes dry before new concrete is placed, blow clean and dampen the area again.

00754.43 Placing Dowel Bars and Tie Bars:

(a) Dowel Bars - Provide smooth, round, epoxy coated dowel bars. Coat with plastic, heavy oil, or other approved material that will neither bond with nor be harmful to the PCC. Use a framework to place dowels that is continuous across the entire lane width, holds the dowels parallel with each other, holds the dowels parallel with the surface of the pavement, and holds the dowels parallel to the roadway centerline. For dowels placed across an expansion joint, use a dowel bar basket or other system of support that leaves no permanent incompressible members in place within the joint. Maximum alignment tolerance shall be 5 degrees or 3/16 inch in the length of the dowel. Place dowels within 3/8 inch of the center of the slab vertically.

Place dowel bars for joint contact at existing concrete pavement surfaces by drilling the existing concrete section and then inserting the dowel bars and grouting them in place. Drill the holes large and deep enough to insert the dowel bars with adequate epoxy or nonepoxy grout. Adjust hole locations to avoid damaging any existing reinforcement when drilling the holes. Blow the dowel bar holes clean with compressed air before grouting. Center the bar in the hole for the full length of embedment before grouting. Pump the grout into the hole around the bar so the back of the hole will be filled first. Do not allow blocking or shimming to impede the flow of the grout into the hole. If dams are needed, place them at the front of the holes to confine the grout. Place the dams to permit the escape of air without leaking grout. Do not remove dams until grout has cured in the hole.

(b) Tie Bars - Provide epoxy coated tie bars and place them for contact-type longitudinal joints by one of the following methods:

- By drilling the hardened concrete section and then inserting the tie bars as resin-bonded anchors in accordance with construction and testing procedures in Section 00535.
- By inserting the tie bars into the plastic slipformed concrete before vibrating and finishing the concrete. The tie bars may be bent before insertion. Replace any loose tie bars by drilling and grouting, as described above, at no additional cost to the Agency.
- By using threaded mechanical splice couplers from the QPL. Submit splices for approval before using. Rebar splices shall be:
- Accompanied by manufacturer's quality compliance certificate according to 00165.35.
- Installed according to manufacturer's recommendations.

00754.44 Handling, Measuring, and Batching Materials - The plant site, layout, Equipment and provisions for transporting material shall be adequate to assure a continuous supply of Material to the Project Site.

(a) Aggregates - Stockpile and remove the aggregate from stockpiles in a manner that holds segregation to a minimum.

Do not use aggregates that become segregated, mixed with earth or foreign material, or contain lumps of hardened material. Thaw frozen aggregates or aggregates containing frozen lumps before use.

(b) Batching - Separately weigh into the hoppers the fine aggregate, each separated size of coarse aggregate, cement and fly ash in the respective proportions set by the mix design. Provide a device to indicate positively that the full amount of cement and fly ash was discharged into the batch box or container. Measure water and admixtures either by volume or by weight.

Conduct batching so that the individual weights of each Material required are within the following tolerances:

Aggregates	± 2%
Cement	- 1% to + 4%
Fly Ash	- 1% to + 4%

00754.45 Mixing Concrete:

(a) General - Mix the concrete in a batch plant mixer, truck mixer, or mobile mixer and the following:

- Charge the batch into the receiving drum so some water enters before the solids and continues to flow uniformly for a portion of the mixing time.
- Keep the skip and the throats of drums free of accumulations.
- Mix the concrete only in the quantity required for immediate use.
- Do not intermix batches.
- Do not retemper concrete by adding water or by other means.

(b) Batch Plant Mixers - The mixing time for batch plant mixers shall be at least 60 seconds unless the Contractor's CCT documents meeting "Concrete Uniformity", according to AASHTO M 157, Annex A1 for concrete produced at the batch plant mixer set up for this Project, to the satisfaction of the Engineer. The mixing time may then be reduced to the extent the test permits but not less than 45 seconds.

(c) Truck Mixers - The mixing time for truck mixers shall be 70 to 100 revolutions at a mixing speed recommended by the manufacturer of the truck mixer.

00754.46 Placing Concrete:

(a) General - Perform the strike-off, consolidation, final floating and surface finishing according to the following:

- Vibrate throughout the concrete until it is uniformly consolidated. Do not segregate.
- Strike off the concrete with templates or screeds designed and manipulated to shape the concrete to the specified Cross Section between the forms, carrying a slight excess of concrete in front of the leading edge of templates or screeds at all times.
- Following the vibrating and strike-off operations, float the concrete. Include transverse floating or other smoothing and finishing actions as necessary. Check and correct the surface according to 00754.49. Keep the surface free from laitance, soupy mortar, marks or irregularities.
- Finish the surface according to 00754.49.

Correct all damage to the Subgrade or Base due to the Contractor's operations, at no additional cost to the Agency, to the satisfaction of the Engineer.

(b) One Lift - Place the concrete in final position in one Lift so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grades and Cross Sections.

(c) Provision for Joints and Other Devices - While placing concrete, make provision for constructing joints, placing dowels, tie bars, and other devices, as shown and directed, and as provided in 00754.43 and 00754.48.

(d) Reject Concrete Material - Reject concrete if it:

- Is not in place within 90 minutes after being mixed.
- Has begun to take an initial set before placement.

(e) Hand Operated Equipment - Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not foul the concrete with foreign matter, or disturb joint devices during such operations. Furnish hand operated mechanical vibrators satisfactory to the Engineer. Use the vibrators to consolidate the concrete pavement at least 6 feet each side of construction and expansion joints and all other areas as directed.

(f) Illumination - During hours of darkness, adequately illuminate work areas at no additional cost to the Agency.

00754.48 Joints:

(a) General - Construct joints of the kinds shown and where shown or directed. Joint types in the concrete pavement will be contraction, construction or expansion. They shall be transverse or longitudinal, as shown or directed. Extend all joints and joint filler to pavement edges or to each other.

Joints shall not vary from specified or indicated line by more than 1/4 inch. The tops of joint filler, when required, shall be slightly, but not more than 1/8 inch, below and paralleling finished pavement grade and Cross Section. Protect top edges of filler from damage by paving operations.

Construct all joints which contain preformed filler before the final floating and surface finishing of the concrete, unless otherwise directed.

(b) Longitudinal Joints - If the Contractor elects to pour the entire width of pavement at one time, construct the longitudinal joint as shown. Longitudinal joints shall be the contact type or weakened plane type as shown:

(1) Longitudinal Contact Joints - Construct longitudinal contact joints when concrete is placed against hardened concrete regardless of age, between strips of pavement or between a strip of pavement and a concrete gutter.

(2) Longitudinal Weakened Plane Joints - Construct weakened plane joints by sawing to the depths and maximum width shown. Saw longitudinal weakened plane joints at the earliest possible time following placement of the concrete to prevent uncontrolled cracking without damaging the pavement or joint. Saws may be single or tandem, as the Contractor elects, and be controlled by guides to true line. Restore curing agents broken or damaged by the sawing operations.

(c) Construction Joints - Construct construction joints when there is an interruption of 30 minutes in the concrete placing operations.

The new concrete placed against the joint shall conform closely to the proportions and consistency of the previously placed concrete except vibrate and consolidate it to a greater degree and with more care than normal. Unless otherwise shown, do not construct construction joints within 10 feet of a transverse expansion or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, remove the concrete back to the last joint and dispose of as directed.

(d) Transverse Contraction Joints - Form transverse contraction joints by sawing to the required dimensions shown on the Plans. Saw transverse contraction joints at the earliest possible time following placement of the concrete to prevent uncontrolled cracking without damaging the pavement or joint. Repair any damage to the curing material during the sawing operations immediately after the sawing is completed.

(e) Sealing Sawed Joints - Fill sawed longitudinal weakened plane joints and transverse contraction joints with poured joint filler. Thoroughly clean joints at the time of sealing. Ensure the curing period for joints is complete before allowing construction Equipment and vehicles on the pavement.

00754.49 Surface Finishing - After the concrete has been given a preliminary finish, check the surface of the fresh concrete in the longitudinal and transverse direction with a 12-foot straightedge. Correct surface deviations more than allowed by 00754.56(a). Lap each successive check with the previous check path by at least half the length of the straightedge.

(a) Textured Finish - Upon completion of the machine floating, straightedge testing, edge tooling and, if necessary, hand floating, and before initial set of the surface concrete, give the surface of the concrete a textured finish.

Accomplish the textured finish with a steel-tine tool with 1/8 inch tines that will mark the finished concrete to a depth of 1/8 inch to 3/16 inch. Randomly space the markings from 1/2 inch to 1 1/4 inches as approved. Avoid overlaps of the texturing. Construct markings either perpendicular or parallel to the roadway centerline to match the adjacent concrete pavement textured finish.

With approval of the Engineer, an astroturf or broom finish may be used in place of tining on roads to receive an overlay.

(b) Transverse Profile - Match the surface of the fresh concrete in the transverse direction to the surface of the existing concrete at the ends of the patch. Taper into existing pavement ruts in the first and last 10 to 20 feet to provide a transverse surface finish for the remainder of the patch meeting the requirements of this section.

00754.52 Edge Tooling and Filling - Tool edges at longitudinal joints and construction joints of new pavement and clean joints of previously placed concrete to remove laitance and mortar resulting from finishing operations, and to provide clean rounded edges without ridges on the surface. Perform tooling of edges at construction joints so that no more than a 1/8 inch radius is produced.

Fill all areas of minor honeycomb or other minor defect in composition of the concrete along the exposed sides of concrete with a stiff mortar of cement and fine aggregate, and apply to the moistened concrete to the satisfaction of the Engineer. Remove and replace areas showing serious defects in composition of the concrete with specified quality concrete for full panel width between longitudinal joints or edges, and for a length not less than a full panel length. Low spots exceeding 1/4 inch in depth, if in hardened concrete, may be filled with an epoxy grout, provided the filling is neat and blends inconspicuously with adjoining concrete. Prepare the area according to the grout manufacturer's recommendations.

00754.53 Curing Concrete - Immediately after the final floating, surface finishing and edging have been completed, and while the concrete surface is still moist, cover and cure the entire exposed surface of the newly placed concrete for at least 72 hours. If the Specifications require opening the lanes to traffic in less than 72 hours, remove curing covers just prior to opening to traffic. Use one of the following provisions:

(a) Liquid Membrane-Forming Compounds - Apply liquid membrane-forming compound uniformly to the concrete by pressure-spray methods at a rate of at least 1 gallon per 150 square feet. Mix the liquid membrane-forming compound thoroughly before and during use. Liquid membrane-forming compounds are not allowed when an asphalt concrete layer will be placed on the new concrete.

(b) Other Coverings - Apply clear or white polyethylene film or insulated curing blankets as a waterproof and moisture-proof covering. Place the film or blankets beyond the edge of the repaired areas and weight to hold in position. Do not mar the concrete with the covering.

00754.54 Longitudinal Pavement Cracks - Remove and replace all patches that show longitudinal cracking or do not bond at no additional cost to the Agency.

00754.55 Spall Repair - In spalled areas, remove the existing pavement according to 00754.41(c). The repair limits shall extend beyond the spalled area a minimum of 3.0 inches. Use only rectangular or square repair shapes. Prepare the repair area according to 00754.41(d) and the PCC repair material manufacturer's recommendations, then apply a coat of epoxy grout or bonding agent to all vertical surfaces and place PCC repair material before grout dries. When a spall repair is placed directly against an adjacent longitudinal joint, place a bond breaker between the existing concrete and the area to be patched. Mix and place PCC repair material according to the manufacturer's recommendation. Use shovels to hand spread and distribute the concrete. Do not use rakes. Do not contaminate the concrete with foreign matter. Cure PCC repair material according to the manufacturer's recommendation.

00754.56 Surface Tolerance, Testing, and Correction - The surface of finished pavement shall not deviate from longitudinal and transverse smoothness more than the limits identified

below. Perform straightedge testing under the supervision of the Engineer as soon as the hardness of the concrete permits.

(a) Straightedge Testing and Tolerance - Test pavement surface longitudinal and transverse smoothness with a 12-foot straightedge. The extent of the testing will be determined by the Engineer. The pavement surface shall not deviate from the straightedge at any point by more than 1/8 inch, except the transverse surface at the patch ends may vary as required in 00754.49(b).

(b) Correcting Deficiencies - Correct all segments that exceed the requirements of 00754.56(a) by one of the following methods:

(1) Remove the non-specification concrete pavement as determined by the Engineer and replace with Specification concrete pavement.

(2) Profile with an abrasive grinder equipped with a cutting head comprised of multiple diamond blades.

Retest according to 00754.56(a). Perform all corrective Work at no additional cost to the Agency, including traffic control.

Maintenance

00754.60 Protection of Concrete - Repair or replace any part of the pavement damaged by traffic or damaged from any other causes before its official acceptance, according to 00170.80. Do not operate construction Equipment or allow Public Traffic on newly placed concrete until all of the following requirements are met:

(a) The Contractor complies with 00150.60.

(b) The concrete attains a compressive strength of at least 3,000 psi as determined by testing at least two cylinders cured according to AASHTO T 23 (field cure) and tested according to AASHTO T 22.

(c) Approval is given by the Engineer before opening to traffic.

(d) The surface of the concrete is protected from scarring or abrasion and kept free of stones, loose mortar and other matter apt to be deleterious to the concrete in the paths of Equipment.

00754.61 Protection of Shoulders - A portion of the shoulder adjacent to the proposed patch, may be removed as necessary to ensure proper forming at the edge or the patch. Prior to opening to traffic, the disturbed shoulder area shall be replaced with material types and thickness similar to the existing shoulder, compacted, and restored to the existing line and grade. Include all cost of the shoulder replacement in the price bid for Concrete Pavement Repair.

Measurement

00754.80 Measurement - The quantities of Work performed under this Section will be measured according to the following:

(a) Concrete Pavement Repair - Concrete pavement repair will be measured on the area basis and will be determined by measuring the width and length of each separately constructed Panel of pavement. The width is the measured edge-to-edge width on the surface of the pavement, perpendicular to centerline. The length is the measurement from end to end of pavement along the center line of the roadway, including the length of the bar lap splices.

The measurement of extra thickness of pavement, as shown or as ordered, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of specified thickness pavement.

(b) Spall Repair - Spall repair will be measured on the area basis and will be determined by measuring the width and length of each separate repair. The width is the measured edge-to-edge width on the surface of the pavement. The length is the measurement from end-to-end of pavement along the center line of the roadway.

The measurement of extra thickness beyond the depth shown in the Plans or as ordered by the Engineer, will be determined by conversion on a proportionate volume basis to an equivalent number of square yards of the specified thickness.

(c) Concrete Pavement Base Repair - Concrete pavement base repair will be measured on the area basis and will be determined by measuring the width and length of each separate repair. The width is the measured edge-to-edge width on the surface of the pavement, perpendicular to centerline. The length is the measurement from end-to-end of the repair along the center line of the roadway.

Payment

00754.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Plain Concrete Pavement Repair	Square Yard
(b) Concrete Pavement Spall Repair	Square Yard
(c) Concrete Pavement Base Repair	Square Yard

Item (a) includes saw cutting, removing concrete pavement, preparing the Base, and preparing the cut edges. Item (a) also includes Base repair, Leveling, or backfilling, up to 2 inches deep.

Item (b) includes sawing and removing concrete.
Item (c) includes Base repair, Leveling, and related backfilling of Subbases or Subgrade greater than 2 inches.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

Section 00756 - Plain Concrete Pavement

(This Section requires SP02001 and SP02050. This Section requires SP02510 if epoxy coated reinforcement is required.)

Comply with Section 00756 of the Standard Specifications modified as follows:

00756.15(a) Concrete Mixture - Replace this subsection, except for the subsection number and title, with the following:

- Sample and test according to the MFTP.
- For all plain concrete pavement, provide personnel according to 00756.30 to sample and test the mix for temperature, air content, slump, water-cementitious ratio, density and yield, from the first load of each placement, whenever there is a visible change in the slump of the concrete, and when a set of cylinders is obtained.
- If the results of any test are outside of the Specification limits, stop the placement of the load. Correct the load or reject it and do not incorporate it into the Work. Test subsequent loads before any further concrete placement. Correct the subsequent loads if any of the tests are still outside the Specification limits. If the load cannot be corrected, reject it and do not incorporate it into the Work. Testing of subsequent loads may return to the specified frequency when the test results from two consecutive loads are shown to meet the Specification limits.

00756.95(a) General - Replace the bullet that begins “The average of the IRI for both…” with the following bullet:

- The IRI in each wheel path is 65.0 inches per mile or less.

End of Section

Section 00759 - Miscellaneous Portland Cement Concrete Structures

(This Section requires SP02001. This Section requires SP02510 if epoxy coated reinforcement is required.)

Comply with Section 00759 of the Standard Specifications modified as follows:

00759.03 Required Submittals – Replace this subsection with the following:

00759.03 Corrective Action Plan - Unless otherwise approved, notify the Engineer before performing corrective action. Include TPAR necessary to complete corrective action work.

At least 7 Calendar Days before concrete structures work is scheduled to begin, submit a corrective action plan. The corrective action plan shall address procedures to correct deficient structures through minor corrective action or replacement according to 00759.55(a), and include:

- List of minor corrective actions that will be used to correct deficiencies, according to 00759.50 and 00759.55.
- Procedures for performing corrective action.
- Proposed concrete grinding equipment and method of grinding.
- Proposed concrete repair material used for resurfacing ground concrete surfaces according to Section 02015.
- Construction activities, equipment and staging necessary to complete corrective action work.

The Engineer will review the corrective action plan(s) and provide a response to the Contractor within 5 Days after receiving the plan. Do not begin concrete structure work until the corrective action plan is approved by the Engineer.

Add the following subsection:

00759.13 High Strength Concrete – Furnish Class 5000 mix meeting the requirements of Section 02001 with fiber mesh meeting the requirements of Section 02045.

00759.22 Smart Level - Replace this subsection, except for the subsection number and title, with the following:

Furnish a 48-inch electronic smart level to measure grades and slopes. Calibrate smart level at the time of inspection.

Add the following subsection:

00759.23 Concrete Resurfacing Equipment - Furnish power-operated scarifying Equipment capable of uniformly removing and preparing the existing surface to depths required. For concrete grinding operations, furnish 12 segment grinders, fine-toothed scarifying Equipment, or other approved grinding Equipment.

00759.50 (a) General – Add the following paragraphs to the end of the subsection:

Construct ADA curb ramps, sidewalks, and other pedestrian facilities meeting the requirements of PROWAG. Verify compliance using smart levels meeting Section 00759.22.

Submit a corrective action plan for each non-compliant Structure after receiving notice of non-compliance from the Engineer. Perform correction of defects according to 00759.55.

00759.50 (b) Curbs, Islands, and Stairs – Add the following to the end of the subsection:

Stamp all sanitary sewer, storm sewer, and water locations centered on the curb exposure with the appropriate brand: “S” for sanitary sewer, “SW” for storm sewer, and “W” for water. Brand shall be a minimum of 4 inches in height and ¼ inch in depth.

00759.50(c) Driveways, Walks, and Surfacings - Replace this subsection, except for the subsection number and title, with the following:

Prevent segregation of the concrete during placement. Strike-off the concrete to the grade shown, and float the surface smooth. After the water sheen disappears, edge the joints and remove edging tool marks prior to final finishing. Lightly cross-broom the surface to a uniform texture. Do not trowel joints or edges after brooming surface.

00759.50(d) Curb Ramps - Replace this subsection, except for the subsection number and title, with the following:

Prevent segregation of the concrete during placement. Strike-off the concrete to the grade shown and float the surface smooth. After the water sheen disappears, edge the joints and remove edging tool marks prior to final finishing. Lightly cross-broom the surface to a uniform texture. Do not trowel joints or edges after brooming surface.

Add the following subsection:

00759.50 (f) Truncated Domes – Furnish truncated dome panels in standard sizes supplied by the manufacturer. Where cutting panels is necessary to provide custom sizes, follow manufacturer’s recommendations and use the following procedures:

- Do not install panels smaller than 2-feet by 2-feet. Provide standard panel sizes and plan cuts to minimize panel waste.
- Cut tiles to custom sizes using a continuous rim diamond blade in a circular saw or mini-grinder. Use a straightedge when cutting straight lines.
- When placing cut panels, butt clean uncut edges against each other. Orient cut edges to the outsides of the ramp.
- Furnish and place anchors for cut panels according to the manufacturer’s recommendations.

Leave factory installed protective cover on truncated domes during entire installation process to prevent concrete from splashing onto the finished surface of the tile.

While concrete is workable, use steel edging trowel with a minimum of 1/8" radius to edge the finished concrete around the panel. Use a steel trowel to finish the concrete around the perimeter of the truncated dome so it is flush with field level of the tile.

Immediately after concrete has cured, remove protective plastic wrap from the truncated dome by cutting the plastic wrap with a sharp knife held tight to the concrete/tile interface. If concrete bled under the plastic, use a soft brass wire brush to clean the residue without damage to the tile surface.
Add the following subsection:

00759.55 Correction of Deficient Structures - Unless otherwise approved, notify the Engineer before performing corrective action. Correct deficiencies at no additional cost to the Agency. Perform corrective actions as directed, according to the approved corrective action plan, and according to the following:

(a) Minor Corrective Action - Submit Equipment and procedure for minor corrective action to the Engineer for approval. Minor corrective action can be performed to correct a deficiency up to 1 square foot per panel. Limit minor corrective action to one area per panel. Perform minor corrective action according to the following:

(1) Concrete Grinding - Grinding to correct high area deficiencies is limited to 3/16 inch in driveway aprons, curb ramps, or refuge and up to 1 inch in other locations. Use equipment meeting the requirements of 00759.23. Resurface all ground concrete surfaces according to 00759.55(a)(2).

(2) Concrete Resurfacing - Resurfacing to correct low area deficiencies is limited to 3/16 inch depth. Existing concrete is to be at least 7 Days old prior to resurfacing. Resurface repair areas according to the following:

a. **Keyway** - Sawcut a keyway at the boundaries of repair areas that are not already defined by panel control joints. Sawcut is to be 1/8 inch wide by 1/4 inch deep. Bevel inside edge of keyway at a 45 degree angle.

b. **Surface Preparation** - Prepare limits of repair area by grinding using equipment from 00759.23. After grinding, sandblast the surface of the repair area. Clean the surface using a low pressure washer, less than 5,000 psi.

c. **Presoak** - Presoak the repair area for a minimum of 30 minutes to saturated surface dry. Prior to resurfacing, ensure there is no ponding water on the surface.

d. **Resurface** - Provide concrete resurfacer from the QPL according to 02015.60; refer to QPL remarks to select an appropriate material based on allowable installation depths. Furnish resurfacer in a color that closely matches the color of surrounding concrete surfaces. Mask boundaries of the repair area. Use hand tools to work resurfacer into keyways and match existing grade at boundaries. Apply a light broom-finish to achieve non-slip surface.

e. **Curing and Return to Traffic** - Wet cure for a minimum of 1 hour or per the manufacturer's recommendation, whichever is more restrictive. Follow manufacturer's recommendation for return to traffic time.

(3) Concrete Crack Acceptance – Cracks of measurable width (greater than "hairline") present outside of joints or other areas where cracking is intended require the structure or panel to be replaced.
(4) ACP Grinding - Taper grind to match existing pavement with a minimum grinding width of 1 foot for each 1/4 inch of ACP removed.

(b) Acceptance of Structures - Once the corrective work or replacement has been completed, acceptance will be based on the Engineer's inspection and approval of the Structure.

00759.90 Payment –

Add the following pay item to the end of the list:

Pay Item	Unit of Measurement
(o) Concrete Walks with Sawcut Joint	Square Foot

Replace the paragraph that begins " Item (k) includes the additional Work required …" with the following paragraph:

Item (k) includes the additional Work required to construct a curb ramp or replace an existing curb ramp. Payment for the area of the curb ramp will be made under the concrete walks Pay item.

Add the following paragraph to the end of the subsection:

Replace the paragraph that begins "No separate or additional payment will be…" with the following paragraph and bullet list:

No separate or additional payment will be made for:

- preplacement conference
- concrete form verification
- any necessary repair or removal and replacement of concrete structures
- providing supervisory personnel who have an active ODOT ADA Certification for Contractors to directly supervise the curb ramp Work
- developing corrective action plans

End of Section

Section 00760 - Unit Pavers

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00760, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00760.00 Scope - This Work consists of furnishing and installing masonry unit pavers at locations shown or directed.

Materials

00760.10 Unit Paving Material - Furnish pavers and related material meeting the following requirements:

- **Paving Unit Type** - Uni-décor or approved equal
- **Unit Color** - Red, black, or red-black. Provide sample color for approval
- **Unit Size** - 80mm in streets, driveways, and roadways or 60mm in pedestrian areas
- **Unit Strength** - 8,000 psi with a maximum of 5 percent absorption (ASTM C 936)
- **Joint Sand** - Fine PCC aggregate conforming to 02690.30(g)
- **Leveling Bed** - Fine PCC aggregate conforming to 02690.30(g)
- **Aggregate Base** - 6” thick, 3/4" – 0
- **Weed Control** - Pre-emergent herbicide conforming to 01040.21

Submit proposed equivalent products to the Engineer for consideration. See 00120.16 and 00180.31.

00760.11 Salvaged Materials – Pavers salvaged as part of removal work on the Project may be reused in new construction if Engineer determines materials conform requirements of 00760.10. Salvaged materials must be structurally sound, whole, and free from cracks and chips.

Construction

00760.40 General - Install pavers according to the manufacturer's instructions.
00760.41 Aggregate Base - Place and compact aggregate to 95 percent density.

00760.42 Sand Base - Place a minimum depth 1 inch leveling bed. Screed to grade and saturate with water to ensure a firm and smooth grade.

00760.43 Weed Control - Apply granular pre-emergent herbicide over the prepared leveling bed according to the manufacturer's instructions.

00760.44 Unit Pavers - Lay out rows so they are straight and parallel to the surrounding lines. Where new or reinstalled pavers butt up against existing pavers, install whole pavers only. Do not cut pavers to fit where pavers butt up against existing pavers. Make all cuts where pavers butt up against curbs, curb ramps, sidewalks, tree wells, or other similar fixed objects. Cut pavers with masonry saw.

00760.45 Joint Sand and Compaction - After placing pavers, sweep joint sand into the joints. Use a vibrating mechanical tamper to compact.

00760.46 Surface Tolerance - Do not deviate the longitudinal and transverse surface grades by more than 1/4 inch in 12 feet. In pedestrian areas, install pavers to slopes and grades meeting PROWAG requirements.

00760.47 Clean Up - Remove excess sand and broken paving material from the site when complete.

Measurement

00760.80 Measurement - The quantities of unit pavers will be measured on the area basis.

Payment

00760.90 Payment - The accepted quantities of unit pavers will be paid for at the Contract unit price, per square foot for the item "Unit Pavers".

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for Base preparation.

End of Section

SP00800 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00800 – PERMANENT TRAFFIC SAFETY AND GUIDANCE DEVICES

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00810 - Metal Guardrail

(This Section requires SP00594 when weatherized guardrail and painting of transitions and terminals are required.)

[NOTE: Except for extra length guardrail posts, do not separately pay for new guardrail posts under this Section. New posts are included in the appropriate guardrail pay item. Replacing existing guardrail posts is covered in Section 00812.]

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 00810 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 00810 of the Standard Specifications modified as follows:

(Use the following subsection .00 when there is no earthwork on the project and grading at guardrail terminals are required to be constructed.)

00810.00 Scope - Add the following paragraph to the end of this subsection:

This Work includes constructing grading at guardrail terminals at locations shown.

(Use the following subsection .10 when weatherized guardrail is required or when only recycled plastic guardrail blocks will be allowed. Delete "(s)" or parentheses as applicable.)

00810.10 Materials - Add the following paragraph*(*s*)* to the end of this subsection:

(Use the following paragraph when weatherized guardrail is required.)

Furnish "weatherized" Class IV metal rail meeting the requirements of AASHTO M 180.

(Use the following paragraph when only recycled plastic guardrail blocks may be used.)

Furnish recycled plastic guardrail blocks. Wood guardrail blocks are not allowed.

(Use the following subsection .11 when weatherized guardrail is required.)

00810.11 Posts - Replace this subsection with the following subsection:

00810.11 Wood Posts - Furnish wood guardrail posts meeting the requirements of 00810.10.

(Use the following subsection .13 when guardrail anchors are required.)

00810.13 Guardrail Anchors - Replace this subsection, except for the subsection number and title, with the following:

Furnish steel guardrail anchors according to Section 02820.

(Use the following lead-in paragraph and subsection .16 when there is no earthwork on the project and grading at guardrail terminals are required to be constructed.)

Add the following subsection:

00810.16 Grading at Guardrail Terminals Materials:

(a) Embankment - Furnish embankment materials meeting the applicable parts of Section 00330.

(b) Aggregate - Furnish either 1" - 0 or 3/4" - 0 size crushed aggregate that is clean, hard, durable, and reasonably well-graded from the maximum size to dust.

(c) Asphalt Concrete Mixture - Furnish asphalt concrete mixture meeting the requirements of 00744.10 through 00744.14.

Acceptance of grading at guardrail terminals materials will be visual by the Engineer.

(Use the following lead-in paragraph and subsection .17 when weatherized guardrail and painting of guardrail transitions and terminals are required. Include 00594.10 and 00594.90(a) in SP00594.)

Add the following subsection:

00810.17 Painted Guardrail - Paint all galvanized metal guardrail transition and guardrail terminal materials according to Section 00594.

(Use the following subsection .41 when there is any possibility that hand dug guardrail posts are required. Obtain information from the Utility Coordinator or the Designer. If in doubt add this language and a quantity of 4 in the schedule of items.)

00810.41 Excavation and Backfill - Add the following paragraph to the end of this subsection:

Hand dig guardrail post holes or use other non-invasive methods when posts are located within 24 inches surrounding the outside dimension of all sides of underground utilities as shown or directed.

(Use the following lead-in paragraph and subsection .44 when grading at guardrail terminals are required and there is no earthwork on the project.)

Add the following subsection:

00810.44 Grading at Guardrail Terminals:

(a) Earthwork - Perform earthwork according to the applicable parts of Section 00330.

(b) Aggregate - Place aggregate in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. Compact each layer of material by rollers conforming in general to 00641.24.

Shape and maintain the surface of each layer during the compaction operation to produce a uniform texture and firmly keyed aggregates.

Continue the compactive effort until there is no reaction or yielding observed under the compactor.

(c) Asphalt Concrete Mixture - Place asphalt concrete mixture according to 00744.40 through 00744.49.

(Use the following subsection .80 when grading at guardrail terminals are required and there is no earthwork on the project.)

00810.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of Materials for all the grading at guardrail terminals are:

(Provide estimated quantities. Delete what does not apply.)

Material	**Amount**
Embankment	___ cu. yd.
Excavation	___ cu. yd.
Aggregate Base	___ cu. yd.
Asphalt Concrete Mixture	___ ton

(Use the following subsection .90 when any of the following apply:

- ***Grading at guardrail terminals are required and there is no earthwork on the project.***
- ***Weatherized guardrail and painting of guardrail transitions and terminals are required.)***

00810.90 Payment -

(Use the following paragraph and pay item when grading at guardrail terminals are required and there is no earthwork on the project.)

Add the following Pay Item to the Pay Item list:

Pay Item	Unit of Measurement
(m) Construct Grading at Guardrail Terminals	Each

(Use the following two paragraphs when grading at guardrail terminals are required and there is no earthwork on the project.)

Add the following paragraph after the paragraph that begins "In Item (l), the type…":

Item (m) includes excavation and embankment work, aggregate, and asphalt concrete mix.

(Use the following two paragraphs when weatherized guardrail and painting of guardrail transitions and terminals are required.)

Add the following paragraph to the end of this subsection:

No separate or additional payment will be made for painting galvanized metal guardrail material.

End of Section

Section 00812 - Adjusting and Repairing Guardrail

Comply with Section 00812 of the Standard Specifications.

End of Section

Section 00815 - Bollards

Comply with Section 00815 of the Standard Specifications.

End of Section

Section 00820 - Concrete Barrier

(This Section requires SP02001.)

Comply with Section 00820 of the Standard Specifications.

End of Section

Section 00830 - Impact Attenuators

Comply with Section 00830 of the Standard Specifications.

End of Section

Section 00840 - Delineators and Milepost Marker Posts

Comply with Section 00840 of the Standard Specifications.

End of Section

Section 00850 - Common Provisions for Pavement Markings

(When this Section is used on a project and when it has a completion date of September 15 or later, contact the Scheduler to determine if a separate completion date for striping is required. If a separate completion date is required, include an interim completion date in 00180.50(h).)

Comply with Section 00850 of the Standard Specifications modified as follows:

00850.10 Materials – Delete the bullet that begins "Methyl Methacrylate"

(Use the following lead-in paragraph and subsection .12 when continental crosswalks will be installed on concrete pavement.)

Add the following subsection:

00850.12 Black Background Paint – Furnish black background paint meeting the following requirements:

Property	Black	Test
Pigment – Percent by weight, minimum	62.0	ASTM D 3723
Total Solids – Percent by weight, minimum	77.0	ASTM D 1644
Nonvolatile vehicle – Percent by weight vehicle, minimum*	43.0	ASTM D 3723 ASTM D 1644
Viscosity, KU @ 77 degrees F	80 – 95	ASTM D 562
Density, lb/gal, minimum	14.0	ASTM D 1475
Volatile Organic Content (VOC) – g/L, maximum	100	ASTM D 3960

(Use the following subsection .30 only with approval from the Engineer and when the project meets ALL of the following requirements:

- ***Only surface applied markings (no groove installed markings or tape), AND***
- ***Less than 2000' of 4" longitudinal markings, AND***
- ***Fewer than 7 legends, AND***
- ***Less than 400 square feet of bars.)***

00850.30 Manufacturer's Representative - Replace this subsection, except for the subsection number and title, with the following:

For Sections referencing 00850.30, the services of a manufacturer's representative are not required. Place pavement markings only when the pavement is ready for the pavement marking material according to the manufacturer's installation instructions.

End of Section

Section 00855 - Pavement Markers

Comply with Section 00855 of the Standard Specifications.

End of Section

Section 00856 - Surface Mounted Tubular Markers

Comply with Section 00856 of the Standard Specifications.

End of Section

Section 00860 - Longitudinal Pavement Markings - Paint

Comply with Section 00860 of the Standard Specifications.

End of Section

Section 00865 - Longitudinal Pavement Markings - Durable

(This Section requires SP00850.)

Comply with Section 0865 of the Standard Specifications.

End of Section

Section 00867 - Transverse Pavement Markings - Legends and Bars

(This Section requires SP00850.)

Comply with Section 00867 of the Standard Specifications modified as follows.

00867.45 Installation – Delete the bullet that begins “Type D: Methyl Methacrylate…”

(Use the following subsection .90 when any of the following apply:

- ***Item (q) is included in the bid schedule.***
- ***Continental crosswalks will be installed on concrete pavement.)***

00867.90 Payment –

(Use the following two paragraphs when the bid schedule contains item (q). Fill in the blank with a description of the pay item and all included details. Obtain information from the Traffic Designer and refer to the payment paragraphs in the standard for examples.)

Add the following paragraph after the paragraph that begins "Item (p) includes one…":

Item (q) includes _(Description of pay item and included details)_.

(Add the following pay item and paragraph when continental crosswalks will be installed on concrete pavement.))

Replace Pay Item (r) with the following Pay Item:

(r) Pavement Bar, Type____, ____ ____ ……..Square Foot

Add the following after the paragraph that begins “In item (q)…”:

In item (r), the type of pavement marking Material will be inserted in the first blank, the word “Surface” or “Grooved” will be inserted in the second blank, and the words “with Black Outline” will be inserted in the third blank when applicable.

End of Section

Section 00868 - Colored Lane Markings

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

(This Section requires SP00850.)

Section 00868, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00868.00 Scope - In addition to the requirements of Section 00850, install colored lane markings according to the following Specifications.

Labor

00868.30 Manufacturer's Representative - Provide a manufacturer's representative according to 00850.30.

00868.31 Manufacturer-Certified Installers - Provide certified installers according to 00850.31.

Construction

00868.45 Installation - Place markings only when the manufacturer's representative determines that the pavement is ready for the pavement marking material.

Apply the material to the pavement according to the manufacturer's installation instructions to the full width shown in the Plans. Joints will be allowed with no overlap or gap allowed at the joint.

Do not install reflective elements.

Install the pavement marking material surface according to the manufacturer's installation instructions to achieve a uniform initial skid resistance greater than or equal to 50 British Pendulum Number (BPN) when tested according to ASTM E303.

Apply one or more of the following marking material types:

- **Preformed, Fused Thermoplastic Film High Skid** - Install preformed, fused thermoplastic film high skid that has factory installed crushed glass or Aggregate on the surface.

- **Methyl Methacrylate** - Apply methyl methacrylate to the pavement to the full width shown in a single application. Colored lane markings shall be 90 mils to 120 mils in thickness, exclusive of projecting surface-applied friction elements, with a continuous and uniform cross-sectional configuration.

00868.75 Manufacturer's Warranty - Furnish a manufacturer warranty that unconditionally warrants to the Agency the product(s) and installation under this Section against failure, according to this subsection and 00170.85(c)(1). Use Agency-supplied warranty forms, available from the Engineer.

"Unconditionally warrant" means that the warranty covers all failures, regardless of the source or cause of the failure, including, without limitation, whether the source or cause is or may be related to workmanship, inspection, or choice of materials.

The Agency inspection of any portion of the Work during the Contract and during the product installation, the Agency acceptance of the Work, corrections under the warranty, or expiration of the warranty shall not relieve the obligations under this warranty.

(a) Warranty Period - The warranty period shall be for 18 months.

(b) Failure - For purposes of this warranty, failure is defined as one or more of the following:

- **Insufficient Color Stability:** Green markings fail to meet the requirements of the Federal Highway Administration Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14) tested according to ASTM D6628.
-
- **Loss of Adhesion** - Markings show 5 percent or greater loss of marking material due to non-adhesion.
-
- **Skid Resistance** - Markings fail to maintain an average skid resistance greater than or equal to 50 British Pendulum Number (BPN) when tested in an equal number of test locations in both wheel path and non-wheel path locations according to ASTM E303.

(c) Remedy - Upon notification by the Engineer of a failure, provide the following remedy at no additional cost to the Agency:

- Repair or replace, at the discretion of the Engineer, all failed pavement markings within 6 months of the Agency's request to do so. Failed pavement markings require repair or replacement of the entire legend or bar, not just the area showing wear.
- Use materials and procedures meeting the Specifications.
- Match repairs to adjoining Work.
- Coordinate timing of repair Work with the Engineer.

(d) Agency's Right to Make Repairs - If, in the opinion of the Engineer, a failure causes or may cause a hazard, the failure may be temporarily corrected by Agency or other forces at no additional cost to the Agency. Replace temporary repairs with permanent repairs at no additional cost to the Agency and according to the Specifications and within the time specified in 00868.75(c).

Measurement

00868.80 Measurement - The quantities of colored lane markings will be measured on the area basis.

Payment

00868.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

(Delete Pay Item(s) from the list that are not included in the Schedule of Items, but do not change the alpha characters next to the pay items.)

Pay Item	Unit of Measurement
(a) Green Bicycle Lane, Preformed Thermoplastic Film	Square Foot
(b) Green Bicycle Lane, Methyl Methacrylate	Square Foot

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

Payment for Work under this Section will be limited to 75 percent of the amount due until the Agency has received the signed warranty.

End of Section

Section 00870 - Curb Painting

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00870, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00870.00 Scope - This work consists of furnishing, preparing and installing paint materials to concrete curbs.

Materials

00870.10 Materials - Furnish high performance latex, designed for streets and parking lots, meeting the requirements of federal specification TT-P-01952E Type II. Colors must meet Traffic Standards for the Traffic Yellow and OSHA Safety Red.

Equipment

00870.20 Equipment - Submit brushes and airless sprayers to the Engineer for approval prior to use.

Construction

00870.40 Installation – Apply paint materials according to the following:

- Thoroughly clean curb surface before applying any paint coat. Remove rust, dirt, oil, grease, and other foreign substances.
- Sweep and dust all surfaces to remove all loose particles and dust immediately before painting.
- Paint only in dry weather or under cover.
- Ensure surface is free from moisture or frost when paint is applied. Do not allow painted surfaces to become wet by condensation or otherwise be subjected to freezing temperatures until the paint has reached a hard set.
- Do not begin painting if the temperature of the surrounding air is less than 5 °F above the dew point.
- Clean and apply fresh paint to any paint injuriously affected by cold, rain, moisture, or condensation.
- Thoroughly stir all paint to agitate and emulsify the contents. Maintain stirring and a uniform consistency of paint until applied. Do not thin or modify the paint.
- Applied paint either wholly by brush or, if approved by the Engineer, in part by brush and in part by approved airless spray in such a way as to secure an even paint film uniform in

thickness, tint and consistency over the entire surface, free from pin holes or excessive brush marks.

- Paint the face and top of curb. Do not paint any gutter pans.
- Apply two separate applications of paint. Retrace the second application directly over the first application.
- Allow paint to thoroughly dry between application of the two separate coats.
- Prevent paint dripping, spattering or spraying of finished surfaces. Cover adjacent surfaces as needed. Clean or remove imperfections and overspray before the paint has dried.
- The Contractor shall be fully responsible for any damage to property of any kind which may result from the operations incidental to the application of any paint.

Measurement

00870.80 Measurement - The quantities of curb painting will be measured on the length basis, to the nearest foot. Measurement will be along the face of curb. No adjustment will be made for different curb height exposures or widths. Measurement along the length of curb will only be made once, regardless of multiple applications of paint on the same surface.

Payment

00870.90 Payment - The accepted quantities of curb painting will be paid for at the Contract unit price, per foot, for the item "Curb Painting".

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and Incidentals necessary to complete the work as specified.

End of Section

SP00900 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 00900 – PERMANENT TRAFFIC CONTROL AND ILLUMINATION SYSTEMS

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 00902 - Crosswalk Closure Supports

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00902, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00902.00 Scope - This Work consists of constructing crosswalk closure supports and associated signs as shown.

Materials

00902.10 Materials - Furnish Materials meeting the following requirements:

Commercial Grade Concrete	00440
Steel	01070.10 and 01070.12
Signs	00940

Construction

00902.40 General - Install crosswalk closure supports and associated signs as shown or directed.

Measurement

00902.80 Measurement - The quantities of crosswalk closure supports will be measured on the unit basis. No separate measurement will be made for signs attached to crosswalk closure supports.

Payment

00902.90 Payment - The accepted quantities of Work done under this Section will be paid for at the Contract unit price, per each, for the item "Crosswalk Closure Supports".

Payment will be payment in full for furnishing and placing all Materials, including signs, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

Section 00905 - Removal and Reinstallation of Existing Signs

Comply with Section 00905 of the Standard Specifications modified as follows:

00905.40 General - Add the following paragraph to the end of this subsection:

Protect and return existing signs and posts meeting current standards and in good condition designated for “removal only” to the City of Bend Publics Works at 575 NE 15th Street, Bend, Oregon. Contact the Streets Division Supervisor at (541) 317-3000 at least one business day prior to delivery. Deliver signs within 14 Calendar Days or removal.

End of Section

Section 00910 - Wood Sign Posts

Comply with Section 00910 of the Standard Specifications.

End of Section

Section 00920 - Sign Support Footings

(This Section requires SP02560. This Section requires SP02510 if epoxy coated reinforcement is required.)

Comply with Section 00920 of the Standard Specifications modified as follows:

00920.80 Measurement – Delete the paragraph that begins "Estimated quantities of concrete…"

End of Section

Section 00930 - Metal Sign Supports

(This Section requires SP02560.)

Comply with Section 00930 of the Standard Specifications.

End of Section

Section 00937 – Preparing and Coating Metal Sign Structures

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 00937, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00937.00 Scope – This work consists of preparing and coating metallic sign supports, including single post, multi-post, triangular base, and exit number supports, sign backs, and illumination poles and arms as shown or as directed and according to Section 00594.

Materials

00937.10 Materials – Furnish materials meeting the requirements of Section 00594 and the following:

(a) Manufacturing – Coat galvanized and aluminum surfaces with products from the same manufacturer, which are compatible with one another.

For galvanized and aluminum surface coating products, furnish one of the following or approved equal:

- Xymax by Rodda Paint
  12000 SW Garden Place
  Portland, OR 97219
  Telephone: 503-521-4300

- Wasser Advance Coatings Technology
  4118 B Place NW Suite B
  Auburn, WA 98001
  Telephone: 253-850-2967

(b) Coating – The coating for all surfaces to be painted shall consist of one single-component, moisture-cured aliphatic polyurethane.

For galvanized surfaces, provide coatings conforming to the following minimum requirements:

Topcoat - Matte Finish:

Generic type:	Micaceous iron oxide-filled, single-component, moisture-cured, aliphatic polyurethane
Vehicle type:	Moisture-cured aliphatic polyurethane
Volume of solids:	50% minimum
VOC content:	2.8 lb/gal maximum

Finish:	Matte
Pigment:	Minimum of 3.0 lb/gal of micaceous iron oxide
Color:	As specified

Topcoat - Semi-Gloss Finish:

Generic type:	Single-component, moisture-cured, aliphatic polyurethane
Vehicle type:	Moisture-cured aliphatic polyurethane
Volume of solids:	60% minimum
VOC content:	2.8 lb/gal maximum
Finish:	Semi-Gloss
Color:	As specified

Construction

00937.40 General – Prepare metal sign supports and apply coatings according to Section 00594 and the following:

(a) New Galvanized Surfaces – Before coating, clean new galvanized surfaces with solvent (SSPC-SP1) followed by either a light brush blast (SSPC-SP7), surface etching with a 7% - 10% hydrochloric acid solution, or a vinyl wash material (designed to prepare galvanized surfaces for coating application) to produce a slightly abraded or etched appearance. Ensure that the surface is free of all debris or material resulting from the surface preparation procedures before painting. Take care that all oil, grease or similar contaminants are removed by the initial solvent cleaning before acid etching. If using abrasive blasting, do not destroy the integrity of the galvanized surface. If using vinyl wash, use material compatible with the applied coating.

(b) Weathered Galvanized Surfaces – Lightly brush-blast (SSPC-SP7) existing weathered galvanized surfaces with a light abrasive to remove loose delaminating surface contaminants, corrosion, and other deleterious material. Perform the abrasive blasting in a manner that will properly clean the surface but not destroy the integrity of the galvanizing. Provide an adequate surface to which the coating system can adhere.

(c) All Surfaces – Remove tears, slivers, and other surface defects, sharp edges, and edges hardened or damaged by flame cutting, shearing, or similar operations. Grind all welds smooth.

Clean all surfaces of material detrimental to the application of the coating system as follows:

(1) Cleaning Methods – Use one or any combination of these cleaning methods:

- high-pressure abrasive blasting
- surface etching with a 7% - 10% hydrochloric acid solution
- vinyl wash compatible with coating
- other means approved by the Engineer

Use methods specified in SSPC-SP1 "Solvent Cleaning", SSPC-SP2 "Hand Tool Cleaning", or SSPC-SP3 "Power Tool Cleaning", as necessary to augment primary cleaning procedures.

(2) Abrasives – Perform blast cleaning using an abrasive of a size which does not destroy the integrity of the galvanized surface, but provides an adequate profile for proper adhesion. Remove all materials detrimental to adhesion of the coating system not removed by solvent cleaning.

Use abrasives having no corrosion products, water, oil, or any other material detrimental to the application and adherence of the coatings. Abrasive cleanliness will be tested using ODOT TM 616. Wet abrasives are allowed if wet abrasive blasting methods are used.

(3) Air – For abrasive blasting or blowing down, use high-pressure air that is free of water, oil, or any other material detrimental to the subsequent application of the coating system. Provide adequate separators and traps. The cleanliness of the air will be tested using ODOT TM 618.

(4) Cleaning Procedures – Perform abrasive blasting operations without damaging partially or entirely completed portions of the work. Do not use blast cleaning adjacent to areas being coated.

Examine the prepared surfaces for corrosion, water, oil, grease, or any other material deposited during cleaning operations. Remove any detrimental material by solvent cleaning and reblast or re-etch if necessary.

(5) Final Preparation – Immediately before coating, ensure that the prepared surface is:

Blown down with high-pressure air supplemented by brushing if necessary

Free of all residue

Acceptable to the Engineer

Measurement

00937.80 Measurement – No measurement of quantities will be made for work done under this Section.

Payment

00937.90 Payment – No separate or additional payment will be made for work done under this Section. Payment will be included in payment made for the appropriate sign support items.

End of Section

Section 00940 - Signs

Comply with Section 00940 of the Standard Specifications modified as follows:

00940.03 Drawings - Replace this subsection, except for the subsection number and title, with the following:

Within 30 calendar days after executing of the Contract, submit electronic working drawings for each non-standard sign on the project. Obtain Agency approval prior to fabrication.

00940.46 Inspection – Delete the sentence that begins “The Contractor’s expense…”

00940.80 Measurement –

Add the following paragraph to the end of this subsection:

Double-sided signs will be measured on both faces of the sign.

(Use the following subsection .80 when agency-furnished signs are required.)

Agency-furnished signs will be measured on the unit basis.

(Use the following subsection .90 when agency-furnished signs are required.)

00940.90 Payment - Add the following Pay Item to the Pay Item list:

(g) Signs, Agency Furnished..... Each

Item (g) includes installation of signs furnished by the agency.

End of Section

Section 00950 - Removal of Electrical Systems

Comply with Section 00950 of the Standard Specifications modified as follows:

00950.02 Definitions - Delete this subsection.

(Use the following subsection .41 when removal work is not shown on the contract plan sheets.)

00950.41 Removal and Abandonment - Add the following to the end of this subsection:

[Option 1 - Use the following when NOT all removal Work is shown on contract plan sheets. Only list Work not shown]

This Work consists of removing existing electrical system*(*s*)* as shown. This Work also consists of removing the following existing electrical system*(*s*)*:

Equipment Description	Location

[Option 2 - Use the following when NO removal Work is shown on contract plan sheets.]

This Work consists of removing the following existing electrical system*(*s*)*:

Equipment Description	Location

(Use the following subsection .42 when salvaging and stockpiling removed materials. List materials and stockpile locations.)

00950.42 Salvaging and Stockpiling Materials - Add the following to the end of this subsection:

The following materials will remain the property of the Agency. Salvage the materials and stockpile them at the locations indicated. Contact Engineer to confirm delivery 48 hours prior to delivery.

Equipment Description	Stockpile Location

End of Section

Section 00960 - Common Provisions for Electrical Systems

(This Section requires SP02560. This Section requires SP02510 if epoxy coated reinforcement is required.)

Comply with Section 00960 of the Standard Specifications modified as follows:

00960.30 Licensed Electricians - Replace the paragraph that begins "According to the Oregon Administrative Rule …" with the following paragraph:

According to the Oregon Administrative Rule 918-282-0120(1), no person or entity shall allow any individual to perform electrical work for which the individual is not properly registered or licensed. Every person who installs electrical systems on the Project shall submit a copy of their electrical license or apprentice registration to the Engineer prior to performing any Work. They must be licensed as an S or a J under Oregon Administrative Rule 918-282.

The conduit system (conduits, junction boxes, and poles bases) for illumination systems is not required to be installed by a licensed electrician.

(Use the following subsection .42(c) when rigid metallic conduit is required.)

Add the following subsection:

00960.42(c) Metallic Conduit – Paint the following with rust-preventative coating:

- Threads on all metal conduit.
- Areas where the coating has been damaged so underlying metal is exposed.
- Exposed, ungalvanized threads resulting from field cuts.

If corrosive Soil conditions exist, coat metallic conduit with a nonmetallic coating or wrap with corrosion protection tape at least 10 mils thick.

(Use the following subsection .42(d) when connecting new conduit to existing conduit is required.)

Add the following subsection:

00960.42(d) Connecting Non-Metallic Conduit to Metallic Conduit - Use a nonmetallic female threaded connector to connect nonmetallic conduit to metallic conduit.

(Use the following subsection .42(e) when installing conduit under railroad tracks is required.)

Add the following subsection:

00960.42(e) Conduit under Railroad Tracks – Install conduit inside a galvanized, rigid metal conduit at the depth required by the governing Railroad company. Construct so that

conduit ends are at least 30 feet beyond the centerline of every track or other distance as required by the Railroad.

(Use the following subsection .42(f) when installing conduit on or in a structure is required.)

Add the following subsection:

00960.42(f) Conduit on Structures - Install conduit according to 00583.40.

(Use the following subsection .42(g) when permanent wood poles are required.)

Add the following subsection:

00960.42(g) Conduit on Wood Poles - Mount conduit on wood poles with two-hole, galvanized, steel conduit straps spaced no more than 3 feet apart. Mount conduit on Utility-owned wood poles according to local Utility regulations. Use stand-off brackets if required.

(Use the following subsection .44 when permanent wood poles are required.)

Add the following subsection:

00960.44 Wood Poles - Submit stamped Working Drawings, details, and calculations for the wood pole designs to the Engineer for review according to 00150.35. Satisfy the requirements of 02120.10 and include designs for the wood poles, guy anchors, guy wires, span wires, pole setting depths, and pole bearing.

(Use the following subsection .45(f) when poles or cabinets are mounted to a structure.)

Add the following subsection:

00960.45(f) Structure Mounted Poles and Cabinets – Bond all poles and cabinets mounted on Structures or walls to a common ground rod at the end of the Structure. Ground the system at the first convenient acceptable location off the Structure.

(Use the following subsection .45(g) when permanent wood poles are required.)

Add the following subsection:

00960.45(g) Wood Poles - Bond all metallic conduit, messenger cable, terminal cabinet, and other metallic parts within 10 feet of the ground line.

(Use the following subsection .45(h) when metallic junction boxes and lids are required.)

Add the following subsection:

00960.45(h) Metallic Junction Boxes and Lids - Bond metal junction boxes and lids to form a continuous effectively grounded and bonded system with metallic conduit, grounding

wire, metal standards and controller cabinets. Leave enough slack in the bond wire connected to the lid to allow complete removal of the lid. Junction boxes only containing circuits that operate at less than 25 V do not need to be bonded.

00960.46 Service Cabinet and Electrical Energy - Replace this subsection, except for the subsection number and title, with the following:

Install service cabinet and associated equipment, then arrange for the Utility providing power to have the service cabinet inspected and make the electrical hook-up prior to field testing. Field test according to 00990.70(g) for traffic signals, or according to 00970.70 for illumination.

(Fill in the table and add or delete rows as necessary. Obtain information from the Signal or Illumination designer. Delete language in orange parentheses that does not apply and delete all orange parentheses.)

Table 00960-1 contains Utility contact information to arrange for *(*the Utility*) (*Utilities*)* to make electrical hookups:

Table 00960-1

Location	Utility	Utility Contact Person's Name, Email and Phone Number	Utility Job Number

(Use the following paragraph when the electrical power is metered, Standard Practice.)

Furnish and install a meter base approved by the serving Utility (with cover by the Utility), where shown.

(Use the following paragraph when the electrical power is billed using a flat rate with no meter. Verify with the Utility provider, IGA, and Engineer.)

Electrical energy is flat-rated. Meter base is not required.

Electrical energy costs will be billed to the Agency for permanent installations.

End of Section

Section 00962 - Metal Illumination and Traffic Signal Supports

(This Section requires SP02560.)

Comply with Section 00962 of the Standard Specifications modified as follows:

(Use the following subsection .05(a) when standard signal mast arm supports are required.)

00962.05(a) Traffic Signal Mast Arm Supports - Add the following to the end of this subsection:

The following standard signal mast arm pole drawings are prequalified for use on the Project:

Valmont Industries Inc.	Drg. DB00719 page 1, Rev. P, 6/8/18 Drg. DB00719 page 2, Rev. P, 6/8/18 Drg. DB00719 page 3, Rev. P, 6/8/18 Drg. DB00719 page 4, Rev. P, 6/8/18 Drg. DB00719 page 5, Rev. P, 6/8/18 Drg. DB01290 page 1, Rev. D, 9/22/20 Drg. DB01290 page 2, Rev. D, 9/22/20 Drg. DB01290 page 3, Rev. D, 9/22/20 Drg. DB01290 page 4, Rev. D, 9/22/20
Ameron Pole Products Division	Drg. OR13TR10, Rev. E, 8/27/18 Drg. OR13TR11, Rev. F, 8/27/18 Drg. OR13TR12, Rev. G, 8/27/18 Drg. OR13TR13, Rev. C, 8/27/18

(Use the following subsection .05(c) when standard illumination supports are required.)

00962.05(c) Illumination Supports - Replace this subsection, except for the subsection number and title, with the following:

Design non-standard luminaire slip base, fixed base, and high mast poles and foundations according to the *AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (2015)*. Design factors include:

Design Wind Velocity.....145 mph
Design Service Wind Velocity.....91 mph

(Use the following subsection .10 to list topcoat colors. Fill in the blanks as instructed and obtain information from the Designer. Copy and repeat the paragraph as needed. Use only basic color names and numbers from the SAE AMS-STD-595 color index.

Example:

For Luminaire Poles 1, 2, 3, 4, 5, provide a topcoat color of Black that matches to SAE AMS-STD-595 color # 17038.)

00962.10 Materials - Add the following to the end of this subsection:

For *(Structure number or item description)*, provide a topcoat color of *(Color Name)* that matches SAE AMS-STD-595 color # *(Color Number)*.

00962.46(j)(2)(a) Anchor Rods for Signal Supports and Fixed Base Luminaire Supports - Replace the paragraph that begins "Mark the position of each turned element…" with the following paragraph:

Mark position of each anchor rod and an outside ridge of each first nut above the base plate with a felt tip pen or similar marker to verify subsequent nut rotation. Rotate all first nuts above the base plate past snug tight an additional amount shown in 00962.46(j)(2)(d) in two passes. "Cheater" bars or slugging wrenches are allowed if required for large diameter anchor rods. After final tightening of the first nut above the base plate, tighten the second nut to a snug tight condition for assemblies with two nuts above the base plate.

(Use the following subsection .48 to specify coating steel signal and luminaire supports.)

00962.48 Coating - Replace this subsection, except for the subsection number and title, with the following:

Prepare and powder coat supports according to the applicable portions of Section 00593 or prepare and coat supports according to the applicable portions of Section 00594. Provide coating materials for field application, repairing damaged coatings, and coating hardware after installation, according to Section 00593 or 00594. Do not coat:

- Slip plate or arm connection surfaces.
- Slip base bolting hardware.
- Anchor rods, anchor rod washers, and anchor rod nuts.

End of Section

Section 00963 - Signal Support Drilled Shafts

(This Section requires SP02510 if epoxy coated reinforcement is required.)

Comply with Section 00963 of the Standard Specifications modified as follows:

00963.10 Materials - Replace the paragraph that begins "Furnish Commercial Grade Concrete…" with the following paragraph:

Furnish Commercial Grade Concrete meeting the requirements of Section 00440 except provide the mixture with a slump of 8 1/2 inches ± 1 1/2 inches.

End of Section

Section 00970 – Highway Illumination - Replace this section with the following:

Section 00970 - Illumination

(This Section requires SP00960 and SP02926. This Section requires SP00962 when illumination supports are required.)

Description

00970.00 Scope – In addition to requirements of Section 00960, Section 00962, and Section 02926, install illumination according to the following Specifications and the requirements of the ***(***Pacific Power***) or (***Central Electric Cooperative, Inc.***)***.

(Use the following paragraph when Pacific Power is the electrical service provider.)

Pacific Power electrical service requirements can be found at the following link: https://www.pacificpower.net/working-with-us/builders-contractors/electric-service-requirements.html

(Use the following subsection .10 when junction boxes will be provided by the power company. Insert contact information.)

Materials

00970.10 Junction Boxes – Junction boxes will be provided by ***(***Pacific Power***) or (***Central Electric Cooperative, Inc.***)***. Coordinate pickup of junction boxes with ***(insert name and phone number)*** at ***(insert pickup location)*** for ***(insert WO#)*** a minimum of one week prior to installation.

Construction

00970.40 Conduit System – In addition to the requirements of 00960, follow the construction requires of ***(***Pacific Power***) or (***Central Electric Cooperative, Inc.***)***.

00970.42 Grounding and Bonding - In addition to the requirements of 00960.45 and 00962.50, ground and bond metal illumination poles according to the following:

Install 1-inch nonmetallic conduit from the pole base to the concrete and polymer concrete junction box at each pole. Install a ground rod in each junction box and install No. 6 AWG copper ground wire from the ground stud in the pole base to the ground rod in the junction box. The ground rod may be installed in the same junction box that provides illumination circuitry to the pole, if a separate and independent conduit is installed for the ground wire. Bond all metal conduit and metal junction box covers, if used, together to the ground rod.

Maintenance

00970.60 Maintaining Existing and Temporary Illumination Systems - Protect existing illumination systems and approved temporary replacements. Shutdown of a system may be allowed for alterations or final removal, as approved. Lighting system shutdowns shall not

interfere with the regular lighting schedule. Notify the Engineer before performing any Work on existing systems.

Determine the exact location of existing conduit runs and pull boxes before using Equipment that may damage such facilities or interfere with any system.

Where Roadways are to remain open to traffic and existing lighting systems are to be modified, keep the existing systems in operation until the final connection to the modified circuit is made. The modified circuit is to be complete and operating by nightfall of the same Day the existing system is disconnected.

Measurement

00970.80 Measurement - The quantities of light pole foundations and trenching and conduit constructed under this Section will be measured according to the following:

- **Each Basis** – Measurement will be by actual count.
- **Length Basis** – Measurement will be along the center of trench. The length of conduit will not be measured.

Payment

00970.90 Payment – The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Pole Foundations	Each
(b) Trenching and Conduit	Foot

Item (a) includes all necessary excavation and/or auguring to installed, cast-in-place or pre-cast pole foundations, or street light sleeves as required by the power company and as shown in the project plans.

Item (b) includes all trenching, installation of conduit, junction boxes, and pull rope required to construct the lighting system as specified.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

00970.91 Electrical Energy Costs - All electrical energy costs for the lighting systems or subsystems will be paid for by the Agency.

End of Section

Section 00990 - Traffic Signals

(This Section requires SP00960 and SP00962. This Section requires SP00902 when crosswalk closure supports are required.)

Comply with Section 00990 of the Standard Specifications modified as follows:

(Use the following lead-in paragraph and subsection .10 only when the "Crosswalk Closure Support" reference in SP00902 has been included or inductive loops are used. Delete material items that do not apply.)

Add the following subsection:

00990.10 Materials - Furnish Materials meeting the following requirements:

Crosswalk Closure Support..... 00902.10
Backer Rod..... 02440.14

Furnish the following Materials from the QPL:

- Hot-Melt Loop Sealant

Add the following subsection:

00990.13 Solar Powered Flashing Beacon System - Furnish a flashing beacon system with a timer switch and cellular modem powered by a minimum 50W solar panel with battery backup capable of connecting to the City's Glance Management software. Furnish a solar powered flashing beacon systems from one of the following suppliers, or approved equal:

- Carmanah Technologies Corp.
  Telephone: 1-844-412-8395

- JSF Technologies, Inc.
  Telephone: 1-800-990-2454

(Use the following lead-in paragraph and subsection .40 when there is work at an existing controller cabinet.)

Add the following subsection:

00990.40 Work in Existing Controller Cabinets - Install new field wiring as shown into the existing controller cabinet without terminating.

New control equipment installed as shown in an existing controller cabinet will be tested prior to installation according to 00990.70.

At existing controller cabinets, including existing temporary controller cabinets already in service, the Agency will be responsible for:

- Storage, delivery, installation, and activation of new control equipment

- Any required modifications to existing control equipment or existing field wiring terminations
- Terminating new field wiring

Prior to the anticipated installation of new control equipment, modification of existing control equipment, or modification of existing field wiring terminations, schedule field testing according to 00990.70(g). Field testing and activation of the new control equipment or modifications will occur within the same work shift. Be present at the Project Site during field testing.

(Use the following lead-in paragraph and subsection .41 when inductive loops are used.)

Add the following subsection:

00990.41 Inductive Loop Detectors:

(a) General - Do not begin saw cutting until the loop layout has been inspected by the Engineer.

Do not place wire in saw cuts until the cuts have been inspected by the Engineer.

(b) Saw Cut and Wire Installation - Saw cut in a manner that is the most practicable, direct line between loops and junction boxes.

Immediately after saw cutting and before the cuttings dry, thoroughly flush each cut with a high-pressure water stream. Before the cuts dry, blow cuts free of water, debris, rock, and grit with compressed air. Slots may also be cleaned by means of a high-pressure water injection/vacuum extraction system. Remove rocks or other material that may be wedged in the cut. Remove and dispose of all cuttings according to 00290.20.

Dry cuts before placing wire.

After the saw cut is cleaned of debris, place the loop wire by pushing it into the slot with a blunt nonmetallic object. Use care to avoid damaging the insulation.

(c) Sealant - Install the sealant in slots according to the manufacturer's instructions. Furnish a copy of the manufacturer's specifications including application procedures. The Engineer may order a test run of any application method or material before filling saw cuts.

In order to prevent heat damage to the insulation, do not allow the temperature of the sealant to exceed 410 °F during application. Install hot-melt sealants in layers to prevent damage to wire insulation. Allow each layer to cool before the next layer is installed. Do not use water to accelerate cooling.

Sealants that crack or pull away from the saw cuts after curing will be rejected.

(d) Resistance and Continuity Testing - The resistance to ground of the loop and loop feeder combinations, shall be 500 MΩ or greater when checked at the following conditions:

- Before splicing and sealing - continuity test
- Before splicing after sealing - resistance test
- After splicing and sealing - resistance test

Furnish a report of the resistance and continuity results for each loop at each testing condition.

(Use the following lead-in paragraph and subsection .42(b) when inductive loops are used.)

Add the following subsection:

00990.42(b) Loop Feeder Cables – When terminating loop feeder cable inside the controller cabinet, do not remove the outside jacket and shield more than 6 inches from the end of the cable. Crimp lugs used for loop wire field terminals may be insulated or non-insulated. Terminate loop feeder shield drain wire to the cabinet input panel grounding bus nearest the feeder wire termination point.

00990.90 Payment - Delete Pay Item (c) from the pay item list.

Delete the paragraph that begins “Item (c) includes furnishing and installing…”

Replace the paragraph that begins “In Items (a), (b), (c), (d), (f) …” with the following paragraph:

In Items (a), (b), (d), (f) and (g), the intersection location will be inserted in the blank.

Replace the paragraph that begins “Item (b) includes furnishing and replacing…” with the following paragraph:

Item (b) includes furnishing and replacing or installing items for an existing traffic signal installation and the detection system.

Replace the paragraph that begins "Mast arm pole and strain pole foundations …" with the following paragraph:

Drilled shaft foundations for traffic signal 15 foot through 55 foot mast arm supports will be paid for according to 00963.90. Drilled shaft foundations for traffic signal 60 foot through 75 foot mast arm supports will be paid for according to 00921.90.

(Use the following paragraph and bullet when installing conduit on or in a structure)

In the paragraph that begins “No separate or additional payment will be…”, add the following bullet to the bullet list:

- Conduit installed according to 00960.42(f)

(Use the following paragraph when crosswalk closure supports are required.)

Crosswalk closure supports will be paid for according to 00902.90.

End of Section

SP01000 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 01000 – RIGHT OF WAY DEVELOPMENT AND CONTROL

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 01012 - Stormwater Control, Water Quality Biofiltration Swale

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

(This Section requires SP00842 and SP01030.)

Section 01012, which is not a Standard Specification, is included for this Project by Special Provision.

Description

01012.00 Scope - This Work consists of furnishing and installing a water quality biofiltration swale as shown.

Materials

(Delete material items that do not apply and include other materials as necessary.)

01012.10 Materials - Furnish Material meeting the following requirements:

Check Dam, Type 2	00280.15(a)
Concrete	00440
Drainage Geotextile, Type 1	02320
Facility Field Markers	00842.10
Drain Rock	00470.18(a)
Manholes, Catch Basins, and Inlets	00470.11
Slope and Channel Liner Matting	00280.14(e)
Riprap	00390.11
Riprap Geotextile, Type 1	02320
Storm Sewer Pipe	00445.11
Subsurface Drain Pipe	00430.10

01012.11 Amended Topsoil - Furnish amended topsoil in accordance with Section 01040.14(d).

01012.12 Pea Gravel - Furnish pea gravel meeting the following gradation requirements:

Sieve Size	Percent Passing (by Weight)

½”	100
3/8”	85-100
No. 4	10-30
No 8	0-10
No. 16	0-5

Construction

01012.40 General - Construct water quality biofiltration swale facility as shown. Perform excavation, fine grading, and placement work only when the facility area is dry and only from the top of the swale area. Do not stockpile excavated material in the facility area. Scarify the subsoil area a minimum 12 inches deep. Place the amended topsoil in maximum 12-inch Lifts. Compact each Lift with a water filled landscape roller.

Maintenance

01012.70 Cleaning - If a stormwater control facility is used for erosion and sediment control, remove all accumulated sediment and debris before completing the facility.

01012.71 Removal - Remove temporary erosion and sediment control features according to 00280.70 only after water quality vegetation has met the establishment requirements of 01030.60.

01012.71 Infiltration Testing – Test the infiltration rate of the water quality swale following excavation but prior to installation of materials shown in City of Bend standard drawing STRM-2. Provide infiltration rate to Engineering within 24-hours of the test. Perform infiltration testing per the following:

(a) Water Testing Volume – Swales and ponds are to be flood tested with the 6-month storm design volume, loaded within 1 hour and fully infiltrated in 24 hours (below visible surface). The swale is required to take the entire volume within the 1 hour period without overflowing.

(b) Infiltration Rates – Infiltration shall be permitted to offset storage design but limited to the lower limit of the published rate of the National Resource Conservation Services (NRCS) soil surveys, unless supported with location specific field testing to use up to, but not exceeding the upper limit.

(c) Infiltration Surface – Includes the floor area or horizontal infiltration area.

(d) Alternate Test – If the initial test fails, or there is concern the swale will not infiltrate in the required 24 hours, the facility may be initially designed or enlarged to contain the volume of two consecutive 50-year storms in a two-hour period (double design). 24-hour drainage compliance will be waived if the facility contains the double design volume without overflowing. If infiltration is included in determination of the design volume, recalculation is required for storage volume based on the measured infiltration rate to ensure the double volume is provided.

Measurement

01012.80 Measurement - No measurement of quantities will be made for Work performed under this Section. The estimated quantities of Materials are:

(Identify swales by the Water Quality Swale (WSQ) number. List each WQS separately. Obtain the WQS #, the items, and the quantities from the Designer. Fill in all the required blanks. Delete items that do not apply. Copy and paste for multiple facilities. Include excavation quantity only when the swale excavation is not part of the Roadway typical section.)

Water Quality Swale __(WQS)__ Quantities:

Item	Quantity
Excavation	____ Cu. Yd.
Drainage Geotextile, Type 1	____ Sq. Yd.
Riprap Geotextile, Type 1	____ Sq. Yd.
Loose Riprap, Class ____	____ Cu. Yd.
Drain Rock	____ Cu. Yd.
Amended Topsoil	____ Cu. Yd.
Ditch Inlet, Type D	____ Each
Concrete Storm Sewer Manhole (Flow Splitter)	____ Each
____ Inch Storm Sewer Pipe	____ Foot
____ Inch Subsurface Drain Pipe	____ Foot
Plastic Board Flow Spreader	____ Foot
Matting, Type ___	___ Sq. Yd.
Check Dam, Type 2	____ Each
Concrete Basin Flow Spreader	____ Each
Rock Basin Flow Spreader with Stone Embankment	____ Cu. Yd.
Rock Basin Flow Spreader with Riprap	____ Cu. Yd.
Porous Pavers	____ Sq. Ft.

Payment

01012.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract lump sum amount for the item "Water Quality Swale, _____".

The drainage facility identification number will be inserted in the blank.

(Use the following paragraph when the swale excavation is included in the Roadway excavation quantity.)

Excavation will be paid according to 00330.90.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

Section 01030 - Seeding

(This Section requires SP01040 when soil testing or planting area preparation is required.)

Comply with Section 01030 of the Standard Specifications modified as follows:

01030.13(a) Label - Add the following to the end of this subsection:

Provide alternate labeling for native plant seeds as follows:

Provide the following seed mix formulas:

- **_____Seeding:**

Botanical Name (Common Name)	**PLS + (% Purity x % Germination) = Amount (lb/acre)**	**(minimum)**	**(minimum)**	**(lb/acre)**
_____ (_____)	_____	_____	_____	_____
_____ (_____)	_____	_____	_____	_____
_____ (_____)	_____	_____	_____	_____
_____ (_____)	_____	_____	_____	_____
_____ (_____)	_____	_____	_____	_____

* Oregon Certified Seed

01030.13(f) Types of Seed Mixes - Add the following to the end of this subsection:

Provide the following seed mixes, or approved equal:

A. Grass seed mixture for areas “Disturbed by Construction”:

Species	Common Name	Percent by Seed Count
Festuca ovina	Creeping Red Fescue	30%
Pesudoregneria spicata	Blue Bunch Wheatgrass	25%
Festuca idahoensis	Idaho Fescue	15%
Achnatherum hymenoides	Indian Ricegrass	10%
Poa secunda ssp. Canbyi	Canby, OR Sandburg Bluegrass	10%
Elymus elymoides	Bottlebrush Squirreltail	5%
Linum lewisii	Blue Flax	5%

Application rate: 4 lbs. /1,000 square feet or approved equal.

* Oregon Certified Seed

B. Seed Mix for Water Quality Swales:

Species	Common Name	Percent by Seed Count
Hordeum brachyantherum	Meadow Barley	25%
Danthonia callifornica	California Oatgrass	15%
Elymus glaucus	Blue Wildrye	10%
Bromus carinatus	California Brome	10%
Festuca roemeri	Roemer's Fescue	10%
Deschampsia cespitosa	Tufted Hairgrass	10%
Agrostis exarata	Spike Bentgrass	10%
Alopecurus geniculatus	Water Foxtail	5%
Deschamsia elongate	Sender Hairgrass	5%

Application rate: 4 lbs. /1,000 square feet or approved equal.

C. Lawn Seed (Turf Areas):

Turf Type Tall Fescue, a minimum of three blends; 8 lb/1,000 sq. ft.

01030.13(g) Availability - Add the following sentence to the end of this subsection:

Submit the seed and seed mixes to be used on the project according to 00150.37.

01030.14(b)(2) East of the Cascades – Add the following sentence to the end of this subsection:

Within wellhead protection areas, applications should only be performed when a soil test confirms a need, and if need is determined, limit the nitrogen application rate to 30 pounds per acre.

01030.14(b)(3) Statewide, Near Water – Add the following paragraph to the end of this subsection:

Applications within 50 feet of open water should only be performed when a soil test confirms a need. Given that the Deschutes River is nitrogen-limited, limit the nitrogen application rate to 30 pounds per acre within subbasins in the City's MS4 area or directly adjacent to the Deschutes River.

(Use the following subsection .15 and bullet(s) to specify other types of mulch not listed in the Standard Specifications, or when hydromulch may be used for temporary erosion control seeding. Delete "(s)" or parentheses as applicable, such as composted yard debris. Use the generic name for the mulch and include Specifications, or cite the ODOT QPL if applicable. Obtain information from the Erosion Control Designer.)

(Use the following subsection .42 to list Specified Weeds and plant species to be removed. Obtain list from the Erosion Control Designer.)

01030.42 Weed Control - Add the following paragraph and bullets after the paragraph that begins "If a pesticide has been approved for…" and before subsection (a):

The Specified Weeds and plant species to be removed include noxious weeds identified on the Deschutes County weed list.

Add the following subsection:

01030.43(c) Seed Application
Prior to seeding the following must occur:

- Remove all course debris (trash, woody debris, loose rocks, etc)
- A soil test is recommended to determine if soil amendments are necessary.
- For steep slopes track-walk the full extent of the slope or prepare a uniform surface and install erosion control matting/blankets. Ensure all ridges and indents are parallel to the slope contours. In addition, install cross slope protection per City of Bend standards drawing E-4 and manufacturer's recommendations.

Seed mix shall be applied with fertilizer and tracer followed by a Bonded Fiber Matrix (BFM) application, or rolled matting installation to promote good seed to soil contact. . BFM applications shall be long strand mulch including tackifier. Install to manufacturer's specifications or to a minimum of 3,000 pounds per acre on slopes flatter than 2H:1V and 3500-4000 lbs per acre on 2H:1V slopes or steeper. The BFM shall be applied from a minimum of two directions to avoid shadowing. See City of Bend standard drawing E-5 for rolled matting installation requirements.

To encourage successful germination, seed application shall occur from October 1 through February 1. Application shall occur when the ground is not frozen. Seeding should not occur outside of the approved time window or on snow unless approved by the City in writing.

(Use the following subsection .60 when the "Plant Seeding, ____" or "Native Plant Seeding, ____" Pay Items are included in the Schedule of Items. Delete "(s)" or the parentheses as applicable.)

01030.60 General - Add the following sentence*(*s*)* after the last bullet:

(Use the following paragraph when the "Plant Seeding, ____" pay item is included in the Schedule of Items.)

The minimum living plant coverage for woody or other plant seeding is 70 percent of ground surface or alternative per City of Bend standard drawing "Stabilization".

(Use the following paragraph when the "Native Plant Seeding, ____" Pay Item is included in the Schedule of Items. Obtain information from the Erosion Control Designer and fill in the blank. Minimum 75 percent)

The minimum living plant coverage for native plant seeding is ____ percent of ground surface.

End of Section

Section 01040 - Planting

Comply with Section 01040 of the Standard Specifications modified as follows:

(Use the following subsection .02 when weed control is required.)

01040.02 Definitions - Add the following definition:

Weed Free - See 01030.02 for weed free definition

01040.04(a) Planting Work Plan –

Replace the bullet that begins “Contract Growing Plan…” with the following:

- Contract Growing Plan or securing plants documents according to 01040.19(g)

Replace the bullet that begins “Plant installation and establishment” with the following:

- Plant installation and establishment plan including a maintenance schedule for weeding, watering, pruning (no shearing), pest treatment, replacement of failing plants, raking, and mulching to establish plant health

Add the following subsection:

01040.14(d) Amended Topsoil – Furnish thoroughly blended topsoil with the following constituents:

- 50-60% clean sand
- 20-30% weed-free topsoil
- 5-20% certified compost and/or peat

(Use the following subsection .19(g) when a contract growing agreement is required.)

01040.19(g) Contract Growing Plant Materials - Add the following sentence to the end of this subsection:

This Project requires a contract growing agreement.

(Use the following subsection .48 when weed control is required.)

01040.48 Planting Area Preparation - Replace the sentence that begins ”Identify, kill, and remove…” with the following sentence:

Identify, kill, and remove Weeds according to 01030.62(b)(3).

(Use the following subsection .71 to include minimum watering frequencies for trees and shrubs. Obtain information from the Designer. Delete what does not apply.)

01040.71 Plant Care and Success Criteria - Add the following to the end of this subsection:

The following watering frequencies are required:

- Deciduous trees that are 1 1/2 inch and larger, water at a frequency of _____.
- Conifer trees that are over 4 feet tall, water at a frequency of _____.
- All shrubs, water at a frequency of _____.

(Use the following subsection .77(d) when sod lawn is required. Obtain the schedule from the Designer.)

01040.77(d) Sod Lawn - Add the following to the end of this subsection:

Provide sod lawn feeding, mowing, and general treatment as follows:

End of Section

Section 01050 - Fences

Comply with Section 01050 of the Standard Specifications.

End of Section

Section 01069 - Metal Handrail and Pedestrian Fence

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

(This Section requires SP00593, SP02830, and SP02831.)

Section 01069, which is not a Standard Specification, is included in this Project by Special Provision.

Description

01069.00 Scope - This Work consists of furnishing and installing metal handrails and pedestrian rail units as shown or directed.

Materials

01069.10 Materials - Furnish Materials meeting the following requirements:

Commercial Grade Concrete..... 00440
Metal Handrail..... 02830
Pedestrian Fence..... 02831

Construction

01069.40 Metal Handrail and Pedestrian Fence:

(a) Handrail Fabricate and install imbedded and bolted down metal handrail as shown.

(b) Pedestrian Fence - Fabricate and install pedestrian fence units as shown.

01069.41 Welding - Welding, welder qualifications, prequalification of weld details and inspection of welds shall conform to AWS D1.1 or AWS D1.2. Submit all welding procedure specifications 7 Days prior to fabrication to the Engineer for approval.

01069.42 Concrete Footings - Dimensions of footings shall not be less than shown and shall fill the excavated areas. Place the concrete with contact against firm Soil at the sides and bottom and tamp around the posts and brace ends after the posts and braces have been brought to and firmly held in proper position. Strike off, slope or crown and smooth the surface of the concrete at the ground level to shed water. Allow to cure for at least 5 Calendar Days before subjecting the posts to strain.

Excavate for concrete footings to reasonably Neat Lines, but not less than the specified dimensions in Soil, or not less than 18 inches deep in Rock. Prevent disturbance of original ground at the sides and bottom of the excavation.

Dispose of Materials removed under these provisions, including excess excavation, in a satisfactory manner.

01069.43 Bolt Holes:

(a) Punched Holes - Use a die with a diameter not exceeding the diameter of the punch by more than 1/16 inch. Ream holes that are required to be enlarged to admit the anchor bolts. Make clean cut holes without torn or ragged edges.

(b) Accuracy of Punched Holes - After punching the holes in the plate, stack the plates with the edges even and insert a cylindrical pin, 1/8 inch smaller in diameter than the nominal size of the punched hole, through the punched holes perpendicular to the face of the plate. No drifting of the rod while passing through each of the punched holes in the stack is allowed. Ensure that the edges of the stack stay in alignment. Non-conforming pieces will be rejected.

Measurement

01069.80 Measurement - The quantities of Work performed under this Section will be measured according to the following:

- **Length Basis** - Metal handrail will be measured on the length basis, by measuring along the top rail member, from center of end post to center of end post.

- **Unit Basis** - Pedestrian fence will be measured on the unit basis. Pedestrian fence will be counted for each 62 inch long unit.

Payment

01069.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Metal Handrail, _____ Rails	Foot
(b) Pedestrian Fence	Each

In item (a), the number of rails will be inserted in the blank.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

Section 01070 - Mailbox Supports

(This Section requires SP02510 if epoxy coated reinforcement is required.)

(Use the following lead-in paragraph when none of the following subsections are included in the project.)

Comply with Section 01070 of the Standard Specifications.

(Use the following lead-in paragraph when any of the following subsections are included in the project.)

Comply with Section 01070 of the Standard Specifications modified as follows:

(Use the following subsections .00, .80, and .90 when existing mailbox supports are reused. Use only when the existing mailbox supports, brackets, hardware, and post sockets are crash worthy and meet current standards. Check with the Designer.)

01070.00 Scope - Add the following paragraph to the end of this subsection:

This Work includes removing, maintaining, and reinstalling existing mailboxes and existing supports.

01070.80 Measurement - Add the following paragraph to the end of this subsection:

The quantities of mailboxes and supports removed, maintained, and reinstalled will be measured on the unit basis, regardless of type, installed in permanent locations.

01070.90 Payment - Add the following Pay Item to the Pay Item list:

(d) Remove and Reinstall Mailbox Supports ..... Each

Item (d) includes removing mailboxes and supports, maintaining them at temporary locations, and reinstalling them at their permanent locations.

End of Section

SP01100 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 01100 – WATER SUPPLY SYSTEMS

Section 01120 – Irrigation Systems

Comply with Section 01120 of the Standard Specifications modified as follows:

01120.01 Qualifications – Replace this subsection with the following:

01120.01 Contractor Requirements - Contractors are required to be properly certified in the installation of automatic irrigation equipment and/or be able to demonstrate the knowledge, skills, and ability to work with the City of Bend, subcontractors, and/or vendors in order to properly install smart irrigation equipment. An independent outside consultant may be hired by the Contractor to fulfill the requirement.

Add the following subsection:

01120.02 References - Always reference the latest version of the following information:

(a) American Society for Testing and Materials
- ASTM D 2241-89: Poly Vinyl Chloride (PVC) Pressure - Rated Pipe (SDR –PR)
- ASTM D 2464-89: Threaded (PVC) Plastic Pipe Fittings, Schedule 40
- ASTM A 5: Steel Pipe and Tubing
- ASTM D 2564-89: Solvent Cements for PVC Plastic Pipe and Fittings
- ASTM D 2774-72: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping (R 1983)
- ASTM D 2855-83: Standard Practice for Making Solvent-Cemented Joints PVC Pipe and Fittings

(b) American Water Works Association
- AWWA C 800-84: Underground Service Line Valves and Fittings with Appendix on Collected Standards for Service Line Materials.

(c) National Electrical Manufacturers Association
- NEMA 250-85 : Enclosures for Electrical Equipment (1000 Volts Maximum) (R1-1986, R-2-1988)

(d) Underwriters' Laboratories, Inc.
- UL 651-89: Schedule 40 and 80 Rigid PVC Conduit

(e) International Assoc. of Plumbing and Mechanical Officials
- UPC-1988 Uniform Plumbing Code

01120.10 General – Add the following before the sentence that begins "Furnish only commercial…":

To facilitate standardization, the City of Bend requires Weathermatic Irrigation controllers, Rain Bird valves, Rainbird or Hunter RWS, Rainbird or Hunter PRS sprinkler bodies, Hunter MSBN, . Submit alternate products for approval by the City of Bend before installation.

Add the following subsection:

01120.11(d)(3) Swing Joint Riser –Schedule 40 PVC 90 Degree Street Elbows - 6504 /5004/5006 Installations (3). The swing arm assembly shall be three Schedule 40 PVC 90 Degree Street Elbows designed to rotate in all directions, as shown on drawings. The nipple length shall be 10 inches.

a. Swing Pipe Tubing - Pop up sprinkler installation only:
The swing pipe shall be flexible black tubing constructed of virgin linear low-density polyethylene material. The tubing shall have a wall thickness of 0.090 inch It shall have an inside diameter of 0.0490 inch for use with SB Series spiral barb fittings without the necessity of glue or clamps. The model number and logo shall be printed at 12-inch intervals along the length of the tubing. Each 18-inch length of tubing shall be capable of pressure testing at the rate of 100 pounds per square inch (psi) per second to a minimum burst pressure of 475 psi. The tubing shall have an operating pressure rating of 80 psi at 110 degrees F. See standard detail drawing.

Add the following subsection:

01120.11(e) Conduit for Control Systems - Conduit shall be Schedule 40, rigid polyvinyl chloride conduit, meeting the requirements of UL 651. Conduits shall be PVC. Size as required.

01120.12 Automatic Controllers –
Enclosures:

1) Weathermatic SmartLine Controller Enslosure – SLPED-ENC
2) Strongbox MPE with Enclosure SB-1852SS
   a. May be used per City Approval

Flow Sensor - Add the following to end of definition:

- Flow sensor shall be SFSI-T15, SLFSI-T20,or SLFSI-B15, as manufactured by Weathermatic. Size as required.The flow sensor shall be installed with a minimum of 10 diameters of straight pipe upstream, and a minimum of 5 diameters of straight pipe downstream to eliminate irregular flow profiles caused by valves, fittings or pipe bends.
- The flow senor shall be installed in a valve box or meter pit of sufficient size to provide access to the flow sensor for service.
- The installed sensor shall require a minimum clearance of approximately 4 inches (100 mm) above sensor for removal of the electronics housing. 3301 W. Kingsley Road • Garland, TX 75041-2207 • Phone: 888-484-3776 Weathermatic.com
- Watertight Wire connections shall be made in the valve box using industry accepted methods and sealing products. The maximum wire run between flow sensor and the controller shall be 2,000 feet if a 20/2 twisted pair shielded cable is used.
- Flow sensor wire shall be run inside gray Schedule 40 PVC conduit no smaller than ¾ inches. Any change in direction shall utilize a sweep.

Smart Link AirCard –Model SL-AIRCARDFLOW-M1NA or M1NA-EXT, as manufactured by Weathermatic Garland, TX 75041 for installation inside of the steel controller enclosure an SL-HG-ANT-LTE Antenna is required to ensure cell signal.

- A cellular network connection must be provided via manufacturer's recommendations with a minimum 1-year service connection following handover to City. Aircard shall have flow activated, connected, and field verified. Enclosures will require the installation of an external antenna to achieve the required connectivity. An external wireless weather sensor shall also be provided with installation location approved by City ~~in a location~~, clear of obstructions per specifications.

Add the following subsection:

(a) Automatic Irrigation Controllers
The controller shall be an EPA WaterSense approved weather based ET controller, with a built-in scheduling engine. The irrigation controller shall be a SL4800 SmartLine Controller manufactured by Weathermatic Garland, TX 75041. The ET controller will be approved by The City of Bend and have the following minimum specifications:

(1) Hardware - The Controller shall be UL-listed and have a minimum 3-year warranty.

(2) Weather Station

- Weather data shall be provided to the controller by a SLW5 Wireless weather station manufactured by Weathermatic Garland, TX 75041 . Weather station shall be mounted on a galvanized post near the controller enclosure at least three meters from ground surface and with an unobstructed West/ S.West exposure. \
- Weather data shall be delivered daily and wirelessly to each controller from a local or onsite weather sensor to calculate accurate ET.
- The communication system shall be able to detect if weather data is received by the controller and engage a backup process to re-send weather data as needed
- The controller shall have the capability to be compatible with any controller-associated weather data sensors and equipment such as “Freeze Clicks,” soil moisture sensors, flow sensors and other weather or water conservation- related data collectors and sensors.

(3) Controller Programming

- Controller shall have station-/zone-specific scheduling capability
- Controller shall include a scheduling engine that uses plant, soil, slope, sprinkler precipitation rate and sun exposure settings to automatically calculate a daily irrigation schedule.
- Controller shall use a maximum allowable depletion (MAD) model FOR EACH ZONE to determine watering days and ‘skip’ (non-watering) option days.
- MAD shall be able to be custom programmed by user or automatically generated by controller.
- Controller shall provide ‘water rationing’ that assures each zone gets a rationed minimal amount of water, if a defined ‘water window’ is insufficient to allow watering to be completed to all zones. Controller shall automatically create cycle and soak sequences for user, based on soil and slope settings.

- Controller shall have the ability to be % (percent) adjusted plus (+) or minus (–) per each station. Controller shall have the ability to run multiple programs at the same time (overlap).
- Controller shall calculate and allow for run times at a resolution of 10-second intervals or smaller.
- Controller shall allow for two programs using set day pattern assignments, including day of week and odd /even day interval. Controller shall allow ET mode to be ON or OFF by station.
- Controller shall have a 'Rain Pause' feature that allows a pause for up to 100 days.
- Controller shall be capable of being operated manually at any time.
- Controller shall have an internal non-volatile memory that will retain the irrigation schedule for a minimum of 10 years without power. A 9 VDC rechargeable battery and recharging circuit shall be included for counting down the program-in-progress during a power outage and shall allow programming of the controller when it is disconnected from the main power supply.

(4) History

- Controller shall be approved by The Irrigation Association's SWAT, (Smart Watering Advanced Technology) Testing Protocol of 100% efficiency and 0% runoff.
- SWAT protocol test results must include actual method of sending/receiving ET to the controller, in the manner being deployed in the field, as part of test results
- Controller shall have a minimum of five public agency studies proving quantified water savings and dry weather runoff reduction.

01120.17(h)(2) Automatic Control Valves – Add the following to the subsections:

a. Remote Control Valves – 100-PE-B, 150-PE-B, 200-PE-B-By Rain Bird Sprinkler Mfg. Corporation, Glendora, California. Provide a scrubber valve (PE-S) for applications where the water supply is not from a potable water source (i.e., dedicated irrigation wells or from surface supplies such as canals) for the 1-inch, 1-½-inch, and 2-inch electric remote control plastic valves.

b. Valve Tags – Each valve shall be number-tagged (Rain Bird Part No. VID1Y24 or brand and part number corresponding to approved equal.)

01120.18 Valve Boxes and Valve Protective Sleeves – Add the following to the end of the subsection:

(a) Carson Box Model 1730 –double check valves. These shall be one-piece plastic with fiber-reinforced plastic cover. Provide brick supports, one (1) under each corner of the box.

(b) AMTEK 12STD PLS – for Remote Control Valves or Manual Valves. These shall be one-piece plastic, 11 x 17-inch, with fiber-reinforced plastic cover, marked with "IRRIGATION." Provide brick supports, one (1) under each corner of box.

Add the following subsection:

01120.22 Sprinklers:

(a) 6504 Full or Part Circle Pop-Up Rotor – Falcon 6504 by Rain Bird Sprinkler Mfg. Corp., I-25 by Hunter Industries, or approved equal. The sprinkler shall have the following:

- The sprinkler shall have a screen attached to the drive housing to filter inlet water, protect the drive from clogging, and simplify its removal for cleaning and flushing the system.
- The sprinkler body shall have a double-wall construction 1-inch Female National Pipe Thread (FNPT) bottom inlet.
- The sprinkler shall have a standard rubber cover that designates the full circle sprinkler from the top, as well as designates each adjustment opening from the top.
- The sprinkler shall have a factory-installed nozzle as specified on the drawings.
- The angle of trajectory shall be 25 degrees from the horizontal.
- Rotor nozzles shall be installed to result in a matched precipitation rate on each zone.

(b) 5006-PC SAM 5006-FC-SAM Full or Part Circle Pop-up Rotor –-5006PC SAM 5006-FC-SAM by Rain Bird Sprinkler Mfg. Corp., PGP Ultra by Hunter Industries, or approved equal. The sprinkler shall have the following:

- Must have internal pressure regulation R-series
- Arc adjustment from the top
- Water-lubricated gear drive design
- Standard rubber cover
- 40-360 degree arc rotation and reversing full circle rotation
- Standard angle nozzle providing 23 to 40 feet distance of throw
- Radius adjustment screw allows 25% radius reduction without changing nozzle
- 6-inch pop-up
- Additional o-rings and seals for extra protection in “gritty” water
- 3/4-inch NPT female bottom-threaded inlet
- Seal-A-Matic pressure regulating check valve option included
- Nozzle as shown on drawing
- Rotor nozzles shall be installed to result in a matched precipitation rate on each zone.

(c) Pop up sprinkler bodies – 1804-SAM-PRS, 1806-SAM-PRS, 1812 SAM-PRS by Rain Bird Sprinkler Mfg. Corp.,or Pro-Spray PRS40 by Hunter Industries, or approved equal. The sprinkler shall have the following:

- Seal-A-Matic pressure regulating pop-up spray sprinkler:, 6-inch, or 12-inch pop-up spray shall be used when indicated on the design
- Sprinklers shall have a Seal-A-Matic check valve and a pressure-regulating device. These units shall be identifiable from the top with SAM-PRS markings on the cap.
- 6-inch pop-up spray shall use the bottom inlet

- Pro-Spray PRS 40 shall only be used with Mp Rotator nozzles, RainBird PRS 45 bodies shall be used with RainBird R-VAN nozzles. The PRS 40 sprinkler body shall not be mixed with Rain Bird PRS 45 or Rain Bird PRS 30 bodies.

(d) MP1000, MP2000, and MP3000 – MP Rotator Adjustable arc, adjustable radius matched precipitation rate sprinkler – By Hunter Industries,The sprinkler shall have the following:

- The sprinkler shall be the viscous fluid brake rotary type and produce multiple rotating streams.
- The sprinkler shall produce and maintain a matched precipitation rate no greater than 0.6 inch per hour throughout the arc adjustment range and radius adjustment range (up to 25% of radius reduction) when spaced at 50% wetted diameter.
- The part circle sprinkler shall have an infinitely adjustable arc between 90 and 210 degrees or between 210 and 270 degrees, depending on the model selected. The full circle sprinkler shall irrigate a full 360 degrees.
- Full or part circle sprinklers shall be capable of up to 25% radius reduction using a stainless steel radius adjustment screw on top of the nozzle. The radius reduction screw shall have a slip clutch mechanism to prevent internal damage if turned past the minimum or maximum radius settings. The radius reduction screw shall reduce the pressure and flow upstream of the nozzle, thereby maintaining stream integrity.
- Part circle sprinklers shall have arc adjustment capabilities using a stainless steel ring at the top edge of the nozzle. The adjustment ring should be effective only while the sprinkler is popped up and ineffective while the sprinkler is not popped up. When turned past the minimum or maximum arc limits, the adjustment mechanism shall have a slip clutch action to prevent internal damage. This same slip clutch shall allow the orientation of the fixed edge of the variable arc when installed on a fixed riser or in a pop-up body. This is independent of and in addition to any ratchet that may exist in a pop-up body.
- The sprinkler shall have a pop-up that occurs at approximately 40 PSI of water pressure, using PRS pop up style sprinkler bodies. Upon cessation of water pressure, the sprinkler shall pop down. When installed in a pop-up body, the sprinkler pop-up shall occur after the pop-up of the body stem. Upon decreasing pressure, the sprinkler pop- down shall occur before the pop-down of the body stem.
- The sprinkler nozzle orifice shall be manufactured from urethane material for durability. The sprinkler shall be fitted with a detachable filter stem.
- Sprinkler assembly models MP1000, MP2000, and MP3000 shall be able to be installed in pop-up sprinkler bodies having a 5/8-27 UNS male threaded stem (Rain Bird) and nominal pop-up heights of 2”, 3”, 4”, 6”, or 12”. Sprinkler assembly shall also be able to be attached to a ½ FIPT x 5/8-27 UNS male threaded adapter (Rain Bird) for use on fixed pipe risers. Models MP1000T, MP2000T, and MP3000T shall be able to be installed in pop-up sprayhead bodies having a 5/8-28 UNS female threaded stem (Toro) and nominal pop-up heights of 2”, 3”, 4”, 6”, or 12.” Sprinkler assembly shall also be able to be attached to a ½ FIPT x 5/8-28 UNS female threaded adapter (Toro) for use on fixed pipe risers.(e) PA-80 Plastic Adapter – The plastic adapter shall have a ½-inch Male National Pipe Thread (MNPT) outlet and a fine threaded female inlet that will accept an 1800 pop-up stem, thus adapting the 1800 Series sprinkler for use with various ½-inch FNPT sprinklers and nozzles.

(f) RWS Root watering system RWS-M-B-1402 by Rainbird or Hunter RZWS-18 will be used for street tree irrigation. Trees shall have one RWS installed on both sides of the tree rootball. RWS and street trees must be plumbed on a separate irrigation zone.
Add the following subsection:

01120.23 Double Check Backflow Prevention Assemblies – Install Watts 007 Series or approved equal on all new systems. Size as required. Permanent test fittings with threaded protective caps to keep out debris shall be installed.

Add the following subsection:

01120.40(a)(3) Blowouts – Install a 1" quick coupler blowout connection point to facilitate winterization by the use of compressed air on all electric solenoid controlled underground irrigation systems. The entire system shall be manually drainable. Install blow out fittings down stream of the backflow, master valve and flow sensor see City of Bend detail for Point of Connection layout. . The end point of each underground mainline circuit 4 inches or larger shall be equipped with a 4-inch x 2-inch mechanical tap cap, 2-inch x 36-inch galvanized nipple, 90 degree fitting, and a brass ball valve. The valve shall be installed with a valve box. See typical drawings for installation details.

01120.43 Piping – Add the following paragraphs to the end of the subsection:

Provide for thermal movement of components in the system. Use threaded nipples for risers to each sprinkler to facilitate easy replacement. Use swing joint riser or swing pipe as specified.

Concrete thrust blocks shall be provided at changes in direction of mainline piping and at the end of mainline piping with the bearing surface against undisturbed soil normal to the direction of the thrust on pipes 3 inches or greater in diameter.

01120.44(c) PVC Pipe –

All pipe joints shall be solvent welded and made according to ASTM D 2855-83 Standard Practice for Making Solvent-Cemented Joints with PVC Pipe and Fittings. Solvent welded joints shall be installed by workers qualified and experienced in the joining of PVC pipe and materials. Threaded joints shall be made with polytetrafluoroethylene sealant. Mechanical joints shall be installed on pipe larger than 3 inches in diameter. Irrigation valves on mainlines 3 inches and larger shall be installed using FIPT FLO PVC saddles sized appropriately. (Example: 4-inch pipe would use a 4-inch x 2-inch FIPT.) Pipe used for irrigation systems must be Sched 40 PVC IP for all main and sprinkler lateral lines, for durability.

Add the following subsection:

01120.45(h) Drain Pockets – Excavate a minimum of 10 cubic feet. Backfill with drain gravel to 12 inches below grade. Cover with geotextile and 6 inches of topsoil.

01120.46 Low Voltage Electrical Installation – Add the following paragraphs to the end of the subsection:

Provide one control circuit for each zone. All exposed wiring above grade, including, low voltage control wiring, shall be in conduit. Provide a 2-inch minimum conduit for future phone or telemetry connections.

Provide 16-gauge insulated 'trace wire' for locating lateral irrigation lines. All splices shall be waterproof conforming to manufacturers specifications. Coil wire ends in the valve box 24" total length before coiling.

Irrigation station wiring shall be 14 AWG direct burial rated single strand wire. Wire should be laid 4-6" off the irrigation mainline in the same trench. Common wire should be white, spare wires should be a separate color and easily distinguishable from active station wires (i.e. black). The number of spare wires shall be a percentage 20% of the total zones installed in a controller up to six spare wires.

01120.49 Backfill – Add the following paragraph to the end of the subsection:

The minimum horizontal clearance between lines for piping 2 inches or less is 4 inches, and 12-inch minimum clearance for 2-1/2-inch and larger pipe. The minimum vertical clearance between pipe shall be 4 inches.

End of Section

Section 01140 - Potable Water Pipe and Fittings

Comply with Section 01140 of the Standard Specifications modified as follows:

01140.00 Scope – Replace this subsection, except for the subsection number and title, with the following:

The Contractor shall secure and comply with all applicable City, County, and State permits including Construction Safety and Health Standards. Prior to installing a water facility in an unimproved street, the street shall be brought to subgrade to ensure that adequate bury, depth of cover, and utility separation is provided.

This section covers the work necessary for furnishing and installing water pipe and fittings normally used for water distribution systems. Water line depth from finished grade to top of pipe shall be a minimum of 36 inches and a maximum of 72 inches.

Proposed corrosion protection measures shall be approved by the City Engineer prior to final design.

01140.10 Materials – Replace this subsection, except for the subsection number and title, with the following:

Furnish Materials meeting the following requirements:

- Unless otherwise specified, all materials shall be new of U.S.A. domestic manufacture with the certification of the country of origin. Materials shall meet all AWWA standards and applicable City, County, and State code requirements, for the specified materials.
- Piping materials used in pump station, meter vault, or control valve applications shall be approved by the City Engineer on a case-by-case basis.
- All fittings being purchased by suppliers shall be purchased directly from the Manufacturer.
- Mechanical joint C153 ductile iron fittings shall be marked with the Manufacturer's name.
- Mechanical joint water main fittings with accessories, 4-inch through 36-inch, shall be manufactured in accordance with and meet all applicable terms and provisions of standards ANSI A21.10 and AWWA C110 and ANSI A21.11 and AWWA C 111, current revisions. Mechanical joint fittings 4- through 24-inch shall be rated for 350 psi working pressure and fittings 30- and 36-inch shall be rated for 250 psi working pressure. Mechanical joint fittings with 14-inch or larger caps and plugs shall be rated for 250 psi working pressure, and 4- through 12-inch minimum size UL listed and marked for Fire Main Equipment. Cement-lined and seal-coated fittings shall meet ANSI A21.4 and AWWA C104 standards. All coated and lined fittings shall meet requirements of NSF-61.
- Approved Manufacturers: Tyler Pipe, Union, Clow, and American Iron Pipe Co.

(a) Ductile Iron Pipe – Ductile iron pipe shall be centrifugally cast in metal molds and cement-lined in accordance with AWWA specification C151-76. Push-on type joint pipe shall be used except where conditions require mechanical joints as shown and approved on plans. No material shall be shipped inside coated pipe. Pipe shall meet the following specifications:

(1) 4-inch through 12-inch I.D., Class 52 Ductile, AWWA Specification C151-76 DI pipe.

(2) 14-inch I.D. and larger, Class 50 Ductile, AWWA Specification C151-76 DI pipe.

Approved Manufacturers: U.S. Pipe, Pacific States Pipe, American Pipe and Griffin Pipe.

(b) Service Pipe – Service lines from the main to the meter stops and 6 feet beyond meter box shall be as follows:

I.D.	Type
1" and smaller	Type K soft annealed copper tubing (non-rigid)
1 1/4 " and larger	Ductile iron or rigid copper (Type K-hard)

(c) Service Saddles – Service saddles for 2-inch water services shall be used on existing and new water lines. Where service saddles are allowed, they shall be Mueller double strap DR2S, Romac 202S, or as approved by the City Engineer. The brass nipple between saddle and valve is to be installed horizontally; saddle bolts shall be torqued to manufacturer's specifications. If a 1-1/2-inch service is desired by the customer, this reduction shall be made within the 2-inch meter setter.

(d) Saddle Tap – Bit size shall be as follows: ¾-inch tap – 11/16-inch bit, and for a 1-inch tap – 15/16-inch bit. All bits to be Mueller or equal, and approved for tapping cast iron, DI, galvanized and steel pipe.

The tapping machine shall be a Mueller #E-5, #D-5, or equal.

(e) Direct Tap – All bits to be Mueller AWWA tapered thread combined drills and taps or equal, and must be approved for tapping cast iron and DI water mains. All taps shall be made with a Mueller B-101 drilling and tapping machine or equal.

(f) Pipe Fittings

(1) Buried – Buried ductile iron fittings with mechanical joints shall meet ANSI 21.10, 250 PSI working pressure, with full body glands (AWWA C-110/C-153), bolts, and gaskets in accordance with ANSI 21.11. A non-toxic vegetable soap lubricant shall be supplied in sufficient quantities for installing the pipe. Lubricant must meet the appropriate AWWA Standards.

(2) Aboveground – Aboveground ductile fittings with threaded flanged joints or restrained joint meeting appropriate ANSI specifications, 250 PSI working pressure, bolts and gaskets in accordance with appropriate ANSI specification.

(3) Solid Sleeves – Solid sleeves 4- to 12-inch in diameter must be a minimum of 12 inches long; 14-inch-diameter or larger must be the long pattern. All solid sleeves must be standard Pacific States (Union /Tyler Foundry) or U.S. Pipe M.J. DI sleeve. Appurtenances shall be of same manufacturer.

(g) Plugs/Caps – Shall be mechanical joint DI and properly restrained.

(h) Special Coatings and Linings – Special coatings and linings shall be approved by the City Engineer prior to the time of purchase.

(i) Concrete for Thrust Blocking – Concrete for thrust blocking shall conform to ASTM C 94, Alternate 2, and shall be proportioned to obtain a 28-day compressive strength of 2500 pounds per square inch. “Sacrete” type products are not allowed.

(j) Marking Tape – Marking tape shall consist of inert polyethylene plastic impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the Soil. Marking tape must be minimum 2 inches wide, APWA blue, and stretchable to a minimum of five times its original size. The tape shall be imprinted continuously over its entire length in permanent black ink with the words "Caution - Water".

01140.11 Handling Pipe and Fittings – Add the following to the end of the subsection:

No more pipe material shall be strung on job than can be installed in one shift. Material that is rejected at the point of delivery because of defects or damage shall be replaced by the Contractor. Material damage subsequent to acceptance by the Engineer or the City shall be replaced by the Contractor.

01140.41 Laying Pipe – Replace this subsection, except for the subsection number and title, with the following:

(a) General – Lay pipe to the lines and grades shown and established or as directed by the Engineer. Where field conditions require deflection or curves not shown, the Engineer will determine methods to be used. Fittings, valves, air release valves, and hydrants shall be installed at the designed locations with joints centered, spigots fully inserted, and valve and hydrant stems plumb.

(b) Push-on Joint Pipe – Ductile iron pipe with rubber gasket Tyton and/or Fastite type joints shall be laid and jointed in strict accordance with the manufacturer’s recommendations and in accordance with the requirements of these Specifications. Deflection limits shall conform with Figure 1. For pipe sizes not listed, maximum deflection shall be one-half the manufacturer’s maximum deflection.

Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer.

Once installed, rubber gaskets cannot be recovered and reused and must be discarded.

(1) Push-on Joint Restraints for Ductile Iron Pipe – Push-on joints shall be restrained using Field Lok gaskets for Tyton joint pipe and fast grip gaskets for Fastite joint pipe, using stainless steel locking segments vulcanized into the gaskets.

(2) Approved Manufacturers of Mechanical Restraints – EBBA Iron 1100 Series “Mega-Lug,” Romac “Romagrip”, and Ford Meter Box “Uni-Flange”.

Maximum Deflection of Tyton Gasket Joint Pipe (Based on 18-Foot Pipe Length)

Pipe Size	Bend in One Joint Angle A	Deflection in Inches D	Approx. Radius in Feet of Curve Produced by Succession Of Joints

6”	2° 00’	8”	450’
8” through 12”	2° 00’	8”	450’
14” through 24”	1° 30’	6”	650’

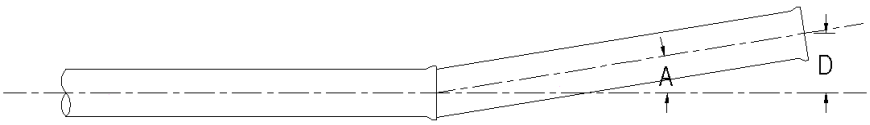


Figure 1
Pipe Deflection

(c) Screw Joint Pipe – Screw joint pipe threads shall be thoroughly cleaned by wire-brushing, swabbing, or other approved method. Approved joint compound shall be applied to the threads prior to making the joint. Joints shall be watertight at test pressures before acceptance.

(d) Installation of Mechanical and Flexible Couplings – Mechanical and flexible couplings shall be provided where indicated on the plans and shall be installed in accordance with the manufacturer’s recommendations. Before pipe lengths are joined, the ends of each pipe shall be thoroughly cleaned of oil, scale, rust, and dirt for a minimum distance of at least 8 inches from the end. Gaskets shall be wiped clean and lubricated with pipe lubricant for installation on the pipe ends. Coupling bolts shall be tightened progressively, drawing up bolts on opposite sides until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other approved wrench type. Mechanical and flexible couplings shall be tested when the tests on the adjacent pipe are made. If the couplings do not pass the requirements of the leakage tests, the couplings shall be removed and reassembled on the pipe, and the leakage test shall be repeated. Deflection shall be in conformance with Figure 1. For pipe sizes not listed, maximum deflection shall be one-half the manufacturer’s maximum deflection.

Maximum Deflection of Mechanical Joint Pipe
Safe Deflection for 150 PSI[1] based on 18-Foot Pipe Length (see Figure 1)

Pipe Size	Maximum Joint Angle A	Deflection in Inches D	Approx. Curve Radius produced by maximum angle
8”-12”	2º 00’	8”	450’
14”-16”	1º 45’	7”	590’
18”-20”	1º 30’	5”	685’
24”	1º	4”	1000’

NOTES:
1. For test pressures above 150 psi, reduce the tabulated deflection by 10% for each additional 150 psi.

(e) Tapping – Tapping of City mains shall be done when the air temperature is at least 35°F and rising. When the air temperature is between 20°F and 35°F, taps may be permitted by the Engineer if the tapping bit is protected and heated to 35°F or above. If a heated tapping bit is used, the work must be backfilled immediately upon completion.

(f) Hot Taps – When appropriate and/or shown on the plans, branches and large services may be connected to existing City of Bend water lines by using a tapping sleeve and tapping valve. This procedure shall be performed only by a City-approved contractor and said approval shall be obtained from the City Engineer or their authorized representative at least 48 hours in advance of performing the hot tap. No pipe shall be exposed for tapping without a City representative onsite.

All hot tap sleeve and tee assemblies shall be air tested prior to start of tapping operation.

(Update paragraph below if there are specific hot taps that need to occur outside of the stated hours.)

Hot taps shall be scheduled only during the hours of 7:30 AM to 3:00 PM, Monday through Friday, including trench backfill.

Size on size taps are not allowed. For cast Iron, PVC, and Steel mains, the tap size shall not be larger than half the diameter of the existing main.

(g) Tapping Sleeve Requirement –Tapping sleeves shall be stainless steel sleeve, JCM 432, Romac SST III (with stainless steel flanges), Muellller H-304, Smith Blair 665, or approved equal.

01140.44 Thrust Restraint – Replace this subsection, except for the subsection number and title, with the following:

(a) Thrust Blocking – All additions and alterations to the City of Bend water system shall incorporate mechanical restraint systems into their design. Thrust blocking and the use of a deadman to supplement mechanical restraints are only allowed with the approval of the City Engineer and must be designed by the Engineer of Record and detailed on plans.

(b) Thrust Blocking Materials – Refer to Section 01140.10(i) above.

(c) Anchorage – Reaction or thrust blocking shall be placed as shown on the plans. Blocking shall be placed between the undisturbed ground and the fitting to be anchored. Reaction blocking shall be placed so as to allow access to fitting joints unless specifically shown otherwise on the Plans. The pipe and joint fittings shall be wrapped with 6 mm plastic sheeting before placing concrete.

(d) Existing Thrust Blocks – No existing thrust blocks shall be removed by Contractor unless a City of Bend representative is on site for inspection and coordination.

01140.45 Marking Tape and Wire – Replace this subsection with the following subsection:

01140.45 Marking Tape – Install marking tape over all mains and services. Place marking tape 1 foot above the top of pipe for its full length, centered on the pipe.

01140.48 Maintaining Service – Add the following:

(c) Connections of new mains shall be made within 30 days of acceptable chlorination and pressure testing unless otherwise approved by the City Engineer.

01140.49 Backfilling – Replace this subsection, except for the subsection number and title, with the following:

(a) Pipe Bedding – The trench shall be excavated to a minimum depth of 6-inches below the pipe to provide minimum bedding. The pipe bedding shall be uniform, at grade, and compacted prior to placing pipe. Trench foundation shall meet the requirements of 00405.44.

(b) Compaction Testing – Refer to specification section 00405.46.

(c) Electrical Continuity – When so stated in the Specifications, the Contractor shall provide adequate means to permit an electric current to pass across all pipe joints. The electrical connection shall be made by driving silicon-bronze wedges between the barrel and the bell of joints using rubber gaskets. Two wedges shall be installed per joint on opposite sides of the pipe on the horizontal centerline. The wedges shall be approximately 1-inch square and shall be tapered from 1/8-inch to 1/16-inch, approximately. The wedges shall have serrated edges to provide good contact. The voltage drop at 500 amperes current flow shall not exceed 1.0 volt per joint.

01140.50 Filling and Flushing - Delete this subsection.

01140.51 Hydrostatic Testing - Delete this subsection.

01140.52 Disinfecting - Delete this subsection.

Add the following subsection:

01140.53 Filling, Flushing, Disinfection, and Hydrostatic Testing:

(a) Certification – The Contractor's employee responsible for conducting these tests shall be approved by the City of Bend. This person shall be present at and shall supervise all phases of these procedures.

Prior to testing, the Contractor shall be certified by the City of Bend Water Division. This Certification shall be contingent upon the Contractor passing a standard test prepared by the City. This test shall prove the Contractor's organizational ability of the steps required for chlorinating/flushing/testing; and a field demonstration of their techniques.

The metering device used in chlorination and/or pressure test procedures must have been certified by the City Water Division within 6 months of the test.

(b) Testing Procedures – Testing shall not occur until the following conditions have been met: 1) All excavation, installation, and backfill of structures, piping, and utilities has been completed, and 2) All compaction tests have been received and reviewed by the City. Testing procedures shall be conducted between 7:30 AM and 3 PM unless otherwise approved by the City inspector Monday through Friday. Pressure testing shall be scheduled so completion is within these normal working hours. Chlorine and pressure tests shall be performed between 7:30 AM and 3 PM when the temperature is, or is expected to be, no less than 33ºF. Chlorine tests require a minimum of 24 hours duration.

No water testing shall occur until sewer and storm facilities have been tested, including CCTV, to the satisfaction of the Private Development City Engineer and/or inspector on all Private Development projects. Deeper utilities shall be tested first unless otherwise approved by the City.

When testing cannot occur during the times noted above, submit a written request to the City at least 7 Calendar Days prior to the test noting the requested start and end time of and a description of why the test cannot be completed within the times noted above.

The Contractor shall not operate any valve connected to City water lines or take any action that would affect the operation of the existing system except with a City representative present, and only at that representative's express direction.

For flushing and testing of water service connections 2-inches and smaller, refer to Specification Section 01170.50 and 01170.51.

(c) Length of Test Section – Limit sections to be tested to 1,000 feet, unless otherwise approved.

(d) Flushing – The Contractor shall be responsible for all pipeline flushing, including but not limited to flushing air from service and main lines at time of chlorination, flushing chlorination water after all chlorination and rechlorination. System flushing procedures shall meet all State and Federal requirements for discharge and disposal.

Following removal of all air in the system, the Contractor shall thoroughly flush all lines with potable water. Flushing velocity shall not be less than 2 feet per second (fps). Flushing is considered completed when the system chlorine residual matches the background chlorine residual level of the City system at that point.

A portion of the flushing process for chlorinated systems may, after start-up with the Inspector, be completed by the Contractor without the Inspector being present. After chlorine residual testing on the City system and the chlorinated systems has been done and the inspector has operated the necessary valves, the Contractor may independently complete the test. The Contractor will be furnished with appropriate forms to be completed as verification that the test results have been completed and the results are in compliance with City's Standards & Specifications.

(e) Chlorination – The Contractor shall be responsible for installation of chlorine taps at the terminal points of all lines, including all dead end lines. Taps may also be required on high points to vent trapped air. Tap location and placement shall be coordinated and observed by the City of Bend. With Inspector approval, fire hydrants may be used as a chlorination injection point.

At connections to existing mains, the maximum allowable distance for hand chlorination of the new main shall be 20-feet.

Chlorine Application – Apply sodium hypochlorite, commercial grade (12.5 percent Cl). This liquid chlorine compound may be used full strength or diluted with water.

Before chlorination, the City Representative shall witness all valves being opened in the system being chlorinated.

The City Representative shall collect all samples for chlorine residual testing as follows:

(1) After chlorination (beginning of test initial value).

(2) Prior to the chlorination solution being flushed at the end of the 24-hour test period (finish value).

(3) After the system has been thoroughly flushed and refilled.

A maximum of 60 parts per million (ppm) and a minimum of 25 ppm of free residual chlorine are the acceptable limits for the initial test. Any residual above or below acceptable initial limits shall be grounds for restarting the chlorination test. If the finished residual value varies by 60% or more than the starting value, the test shall be deemed to have failed and rechlorination shall be required after thoroughly flushing the line.

If after three chlorinations no passing level is obtained, the line shall be deemed contaminated, be removed, and replaced by the Contractor at their expense.

After testing, chlorination taps must be removed and plugged at the main.

(f) Bacteriological Testing – Comply with AWWA C651.

(g) Pressure Testing – Comply with AWWA C600.

(h) Flow Testing – The Contractor shall flow test all services and hydrants for a minimum of 2 minutes prior to acceptance of the system by the City. Flow testing equipment shall be checked and approved by the City and the test conducted under direct supervision of the City. Test reports shall provide the following information:
Hydrant flow in gallons per minute (gpm)
Hydrant static pressure
Station of hydrant
Service line flow in gpm
Lot and block of service

(i) Other Tests – The City Representative may require other tests, such as volatile organic compounds, inorganic chemicals, or synthetic organic chemicals, if there is reason to believe the line has been contaminated by such compounds. The costs of these tests can be substantial and shall be borne by the Contractor. Failure to pass such other tests shall be grounds to reject the work and cause it to be replaced.

(j) Cleanup – Upon completion of the testing and acceptance of the tests by the City of Bend, the Contractor shall clean the area as directed by the City.

01140.80 Measurement – Replace this subsection, except for the subsection number and title, with the following:

(a) Pipe – Pipe length shall be measured horizontally from centerline to centerline of valves, fittings or to the end of the pipe, whichever is applicable. Measurement of the various depth classes as stated in the Bid Schedule shall be from the pipe invert as

constructed to the design subgrade elevation or the finished ground surface at the point of measurement.

(b) Fittings Measurement – Measurement of fittings shall be made on a unit price basis for the type, kind, and size specified and installed. No separate or additional payment shall be made for couplings, joint lubricant, nuts, bolts, washers, and other fitting-related hardware or supplies.

(c) Thrust Blocks – Measurement for thrust blocks shall be made on a unit price basis for each thrust block installed.

(d) Testing and Disinfection – When neither specified nor listed in the proposal for separate payment, flushing, chlorination, and testing shall be considered incidental work for which no separate payment shall be made.

(e) Incidental Basis – Items not listed in the Bid Schedule shall be considered incidental work for which no separate payment shall be made.

End of Section

Section 01150 - Potable Water Valves

Comply with Section 01150 of the Standard Specifications modified as follows:

01150.10 Materials – Replace this subsection, except for the subsection number and title, with the following:

(a) Resilient Seated Epoxy Coated Gate Valves – Buried epoxy-coated iron body gate valves shall meet AWWA standards (C-509 and C-515), have non-rising stems, be rated at 200 pounds (lb) working pressure and 350 lb hydrostatic pressure, open left – 2-inch-square operating nuts, resilient seat, with brass fittings, "O" ring stem pressure seals, non-directional, mechanical joints with full body glands (AWWA C-110); as manufactured by Mueller, Kennedy, Waterous, CLOW, or American Flow Control, and as approved by the City Engineer.

Aboveground or in-vault gate valves shall be equipped with hand wheels.

(b) Butterfly Valves – Butterfly valves shall meet the requirements of AWWA C-504 latest revision, Class 150B mechanical joint etc., except worm gear operators are not permitted. Valves shall be Mueller line seal seat in body, Kennedy style 4500, M&H/Clow style 4500, or approved equal. The valve can be domestic or non-domestic, unless contractually obligated otherwise. Where 18 inches of cover cannot be obtained from operating nut to finish grade, butterfly valves shall be required. Butterfly valves shall be used on all water lines of 10-inch size and larger, or where 24 inches of cover cannot be obtained on smaller mains.

Aboveground or in-vault butterfly valves shall be equipped with hand wheels.

(c) Valve Boxes – Valve boxes shall be an East Jordan Iron Works #00363912 18-inch box rated at 3500 psi (see Standard Drawing W-30). The valve box shall have a 7-inch I.D. with a 12-inch flange on the top, and a lid with raised letters on the top reading: "Bend Water" as shown in the Standard Drawings.

The East Jordan Iron Works series #00363912 shall have a section of PVC 3034 placed below the 18- inch box with a 6-inch to 12-inch overlap. It shall be cut to the proper length to allow adjustment in the depth of cover.

(d) Check Valves

(1) Swing Check Type – Swing check valves shall be bronze-mounted with cast or ductile iron body with outside lever and spring unless otherwise specified.

(2) Spring Loaded Plug or Disc Type – Spring-loaded plug or disc type check valves shall be bronze-mounted with bronze, cast, or DI body, bronze plug or disc, stainless steel spring, and resilient seal suitable for clear cold water service. The plug or disc of the check valves shall be easily removed and replaced.

(3) Hydraulic Cushion Type – Hydraulic cushion type check valves shall be of bronze, cast or ductile iron, with bronze disc and disc faces, seat rings, and pivot pins.

The valve shall provide drop-tight sealing. The valve shall be provided with an adjustable speed, integrally mounted oil dashpot mechanical snubber system.

01150.40 General – Add the following to the end of the subsection:

(d) General – Before installation, valves shall be cleaned of all foreign material and inspected in open-closed position. Unless otherwise indicated, gate valves shall be mounted with the stem vertical. Butterfly valves shall be mounted with the stem vertical and on the 'curb' side of the main. Horizontal valves shall be mounted in such a manner that adequate clearance is provided for operation. Installation practices shall conform to the manufacturer's recommendations.

(e) Valve Boxes – A metal valve box shall be provided for every valve unless the valve is located in a vault. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve. The box cover shall be flush with the surface of the finished pavement or such level as may be directed by the Inspector.

01150.80 Measurement – Add the following subsection:

(a) Incidental Basis – When neither specified nor listed in the proposal for separate payment, valves shall be considered incidental work for which no separate payment shall be made.

01150.90 Payment – Delete the paragraph that begins "No separate or additional…" and replace with the following:

No separate or additional payment will be made for:

- earthwork not covered under other Pay Items
- jointing
- blocking of valves
- protective coatings
- valve boxes
- valve box extensions
- valve operator extensions
- valve reconnections
- hydrostatic testing

When neither specified nor listed in the proposal for separate payment, valves shall be considered incidental work for which no separate payment shall be made.

End of Section

Section 01160 – Hydrants and Appurtenances

Comply with Section 01160 of the Standard Specifications, modified as follows:

01160.10 Materials – Replace this subsection, except for the subsection number and title, with the following:

(a) Hydrants - Traffic model fire hydrants shall meet AWWA specification C-502-64 with dry top. They shall have a center stem compression, 5-¼-inch valve opening, (2) 2-½-inch hose and (1) 5-1/4-inch steamer nozzles with National Standard Threads, 6-inch mechanical joint inlet connection, open left (1) 1-½-inch pentagon operating nut, and gaskets in nozzles. The bury line shall be used as control to ensure proper installation of hydrants. At no time shall finish grade be less than 3 inches below the bury line, or higher than the bury line of the hydrant. If a hydrant is not provided with a bury line, the bottom flange of the hydrant shall be used as control and finish grade shall be set at exactly 4 inches below the bottom flange, or as directed by the City's representative. Hydrants shall be Mueller Super Centurion 250, Kennedy Guardian, or approved equal.

(b) Hydrant Extensions - Hydrant extensions shall not be allowed on any City of Bend fire hydrant.

(c) Drain Rock – Drain rock for under fire hydrants shall be commercially available 2" – 4" crushed or river run drain rock free of organic matter, sand, loam, clay, and other small particles that shall tend to restrict water flow through the gravel.

01160.40 Setting Hydrants – Replace this subsection, except for the subsection number and title, with the following:

Inspect all hydrants upon delivery in the field to ensure proper working order. Install hydrants as shown or directed.

(a) Location - Hydrants shall be located as shown on the Plans or as directed by the City Engineer. All hydrants shall have two (2) reference points (swing ties) indicating the face of hydrant, tops of curb, and face of curb. The center of the operating nut on the hydrant barrel shall be set a minimum of 42 inches from face of curb as shown in the Standard Drawings. Hydrants shall be placed outside the pedestrian path of travel so that pedestrians, including people with disabilities, will have access to sidewalks and pedestrian paths.

Hydrants susceptible to traffic shall be protected by a 6-foot-by-6-foot concrete pad and bollards if deemed necessary by the City Engineer.

(b) Position –

(1) No hydrant shall have more than a 6-foot bury. If deeper, no extensions; use bends to gain appropriate height.

(2) All hydrants shall be installed plumb with their nozzles parallel with or at right angles to the curb with the pumper nozzle facing the curb. Hydrants shall be set to the established grade. All hydrants shall be surrounded by a concrete pad as shown on the Standard Drawings. Hydrant pads shall be placed flush with sidewalks and curbs at 2% grade.

(c) Hydrant Drainage – Unless otherwise specified in the Plans or Special Provisions, hydrant drainage shall be provided at the base of the hydrant by placing a geotech mat against the native earth and drain rock from the bottom of the trench to at least 6 inches above the waste opening in the hydrant and to a distance of 1 foot around the bowl. No drainage system shall be directly connected to a storm or sanitary sewer.

(d) Painting – At the direction of the City, hydrants will be re-painted with one coat of rust-preventive enamel paint, at least 6 mils dry film thickness. Paint shall be applied with a brush only. Keep paint off brass components. Color shall be manufacturer's red. . For a typical hydrant drawing, see Standard Drawings. Steel bollards shall be painted red.s.

(e) Service – Once hydrants are installed and prior to placing drain rock, hydrants shall be covered with a minimum 3 mill thickness garbage bag to protect the factory paint finish and to denote the hydrant is out of service. The bag shall remain secured over the hydrant until the hydrant is placed in service.

(f) Hydrant Operation – Following installation, no person shall operate a City of Bend fire hydrant without first obtaining a City of Bend hydrant meter permit.

01160.80 Measurement – Replace this subsection, except for the subsection number and title, with the following:

Measurement shall be made on a unit basis for the type of hydrant specified and installed. When not listed in the Bid Schedule for separate payment, fire hydrants shall be considered incidental work for which no separate payment shall be made.

New pipe for hydrant connections to existing mains and lateral tees will be measured according to Section 01140.80. Gate valves will be measured according to 01150.80.

End of Section

Section 01170 – Potable Water Service Connections, 2 Inch and Smaller

Comply with Section 01170 of the Standard Specifications modified as follows:

01170.10 Materials – Replace this subsection, except for the subsection number and title, with the following:

(a) Refer to Specification Section 01140.10 for service pipe and saddle material requirements. Any services larger than 1 inch shall be attached to the main line using a saddle connection. Service taps on C-900 shall be installed using a Ford S90 tapping saddle or equal.

(b) Fittings for copper shall be 110 CTS or quick joint compression type with stainless steel gripper as manufactured by Ford Meter Box, A.Y. McDonald, Mueller or approved equal.

(c) Meters – The meter will have no moving parts and constructed of a noncorrosive material. The meter will utilize an electromagnetic or ultrasonic measurement system. The meter must meet federal low lead requirements and be compliant with American water works Standard C-700, C-710, NSF/ANSI Standard 61 Annex F-G. The meter must be capable of measuring water flow in cubic feet and show reverse flow. The meter must operate with a maximum working pressure of 175 PSI without leakage, damage or effect on accuracy. A 1” meter will have an allowable pressure loss not to exceed 4 PSI at 30 GPM. The ¾” meter shall guarantee 1.5% accuracy rate at normal operating flows of 3 GPM for the service life of the meter. The 1” meter shall guarantee 1.5% accuracy rate at normal operating flows of 4 GPM for the service life of the meter. The meter will fit within the City of Bend Premises Isolation Program specification. The meter and register must be fully compatible with all ACLARA MTU firmware, factory constructed NICOR ends, Extended Range 2-way transmitting system and the newest available version of ACLARA MTU. The meter shall also be 9” lay length for ¾” meters and 11-inch lay for 1” meters.

When provided by the Contractor, water meters shall be brought to the City for identification stamping prior to installation.

(d) Meter Setters - All 1.5- to 2-inch meters shall use a 2-inch meter setter with a 12-inch height, 17-inch meter spacing, high bypass ball valve with padlock wing, meter support brackets and flanged angle ball valve with padlock wings as manufactures by Mueller, A.Y. McDonald, Ford Meter Box, or approved equal.

(e) Corporation Stop – Corporation stops shall be 110 CTS or quick joint compression type full port ball valve as manufactured by Ford Meter Box, A.Y. McDonald, Mueller or approved equal. CC thread shall be used for direct tapping of ductile iron pipe. MIP thread shall be used for service saddle taps on all other water main material types.

(f) Meter Stop – Angle meter stops shall be 110 CTS or quick joint compression type with padlock wings as manufactured by Ford Meter Box, A.Y. McDonald, Mueller or approved equal.

(g) Meter Boxes – All boxes shall include a CI reader lid. Meter vaults shall be traffic rated. Meter boxes approved by the City of Bend Water Division include:

- Armorcast:
  - Box: 17 x 30 x 18 Polymer Concrete (A6001640)
  - Lid: 17 x 30 Cover with Cast Iron Hinged Lid
- Quazite:
  - Box: 17 x 30 x 18, Flared, Polymer Concrete (PT1730BA18)
  - Lid: 17 x 30 Cover with Hinged Cast Iron Reader Door
- Oldcastle:
  - Box: 17 x 30 x 18, Tapered, Polymer Concrete (PC1730-18)
  - Lid: 17 x 30 Cover with Hinged Cast Iron Lid (FHC173002SW002YBLT)

01170.40 General – Replace this subsection, except for the subsection number and title, with the following:

(a) All services shall have 3 feet of cover.

(b) Bedding and pipe zone material shall be placed 6 inches below and 12 inches above all pipes. The material shall be compacted with hand-held compaction equipment to 95% density as determined by AASHTO T-99, Standard Proctor.

(c) All services shall be flushed of all foreign objects before connecting double check valve.

(d) All services shall be flushed and checked for flow.

(e) Services installed during water line construction and prior to meter placement shall be constructed with temporary meter jumpers and supplied by the Contractor.

(f) Service runs between the corporation stop and the meter setting shall not contain fittings unless approved by the City Engineer.

(g) Electrical continuity shall be provided on all services as shown in the Standard Drawings.

(h) Existing water services to be abandoned must be cut at the corporation stop and removed from the right-of-way. Place a watertight cap on the existing corporation stop. Corporation stops on services larger than 1 inch shall be removed and replaced with a plug at the water main. Whenever possible the water service line including any fittings and valves shall be physically removed from the right-of-way.

(i) All property that is subject of a site plan, or any new construction that is being served by an inadequate water service, shall be required to upgrade the existing water service to City standards. All water services shall have a minimum of 10 feet horizontal separation from any sanitary sewer and “franchise utilites” in the public right of way.

(j) Detection tape shall be installed on all services.

(k) Temporary water use during construction must be metered and shall be protected from backflow using an approved backflow protection device.

(l) Meter boxes shall be installed at each meter. Meter boxes shall be installed as shown on the Standard Drawings. The box shall be elevated to existing ground level or proposed finish grade. Water service meter boxes shall be set with a minimum distance of 18 inches between each water service box. Meter boxes shall be located in landscape areas where possible and shall only be installed within hardscape when approved by the City Engineer. All water services shall have a minimum of 10 feet horizontal separation from any sanitary sewer in the public right-of-way.

(m) Meter Installations – Meter installations shall be constructed as shown in the Standard Drawings. When a meter is not installed at time of completion, a jumper spacer set to the dimension of the proposed meter and backflow prevention device shall be installed to provide service. This jumper shall be a galvanized nipple or Schedule 80 polyvinyl chloride (PVC).

All meter installations shall be constructed with an electric wire jumper of not less than 10 gauge. The material of the electric jumper shall be the same or galvanically compatible with the material of the water service; that is, galvanized wire on galvanized pipe and copper wire on copper pipe.

(n) In areas where new concrete curb is being installed over a water service, stamp all water service locations on the top of the curb with brand "W" for water per Specification Section 00759.50(b).

Add the following subsection:

01170.43 Fire Services – All fire line backflow prevention assemblies, whether Double Check or Reduced Pressure Principle Device, shall include a detector assembly complete with a bypass line with double check or reduced pressure principle device assembly inline and a meter that meets City of Bend specifications.

Backflow assemblies may be installed in the vertical position, provided that the assemblies are spring-loaded and meet the following criteria:

- 4-inch diameter or smaller, and/or specifically listed in the Oregon Health Division's Approved Backflow Prevention Assembly List.
- Recommended by the manufacturer for vertical installation.
- Has the normal flow upward.
- Fire lines shall require backflow protection commensurate with the degree of hazard (per UPC Chapter 6).

Add the following subsection:

01170.44 Backflow Requirements – All services shall have an approved backflow prevention assembly installed commensurate with the degree of hazard for the premises it serves. Backflow prevention shall be in accordance with OAR 333-061-070/UPC Chapter 6 and conditions set forth in the City of Bend Cross Connection Ordinance. Assembly shall be installed on the Owner's side of meter. If approved by the City of Bend Cross Connection Specialist, and the backflow assembly is a Reduced Pressure Principle Device Assembly, it

may be installed immediately inside the building being served. In all cases, the device must be installed upstream of the first branch line leading off the service line. See examples from Standard Details W-15, W-15A, W-15B. Such backflow prevention device assembly(s) shall be installed and approved before water service shall be provided.

Double-check valves to be installed at the time the meter is installed.

All backflow prevention device assemblies, once installed, shall be inspected by the City of Bend Cross Connection Inspector or authorized agent. Prior to acceptance and initiation of service, the device shall be tested by an Oregon State Certified backflow tester with the results forwarded to and received by City of Bend Public Works Cross Connection Program.

(Designer to consider whether backflow prevention device assemblies [e.g. double check valves] should be paid for under Specification Section 01150, 01170, or be incidental to other work and include clarifying language in the appropriate specification measurement and payment sections. Consider application [e.g. residential, commercial, irrigation] and whether installation is new or a retrofit. Consider including a pay item (length basis) for the tail if the length may vary by location when connecting to existing services. May have multiple bid items by service and type of work being performed. Also consider noting which property is associated with a particular bid item.)

01170.50 Flushing and Disinfecting – Replace this subsection with the following:

01170.50 Flushing and Sampling– Before tapping the main for installation of service connections and sampling stations to existing water mains, flush the service connections and sample stations according to Section 01140. For installation of service connections and sampling stations concurrent with new water mains, flush service connections and sampling stations according to Section 01140. Sample all service connections according to Section 01140.53. Chlorinate all services according to Section 01140.53.

01170.90 Payment – Replace this subsection, except for the subsection number and title, with the following:

The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	**Unit of Measurement**
(a) Inch Water Service Connection Piping	Foot
(b) Reconnecting Existing Water Services,	Inch Each
(c) Inch Water Meter Assembly	Each
(d) Relocate Water Meter Assembly	Each
(e) New Residential Meter Box	Each
(f) Water Sampling Station	Each

In items (a) and (b), the nominal pipe diameter will be inserted in the blank.
Item (a) includes excavating, tapping the main, laying and jointing the pipe and fittings, corporation stop, saddle, appurtenances, connection to meter, installing meter box when specified, backfilling, testing, and flushing and disinfection of the water service.

Item (b) includes excavating, tapping the main, laying and jointing the pipe and fittings, appurtenances, backfilling, testing, and flushing and disinfection of the reconnected service connection.

Item (c) includes excavating, installation of meter box when specified, angle meter valve, meter setter, customer service valve and appurtenances, backfilling, surface restoration, testing, and flushing and disinfection.

Item (d) includes moving the existing meter and meter stop to the new location specified and bringing to current standard, installing a new copper tail behind the meter, and connecting the tail to the existing service line to the property. Work behind the meter must be completed by a licensed plumber.

Item (e) includes furnishing new meter box. Installation of meter box is included in Item (a).

Item (f) includes sampling station and ball valve.
Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

End of Section

SP02000 (Special Provisions for the 2021 Book) (Last updated: 12-10-2021)

PART 02000 – MATERIALS

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [orange text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all orange text before preparing the final document.)

Section 02001 - Concrete

(This Section requires SP02030 and SP02690.)

Comply with Section 02001 of the Standard Specifications modified as follows:

02001.02 Abbreviations and Definitions: Replace the sentence that begins "**Pozzolans** - Fly ash, silica fume…" with the following sentence:

Pozzolans - Fly ash, natural pozzolans, silica fume, and high-reactivity pozzolans.

Replace the sentence that begins "**Supplementary Cementitious Materials** - Fly ash, silica fume…" with the following sentence:

Supplementary Cementitious Materials - Pozzolans and ground granulated blast furnace slag.

02001.15(a) Current Mix Designs - Replace this subsection, except for the subsection number and title, with the following:

Mix designs that meet the requirements for the specified class of concrete and are currently being used or have been used within the past 24 months on any project, public or private, may be submitted for review. Provide individual test results that comprise the average if more than one data point exists. For paving designs the flexural strength testing must be from within the last two years. For HPC designs the length change and permeability tests must be from within the last two years.

02001.20(a) Strength - Replace Table 2001-1 with the following Table 2001-1:

Table 02001-1

Concrete Strength and Water/Cementitious Material (w/cm) Ratio		
Type of Concrete	**Strength f'_c (psi)**	**Maximum w/cm Ratio**
Structural	3300	0.50
	3300 (Seal)	0.45
	4000	0.48
	4000	

	(Drilled Shaft)	
	HPC4500	0.40
	HPC(IC)4500	
	5000 +	
Paving	5000	0.44
PPCM's (with cast-in-place decks and no entrained air)	5000	0.48
	5500	0.44
	6000 +	0.42

02001.30(e)(1) HPC Coarse Aggregate Content - Delete the paragraph that begins "Two or more Aggregate products or sources…"

End of Section

Section 02015 – Portland Cement Concrete Repair Material

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Comply with Section 02015 of the Standard Specifications modified as follows:

Add the following subsection:

02015.60 Portland Cement Concrete Repair, Resurfacers - Furnish PCC resurfacers from the QPL.

End of Section

Section 02030 – Supplementary Cementitious Materials

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Comply with Section 02030, of the Standard Specifications modified as follows:

02030.00 Scope - Replace this subsection, except for the subsection number and title, with the following:

This Section includes the requirements for fly ash, natural pozzolans, silica fume, ground granulated blast furnace slag and high reactivity pozzolans used in portland cement concrete.

02030.10 Fly Ash - Replace this subsection, except for the subsection number and title, with the following:

Furnish Class C and Class F fly ash from the QPL and conforming to AASHTO M 295 (ASTM C618).

Add the following subsection:

02030.15 Natural Pozzolans - Furnish Class N natural pozzolans from the QPL and conforming to AASHTO M 295 (ASTM C618).

02030.50 Metakaolin - Replace this subsection with the following:

02030.50 High Reactivity Pozzolans - Furnish high-reactivity pozzolans from the QPL and conforming to AASHTO M 321.

End of Section

Section 02050 - Curing Materials

Comply with Section 02050 of the Standard Specifications modified as follows:

02050.10 Liquid Compounds - Replace the paragraph that begins “Furnish liquid membrane-forming curing…“ with the following paragraph:

Furnish liquid membrane-forming curing compounds from the QPL and meeting the requirements of ASTM C309.

End of Section

Section 02221– Repair, Resurfacing, and Lining Materials for Manhole Rehabilitation

Section 02221, which is not a Standard Specification, is included in this Project by Special Provision.

Description

02221.00 Scope - This Section includes the requirements for cleaning, repair, and lining system materials used in manhole rehabilitation.

02221.01 Reference Standards - Furnish materials conforming to the requirements of:

- ACI 506.2-77: Specifications for Materials, Proportioning, and Application of Shotcrete
- ASTM C109: Compressive Strength Hydraulic Cement Mortars
- ASTM C579: Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars
- ASTM C1583M: Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-Off Method)
- ASTM D638: Tensile Properties of Plastics
- ASTM D790: Flexural Properties of Unreinforced and Reinforced Plastics
- ASTM D695: Compressive Properties of Rigid Plastics
- ASTM D2240: Durometer Hardness, Type Shore D 80 – 85%
- ASTM D4541: Pull-off Strength of Coatings Using a Portable Adhesion Tester
- ASTM D7234: Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
- ASTM D2584: Volatile Matter Content.
- ASTM D543: Resistance of Plastics to Chemical Reagents

02221.02 General - Use materials meeting the following minimum requirements:

(a) All component materials shall be easily transportable by common carriers.

(b) Packing of component materials shall be compatible with field storage requirements.

(c) Components shall be packed in such a fashion as to provide for maximum worker safety when handling the materials and minimize spillage when preparing for use.

(d) Mixing of the components shall be compatible with field applications, not require precise measurements, and be within the limits recommended by the manufacturer.

(e) Catalyzation shall take place at the point of repair.

(f) Cleanup shall be done without inordinate use of flammable or hazardous chemicals.

Materials

02221.11 Wall Cleaning:

(a) Use clean water.

(b) Use detergent or muriatic acid capable of removing dirt, grease, oil and other matter which would prevent a good bond of lining material to wall. Apply in accordance with the manhole rehabilitation system manufacturer's recommendations.

02221.12 Repair and Resurfacing Products - Repair materials must be compatible with the specified rehabilitation system and applied in accordance with the manufacturer's recommendations.

(a) General - The following products may be accepted and approved as compatible repair and resurfacing products for use:

(1) 100% solids, solvent-free epoxy grout specifically formulated for polyurethane or epoxy topcoating compatibility.

(2) When approved for use by the manufacturer, factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be trowelled or pneumatically spray applied may be approved if specifically formulated to be suitable for topcoating with the specified rehabilitation product(s).

(b) Repair and Resurfacing – Use repair materials compatible with the specified rehabilitation method and applied in accordance with the recommendations of the manufacturers of both the repair material and the rehabilitation material.

The following products may be accepted and approved as compatible repair and resurfacing basecoat materials:

(1) Repair Mortar - When approved for use by the rehabilitation material manufacturer, factory blended, rapid setting, high early strength, non-shrink repair mortar that can be troweled or pneumatically spray applied may be approved if specifically formulated to be suitable for topcoating with the specified rehabilitation product(s). Such repair mortars shall not be used unless the rehabilitation system manufacturer(s) provides information as to its compatibility with the rehabilitation system products. Project-specific submittals shall be provided including application, cure time and surface preparation procedures that permit optimum bond strength with the rehabilitation material.

(2) Wall Patch - Wall patch shall be a quick-setting cementitious material and compatible with the rehabilitation material. Mix and apply according to manufacturer's recommendations. Wall patch shall have the following minimum physical properties:

Property	Minimum Value
Compressive Strength (ASTM C 109B)	1,400 psi, 1 hour, 2,000 psi, 24 hours
Shrinkage (ASTM C 596)	< 0.06% at 90% R.H.
Bond Strength (ASTM C 321)	900 psi, 24 hours
Flexural Strength	500 psi, 24 hour, 900 psi, 28 days
Cement	Sulfate resistant
Density, when applied	105 +/- 5 pcf

(c) Leak Control – Use hydraulic cement (a rapid setting cementitious product specifically formulated for leak control) to stop minor water infiltration. Mix and apply according to manufacturer's recommendations. Hydraulic cement must have the following minimum physical properties:

Property Minimum Value
Compressive Strength (ASTM C-109) ……600 psi, 6 hours,
2,000 psi, 24 hours
Shrinkage (ASTM C 596) ……<0.06% at 90% R.H.
Bond Strength (ASTM C 321) ……..40 psi, 1 hour,
80 psi, 24 hours

The hydraulic cement shall require no additives, set in 45-90 seconds, be dimensionally stable, and freeze/thaw and sulfate resistant.

02221.13 Primer – Use primers for specific substrates as recommended by the rehabilitation system manufacturer, or as listed below:

(a) Concrete: Sikaflex 429 primer, or approved equal

(b) Metal: Sikaflex 260 primer, or approved equal

(c) Plastic: Sikaflex 449 primer, or approved equal

02221.14 Corrosion Inhibitor for Reinforced Steel – Use a water-based epoxy resin, anti-corrosion coating and bonding agent such as Armatec 110 EpoCem, manufactured by the Sika Corporation, or approved equal.

02221.15 Rehabilitation Materials - Engineered materials applied as a system to restore or augment the structural capacity of existing manholes and/or protect against corrosion.

(a) Structural Lining Material - Material shall have the following minimum physical properties:

Property Minimum Value
Compressive Strength (ASTM C109) 4,000 psi, 24 hours,
9,000 psi, 28 days
Flexural Strength (ASTM C293) 400 psi, 24 hours,
1,250 psi, 28 days
Tensile Strength (ASTM C496) 700 psi, 28 days
Shrinkage, RH 90% (ASTM C596)……..0.01%, 28 days
Bond Strength……..Substrate failure
Freeze/Thaw after 300 Cycles (ASTM C666)……...No visible damage after 300 cycles

The physical requirements must be verified by an independent, certified, third-party testing laboratory within the last five years. The material shall have zero sag when applied in a single coat of 1-inch or less.

Product and manufacturer:

- Mainstay ML-72, Madewell Products Corporation
- Strong Seal MS-2A, Strong Seal Systems
- or approved equal.

(b) Protective Coating Material - Furnish protective coating materials resistant to hydrogen sulfide. Approved materials for hydrogen sulfide resistance include epoxy, multi-layer polyurea lining systems, and polyurethane materials.

Epoxy shall have the following minimum physical properties:

Property	Value
Compressive Strength (ASTM D695)	16,000 psi min.
Flexural Modulus (ASTM D790)	600,000 psi min
Flexural Strength (ASTM D790)	8,000 psi min.
Tensile Strength (ASTM D638)	7,600 psi min.
Elongation (ASTM D638)	3% min.
Hardness, Shore D (ASTM D2240)	88 min.
Acid Exposure	pH 1, H_2SO_4
Adhesion, Concrete (ASTM D7234)	Substrate Failure
Abrasion (ASTM D4060)	112 mg loss/1,000 cycles, max.

The physical requirements must be verified by an independent, certified, third-party testing laboratory within the last five years. The material shall be 100% epoxy solids (by volume), with zero shrinkage (wet film thickness and dry film thickness shall be the same) and be 100% free of Volatile Organic Compounds. Minimum dry film thickness shall be 125 mils.

Product and manufacturer:

- Raven 405, Raven Lining Systems
- SewerGard 210, Sauereisen
- or approved equal.

The multi-layer polyurea lining system shall be a multi-layer lining system in accordance with the following requirements:

1. The liner system shall be a multi-component stress skin panel liner system as described below:

Layer	Material	Minimum Thickness
Moisture Barrier	Modified Polymer	100 mils
Surfacer	Polyurethane/Polymeric blend foam	500 mils
Corrosion barrier	Modified Polymer	150 mils
Total Installation		750 mils

2. The modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the wastewater environment with the following physical properties:

Parameter	Value	Method
Tensile Strength, psi	>2,400	ASTM D412
Elongation, %	>300	ASTM D412
Tear Strength, PSI	>500	ASTM D624
Shore A Hardness	>96	ASTM D2240
Flexural Modulus	>2,400	ASTM D522

3. The polyurethane/polymeric blend foam shall be a rigid structure foam, low viscosity two-component blend with the following physical properties:

Parameter	Value	Method
Density, lbs/ft3	4-10	ASTM D1622
Compression Strength, psi	90-150	ASTM D1621
Closed Cell Content, %	>95	
Shear Strength, psi	225-250	ASTM C273

Product and manufacturer:

- Spectrashield, CCI Spectrum, Inc.

Polyurethane shall have the following physical properties:

Property	Value
Flexural Modulus (ASTM D790)	735,000 psi min.
Long Term Flexural Modulus of Elasticity (ASTM D6992)	529,000 psi min.
Compressive Strength (ASTM D695)	18,000 psi min.
Tensile Strength (ASTM D638)	7,450 psi min.
Elongation (ASTM D638)	2% min.
Acid Exposure	pH 1, H_2SO_4
Abrasion (ASTM D4060)	17.7 mg loss/1,000 cycles, max.
Hardness, Shore D (ASTM D2240)	85 min.

The physical requirements must be verified by an independent, certified, third-party testing laboratory within the last five years. The material shall be 100% polyurethane solids, self-priming, and free of Volatile Organic Compounds.

Product and manufacturer:

- SprayWall, SprayRoq
- or approved equal.

Finishing, Cleaning Up, and Testing

02221.70 Acceptance - Acceptance of repair, resurfacing and lining materials for manhole rehabilitation will be according to 00165.35 and this Section.
End of Section

Section 02415 – Plastic Pipe

Comply with Section 02415 of the Standard Specifications modified as follows:

02415.40 Polypropylene Pipe - Replace the sentence that begins "Dual wall polypropylene pipe …" with the following sentence:

Dual wall polypropylene pipe and fittings ..... ASTM F2764

End of Section

Section 02450 – Manhole and Inlet Materials

Comply with Section 02450 of the Standard Specifications modified as follows:

02450.30 Metal Frames, Covers, Grates, and Steps – Add the following to the end of the subsection:

Furnish cast iron frames and grates conforming to the requirements of ASTM A536. Furnish ductile iron frames and grates conforming to the requirements of ASTM A48.

Add the following subsection:

02450.31 Composite Frames and Covers - Composite frames and covers shall be secured to protect against unauthorized access and to restrict movement of the cover. Covers shall be fabricated of corrosion resistant composite materials have a quarter turn security bolt locking mechanism machined from 17-4PH H900 stainless steel. Covers shall have a minimum load rating of H-20. Secure frames to structure with concrete anchor bolts with a minimum ultimate pullout strength of 2,500 lbs and a minimum ultimate sheer strength of 3,000 lbs. Apply a closed cell, hydrophobic polyurethane water repellant sealer around the entire frame circumference prior to tightening concrete anchor bolts.

Frame and Cover Product and manufacturer:

- EJ Composite Access Solutions by EJ USA, Inc.
- or approved equal.

Security Lock Product and manufacturer:

- TITUS TwistLIFT by TITUS Industrial Group, Inc
- or approved equal.

End of Section

Section 02451 – Polymer Concrete Manholes

Section 02451, which is not a Standard Specification, is included in this Project by Special Provision.

Description

02451.00 Scope – This Section includes requirements for polymer concrete manholes.

Materials

02451.10 Polymer Concrete Manhole Sections – Furnish polymer concrete manhole risers, cones, flattops, grade rings and base sections design to meet the loading requirements of ASTM C478, ASTM C857 and ACI 350-06 as modified for polymer concrete manhole design as follows:

1. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment.
2. Reinforcement – Use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.
3. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness.
4. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, and foreign inclusions that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. The nominal internal diameter of manhole components shall not vary more than 2%.
5. Marking and Identification - Each manhole shall be marked with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date.
6. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or rubber gasketed joint (ASTM C990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity.
7. Minimum clearance between wall penetrations and joints shall be per manufacturer's design.
8. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material, monolithically. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material.
9. Provide resilient connectors conforming to requirements of ASTM C923. All connectors are to be watertight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

10. Furnish tops to support AASHTO HS-20 or HL-93 or vehicle loading or loads as required and per Section 02450.30.

02451.20 Grouting – All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal.

End of Section

Section 02452 – Crystalline Waterproofing Additive

Section 02452, which is not a Standard Specification, is included in this Project by Special Provision.

Description

1.01 SUMMARY

A. Section Includes: Furnishing of all labor, materials, services and equipment necessary for the supply and installation of crystalline waterproofing additive to concrete structures as indicated on the drawings and as specified herein. The crystalline waterproofing material shall be added to concrete during the mixing cycle and shall be used in above or below-grade walls and slabs, including liquid retaining structures where enhanced chemical resistance is required.

1.02 REFERENCES

A. Applicable Standards: The following standards are referenced herein:

1. American Society for Testing and Materials (ASTM)
2. Army Corps of Engineers (CRD)
3. American Concrete Institute (ACI)
4. NSF International (NSF)

1.03 SYSTEM DESCRIPTION

A. Crystalline Waterproofing Additive: Concrete waterproofing system shall be of the crystalline type, defined by the ACI 212.3R – 10 Report on Chemical Admixtures for Concrete as a “PRAH” type hydrophilic admixture. It shall react such that it chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. Testing Requirements: Crystalline waterproofing system shall be tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein. Independent tests verifying these results shall be submitted prior to approval.

B. Independent Laboratory: Testing shall be performed by an independent laboratory meeting the requirements of the recognized specifying body of the country in which the testing is performed. Testing laboratory shall obtain all concrete samples and waterproofing product samples.

C. Crystalline Formation: Crystallizing capability of waterproofing system shall be evidenced by independent SEM (Scanning Electron Microscope) photographs showing crystalline formations within the concrete matrix at a magnification no greater than 2,000 times.

D. Water Permeability: Independent testing shall be performed according to U.S. Army Corps of Engineers CRD-C48 - Mod “Permeability of Concrete” and the European Standard EN-12390-8. Under CRD-C48 treated concrete samples shall be pressure

tested to 150 psi (350-foot head of water) or 1.05 MPa (106 m head of water). The treated samples shall exhibit no measurable leakage against control samples which shall exhibit full saturation and measurable leakage. EN-12390-8 testing shall show at least a 75 percent reduction in depth of water penetration for Admixture treated concrete as compared to the control concrete.

E. Petroleum Product Permeability: Independent testing shall be performed according the European EN – 12390-8. Treated samples shall show a more than an 80% reduction in depth of penetration for both diesel and unleaded gasoline as compared to a control concrete.

F. Acid Resistance: Independent testing shall be performed to determine “Sulfuric Acid Resistance of Concrete Specimens”. Treated concrete samples (dosage rates of 3%) shall be and tested against untreated control samples after 40 days of curing. All samples shall be immersed in 7% sulfuric acid and weighed daily until a control sample reaches a weight loss of 50%. At this time on final weighing the percentage weight loss of the 3% treated samples shall be 40% or lower.

G. Chloride Resistance: Independent testing shall be performed according the European Nordtest, NT Build 443 or other chloride penetration ponding test. Treated samples shall show a 50 percent or greater reduction in the chloride diffusion coefficient as versus the control concrete. Further, service life modeling based in testing shall show at least a doubling in expected time to corrosion for the reinforcing steel in the treated samples versus the control concrete.

H. Sulfate Resistance: Independent testing shall be performed against Australian Standard AS 1141.24, US Bureau of Reclamation - Procedure for Length Change of Hardened Concrete Exposed to Alkali Sulfates or another recognized international standard for weight loss and length change. Samples exposed to Ammonium Sulfate solution for 25 weeks shall show a weight loss of at least 25 percent less than the control concrete and a length change of - 0.01 percent or less than the control.

I. Freeze Thaw Resistance Testing: Independent testing against JUS U.M1.016, ASTM – C-666 or other recognized international standard for durability of air entrained treated samples shall show at least a 60 percent improvement for treated concrete versus that of a control concrete when subjected to 250 freeze thaw cycles.

J. Salt Scaling Resistance: Independent testing against JUS U.M1.055, ASTM C667 or other recognized international standard for salt scaling resistance shall show no visible scaling for treated sample versus a control sample which shall show showing scaling to a depth of at least 0.5 mm when samples are subjected to 25 freeze thaw cycles.

K. Compressive Strength: Independent testing shall be performed according to ASTM C39 “Compressive Strength of Cylindrical Concrete Specimens.” Concrete samples containing the crystalline waterproofing additive shall be tested against untreated control sample. At 28 days, the treated samples shall exhibit an increase in compressive strength over the control sample.

L. Concrete Shrinkage: Independent testing against Australian Standard AS 1012.13, ASTM C-157 or other recognized international standard for concrete shrinkage shall show reduced shrinkage for admixture modified concrete as compared to a control sample.

M. Fire Testing: Independent testing against a recognized international standard for fire testing shall show negligible difference between admixture treated concrete versus control concrete when slabs are exposed to a hydrocarbon fire.

N. Potable Water Approval: Independent testing shall be performed according to NSF Standard 61 and approved for use of waterproofing material on structures holding potable water shall be evidenced by NSF certification.

1.05 SUBMITTALS

A. General: Submit listed submittals in accordance with conditions of the Contract and with Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications. Also include manufacturer's certification or other data substantiating that products comply with requirements of Contract Documents.

C. Test Reports: Submit, for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.

D. Manufacturer's Certification: Provide certificate signed by manufacturer or manufacturer's representative certifying that the materials to be installed comply in all respects with the requirements of this specification.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer to have no less than 10 years' experience in manufacturing the crystalline waterproofing additive for the required work and be capable of providing field service representation during construction phase. Manufacturers that cannot provide the performance test data specified herein will not be considered for the project. Manufacturer to be ISO 9001 certified.

B. Applicator: Installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.

C. Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with Architect/Engineer, owner's representative, applicator (concrete supplier), concrete placer and waterproofing manufacturer's representative to verify and review the following:

    1. Project requirements for waterproofing as set out in Contract Document.

    2. Manufacturer's product data including application instructions.

D. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver packaged waterproofing materials to project site in original undamaged containers, with manufacturer's labels and seals intact.

C. Storage: Store waterproofing materials in dry, enclosed location, at temperature and humidity conditions recommended by manufacturer.

1.08 WARRANTY

A. Project Warranty: Refer to conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Manufacturer shall provide standard product warranty executed by authorized company official. Term of warranty shall be 1 year from Date of Substantial Completion.

Materials

2.01 MATERIALS

A. Acceptable Manufacturer: Xypex Chemical Corporation, 13731 Mayfield Place, Richmond, B.C., Canada V6V 2G9; Telephone 800-961-4477, 604-273-5265; Fax 604-270-0451; E-mail info@xypex.com; Website www.xypex.com.

B. Proprietary Products: Xypex crystalline waterproofing additives as follows:

1. Xypex Admix C-500 or Xypex Admix C-1000
2. Xypex Concentrate

C. Substitutions: No substitutions allowed without submission of test data proving that performance of requested substitute product is equal or better than the specified materials.

D. Source Quality: Obtain proprietary crystalline waterproofing products from a single manufacturer.

E. Or approved equal

2.02 DOSAGE AND MIXING

A. General: Xypex Admix must be added to concrete mix at time of batching.

B. Dosage Rate: Under normal conditions, the crystalline waterproofing powder shall be added to the concrete mix at a rate of 2 to 3 percent by weight of portland cement content. For enhanced chemical protection or meeting specific project requirements, consult with manufacturer or its authorized representative to determine appropriate dosage rates.

C. Waterproofing Construction Joints and Cold Joints Between Pours: Xypex Concentrate, single coat crystalline waterproofing; proprietary compound of Portland cement, silica sand and active chemicals, mixed with water at 3 parts powder to 1 part water or in proportions recommended by manufacturer to achieve full coverage with application method used. Application rate: 2.0 pounds/square yard (1.09 kg/square m).

D. Dry Pack Joint Compound: Dry pack consistency mixture of Xypex Concentrate; proprietary compound of Portland cement, silica sand and active chemicals; and water at 6 parts powder to 1 part water or in proportions recommended by manufacturer.

Construction

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data regarding installation, including technical bulletins, product catalogue, installation instructions and product packaging labels.

3.02 PROJECT CONDITIONS

A. Reinforcement: All reinforcement shall be rib deformed bar in accordance with applicable standards. Exposed concrete decks (joint free) shall contain sufficient reinforcement to minimize thermal movement and control cracking.

B. Setting Time and Strength: Some retardation of set may occur when using Xypex Admix. The amount of retardation will depend upon the concrete mix design, the dosage rate of the Admix, temperature of concrete and climatic conditions. Concrete containing Xypex Admix may develop higher ultimate strengths than plain concrete. Conduct trial mixes under project conditions to determine setting time and strength of the concrete. Consult with manufacturer or manufacturer's representative regarding concrete mix design, project conditions and proper dosage rate.

C. Weather Conditions: For mixing, transporting and placing concrete under conditions of high temperature or low temperature follow concrete practices as referred to in ACI 305R-77 (Hot Weather Concreting) and ACI 306R-78 (Cold Weather Concreting). For flatwork being placed in either hot, dry or windy conditions use of monomolecular film (evaporation retardant) is recommended to control loss of bleed water.

3.03 APPLICATION

A. General: Xypex Admix shall be added to the concrete mix at time of batching. Thorough blending of the Xypex Admix throughout the concrete mix is essential for correct performance of the product and, therefore, care should be taken to ensure that a homogeneous mixture is obtained.

B. Concrete Batching and Mixing: Procedures for mixing will vary according to type of batch plant operation and equipment.

1. Ready Mix Plant - Dry Batching Operation: Add Xypex Admix powder to drum of ready-mix truck, then add 60% - 70% of required water along with 300 – 500 pounds (136 - 227 kg) of aggregate. Mix the materials for 2 - 3 minutes to ensure that the Admix is distributed evenly throughout the mix water. Add balance of materials to the ready-mix truck and mix in accordance with standard batch practices.

2. Ready Mix Plant - Central Mix Operation: Mix Xypex Admix with water to form a very thin slurry (e.g. 15 - 20 pounds or 6.75 - 9 kg of powder mixed with 3 gallons or 13.6 liters of water). Pour the required amount of material in drum of ready-mix truck. The aggregate, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the Xypex Admix throughout the concrete.

3. Pre-cast Batch Plant - Pan Type Mixer: Add Xypex Admix to the rock and sand, then mix thoroughly for 2 - 3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices.

C. Construction and Cold Joints:

1. One coat of Xypex Concentrate slurry at a rate of 2 pounds/square yard is to be applied to the entire concrete substrate surface where the existing and new concrete will interface. Allow slurry to set or dry. No curing is required.
2. For hydrostatic conditions also apply sealing strips at each construction joint by filling grooves coinciding with construction joint.
    a. If grooves have not been preformed, at least 1-inch (25-mm) wide and minimum 1.5-inch (37-mm) deep, saw cut and chip grooves to that dimension.
    b. Apply specified slurry coat to slot at rate recommended by manufacturer.
    c. Fill and form surfaces using specified dry pack repair compound while slurry coat is still green, but after slurry coat has reached initial set.
    d. Compact tightly using pneumatic packer or hammer and block.

3.04 CURING

A. General: Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, “Standard Practice for Curing Concrete”.

B. Curing Compounds: Curing compounds may be used if project requirements or conditions prevent moist curing. Curing compounds shall comply with ASTM C-309.

3.05 PROTECTION

A. Protection: Protect installed product and finished surfaces from damage during construction.

3.06 FIELD QUALITY CONTROL

A. Examination for Defects: Do not conceal Xypex treated concrete before it has been observed by Architect / Engineer, waterproofing manufacturer’s representative and other designated entities. Concrete shall be examined for structural defects such as honeycombing, rock pockets, tie holes, faulty construction joints, cold joints and cracks. Such defects to be repaired in accordance with manufacturer’s repair procedures.

B. Flood Testing for Suspended Slabs:

1. Perform flood test on completed waterproofing installation before placement of other construction.
2. Plug or dam drains and fill area with water to a depth of two inches (50 mm) or to within 0.5 inch (12.5 mm) of top of waterproofing treatment.
3. Let water stand for 24 hours.
4. If leaks are discovered, make repairs and repeat test until no leaks are observed.

3.07 INTERFACE WITH OTHER MATERIALS

A. Backfilling: Normal backfilling procedures may be used after concrete has been cured for at least seven days. If backfill takes place within seven days after concrete placement, then backfill material shall be moist so as not to draw moisture from the

concrete. In no event shall backfilling take place before concrete has gained sufficient strength to withstand the applied load.

B. Grout, Cement Parge Coat, Plaster or Stucco: Because concrete containing Xypex Admix forms a relatively smooth surface and the resulting crystalline formation fills the concrete pores thereby reducing suction characteristics of the concrete, it may be necessary to use a suitable bonding agent for proper bonding of cementitious systems.

C. Responsibility to Ensure Compatibility: Xypex Chemical Corporation makes no representations or warranties regarding compatibility of Xypex treated concrete with coatings, plasters, stuccos, tiles or other surface-applied materials. It shall be the responsibility of the installer of the surface-applied material that is to be applied over the Xypex treated concrete, to take whatever measures are necessary, including testing, to ensure acceptance by or adhesion to the waterproofing treatment.

End of Section

Section 02510 - Reinforcement

Comply with Section 02510 of the Standard Specifications modified as follows:

02510.11(c) Coated Reinforcement Ties and Supports - Replace this subsection, except for the subsection number and title, with the following:

Ties and supports for coated reinforcement, including ties for coated to uncoated reinforcement connections, shall be nonmetallic coated.

End of Section

Section 02530 - Structural Steel

Comply with Section 02530 of the Standard Specifications modified as follows:

002530.10 Structural Steel for Bridges - Replace this subsection, except for the subsection number and title, with the following:

Structural steel for Bridges shall conform to the following, as shown or specified:

- AASHTO M 270, Grade 36 (ASTM A709, Grade 36)
- AASHTO M 270, Grade 50 (ASTM A709, Grade 50)
- AASHTO M 270, Grade 50W (ASTM A709, Grade 50W)
- AASHTO M 270, Grade HPS 70 (ASTM A709 Grade HPS 70)
- AASHTO M 270, Grade HPS 70W (ASTM A709 Grade HPS 70W)

Impact test requirements, for both non-fracture-critical tension components (T), and fracture-critical tension components (F), are to be according to Zone 2 requirements of AASHTO M 270 Tables 11 and 12, respectively.

End of Section

Section 02560 - Fasteners

Comply with Section 02560 of the Standard Specifications modified as follows:

02560.30(b) High Strength Tie Rods, Anchor Bolts and Anchor Rods - Add the following paragraph to the end of this subsection:

End stamp all ASTM F1554, Grade 105 according to ASTM F1554 Supplementary Requirements S2 and S3. If the end of the bolt is to be embedded in concrete, the projecting end from the concrete shall be the marked end.

End of Section

Section 02630 – Base Aggregate

Comply with Section 02630 of the Standard Specifications.

End of Section

Section 02690 - PCC Aggregates

Comply with Section 02690 of the Standard Specifications modified as follows:

02690.20(e) Grading and Separation by Sizes for Prestressed Concrete - Replace this subsection with the following subsection:

02690.20(e) Grading and Separation by Sizes - Sampling shall be according to AASHTO R 90. Sieve analysis shall be according to AASHTO T 27 and AASHTO T 11. Provide aggregates meeting the gradation requirements of Table 02690-1 for structural concrete. Provide a CAgT to perform sampling and testing when required.

Table 02690-1
Gradation of Coarse Aggregates
Percent passing (by Weight)

		Sieve Size											
Size Number	Nominal Size Square Openings	(2½ in.)	(2 in.)	(1½ in.)	(1 in.)	(¾ in.)	(½ in.)	(⅜ in.)	(No. 4)	(No. 8)	(No. 16)	(No. 50)	(No. 200)
3	(2 to 1 in.)	100	90 to 100	35 to 70	0 to 15	—	0 to 5	—	—	—	—	—	**
357*	(2 in. to No. 4)	100	95 to 100	—	35 to 70	—	10 to 30	—	0 to 5	—	—	—	**
4	(1½ to ¾ in.)	—	100	90 to 100	20 to 55	0 to 15	—	0 to 5	—	—	—	—	**
467*	(1½ to No. 4)	—	100	95 to 100	—	35 to 70	—	10 to 30	0 to 5	—	—	—	**
5	(1 to ½ in.)	—	—	100	90 to 100	20 to 55	0 to 10	0 to 5	—	—	—	—	**
56	(1 to ⅜ in.)	—	—	100	90 to 100	40 to 85	10 to 40	0 to 15	0 to 5	—	—	—	**
57	(1 to No. 4)	—	—	100	95 to 100	—	25 to 60	—	0 to 10	0 to 5	—	—	**
6	(¾ to ⅜ in.)	—	—	—	100	90 to 100	20 to 55	0 to 15	0 to 5	—	—	—	**
67	(¾ to No. 4)	—	—	—	100	90 to 100	—	20 to 55	0 to 10	0 to 5	—	—	**
68	(¾ to No. 8)	—	—	—	100	90 to 100	—	30 to 65	5 to 25	0 to 10	0 to 5	—	**
7	(½ to No. 4)	—	—	—	—	100	90 to 100	40 to 70	0 to 15	0 to 5	—	—	**
78	(½ to No. 8)	—	—	—	—	100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5	—	**
8	(⅜ to No. 8)	—	—	—	—	—	100	85 to 100	10 to 30	0 to 10	0 to 5	—	**
89	(⅜ to No. 16)	—	—	—	—	—	100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5	**

* Use two or more seperated sizes which when combined meet these gradation limits.

** See 02690.20(a). Do Not evaluate material passing the No. 200 sieve according to 00165.40.

02690.20(f) Grading and Separation by Sizes for Other Concrete - Delete this subsection.

02690.30(g) Grading - In the paragraph that begins “Sampling shall be according to…”, replace the words “AASHTO T 2” with the words “AASHTO R 90”.

End of Section

Section 02830 - Metal Handrail

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 02830, which is not a Standard Specification, is included in this Project by Special Provision.

Description

02830.00 Scope - This Section includes the requirements for the steel in handrail for stairways and pedestrian facilities.

Materials

02830.10 Shapes, Plates, and Bars - Shapes, plates, and bars shall conform to ASTM A36.

Punch anchor plate bolt holes at the locations shown before fabrication.

02830.20 Steel Pipe - Steel pipe shall conform to ASTM A500, seamless, Grade B.

02830.21 Steel Tube - Steel tube shall conform to ASTM A500, seamless, Grade B.

02830.22 Fasteners - Fasteners shall meet the requirements of Section 02560. Machine screws shall be SAE 18 8 stainless steel.

02830.30 Galvanizing - Hot-dip galvanize all handrail components according to AASHTO M 111 (ASTM A123) after shop fabrication.

02830.31 Repair of Hot-Dip Galvanizing - Repair damaged hot-dip galvanizing according to ASTM A780 and ASTM A123. Minimum zinc content for Method A2 is 94 percent on the dry film.

02830.40 Incidentals - Plates, caps, and miscellaneous pieces necessary to complete the rail shall be as shown.

02830.50 Acceptance - Acceptance of handrail Materials will be according to 00165.35 and this Section.

End of Section

Section 02831 - Pedestrian Fence

(This Section is not published in the Oregon Standard. Delete item(s) that are included in the subsection, paragraph, sentence, or bullet that are not required on the Project. In general, do not re-number or re-letter subsections when item(s) are deleted.)

Section 02831, which is not a Standard Specification, is included in this Project by Special Provision.

Description

02831.00 Scope - This Section includes the requirements for the metals in pedestrian fence.

Materials

02831.10 Aluminum Parts - Posts, post caps, post bases, rails, and spindles shall conform to 6061-T6 aluminum. Punch post base bolt holes at the locations shown before fabrication.

02831.20 Fasteners - Fasteners shall meet the following requirements:

Threaded rods –	ASTM A193 Grade B7 Galvanized
1/2 inch dia. steel nuts –	ASTM A194 Grade 8M Galvanized
1/2 inch dia. SAE steel flat washers –	ASTM F436 Type 1 Galvanized

02831.40 Acceptance - Acceptance of pedestrian rail Materials will be according to 00165.35 and this Section.

End of Section

Section 02910 – Sign Materials

Comply with Section 02910 of the Standard Specifications modified as follows:

02910.75 Manufacturer's Warranty – Add the following paragraph to the end of the subsection:

The Agency will date all approved signs at project completion. That date is the start of the Warranty period.

End of Section

Section 02926 - Highway Illumination Materials

Comply with Section 02926 of the Standard Specifications modified as follows:

Add following subsection:

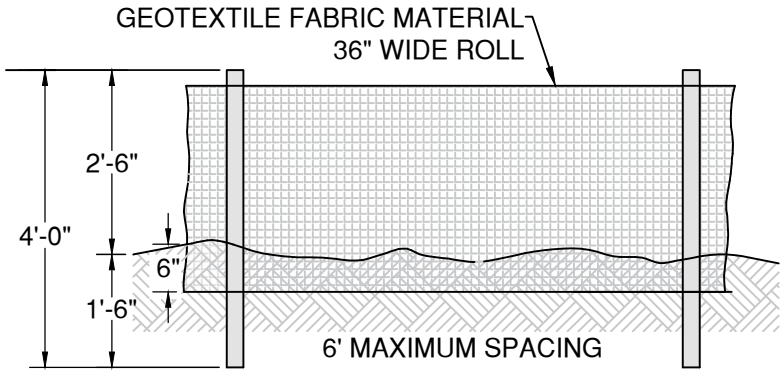
02926.41(f) Electrical Splice Materials - Furnish electrical splice materials meeting the following requirements:

- **Split bolt** - Made of silicon bronze to securely join the wires both mechanically and electrically.
- **Heat-shrink tubing** - Split-resistant and adhesive-lined tube made of polyolefin complying with UL 224 or UL 486D, temperature range -67°F to 230 °F, with 600 V rated inner melting wall or liner to provide void-free encapsulated insulation.
- **Insulating rubber tape** - Electrical grade, nondrying, rubber based, elastic type complying with ASTM D4388.
- **Insulating vinyl plastic tape** - Low temperature (0°F) resistant, vinyl chloride plastic, electrical insulating tape with pressure-sensitive adhesive. Comply with ASTM D3005.

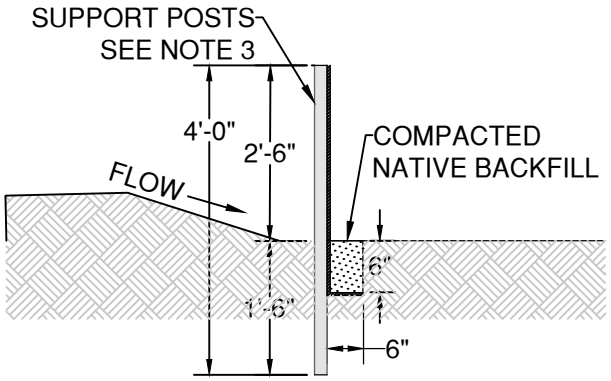
End of Section

CITY OF BEND STANDARD DRAWINGS

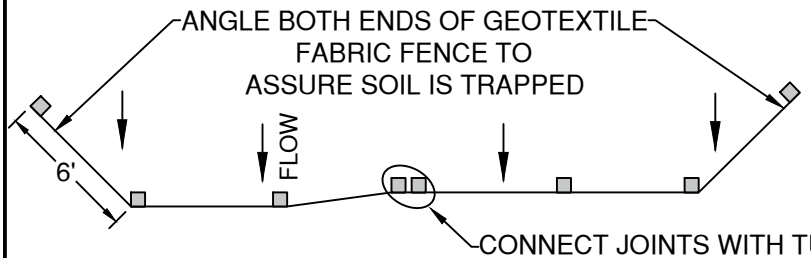
Erosion (E)



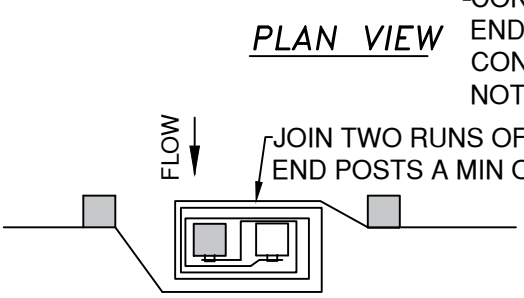
FRONT VIEW



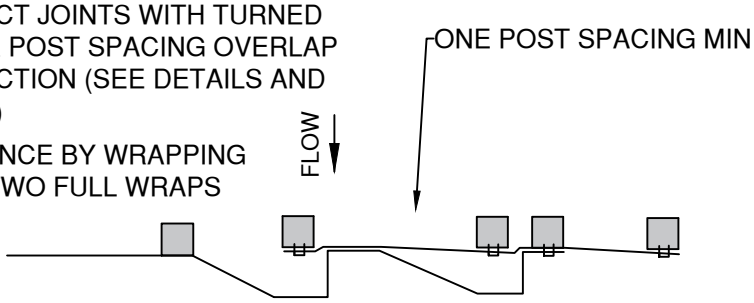
PROFILE VIEW



PLAN VIEW



TURNED END CONNECTION

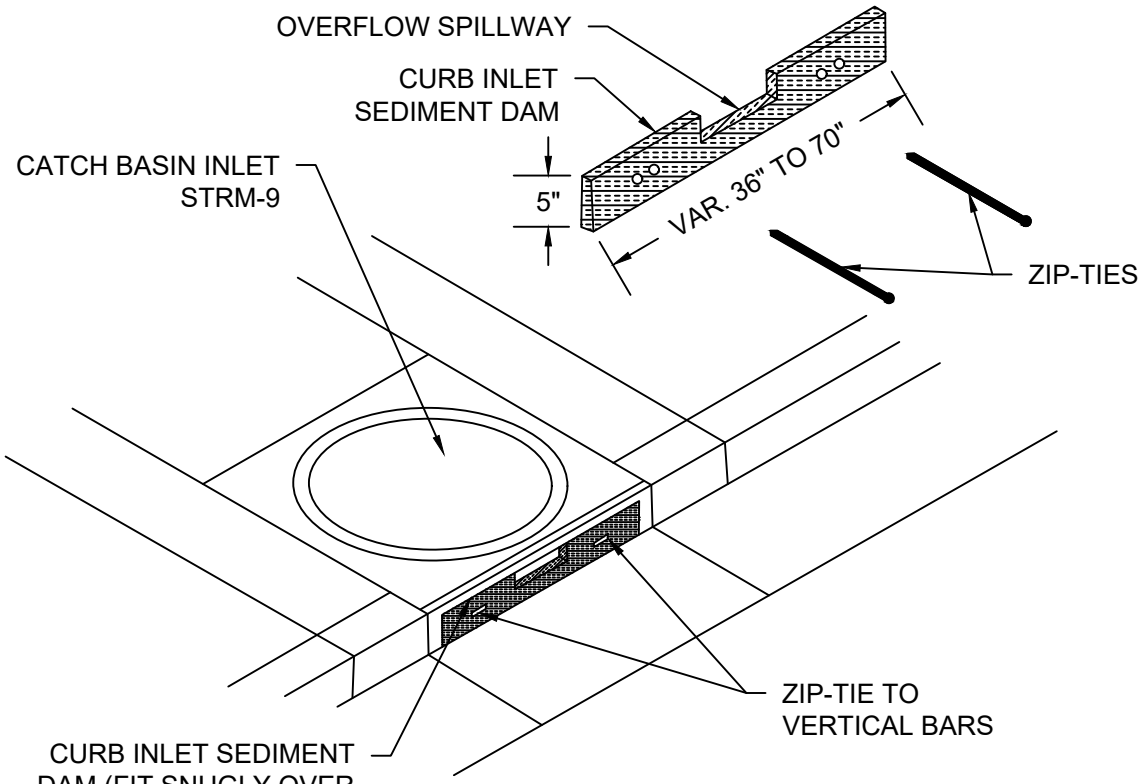


POST SPACING OVERLAP CONNECTION

NOTES:

1. FABRIC WITHOUT SEWN-IN SLEEVES IS NOT RECOMMENDED. IF USED, INSTALL FENCE POSTS PER MANUFACTUER RECOMMENDATIONS.
2. THE GEOTEXTILE FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, GEOTEXTILE SHALL BE SPLICED TOGETHER AT A SUPPORT POST UTILIZING A TURNED END OR POST SPACING OVERLAP CONNECTION.
3. THE FENCE POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND INSTALLED INTO THE GROUND 18 INCHES MIN. FENCE POSTS SHALL BE 2" X 2" FIR, PINE, OR STEEL. THE GEOTEXTILE FABRIC FENCE SHALL BE INSTALLED TO FOLLOW THE SLOPE CONTOURS, TO MAXIMIZE PONDING EFFICIENCY WHERE FEASIBLE.
4. BURY BOTTOM OF THE GEOTEXTILE FABRIC 6 INCHES BELOW GRADE. BACKFILL AND COMPACT.
5. POSTS SHALL BE INSTALLED WITHIN THE SLEEVE ON THE UPHILL SIDE GEOTEXTILE FABRIC.
6. GEOTEXTILE FABRIC FENCE SHALL BE REMOVED WHEN IT HAS SERVED ITS USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED.
7. GEOTEXTILE FABRIC FENCES SHALL BE INSPECTED BY APPLICANT/CONTRACTOR AFTER EACH RAIN OR SNOW EVENT AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
8. MAXIMUM RECOMMENDED FENCE WIDTH IS 500 FEET. MAXIMUM TRIBUTARY AREA IS 0.25 ACRE PER 100' OF FENCE. MAXIMUM RECOMMENDED SLOPE LENGTH IS 100'.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		SEDIMENT FENCE DETAIL	STD DWG E-1

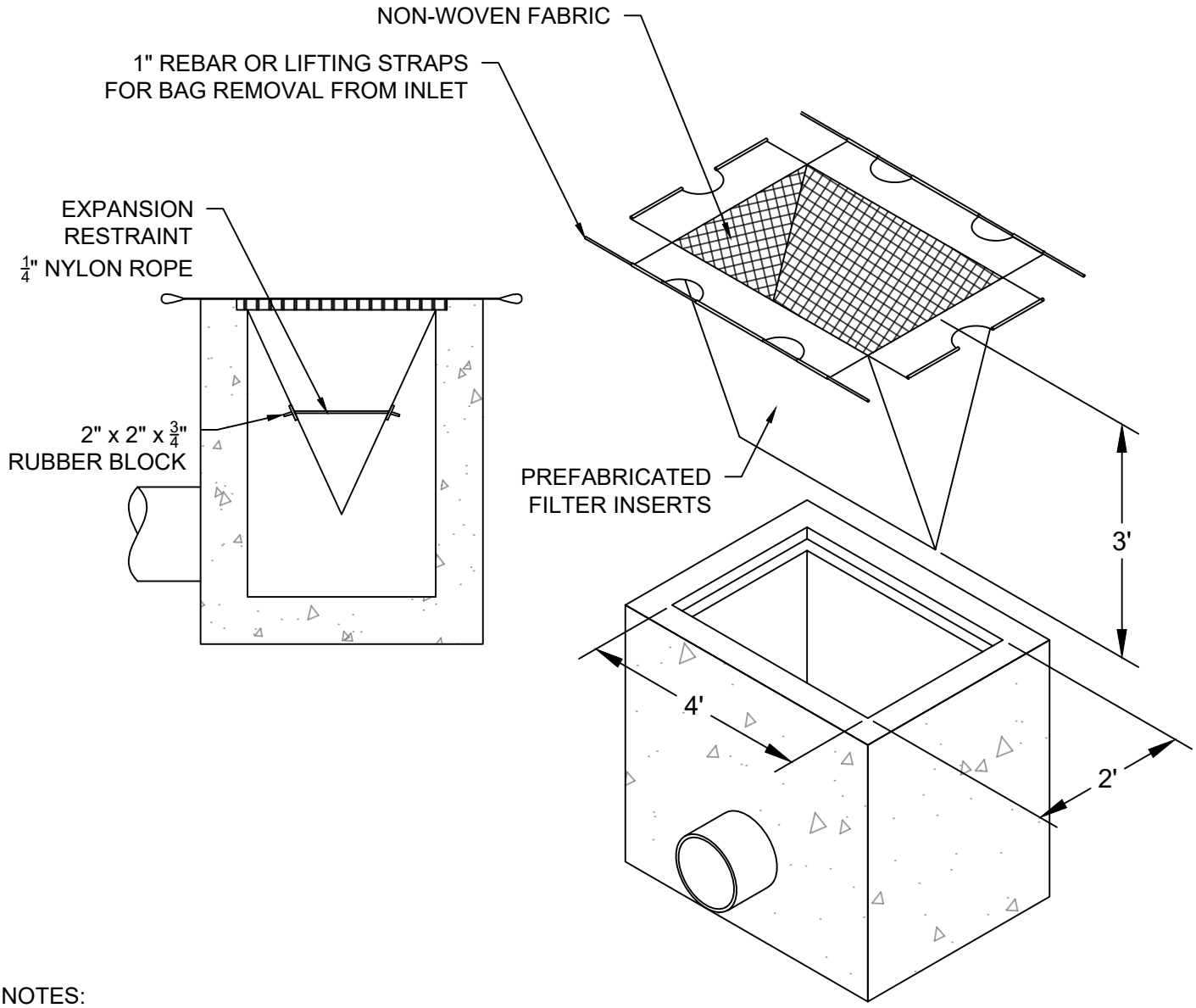


CURB INLET SEDIMENT DAM

NOTES:

1. INSTALL SEDIMENT DAM ACCORDING TO MANUFACTURE'S RECOMMENDATION. ENDS SHALL NOT EXTEND BEYOND THE MOUNT OF THE INLET.
2. SEDIMENT DAMS ARE REQUIRED TO BE ACCOMPANIED BY ADDITIONAL BMPS TO PREVENT THE POTENTIAL OF SEDIMENTS ENTERING PROJECT STORM SYSTEMS.
3. INSPECTION & MAINTENANCE:
   - 3.1. INSPECT DAMS WEEKLY AND DAILY DURING STORM EVENTS.
   - 3.2. CLEAN, OR REPLACE, DAMS WHEN DEBRIS HAS REACH A HEIGHT OF 2 INCHES.
   - 3.3. CONTRACTOR IS RESPONSIBLE FOR REMOVING DAMS AND PROPERLY DISPOSING OF ALL MATERIALS ONCE THE PROJECT HAS BEEN PERMANENTLY STABILIZED.

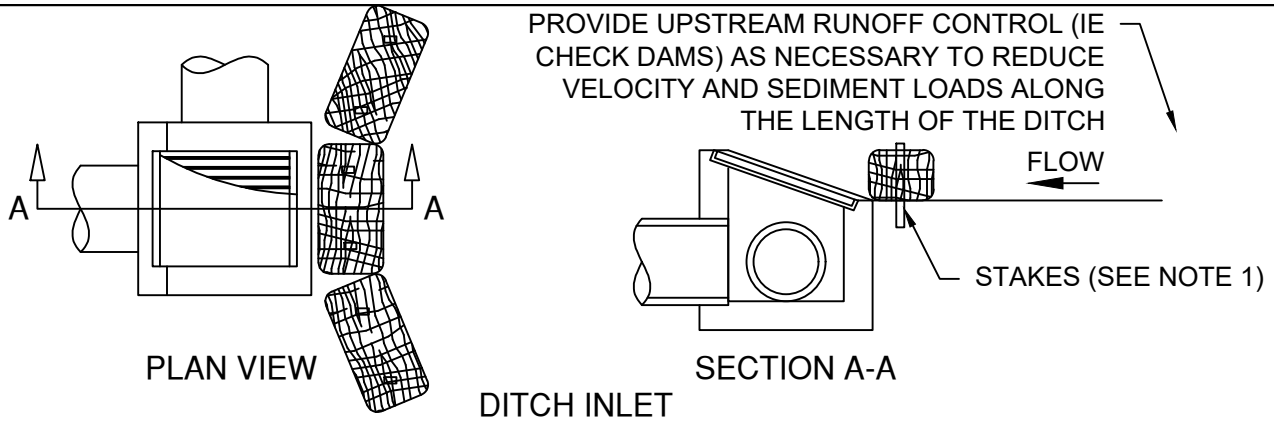
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CURB INLET PROTECTION	STD DWG E-2A



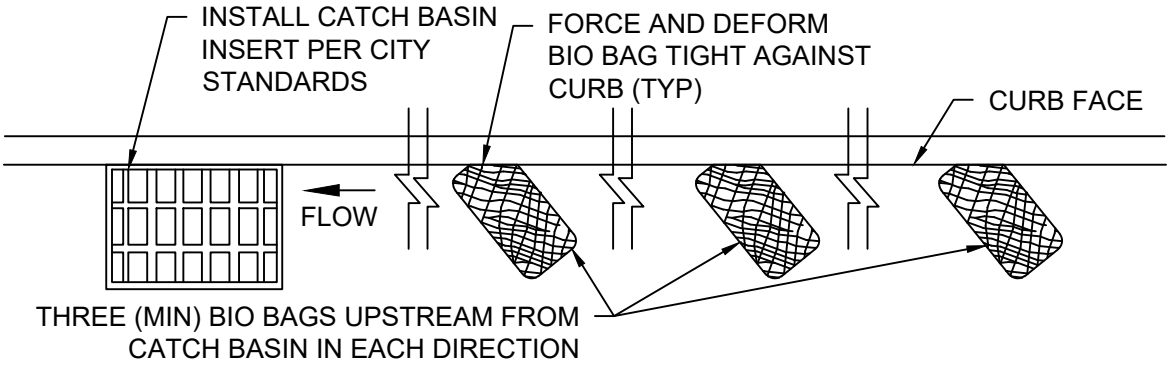
NOTES:

1. INSTALL PRE-FABRICATED FILTER INSERTS ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
2. FIELD FABRICATED INSERTS ARE NOT PERMITTED.
3. PRE-FABRICATED INSERTS WITH A PROVISION FOR OVERFLOW ARE REQUIRED AND ARE TO BE ACCOMPANIED BY ADDITIONAL BMPS TO PREVENT THE POTENTIAL OF SEDIMENTS ENTERING PROJECT STORM SYSTEMS.
4. PAIR WITH THE CURB LINE SEDIMENT ATTENUATEOR (SEE E-2C) AS REQUIRED.
5. INSPECT & MAINTENANCE:
   - 5.1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
   - 5.2. CLEAN, OR REPLACE, INSERTS WHEN 50% OF THE SUMP AREA HAS FILLED WITH DEBRIS.
   - 5.3. CONTRACTOR IS RESPONSIBLE FOR REMOVING INSERTS AND PROPERLY DISPOSING OF ALL MATERIALS ONCE THE PROJECT HAS BEEN PERMANENTLY STABILIZED.

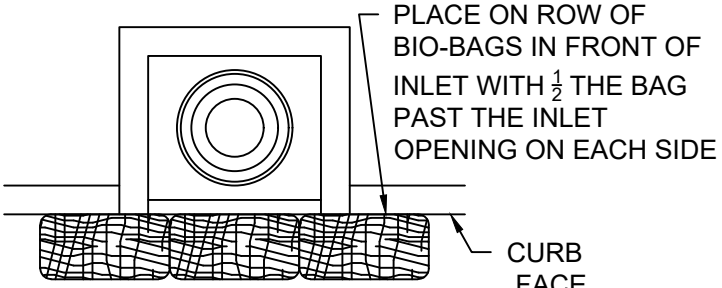
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		GRATED INLET PREFABRICATED FILTER INSERT	STD DWG E-2B



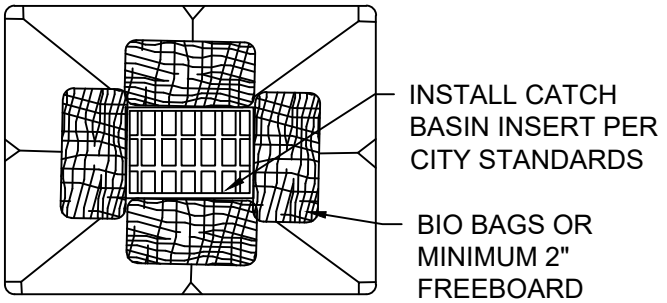
DITCH INLET



TYPE 1 CURBLINE SEDIMENT ATTENUATOR



TYPE 4 CURB CUT/ CURB INLET

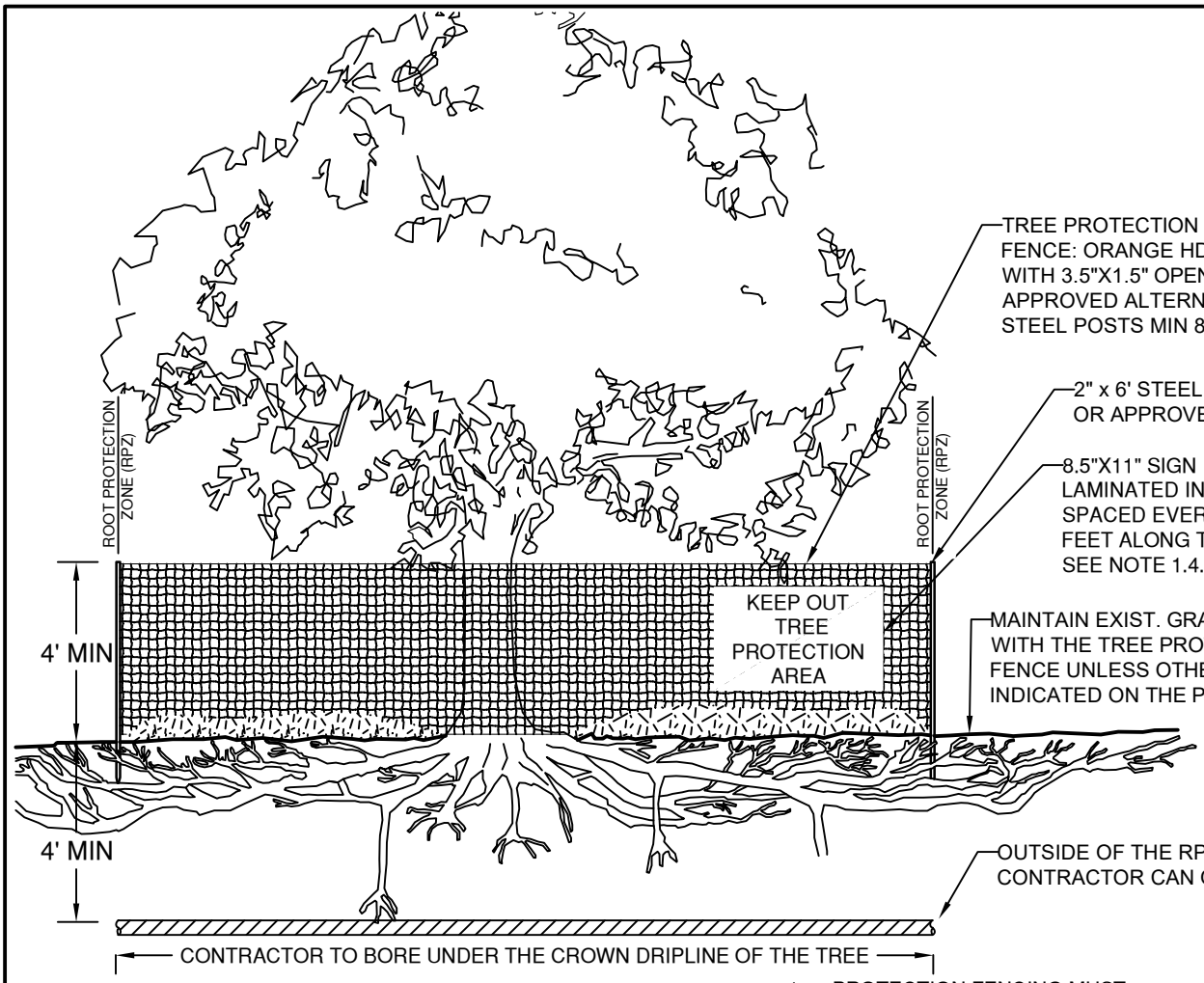


TYPE 3 AREA DRAIN / NON-HARDSCAPE INLET

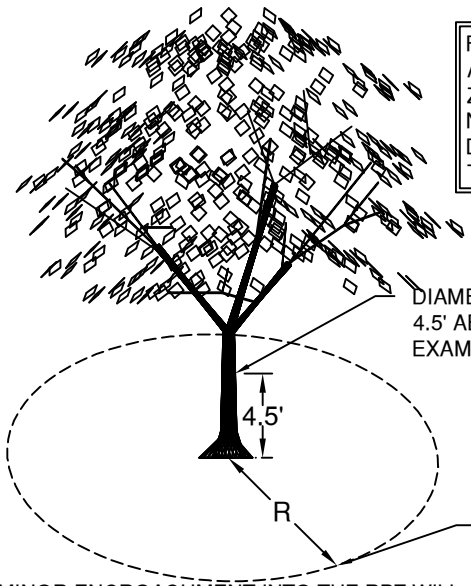
NOTES:

1. BIO-BAGS SHOULD BE STAKED WHERE APPLICABLE USING (2) 1"x2"x24" WOOD STAKES OR APPROVED EQUAL. LONGER STAKES WILL BE REQUIRED THERE IS HIGH RUNOFF OR LARGE SEDIMENT LOADS ANTICIPATED TO MAINTAIN BIO-BAGS IN POSITION.
2. TYPE 1 CURBLINE SEDIMENT ATTENUATOR SHALL BE INSTALLED AS REQUIRED.
3. BIO BAGS MAY BE REPLACED WITH A 2" MINIMUM FREEBOARD BETWEEN DISTURBED GROUND AND INLET GRATE.
4. SEDIMENT BARRIERS SHALL BE MAINTAINED UNTIL UPHILL AREA IS PERMANENTLY STABILIZED.
5. BIO-BAGS ARE NEVER TO BE PLACED IN COLLECTOR OR ARTERIAL STREETS UNLESS OTHERWISE APPROVED BY THE CITY.
6. INSPECTION & MAINTENANCE:
   - 6.1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
   - 6.2. CLEAN, OR REPLACE, BIO-BAGS WHEN DEBRIS HAS REACH A HEIGHT OF 2 INCHES.
   - 6.3. CONTRACTOR IS RESPONSIBLE FOR REMOVING BIO-BAGS AND PROPERLY DISPOSING OF ALL MATERIALS ONCE THE PROJECT HAS BEEN PERMANENTLY STABILIZED.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		BIO BAG INLET PROTECTION	STD DWG E-2C



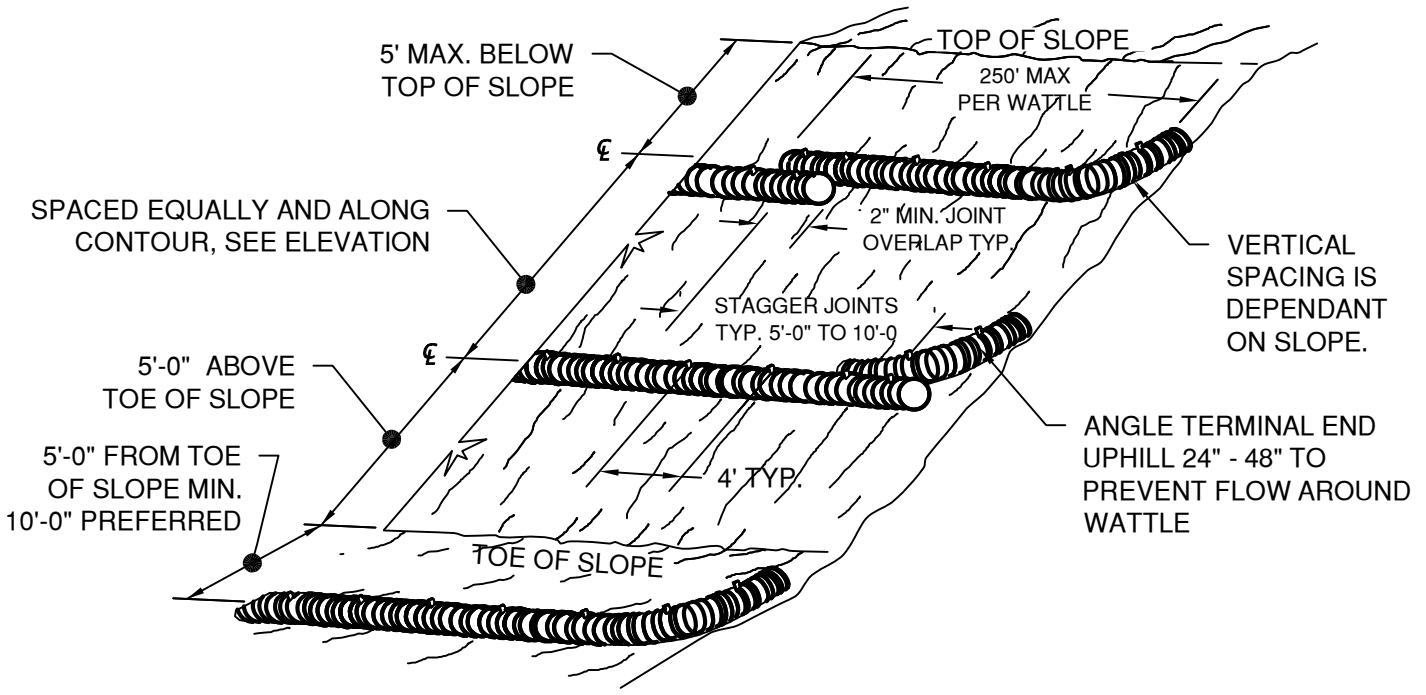
1. PROTECTION FENCING MUST:
   - 1.1. BE INSTALLED PRIOR TO ANY GRADING AND/OR SITE IMPROVEMENTS. FENCING TO BE MAINTAINED UNTIL THE GRADING PERMIT / SITE PERMIT IS COMPLETE.
   - 1.2. TREE PROTECTION METHODS MUST BE CONSISTENT WITH INTERNATIONAL SOCIETY OF ARBORICULTURE (ISA) BEST MANAGEMENT PRACTICES.
   - 1.3. PROTECTION FENCING MUST BE INSTALL AT THE EDGE OF THE ROOT PROJECTION ZONE AND PERMISSIBLE ENCROACHMENT AREA. EXISTING STRUCTURES AND/OR SECURE FENCING AT LEAST 3.5 FEET TALL CAN SERVE AS THE REQUIRED PROTECTION FENCING.
   - 1.4. SIGNAGE DESIGNATING THE PROTECTION ZONE AND PENALTIES FOR VIOLATIONS MUST BE SECURED ON EACH FENCE AS REQUIRED BY THE BDC.
   - 1.5. FENCING IS TO BE INSPECTED WEEKLY OR AFTER HIGH WINDS. REPAIR AS NEEDED TO ENSURE CONFORMANCE.
2. ANY LANDSCAPING OR IRRIGATION APPROVED WITHIN THE ROOT PROTECTION ZONE MAY BE INSTALLED BEFORE OR AFTER THE REMOVAL OF THE PROTECTION FENCING AND MUST NO DISTURB EXISTING TREES, INCLUDING ROOTS, WITHIN THE ROOT PROTECTION ZONE.
3. NO EQUIPMENT SHALL OPERATE INSIDE THE PROTECTION FENCING. AREA WITHIN THE FENCING WILL NOT BE USED FOR STAGING OR STORAGE.



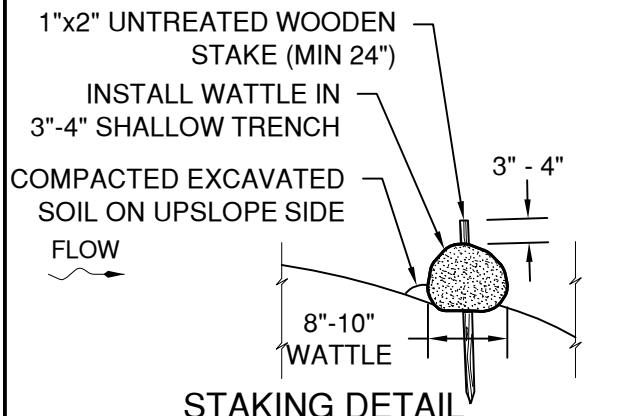
FENCE IS TO BE LOCATED AT THE ROOT PROTECTION ZONE. THIS MAY OR MAY NOT EXCEED THE TREES DRIP LINE, DEPENDENT ON THE TREE SIZE AT DBH.

MINOR ENCROACHMENT INTO THE RPZ WILL BE CONSIDERED WHERE IDENTIFIED IN AND APPROVED DURING PERMIT REVIEW.

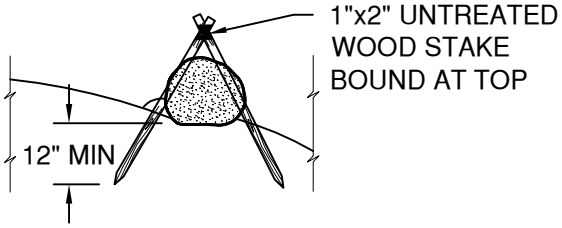
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
-		TREE/VEGETATION PROTECTION FENCING	STD DWG E-3



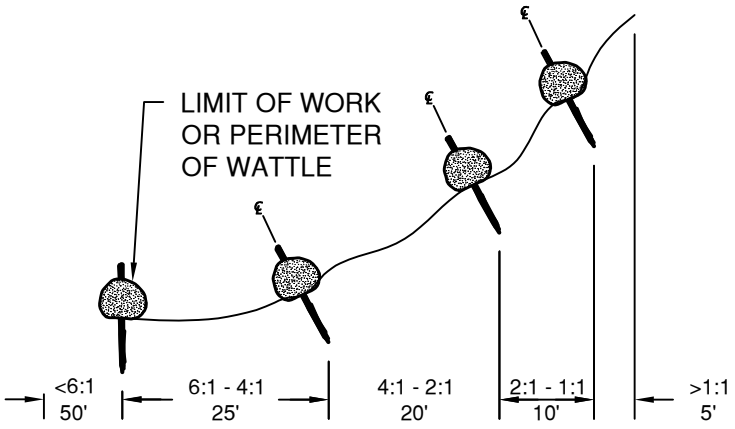
SLOPE APPLICATION - PERSPECTIVE VIEW



STAKING DETAIL



ALTERNATIVE STAKING DETAIL

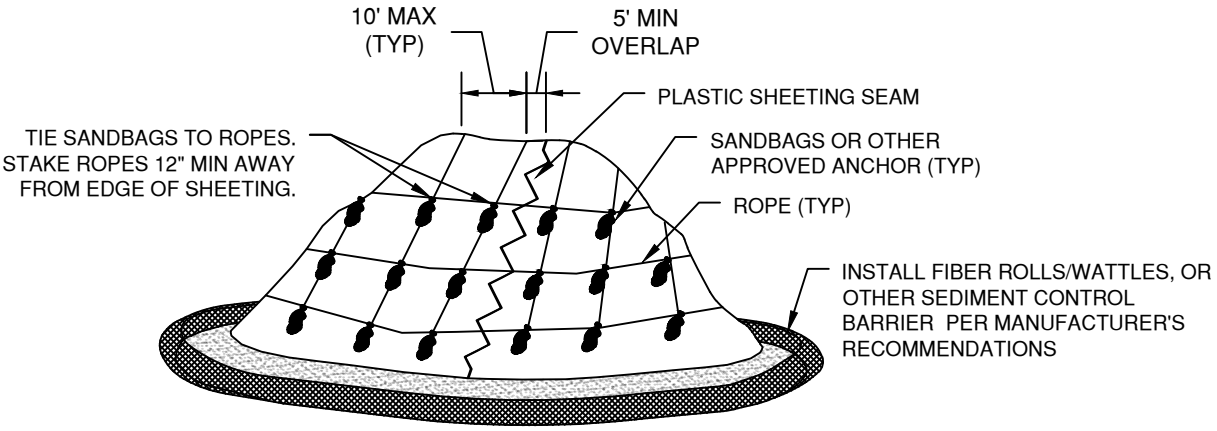


SLOPE APPLICATION - PLAN VIEW

INSPECTION & MAINTENANCE

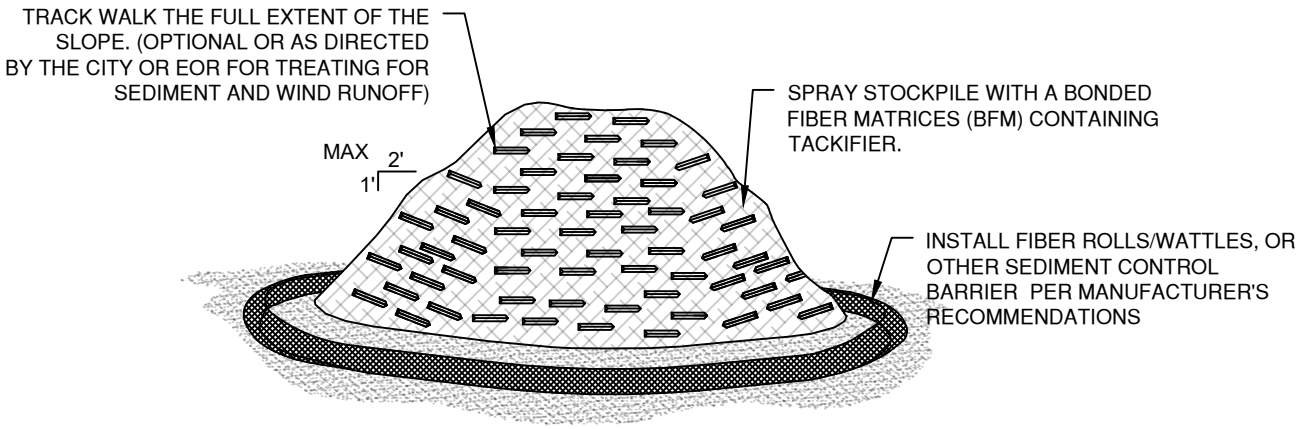
1. INSPECT WEEKLY AND AFTER MAJOR STORM
2. REMOVE ACCUMULATED SEDIMENT WHEN IT IS 1/3 CAPACITY OF WATTLE.
3. REPAIR ADJACENT RILLS OR GULLIES PROMPTLY.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		WATTLES	STD DWG E-4



TEMPORARY STOCKPILE STABILIZATION

NTS



PERMANENT STOCKPILE STABILIZATION

NTS

NOTES:

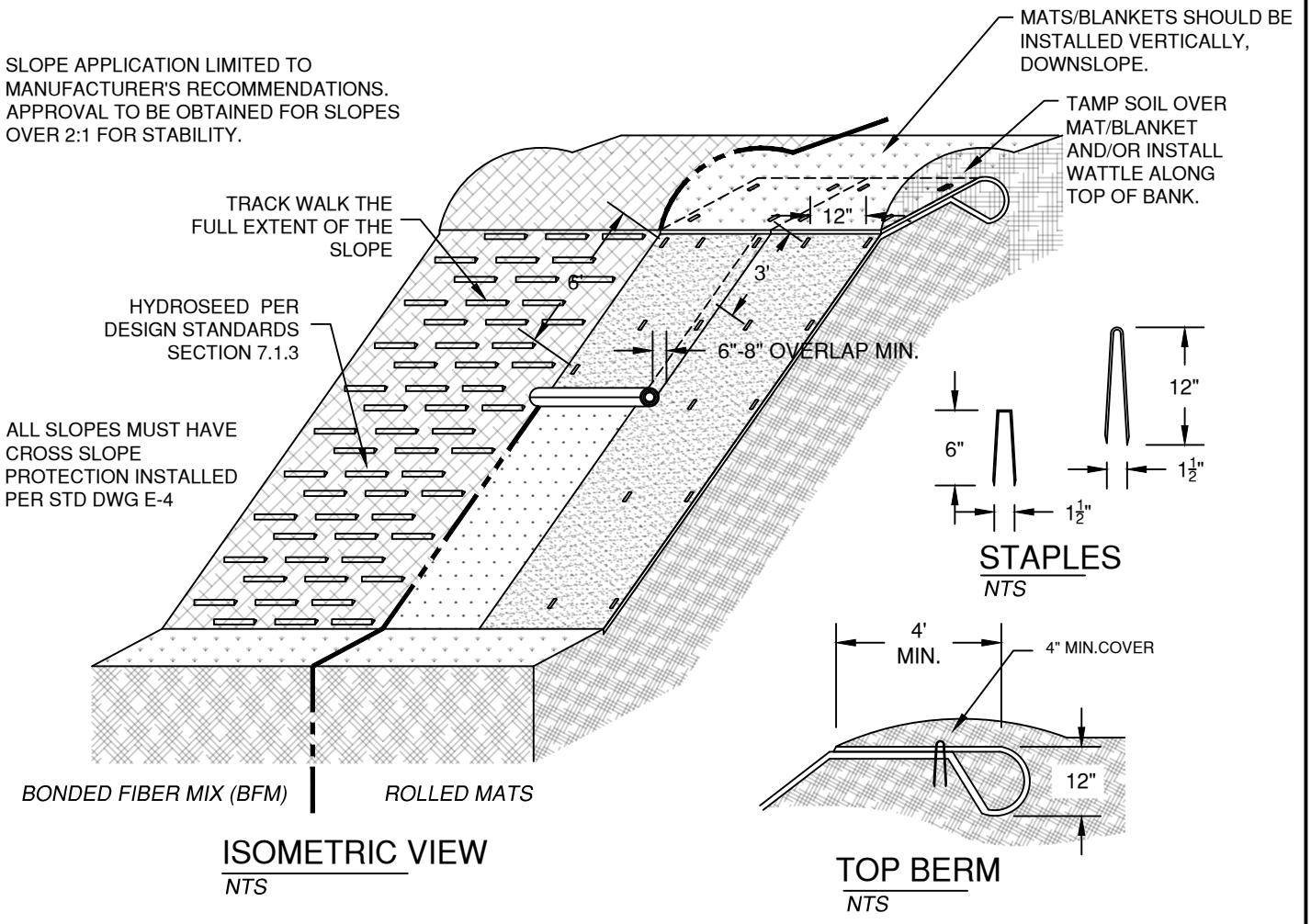
TEMPORARY STOCKPIPE STABILIZATION:

1. INSTALL PLASTIC SHEETING VERTICALLY DOWN SLOPE.
2. INSTALL PLASTIC SHEETING SO EDGES OVERLAP AND ARE SHINGLED AWAY FROM PREVAILING WINDS.
3. PLASTIC SHEETING SHOULD ONLY BE UTILIZED AS REQUIRED BY THE CITY WHERE OTHER METHODS OF STOCKPILE STABILIZATION HAVE NOT PERFORMED.

INSPECTION AND MAINTENANCE:

1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS
2. REPLACE TORN SHEETS AND REPAIR OPEN SEAMS.
3. COMPLETELY REMOVE ALL PLASTIC AND REPLACE WHEN IT BEGINS TO DETERIORATE.
4. COMPLETELY REMOVE PLASTIC WHEN IT IS NO LONGER NEEDED.
5. CHECK ANCHORING SYSTEMS AND REPAIR OR ADD ANCHORS.
6. VERIFY EFFECTIVE FUNCTION OF BMP AT TOE OF SLOPE.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STOCKPILE STABILIZATION	STD DWG E-5



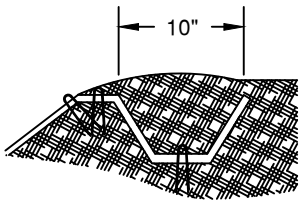
NOTES:

1. PRIOR TO A SITE'S FINAL APPROVAL, ALL DISTURBED STEEP SLOPES MUST BE TREATED FOR LONG-TERM EROSION CONTROL. DISTURBED SOIL OF LESSER SLOPE SHALL BE STABILIZED AND TREATED IF SOIL HAS THE POTENTIAL TO LEAVE THE SITE OR ENTER A STORM DRAIN SYSTEM.
2. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS OR LARGE ORGANIC DEBRIS. MATS/BLANKETS SHALL BE HAVE GOOD SOIL CONTACT.
3. APPLY PERMANENT SEEDING BEFORE PLACING MATS/BLANKETS.
4. LAY BLANKETS LOOSELY AND STAKE/STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH.
5. MINIMUM STAKING OR STAPLING LAYOUT PATTERN - SEE MANUFACTURERS SPECIFICATIONS. USE 6-INCH STAPLES ON COMPACTED SOILS AND 12-INCH STAPLES ON LOOSE SOILS.

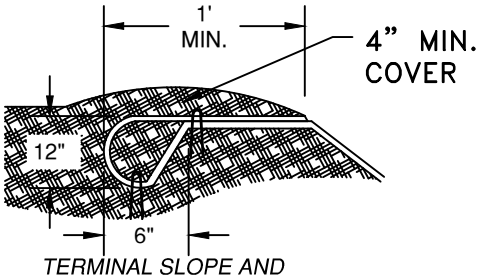
INSPECTION AND MAINTENANCE:

1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
2. REPAIR ANY DAMAGED AREA OF THE MAT, BLANKET OR BFM. MAINTAIN OR PROVIDE ADDITIONAL ANCHORS AS NECESSARY TO MAINTAIN GROUND CONTACT.
3. IF EROSION OCCURS, REPAIR AND PROTECT THE ERODED AREA. ADDITIONAL CROSS SLOPE PROTECTION MAY BE REQUIRED.

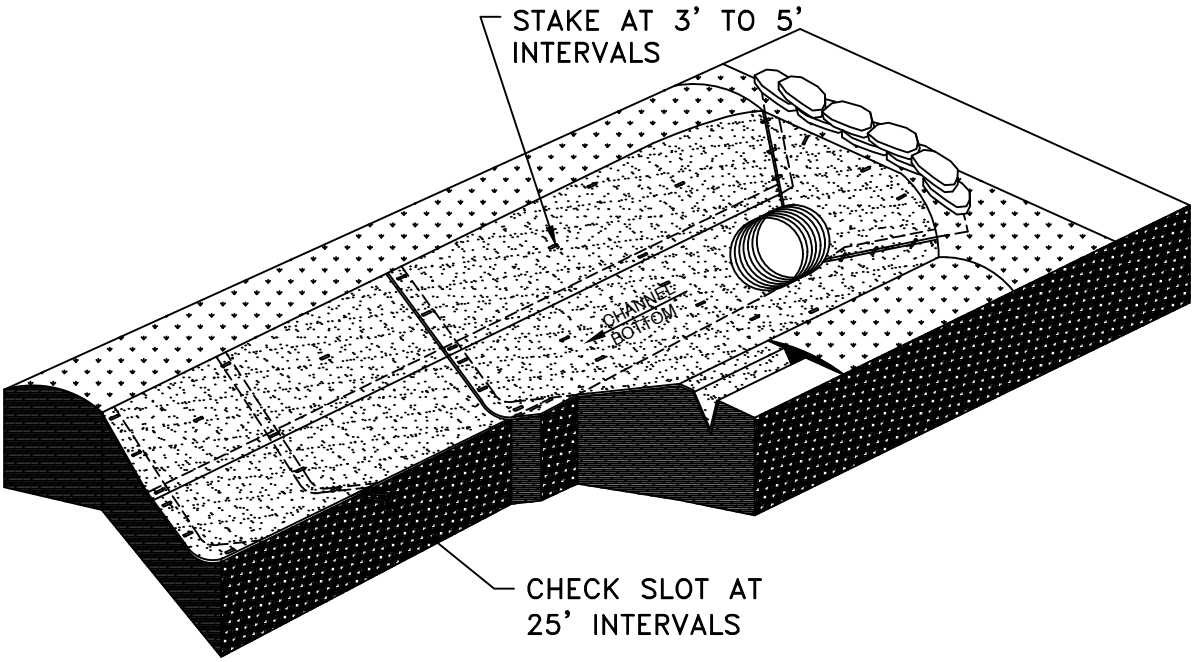
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
	CITY OF BEND	SLOPE STABILIZATION	STD DWG E-5B

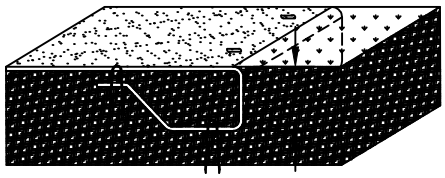


LONGITUDINAL ANCHOR TRENCH
NTS

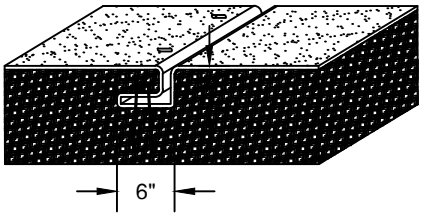


TERMINAL SLOPE AND
CHANNEL ANCHOR TRENCH
NTS





INITIAL ANCHOR TRENCH
NTS

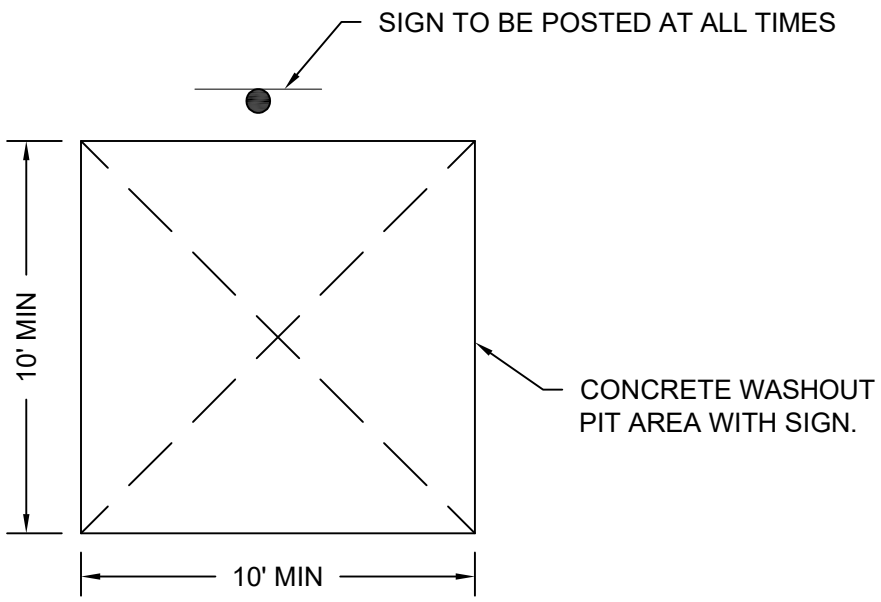


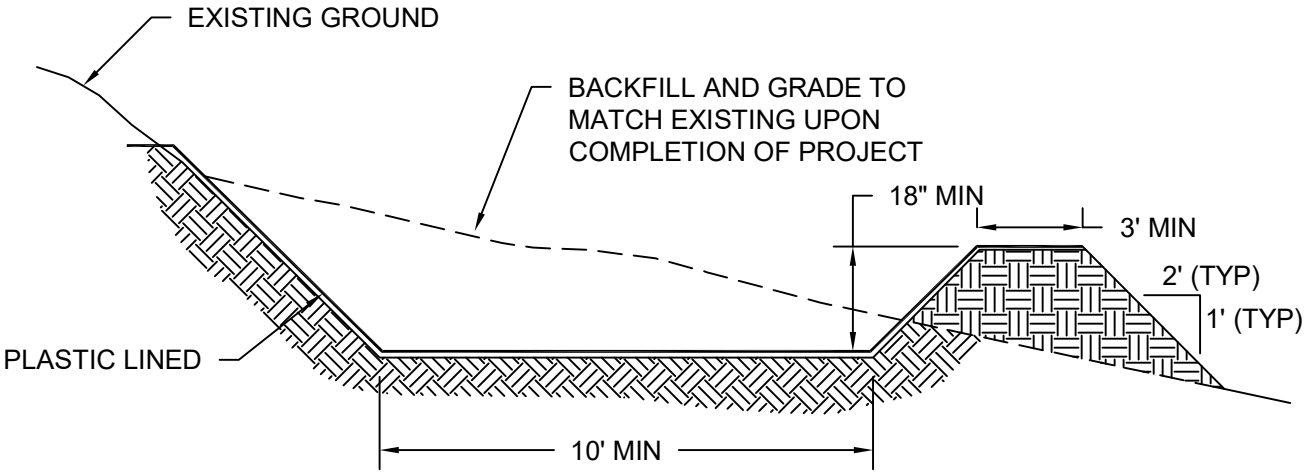
INTERMITTENT CHECK SLOT
NTS

NOTES:
1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS RECOMMENDATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURES RECOMMENDATIONS.
3. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
4. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
5. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH.

CHANNEL STABILIZATION
NTS

DRAWN LJC	CITY OF BEND	CITY OF BEND		SCALE NTS
DIV EROSION		STANDARD DRAWING		DATE 10/01/21
REV / DATE		710 NW WALL ST., BEND, OREGON 97701		APPR
12/1/17		EROSION BLANKET - CHANNEL INSTALLATION		STD DWG E-6

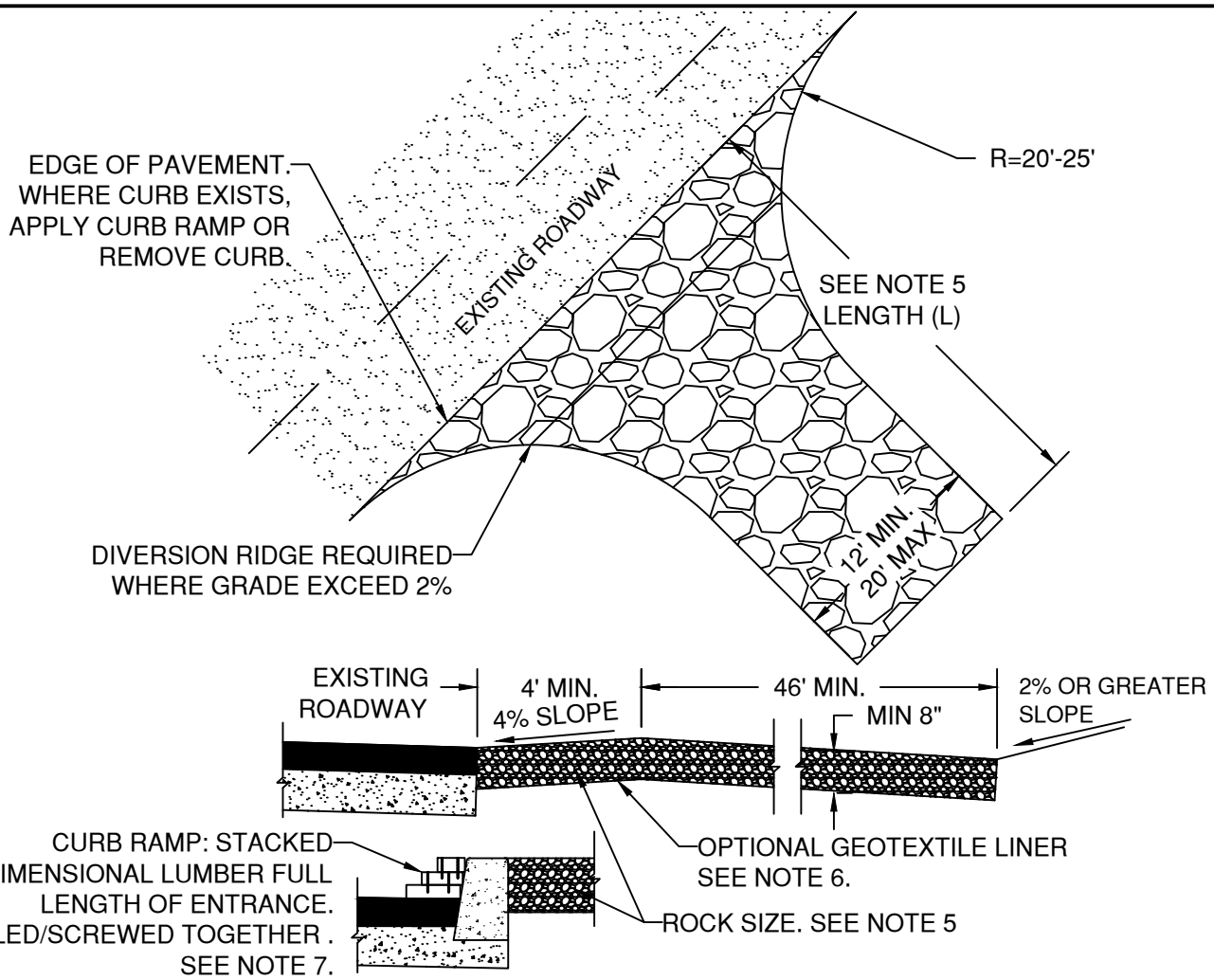




NOTES:
1. LOCATE THE WASHOUT A MINIMUM OF 50 FEET FROR ANY STORMWATER INLET AND/OR WATERBODY.
2. PREFABRICATED WASHOUT DEVICES MAY BE UTILIZED.

INSPECTION & MAINTENANCE:
3. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
4. WASHOUT FACILITIES MUST BE SERVICED OR REPLACED AND READY FOR USE ONCE THE FACILITY IS 75% FULL.
5. CONCRETE WASHOUT AREA TO BE REPAIRED AND/OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE.
6. WASHOUT AREA TO BE REPAIRED AND/OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE, WASHOUT AND SOLIDS.
7. UPON COMPLETION OF CONSTRUCTION ACTIVITIES, THE WASHOUT SHALL BE REMOVED AND THE AREA RESTORED TO FINISHED GRADE AND PRE-EXISTING CONDITIONS. CONTRACTOR TO LEGALLY DISPOSE OF WASTE MATERIALS.
8. CONTRACTOR SHALL TAKE PRECAUTIONS SO AS TO NOT OVERFLOW THE PIT.

DRAWN CJH DIV EROSION REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 CONCRETE TRUCK WASHOUT	SCALE NTS DATE 11/01/2024 APPR STD DWG E-7



NOTES:

1. CONSTRUCTION ENTRANCE TO BE INSTALLED PRIOR TO ANY OTHER WORK ON SITE AND IS APPLICABLE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED.
2. TIRE WASH FACILITY MAY BE REQUIRED ON SITE TO PREVENT TRACKING ONTO EXISTING ROADWAY. IF REQUIRED, CONSTRUCT TIRE WASH FACILITY PER ODOT STD DWG RD1060.
3. THE CONSTRUCTION AND USE OF THIS ENTRANCE IN NO WAY NEGATES THE CONTRACTOR`S RESPONSIBILITIES TO PREVENT TRACKING OF MATERIAL ONTO EXISTING ROADWAY.
4. ALTERNATIVE PROPRIETARY ENTRANCE MAY BE USED AS APPROVED BY THE CITY.
5. ROCK WILL BE CLEAN AND OPEN GRADED.
   - 5.1. FOR DEVELOPMENT (1-4 RESIDENTIAL UNITS), 3/4-INCH ROCK, L= 20 FEET. "SMALL INDIVIDUAL LOT"
   - 5.2. FOR ALL OTHER DEVELOPMENTS, 3 INCH TO 6 INCH ROCK, L= 50 FEET.
   - 5.3. 1 INCH TO 3 INCH ROCK CAN BE USED AS APPROVED BY THE CITY, L=100 FEET.
6. GEOTEXTILE LINER WILL BE REQUIRED UNDER ROCK WHERE SOILS ARE CLAY OR SHOW SIGNS OF PUMPING THROUGH ROCK.
7. STACKING OF MATERIAL AT CURB FACE FOR CONSTRUCTION ENTRANCE NOT PERMITTED IN BIKE LANES. WHERE BIKE LANES EXIST, CURB CUT MUST BE PERFORMED. DAMAGED CURB WILL BE REMOVED AND REPLACED.
8. INSPECTION & MAINTENANCE:
   - 8.1. INSPECT WEEKLY AND AFTER STORM EVENTS
   - 8.2. MUST BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING/SEDIMENT TRANSFER. INCLUDING BUT NOT LIMITED TO TOPPING, REMOVAL AND REPLACEMENT OF CONTAMINATED ROCK WITH CLEAN ROCK.
   - 8.3. ANY MATERIAL THAT STILL MAKES IT ONTO THE ROAD MUST BE SWEPT IMMEDIATELY AND PROPERLY DISPOSED OF. WASHING OF STREET IS NOT PERMITTED.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CONSTRUCTION ENTRANCE	STD DWG E-8

TEMPORARY STABILIZATION
(EARTHWORK NOT AT FINISHED GRADE)

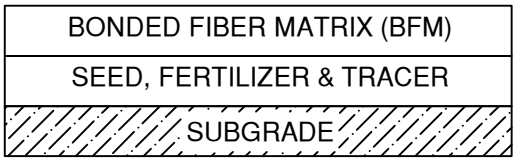
SEE BEND STANDARDS AND SPECIFICATIONS II, CHAPTER 7.1.3

TEMPORARY STABILIZATION IS REQUIRED WITHIN 10 DAYS OF INACTIVITY OR AS APPROVED BY CITY

ROUTINE PROJECT COMPLIANCE

TEMPORARY STABILIZATION OPTION PROFILES

TEMPORARY STABILIZATION **OPTION A**



TEMPORARY STABILIZATION **OPTION B**

ALTERNATIVE AS APPROVED BY THE CITY IN WRITING

PERMANENT STABILIZATION
(EARTHWORK AT FINISHED GRADE OR PROJECT IS DESIGNATED INACTIVE)

SEE BEND STANDARDS AND SPECIFICATIONS II, CHAPTER 7.1.3

PERMANENT STABILIZATION IS REQUIRED WITHIN 10 DAYS OF PROJECT COMPLETION OR IF NO WORK OCCURS AT THE PROJECT SITE OVER A 30 DAY PERIOD

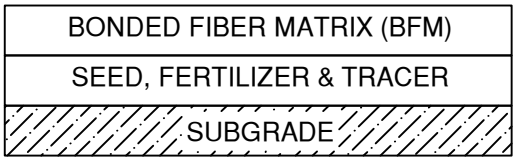
FINAL PROJECT APPROVAL

NOTES:

A. WHEN A PROJECT IS DEEMED IN ACTIVE, WITH NO WORK OCCURRING OVER A 30 DAY PERMIT. THE PROJECT WILL BE REQUIRED TO BE PERMANENTLY STABILIZED.
B. FOR PROJECTS WHERE SLOPES EXCEED 5%, SEE SLOPE / STOCKPILE STABILIZATION STANDARDS FOR ADDITIONAL DETAILS AND REQUIREMENTS.
C. WHEN THE POTENTIAL EXISTS FOR SEDIMENT TO IMPACT ADJACENT PROPERTY OR PUBLIC AND PRIVATE STORM DRAINAGE SYSTEMS ADDITIONAL BMPs MAY BE REQUIRED BY THE CITY TO ENSURE PROTECTION AND FULL STABILIZATION PRIOR TO FINAL APPROVAL.

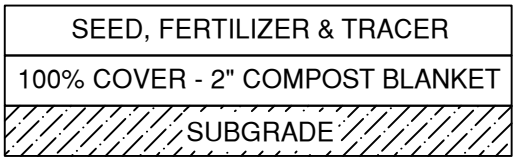
PERMANENT STABILIZATION OPTION PROFILES

PERMANENT STABILIZATION **OPTION A**



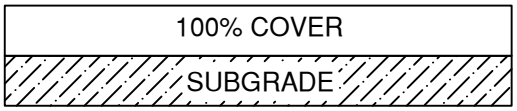
GERMINATION MUST ACHIEVE UNIFORM AERIAL PLANT COVERAGE OF >70%

PERMANENT STABILIZATION **OPTION B**



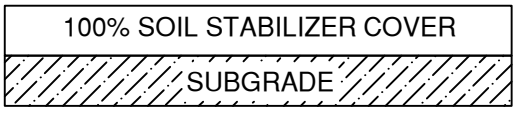
NO GERMINATION OR AERIAL COVERAGE REQUIRED.

PERMANENT STABILIZATION **OPTION C**



ALLOWED IN AREAS <5% SLOPE ONLY. COVER INCLUDES A 2 IN. THICK ROCK OR ORGANIC MULCH BLANKET.

PERMANENT STABILIZATION **OPTION D**

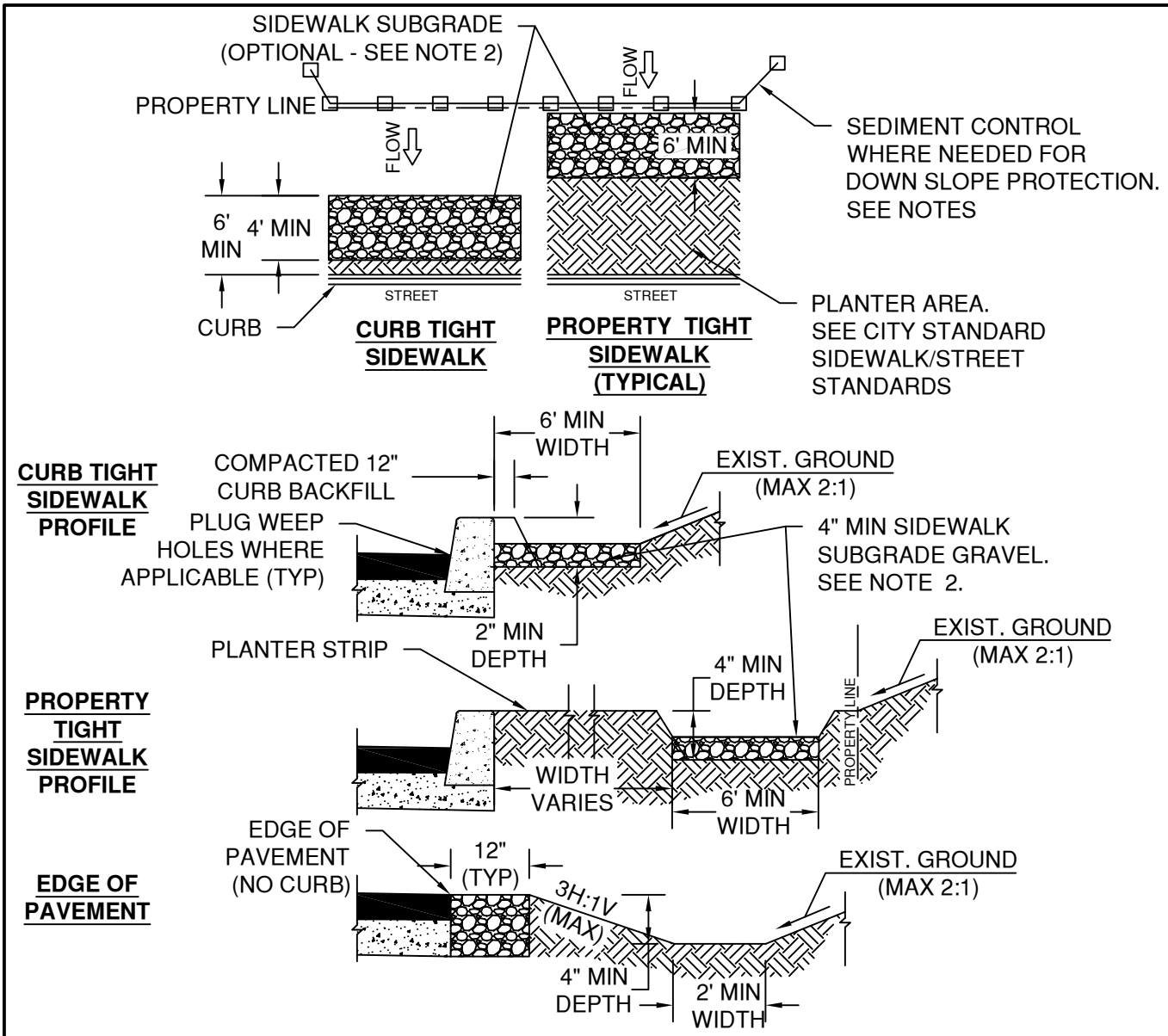


ALLOWED IN AREAS OF RESIDENTIAL DEVELOPMENT WITH <5% SLOPE, WHERE FINAL LOT GRADE IS ACHIEVED BUT VERTICAL CONSTRUCTION IS TO OCCUR AS A SEPARATE PHASE. APPLIED AT MANUFACTURE'S RECOMMENDED RATE WITH AN EFFECTIVE PERIOD OF NO LESS THAN 6 MONTHS.

PERMANENT STABILIZATION **OPTION E**

ALTERNATIVE AS APPROVED BY THE CITY IN WRITING

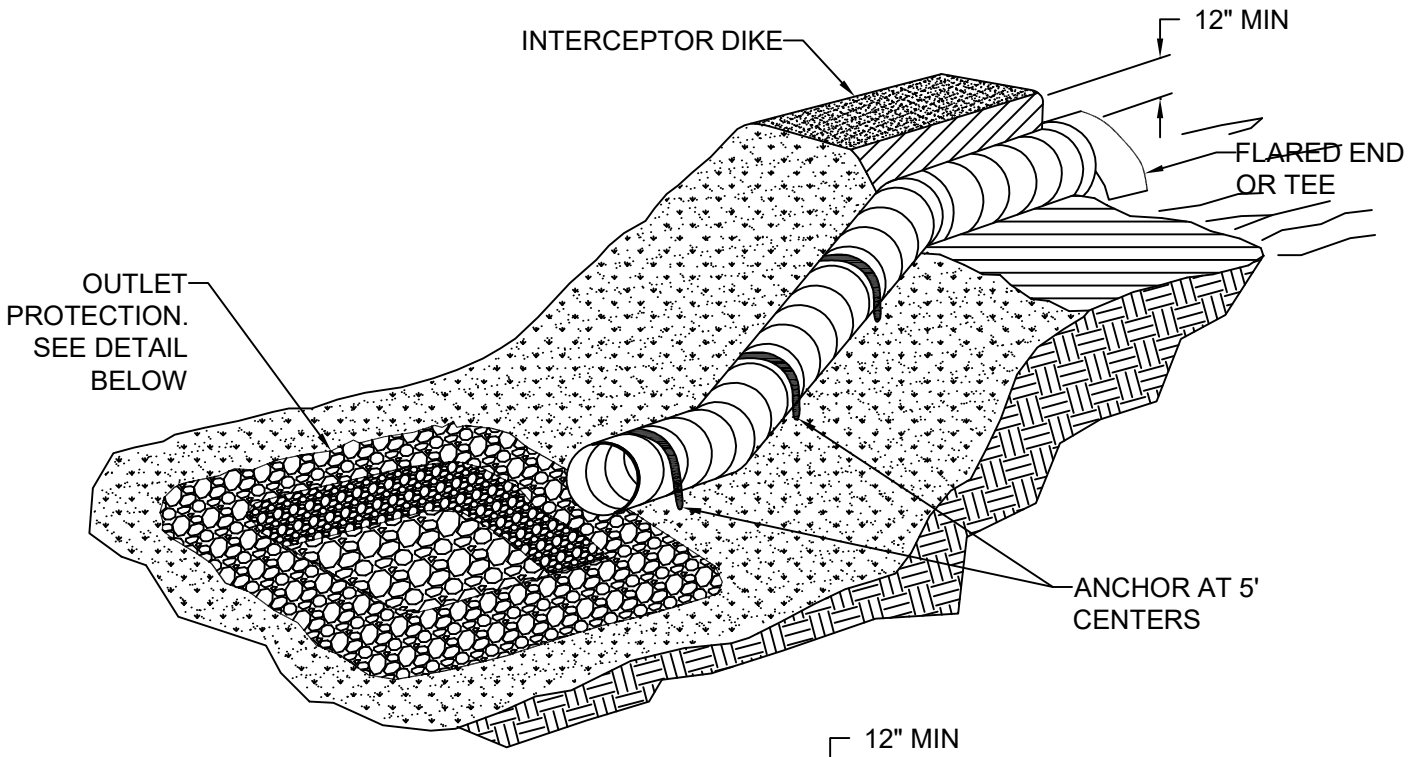
DRAWN CJH	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV EROSION			DATE 11/01/2024
REV / DATE			APPR
		STABILIZATION REQUIREMENTS	STD DWG E-9

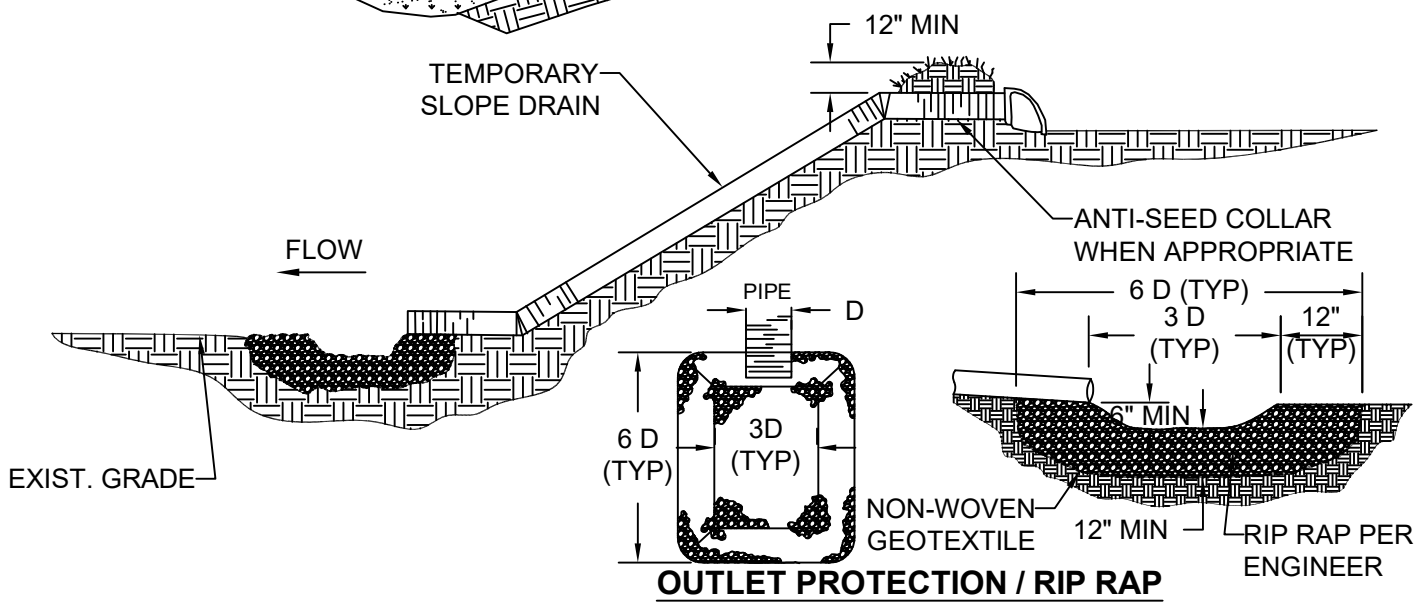


NOTES:

1. WHERE SIDEWALKS ARE INSTALLED, OR THE PROPERTY SLOPES AWAY FROM THE ROAD, THIS STANDARD IS NOT APPLICABLE. DISTURBED SOILS ARE TO BE STABILIZED TO CITY STANDARDS. WHERE SEDIMENT CONTROL IS INSTALLED, IT MUST BE PLACED AT THE PROPERTY LINE OUTSIDE THE RIGHT OF WAY, ALLOWING ACCESS TO THE RIGHT OF WAY. STORMWATER FLOWS INTO THE RIGHT OF WAY WILL BE REMEDIED, PER COSM AND TITLE 16, WITH LOT DEVELOPMENT.
2. THE GRAVEL SIDEWALK SUBGRADE / BASE IS OPTIONAL. WHERE APPLIED, GRAVEL TO BE REMOVED OR ADDITIONAL GRAVEL TO BE ADDED (TO ACHIEVE CITY STANDARDS) WITH SIDEWALK CONSTRUCTION DEPENDING ON LEVEL OF GRAVEL CONTAMINATION.
3. SITE SLOPES GRATER THAN 5% TOWARDS THE SIDEWALK/STREET SUBGRADE MAY BARRIER REQUIRE ADDITIONAL SEDIMENT CONTROL BMPS (SEDIMENT FENCE, STRAW WATTLE, ETC.)
4. SIDEWALK SUBGRADE GRAVEL TO MEET CITY STANDARDS.
5. INSPECTION & MAINTENANCE:
   - 5.1. INSPECT WEEKLY AND AFTER STORM EVENTS.
   - 5.2. REMOVE SEDIMENT WHEN ACCUMULATION IS GREATER THAN 50% OF THE CAPACITY.

DRAWN CJH	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV EROSION			DATE 11/1/2024
REV / DATE			APPR
		SUBGRADE BARRIER	STD DWG E-10





OUTLET PROTECTION / RIP RAP

GRADE RIPRAP SHALL BE THE CLASS AND SIZE OF ROCK ACCORDING TO THE FOLLOWING:					
CLASS 50	CLASS 100	CLASS 200	CLASS 700	CLASS 2000	
WEIGHT OF ROCK (LBS)					% (BY WEIGHT)
50-30	100-60	200-140	700-500	2000-1400	20
30-15	60-25	140-80	500-200	1400-700	30
15-2	25-2	80-8	200-20	700-40	40
2-0	2-0	8-0	20-0	40-0	10

RIPRAP:

- ROCK FOR RIPRAP SHALL BE ANGULAR IN SHAPE.
- THICKNESS OF A SINGLE RAMP SHALL NOT BE LESS THAN 1/3 ITS LENGTH.
- DESIGN BASED ON ODOT HYDRAULICS MANUAL AND COSM.

RIPRAP INSTALLATION:

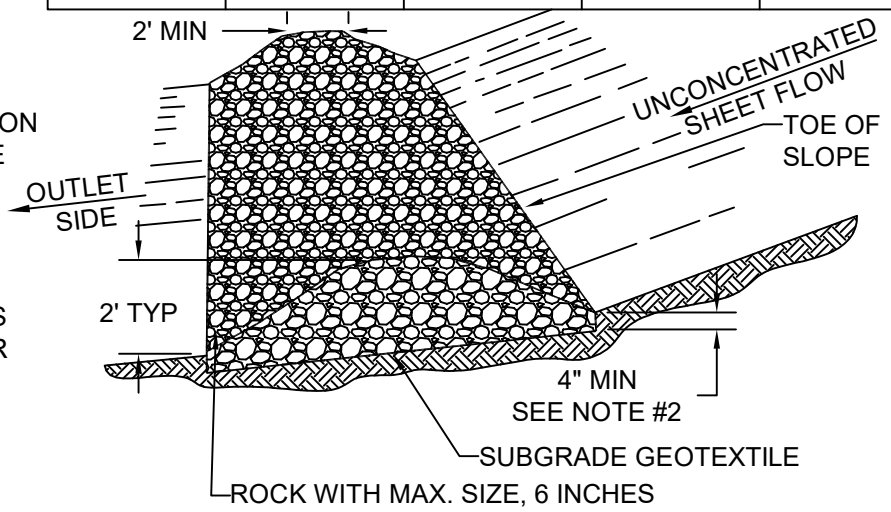
- EXCAVATE BELOW FINISHED GRADE TO DEPTH & DIMENSION SHOWN ON APPROVED PLANS.
- INSTALL WOVEN GEOTEXTILE FABRIC.
- PLACE RIP RAP TO FINISHED GRADE.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
-		PIPE SLOPE DRAIN	STD DWG E-11

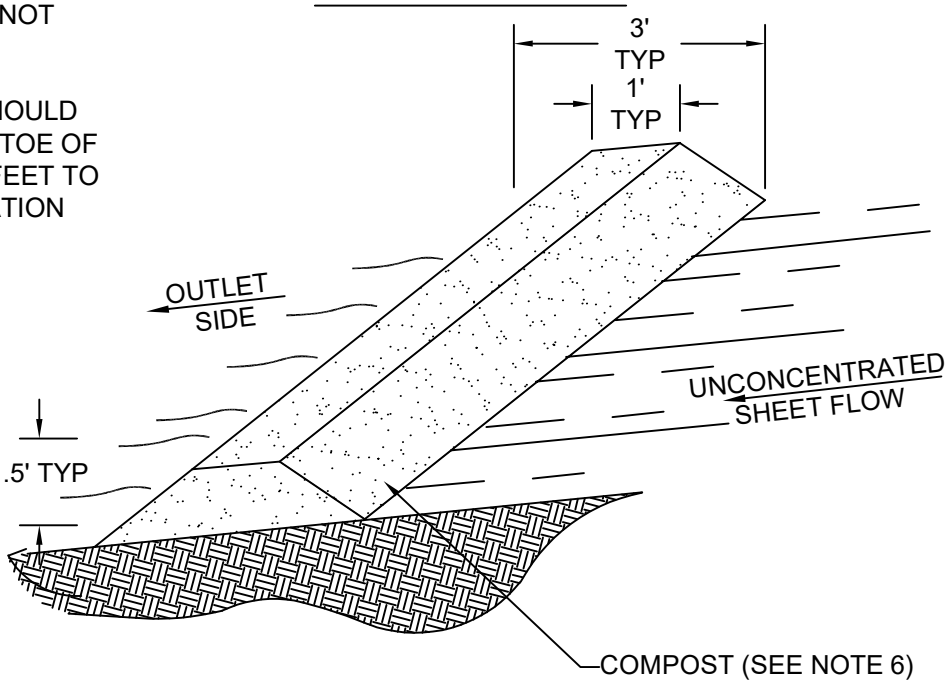
NOTES:

1. DIRECT THE OUTLET SIDE OF THE ROCK/COMPOST FILTER BERMS ONTO A STABILIZED AREA, SUCH AS VEGETATION AND/OR ROCK.
2. EMBED ROCK FILTER BERM A MIN. OF 4" INTO THE EXISTING GROUND/EMBANKMENT.
3. USE ROCK FILTER BERM ON 2H:1V OR FLATTER SIDE SLOPES.
4. PLACE FILTER BERMS ALONG OR ON THE GROUND CONTOUR WITH THE ENDS TURNED UP SLOPE.
5. PRIOR TO INSTALLING A FILTER BERM IN A VEGETATED AREA, ENSURE THAT THE VEGETATION IS CUT TO A HEIGHT OF NO GREATER THAN 3" PRIOR TO INSTALLATION.
6. COMPOST HAS NOT BEEN CHEMICALLY TREATED AND IS WEED-FREE, PLASTIC-FREE, DECOMPOSED, NON-WOODY PLANT MATERIAL; ANIMAL WASTE IS NOT ALLOWED.
7. WHERE POSSIBLE, BERMS SHOULD BE PLACED AWAY FROM THE TOE OF THE SLOPE A MINIMUM OF 5 FEET TO ALLOW FOR ENERGY DISSIPATION AND STORAGE.

FILTER BERM DIMENSIONS AND SPACING BASED ON SLOPE				
SLOPE	BERM SPACING	BERM DIMENSIONS		
		HEIGHT	BOTTOM WIDTH	TOP WIDTH
>50:1	250 Ft	1 Ft	2 Ft (MIN)	1 Ft
50:1 - 10:1	125 Ft	1 Ft	2 Ft (MIN)	1 Ft
10:1 - 5:1	100 Ft	1 Ft	2 Ft (MIN)	1 Ft
3:1 - 2:1	50 Ft	1.30 Ft	2.6 Ft (MIN)	1 Ft
>2:1		1.50 Ft	3 Ft (MIN)	1 Ft



ROCK FILTER BERM

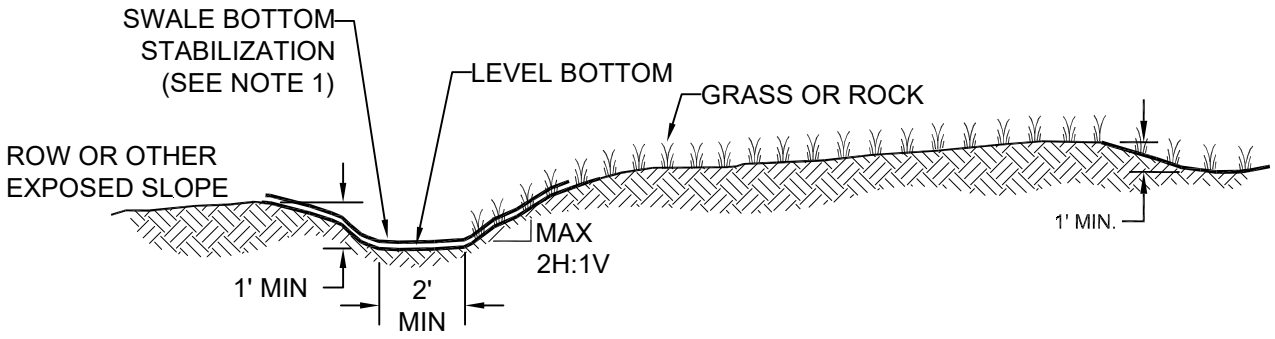


COMPOST FILTER BERM

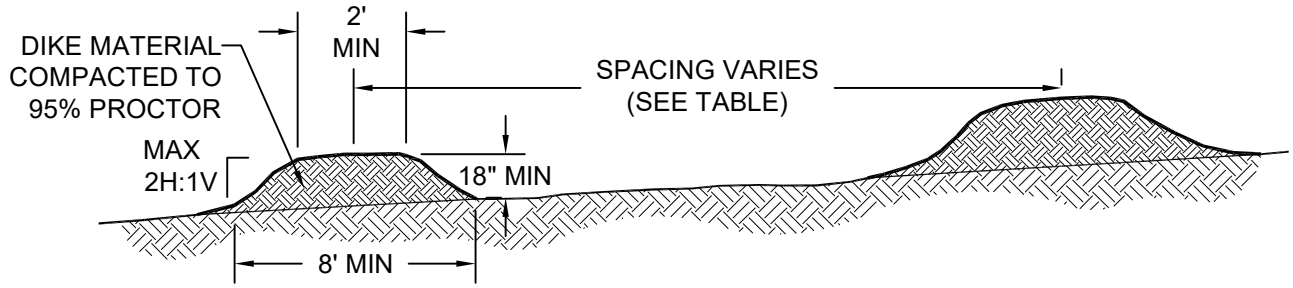
INSPECT & MAINTENANCE:

1. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
2. REMOVE SEDIMENT WHEN ACCUMULATION IS AT 1/3 THE CAPACITY.
3. REPAIR ANY BREAKS OR EROSION OCCURRING IN THE BERM.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
-		FILTER BERMS	STD DWG E-12



DIVERSION SWALE



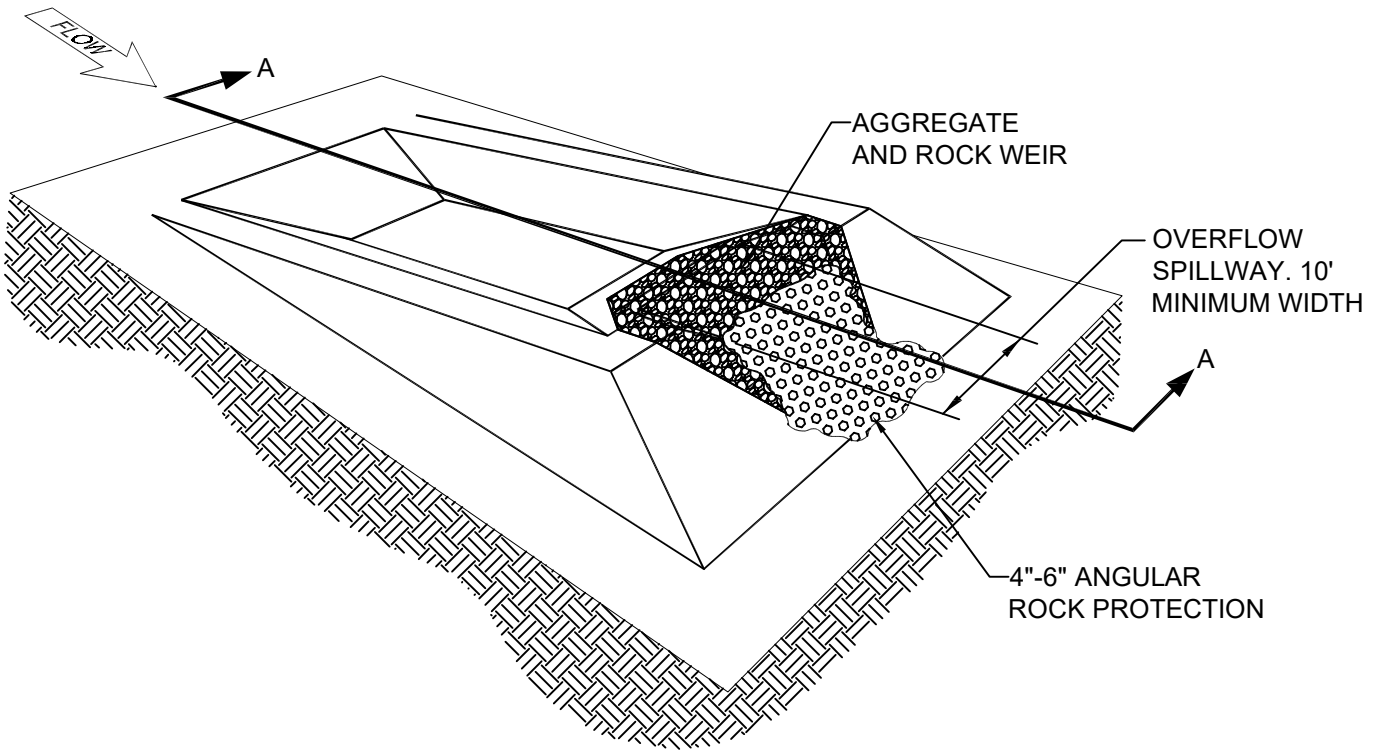
TEMPORARY DIVERSION DIKE

NOTES:
1. STABILIZE SWALE BOTTOMS WITH ESTABLISHED VEGETATION OR EROSION CONTROL BLANKETS PRIOR TO USE.
2. CONSTRUCT WITH POSITIVE DRAINAGE TO AN APPROVED OUTLET, SUCH AS SEDIMENTATION POND/TRAP.

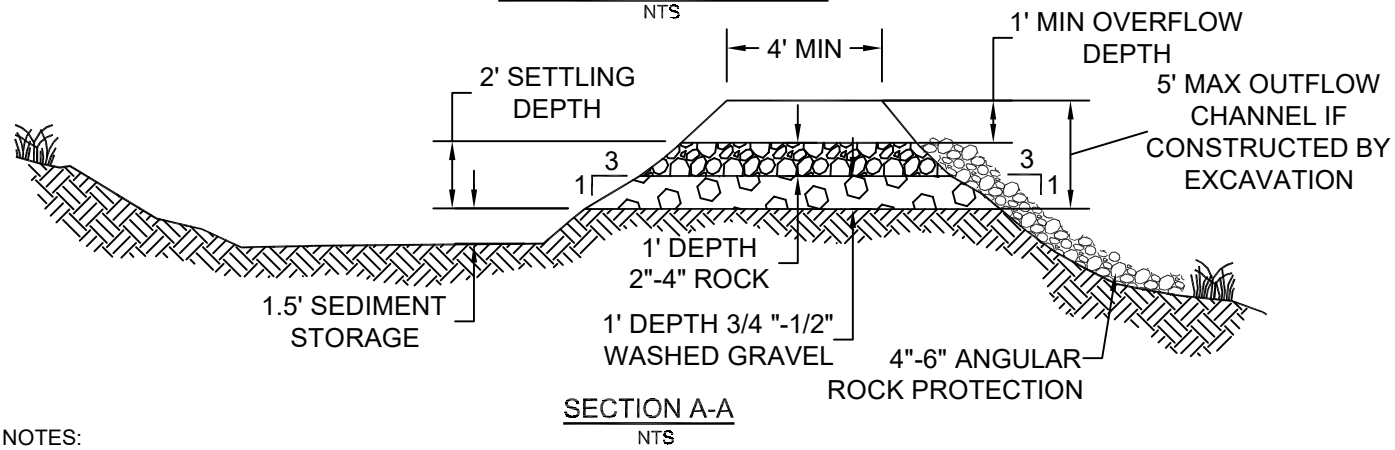
INSPECTION AND MAINTENANCE:
3. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
4. IMMEDIATELY REPAIR DAMAGE OCCURRING AS A RESULT OF RUNOFF OR CONSTRUCTION ACTIVITY.
5. IF DIKE OR SWALE REGULARLY OVERFLOW, INCREASE CAPACITY OR FREQUENCY OF DIKES/SWALES.
6. DIRECT TRAFFIC TO MINIMIZE IMPACTS OVER DIKES / SWALES.

DIVERSION SPACING	
SLOPE	**SPACING**
< 5%	300 FEET
5 - 10 %	200 FEET
10 - 40 %	100 FEET

DRAWN CJH	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV EROSION			DATE 11/01/2024
REV / DATE: -			APPR
	CITY OF BEND	DIVERSION SWALES AND DIKES	STD DWG E-13



SEDIMENT TRAP OUTLET
NTS

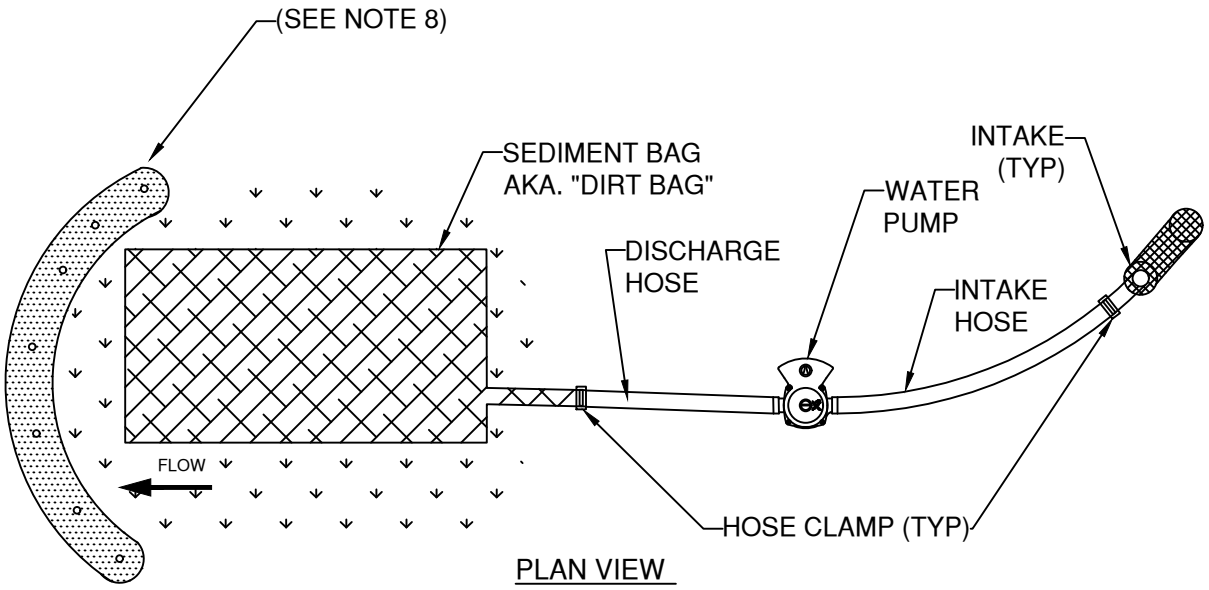


SECTION A-A
NTS

NOTES:
1. MAY BE CONSTRUCTED BY EXCAVATION OR BY BUILDING A BERM.
2. NO SEDIMENT LADEN WATER IS ALLOWED TO DISCHARGE FROM THE PROJECT. A FILTER MUST BE CONSTRUCTED TO FILTER RUNOFF FROM THE SEDIMENT TRAP PRIOR TO DISCHARGE FROM THE CONSTRUCTION SITE.
3. UTILIZE A SEDIMENT TRAP AT THE LOW POINT(S) OF THE PROJECT WITHIN PERIMETER CONTROL BMPs.

INSPECTION AND MAINTENANCE:
4. INSPECT WEEKLY AND DAILY DURING STORM EVENTS.
5. SEDIMENT FROM THE TRAP WHEN ACCUMULATION IS AT 1/3 CAPACITY.
6. REPAIR ANY DAMAGE TO THE TRAP, EMBANKMENTS OR SLOPES.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
-		SEDIMENT TRAP	STD DWG E-14



PLAN VIEW

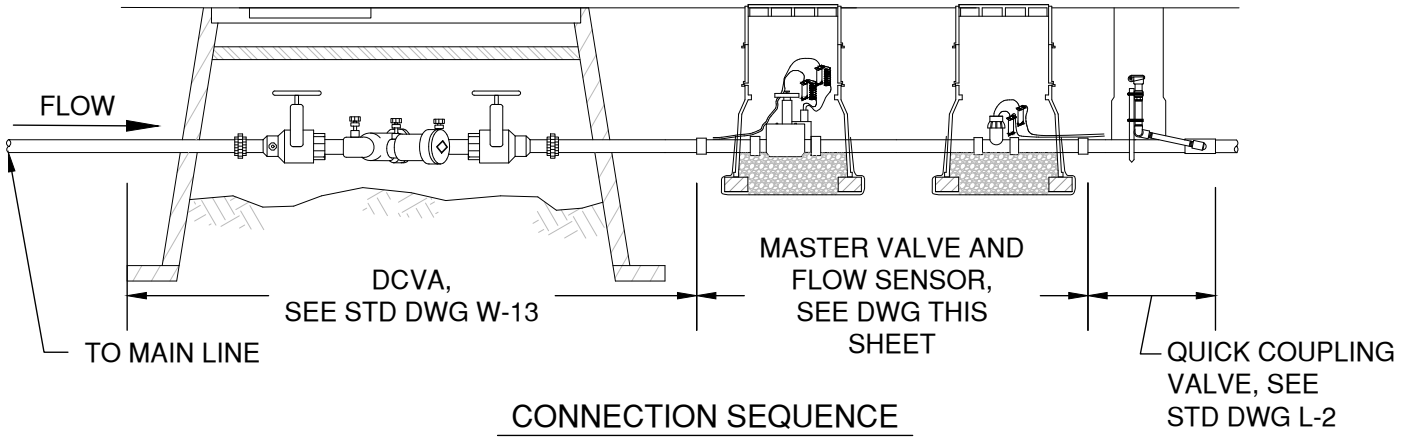
NOTES:

1. THE SEDIMENT BAG SHALL BE MANUFACTURED USING A POLYPROPYLENE 8 OZ. NON-WOVEN GEOTEXTILE SEWN INTO A BAG WITH A DOUBLE NEEDLE, USING A HIGH STRENGTH THREAD.
2. EACH STANDARD SEDIMENT BAG MUST HAVE A FILL SPOUT LARGE ENOUGH TO ACCOMMODATE A 4" DISCHARGE HOSE. STRAPS ARE ATTACHED TO SECURE THE HOSE AND PREVENT PUMPED WATER FROM ESCAPING WITHOUT BEING FILTERED.
3. THE SEDIMENT BAG SHALL MEET OR EXCEED OVERALL BAG REMOVAL EFFICIENCY RATE OF 97.55%.
4. WATER BEING DISCHARGED FROM THE SEDIMENT BAG MUST BE FREE OF ALL SEDIMENT PRIOR TO LEAVING THE SITE OR ENTERING INTO THE STORM SYSTEM.
5. SEDIMENT BAG IS FULL WHEN IT NO LONGER CAN EFFICIENTLY FILTER SEDIMENT OR ALLOW WATER TO PASS AT A RATE LESS THAN 50% OF MANUFACTURER'S DESIGNED FLOW RATE.
6. DURING USE, THE SEDIMENT BAG MUST BE MONITORED.
7. DISPOSE OF USED SEDIMENT BAG OFF SITE OR AS APPROVED BY CITY OF BEND.
8. WHEN APPROPRIATE, INSTALL DOWNSTREAM SEDIMENT CONTROL MEASURES PER CITY OF BEND.
9. STANDARDS.FOR BEST RESULTS, PLACE SEDIMENT BAG ON FLAT SURFACE.
10. SEDIMENT BAG SHOULD BE PLACED ON EXISTING VEGETATION, ROCK, OR BED OF STRAW. SEDIMENT BAG SHOULD NOT BE PLACED ON BARE GROUND.

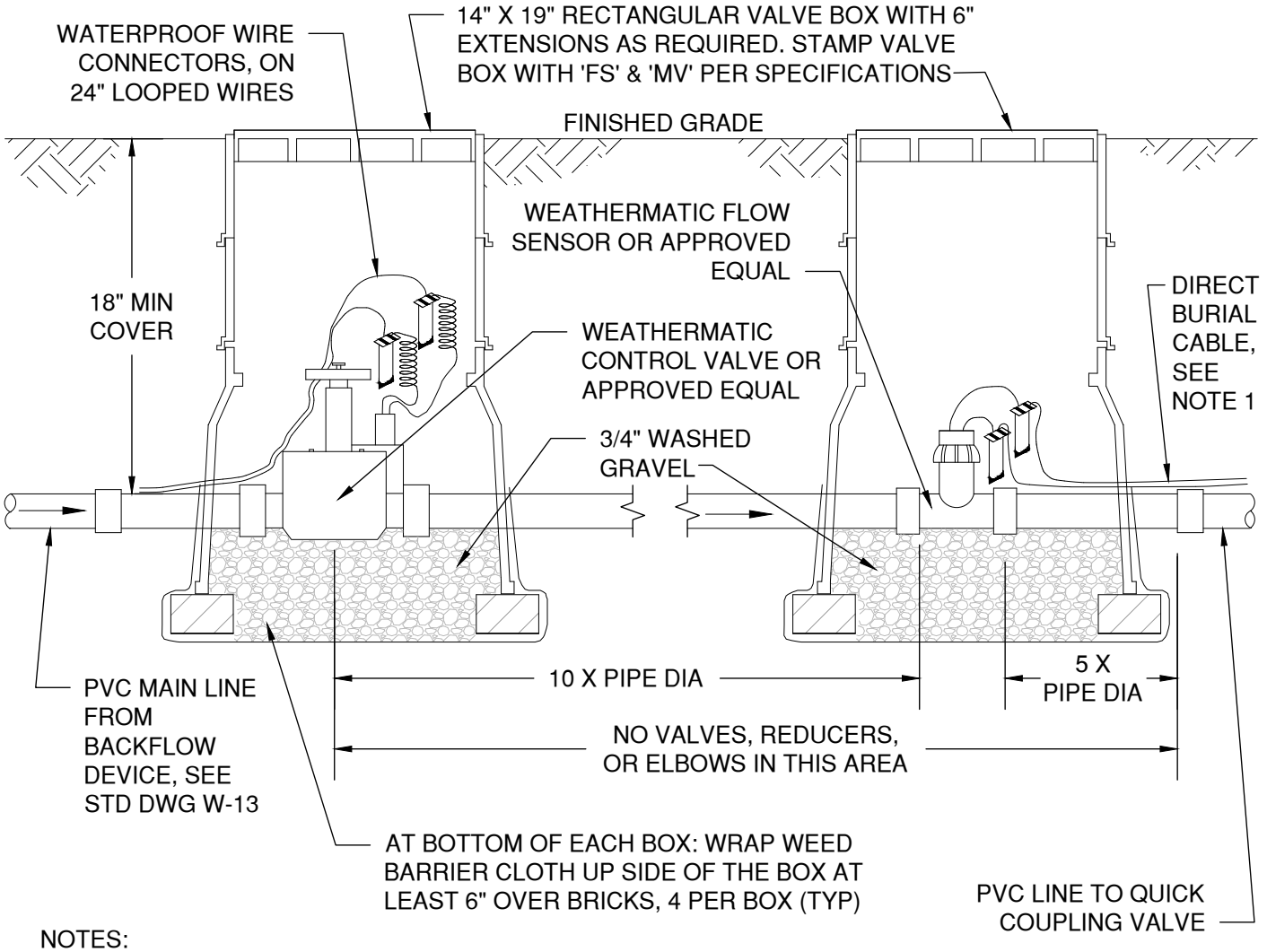
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV EROSION		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		DEWATERING SEDIMENT BAG	STD DWG E-15

CITY OF BEND STANDARD DRAWINGS

Landscaping (L)



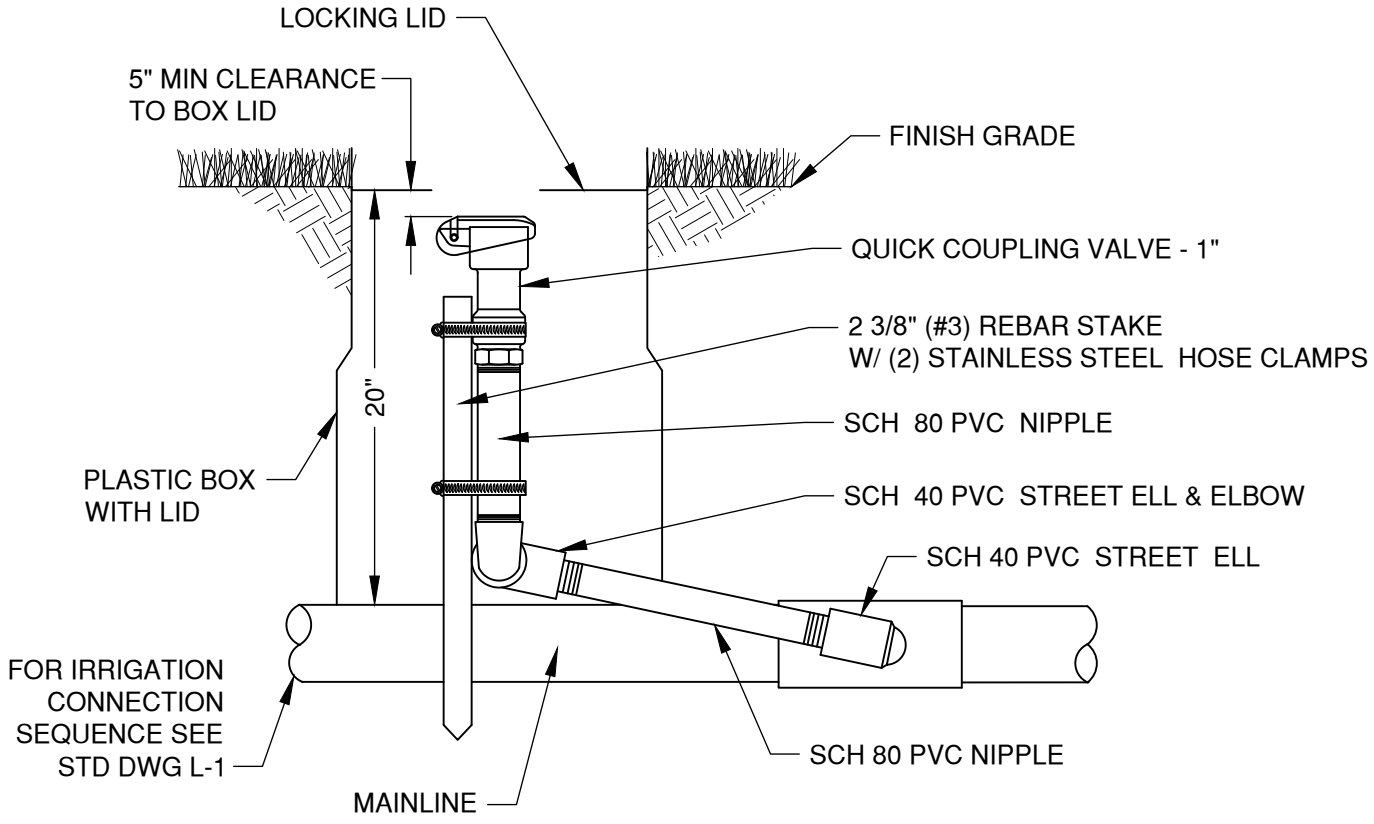
CONNECTION SEQUENCE



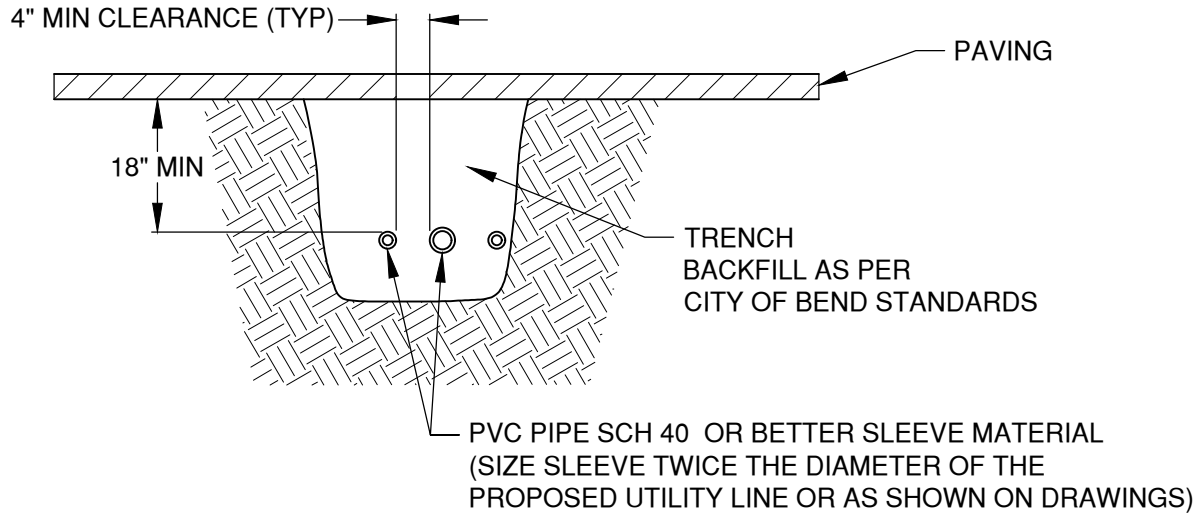
NOTES:

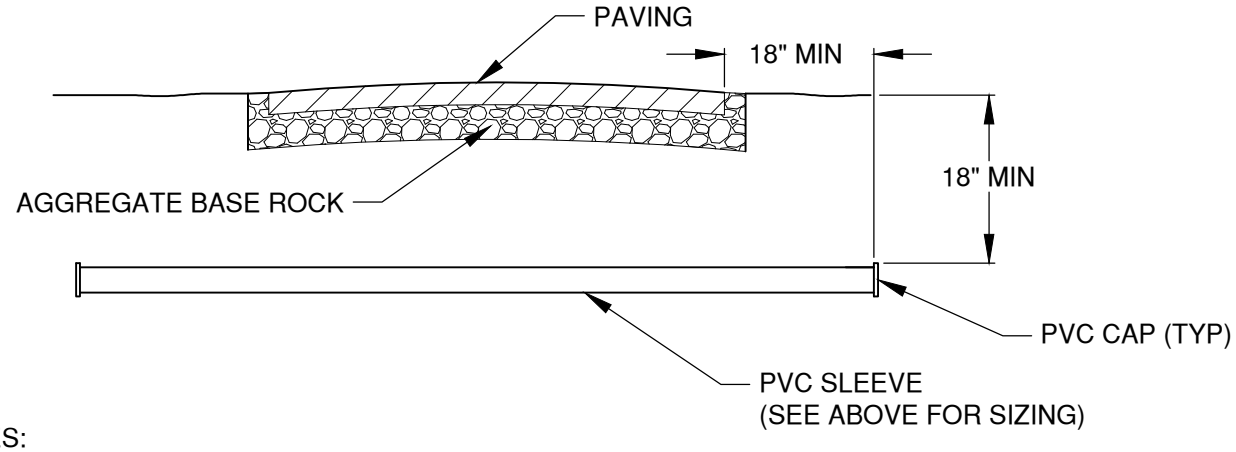
1. DIRECT BURIAL 1 PAIR, TWISTED SHIELDED CABLE-MIN CONDUCTOR SIZE 20 AWG. DO NOT EXCEED 2,000 FEET IN LAYING DISTANCE FROM FLOW SENSOR TO IRRIGATION CONTROLLER.
2. SIZE FLOW SENSOR BASED ON REQUIRED GPM NEEDED ON PROJECT.
3. MIN DISTANCES BETWEEN ANY FITTING OR VALVE AND FLOW SENSOR ARE NOTED ABOVE.

DRAWN ARS DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 04/16/2026 APPR
		IRRIGATION CONNECTION SEQUENCE AND MASTER VALVE AND FLOW SENSOR	STD DWG L-1



DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 04/16/2026
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		IRRIGATION BLOWOUT - QUICK COUPLING VALVE	STD DWG L-2

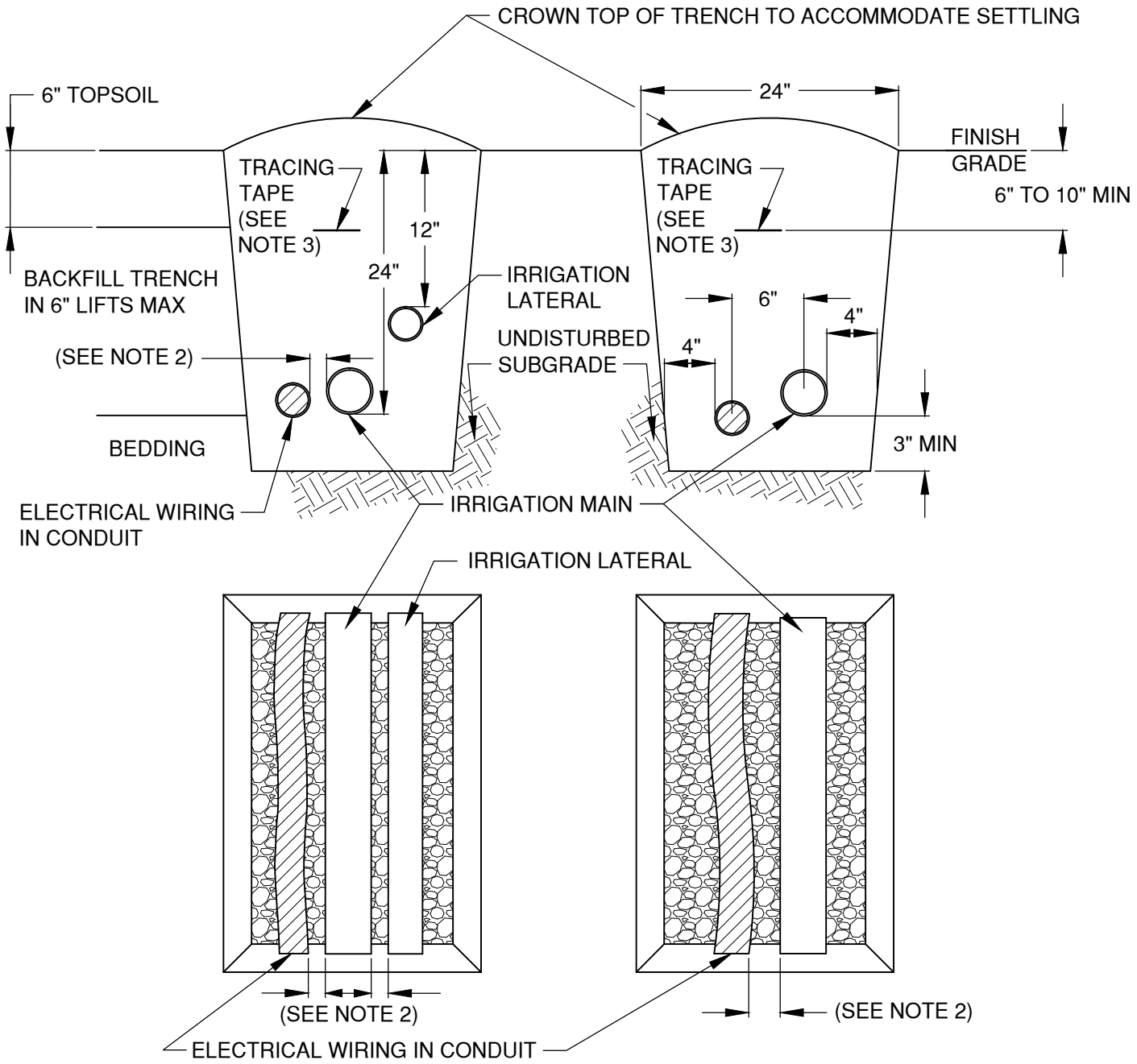




NOTES:

1. COMPACTION SHALL MEET 00405.46C PER CITY OF BEND SPECIAL PROVISIONS
2. 12" MIN COVER UNDER SIDEWALKS
3. SEE STD DWGS R-10 AND R-11 FOR TRENCH BACKFILL AND ROAD RESTORATION REQUIREMENTS.

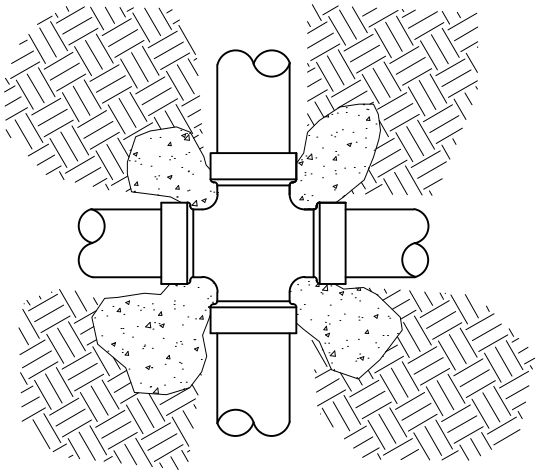
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		IRRIGATION SLEEVE UNDER PAVING	STD DWG L-3



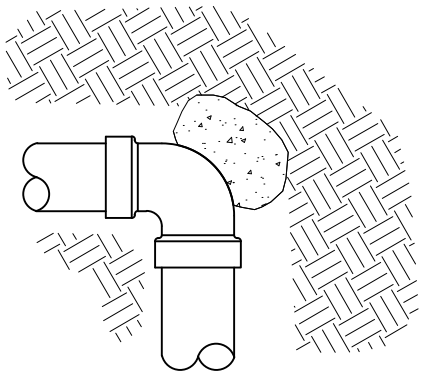
NOTES:

1. MINIMUM DEPTH OVER PVC PIPE:
   - 10" FOR 1-1/4" OR SMALLER
   - 12" FOR 1-1/2" TO 2" PIPE
   - 14" FOR 2-1/2" TO 3" LATERALS
   - 18" FOR MAINLINE PIPING AND SLEEVES
2. CLEARANCE BETWEEN PIPE:
   - 4" FOR PIPE 2" AND SMALLER
   - 6" FOR LARGER PIPE
3. PROVIDE A DETECTABLE TAPE OR WIRE USING A CONTINUOUS MINIMUM 14 GAUGE SINGLE STRAND LOCATOR WIRE IN TRENCH A MINIMUM 6" TO 10" BELOW FINISH GRADE. TRACING TAPE OR WIRE SHALL BE LOCATED A MINIMUM 6" ABOVE PIPING ON MAINLINE INSTALLATIONS

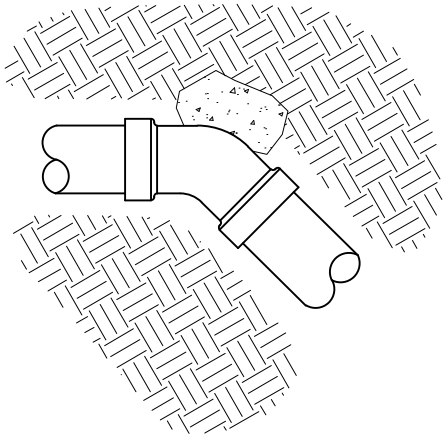
DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		IRRIGATION - TYPICAL TRENCH	STD DWG L-4



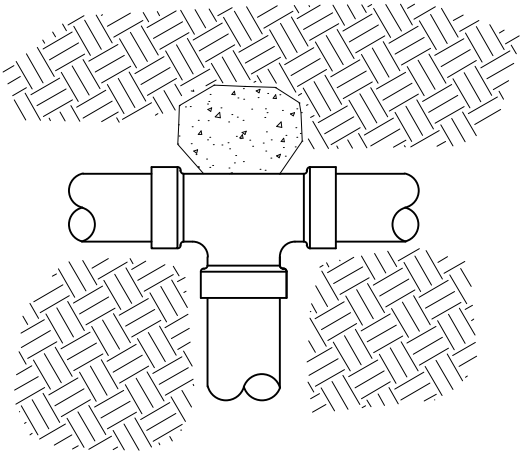
CROSS



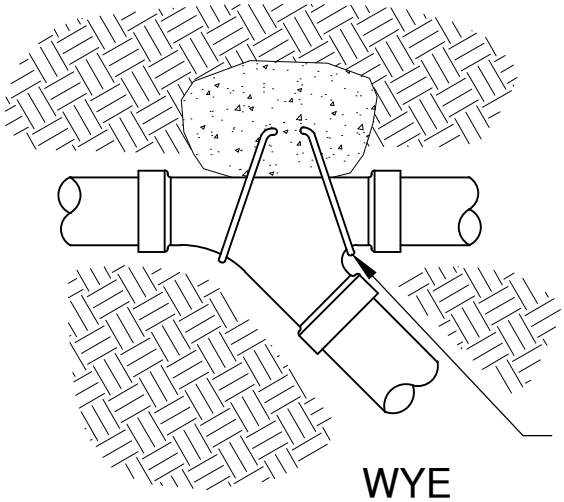
ELL



45° ELL



TEE



WYE

NOTES:

1. SUPPLY LINES 3" IN DIAMETER AND LARGER SHALL RECEIVE THRUST BLOCKS
2. USE A MINIMUM 1 CU FT OF CONCRETE IN EACH THRUST BLOCK POUR

DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		IRRIGATION FITTINGS	STD DWG L-5

1 30" LINEAR LENGTH OF WIRE, COILED

2 WATER PROOF CONNECTION (1 OF 2)

3 ID TAG

4 VALVE BOX WITH COVER: AMETEK STANDARD OR EQUAL

5 FINISH GRADE/TOP OF MULCH ALLOW 2" DEPTH MIN FOR BARK IF LOCATED IN SHRUB BED

6 REMOTE CONTROL VALVE: AS SPECIFIED ON DRAWING

7 PVC SCHEDULE 40 PIPE

8 PVC SADDLE FEMALE THREAD

9 TREATED WOOD OR BRICK SUPPORT (LENGTH AS REQ'D.)

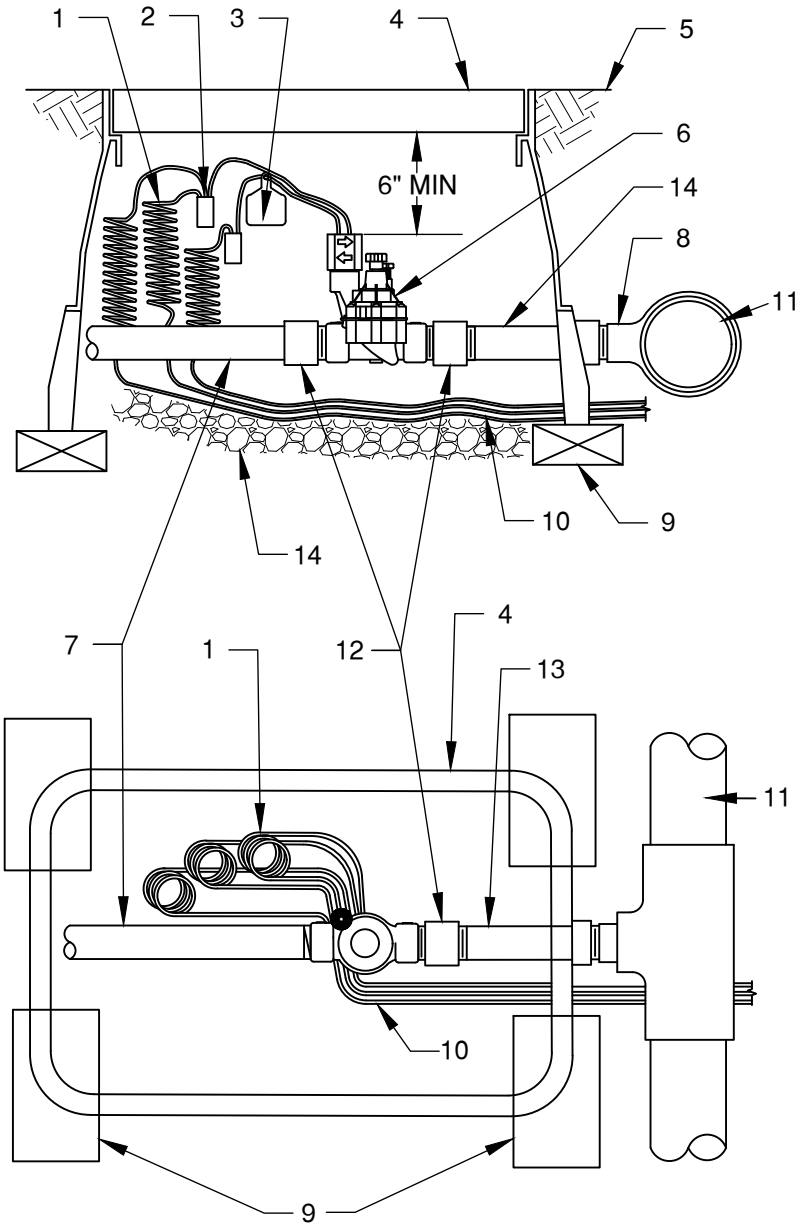
10 CONTROL WIRING 24 VAC

11 PVC MAINLINE PIPE

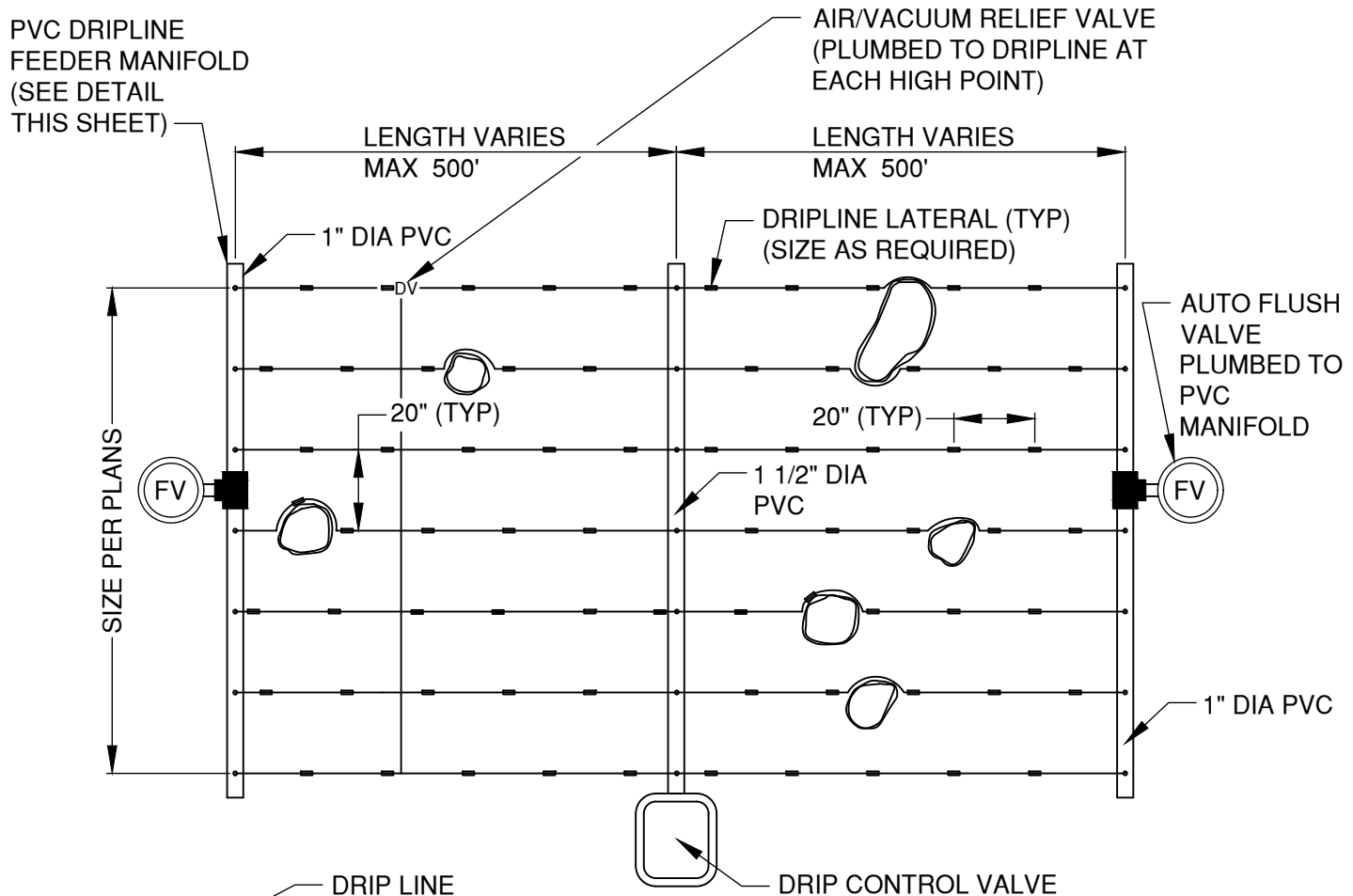
12 SCH 80 MALE ADAPTER

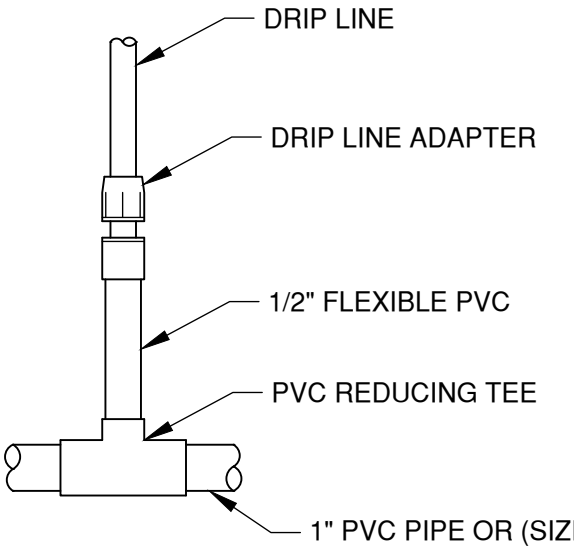
13 PVC SCH 40

14 GRAVEL BED AT BOTTOM OF BOX 6" MIN DEPTH



DRAWN LJC DIV SANITARY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 IRRIGATION REMOTE CONTROL VALVE	SCALE NTS DATE 04/16/2026 APPR STD DWG L-6



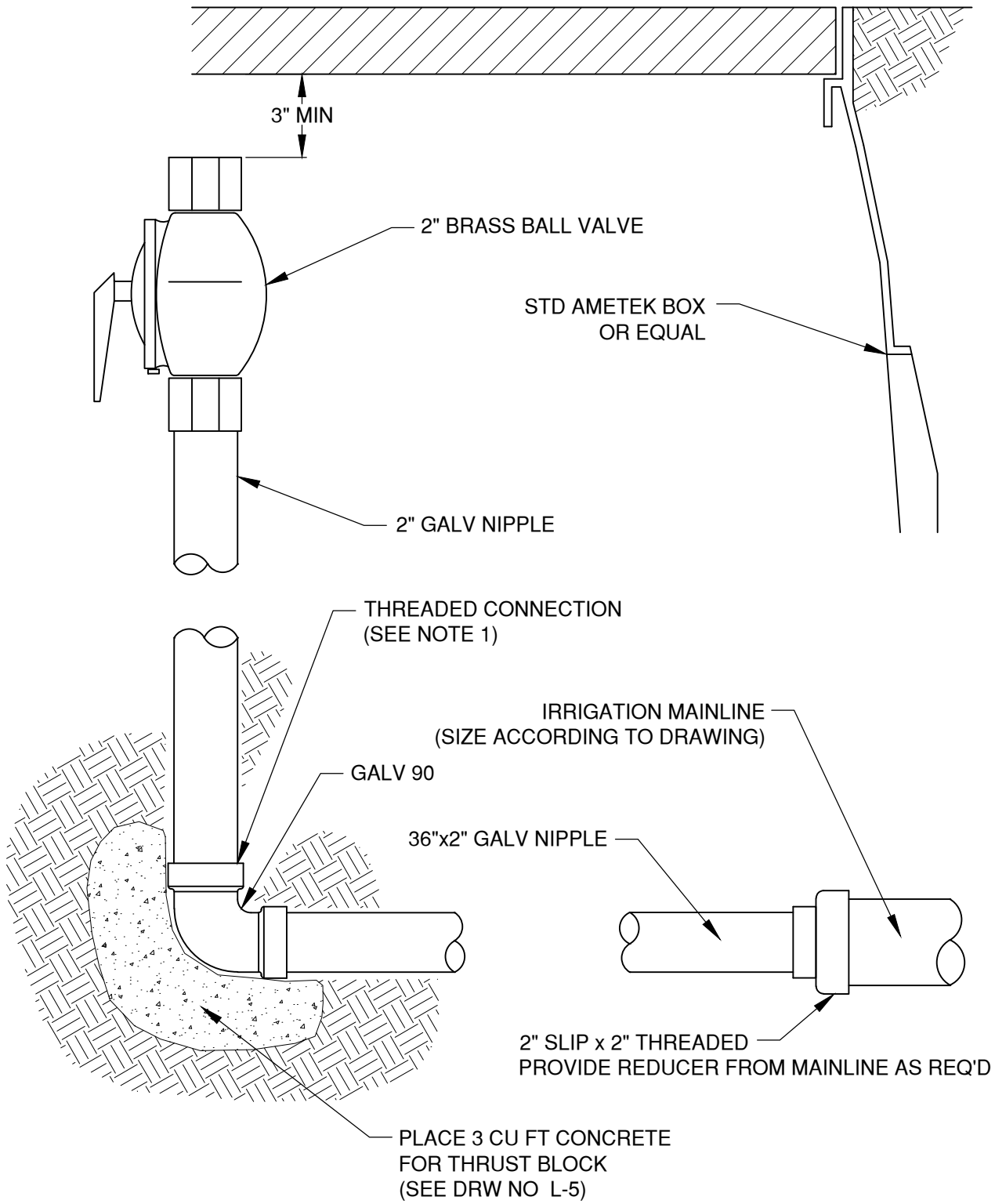


TYPICAL PVC DRIPLINE MANIFOLD CONNECTION

NOTES:

1. RELOCATE DRIP LINES AROUND OBSTACLES AS NEEDED

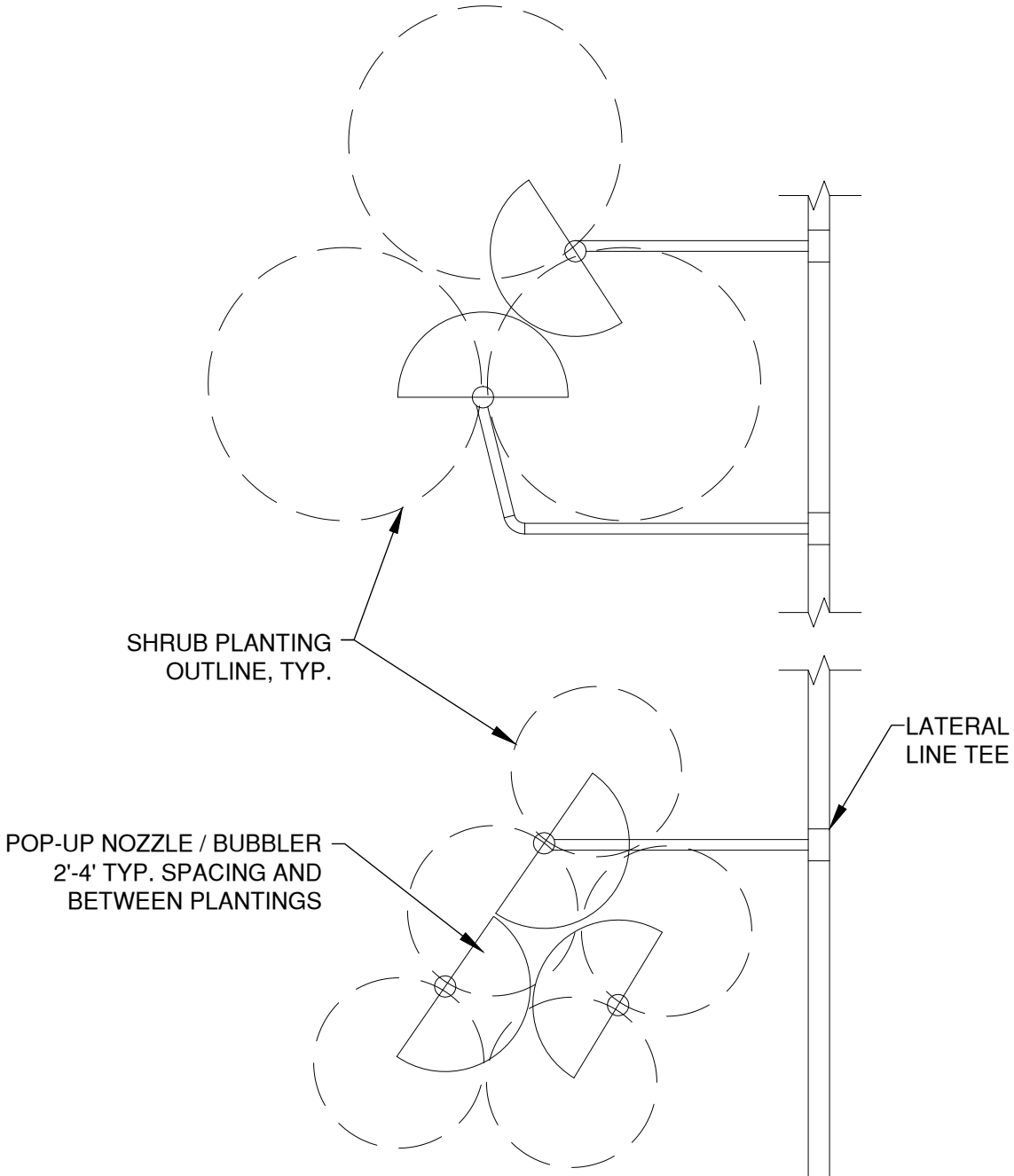
DRAWN LJC DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PLANTING OR TURF BED DRIP LAYOUT	SCALE NTS DATE 04/16/2026 APPR STD DWG L-7



NOTES:

1. PROVIDE ALL THREADED CONNECTIONS WITH A NON-HARDENING, JOINT COMPOUND, COMPATIBLE WITH MANUFACTURERS RECOMMENDATION

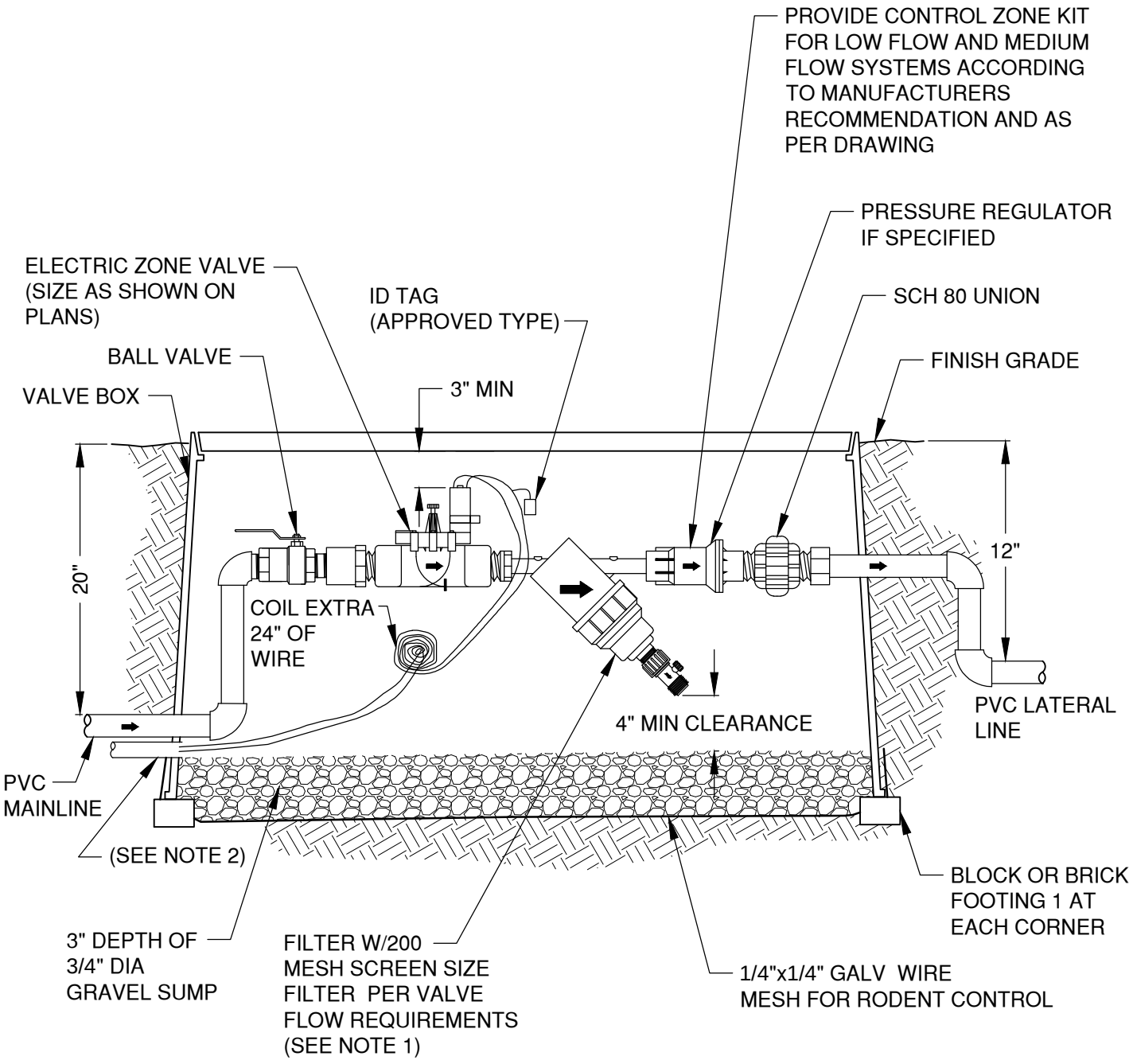
DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TERMINATION POINT	STD DWG L-8



NOTES:

1. NOZZLE DEVICE TO MEET CITY OF BEND STANDARDS AND NOT EXCEED A THROW DISTANCE OF 4' AND A PRECIPITATION RATE UNDER 1" PER HOUR.
2. INSTALL NOZZLES ON 6" OR 12" POP-UP BODIES. UTILIZE PRESSURE COMPENSATING BODIES TO ALIGN WITH NOZZLE BUBBLER SELECTION.

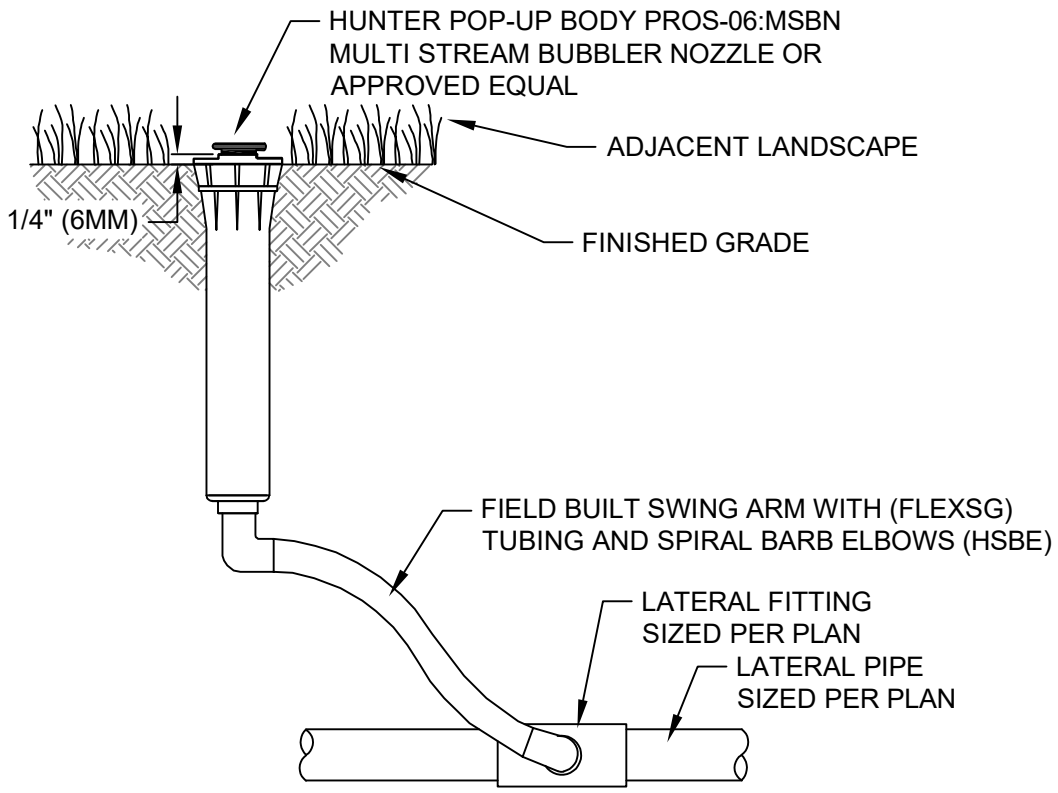
DRAWN ARS	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 04/16/2026
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		MULTI STREAM BUBBLER LAYOUT	STD DWG L-9



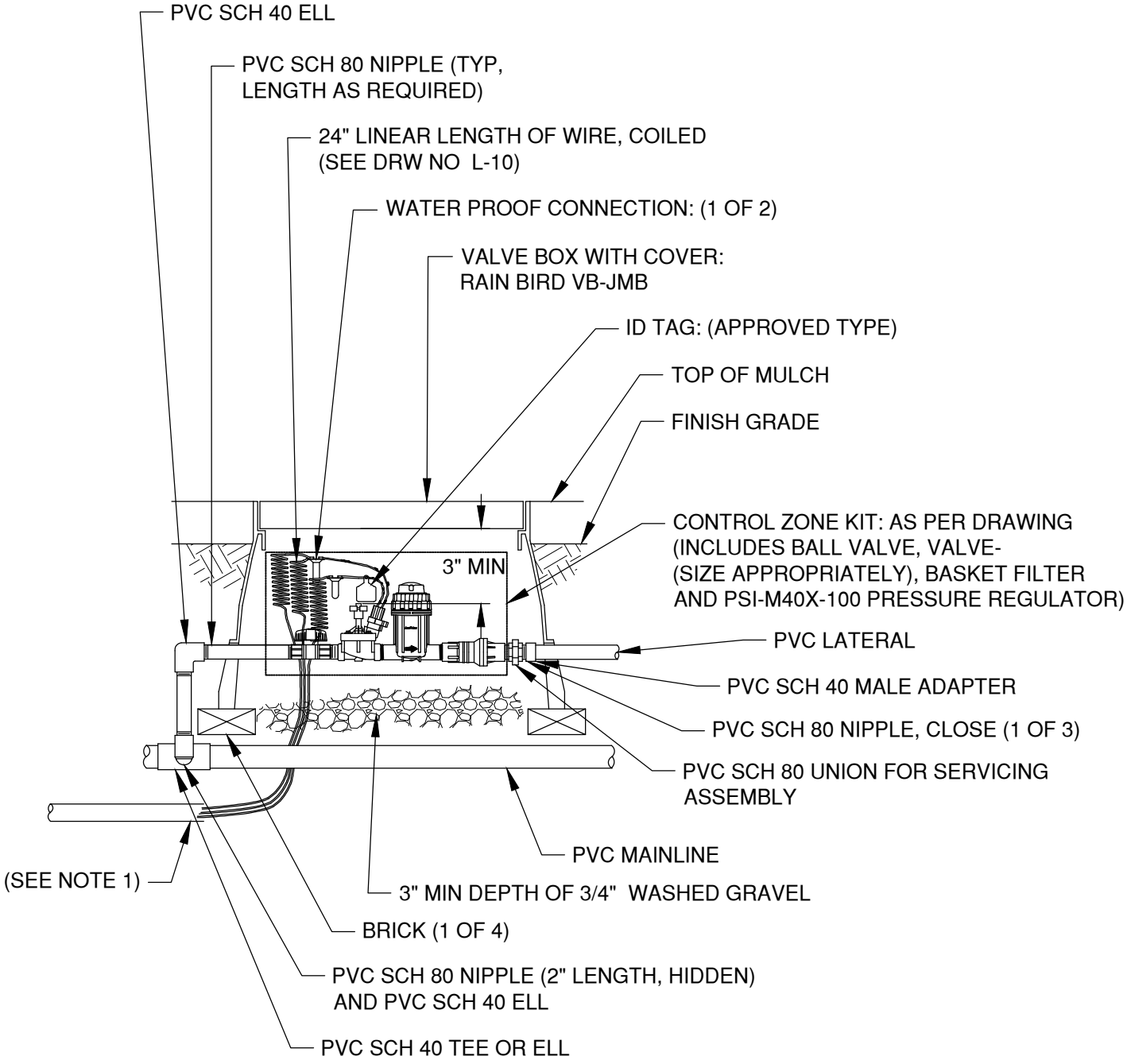
NOTES:

1. PROVIDE ADEQUATE SPACE FOR SERVICING THE SYSTEM
2. ALL ELECTRICAL WIRE TO BE INSTALLED IN APPROVED CONDUIT

DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		DRIP CONTROL VALVE, FILTER, AND REGULATOR	STD DWG L-10



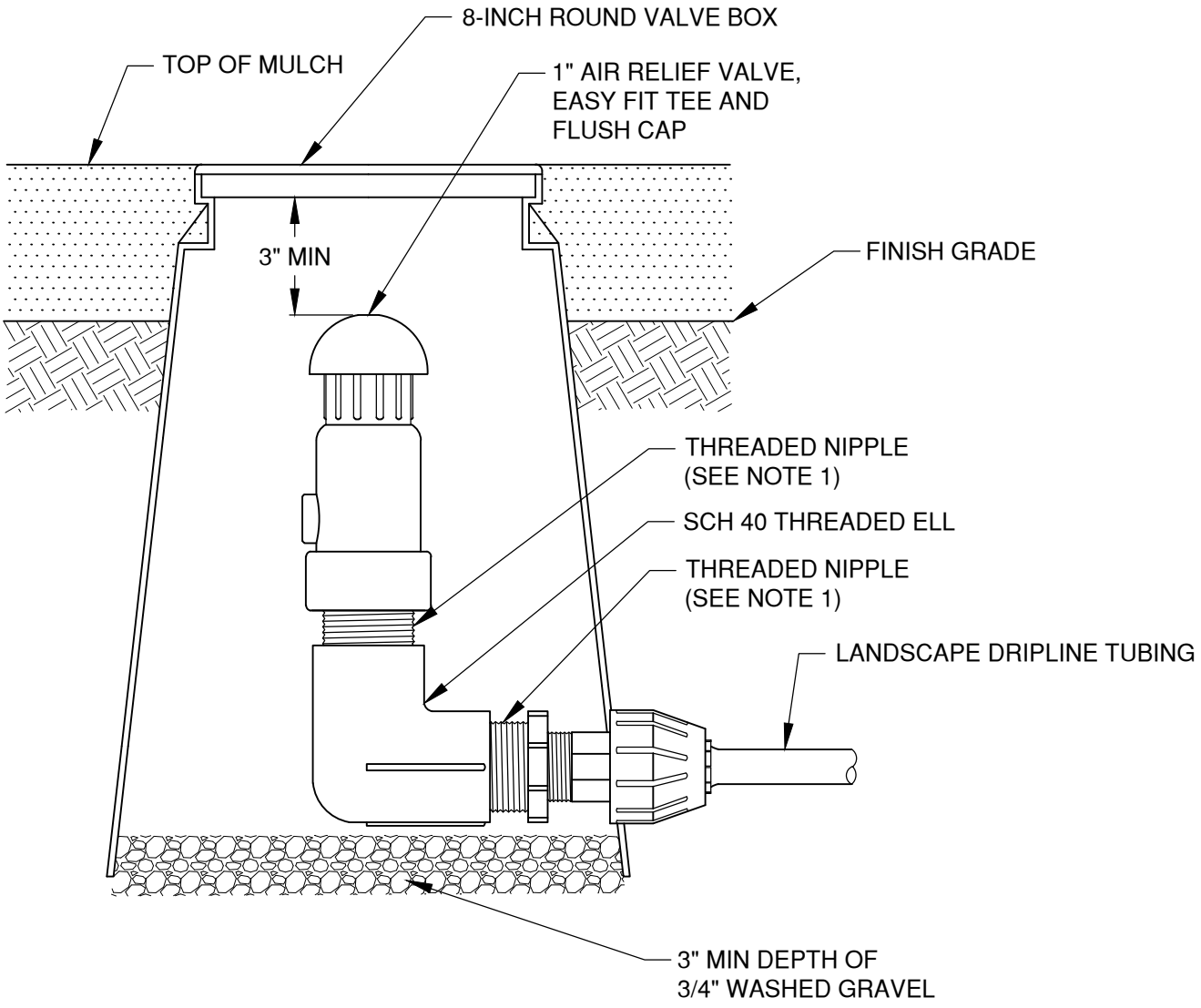
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		MSBN MULTI-STREAM BUBBLER	STD DWG L-11



NOTES:

1. ALL ELECTRICAL WIRE TO BE INSTALLED IN APPROVED CONDUIT

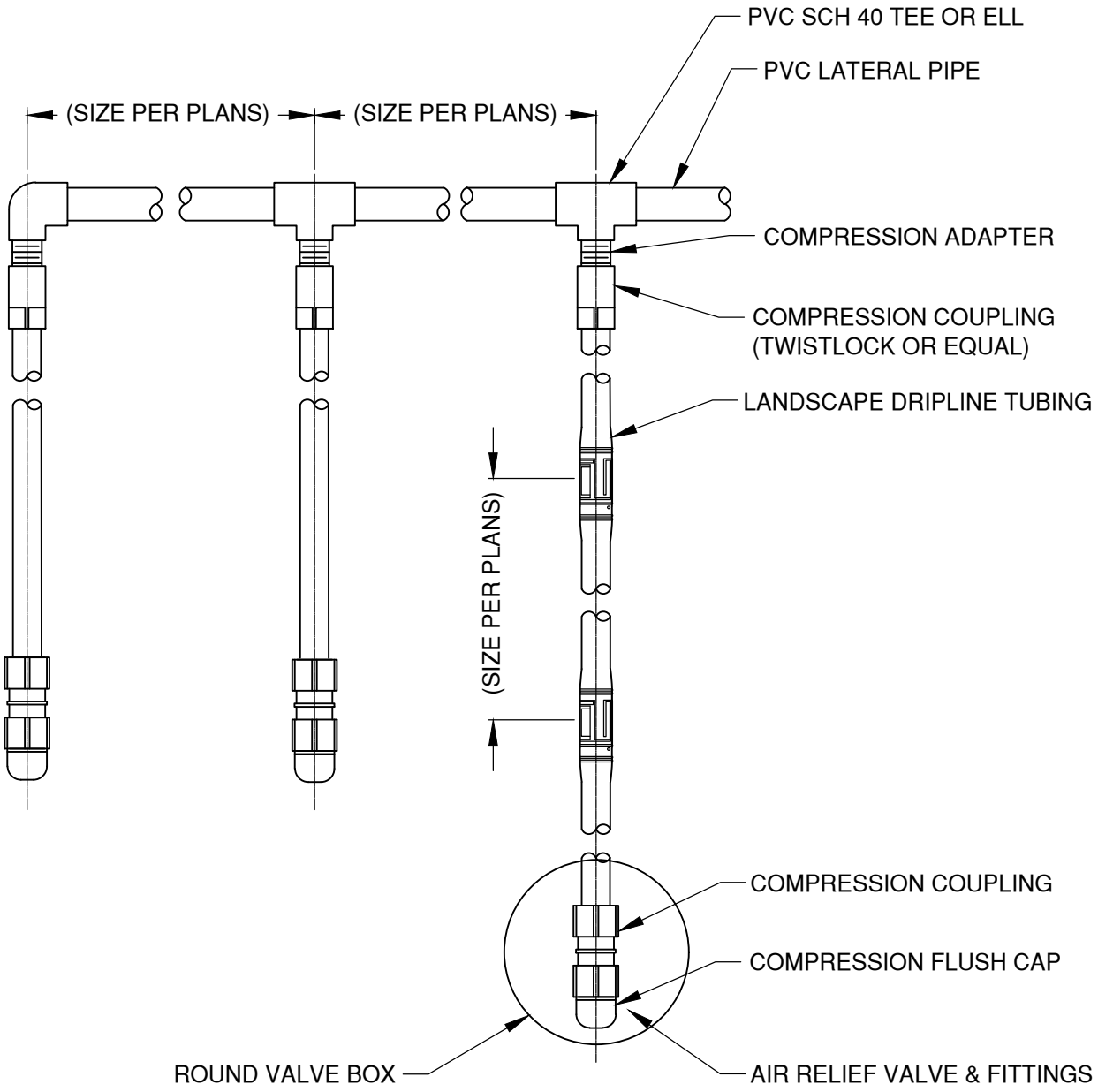
DRAWN LJC DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 1" COMM. CONTROL ZONE KIT WITH BASKET FILTER	SCALE NTS DATE 12/1/17 APPR STD DWG L-12



NOTES:

1. PROVIDE ALL THREADED CONNECTIONS WITH A NON-HARDENING, JOINT COMPOUND, COMPATIBLE WITH MANUFACTURERS RECOMMENDATIONS

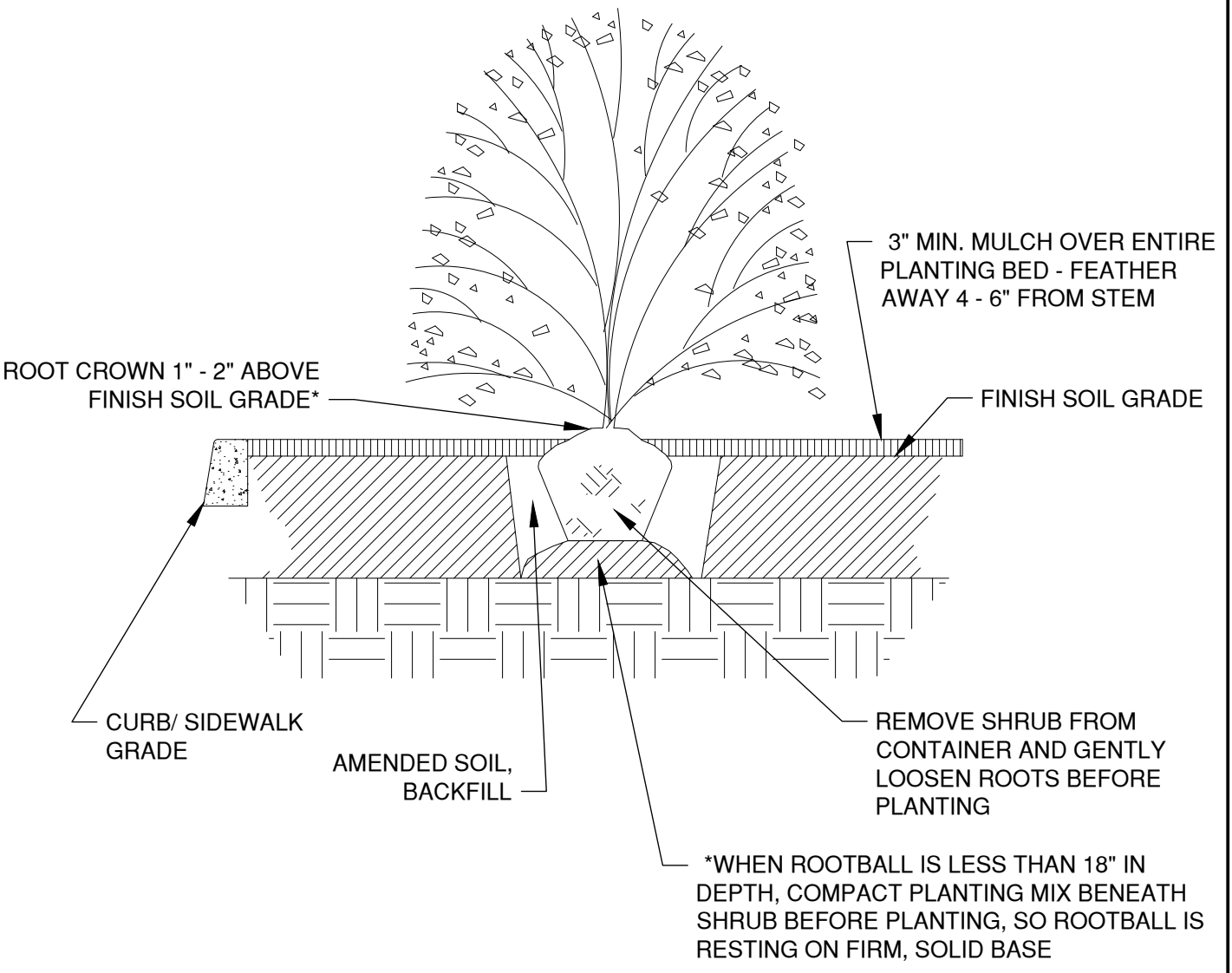
DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		AIR RELIEF VALVE IN KIT - AR VALVE KIT	STD DWG L-13



NOTES:

1. LATERAL AND EMITTER SPACING DEPENDS ON SOIL TYPE, AND PLANT SPECIES.
2. SEE OSS - DET 6110 - PLANTING OR TURF BED DRIP LAYOUT FOR OVERALL SPECIFICATION

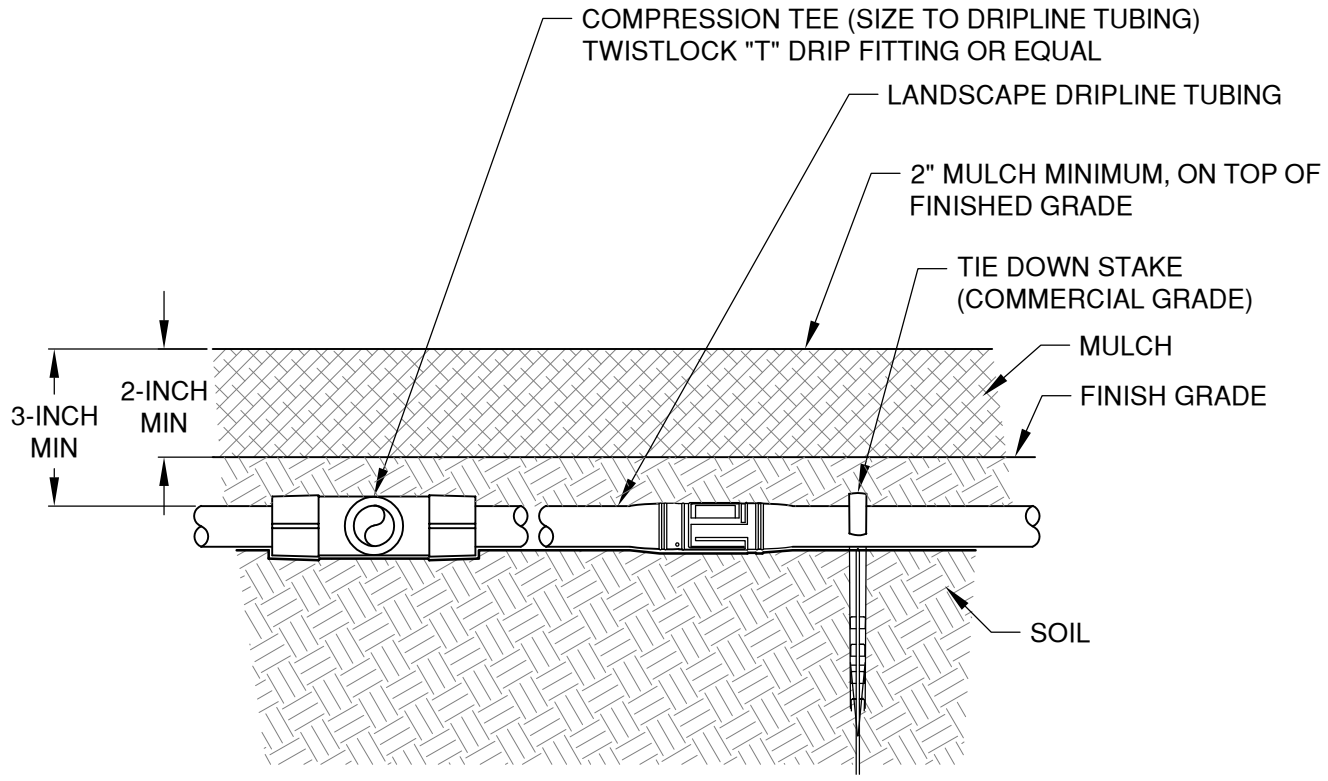
DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV LNDSCP		STANDARD DRAWING	DATE 12/1/17
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
1 / 12/10/21		DRIP IRRIGATION MAINLINE LAYOUT	STD DWG L-14



NOTES:

1. SHRUBS PLANTED OUTSIDE OF LANDSCAPE MEDIANS, I.E. IN ROADSIDES, SHALL BE PLANTED IN A PLANTING PIT.

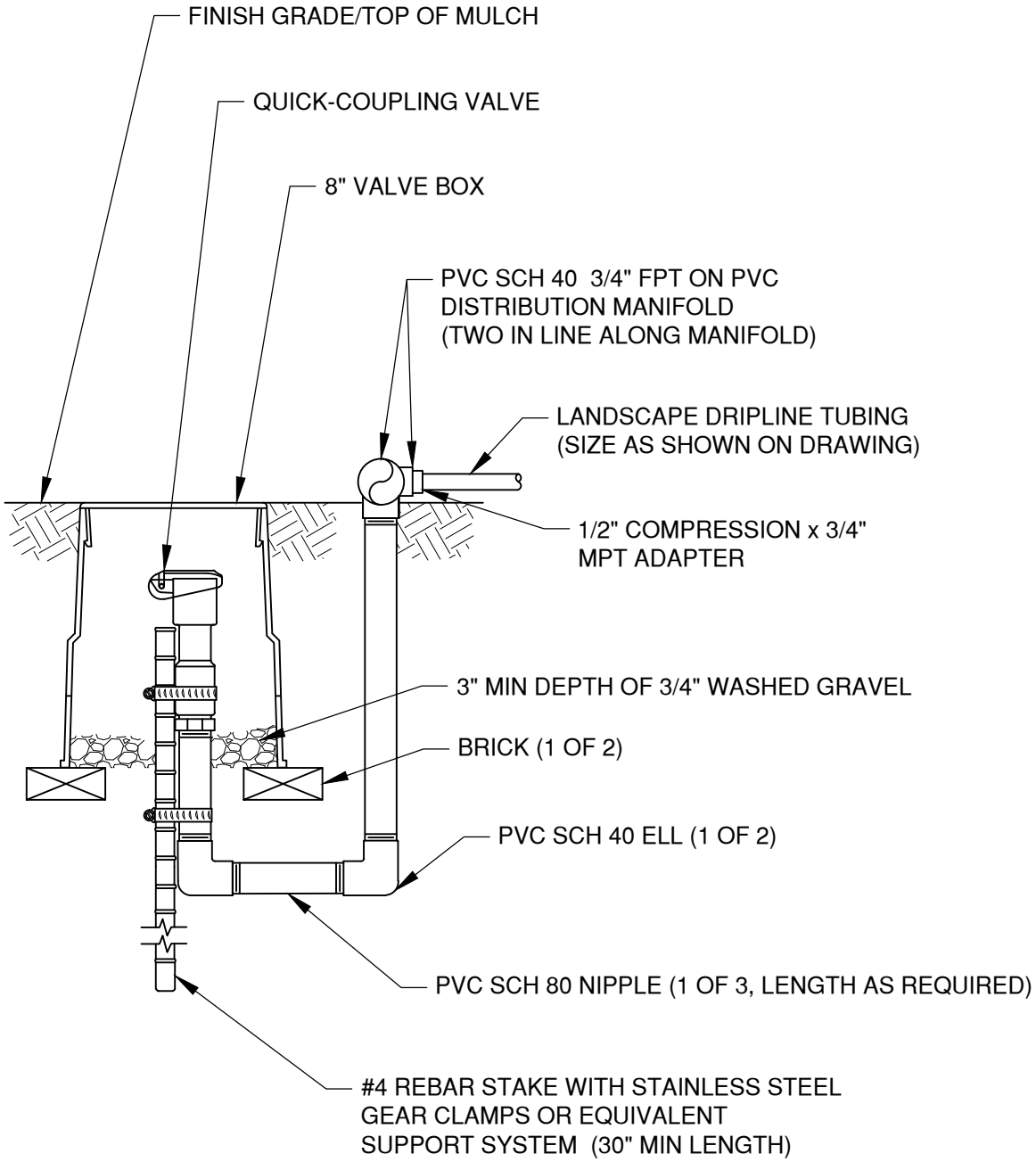
DRAWN ARS DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PLANTING DETAIL	SCALE NTS DATE 04/16/2026 APPR STD DWG L-15



NOTES:

1. IF PUTTING LANDSCAPE DRIPLINE UNDER SOIL, DO NOT BURY MORE THAN 2" BELOW GRADE AND INCLUDE AIR RELIEF VALVE (SEE DRW NO L-13 "AIR RELIEF VALVE KIT-AR VALVE KIT")

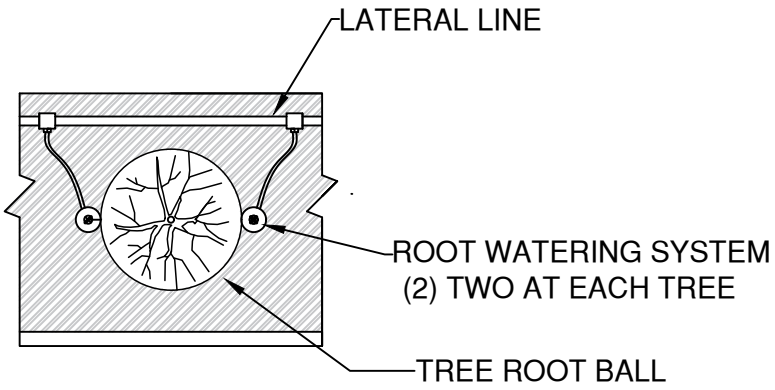
DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV LNDSCP			DATE 11/01/2024
REV / DATE			APPR
		DRIPLINE 2" BELOW GRADE POTABLE SYSTEM	STD DWG L-16



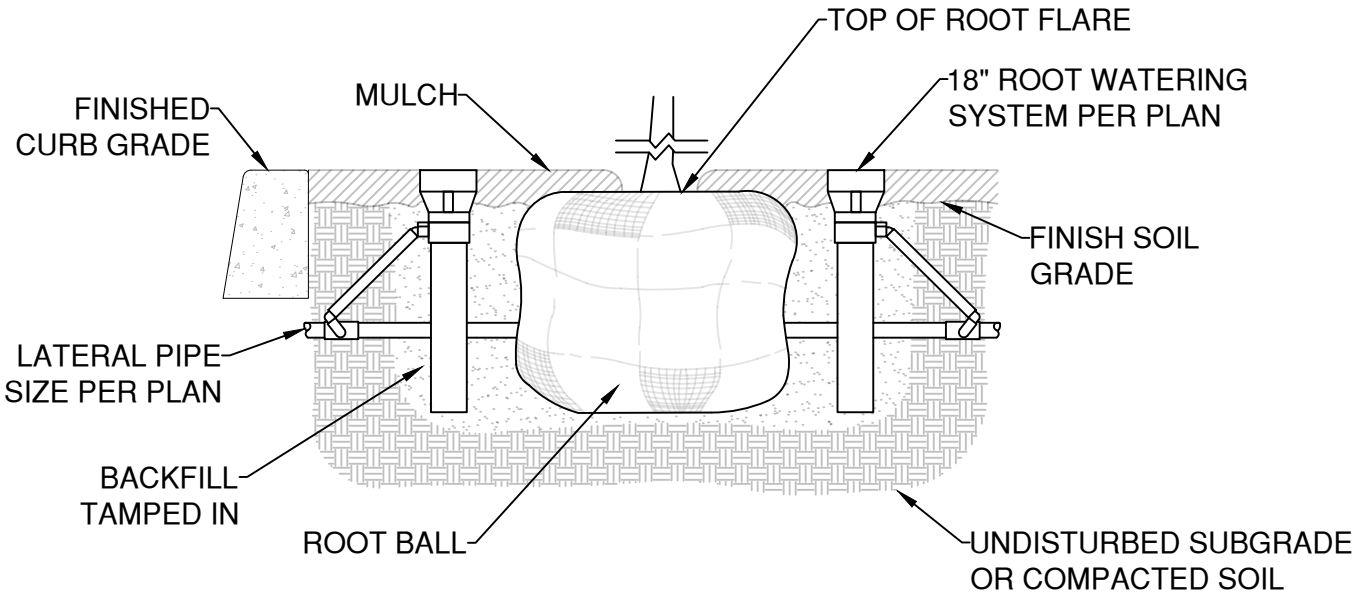
NOTES:

1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE

DRAWN LJC DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 LANDSCAPE DRIPLINE FLUSH POINT POTABLE SYSTEM	SCALE NTS DATE 12/1/17 APPR STD DWG L-17



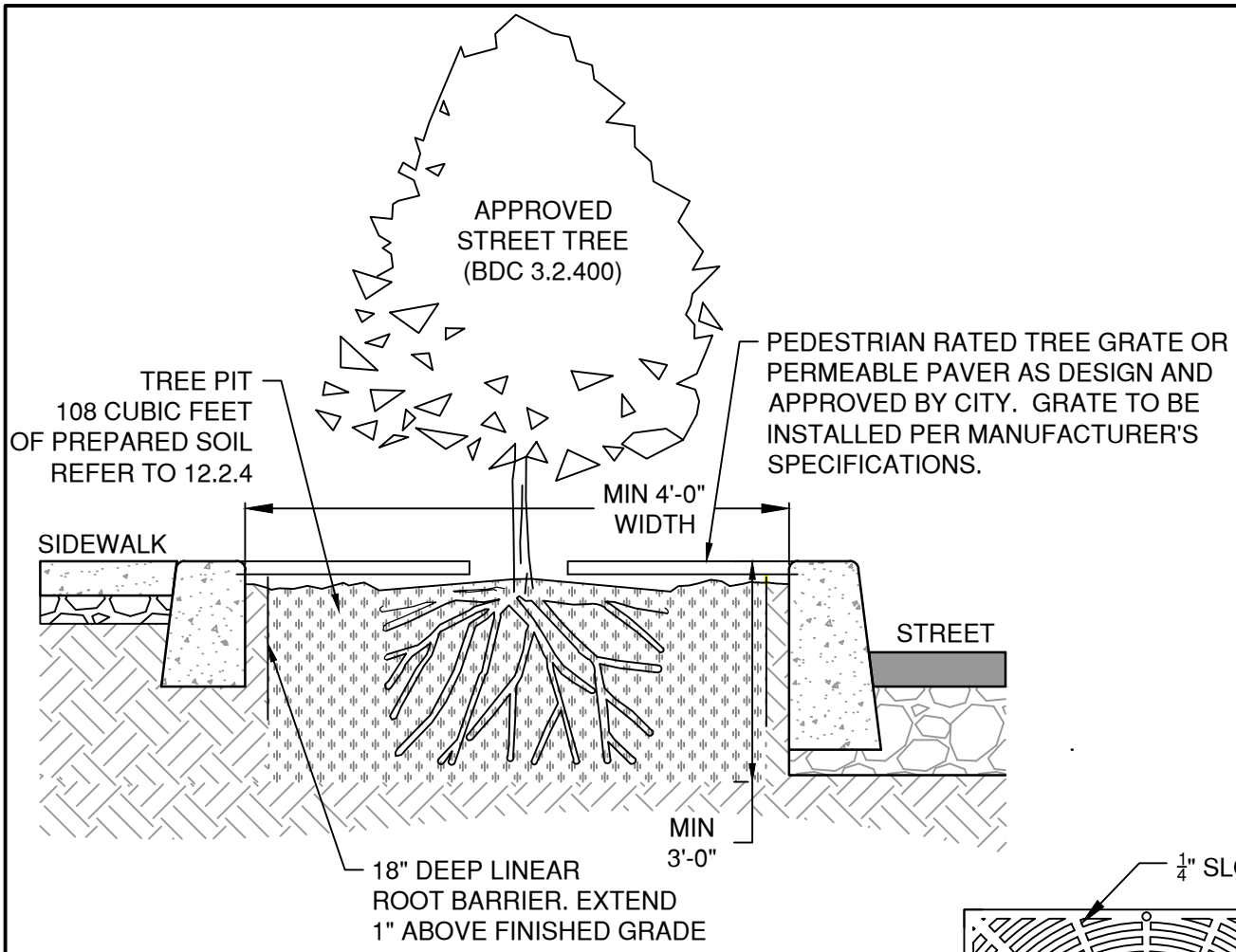
PLAN

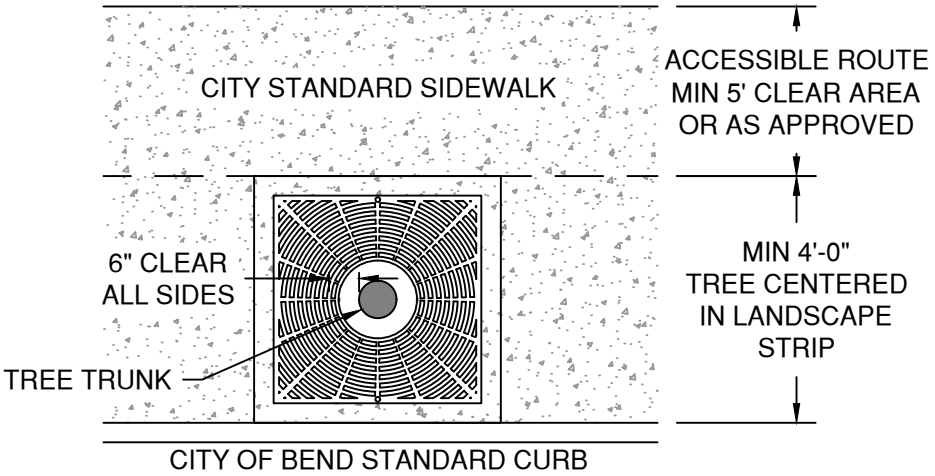


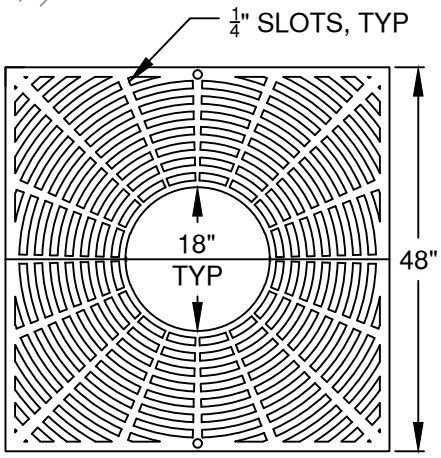
SECTION

NOTES:
1. POSITION UNITS EVENLY AND SPACED AROUND ROOT BALL OF TREE
2. INSTALL TOP OF ROOT WATER SYSTEM EVEN WITH TOP OF MULCH
3. INSTALL ONE ROOT WATERING SYSTEM WHEN SHOWN AS ONE ON PLAN SHEETS

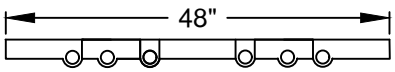
DRAWN ARI	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TREE ROOT WATERING SYSTEM DETAIL	STD DWG L-18







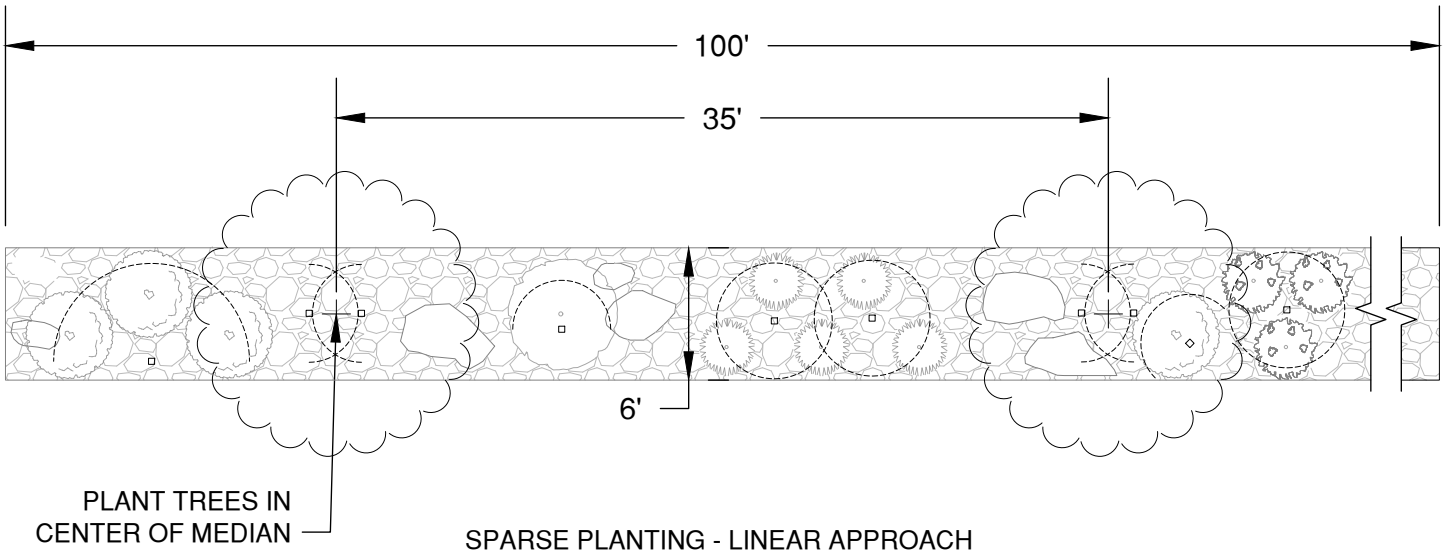
TREE GRATE - PLAN



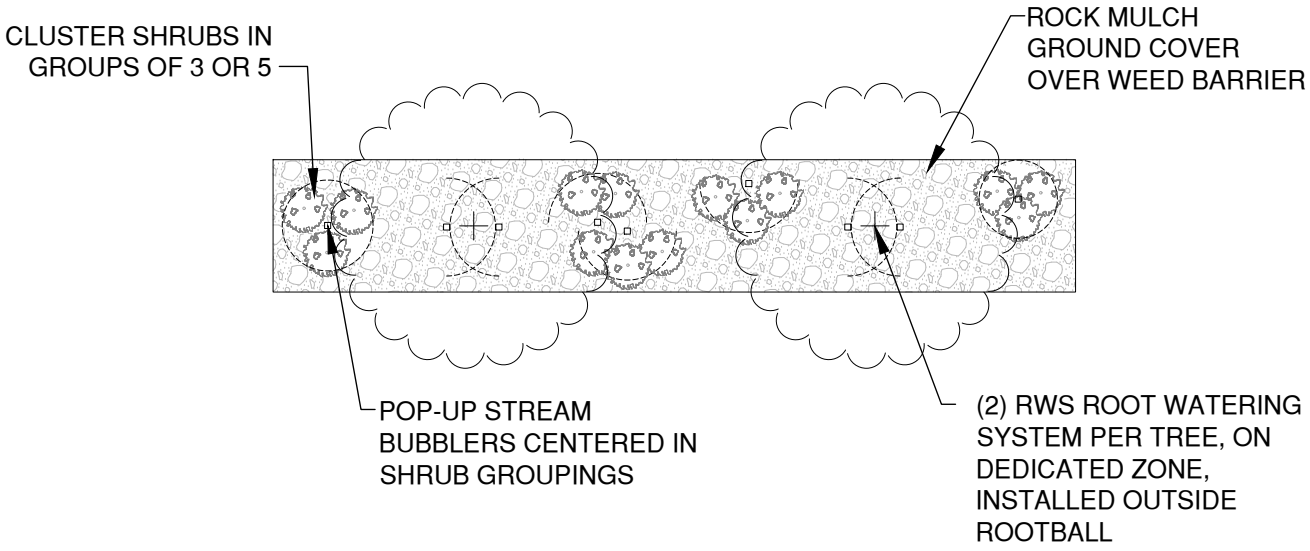
TREE GRATE - PROFILE

NOTES:
1. MINIMUM TREE WELL DIMENSIONS DICTATED BY BEND DEVELOPMENT CODE 12.2.4.1.
2. VEGETATION WITHIN THE TREE WELL SHALL HAVE DRIP SYSTEM IRRIGATION INSTALLED PER L-18.
3. TREE GRATE SHALL BE EJ 8954 PLAZA SET, OR APPROVED EQUAL.

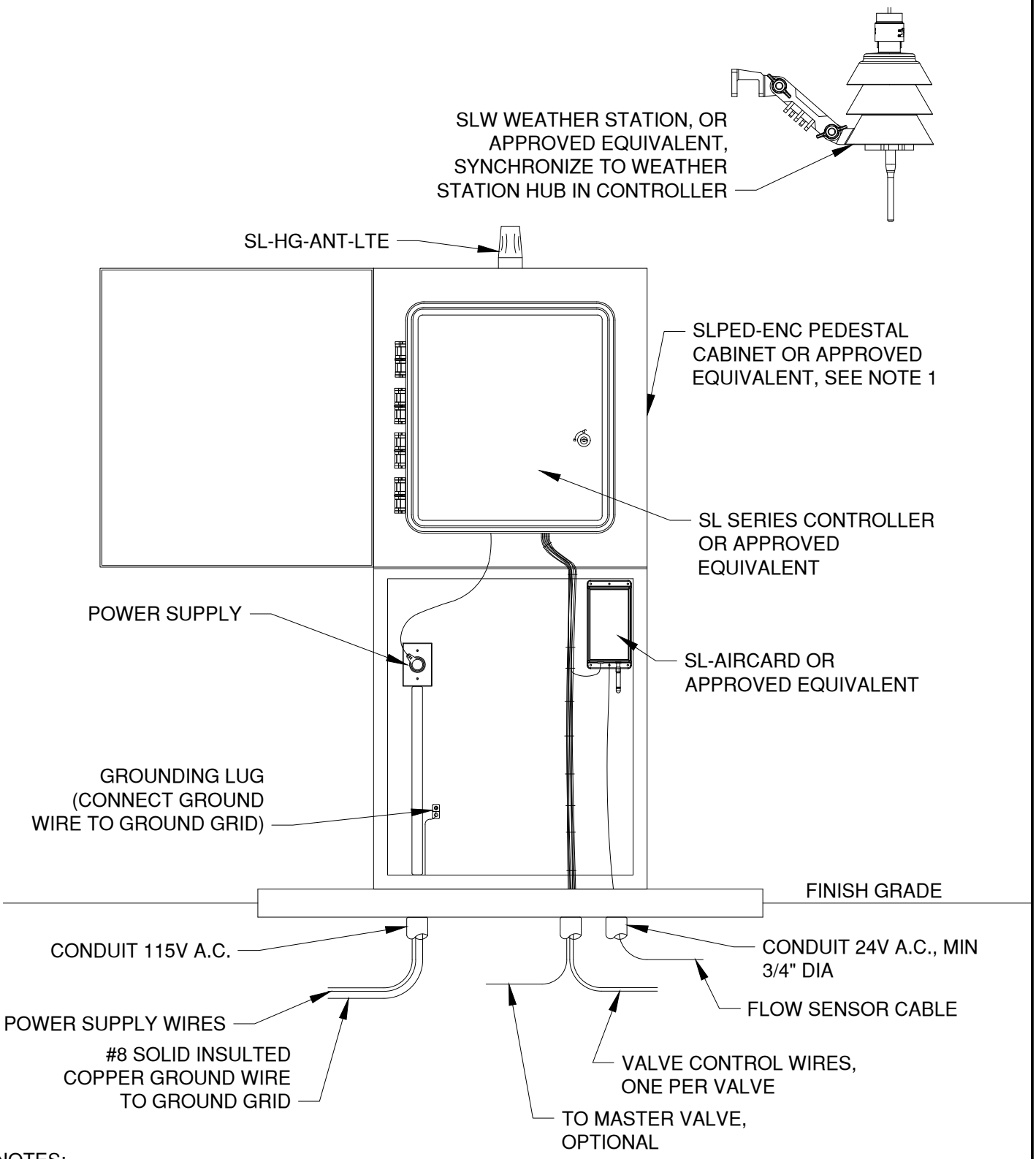
DRAWN AJD DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 TREE WELL DETAIL	SCALE NTS DATE 01/31/2022 APPR STD DWG L-19



SPARSE PLANTING - LINEAR APPROACH
CLUSTER GROUP EXAMPLE



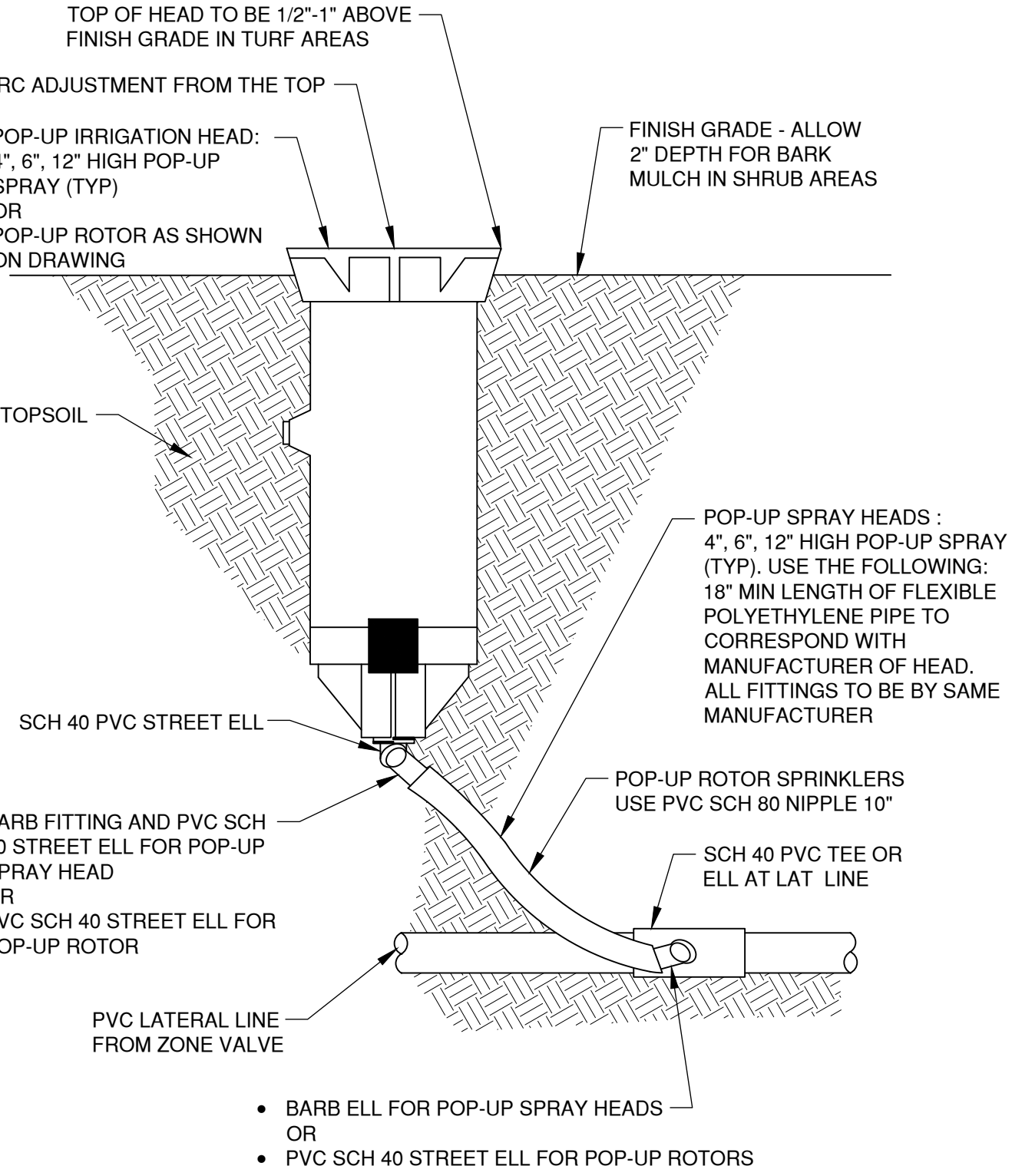
DRAWN ARS DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PLANTING DISTRIBUTIONS AND IRRIGATION LAYOUT	SCALE NTS DATE 04/16/2026 APPR STD DWG L-20



NOTES:

1. STRONGBOX MPE WITH SB-1852SS, OR EQUIVALENT, MAY BE USED TO CONSOLIDATE COMPONENTS.

DRAWN ARS DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 IRRIGATION CONTROLLER ENCLOSURE	SCALE NTS DATE 04/16/2026 APPR STD DWG L-21



DRAWN LJC DIV LNDSCP REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 SPRINKLER HEAD AND JOINTS	SCALE NTS DATE 04/16/2026 APPR STD DWG L-23

CITY OF BEND STANDARD DRAWINGS

Roadway (R)

GENERAL NOTES FOR STD DWGS R-1A THROUGH R-1H:

1. CENTER STREETS IN THE RIGHT-OF-WAY UNLESS OTHERWISE APPROVED BY CITY ENGINEER FOR UNIQUE TRANSITIONS OR SITE CONSTRAINTS.
2. THE LEVEL OF TRAFFIC STRESS PER THE ODOT APM CH. 14 IS SHOWN ON EACH STANDARD CROSS-SECTION. MODIFICATION OF THE CROSS-SECTIONS MUST PROVIDE THE APPROPRIATE LTS.
3. INSTALL SIDEWALKS/SHARED-USE PATHS PROPERTY TIGHT. SIDEWALKS/SHARE-USE PATHS MAY MEANDER AROUND UTILITIES, TREES, AND OTHER NON-MOVEABLE OBJECTS. METERS, MANHOLES, AND VALVES ARE NOT PERMITTED WITHIN THE SIDEWALK UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. EXCEPTIONS WILL ONLY BE PERMITTED IF SIDEWALK CANNOT MEANDER AROUND THE EXISTING CONSTRAINT, OR THE OBSTACLE CANNOT BE REMOVED/RELOCATED. EASEMENTS ARE REQUIRED WHERE SIDEWALK/SHARED-USE PATH MEANDERS OUT OF THE RIGHT-OF-WAY.
4. PAVEMENT SECTIONS FOR STREETS AND SIDEWALKS PER THE THICKNESSES NOTED IN TABLE BELOW OR AS SPECIFIED IN A STAMPED GEOTECHNICAL REPORT APPROVED BY THE CITY ENGINEER.
5. RETAINING WALLS AND STAIRS ARE NOT PERMITTED WITHIN THE RIGHT-OF-WAY UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
6. STREET CROSS-SECTION/IMPROVEMENT STANDARDS ARE BASED ON STREET CLASSIFICATION. REFERENCE THE BEND DEVELOPMENT CODE SECTION 3.4 PUBLIC IMPROVEMENTS STANDARDS AND STANDARD CROSS-SECTIONS FOR ADDITIONAL DETAIL.
7. THE CROSS-SLOPE OF THE PLANTER STRIP BETWEEN THE CURB AND RIGHT-OF-WAY SHALL NOT BE STEEPER THAN 4H:1V TO PROVIDE A RECOVERABLE ROADSIDE SLOPE. 50H:1V (2%) IS TYPICAL/PREFERRED.
8. MAX 1.5H:1V CUT SLOPES PERMITTED IN ROCK CUTS WHEN APPROVED BY A GEOTECHNICAL ENGINEER.
9. MASTER PLAN DEVELOPMENTS PER BEND DEVELOPMENT CODE 4.5.100(E)(2)(C) MAY PROPOSE MODIFIED STREET SECTIONS THAT INCLUDE ADDITIONS TO OR ENHANCEMENTS OF THE BASIC MINIMUM STANDARD SECTIONS SHOWN HERE.
10. OFF STREET SHARED-USE PATHS (PATHS MEETING THE GENERAL ALIGNMENT OF THE TSP LOW STRESS NETWORK AND ARE MORE THAN 30 FT OUTSIDE OF THE RIGHT-OF-WAY) ARE ENCOURAGED, PARTICULARLY ALONG ARTERIAL STREET CORRIDORS. SIDEWALKS MAY BE REDUCED TO A MINIMUM 6 FT OR ELIMINATED WHEN THE SAME SIDE OF THE ROAD CORRIDOR IS SERVED BY A SHARED-USE PATH DEPENDING ON ADJACENT LAND USE AND PEDESTRIAN/BIKE ACCESS AND WITH CITY ENGINEER APPROVAL.
11. TWELVE-FOOT CENTER MEDIAN ON ARTERIAL AND COLLECTOR CROSS-SECTIONS INCLUDES EITHER A STRIPED MEDIAN (TWO-WAY LEFT TURN LANE, DOUBLE YELLOW, AND/OR TURN BAY) OR A NINE-FOOT RAISED REFUGE ISLAND WITH A ONE AND A HALF FOOT SHY LINE STRIPE EACH SIDE AS REQUIRED PER STANDARDS.
12. RAISED MEDIANS ARE AT THE CITY ENGINEER'S DISCRETION ON ARTERIALS & COLLECTORS. MEDIAN REFUGE ISLANDS FOR STREET CROSSINGS ON A LOW STRESS ROUTE OR AN ENHANCED CROSSING ON A CONNECTOR ROUTE DO NOT REQUIRE CITY ENGINEER APPROVAL.
13. ON-STREET PARKING SPACES ARE NOT STRIPED. IN HIGH PARKING DEMAND AREAS, A PARKING LINE MAY BE USED WITH CITY ENGINEER APPROVAL.
14. SEE BEND DEVELOPMENT CODE 3.4.200(F)(3) FOR STREETS AND INTERSECTIONS NOT IDENTIFIED FOR TRAVEL LANE EXPANSION WHERE ADDITIONAL RIGHT-OF-WAY IS NOT REQUIRED FOR VEHICLE TRAVEL LANES.
15. PLTS = PEDESTRIAN LEVEL OF TRAFFIC STRESS / BLTS = BICYCLISTS LEVEL OF TRAFFIC STRESS.
16. DEVIATIONS FROM THE PAVEMENT SECTIONS PROVIDED IN THE TABLE BELOW REQUIRE A STAMPED GEOTECHNICAL REPORT. PCC ROADWAYS REQUIRE A STAMPED GEOTECHNICAL REPORT.
17. SEE CITY SPEC 00744/00745 FOR MAXIMUM AC PAVEMENT LIFT THICKNESS.
18. WHERE EXISTING GROUND CROSS SLOPE EXCEEDS 12%, CURB-TIGHT SIDEWALK IS ALLOWED PER DESIGN STANDARD 3.4.7 - HILLSIDE.

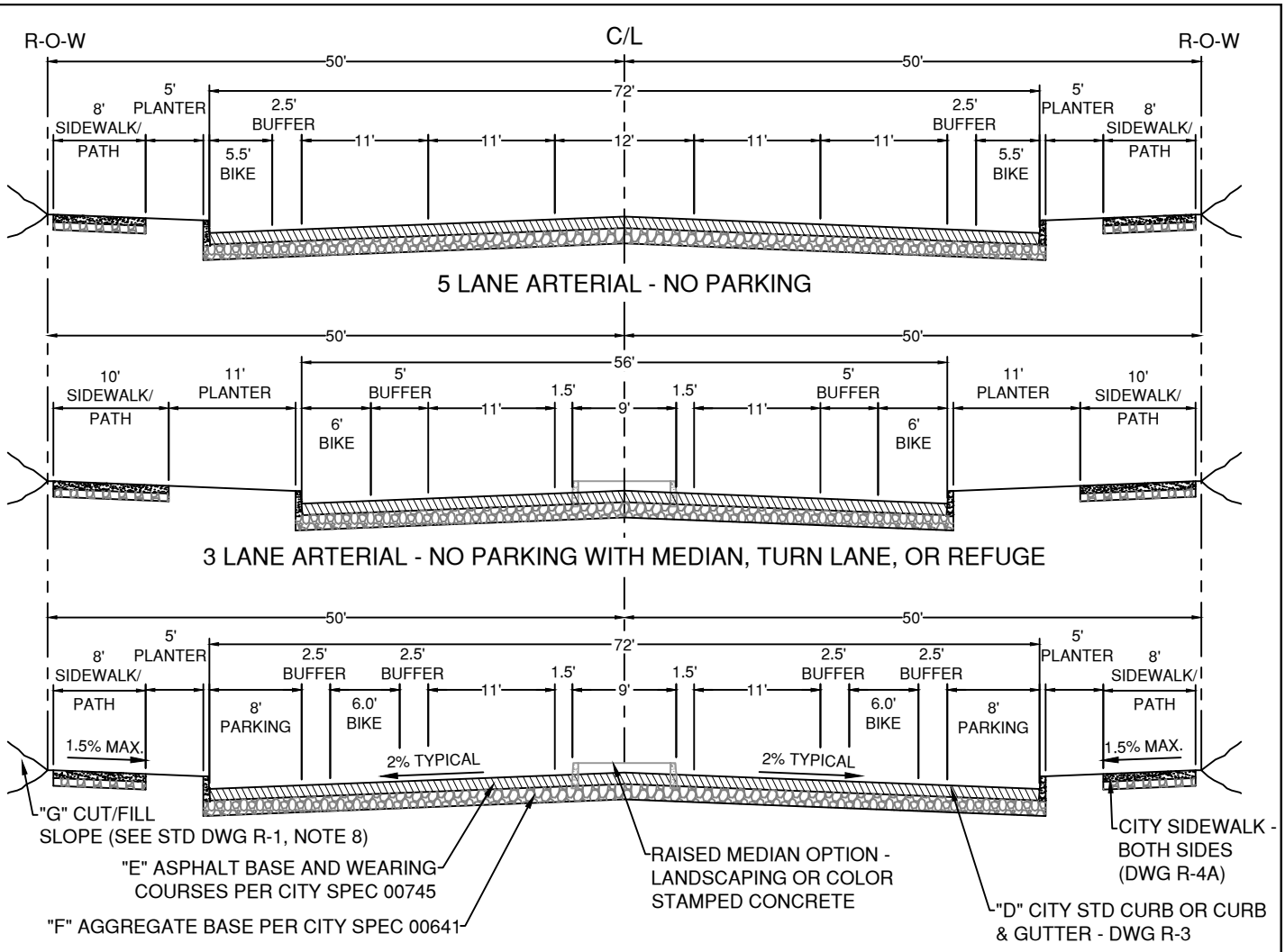
STREET TYPE	"A" ROW	"B" STREET	"C" SIDEWALK	"D" CURB	"E" ACP DEPTH/LEVEL	"F" BASE	"G" CUT/FILL
ARTERIAL	PER R-1A			7"/16"	8" - LEVEL III	10"	4H:1V
COLLECTOR	PER R-1B & R-1C			6"/14"	6" - LEVEL III	8"	4H:1V
LOCAL	PER R-1D & R-1E			6"/12"	4" - LEVEL III	6"	2H:1V
INDUSTRIAL LOCAL	PER R-1F			6"/12"	4" - LEVEL III	8"	2H:1V
ALLEY	PER R-1G			--	4" - LEVEL III	6"	2H:1V
ROUNDABOUT - ACP	VARIES	VARIES	VARIES	**	8" - LEVEL IV	10"	4H:1V
ROUDABOUT - PCC ***	VARIES	VARIES	VARIES	**	*	*	4H:1V

* THE STANDARD PAVEMENT SECTION FOR ARTERIAL STREETS IS ASPHALT. FOR RECONSTRUCTION, NEW STREETS MORE THAN 1/4 MILE LONG, AND FOR ROUNDABOUTS, A LIFE CYCLE COST ANALYSIS EVALUATING ASPHALT, PERPETUAL PAVEMENT, CONCRETE, AND OTHER SECTIONS SHALL BE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER.

* CURBS AT ROUNDABOUTS AND ON SPLITTER ISLANDS SHALL BE HIGH-STRENGTH PER CITY SPEC 00759.13.

*** DOWELING REQUIRED AT ROUNDABOUT JOINTS

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
	CITY OF BEND	TYPICAL STREET CROSS-SECTIONS - GENERAL NOTES	STD DWG R-1

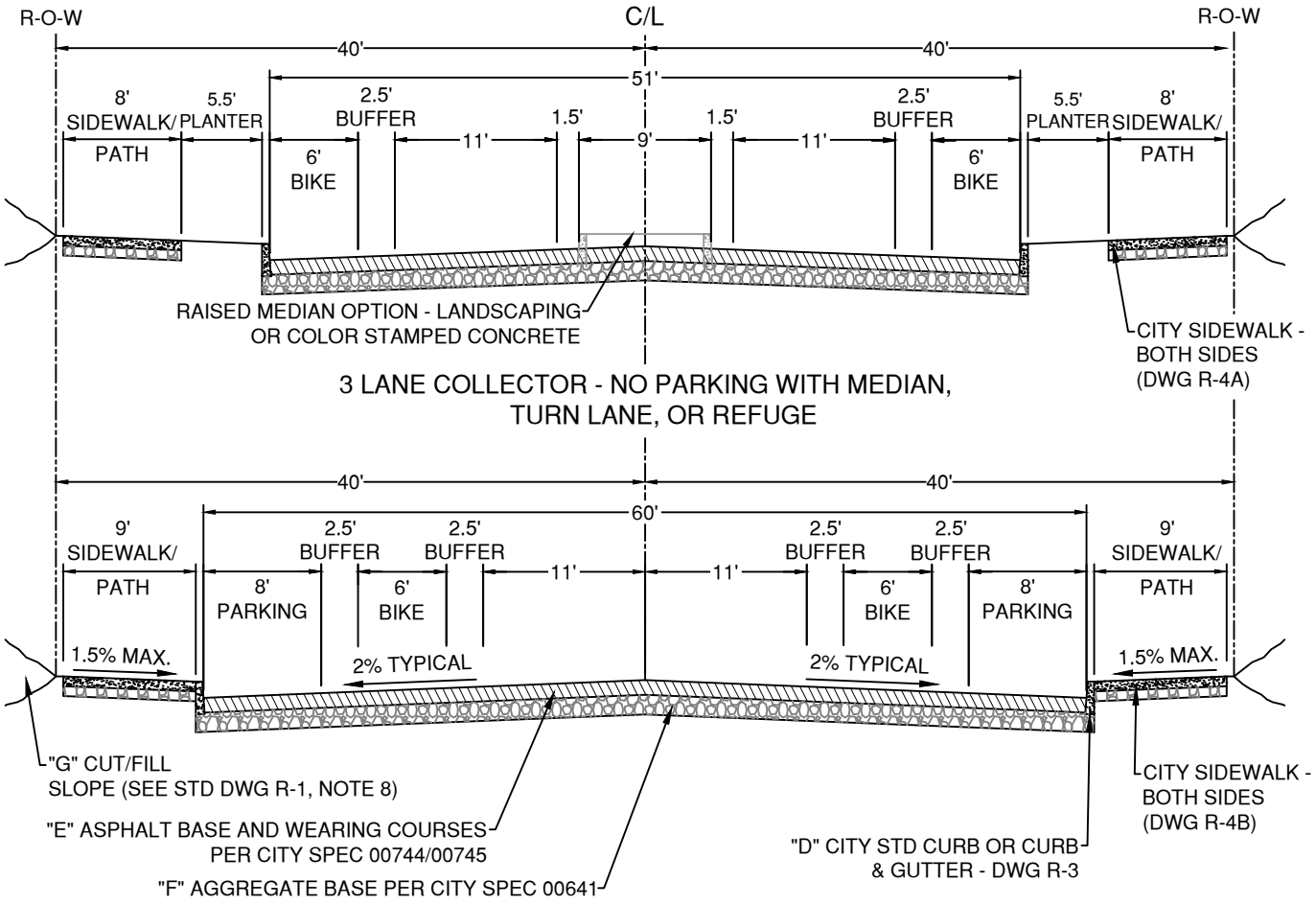


PLTS: 1 ≤ 35 MPH 2 ≥ 40 MPH	BLTS: 1 (SUP)	BLTS: 1 ≤ 30 MPH (BIKE LANE) 2 = 35 MPH 3 ≥ 40 MPH

ARTERIAL GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES.
2. WHERE PERMITTED BY THE BEND DEVELOPMENT CODE, ON-STREET PARKING MAY BE PROVIDED ON ARTERIAL STREETS WITH SPEEDS 35 MPH OR LESS. ON-STREET PARKING DESIGN PER ENGINEERING STANDARDS.
3. PROTECTED BIKE LANES, OTHER THAN PARKING PROTECTED, REQUIRE CITY ENGINEER APPROVAL. PARKING PROTECTED BIKE LANES ALLOWED ON A CASE-BY-CASE BASIS.
4. SIDEWALK MAY MEANDER WITH A MINIMUM 5 FT PLANTER STRIP. DESIGN MEANDERING CURVES FOR 10 MPH.
5. FOR EXISTING ARTERIAL SECTIONS IN 100 FT RIGHT-OF-WAY WITH 52 FT PAVEMENT WIDTHS, THE CITY ENGINEER MAY APPROVE REDUCING THE BIKE LANE TO 6/2.5 FT TO MATCH THE 52 FT CURB-TO-CURB EXISTING CONSTRUCTED SECTIONS; EXCEPTION DOES NOT APPLY TO SECTIONS (NEW OR RECONSTRUCTED) AT THE OUTER EXTENTS OF THE NETWORK WHERE UNDEVELOPED LAND AND FUTURE EXPANSIONS/RECONSTRUCTIONS CAN ACCOMMODATE THE 56/72 FT PAVEMENT SECTION.
6. THE FIVE-LANE ARTERIAL SECTION IS TO BE USED ON 3RD STREET, 27TH STREET SOUTH OF NEFF ROAD, REED MARKET ROAD EAST OF US 97, AND OTHER MAJOR ARTERIAL STREETS AS IDENTIFIED BY A TRAFFIC ANALYSIS WITH CITY ENGINEER APPROVAL (SEE STANDARDS FOR LANE ADDITIONS).
7. PARKING IS NOT PERMITTED ON A FIVE LANE ARTERIAL.
8. FOR PARKING ON ONE SIDE OF A THREE LANE ARTERIAL, COMBINE THE APPLICABLE HALF STREET SECTIONS FROM THE NO PARKING AND PARKING ON BOTH SIDES TYPICAL SECTIONS. THE ROAD CENTERLINE SHALL REMAIN IN THE CENTER OF ROW TO ALLOW FOR FUTURE EXPANSION.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		TYPICAL STREET CROSS-SECTIONS - ARTERIAL	STD DWG R-1A



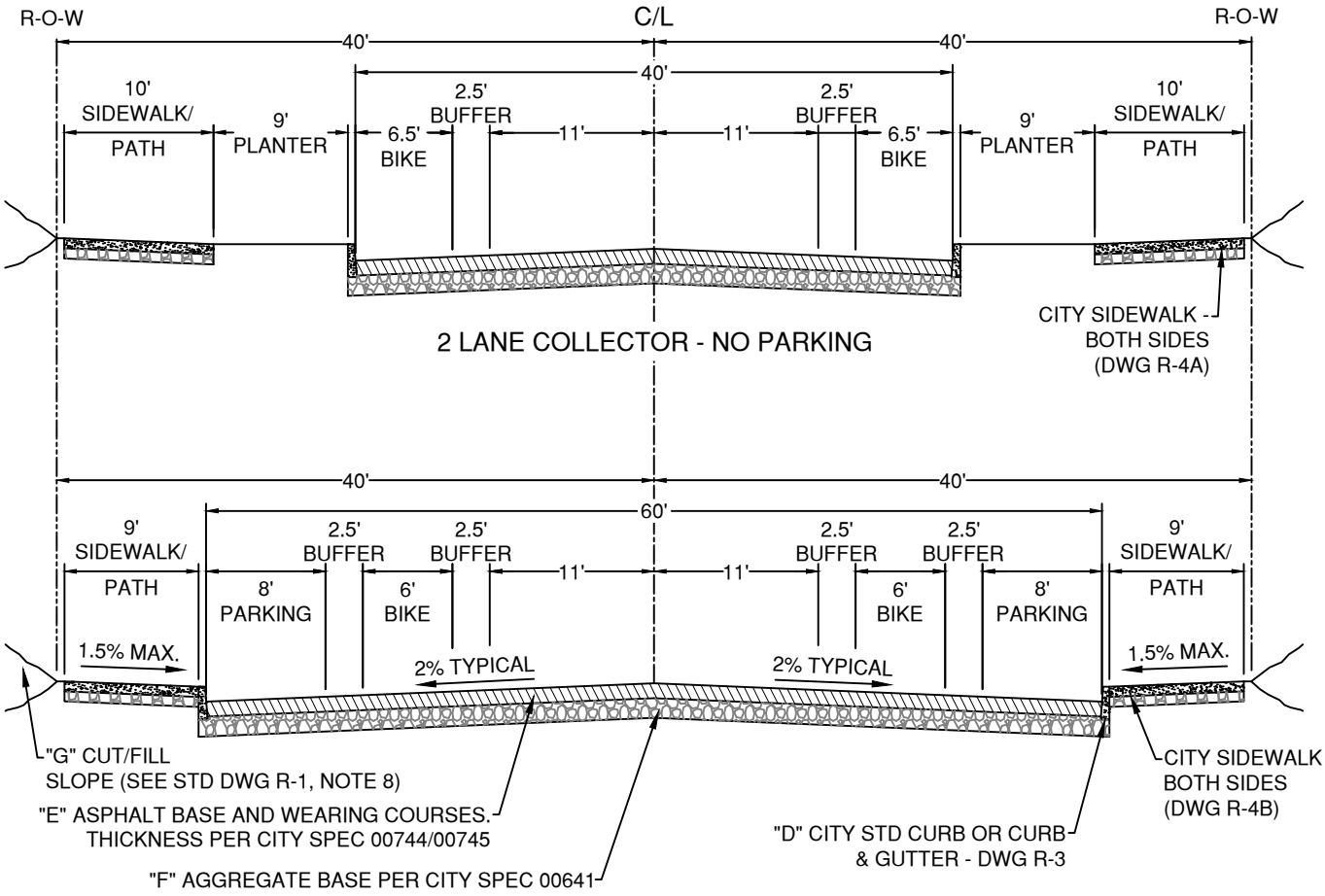
2 LANE COLLECTOR - PARKING BOTH SIDES

PLTS: 1 ≤ 35 MPH 2 ≥ 40 MPH	BLTS: 1 (SUP)	BLTS: 1 ≤ 30 MPH (BIKE LANE) 2 = 35 MPH 3 ≥ 40 MPH

MAJOR COLLECTOR GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES.
2. WHERE PERMITTED BY THE BEND DEVELOPMENT CODE, ON-STREET PARKING MAY BE PROVIDED ON COLLECTOR STREETS WITH SPEEDS 35 MPH OR LESS. ON-STREET PARKING DESIGN PER ENGINEERING STANDARDS.
3. WHERE THE CROSS-SECTION DOES NOT PROVIDE FOR TREES IN A PLANTER STRIP, DEVELOPMENT MUST STILL MEET BEND DEVELOPMENT CODE TREE REQUIREMENTS IN AN ALTERNATE LOCATION ON-SITE OR PROVIDE MITIGATION AND RECEIVE APPROVAL OF A VARIANCE AS REQUIRED BY CODE.
4. PROTECTED BIKE LANES, OTHER THAN PARKING PROTECTED, REQUIRE CITY ENGINEER APPROVAL. PARKING PROTECTED BIKE LANES ALLOWED ON A CASE-BY-CASE BASIS.
5. SIDEWALK MAY MEANDER WITH A MINIMUM 5 FT PLANTER STRIP. DESIGN MEANDERING CURVES FOR 10 MPH.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 07/02/2025 APPR
		TYPICAL STREET CROSS-SECTIONS - MAJOR COLLECTOR	STD DWG R-1B



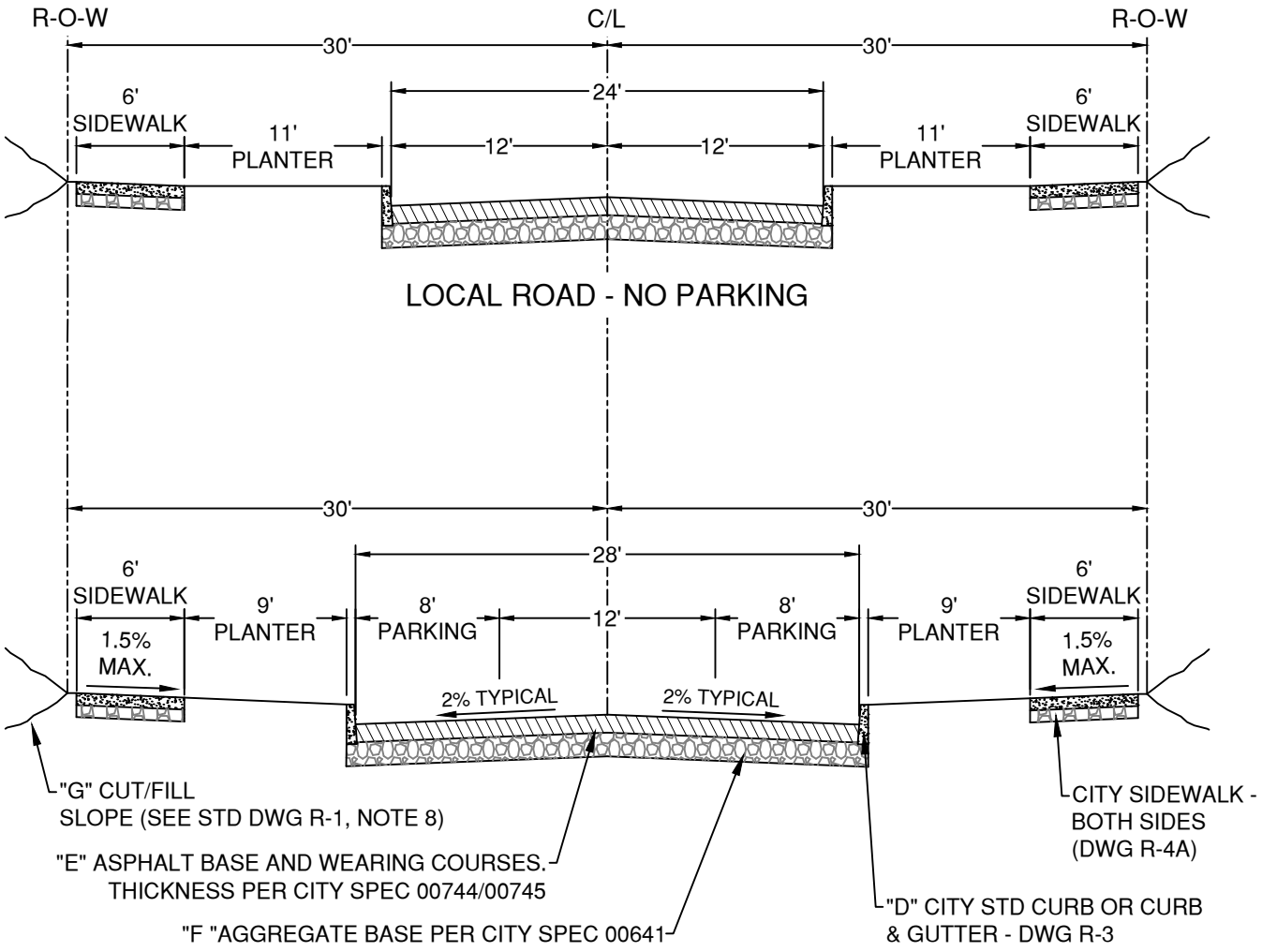
2 LANE COLLECTOR - PARKING BOTH SIDES

PLTS: 1 ≤ 35 MPH 2 ≥ 40 MPH	BLTS: 1 (SUP)	BLTS: 1 ≤ 30 MPH (BIKE LANE) 2 = 35 MPH 3 ≥ 40 MPH

MINOR COLLECTOR GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES.
2. WHERE PERMITTED BY THE BEND DEVELOPMENT CODE, ON-STREET PARKING MAY BE PROVIDED ON COLLECTOR STREETS WITH SPEEDS 35 MPH OR LESS. ON-STREET PARKING DESIGN PER ENGINEERING STANDARDS.
3. WHERE THE CROSS-SECTION DOES NOT PROVIDE FOR TREES IN A PLANTER STRIP, DEVELOPMENT MUST STILL MEET BEND DEVELOPMENT CODE TREE REQUIREMENTS IN AN ALTERNATE LOCATION ON-SITE OR PROVIDE MITIGATION AND RECEIVE APPROVAL OF A VARIANCE AS REQUIRED BY CODE.
4. PROTECTED BIKE LANES, OTHER THAN PARKING PROTECTED, REQUIRE CITY ENGINEER APPROVAL. PARKING PROTECTED BIKE LANES ALLOWED ON A CASE-BY-CASE BASIS.
5. SIDEWALK MAY MEANDER WITH A MINIMUM 5 FT PLANTER STRIP. DESIGN MEANDERING CURVES FOR 10 MPH.
6. FOR PARKING ON ONE SIDE, COMBINE THE APPLICABLE HALF STREET SECTIONS FROM THE NO PARKING AND PARKING ON BOTH SIDES TYPICAL SECTIONS. THE ROAD CENTERLINE SHALL REMAIN IN THE CENTER OF ROW TO ALLOW FOR FUTURE EXPANSION.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 07/02/2025 APPR
		TYPICAL STREET CROSS-SECTIONS - MINOR COLLECTOR	STD DWG R-1C



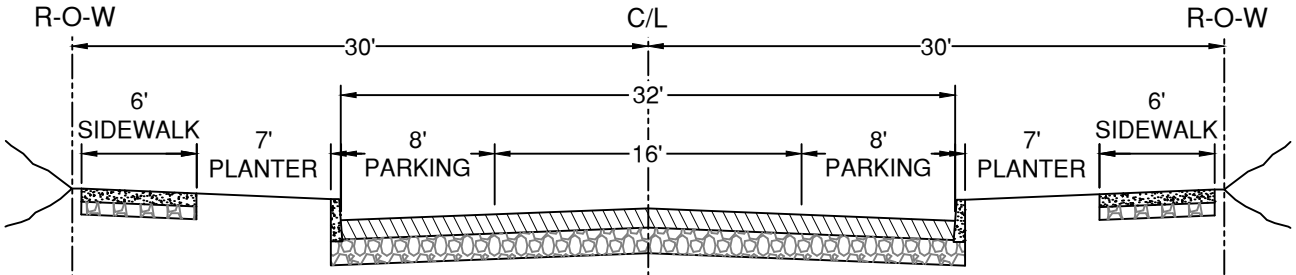
28' LOCAL ROAD - PARKING BOTH SIDES (SEE NOTE 3)

PLTS: 1	BLTS: 1
	2 (STRIPED CENTERLINE)

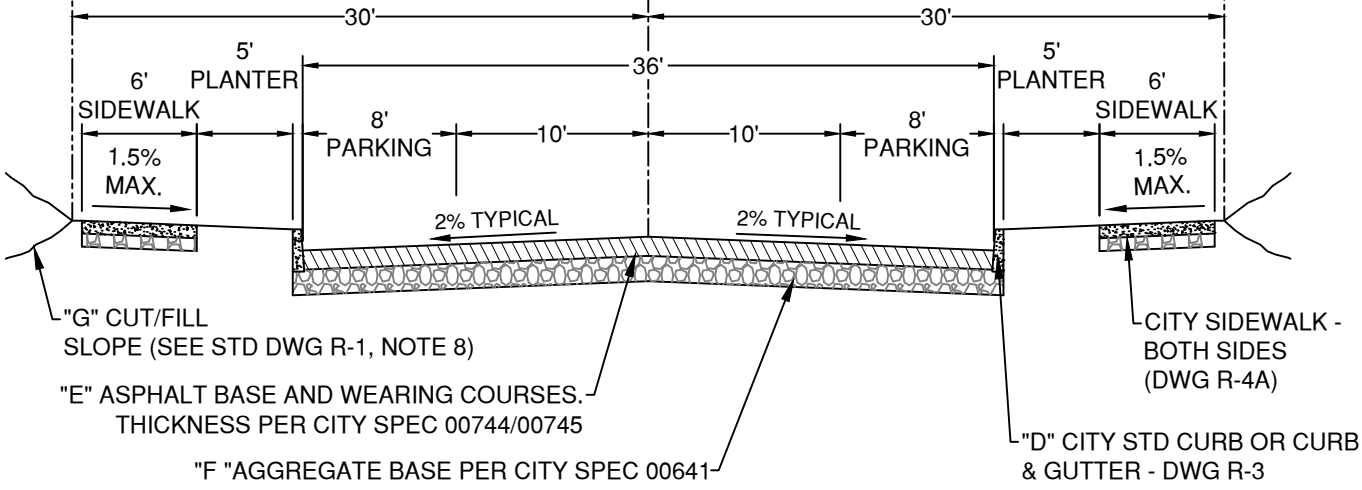
LOCAL ROAD GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES
2. UTILITY EASEMENTS MAY BE REQUIRED FOR PEDESTALS, TRANSFORMERS, ETC.
3. LOCAL ROADS WITH TRAVEL LANES LESS THAN 10' IN EACH DIRECTION ARE CONSIDERED QUEUING STREETS. SEE DESIGN STANDARDS SECTION 3.4.2.2 FOR APPROPRIATE QUEUING STREET APPLICATIONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 07/02/2025
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL STREET CROSS-SECTION - LOCAL	STD DWG R-1D



32' LOCAL ROAD - PARKING BOTH SIDES (SEE NOTE 3)



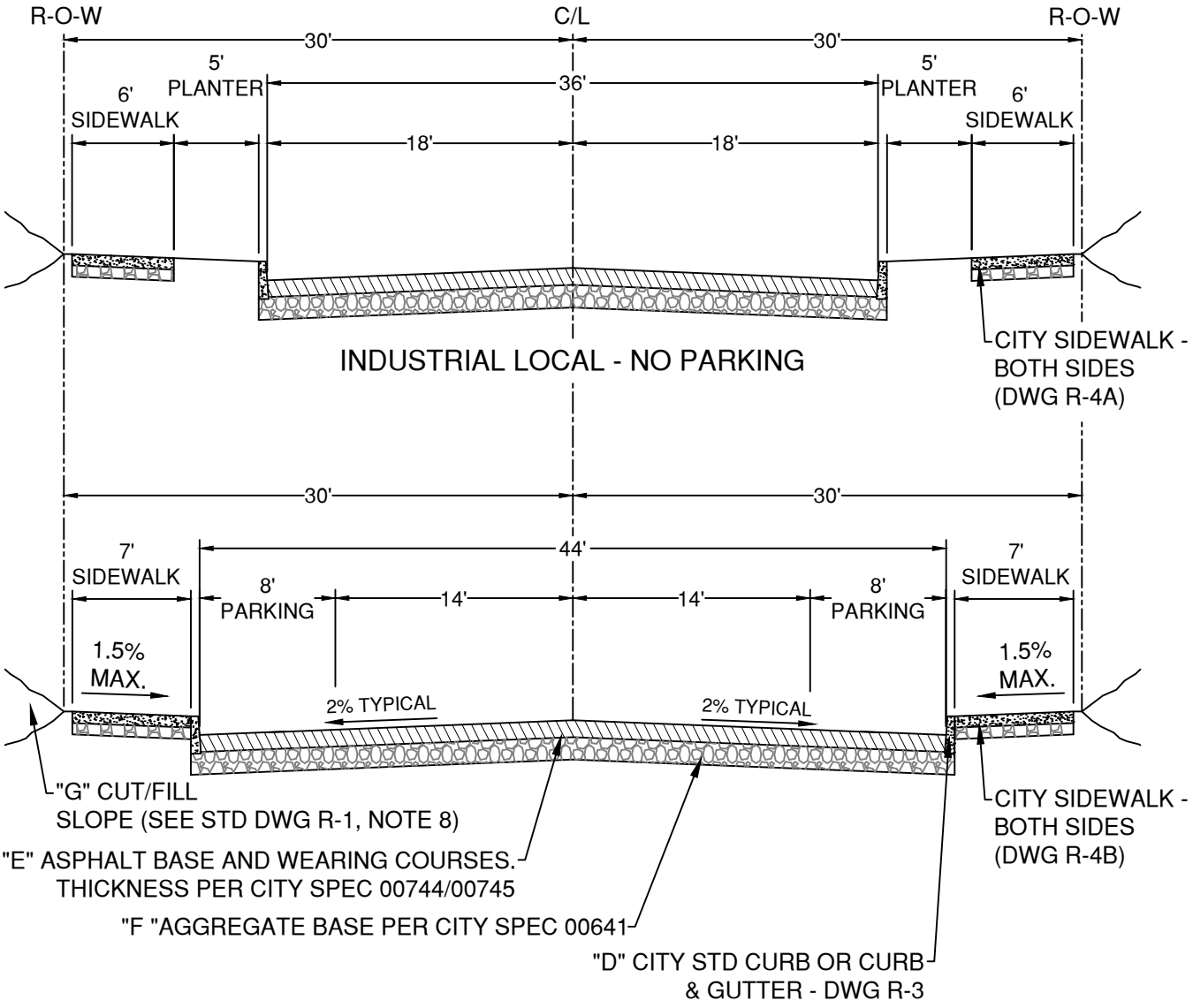
36' LOCAL ROAD - PARKING BOTH SIDES

PLTS: 1	BLTS: 1
	2 (STRIPED CENTERLINE)

LOCAL ROAD GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES
2. UTILITY EASEMENTS MAY BE REQUIRED FOR PEDESTALS, TRANSFORMERS, ETC.
3. LOCAL ROADS WITH TRAVEL LANES LESS THAN 10' IN EACH DIRECTION ARE CONSIDERED QUEUING STREETS. SEE DESIGN STANDARDS SECTION 3.4.2.2 FOR APPROPRIATE QUEUING STREET APPLICATIONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 07/02/2025
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL STREET CROSS-SECTION - LOCAL	STD DWG R-1E



INDUSTRIAL LOCAL - NO PARKING

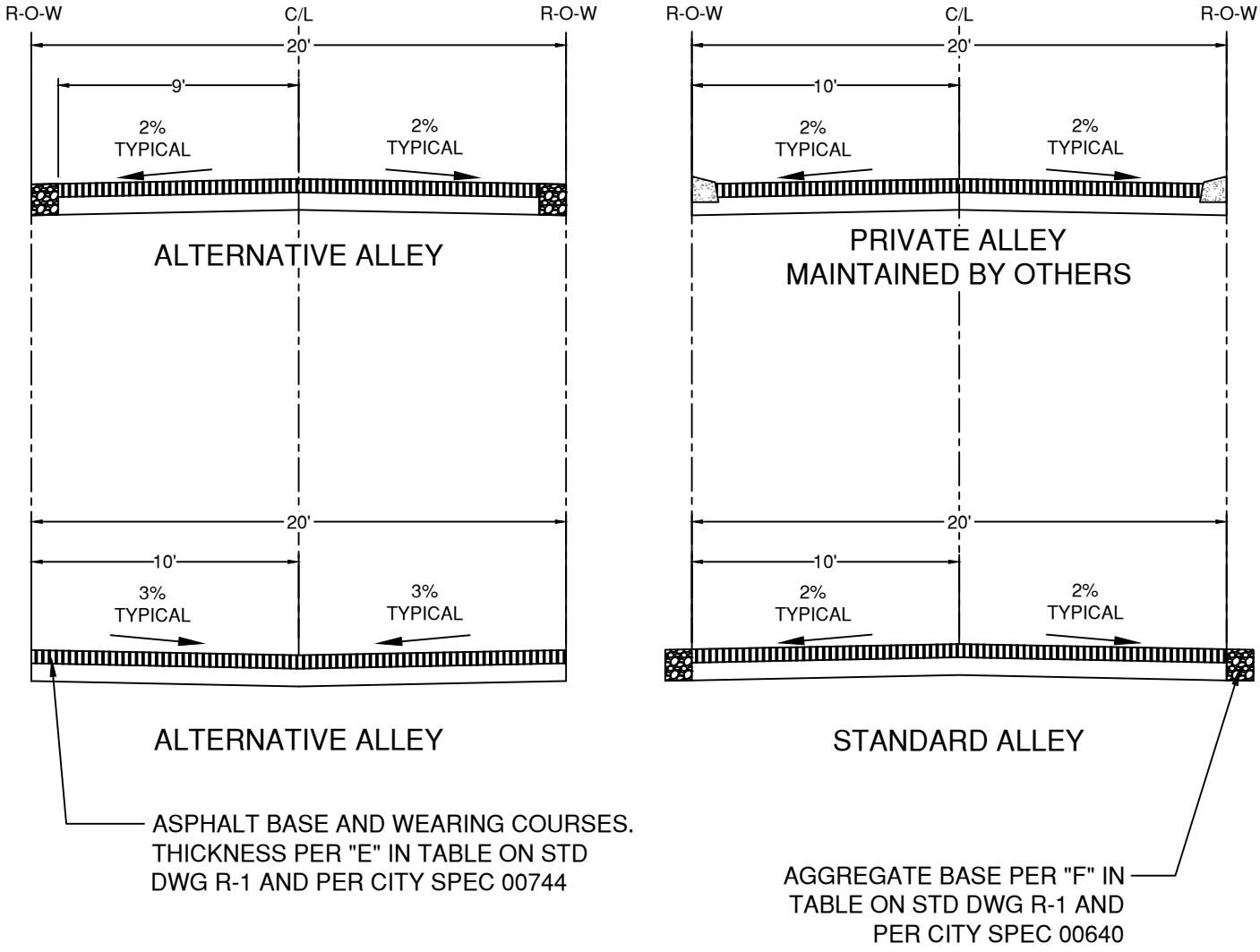
INDUSTRIAL LOCAL - PARKING BOTH SIDES

PLTS: 1	BLTS: 1
	2 (STRIPED CENTERLINE)

LOCAL ROAD GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES
2. THE SIDE PARKING IS ON MAY ALTERNATE BY BLOCK. PROVIDE PARKING NEXT TO PARKS, SCHOOLS, AND OTHER ACTIVITY GENERATING LAND USES.
3. UTILITY EASEMENTS MAY BE REQUIRED FOR PEDESTALS, TRANSFORMERS, ETC.
4. FOR PARKING ON ONE SIDE, COMBINE THE APPLICABLE HALF STREET SECTIONS FROM THE NO PARKING AND PARKING ON BOTH SIDES TYPICAL SECTIONS. THE ROAD CENTERLINE SHALL REMAIN IN THE CENTER OF ROW TO ALLOW FOR FUTURE EXPANSION.

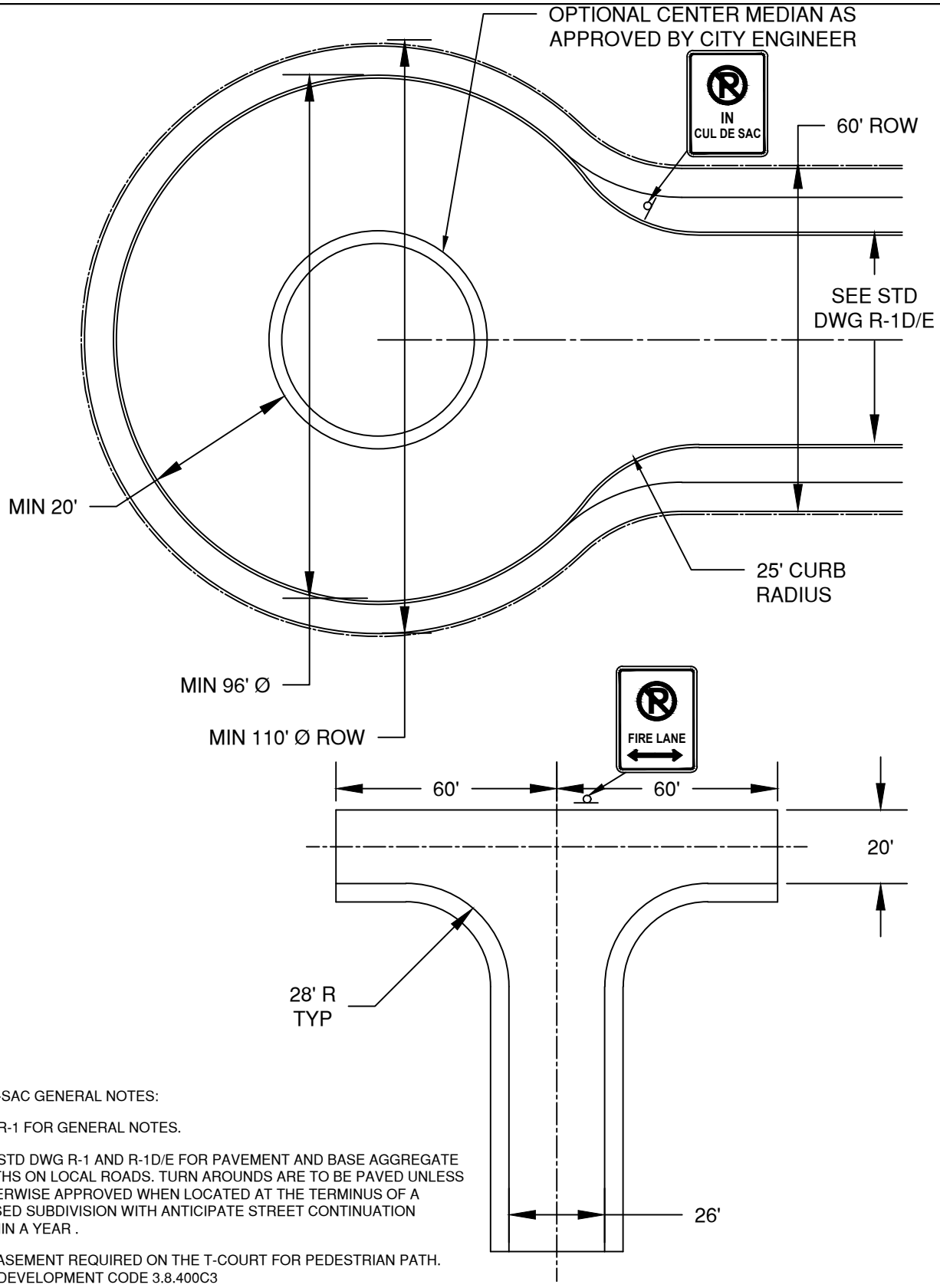
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY	STANDARD DRAWING		DATE 07/02/2025
REV / DATE	710 NW WALL ST., BEND, OREGON 97701		APPR
		TYPICAL STREET CROSS-SECTION - INDUSTRIAL LOCAL	STD DWG R-1F



ALLEY GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES.
2. NEW ALLEY RIGHT-OF-WAY AND PAVED WIDTH WILL BE 20' WIDE. WHERE ALLEYS ARE INSTALLED IN EXISTING RIGHT-OF-WAY, THE PAVED WIDTH MAY BE UP TO 2 FEET LESS THAN THE RIGHT-OF-WAY WIDTH. 1-FOOT WIDE BUFFERS ON EACH SIDE OF THE ALLEY MAY BE LEFT UNPAVED WHEN ALLEYS ARE INSTALLED IN EXISTING RIGHT-OF-WAY.
3. SURFACE RESTORATION OF TRANSVERSE TRENCHING WILL NOT REQUIRE ASPHALT IF THE EXISTING ALLEY IS UNPAVED. RESTORE SURFACE TO MATCH EXISTING.

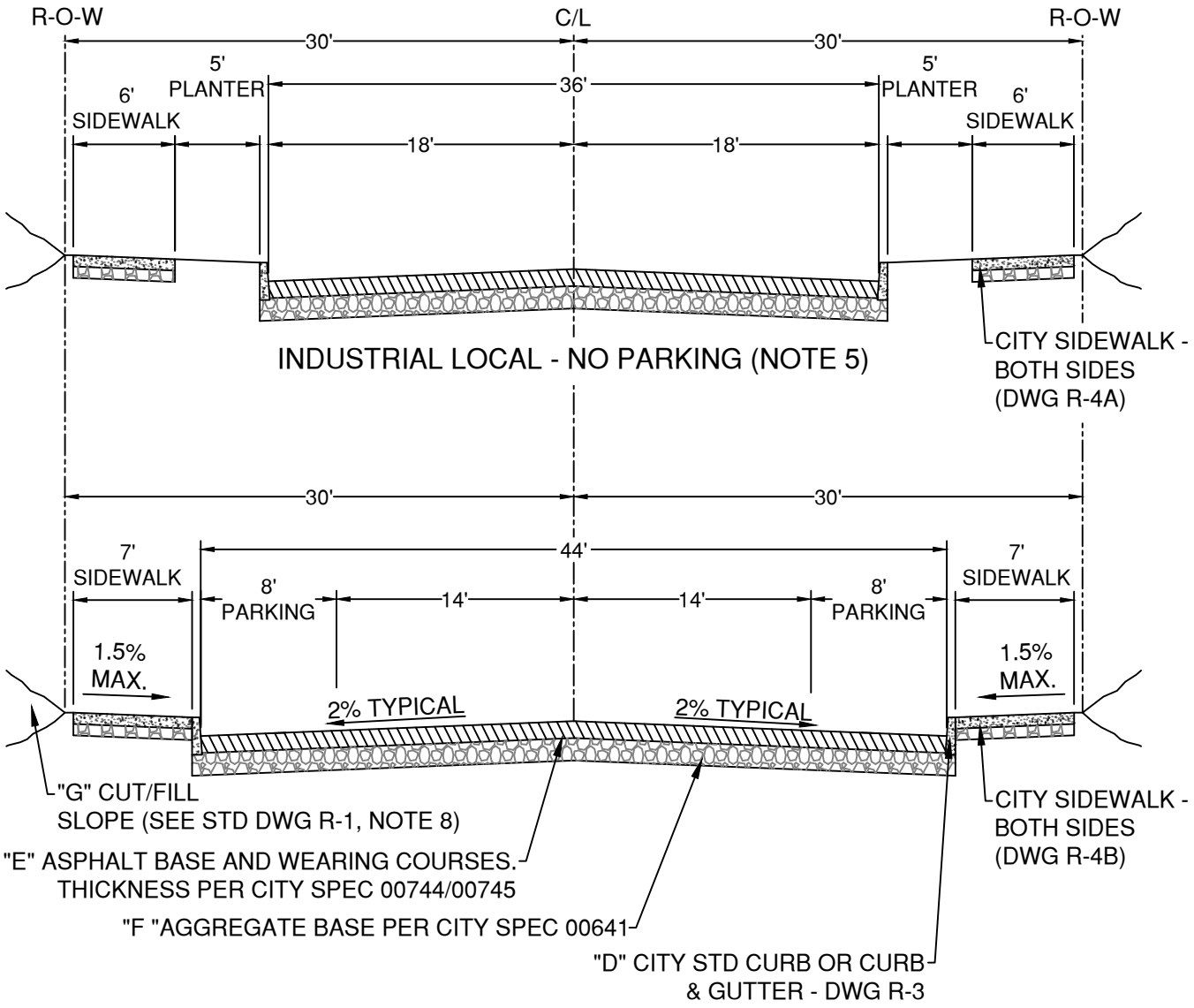
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL STREET SECTION - ALLEY	STD DWG R-1G



CUL-DE-SAC GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES.
2. SEE STD DWG R-1 AND R-1D/E FOR PAVEMENT AND BASE AGGREGATE DEPTHS ON LOCAL ROADS. TURN AROUNDS ARE TO BE PAVED UNLESS OTHERWISE APPROVED WHEN LOCATED AT THE TERMINUS OF A PHASED SUBDIVISION WITH ANTICIPATE STREET CONTINUATION WITHIN A YEAR .
3. 10' EASEMENT REQUIRED ON THE T-COURT FOR PEDESTRIAN PATH. SEE DEVELOPMENT CODE 3.8.400C3
4. TURN AROUNDS TO BE IN COMPLIANCE WITH OREGON FIRE CODE.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL STREET DEAD-END TURNAROUND	STD DWG R-1H



INDUSTRIAL LOCAL - NO PARKING (NOTE 5)

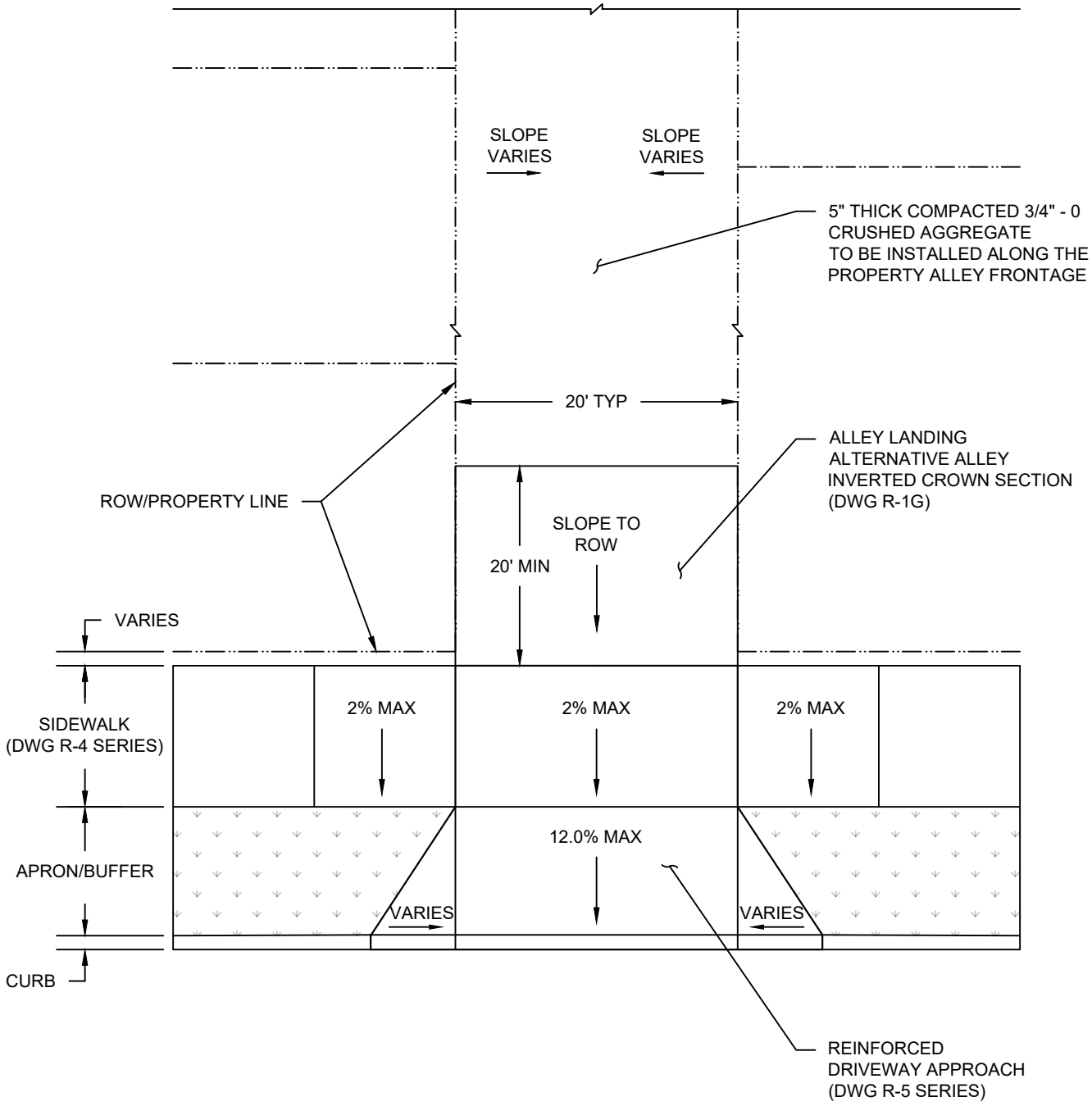
INDUSTRIAL LOCAL - PARKING BOTH SIDES

PLTS: 1	BLTS: 1
	2 (STRIPED CENTERLINE)

LOCAL ROAD GENERAL NOTES:

1. SEE R-1 FOR GENERAL NOTES
2. THE SIDE PARKING IS ON MAY ALTERNATE BY BLOCK. PROVIDE PARKING NEXT TO PARKS, SCHOOLS, AND OTHER ACTIVITY GENERATING LAND USES.
3. UTILITY EASEMENTS MAY BE REQUIRED FOR PEDESTALS, TRANSFORMERS, ETC.
4. FOR PARKING ON ONE SIDE, COMBINE THE APPLICABLE HALF STREET SECTIONS FROM THE NO PARKING AND PARKING ON BOTH SIDES TYPICAL SECTIONS. THE ROAD CENTERLINE SHALL REMAIN IN THE CENTER OF ROW TO ALLOW FOR FUTURE EXPANSION.
5. ON-SITE PARKING MAY BE PERMITTED WHEN PARKING IS RESTRICTED WITHIN 100 FEET OF INTERSECTIONS ON BLOCKS WHERE LAND USE / SITE DESIGN DOES NOT SERVE LARGER VEHICLES

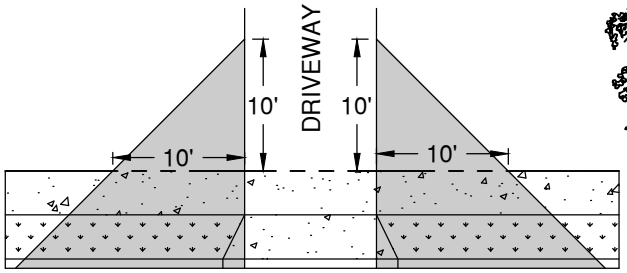
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL STREET CROSS-SECTION -INDUSTRIAL LOCAL	STD DWG R-1F



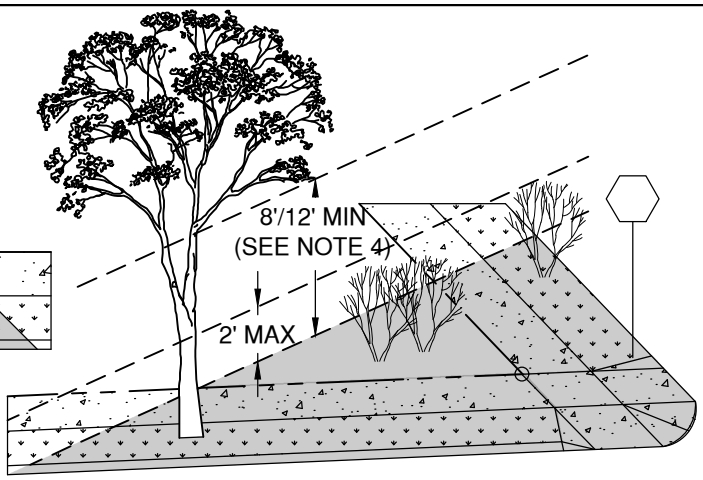
GENERAL NOTES:

1. IF THERE IS ALLEY ACCESS TO THE PROPERTY AND ONE OR MORE OF THE ALLEY DRIVEWAY APPROACHES ARE NOT IMPROVED TO CITY OF BEND STANDARDS AND SPECIFICATIONS, THEN AN ALLEY APPROACH MUST BE IMPROVED TO CITY OF BEND STANDARDS AND SPECIFICATIONS WITH THE PROPOSED DEVELOPMENT.
2. REFER TO THE BEND DEVELOPMENT CODE 4.2.400 FOR ADDITIONAL MINIMUM DEVELOPMENT STANDARDS REQUIREMENTS.

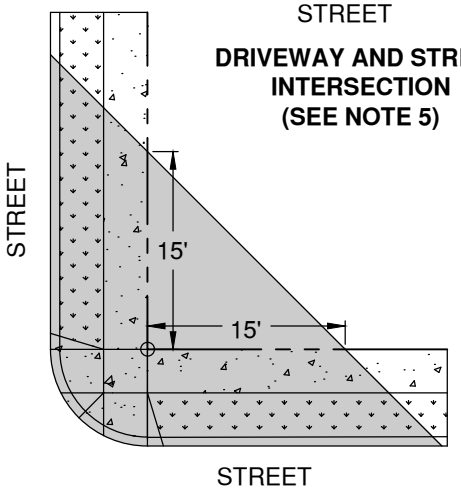
DRAWN DSE DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 RESIDENTIAL ALLEY IMPROVEMENTS	SCALE NTS DATE 04/21/2023 APPR STD DWG R-1J



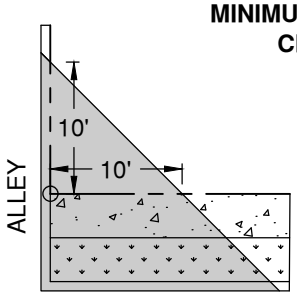
DRIVEWAY AND STREET INTERSECTION (SEE NOTE 5)



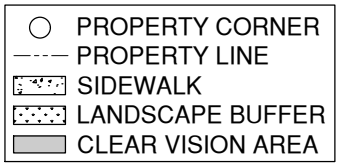
MAX HEIGHT OF SHRUBS AND MINIMUM LIMBING REQUIRED IN CLEAR VISION AREA



STREET/STREET INTERSECTION



STREET/ALLEY INTERSECTION

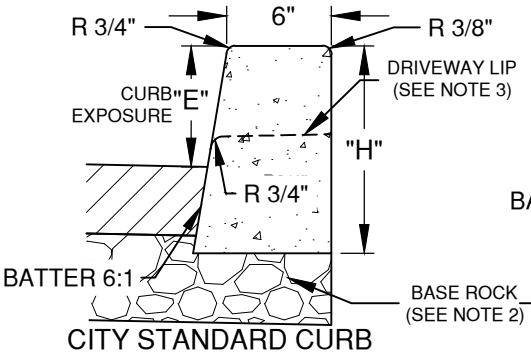


CLEAR VISION AREAS ARE ESTABLISHED AS FOLLOWS:

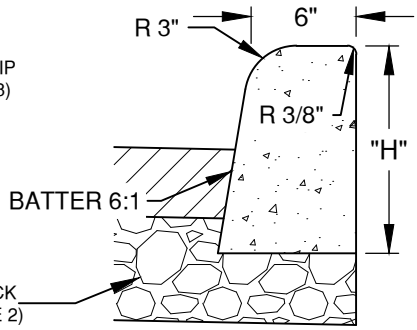
1) CLEAR VISION TRIANGLES SHALL BE ESTABLISHED AT THE CORNER OF ANY PROPERTY ADJACENT TO INTERSECTIONS OF PUBLIC OR PRIVATE STREETS, ALLEYS, MID-BLOCK LANES, AND/OR RAILROAD RIGHTS-OF-WAY.
2) THE TWO LEGS OF THE CLEAR VISION TRIANGLE ARE EACH MEASURED FROM THE POINT OF INTERSECTION OF THE TWO CORNER LOT LINES, SPECIAL SETBACK LINES, OR ACCESS EASEMENT LINES. WHERE LOT LINES HAVE ROUNDED CORNERS, THE LOT LINES ARE EXTENDED IN A STRAIGHT LINE TO A POINT OF INTERSECTION. THE CLEAR VISION AREA EXTENDS TO THE FACE OF CURB AT THE STREET OR ALLEY
3) THE LENGTH OF BOTH LEGS OF THE CLEAR VISION AREA TRIANGLE IS AS FOLLOWS:
   TYPICAL, ALL ZONES: 15 FEET
   RAILROADS: 15 FEET
   ALLEY INTERSECTION: 10 FEET
   DRIVEWAYS: 10 FEET
4) WITHIN THE CLEAR VISION AREA, OBSTRUCTIONS TO VISION OTHER THAN A STREET SIGN, HYDRANT, CROSSWALK CLOSED SIGNS, SIGN POST, OR POLE LESS THAN 8 INCHES IN DIAMETER SHALL BE CLEARED FROM PROPERTY UNDER THE CONTROL OF THE CITY, HOMEOWNER, OR DEVELOPER. SHRUBS OR FOLIAGE MUST NOT EXCEED 2'-0" IN HEIGHT. PLANTING NEW TREES OR INSTALLATION OF COMMUNICATION TOWERS AND TRANSFORMERS, ARE NOT PERMITTED WITHIN THE CLEAR VISION AREA. EXISTING TREES MUST BE MAINTAINED/LIMBED TO A MINIMUM OF 8'-0" ABOVE THE TOP OF CURB OR 12'-0" ABOVE ADJACENT BIKE LANES.
5) DRIVEWAY APPROACHES, ON-STREET PARKING AND DRIVEWAYS ARE NOT PERMITTED WITHIN THE CLEAR VISION AREA. ON-STREET PARKING DESIGN DOES NOT INCLUDE SPACES WITHIN 20 FEET OF AN ACCESSIBLE RAMP OR WITHIN 10 FEET OF A DRIVEWAY APPROACH.

NOTE: INTERSECTION SIGHT TRIANGLES ARE DISTINCT FROM, AND IN ADDITION TO, CLEAR VISION AREAS. INTERSECTION SIGHT TRIANGLE DIMENSIONS VARY WITH STREET WIDTH, GEOMETRY, TOPOGRAPHY, AND POSTED SPEED; ADDITIONAL CLEARING AS NECESSARY TO PROVIDE CLEAR INTERSECTION SIGHT DISTANCE IS ALSO REQUIRED; SEE CHAPTER 3.3 OF THE CITY OF BEND DESIGN STANDARDS.

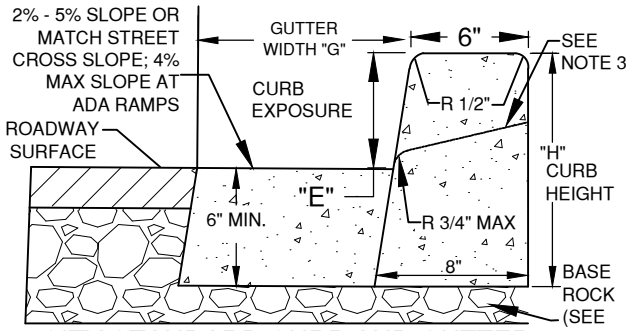
DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		CLEAR VISION AREAS AT INTERSECTIONS	STD DWG R-2



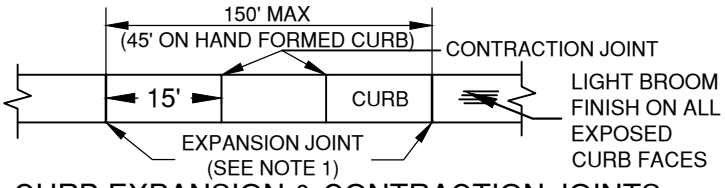
CITY STANDARD CURB



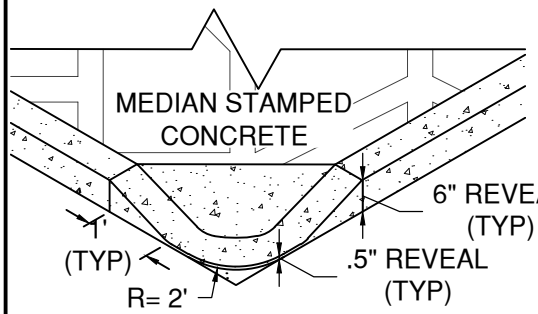
CITY ISLAND/MEDIAN MOUNTABLE CURB

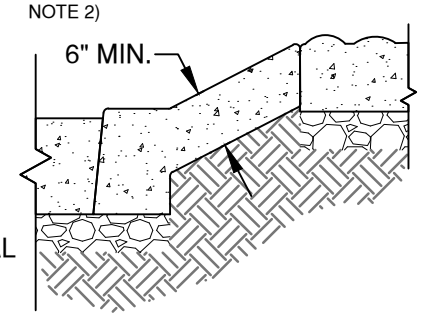


CITY STANDARD CURB AND GUTTER

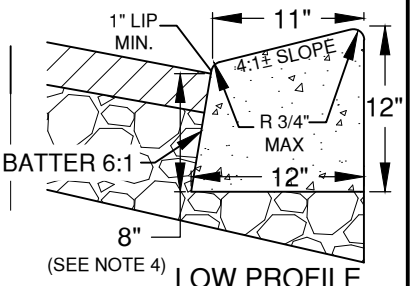


CURB EXPANSION & CONTRACTION JOINTS

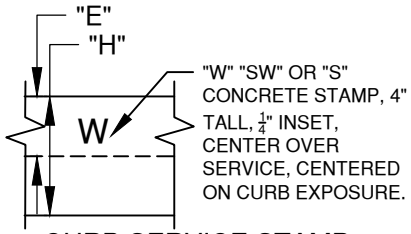




TAPERED CURB

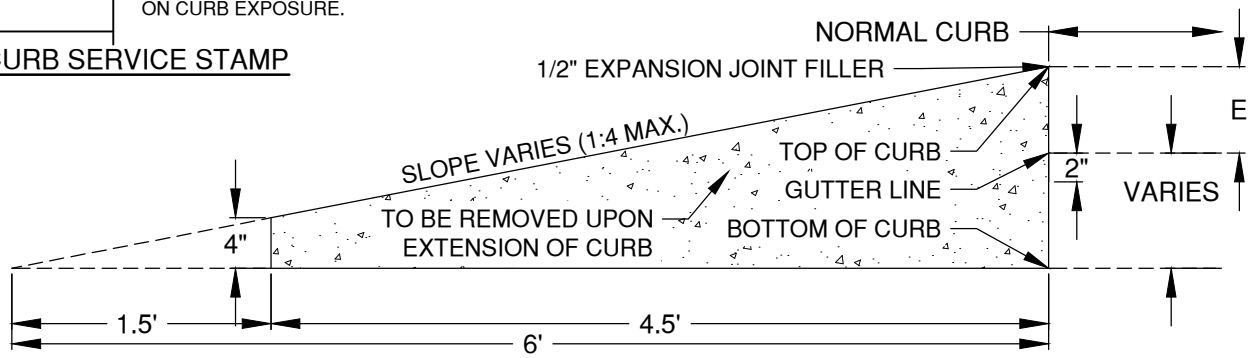


LOW PROFILE MOUNTABLE CURB



CURB SERVICE STAMP

ROAD CLASS	CURB HEIGHT - H	CURB EXPOSURE - E	GUTTER WIDTH - G
ARTERIAL	16"	7"	12"
COLLECTOR	14"	6"	18"
LOCAL	12"	6"	18"



CURB ENDING DETAIL

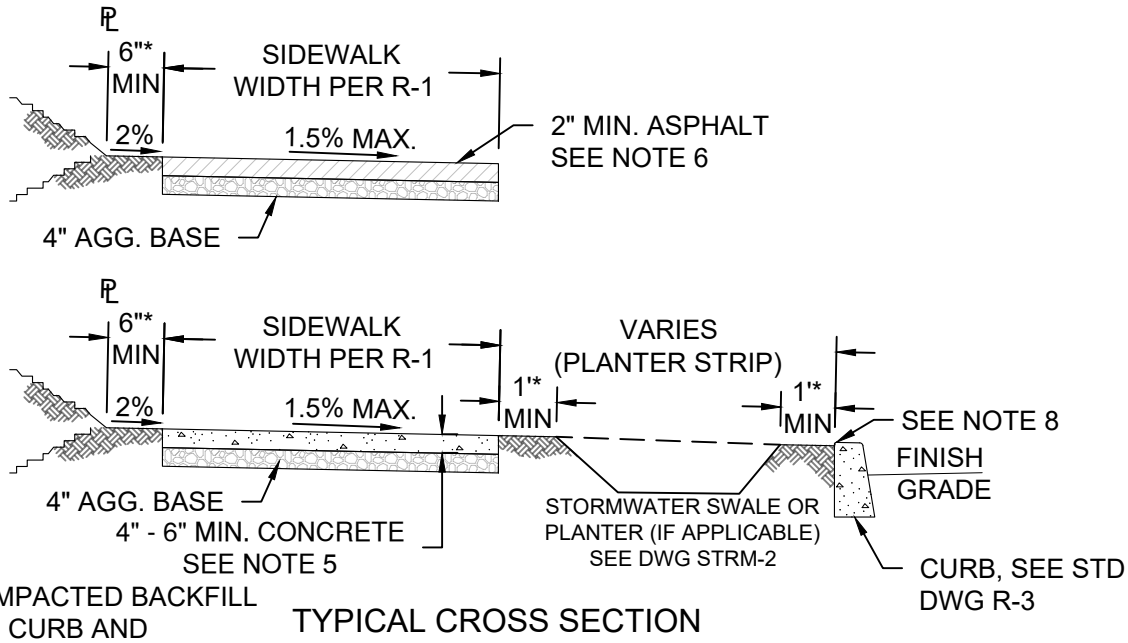
SEE NOTES ON STD DWG R-3A

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 03/22/2023
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CONCRETE CURB	STD DWG R-3

NOTES FOR STD DWG R-3:

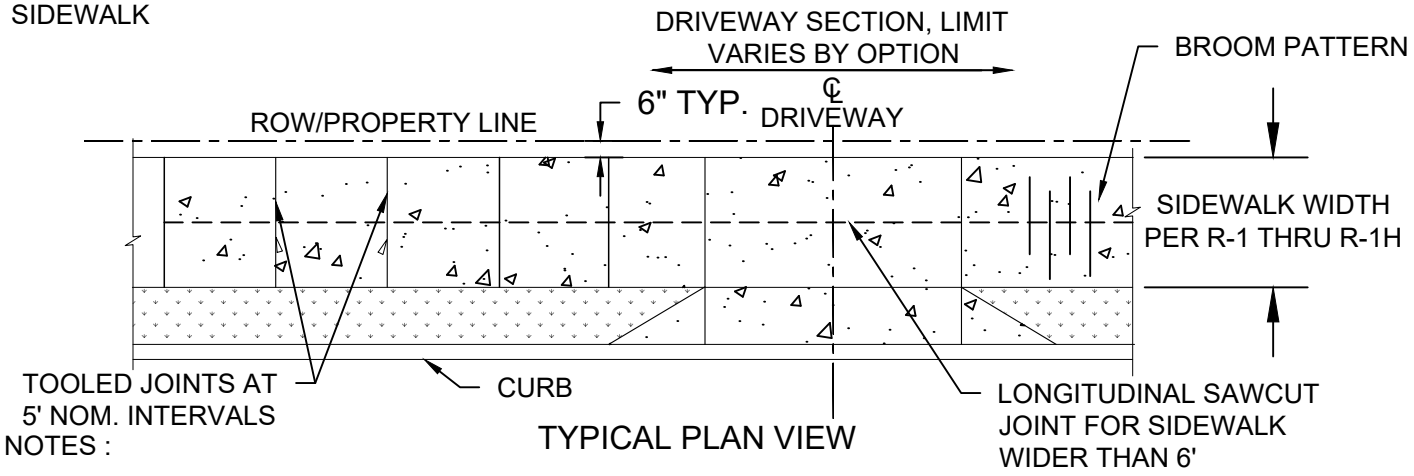
1. EXPANSION JOINTS REQUIRED AT END OF RADII, DRIVEWAY APRONS, POINTS OF CURVATURE, AND NO GREATER THAN 150' MAXIMUM.
2. AGGREGATE BASE SHALL CONFORM TO SPECIFICATION SECTION 00640/00641. DEPTH AS REQUIRED TO MATCH BOTTOM OF STREET SECTION, 4" MIN.
3. SLOPE DRIVEWAY TOWARD STREET. 3/4" MAXIMUM LIP AT GUTTER, 1" ON COLLECTORS AND ARTERIALS.
4. MOUNTABLE CURB PERMITTED ON LOCAL STREET CUL-DE-SACS, ALLEYS, AND WHERE PERMITTED BY THE CITY ENGINEER. WHERE SIDEWALK ABUTS CURB, SIDEWALK SHALL BE MIN. 6" THICK
5. CURB AND GUTTER MAY BE REQUIRED WHEN GUTTER SLOPE IS BETWEEN 0.5% - 0.75%.
6. CONCRETE MATERIAL AND PLACEMENT SHALL CONFORM TO SPECIFICATION SECTION 00759.
7. LOCATE TAPERED CURB ON DOWNSTREAM SIDE OF PEDESTRIAN REFUGE IN CENTER MEDIAN CURB RAMPS TO PROTECT FROM SNOW PLOW DAMAGE.
8. TACK COAT IS TO BE APPLIED TO CURB FACE PRIOR TO PAVING.

DRAWN AJD		CITY OF BEND		SCALE NTS
DIV ROADWAY		STANDARD DRAWING		DATE 03/22/2023
REV	DATE	710 NW WALL ST., BEND, OREGON 97701		APPR
		CITY OF BEND	CONCRETE CURB NOTES	STD DWG R-3A



*PROVIDE COMPACTED BACKFILL ADJACENT TO CURB AND SIDEWALK

TYPICAL CROSS SECTION

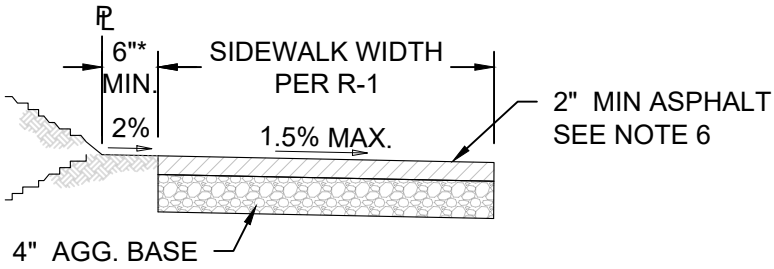


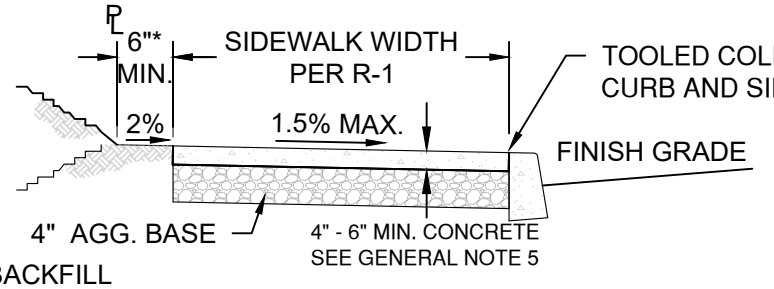
TYPICAL PLAN VIEW

NOTES :

1. SIDEWALKS SET BACK ADJACENT TO PROPERTY LINE ARE STANDARD. USE CURB-TIGHT SIDEWALKS ONLY WHERE PERMITTED. SIDEWALK SHALL BE PROPERTY-TIGHT EXCEPT TO MEANDER AROUND TREES OR BARRIERS (UTILITIES, SIGNS, ETC.) OR PER DESIGN STANDARD SECTION 3.4.7 - HILLSIDE.
2. CONST. EXPANSION JOINTS AT 25' MAXIMUM SPACING, AND AT POINTS OF TANGENCY, AND ON EACH SIDE OF DRIVEWAY APRONS. EXPANSION JOINTS MUST BE FULL DEPTH OF PAVING SECTION.
3. CONST. CONTRACTION JOINTS AT 5' MAXIMUM SPACING, AND AT ENDS OF EACH RAMP.
4. FOR DRIVEWAY DETAILS, SEE STD. DRGS. R-5A THROUGH R-5E.
5. SIDEWALK THICKNESS MINIMUM 4" THICK , TYPICAL. MINIMUM 6" THICK IF SIDEWALK IS INTENDED AS PORTION OF DRIVEWAY, CURB RAMP, OR ADJACENT TO MOUNTABLE CURB.
6. ASPHALT SHARED-USE PATH WHERE APPROVED BY THE ENGINEER.
7. SIDEWALK BASE WILL BE VISUALLY INSPECTED FOR COMPACTION. CITY INSPECTORS CAN REQUIRE COMPACTION TESTING WHERE BASE ROCK COMPACTION IS VISUALLY OUT OF COMPLIANCE WITH SPECIFICATIONS 00640 / 00641.
8. LANDSCAPING MUST BE 1/4 TO 1/2 INCH BELOW THE TOP OF ADJACENT SIDEWALK AND CURB.

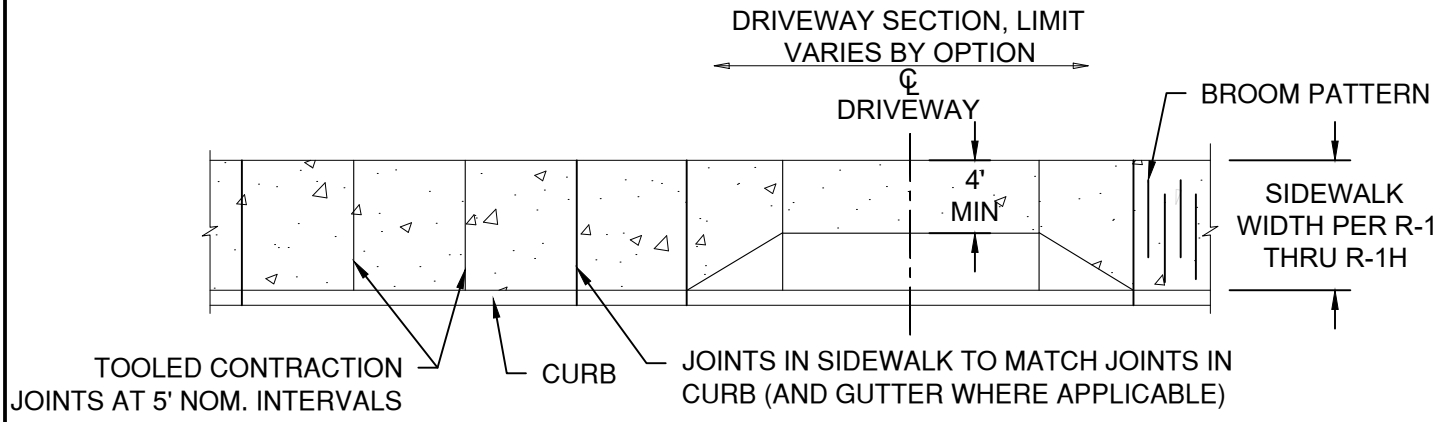
DRAWN CJH DIV ROADWAY REV / DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 SHARED-USE PATH/SIDEWALK, SETBACK	SCALE NTS DATE 04/16/2026 APPR STD DWG R-4A





*PROVIDE COMPACTED BACKFILL
ADJACENT TO CURB AND SIDEWALK

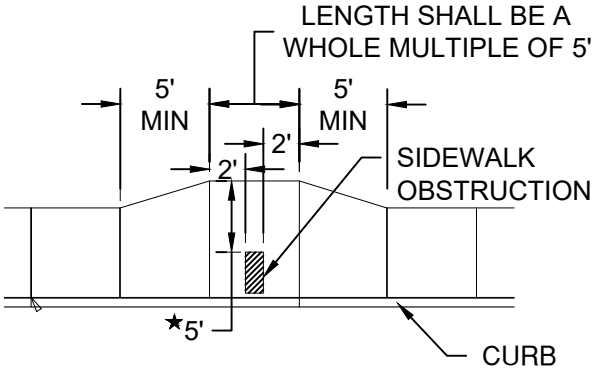
TYPICAL CROSS SECTION



TYPICAL PLAN VIEW

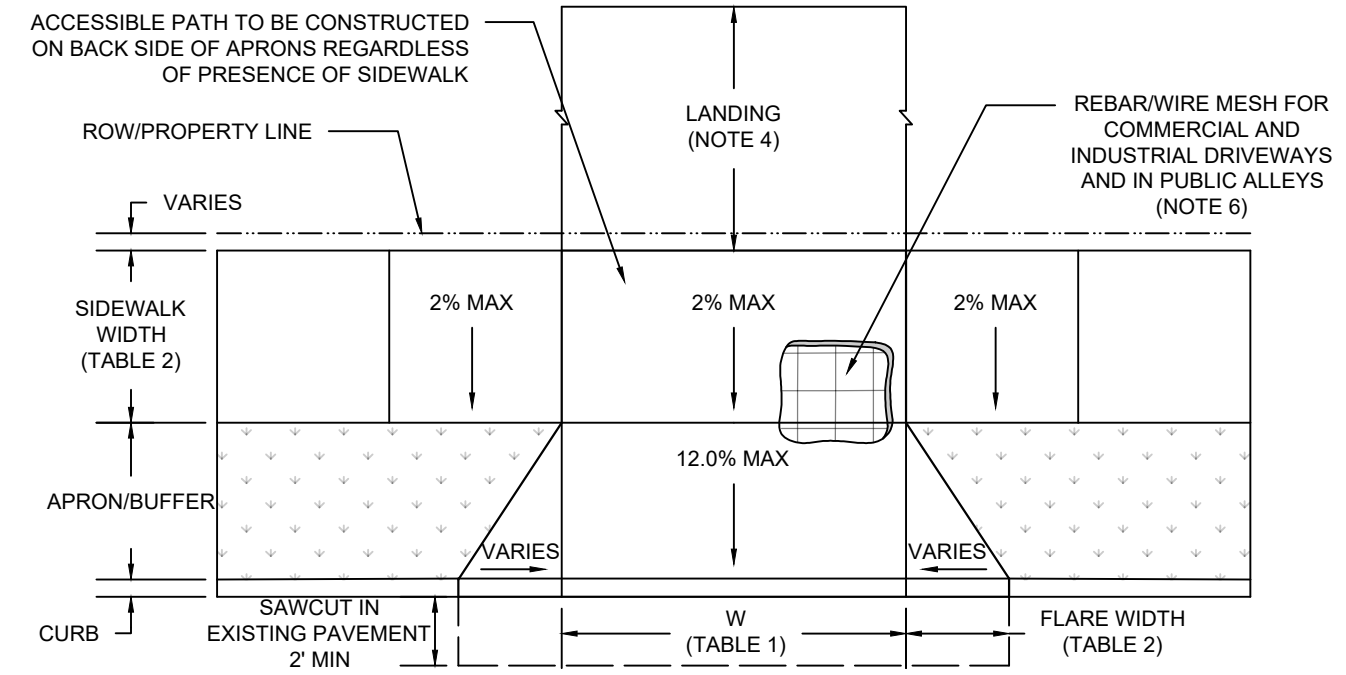
NOTES:

1. SIDEWALKS SET BACK ADJACENT TO PROPERTY LINE ARE STANDARD. USE CURB-TIGHT SIDEWALKS ONLY WHERE PERMITTED.
2. CONST. EXPANSION JOINTS AT 25' MAXIMUM SPACING, AND AT POINTS OF TANGENCY, AND ON EACH SIDE OF DRIVEWAY APRONS. EXPANSION JOINTS MUST BE FULL DEPTH OF PAVING SECTION.
3. CONST. CONTRACTION JOINTS AT 5' MAXIMUM SPACING, AND AT ENDS OF EACH RAMP.
4. FOR DRIVEWAY DETAILS, SEE STD. DRGS. R-5A THROUGH R-5E.
5. SIDEWALK THICKNESS MINIMUM 4" THICK, TYPICAL. MINIMUM 6" THICK IF SIDEWALK IS PORTION OF DRIVEWAY, CURB RAMP, OR ADJACENT TO MOUNTABLE CURB.
6. ASPHALT SHARED-USE PATH WHERE APPROVED BY THE ENGINEER.
7. SIDEWALK BASE WILL BE VISUALLY INSPECTED FOR COMPACTION. CITY INSPECTOR CAN REQUIRE COMPACTION TESTING WHERE BASE ROCK COMPACTION IS VISUALLY OUT OF CONFORMANCE WITH SPECIFICATIONS 00640 / 00641.



★ WHEN SITE CONSTRAINTS PROHIBIT A 5' PASSAGE, THE ENGINEER MAY DIRECT THIS TO BE REDUCED, BUT NO LESS THAN 4' REQUIRED SIDEWALK WIDENING AROUND OBSTRUCTIONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 04/16/2026
REV / DATE / ROADWAY			APPR
		SHARED-USE PATH/SIDEWALK, CURB-TIGHT	STD DWG R-4B



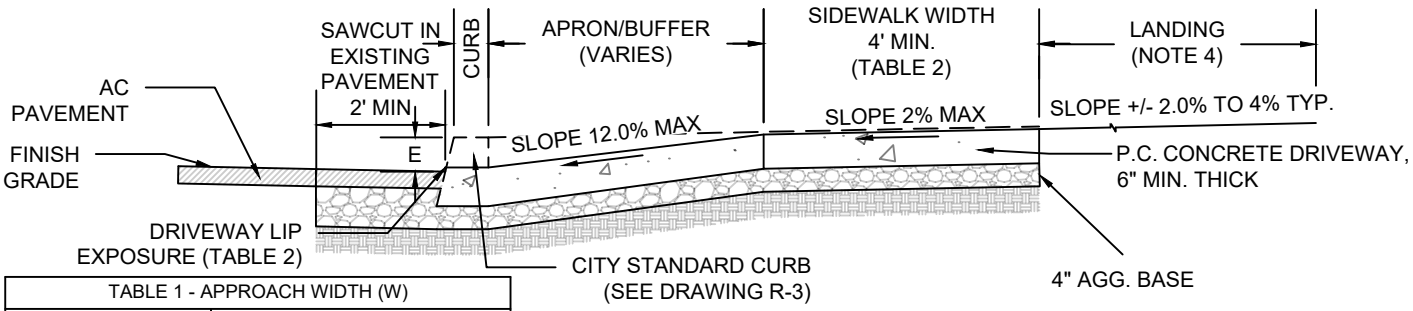


TABLE 1 - APPROACH WIDTH (W)	
TYPE	WIDTH
RESIDENTIAL	10' - 24'
SINGLE FAMILY	10'-24'
TOWNHOME	32' MAX SHARED; 16' MAX LOCAL STREETS
DUPLEX	SUM 32' MAX (2 APRON MAX)
TRIPLEX	SUM 32' MAX (3 APRON MAX)
QUADPLEX	SUM 32' MAX (4 APRON MAX)
MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'

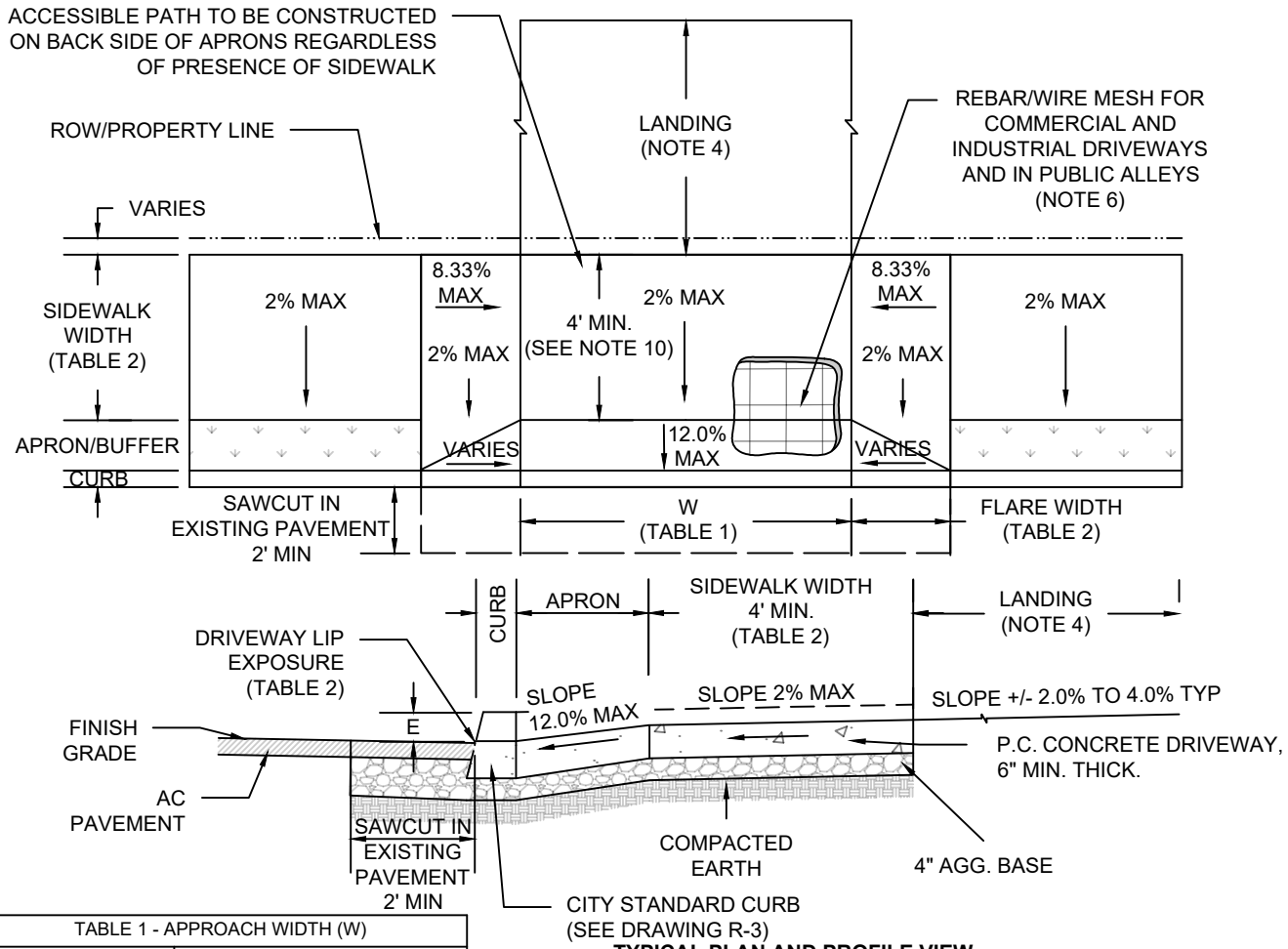
TYPICAL PLAN AND PROFILE VIEW
DRIVEWAY APPROACH, SETBACK SIDEWALK (STANDARD)

TABLE 2 - DRIVEWAY APPROACH WITH SETBACK SIDEWALK SPECIFICATIONS				
TYPE OF STREET	SIDEWALK WIDTH	LIP EXPOSURE	APRON GRADE, POSITIVE GRADE TO ROW	FLARE WIDTH
LOCAL	PER R-1D THRU R-1F	$\frac{3}{4}$"	12.0% MAX	3'
COLLECTOR	PER R-1B & R1-C	1"	12.0% MAX	6'
ARTERIAL	PER R-1A	1"	12.0% MAX	6'

GENERAL NOTES:

1. SIDEWALKS SHALL MEET ALL STANDARDS OF CURRENT PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
2. CURB AND SIDEWALK TYPES VARY, SEE PLANS. SEE STD. DRG. R-3 FOR CURB DETAILS. SEE STD. DRGS. R-4A & R-4B FOR SIDEWALK DETAILS.
3. TOOLED JOINTS ARE REQUIRED AT ALL DRIVEWAY SLOPE BREAK LINES.
4. THE LANDING SHALL BE PAVED WITH CONCRETE OR ASPHALT SURFACE FOR A MINIMUM OF 20 FEET ON ALLEYS. LANDINGS ON PRIVATE LOTS SHALL BE IN ACCORDANCE WITH THE BEND DEVELOPMENT CODE. CONSTRUCT AS DIRECTED OR AS SHOWN ON PLANS. DO NOT ENTER PRIVATE PROPERTY WITHOUT APPROPRIATE PERMIT OR EASEMENT. MATERIAL WITHIN THE ROW SHALL BE CONCRETE.
5. CHECK THE GUTTER FLOW DEPTH AT DRIVEWAY LOCATIONS TO ASSURE THAT THE DESIGN FLOOD DOES NOT OVERTOP THE BACK OF SIDEWALK AT DRIVEWAY. IF OVERTOPPING OCCURS PLACE AN INLET AT UPSTREAM SIDE OF DRIVEWAY OR PERFORM OTHER APPROVED DESIGN MITIGATION.
6. #4 REBAR (2'0" ON CENTER, TO BE SUSPENDED TO CENTER OF CONCRETE DEPTH) REQUIRED IN COMMERCIAL AND INDUSTRIAL DRIVEWAYS AND IN PUBLIC ALLEYS. 6"X6" 10 GAUGE MINIMUM WELDED WIRE MAY BE USED IN LIEU OF REBAR.
7. CONCRETE DRIVEWAY APRON REQUIRED WHERE SIDEWALK AND/OR CURB IS EXISTING/PROPOSED, OTHERWISE AN ASPHALT APPROACH CAN BE INSTALLED TO EDGE OF PAVEMENT TO SIMILAR WIDTHS OF THE DRIVEWAY APRON AS APPROVED BY THE CITY ENGINEER.
8. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.
9. THIS SAME STANDARD APPLIES TO ALLEYS
10. NO PAVERS OR HEATED SIDEWALKS/APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.

DRAWN AJD	CITY OF BEND	SCALE NTS	
DIV ROADWAY	STANDARD DRAWING	DATE 11/01/2024	
REV / DATE	710 NW WALL ST., BEND, OREGON 97701	APPR	
CITY OF BEND	DRIVEWAY APPROACH, SETBACK (STANDARD)	STD DWG R-5A	



TYPICAL PLAN AND PROFILE VIEW
DRIVEWAY APPROACH, SETBACK, PARTIALLY LOWERED
(ALTERNATE B)

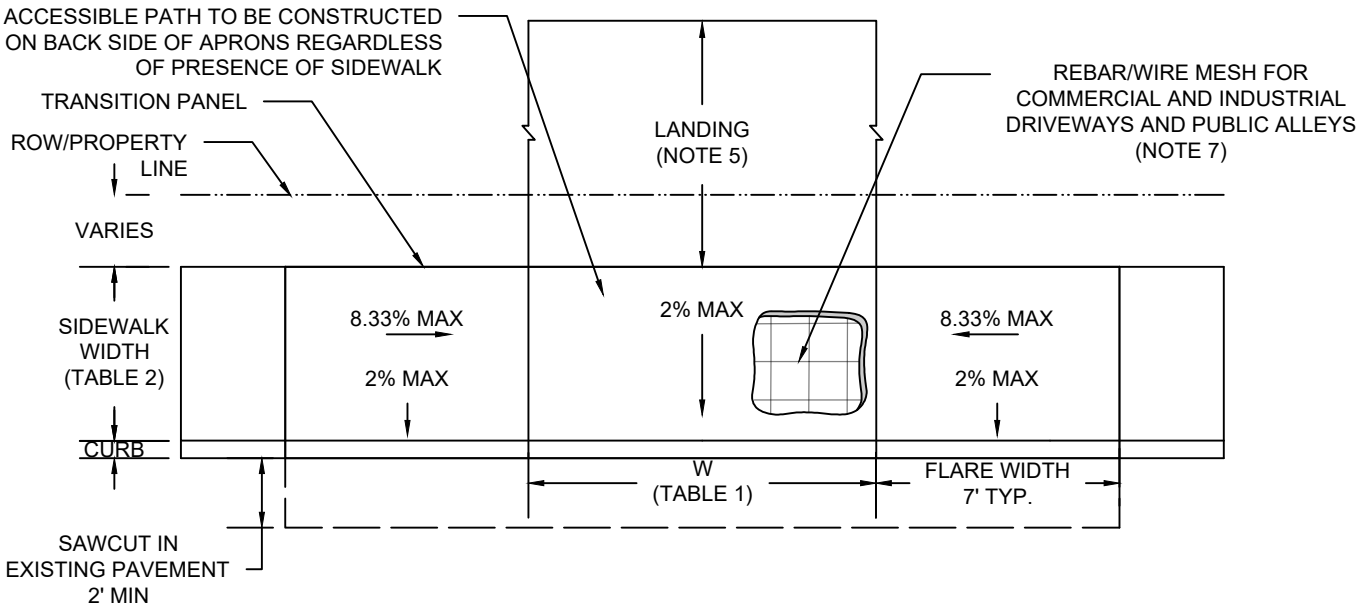
TABLE 1 - APPROACH WIDTH (W)	
TYPE	WIDTH
RESIDENTIAL	10' - 24'
SINGLE FAMILY	10'-24'
TOWNHOME	32' MAX SHARED; 16' MAX LOCAL STREETS
DUPLEX	SUM 32' MAX (2 APRON MAX)
TRIPLEX	SUM 32' MAX (3 APRON MAX)
QUADPLEX	SUM 32' MAX (4 APRON MAX)
MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'

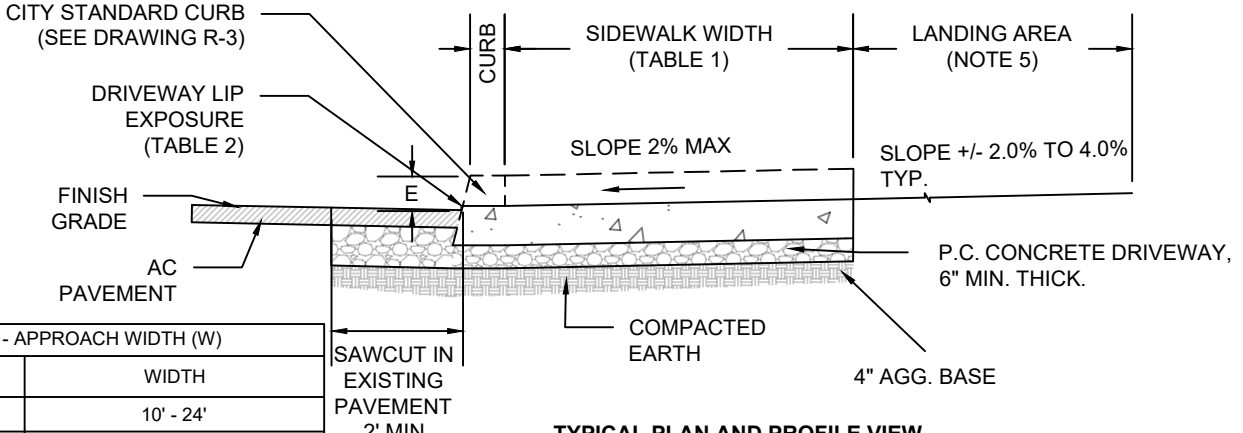
TABLE 2 - DRIVEWAY APPROACH WITH SETBACK SIDEWALK SPECIFICATIONS				
TYPE OF STREET	SIDEWALK WIDTH	LIP EXPOSURE	APRON GRADE, POSITIVE GRADE TO ROW	FLARE WIDTH
LOCAL	PER R-1D THRU R-1F	$\frac{3}{4}$"	12.0% MAX	3'
COLLECTOR	PER R-1B & R1-C	1"	12.0% MAX	6'
ARTERIAL	PER R-1A	1"	12.0% MAX	6'

GENERAL NOTES:

1. SIDEWALKS SHALL MEET ALL STANDARDS OF CURRENT PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
2. CURB AND SIDEWALK TYPES VARY, SEE PLANS. SEE STD. DRG. R-3 FOR CURB DETAILS. SEE STD. DRGS. R-4A & R-4B FOR SIDEWALK DETAILS.
3. TOOLED JOINTS ARE REQUIRED AT ALL DRIVEWAY SLOPE BREAK LINES.
4. THE LANDING SHALL BE PAVED WITH CONCRETE OR ASPHALT SURFACE FOR A MINIMUM OF 20 FEET ON ALLEYS. LANDINGS ON PRIVATE LOTS SHALL BE IN ACCORDANCE WITH THE BEND DEVELOPMENT CODE. CONSTRUCT AS DIRECTED OR AS SHOWN ON PLANS. DO NOT ENTER PRIVATE PROPERTY WITHOUT APPROPRIATE PERMIT OR EASEMENT. MATERIAL WITHIN THE ROW SHALL BE CONCRETE.
5. CHECK THE GUTTER FLOW DEPTH AT DRIVEWAY LOCATIONS TO ASSURE THAT THE DESIGN FLOOD DOES NOT OVERTOP THE BACK OF SIDEWALK AT DRIVEWAY. IF OVERTOPPING OCCURS PLACE AN INLET AT UPSTREAM SIDE OF DRIVEWAY OR PERFORM OTHER APPROVED DESIGN MITIGATION.
6. #4 REBAR (2'0" ON CENTER, TO BE SUSPENDED TO CENTER OF CONCRETE DEPTH) REQUIRED IN COMMERCIAL AND INDUSTRIAL DRIVEWAYS AND IN PUBLIC ALLEYS. 6"X6" 10 GAUGE MINIMUM WELDED WIRE MAY BE USED IN LIEU OF REBAR.
7. CONCRETE DRIVEWAY APRON REQUIRED WHERE SIDEWALK AND/OR CURB IS EXISTING/PROPOSED, OTHERWISE AN ASPHALT APPROACH CAN BE INSTALLED TO EDGE OF PAVEMENT TO SIMILAR WIDTHS OF THE DRIVEWAY APRON AS APPROVED BY THE CITY ENGINEER.
8. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.
9. THIS SAME STANDARD APPLIES TO ALLEYS
10. WHERE ON A LOW STRESS ROUTE, THE SIDEWALK/PATH WIDTH THROUGH THE DRIVEWAY APRON MUST BE MAINTAINED.
11. NO PAVERS OR HEATED SIDEWALKS/APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		DRIVEWAY APPROACH, SETBACK, PARTIALLY LOWERED (ALTERNATE B)	STD DWG R-5B





TYPICAL PLAN AND PROFILE VIEW
DRIVEWAY APPROACH, CURB-TIGHT, FULLY LOWERED (ALTERNATE C)

TABLE 1 - APPROACH WIDTH (W)	
TYPE	WIDTH
RESIDENTIAL	10' - 24'
SINGLE FAMILY	10'-24'
TOWNHOME	32' MAX SHARED; 16' MAX LOCAL STREETS
DUPLEX	SUM 32' MAX (2 APRON MAX)
TRIPLEX	SUM 32' MAX (3 APRON MAX)
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MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'

TABLE 2 - DRIVEWAY APPROACH WITH SETBACK SIDEWALK SPECIFICATIONS

TYPE OF STREET	SIDEWALK WIDTH	LIP EXPOSURE	APRON GRADE, POSITIVE GRADE TO ROW	FLARE WIDTH
LOCAL	PER R-1D THRU R-1F	$\frac{3}{4}$"	12.0% MAX	3'
COLLECTOR	PER R-1B & R1-C	1"	12.0% MAX	6'
ARTERIAL	PER R-1A	1"	12.0% MAX	6'

GENERAL NOTES:
1. SIDEWALKS SHALL MEET ALL STANDARDS OF CURRENT PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
2. CURB AND SIDEWALK TYPES VARY, SEE PLANS. SEE STD. DRG. R-3 FOR CURB DETAILS. SEE STD. DRGS. R-4A & R-4B FOR SIDEWALK DETAILS.
3. TOOLED JOINTS ARE REQUIRED AT ALL DRIVEWAY SLOPE BREAK LINES.
4. THE LANDING SHALL BE PAVED WITH CONCRETE OR ASPHALT SURFACE FOR A MINIMUM OF 20 FEET ON ALLEYS. LANDINGS ON PRIVATE LOTS SHALL BE IN ACCORDANCE WITH THE BEND DEVELOPMENT CODE. CONSTRUCT AS DIRECTED OR AS SHOWN ON PLANS. DO NOT ENTER PRIVATE PROPERTY WITHOUT APPROPRIATE PERMIT OR EASEMENT. MATERIAL WITHIN THE ROW SHALL BE CONCRETE.
5. CHECK THE GUTTER FLOW DEPTH AT DRIVEWAY LOCATIONS TO ASSURE THAT THE DESIGN FLOOD DOES NOT OVERTOP THE BACK OF SIDEWALK AT DRIVEWAY. IF OVERTOPPING OCCURS PLACE AN INLET AT UPSTREAM SIDE OF DRIVEWAY OR PERFORM OTHER APPROVED DESIGN MITIGATION.
6. #4 REBAR (2'0" ON CENTER, TO BE SUSPENDED TO CENTER OF CONCRETE DEPTH) REQUIRED IN COMMERCIAL AND INDUSTRIAL DRIVEWAYS AND IN PUBLIC ALLEYS. 6"X6" 10 GAUGE MINIMUM WELDED WIRE MAY BE USED IN LIEU OF REBAR.
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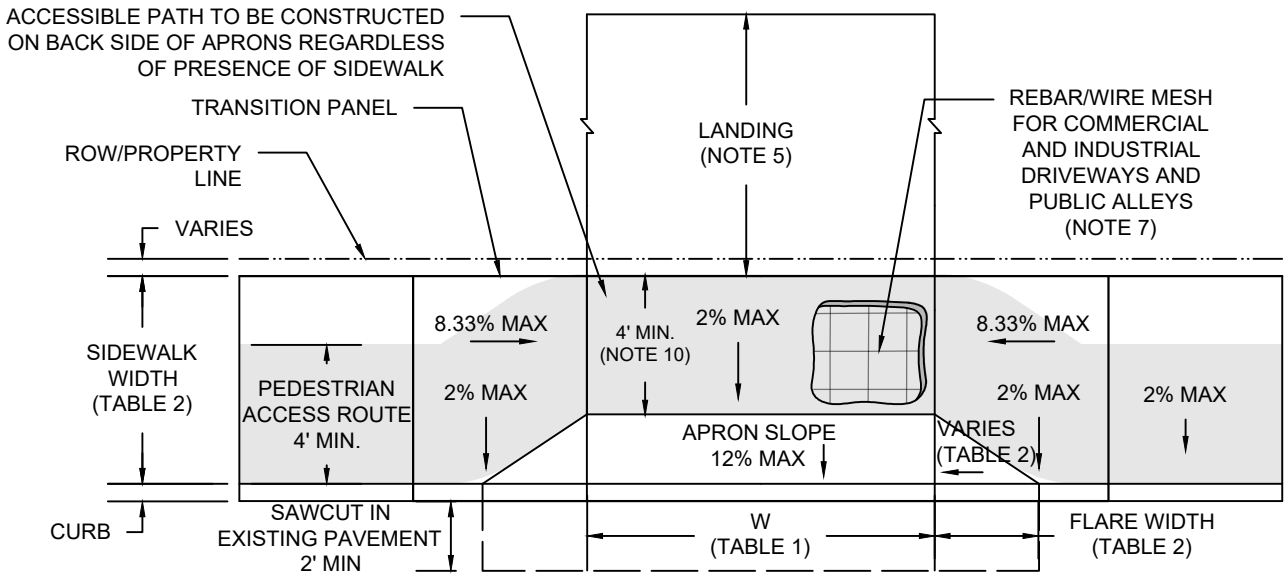
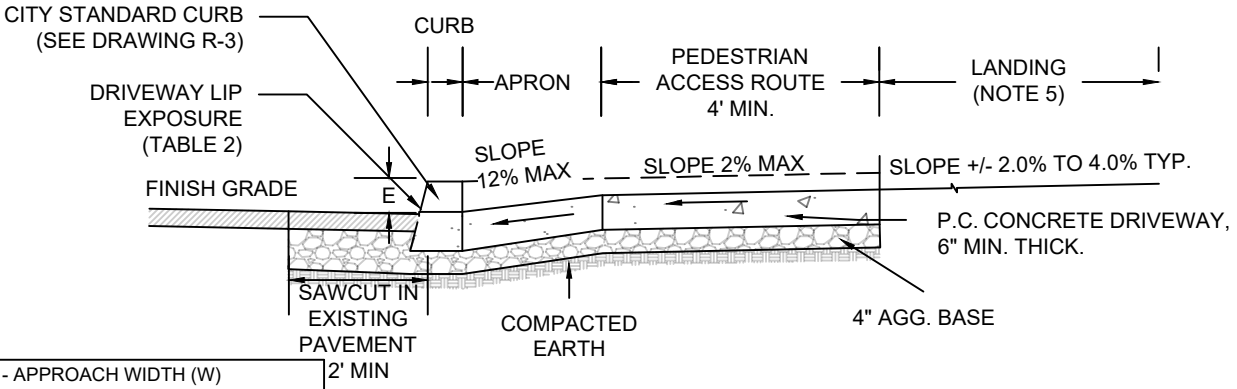
8. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.
9. THIS SAME STANDARD APPLIES TO ALLEYS
10. NO PAVERS OR HEATED SIDEWALKS/APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.

DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 11/01/2024
REV / DATE			APPR
		DRIVEWAY APPROACH, CURB-TIGHT, FULLY LOWERED (ALTERNATE C)	STD DWG R-5C





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MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'

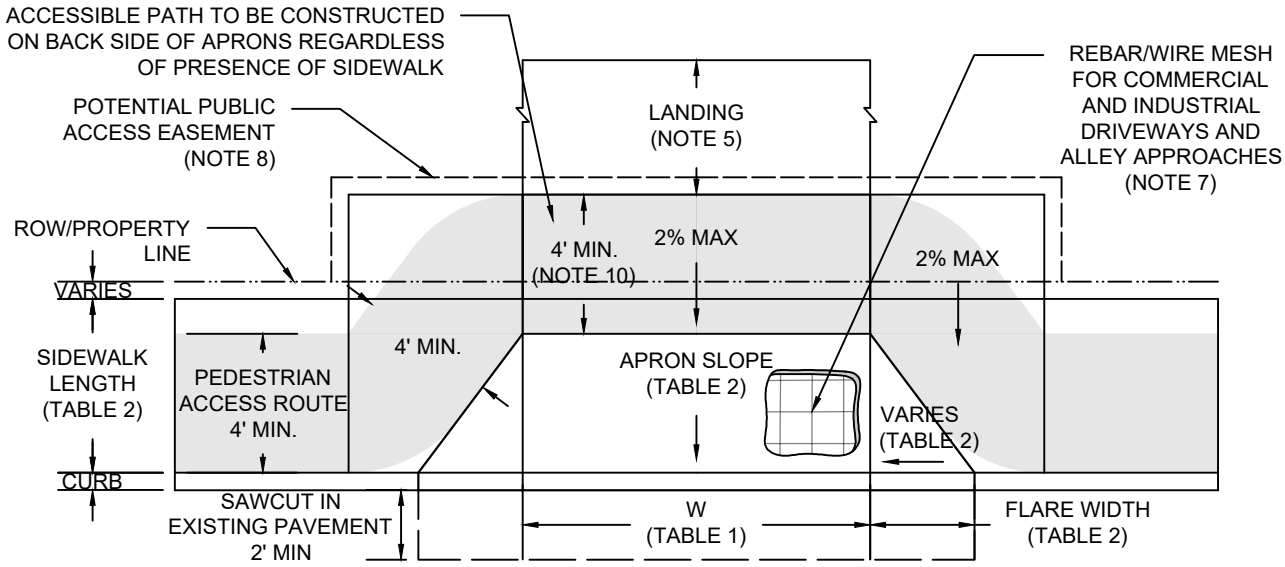
TYPICAL PLAN AND PROFILE VIEW
DRIVEWAY APPROACH, CURB-TIGHT, PARTIALLY LOWERED (ALTERNATE D)

TABLE 2 - DRIVEWAY APPROACH WITH SETBACK SIDEWALK SPECIFICATIONS				
TYPE OF STREET	SIDEWALK WIDTH	LIP EXPOSURE	APRON GRADE, POSITIVE GRADE TO ROW	FLARE WIDTH
LOCAL	PER R-1D THRU R-1F	$\frac{3}{4}$"	12.0% MAX	3'
COLLECTOR	PER R-1B & R1-C	1"	12.0% MAX	6'
ARTERIAL	PER R-1A	1"	12.0% MAX	6'

GENERAL NOTES:

1. SIDEWALKS SHALL MEET ALL STANDARDS OF CURRENT PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
2. CURB AND SIDEWALK TYPES VARY, SEE PLANS. SEE STD. DRG. R-3 FOR CURB DETAILS. SEE STD. DRGS. R-4A & R-4B FOR SIDEWALK DETAILS.
3. TOOLED JOINTS ARE REQUIRED AT ALL DRIVEWAY SLOPE BREAK LINES.
4. THE LANDING SHALL BE PAVED WITH CONCRETE OR ASPHALT SURFACE FOR A MINIMUM OF 20 FEET ON ALLEYS. LANDINGS ON PRIVATE LOTS SHALL BE IN ACCORDANCE WITH THE BEND DEVELOPMENT CODE. CONSTRUCT AS DIRECTED OR AS SHOWN ON PLANS. DO NOT ENTER PRIVATE PROPERTY WITHOUT APPROPRIATE PERMIT OR EASEMENT. MATERIAL WITHIN THE ROW SHALL BE CONCRETE.
5. CHECK THE GUTTER FLOW DEPTH AT DRIVEWAY LOCATIONS TO ASSURE THAT THE DESIGN FLOOD DOES NOT OVERTOP THE BACK OF SIDEWALK AT DRIVEWAY. IF OVERTOPPING OCCURS PLACE AN INLET AT UPSTREAM SIDE OF DRIVEWAY OR PERFORM OTHER APPROVED DESIGN MITIGATION.
6. #4 REBAR (2'0" ON CENTER, TO BE SUSPENDED TO CENTER OF CONCRETE DEPTH) REQUIRED IN COMMERCIAL AND INDUSTRIAL DRIVEWAYS AND IN PUBLIC ALLEYS. 6"X6" 10 GAUGE MINIMUM WELDED WIRE MAY BE USED IN LIEU OF REBAR.
7. CONCRETE DRIVEWAY APRON REQUIRED WHERE SIDEWALK AND/OR CURB IS EXISTING/PROPOSED, OTHERWISE AN ASPHALT APPROACH CAN BE INSTALLED TO EDGE OF PAVEMENT TO SIMILAR WIDTHS OF THE DRIVEWAY APRON AS APPROVED BY THE CITY ENGINEER.
8. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.
9. THIS SAME STANDARD APPLIES TO ALLEYS
10. WHERE ON A LOW STRESS ROUTE, THE SIDEWALK/PATH WIDTH THROUGH THE DRIVEWAY APRON MUST BE MAINTAINED.
11. NO PAVERS OR HEATED SIDEWALKS/APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.

DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 11/01/2024
REV / DATE			APPR
		DRIVEWAY APPROACH, CURB-TIGHT, PARTIALLY LOWERED (ALTERNATE D)	STD DWG R-5D



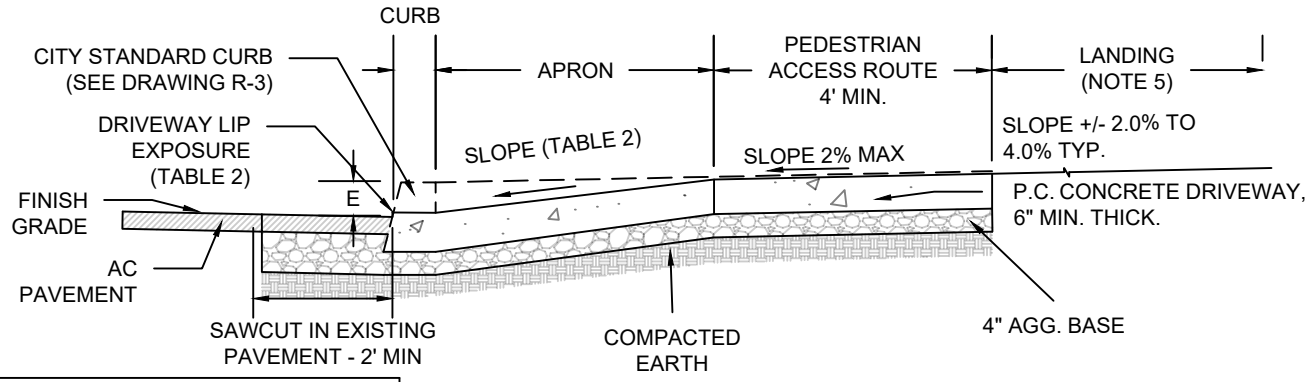


TABLE 1 - APPROACH WIDTH (W)	
TYPE	WIDTH
RESIDENTIAL	10' - 24'
SINGLE FAMILY	10'-24'
TOWNHOME	32' MAX SHARED; 16' MAX LOCAL STREETS
DUPLEX	SUM 32' MAX (2 APRON MAX)
TRIPLEX	SUM 32' MAX (3 APRON MAX)
QUADPLEX	SUM 32' MAX (4 APRON MAX)
MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'

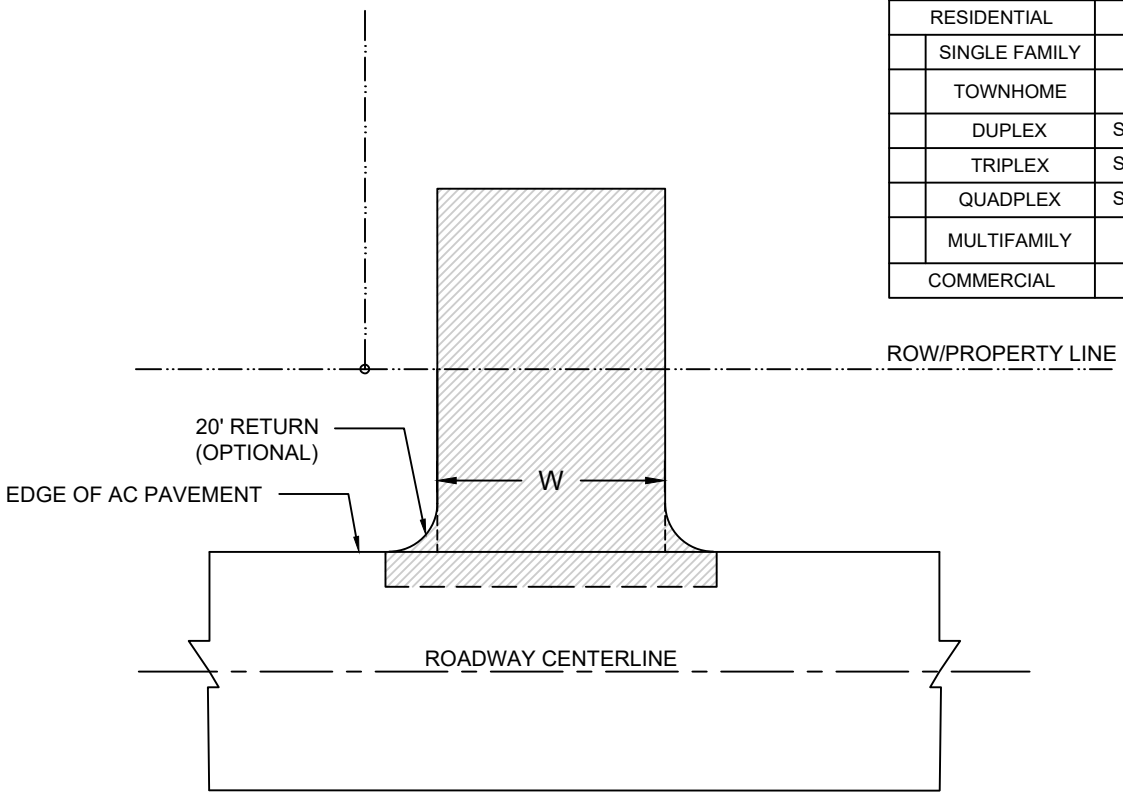
TYPICAL PLAN VIEW
DRIVEWAY APPROACH, CURB-TIGHT, WRAPPING SIDEWALK
(ALTERNATE E)

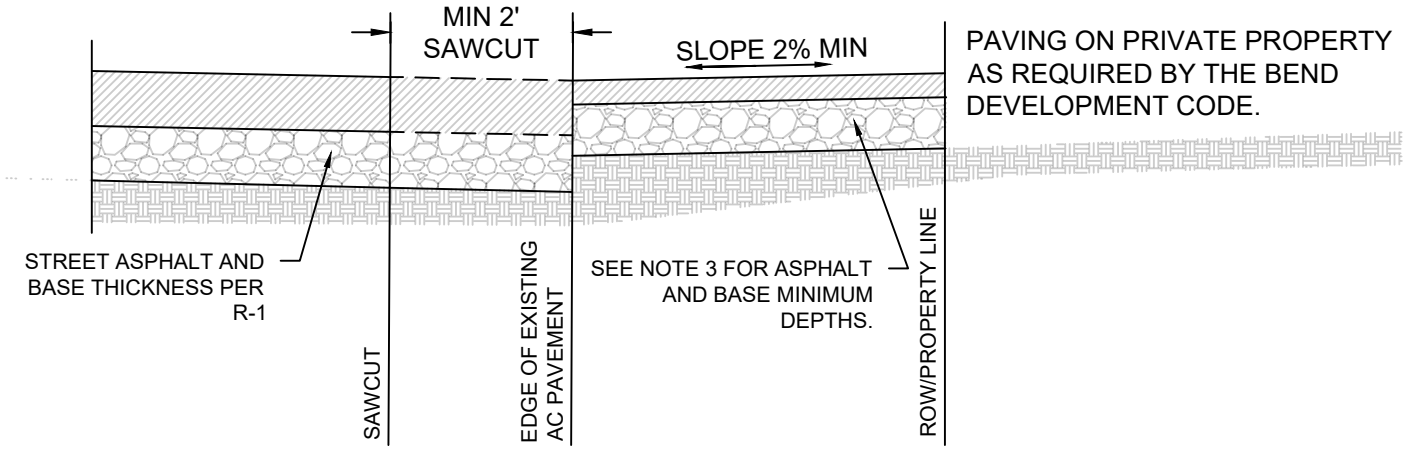
TABLE 2 - DRIVEWAY APPROACH SPECIFICATIONS WITH CURB-TIGHT WRAPPING SIDEWALK				
TYPE OF STREET	MINIMUM SIDEWALK WIDTH	LIP EXPOSURE	APRON GRADE, POSITIVE GRADE TO ROW	FLARE WIDTH
LOCAL	PER R-1D THRU R-1F	$\frac{3}{4}$"	12.0% MAX	3'
COLLECTOR	PER R-1B & R1-C	1"	12.5% MAX	6'
ARTERIAL	PER R-1A	1"	12.5% MAX	6'

GENERAL NOTES:
1. SIDEWALKS SHALL MEET ALL STANDARDS OF CURRENT PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
2. CURB AND SIDEWALK TYPES VARY, SEE PLANS. SEE STD. DRG. R-3 FOR CURB DETAILS. SEE STD. DRGS. R-4A & R-4B FOR SIDEWALK DETAILS.
3. TOOLED JOINTS ARE REQUIRED AT ALL DRIVEWAY SLOPE BREAK LINES.
4. THE LANDING SHALL BE PAVED WITH CONCRETE OR ASPHALT SURFACE FOR A MINIMUM OF 20 FEET ON ALLEYS. LANDINGS ON PRIVATE LOTS SHALL BE IN ACCORDANCE WITH THE BEND DEVELOPMENT CODE. CONSTRUCT AS DIRECTED OR AS SHOWN ON PLANS. DO NOT ENTER PRIVATE PROPERTY WITHOUT APPROPRIATE PERMIT OR EASEMENT. MATERIAL WITHIN THE ROW SHALL BE CONCRETE.
5. CHECK THE GUTTER FLOW DEPTH AT DRIVEWAY LOCATIONS TO ASSURE THAT THE DESIGN FLOOD DOES NOT OVERTOP THE BACK OF SIDEWALK AT DRIVEWAY. IF OVERTOPPING OCCURS PLACE AN INLET AT UPSTREAM SIDE OF DRIVEWAY OR PERFORM OTHER APPROVED DESIGN MITIGATION.
6. #4 REBAR (2'0" ON CENTER, TO BE SUSPENDED TO CENTER OF CONCRETE DEPTH) REQUIRED IN COMMERCIAL AND INDUSTRIAL DRIVEWAYS AND IN PUBLIC ALLEYS. 6"X6" 10 GAUGE MINIMUM WELDED WIRE MAY BE USED IN LIEU OF REBAR.
7. CONCRETE DRIVEWAY APRON REQUIRED WHERE SIDEWALK AND/OR CURB IS EXISTING/PROPOSED, OTHERWISE AN ASPHALT APPROACH CAN BE INSTALLED TO EDGE OF PAVEMENT TO SIMILAR WIDTHS OF THE DRIVEWAY APRON AS APPROVED BY THE CITY ENGINEER.
8. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.
9. THIS SAME STANDARD APPLIES TO ALLEYS
10. WHERE ON A LOW STRESS ROUTE, THE SIDEWALK/PATH WIDTH THROUGH THE DRIVEWAY APRON MUST BE MAINTAINED.
11. NO PAVERS OR HEATED SIDEWALKS/APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.

DRAWN CJH	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 11/01/2024
REV / DATE			APPR
		DRIVEWAY APPROACH, CURB-TIGHT, WRAPPING SIDEWALK (ALTERNATE E)	STD DWG R-5E

TABLE 1 - APPROACH WIDTH (W) - REFER TO NOTE 4	
TYPE	WIDTH
RESIDENTIAL	10' - 24'
SINGLE FAMILY	10'-24'
TOWNHOME	32' MAX SHARED; 16' MAX LOCAL STREETS
DUPLEX	SUM 32' MAX (2 APRON MAX)
TRIPLEX	SUM 32' MAX (3 APRON MAX)
QUADPLEX	SUM 32' MAX (4 APRON MAX)
MULTIFAMILY	20' - 30'
COMMERCIAL	10' - 35'





GENERAL NOTES:
1. CONCRETE DRIVEWAY APRONS REQUIRED WHERE SIDEWALK AND/OR CURB IS EXISTING OR PROPOSED, OTHERWISE AN ASPHALT APPROACH CAN BE INSTALLED TO EDGE OF PAVEMENT TO SIMILAR WIDTHS OF THE DRIVEWAY APRON AS APPROVED BY THE CITY ENGINEER.
2. NO PAVERS OR HEATED APRONS ARE PERMITTED WITHIN THE RIGHT OF WAY.
3. COMMERCIAL OR INDUSTRIAL USE MUST BE CONSTRUCTED TO A MINIMUM 4" ASPHALT OVER MINIMUM 6" BASE ROCK. RESIDENTIAL LOTS MUST HAVE NOT LESS THAN 2" ASPHALT OVER 4" BASED ROCK.
4. REFER TO THE BEND DEVELOPMENT CODE 3.1.400 AND 3.6.200 FOR NUMBER AND WIDTH OF APRONS PERMITTED PER LOT.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		DRIVEWAY APPROACH, ASPHALT	STD DWG R-5F

GENERAL NOTES :

1. CITY OF BEND STD DWGS R-6, R-6A, R-6B, AND R-6C ARE INTENDED AS A SUMMARY OF PROWAG REQUIREMENTS. SEE CURRENT PROWAG GUIDELINES FOR COMPLETE REQUIREMENTS.
2. SLOPES USED FOR DESIGN ARE TYPICALLY LESS THAN THE MAXIMUMS TO ALLOW FOR CONSTRUCTION TOLERANCES. RECOMMENDED DESIGN SLOPES ARE AS FOLLOWS:

PROWAG MAX. SLOPE	DESIGN MAX. SLOPE
1:10 (10%)	9.5%
1:12 (8.33%)	7.5%
1:20 (5.0%)	4.5%
1:50 (2%)	1.5%

3. GRADE BREAKS ARE NOT PERMITTED ON THE SURFACE OF CURB RAMPS, BLENDED TRANSITIONS, LANDINGS, AND GUTTER AREAS WITHIN THE PEDESTRIAN ACCESS ROUTE.
4. THE COUNTER SLOPE OF THE GUTTER OR STREET AT THE FOOT OF A CURB RAMP, LANDING, OR BLENDED TRANSITION SHALL BE 5% MAXIMUM.
5. SURFACES OF CURB RAMPS, BLENDED TRANSITIONS, AND LANDINGS SHALL COMPLY WITH R302.7. GRATINGS, ACCESS COVERS, AND OTHER APPURTENANCES SHALL NOT BE LOCATED ON CURB RAMPS, LANDINGS, BLENDED TRANSITIONS AND GUTTERS WITHIN THE PEDESTRIAN ACCESS ROUTE.
6. SURFACE DISCONTINUITIES SHALL NOT EXCEED 0.5 in. MAXIMUM. VERTICAL DISCONTINUITIES BETWEEN 0.25 in. AND 0.5 in. MAXIMUM SHALL BE BEVELED AT 1:2 MINIMUM. THE BEVEL SHALL BE APPLIED ACROSS THE ENTIRE LEVEL CHANGE. SEE PROWAG R302.7.2.
7. WHERE SIDEWALKS ARE CONSTRUCTED OUTSIDE THE RIGHT OF WAY, A PUBLIC ACCESS EASEMENT MUST BE RECORDED OVER THE PRIVATE PROPERTY ENCROACHMENT.
8. 6 INCHES OF COMMERCIAL GRADE CONCRETE PER CITY SPEC 00440 AND 4 INCHES OF STATE SPEC AGGREGATE PER CITY SPEC 00640/00641 IS REQUIRED FOR CONSTRUCTION OF CURB RAMPS, FLARES, AND LANDINGS.
9. DETECTABLE WARNING SURFACES COMPLYING WITH PROWAG R305 SHALL BE PROVIDED, WHERE A CURB RAMP, LANDING, OR BLENDED TRANSITION CONNECTS TO A STREET.
10. DETECTABLE WARNING SURFACES SHALL EXTEND 24 in. MINIMUM IN THE DIRECTION OF TRAVEL AND THE FULL WIDTH OF THE CURB RAMP (EXCLUSIVE OF FLARES), THE LANDING, OR THE BLENDED TRANSITION.
11. THE ROWS OF TRUNCATED DOMES IN A DETECTABLE WARNING SURFACE SHALL BE ALIGNED TO BE PERPENDICULAR OR RADIAL TO THE GRADE BREAK BETWEEN THE RAMP, LANDING, OR BLENDED TRANSITION AND THE STREET.
12. THE CLEAR WIDTH OF LANDINGS BLENDED TRANSITIONS, AND CURB RAMPS, EXCLUDING FLARES, SHALL BE 4.0 FT. MINIMUM.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CURB RAMP GENERAL NOTES	STD DWG R-6

CURB EXPOSURE TO BE MINIMUM 3-INCHES (6-INCH PREFERRED) BETWEEN RAMPS UNLESS OTHERWISE APPROVED.

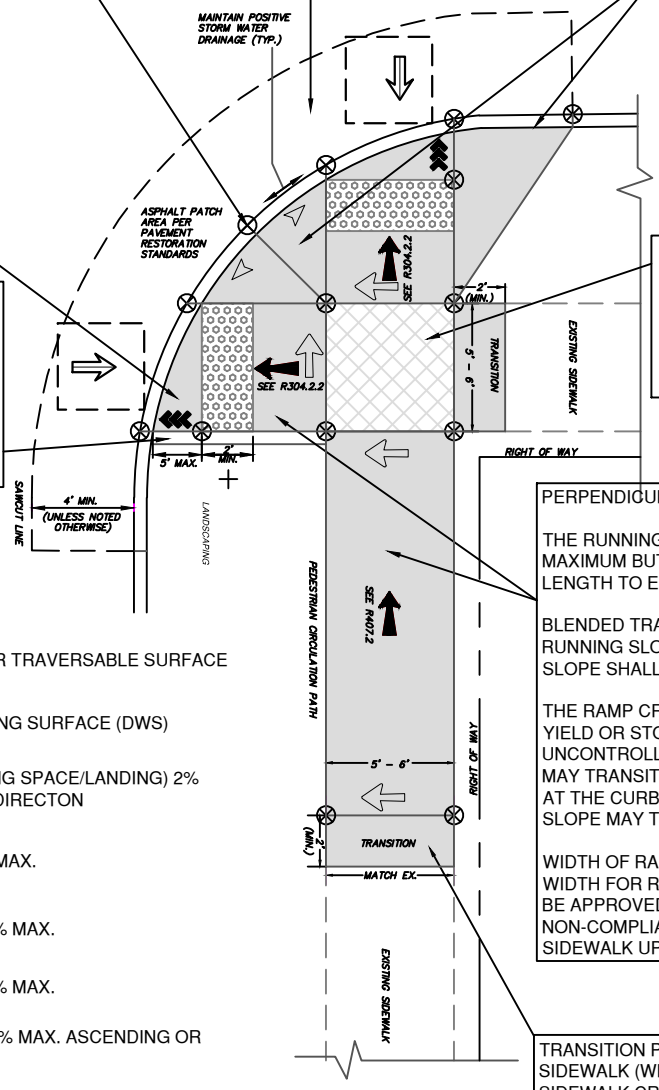
ONE CORNER OF THE DETECTABLE WARNING MUST BE WITHIN 2 in. OF THE GRADE BREAK; NO OTHER POINT ON THE LEADING EDGE OF THE DETECTABLE WARNING MAY BE MORE THAN 5 ft. FROM THE BACK OF CURB.

WHERE BOTH ENDS OF THE BOTTOM GRADE BREAK, COMPLYING WITH PROWAG R305.2.1, ARE 5.0 ft. OR LESS FROM THE BACK OF CURB, THE DETECTABLE WARNING SHALL BE LOCATED ON THE RAMP SURFACE AT THE BOTTOM GRADE BREAK. WHERE EITHER END OF THE BOTTOM GRADE BREAK IS MORE THAN 5.0 ft. FROM THE BACK OF CURB, THE DETECTABLE WARNING SHALL BE LOCATED ON THE LOWER LANDING.

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED PARALLEL TO THE CURB LINE, SHALL BE PROVIDED WHERE A PEDESTRIAN CIRCULATION PATH CROSSES THE CURB RAMP OR WHEN THE FLARE ABUTS A HARD SURFACE.

FLARES REQUIRED UNLESS BARRIERS EXIST OR WHERE APPROVED BY THE CITY ENGINEER. FLARE SLOPE CAN EXCEED 10% WHERE ABUTTING MIN 2' LANDSCAPING AREA.

GRADE BREAKS AT THE TOP AND BOTTOM OF PERPENDICULAR CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF RAMP RUN. AT LEAST ONE END OF THE BOTTOM GRADE BREAK SHALL BE AT THE BACK OF CURB. THE GRADE FROM THE BOTTOM OF THE DETECTABLE WARNING TO THE LANDING SHALL BE A CONTINUOUS GRADE (5% MAXIMUM). SURFACE SLOPES THAT MEET THE GRADE BREAKS SHALL BE FLUSH.



FLARED SIDES ARE PREFERRED, PARTICULARLY WHERE SUBJECT TO DAMAGE FROM ONCOMING TRAFFIC AND SNOWPLOWS. IF ADJACENT CONSTRAINTS PREVENT FLARE CONSTRUCTION, SIDE OF RAMPS MAY BE RETURNED IF PROTECTED FROM CROSS TRAVEL BY LANDSCAPING, STREET FURNITURE, POLES, OR EQUIPMENT.

A LANDING 5.0 ft. MINIMUM BY 5.0 ft. MINIMUM SHALL BE PROVIDED AT THE TOP OF THE CURB RAMP AND SHALL BE PERMITTED TO OVERLAP OTHER LANDINGS AND CLEAR SPACE. RUNNING AND CROSS SLOPES AT INTERSECTIONS SHALL BE 2% MAXIMUM.

PERPENDICULAR CURB RAMPS

THE RUNNING SLOPE SHALL BE 5% MINIMUM AND 8.3% MAXIMUM BUT SHALL NOT REQUIRE THE RAMP LENGTH TO EXCEED 15.0 FT.

BLENDED TRANSITIONS SHALL COMPLY WITH R303.3. RUNNING SLOPE SHALL BE 5% MAXIMUM AND CROSS SLOPE SHALL BE 2% MAXIMUM.

THE RAMP CROSS SLOPE SHALL NOT EXCEED 2% AT YIELD OR STOP CONTROLLED INTERSECTIONS. AT UNCONTROLLED INTERSECTIONS, THE CROSS SLOPE MAY TRANSITION FROM 2% AT THE LANDING UP TO 5% AT THE CURB. AT MIDBLOCK CROSSINGS, THE CROSS SLOPE MAY TRANSITION TO MATCH THE ROAD GRADE.

WIDTH OF RAMP TO MATCH SUP/SIDEWALK STANDARD WIDTH FOR ROAD CROSS-SECTION; ALTERNATE MAY BE APPROVED BY CITY ENGINEER IN EXISTING NON-COMPLIANT AREAS WITH NO PLANS FOR SIDEWALK UPGRADES.

TRANSITION PANEL FROM RAMP TO EXISTING SIDEWALK (WHERE REQUIRED TO MATCH EX. SIDEWALK CROSS SLOPE). MAX. GRADES ARE NOT SPECIFIED BY PROWAG. ADJUST LENGTH AS NEEDED TO PROVIDE 0.5% CHANGE PER FT. IF PROPOSED MATCH LINE LOCATION FALLS WITHIN 2 FEET FROM AN EXISTING JOINT IN THE SECTION OF SIDEWALK TO REMAIN, THE EXISTING WALK SHALL BE REMOVED BACK TO THE NEXT JOINT.

SIDEWALK OR OTHER TRAVERSABLE SURFACE

DETECTABLE WARNING SURFACE (DWS)

LEVEL AREA (TURNING SPACE/LANDING) 2% MAX. SLOPE IN ANY DIRECTON

CROSS SLOPE 2.0% MAX.

RUNNING SLOPE 5.0% MAX.

RUNNING SLOPE 8.3% MAX.

COUNTER SLOPE 5.0% MAX. ASCENDING OR DESCENDING

FLARE SLOPE 10% MAX.

4'X4' CLEAR SPACE

REQUIRED DESIGN ELEVATIONS
SLOPES TO BE SHOWN WITH DESIGN

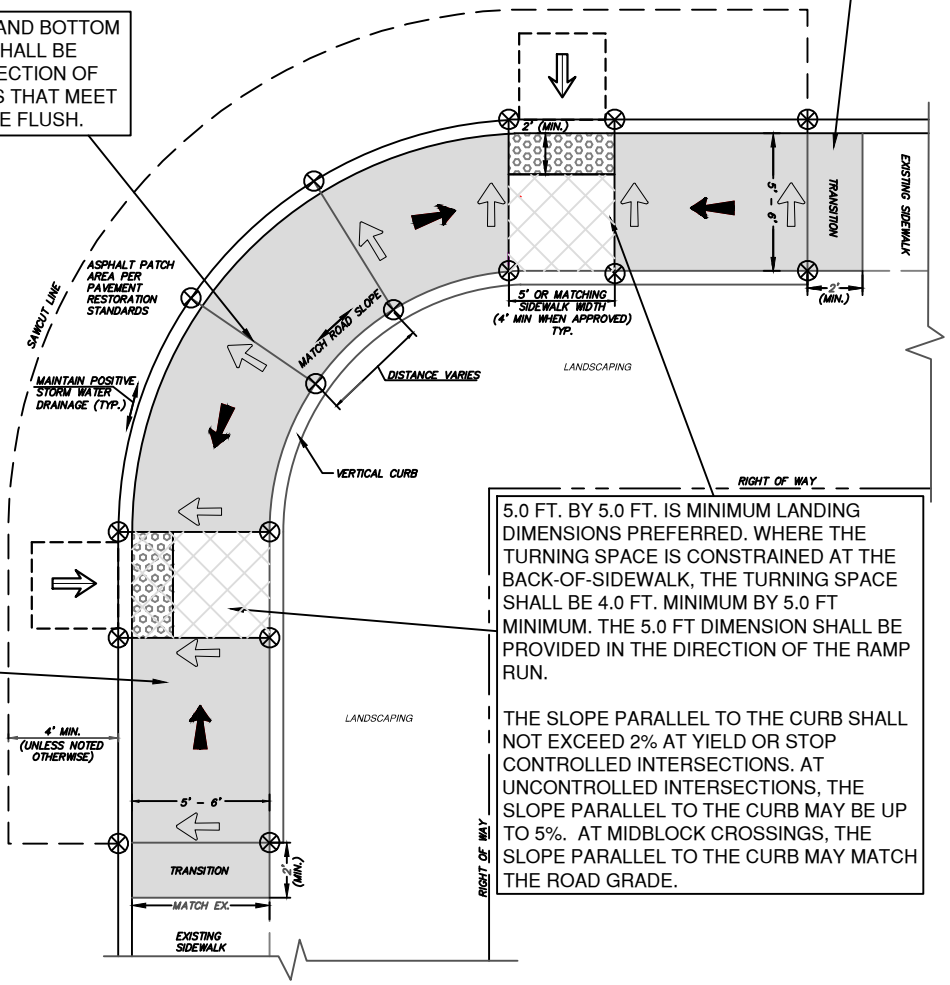
TYPICAL PERPENDICULAR CURB RAMP
ACCORDING TO PROWAG REQUIREMENTS

NOT TO SCALE – ROTATED TO FIT

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL PERPENDICULAR CURB RAMP	STD DWG R-6A

TRANSITION PANEL FROM RAMP TO EXISTING SIDEWALK (WHERE REQUIRED TO MATCH EX. SIDEWALK CROSS SLOPE). MAX. GRADES ARE NOT SPECIFIED BY PROWAG. ADJUST LENGTH AS NEEDED TO PROVIDE SMOOTH TRANSITION. IF PROPOSED MATCH LINE LOCATION FALLS WITHIN 2 FEET FROM AN EXISTING JOINT IN THE SECTION OF SIDEWALK TO REMAIN, THE EXISTING WALK SHALL BE REMOVED BACK TO THE NEXT JOINT.

GRADE BREAKS AT THE TOP AND BOTTOM OF PARALLEL CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF RAMP RUN. SURFACE SLOPES THAT MEET THE GRADE BREAKS SHALL BE FLUSH.



PARALLEL CURB RAMPS

THE RUNNING SLOPE SHALL BE 8.33% MAXIMUM BUT SHALL NOT REQUIRE THE RAMP LENGTH TO EXCEED 15.0 FT.

THE CROSS SLOPE SHALL BE 2% MAXIMUM.

THE CLEAR WIDTH OF LANDINGS BLENDED TRANSITIONS, AND CURB RAMPS, EXCLUDING FLARES, SHALL BE 4.0 ft. MINIMUM.

LANDING WIDTH SHALL MATCH THE ADJACENT SIDEWALK WIDTH, 5.0 FT MIN., UNLESS OTHERWISE APPROVED.

5.0 FT. BY 5.0 FT. IS MINIMUM LANDING DIMENSIONS PREFERRED. WHERE THE TURNING SPACE IS CONSTRAINED AT THE BACK-OF-SIDEWALK, THE TURNING SPACE SHALL BE 4.0 FT. MINIMUM BY 5.0 FT MINIMUM. THE 5.0 FT DIMENSION SHALL BE PROVIDED IN THE DIRECTION OF THE RAMP RUN.

THE SLOPE PARALLEL TO THE CURB SHALL NOT EXCEED 2% AT YIELD OR STOP CONTROLLED INTERSECTIONS. AT UNCONTROLLED INTERSECTIONS, THE SLOPE PARALLEL TO THE CURB MAY BE UP TO 5%. AT MIDBLOCK CROSSINGS, THE SLOPE PARALLEL TO THE CURB MAY MATCH THE ROAD GRADE.

TYPICAL PARALLEL CURB RAMP
ACCORDING TO PROWAG REQUIREMENTS
NOT TO SCALE – ROTATED TO FIT

SIDEWALK OR OTHER TRAVERSABLE SURFACE

DETECTABLE WARNING SURFACE (DWS)

LEVEL AREA (TURNING SPACE/LANDING) 2% MAX. SLOPE IN ANY DIRECTON

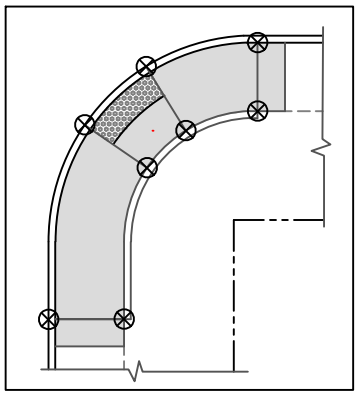
CROSS SLOPE 2.0% MAX.

RUNNING SLOPE 8.3% MAX.

COUNTER SLOPE 5.0% MAX. ASCENDING OR DESCENDING

4'X4' CLEAR SPACE

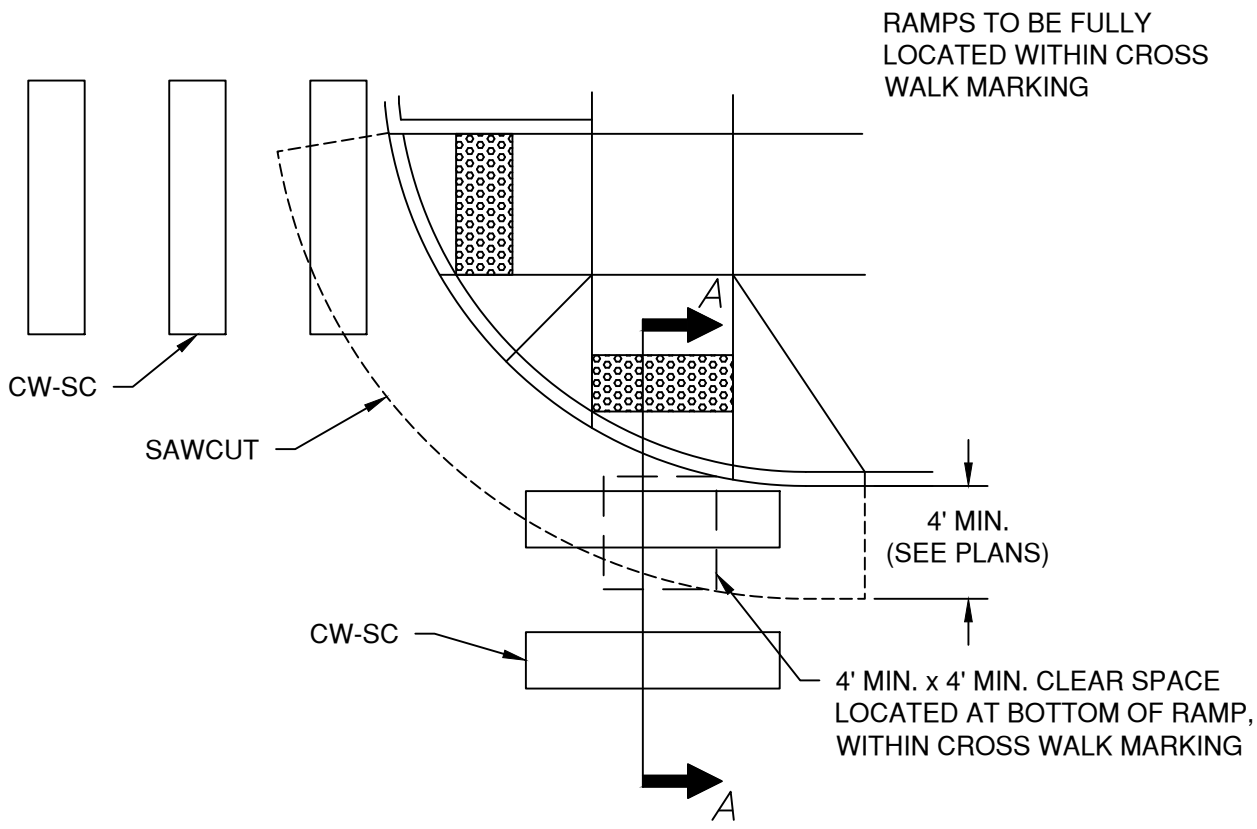
REQUIRED DESIGN ELEVATIONS SLOPES TO BE SHOWN WITH DESIGN



TYPICAL DIAGONAL CURB RAMP
REQUIRES CITY APPROVAL FOR CONSTRUCTION
ACCORDING TO PROWAG REQUIREMENTS
NOT TO SCALE – ROTATED TO FIT

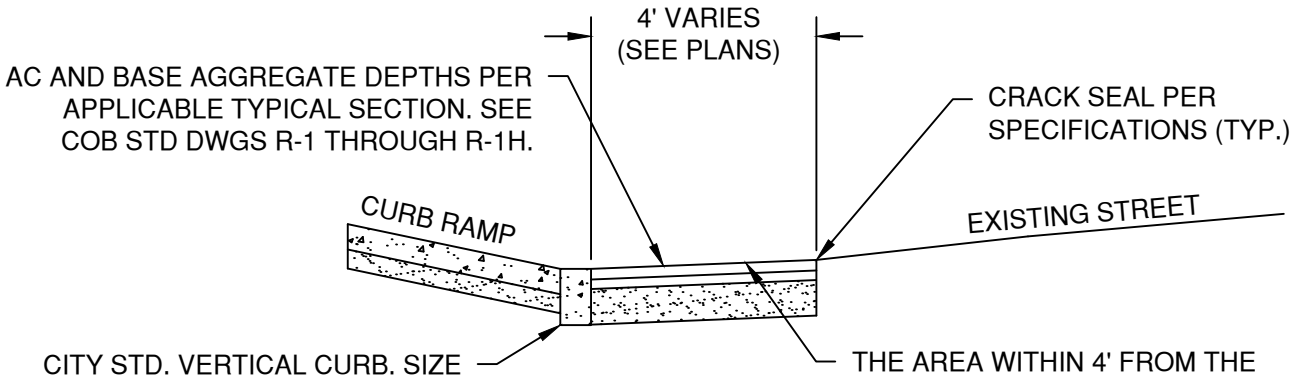
NOTE: DIAGONAL CURB RAMP ALTERNATE IS ONLY ALLOWED WHEN DIRECTIONAL RAMPS ARE NOT POSSIBLE AND MUST BE APPROVED BY THE CITY ENGINEER.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL PARALLEL CURB RAMP	STD DWG R-6B



CROSS WALK - CURB RAMP ORIENTATION

NOT TO SCALE



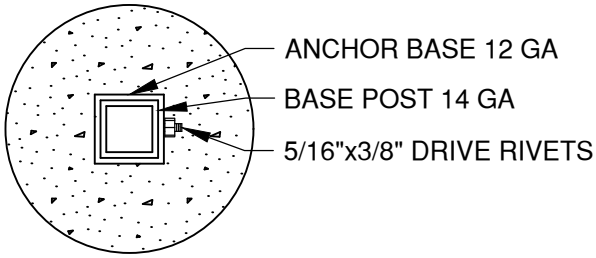
NOTE: IN AREAS WITH UNIT PAVER CROSS WALKS, REMOVE EXISTING PAVERS, AND RE-INSTALL AT GRADES TO ACHIEVE THESE REQUIREMENTS.

TYPICAL RAMP / ASPHALT PATCH SECTION

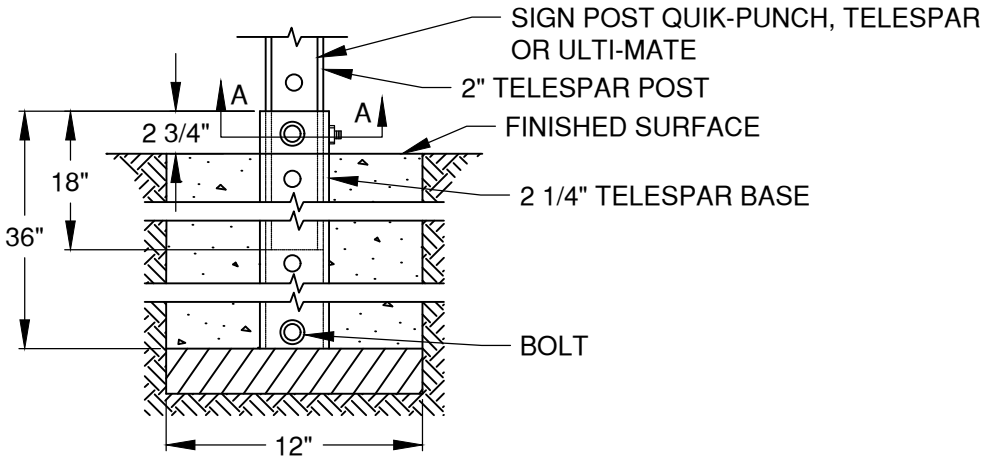
NOT TO SCALE

DRAWN ARI	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 04/16/2026
REV / DATE			APPR
		CURB RAMP DETAILS	STD DWG R-6C

INSTALLATION IN NEW CONSTRUCTION



SECTION A-A

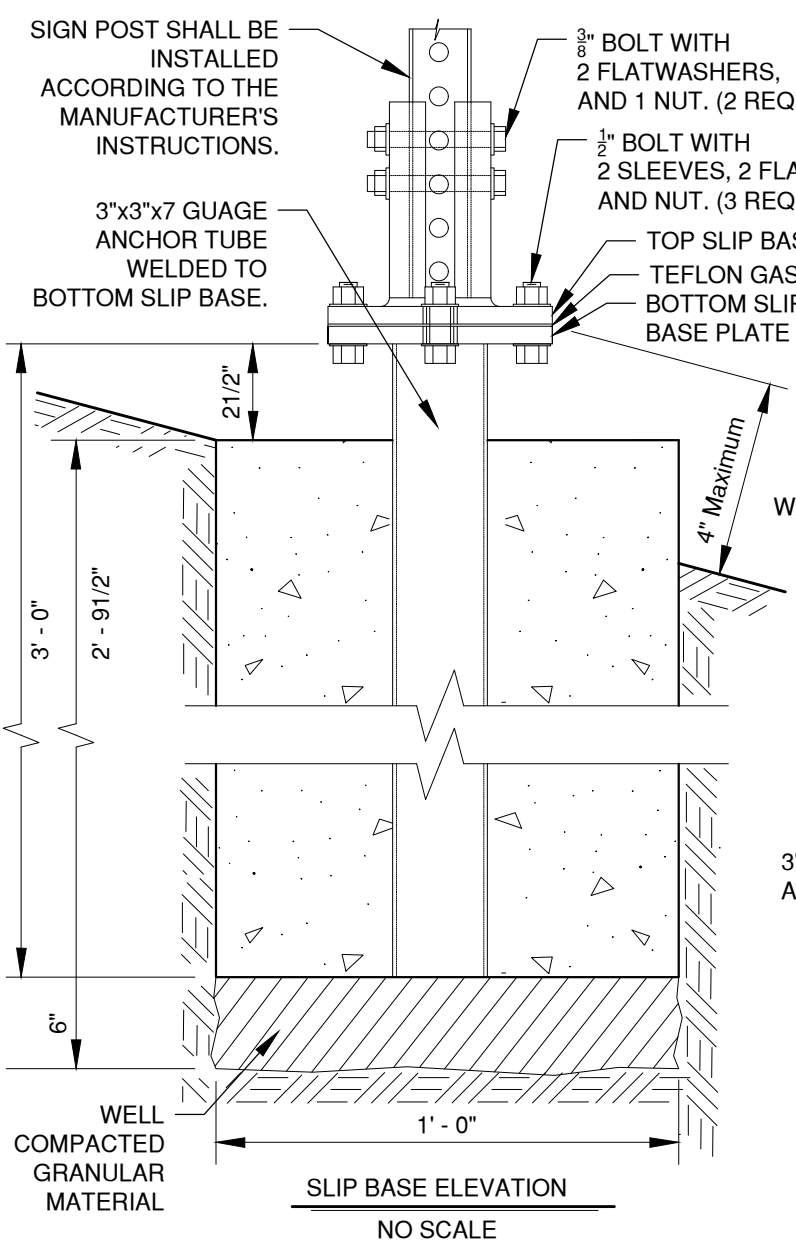


ANCHOR BASE DETAIL

NOTES:

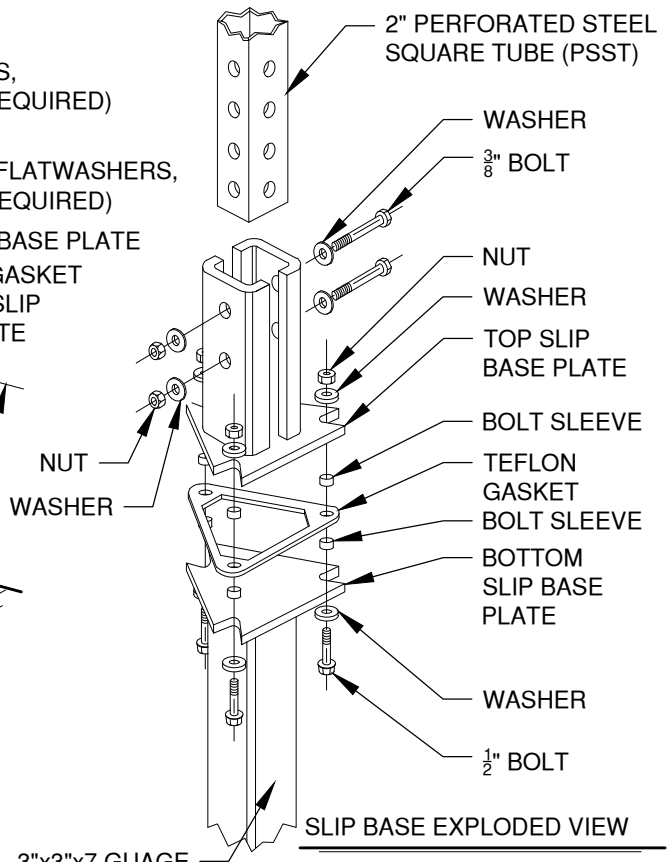
1. USE PSST ANCHOR BASE FOUNDATION FOR ALL SIGN LOCATIONS OTHER THAN IN MEDIANS AND ROUNDABOUT SPLITTER ISLANDS PER STD DWG R-7A.
2. ANCHOR BASE HOLES AND BOTTOM OF ANCHOR BASE SHALL BE COVERED SO THAT CONCRETE DOES NOT SEEP INTO ANCHOR BASE DURING SETTING
3. BASE SHOULD BE SET SEPARATELY FROM POST WITH ANCHOR BOLT IN BASE BOTTOM ONLY
4. POST SHOULD BE ABLE TO SLIDE FREELY WHEN RIVET IS REMOVED
5. FOR LARGE SIGNS THAT EXCEED WINDLOADS 2 1/2" POSTS MAY BE APPROVED BY CITY ENGINEER

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PSST ANCHOR BASE FOUNDATION	SCALE NTS DATE 01/31/2022 APPR STD DWG R-7



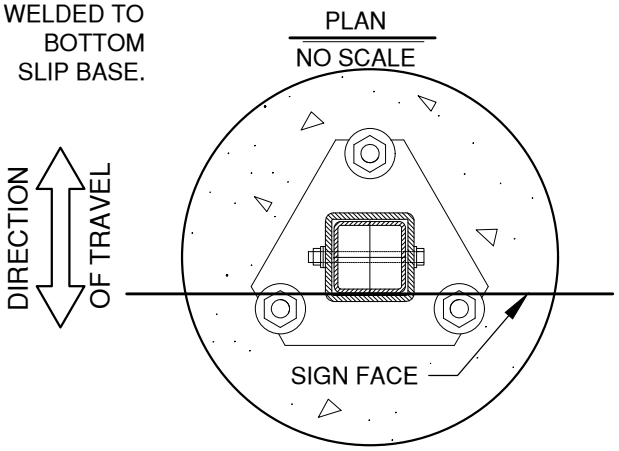
SLIP BASE ELEVATION

NO SCALE



SLIP BASE EXPLODED VIEW

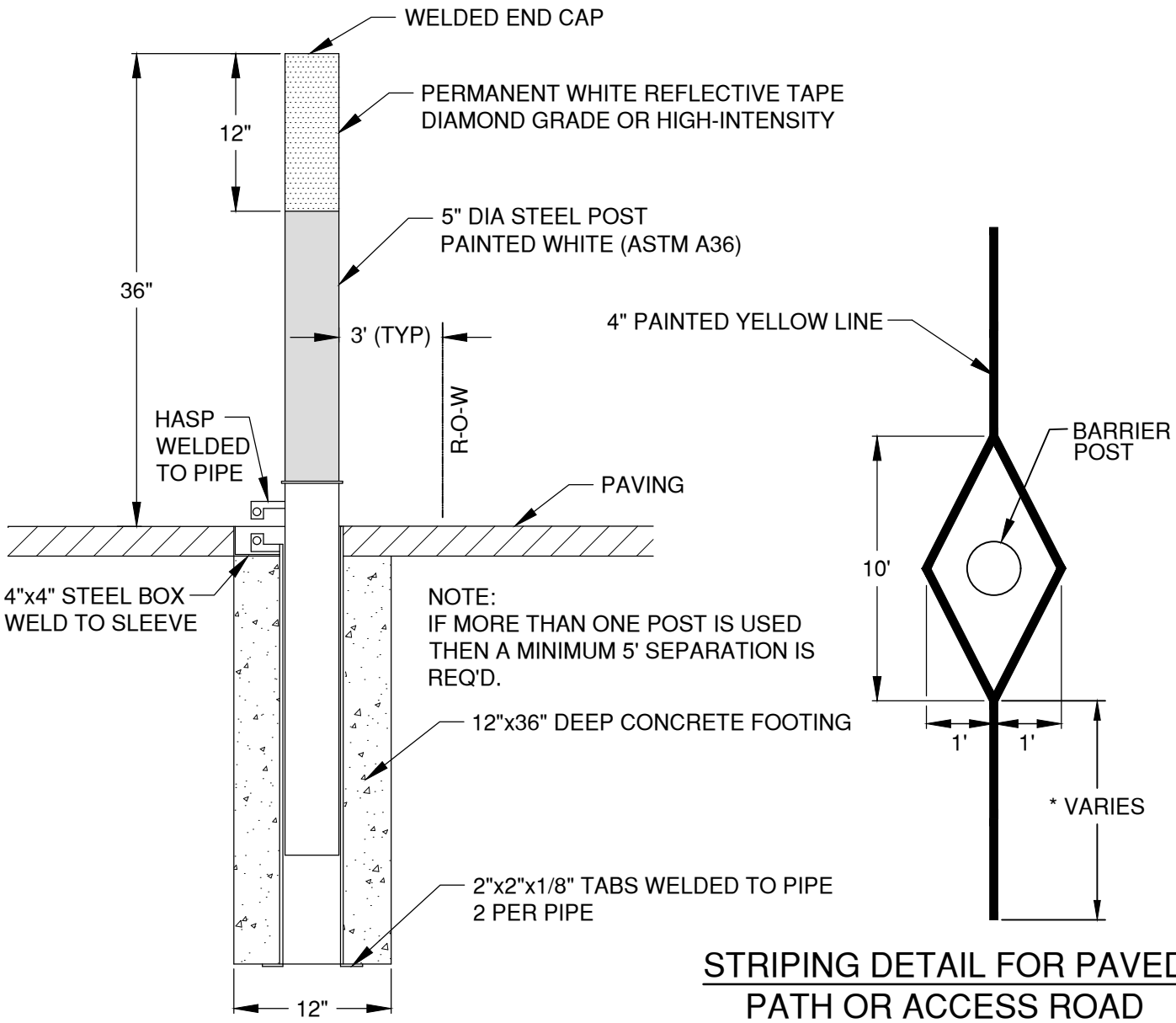
NO SCALE



NOTES:

1. USE PSST SLIP BASE FOUNDATION FOR SIGNS INSTALLED IN MEDIANS AND ROUNDABOUT SPLITTER ISLANDS.
2. MATERIAL GRADE FOR BASE HARDWARE CONNECTION SHALL BE ACCORDING TO THE MANUFACTURER'S RECOMMENDATION AND BASED ON CRASH TESTING.
3. SLIP BASE STEEL SHALL BE HOT DIPPED GALVANIZED OR APPROVAL EQUAL.
4. FOOTING CONCRETE SHALL BE COMMERCIAL GRADE CONCRETE (FC=3000PSI) PER SPECIFICATION 00440. THE CGC MIXTURE MAY BE ACCEPTED AT THE SITE OF PLACEMENT ACCORDING TO 00440.14.
5. ALL SLIP BASES SHALL BE PRE-ASSEMBLED BY THE MANUFACTURER AND SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
6. SLIP BASE DETAILS SHOWN ARE NOT FOR A SPECIFIC MANUFACTURER AND ARE ONLY SHOWN TO CONVEY GENERAL PIECES OF A SLIP BASE SYSTEM. SPECIFIC SLIP BASE MATERIAL WILL BE ACCORDING TO THE MANUFACTURER'S DOCUMENTATION.
7. FOR LARGE SIGNS THAT EXCEED WINDLOADS, 2 1/2" PSST MAY BE APPROVED BY CITY ENGINEER

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PSST SLIP BASE FOUNDATION	STD DWG R-7A



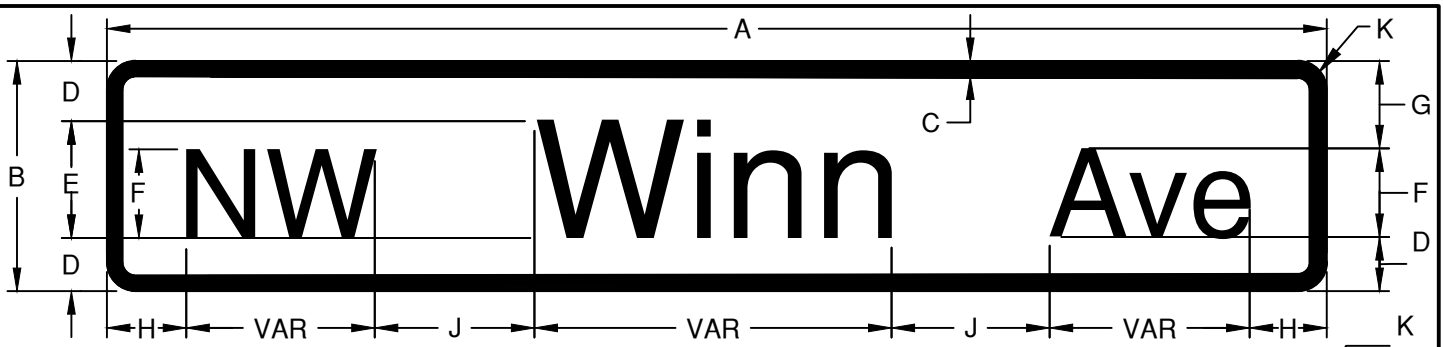
STRIPING DETAIL FOR PAVED PATH OR ACCESS ROAD

* Length of approach line varies by location, where possible, 25' min.

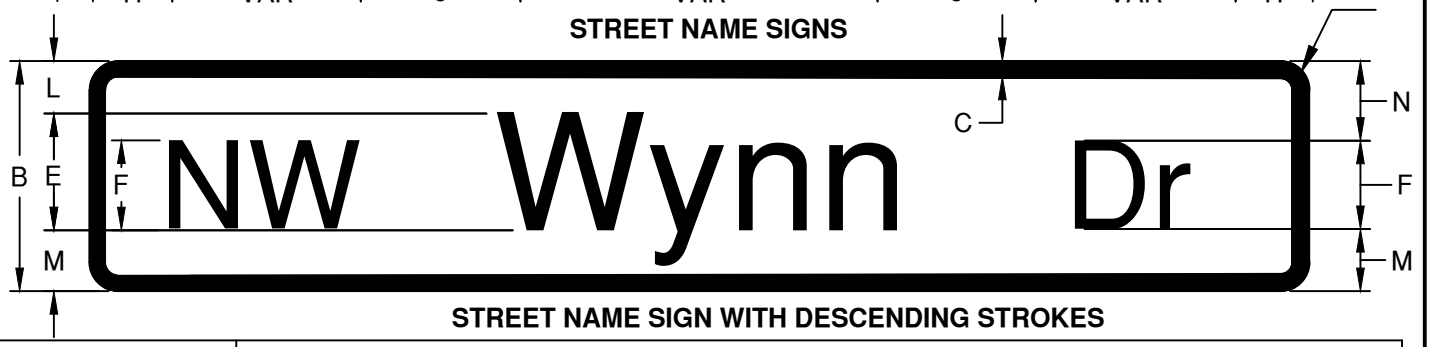
NOTES:

1. POSTS OR BOLLARDS SHALL BE SET BACK BEYOND THE CLEAR ZONE OF THE ADJACENT STREET OR BE OF A BREAKAWAY DESIGN. THE POST SHALL BE PERMANENTLY REFLECTORIZED FOR NIGHTTIME VISIBILITY AND PAINTED WHITE FOR IMPROVED DAYTIME AND NIGHT TIME VISIBILITY.
2. ON PAVED PATHS OR ACCESS ROADS, APPLY PAVEMENT MARKINGS PER STRIPING DETAIL.

DRAWN AJD DIV ROADWAY REV / DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 REMOVABLE POST AND MARKINGS	SCALE NTS DATE 01/31/2022 APPR STD DWG R-7B



STREET NAME SIGNS



STREET NAME SIGN WITH DESCENDING STROKES

SIGN LOCATION	DIMENSIONS												
	A	B	C	D	E	F	G	H	J	K	L	M	N
LOCAL	VAR	8	0.375	2	4C	3C	3	3 MIN	3	1	1.75	2.25	2.75
COLLECTOR/ ARTERIAL ≤ 40MPH	VAR	12	0.5	3	6C	4.5C	5	4.5 MIN	4.5	1.5	2.75	3.25	4.75
COLLECTOR/ ARTERIAL > 40 MPH	VAR	18	0.75	5	8C	6C	7.67	5.33 MIN	6	1.875	5	5	7.67
OVERHEAD	VAR	24	1	6	12C	9C	10	9 MIN	9	2.25	5	6	9.50

NOTES:

1. SIGNS INSTALLED ALONG PUBLIC STREETS SHALL BE FABRICATED AND INSTALLED TO CONFORM TO THE MUTCD AND CITY OF BEND SPECIFICATIONS.
2. UNLESS OTHERWISE SPECIFIED, STREET NAME SIGNS SHALL BE FABRICATED AS FOLLOWS:
   a. SIGN SUBSTRATE: SHEET ALUMINUM (GAUGE 0.80 FOR GROUND-MOUNT) WITH ROUNDED CORNERS
   b. RETRO-REFLECTIVE SHEETING: GREEN BACKGROUND WITH WHITE LEGEND, USING HIP/TYPE G FOR GROUND-MOUNTED SIGNS, AND DIAMOND GRADE/TYPE G2 FOR SIGNS MOUNTED OVERHEAD;
   c. LETTERING SHALL BE LOWER-CASE WITH INITIAL UPPER-CASE LETTERS;
   d. SERIES C2000 FONT, WITH LETTERING AND LETTER SPACING PER THE FEDERAL HIGHWAY ADMINISTRATION'S STANDARD ALPHABETS AS SHOWN IN THE CURRENT EDITION OF THE STANDARD HIGHWAY SIGNS AND PAVEMENT MARKINGS MANUAL. (* EXCEPT FOR OVERHEAD SIGNS, WHERE SIGNS EXCEED 36" LONG, SERIES B2000 FONT SHALL BE USED);
   e. BOTTOM STREET SIGNS (CLOSEST TO THE REGULATORY/STOP SIGN) SHALL BE TWO SINGLE-SIDED WITH PREDRILLED HOLES. SIGNS SHALL BE RIVETED BACK TO BACK ON THE SQUARE TUBE POST , CENTERED ON THE POST.
   f. BOTTOM STREET SIGNS SHALL BE USED FOR SIDE STREET (STOP CONTROLLED STREET).
   g. TOP STREET SIGN SHALL BE DOUBLE SIDED. TOP SIGN USED FOR MAINLINE STREET (NON-STOP CONTROLLED STREET).
3. ALL SIGNS SHALL BE REVIEWED AND APPROVED BY THE CITY OF BEND ENGINEERING DEPARTMENT PRIOR TO FABRICATIONS AND INSTALLATION.
4. TYPICAL INSTALLATION INCLUDES 2-INCH SQUARE TUBE CAPS WITH 90-DEGREE ANGLE BRACKETS ON 2-INCH PERFORATED SQUARE TUBE STEEL POSTS. USE 5- OR 6-INCH BLADE MOUNTS FOR SIGNS LESS THAN 36” WIDE; 12-INCH MOUNTS FOR SIGNS 36-INCHES OR WIDER OR OVER 6-INCHES HIGH. SEE STANDARD DRAWINGS R-7 AND R-9.
5. SIGN WIDTHS VARY WITH LEGEND. WHERE SITE CONSTRAINTS LIMIT AVAILABLE SPACE, REDUCED LETTER HEIGHT, FONT STYLE, LINE SPACING, OR EDGE SPACING WILL BE CONSIDERED. REDUCTIONS IN SPACING BETWEEN LETTERS OR WORDS IS NOT PERMITTED.
6. WHERE PRIVATE STREETS INTERSECT WITH PUBLIC STREETS, INSTALL A BLACK ON YELLOW PRIVATE DR SIGN WITH 4-INCH CAPITAL LETTERS (ODOT SIGN POLICY SIGN #OW14-3) DIRECTLY BELOW THE PRIVATE STREET NAME SIGN (OR ON A SEPARATE POST, IF NOT AT AN INTERSECTION).
7. FOR ADDITIONAL INFORMATION, REFER TO MUTCD SECTION 2A AND 2D, AND CITY OF BEND TECHNICAL SPECIFICATION SECTION 00940.
8. CONFIRM SIGN SIZE WITH CITY ENGINEER FOR SIGNS ON EXISTING TRAFFIC SIGNAL POLES OR MAST ARMS.
9. LARGER SIGNS ARE PLACE PLACED FACING THE FASTER STREET (COLLECTORS AND ARTERIALS).

DRAWN	AJD
DIV	ROADWAY

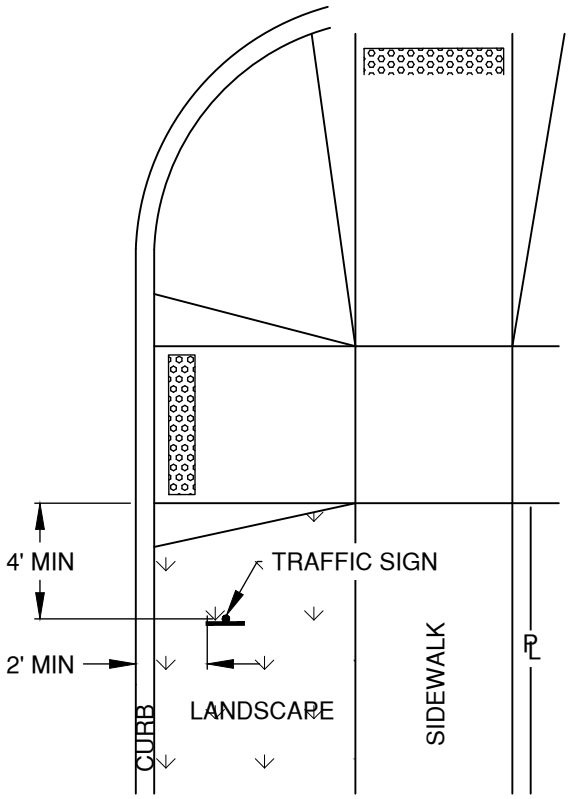
REV	DATE	APPR

CITY OF BEND

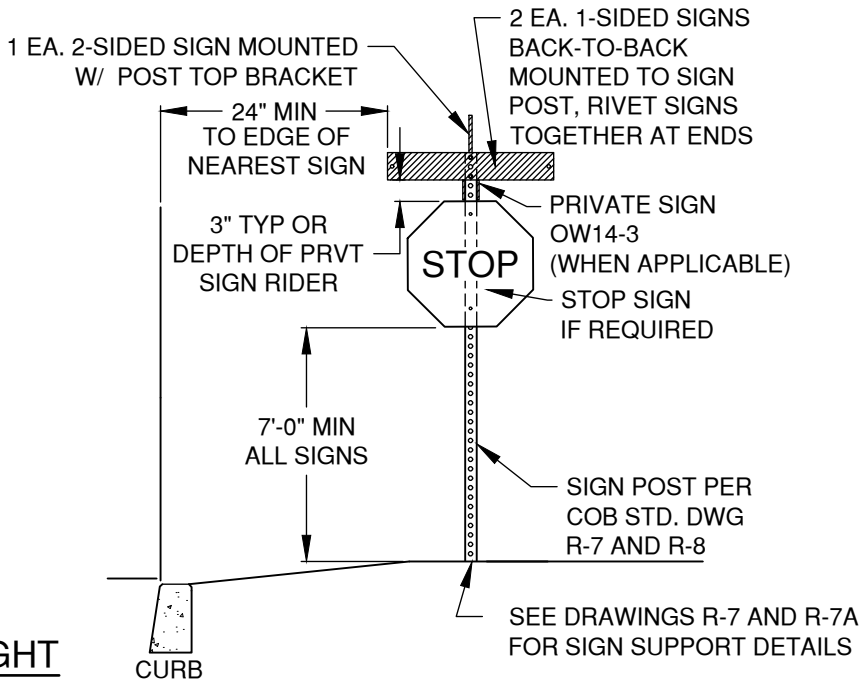
CITY OF BEND
STANDARD DRAWING
710 NW WALL ST., BEND, OREGON 97701

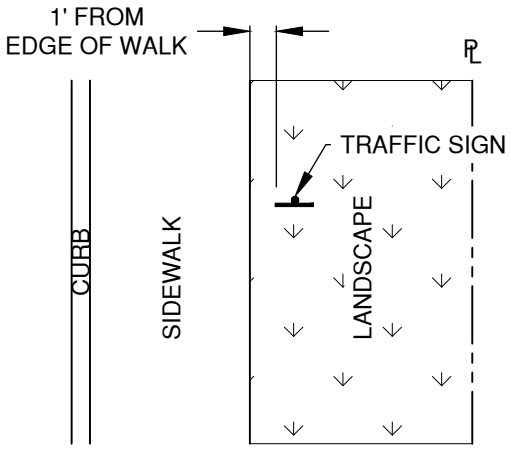
STANDARD STREET NAME SIGNS

SCALE	NTS
DATE	11/01/2024
APPR	
STD DWG	R-8

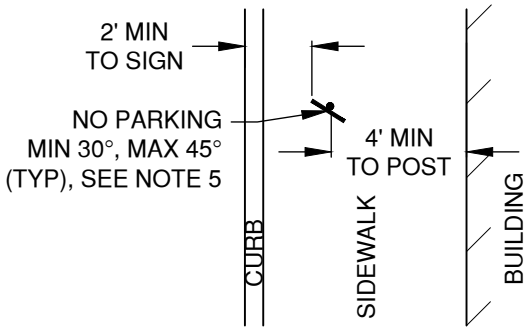


SIDEWALK PROPERTY TIGHT





SIDEWALK CURB TIGHT



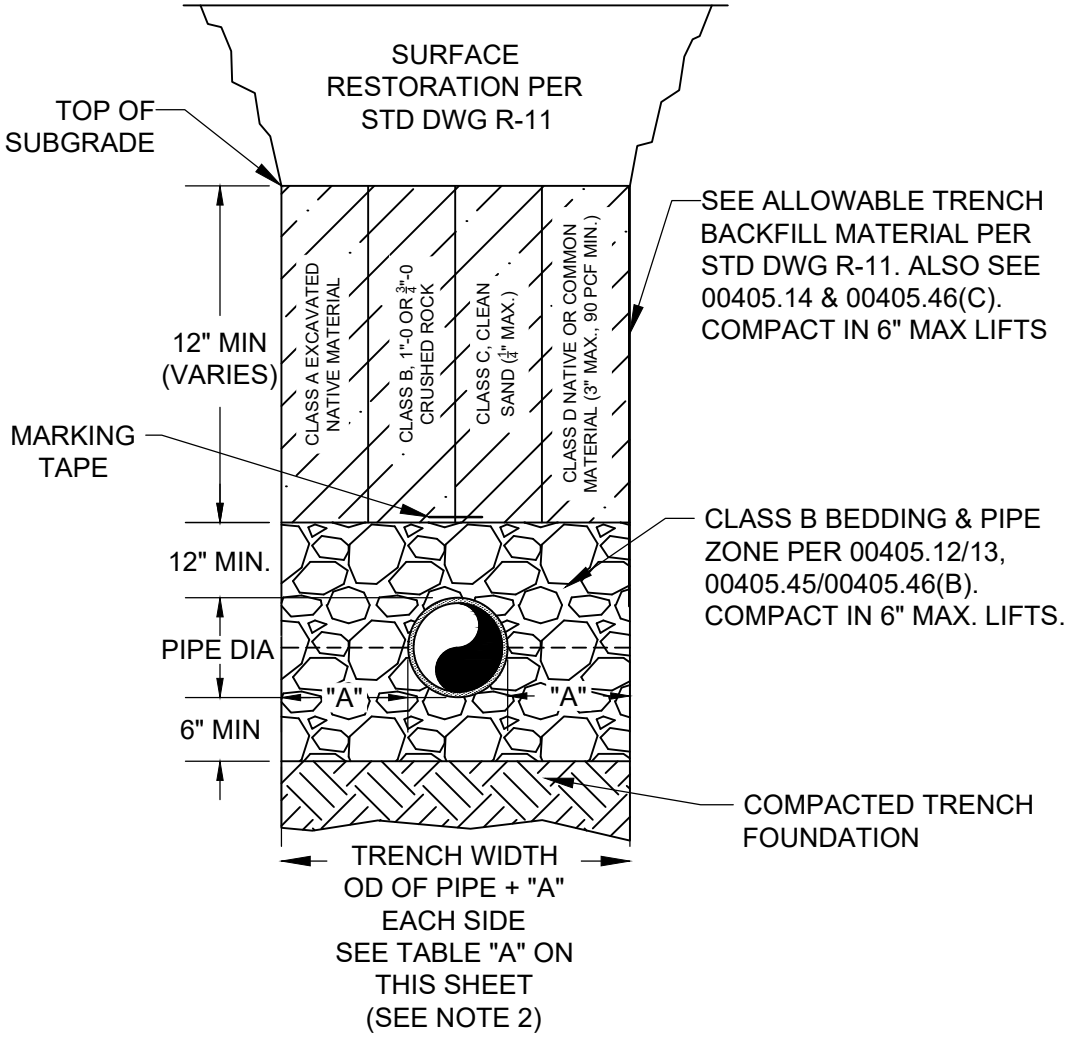
SIDEWALK FROM CURB TO NEAR BUILDING

NOTES:

1. SET TO MUTCD SPECS
2. SEE R-8 FOR COB STREET NAME SIGN REQUIREMENTS.
3. CHECK THAT SIGN IS NOT OBSCURED BY VEGETATION, TRIM IF NEEDED.
4. INSTALL ALL SIGNS WITH 5/16"X3/8" DRIVE RIVETS.
5. WHERE NO PARKING SIGN IS USED, IT MUST BE ANGLED.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 STANDARD STREET SIGN PLACEMENT	SCALE NTS DATE 04/16/2026 APPR STD DWG R-9

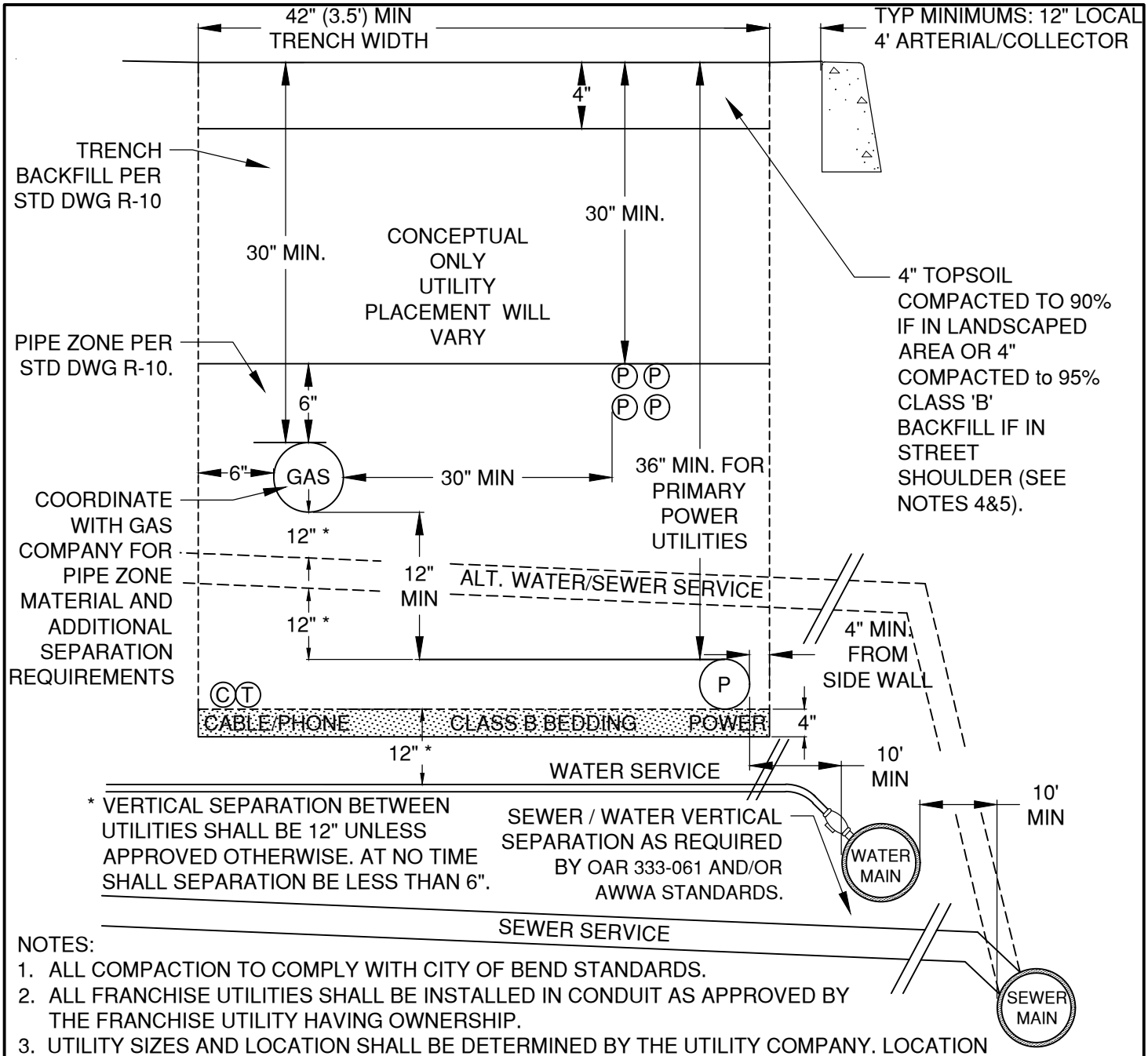
TABLE A	
PIPE DIA (IN)	"A" (IN)
4	10
6	10
8	10
10	10
12	12
15	12
18	16
21	16
24	18
30	18
36	24
42	24
48	24
54	24
60	24
66	24
72	24



NOTES:

1. ALL COMPACTION TO COMPLY WITH SPECIFICATION SECTION 00330.43 AND 00405.46(c).
2. A FRANCHISE UTILITY THAT IS A SINGLE CONDUIT AND IS 4 INCHES IN DIAMETER OR LESS MAY BE CENTERED IN A 12-INCH WIDE TRENCH PROVIDED THAT THE TRENCH CAN ACCOMMODATE THE COMPACTION EQUIPMENT. TRENCH PATCH SHALL BE IN ACCORDANCE WITH STD DWG R-11 WHERE THE TEE PATCH SHALL NOT BE LESS THAN 12 INCHES ON BOTH SIDES OF THE TRENCH. OVERALL WIDTH MAY BE REDUCED FROM 4 FEET, BUT IN NO CIRCUMSTANCES RESULT IN TEE PATCHES LESS THAN 12 INCHES AND AN OVERALL MINIMUM WIDTH OF 3 FEET.
3. CLASS E - CLSM, MAY BE ALLOWED FOR TRENCH BACKFILL WHERE COMPACTION CANNOT BE MET DUE TO THE PRESENCE OF EXISTING UTILITIES

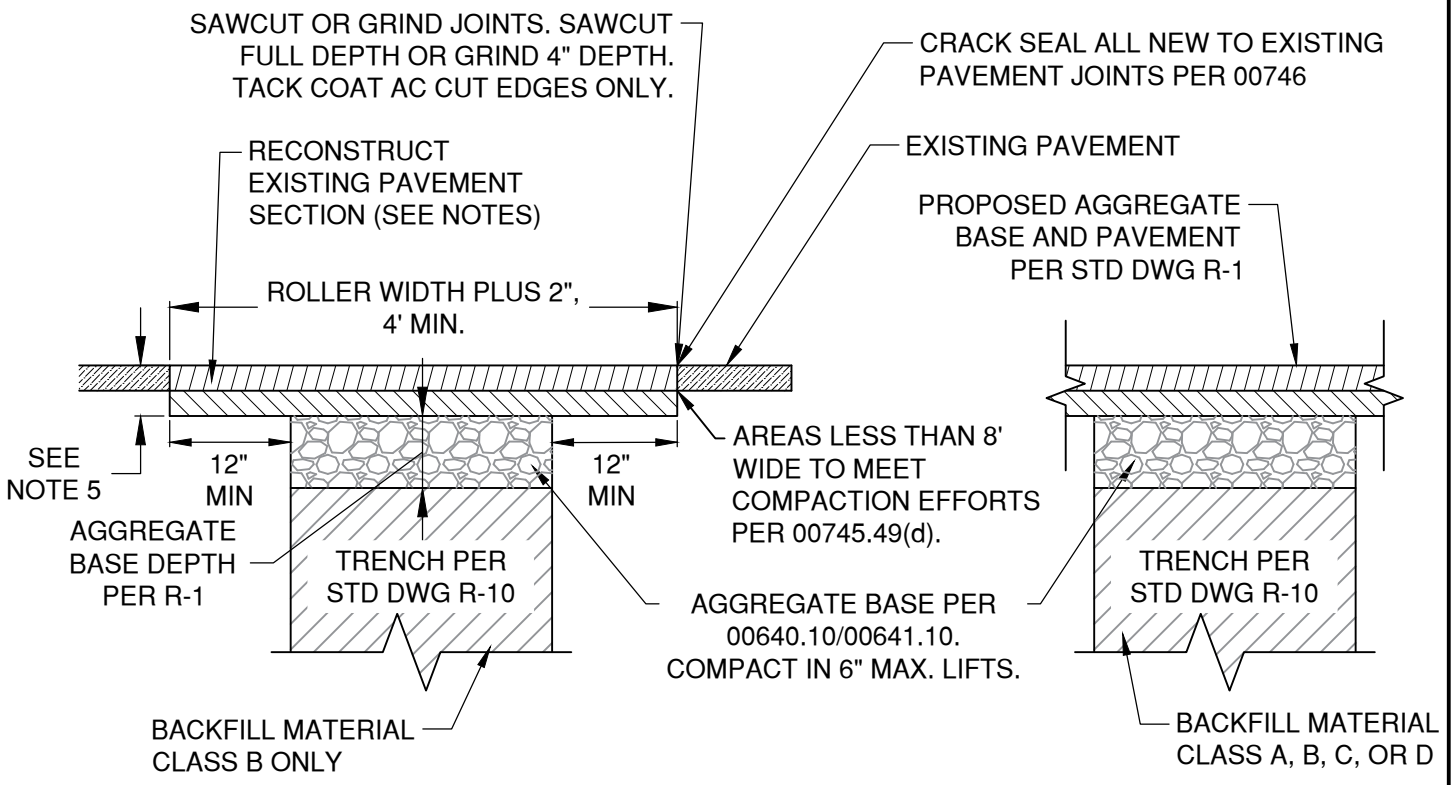
DRAWN AJD		CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE	CITY OF BEND	710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL TRENCH SECTION	STD DWG R-10



NOTES:

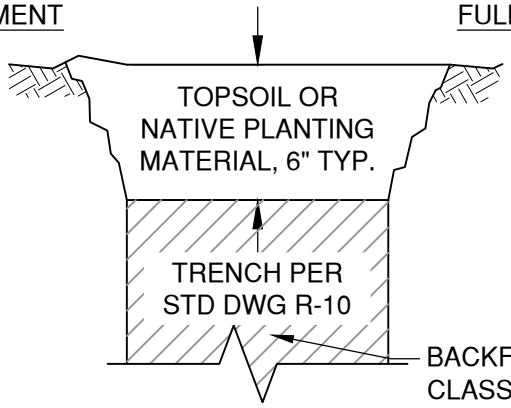
1. ALL COMPACTION TO COMPLY WITH CITY OF BEND STANDARDS.
2. ALL FRANCHISE UTILITIES SHALL BE INSTALLED IN CONDUIT AS APPROVED BY THE FRANCHISE UTILITY HAVING OWNERSHIP.
3. UTILITY SIZES AND LOCATION SHALL BE DETERMINED BY THE UTILITY COMPANY. LOCATION TO BE SHOWN AND APPROVED BY CITY WITH A RIGHT OF WAY (ROW) PERMIT.
4. WHERE STORM SWALES ARE PROPOSED WITHIN THE LANDSCAPE STRIP, FRANCHISE UTILITIES SHALL BE INSTALLED OUTSIDE OF THE SWALE AREA.
5. TOP SOIL LAYER TO BE COMPACTED TO 90% MAX DENSITY. WHERE SIDEWALK IS PLACED OVER FRANCHISE UTILITY TRENCH, NO TOP SOIL SHALL BE PLACED AND SIDEWALK TO BE CONSTRUCTED TO COMPLY WITH CITY STANDARDS R-4A AND R-4B
6. STANDARD SHOWN FOR NEW CONSTRUCTION. MODIFICATIONS SHALL BE MADE WHEN WITHIN EXISTING DEVELOPMENTS WHERE APPROVED BY THE CITY ENGINEER.
7. UTILITIES OUTSIDE THE RIGHT OF WAY SHALL BE WITHIN A PUBLIC UTILITIES EASEMENT (PUE). BACKFILL AND INSTALLATION REQUIREMENTS STILL COMPLY WITH THE PUE.
8. NO SWALES OR SURFACE STORMWATER DRAINAGE FACILITIES ARE PERMITTED OVER FRANCHISE UTILITIES.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		FRANCHISE UTILITY JOINT TRENCH	STD DWG R-10A



TYPICAL SURFACE RESTORATION IN EXISTING PAVEMENT

TYPICAL SURFACE RESTORATION IN FULL RECONSTRUCT OR NEW ROAD

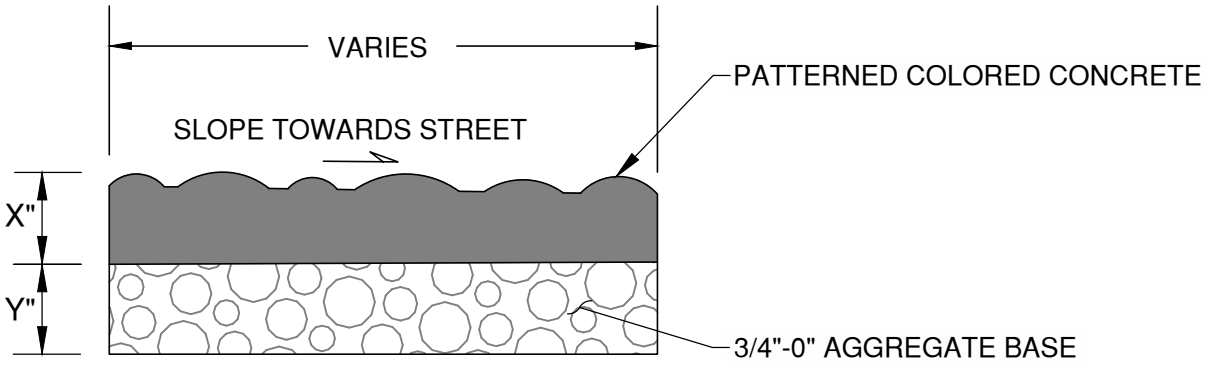


TYPICAL SURFACE RESTORATION IN UNIMPROVED AREAS

NOTES:

1. SURFACE RESTORATION IN EXISTING PAVEMENT TO COMPLY WITH SPECIFICATION 00495.
2. UNIMPROVED AREA CONSISTS OF ANY PORTION OF THE ROW THAT HAS NOT BEEN IMPROVED TO A CITY STANDARD AND CONSISTS MOSTLY OF NATIVE VEGETATED AREAS. UNIMPROVED AREAS ALSO INCLUDE AREAS WITHIN THE LANDSCAPE STRIP AND PUEs.
3. ALL EXISTING AC OR PCC PAVEMENT SHALL BE SAWCUT PRIOR TO REPAVING. CONCRETE SHALL BE CUT AND REPLACED TO THE NEAREST JOINT(S).
4. CONCRETE PAVEMENT SHALL BE REPLACED WITH CONCRETE TO A MINIMUM THICKNESS OF 6" OR TO THE THICKNESS OF REMOVED PAVEMENT, WHICHEVER IS GREATER
5. PLACE ACP A MINIMUM THICKNESS PER R-1 OR TO THE THICKNESS OF REMOVED PAVEMENT, WHICHEVER IS GREATER. PLACE ACP IN 2" MAX LIFTS.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		TRENCH SURFACE RESTORATION	STD DWG R-11

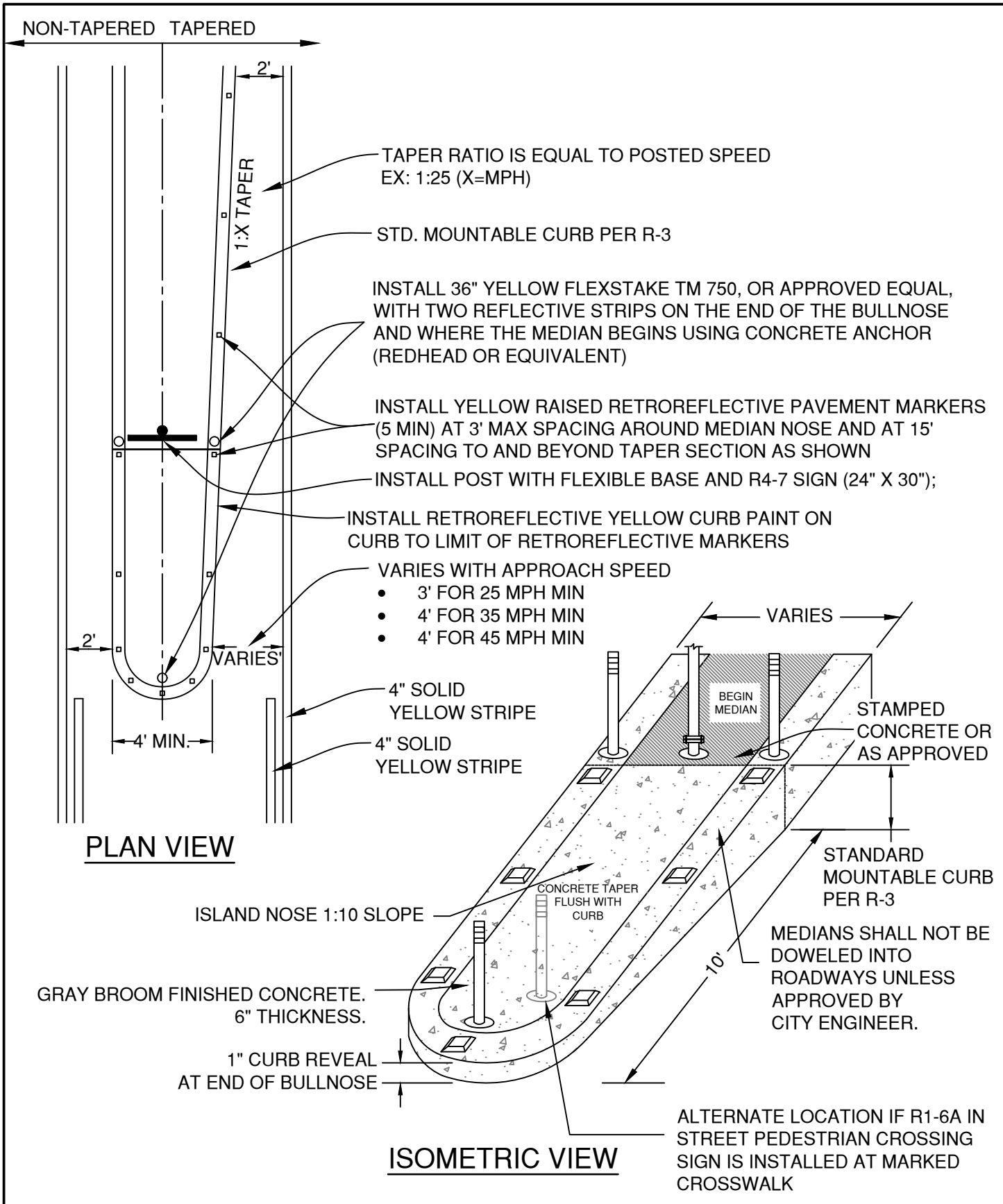


X DIMENSION:
- MEDIAN/ALL ADJACENT TO TRAVEL LANE = 6"
- ONLY BACK SIDE OF SIDEWALK OR SEPARATE FROM TRAVEL LANE = 4"
- TRUCK APRON = 9"

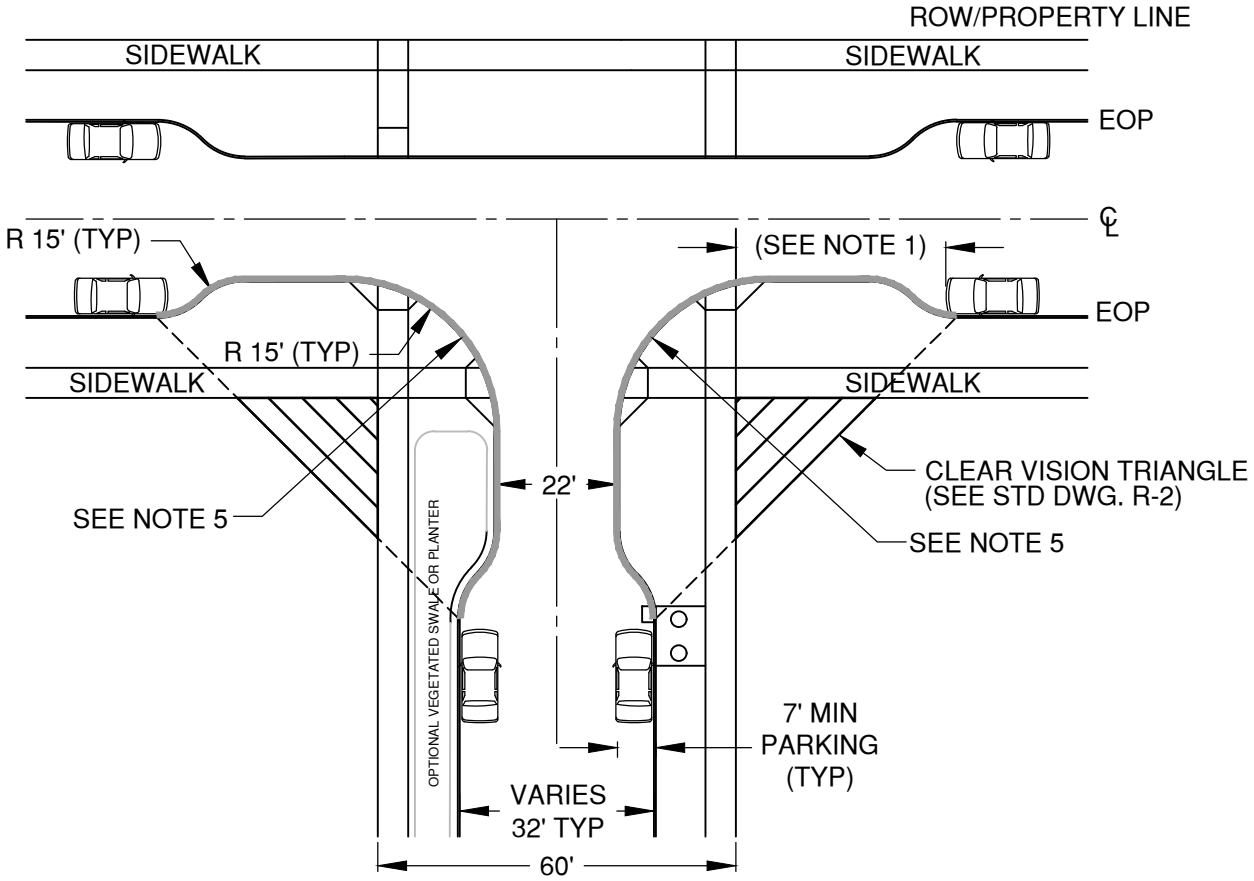
Y DIMENSION:
- MEDIAN/ALL ADJACENT TO TRAVEL LANE = 6"
- ONLY BACK SIDE OF SIDEWALK OR SEPARATE FROM TRAVEL LANE = 4"
- TRUCK APRON = 6"

NOTE:
1. STAMPED CONCRETE SURFACE TEXTURE PATTERN SHALL BE BRICKFORM "FLAGSTONE" TM-700) WITH SAWCUT GROOVE JOINTS 1/3 CONCRETE DEPTH.
2. GLAZE AND SEAL PER MANUFACTURERS SPECS.
3. INTEGRAL COLOR: DAVIS SPANISH GOLD (3 LBS. #5084)
4. RELEASE COLOR: DAVIS DARK GREY (#860)

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PATTERNED COLORED CONCRETE DETAIL	STD DWG R-24



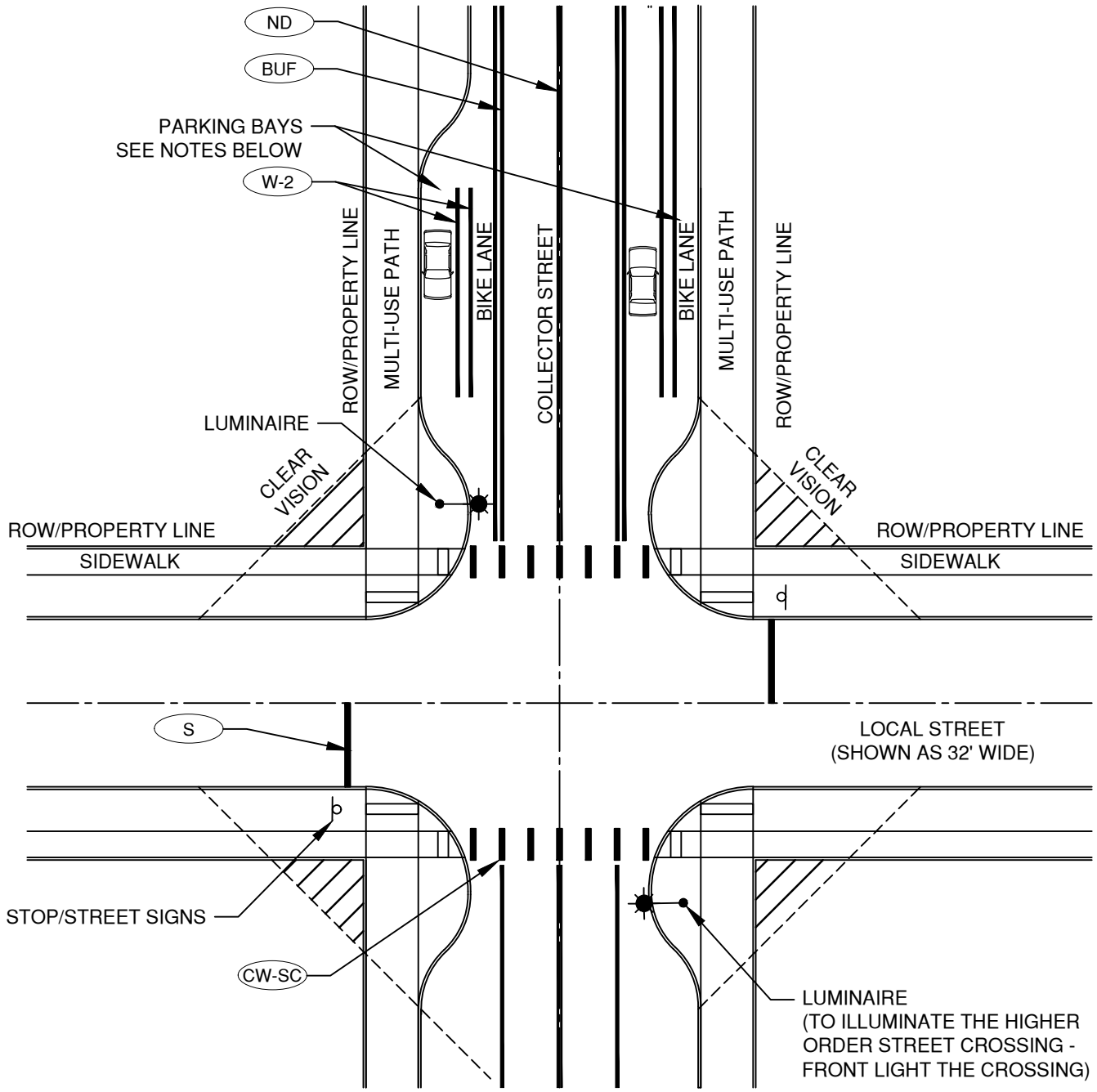
DRAWN ARI DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 MEDIAN / ISLAND END DETAIL	SCALE NTS DATE 04/16/2026 APPR STD DWG R-25



NOTES:

1. NO PARKING WITHIN THE CLEAR VISION OR 20 FEET OF THE INTERSECTION, WHICHEVER IS GREATER.
2. AS REQUIRED BY THE CITY ENGINEER, INSTALL YELLOW 36" TALL YELLOW SURFACE MOUNTED TUBULAR MARKERS, PER SPECIFICATION SECTION 00856 FOR PLOW SIGNAGE AT CURB EXTENSIONS.
3. USE LOW GROWING VEGETATION FOR BIORETENTION SWALES/ PLANTERS LOCATED IN CURB EXTENSIONS.
4. CURB RETURNS TO BE CONSTRUCTED PER DESIGN STANDARD.
5. YELLOW CURB PAINT ON RETURNS IS REQUIRED IN COMMERCIAL AND HIGH DENSITY RESIDENTIAL AREAS

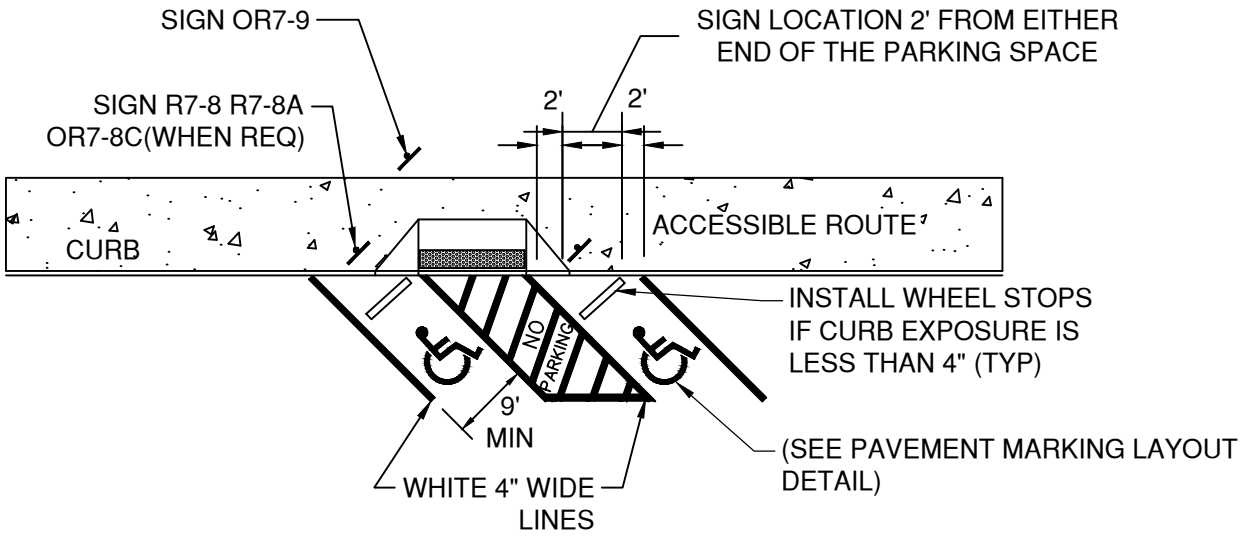
DRAWN AJD DIV ROADWAY REV / DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		LOCAL STREET CURB EXTENSIONS	STD DWG R-26



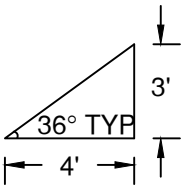
NOTES:

1. PARKING BAYS SHALL BE DESIGNED OUTSIDE THE CLEAR VISION OF THE INTERSECTION. PARKING WILL BE PERMITTED IF CLEAR VISION AND SIGHT DISTANCE AS ANALYZED AS SAFE BY A PROFESSIONAL ENGINEER.
2. PARKING BAYS ON COLLECTORS ARE PERMITTED AS DIRECTED BY THE DEVELOPMENT CODE.
3. NO MORE THAN 10 PARKING BAYS WILL BE PERMITTED TOGETHER. TERMINATION OF BAYS WILL BE FOR VEGETATION PLANTING, UTILITY INSTALLATION (FRANCHISE UTILITY VAULTS, STORM FACILITIES, ETC).
4. PARKING IS NOT PERMITTED WITHIN THE INTERSECTION'S CLEAR VISION AND SIGHT DISTANCE AS DETERMINED BY AASHTO REQUIREMENTS AND ENGINEER REVIEW.
5. USE PARKING SEPARATED BIKE LANE WHERE PARKING BAYS ARE LONG/BLOCK LENGTH AND ADEQUATE EXIT/ENTER SIGHT DISTANCE CAN BE PROVIDED.

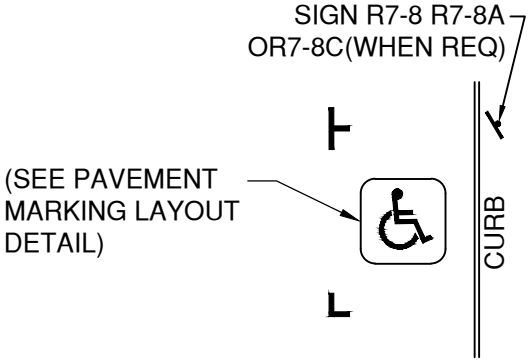
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		COLLECTOR / LOCAL INTERSECTION	STD DWG R-27



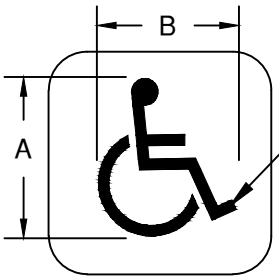
ANGLED PARKING PLAN



ACCESS AISLE ANGLE LAYOUT

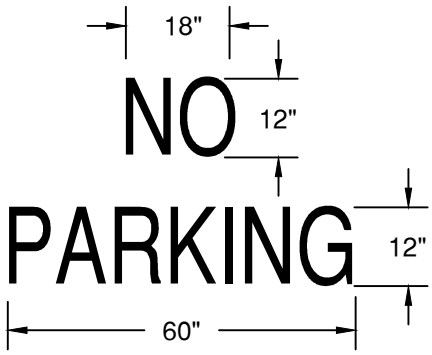


PARALLEL PARKING PLAN



LEGEND	DIMENSIONS (INCHES)		
	A	B	C
MINIMUM	28	24	3
STANDARD	41	36	4

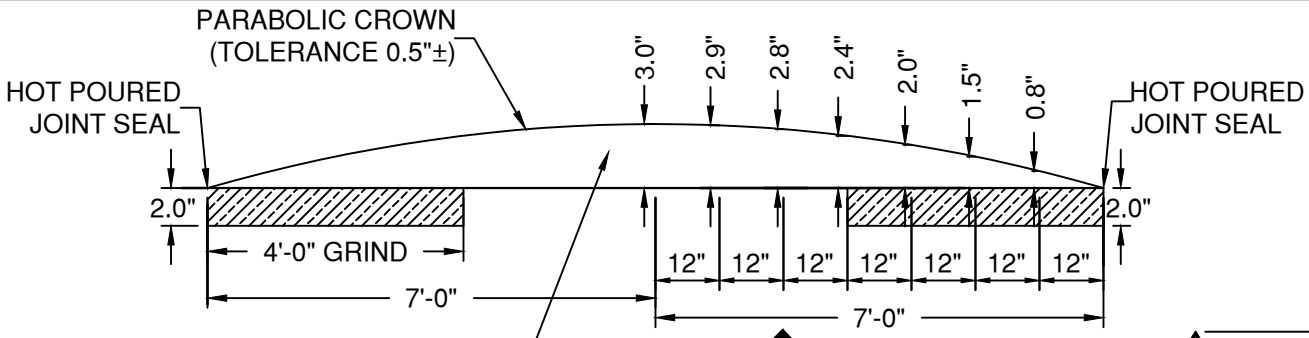
PAVEMENT MARKING LAYOUT

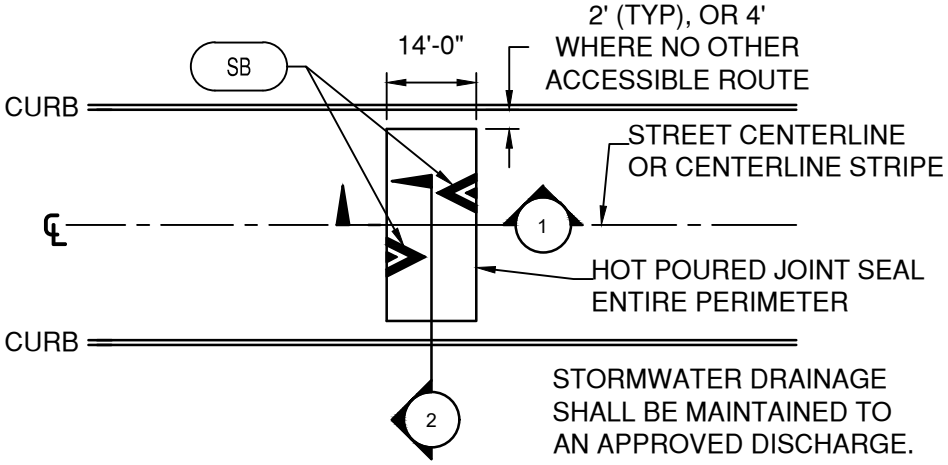


NOTE:

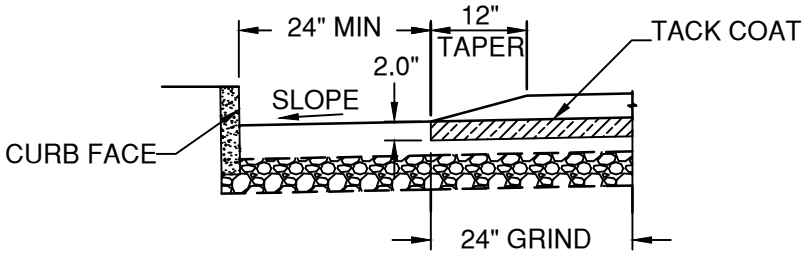
1. THIS IS ONE EXAMPLE OF AN ACCESSIBLE PARKING CONFIGURATION. REFER TO ODOT ACCESSIBLE PARKING STANDARDS FOR ADDITIONAL DETAILS AND OTHER CONFIGURATIONS.
2. ALL SIGNS AND PLACEMENT SHALL CONFORM TO ODOT STANDARDS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY	STANDARD DRAWING		DATE 01/31/2022
REV DATE	710 NW WALL ST., BEND, OREGON 97701		APPR
	ACCESSIBLE PARKING - ANGLE		STD DWG R-29

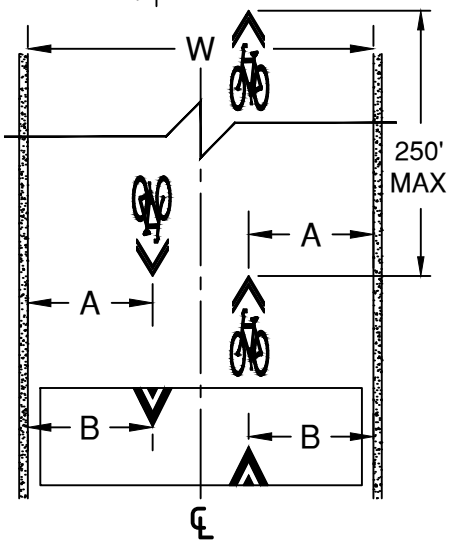




PLAN VIEW



CROSS
SECTION AT
CURB
2

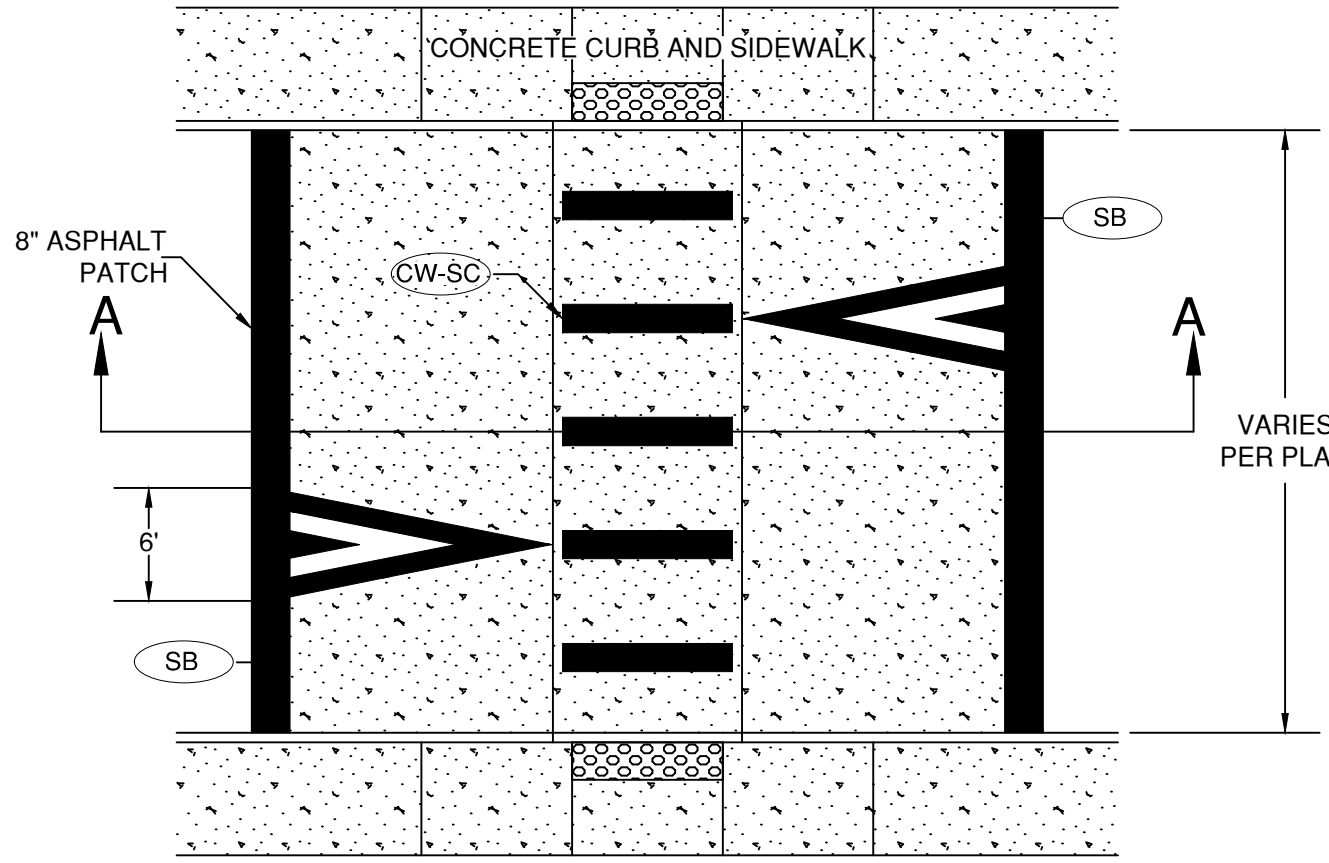


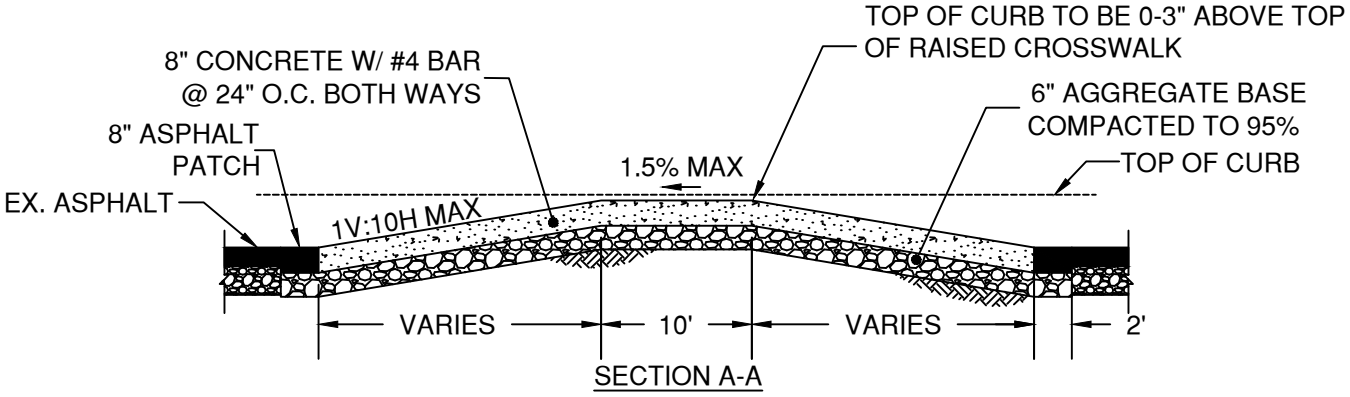
W	A	B	A	B
28'	12'	11'	7'	12'
30'	12'	11.5'	7'	12.5'
32'	13'	12'	7'	13'
34'	13'	12.5'	7'	14'
36'	13'	13'	7'	15'
	PARKING BOTH SIDES		PARKING ONE SIDE	

NOTES:

1. SPEED HUMPS ARE ONLY PERMITTED IN SELECT LOCATIONS. REFER TO CITY DESIGN STANDARDS.
2. WHERE SPEED HUMP IS A RETRO-FIT TO AN EXISTING ROAD:
   2.1. GRIND / KEY-IN PERIMETER TO THE DIMENSIONS SHOWN OR AS DIRECTED BY THE ENGINEER.
   2.2. APPLY TACK COAT TO ALL EXISTING SURFACES WHERE SPEED HUMP WILL BE IN CONTACT.
3. HOT POURED JOINT SEAL THE ENTIRE PERIMETER AFTER INSTALLATION.
4. ALL VERTICAL DIMENSIONS HAVE A REQUIRED MAXIMUM TOLERANCE OF +/- 1/4".
5. THE DISTANCE BETWEEN CURB AND EDGE OF THE SPEED HUMP VARIES. SEE ENGINEERED PLANS.
6. PAVEMENT MARKINGS ON SPEED BUMP SHALL BE INSTALLED CONCURRENTLY WITH THE ASPHALT STRUCTURES. PAVEMENT MARKINGS SHALL BE THERMO-PLASTIC.
7. PAVEMENT MARKINGS SHALL BE INSTALLED BEFORE OPENING ANY LANE TO TRAFFIC THAT IS OCCUPIED BY A NEW SPEED BUMP.
8. SPEED HUMPS ARE NOT PERMITTED IN ACCESSIBLE ROUTES OR WHERE IN CONFLICT WITH DRIVEWAYS.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		SPEED HUMPS AND SHARROW PLACEMENT	STD DWG R-32

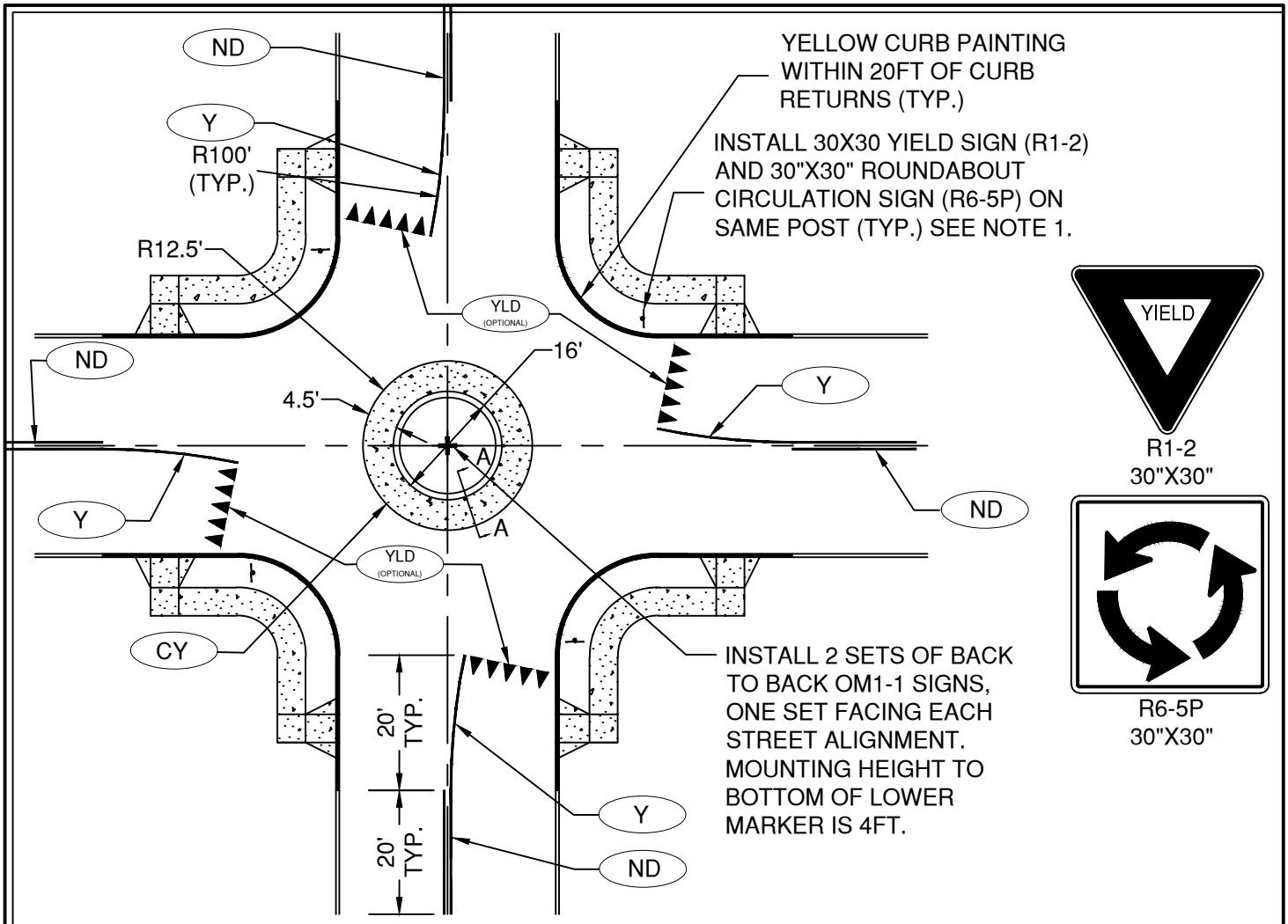


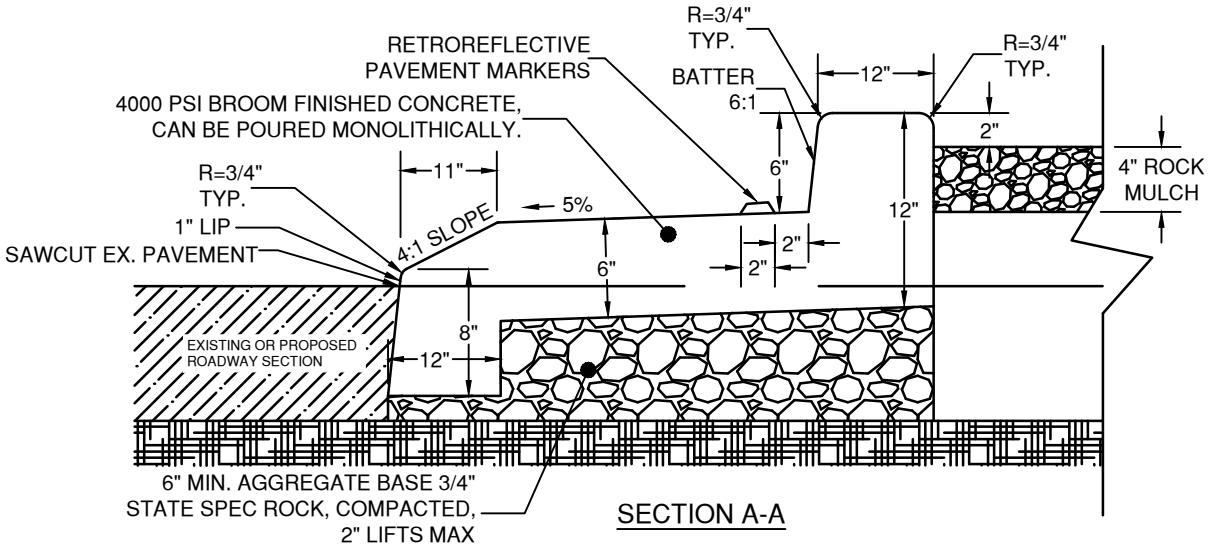


NOTES:

1. RAISED CROSSWALKS ARE ONLY PERMITTED IN SELECT LOCATIONS. REFER TO CITY DESIGN STANDARDS.
2. HOT POURED JOINT SEAL THE ENTIRE PERIMETER AFTER INSTALLATION.
3. PAVEMENT MARKINGS ON RAISED CROSSWALKS SHALL BE THERMO-PLASTIC.
4. PAVEMENT MARKINGS SHALL BE INSTALLED BEFORE OPENING ANY LANE TO TRAFFIC THAT IS OCCUPIED BY A NEW SPEED BUMP.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		RAISED CROSSWALK	STD DWG R-33



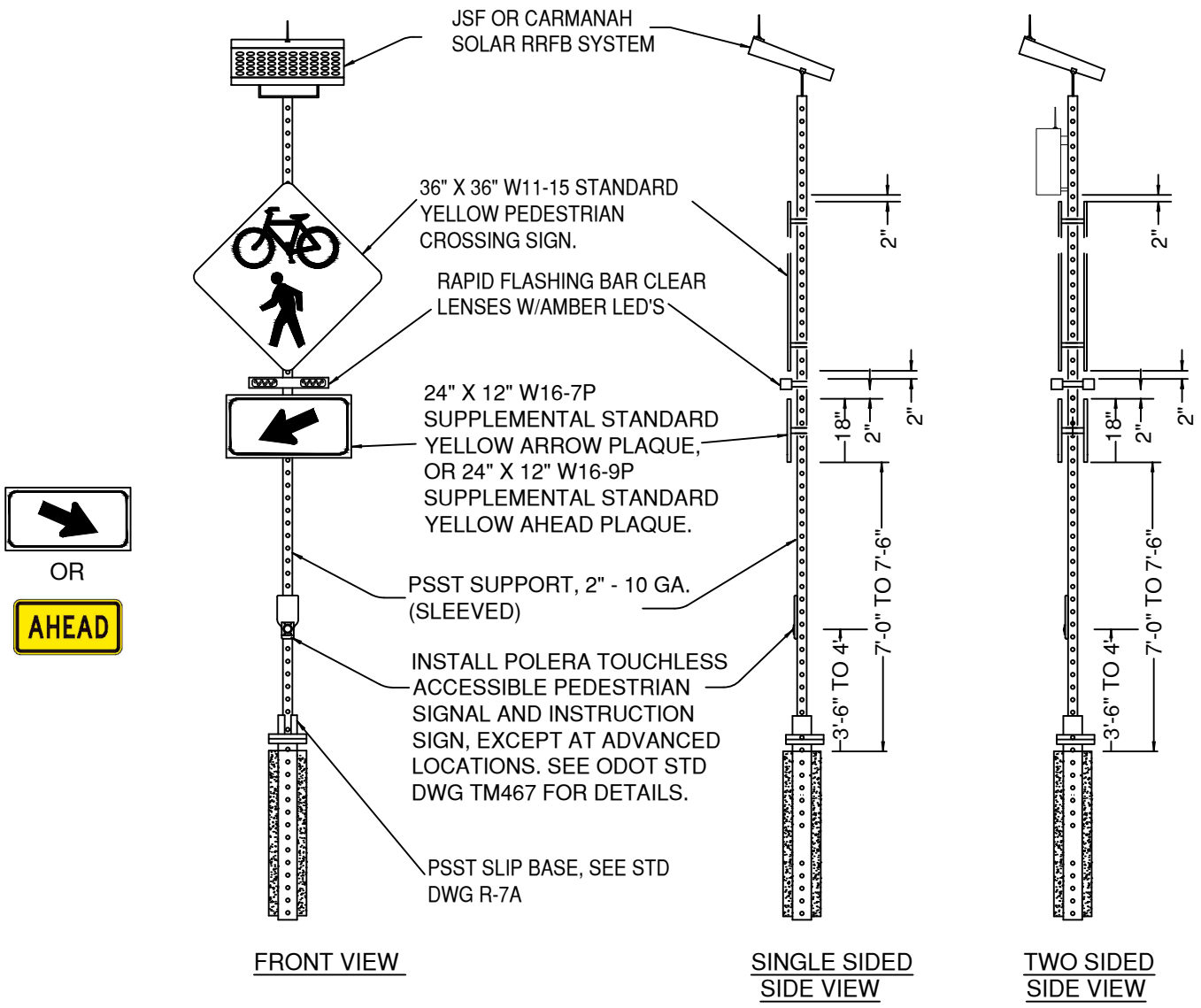


SECTION A-A

NOTES:

1. STANDARD IS YIELD CONTROL. TWO-WAY STOP MAY BE CONSIDERED FOR CIRCLES WITH INSUFFICIENT CIRCULATING DIAMETER FOR CROSSWALK OR SIGHT DISTANCE OBSTRUCTION THAT CANNOT BE MITIGATED

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TRAFFIC CIRCLE	STD DWG R-34

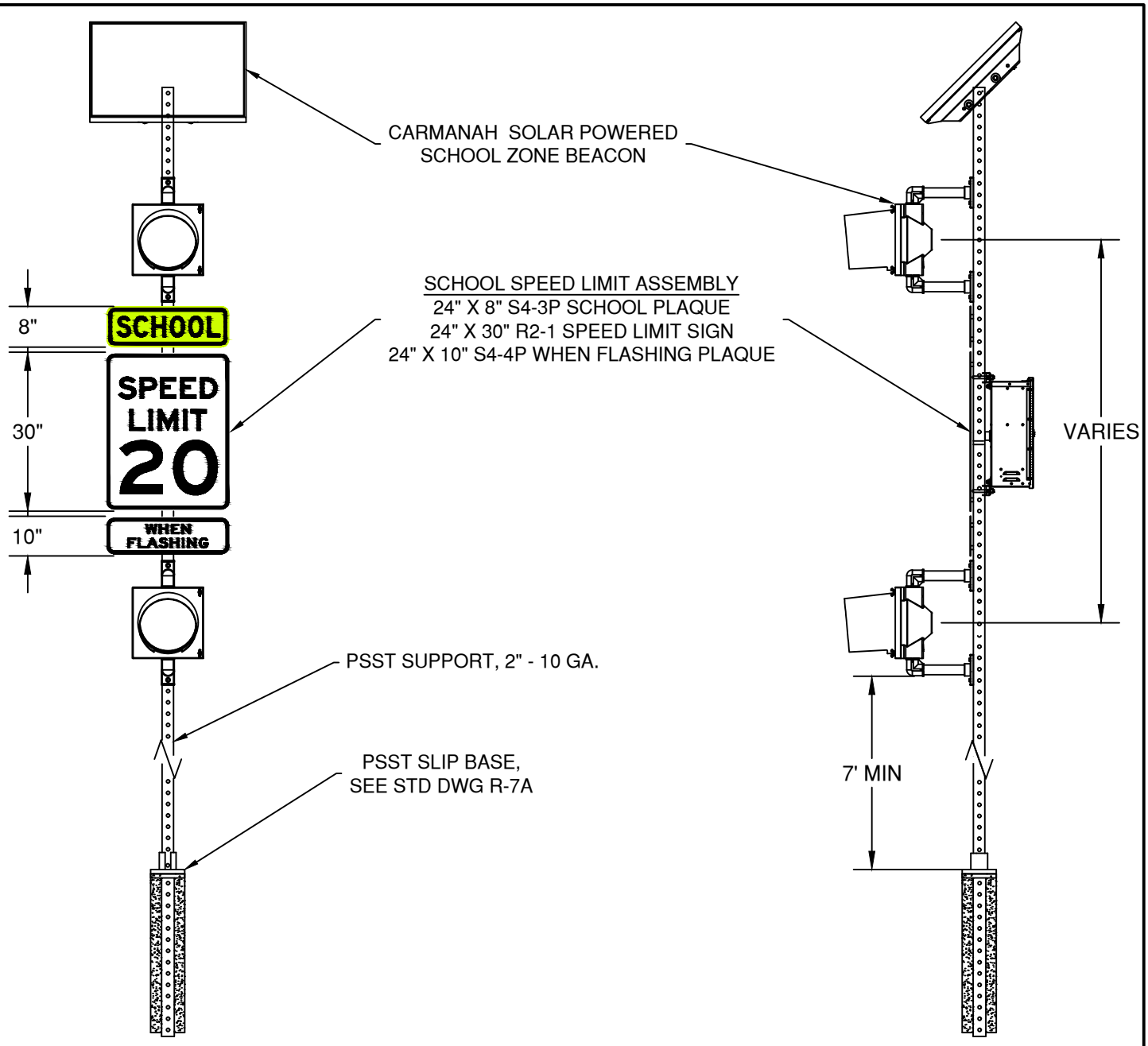


RECTANGULAR RAPID FLASHING BEACON SYSTEM
PSST INSTALLATION

NOTES:

1. REMOVE SOLAR EQUIPMENT IF USING COMMERCIAL POWER
2. USE APPLIED INFORMATION AI-500-030 LOW POWER MONITORING DEVICE
3. USE SCHOOL CROSSING (S1-1) FOR DESIGNATED SCHOOL CROSSING
4. USE DOUBLE SIDED SIGNS IN MEDIANS
5. ADD RADIO NETWORK CONTROLLER (APPLIED INFORMATION CONTROLLER GLANCE LOW POWER MONITORING DEVICE) INCLUDING ANY RETROFIT / MOUNTING KIT.

DRAWN ARI	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 04/16/2026
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		RECTANGULAR RAPID FLASHING BEACON	STD DWG R-35A



SOLAR POWER SCHOOL ZONE BEACON
PSST INSTALLATION

NOTES:

1. REMOVE SOLAR EQUIPMENT IF USING COMMERCIAL POWER
2. ADD RADIO NETWORK CONTROLLER FOR WIRELESS EQUIPMENT IF NEEDED
3. ADD RADIO NETWORK CONTROLLER (APPLIED INFORMATION CONTROLLER GLANCE LOW POWER MONITORING DEVICE) INCLUDING ANY RETROFIT / MOUNTING KIT.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 FLASHING SCHOOL ZONE BEACON	SCALE NTS DATE 11/01/2024 APPR STD DWG R-35B

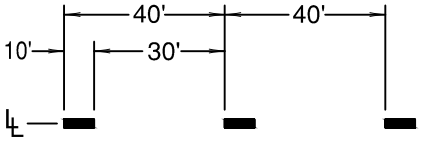
W

4" WHITE LINE

W-2

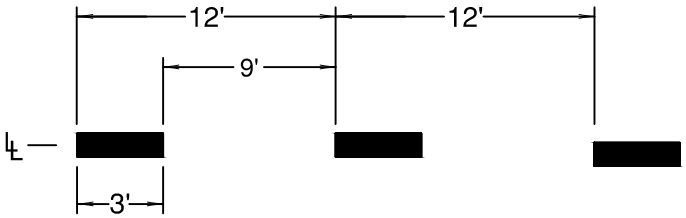
8" WHITE LINE

WB



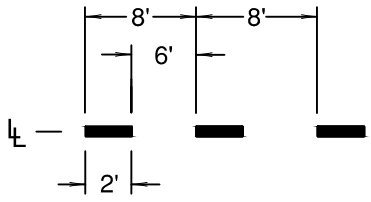
4" WHITE BROKEN LINE

DLL-2



8" WHITE DOTTED LANE LINE

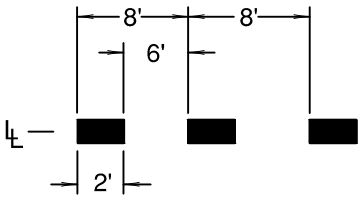
WD



4" WHITE DOTTED LINE

For lane extensions

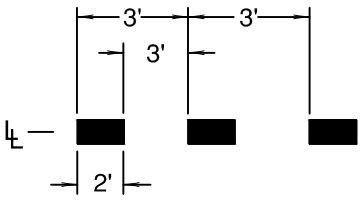
WD-2



8" WHITE DOTTED LINE

For lane extensions

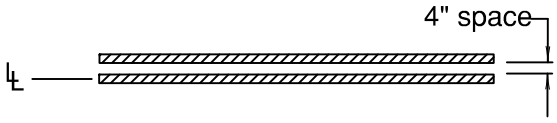
WRAB



8" WHITE DOTTED ROUNDABOUT CIRCULATING LINE

INSTALL AS TYPE B-HS PREFORMED THERMOPLASTIC

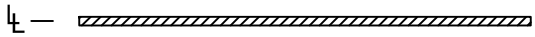
NDW



NARROW DOUBLE NO-LANE CHANGE TWO 4" WHITE LINES

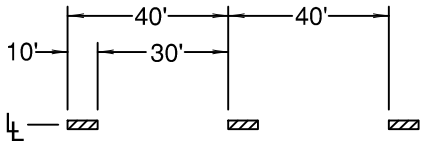
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PAVEMENT MARKINGS - WHITE	STD DWG R-40

Y



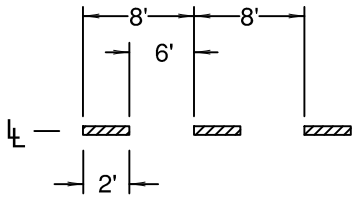
4" YELLOW LINE

YB



4" YELLOW BROKEN LINE

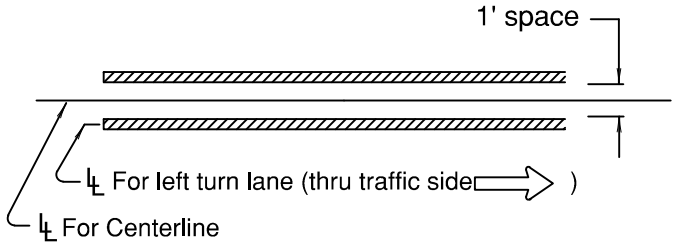
YD



4" YELLOW DOTTED LINE

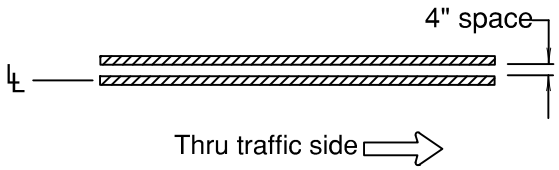
For lane extensions

D



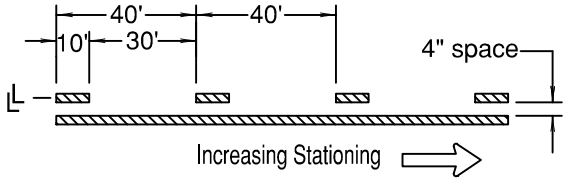
DOUBLE NO-PASS
TWO 4" YELLOW LINES

ND



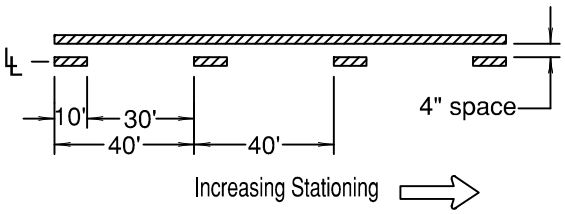
NARROW DOUBLE NO-PASS
TWO 4" YELLOW LINES

NPR



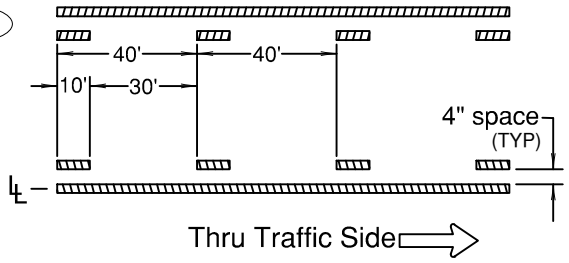
NO-PASS RIGHT
4" YELLOW LINES

NPL



NO-PASS LEFT
4" YELLOW LINES

TWL

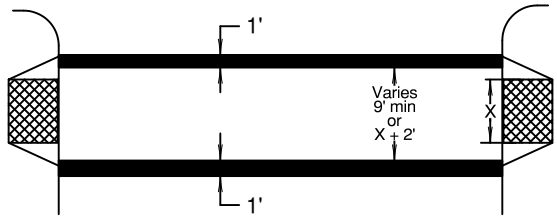


TWO-WAY LEFT TURN
4" YELLOW LINES

SEE R-44 FOR ARROW PLACEMENT

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PAVEMENT MARKINGS - YELLOW	SCALE NTS DATE 01/31/2022 APPR STD DWG R-41

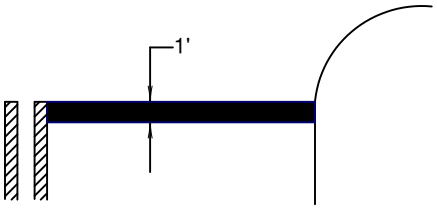
CW



STANDARD CROSSWALK
TWO 1' WHITE BARS

*Not used for new applications - use CW-SC

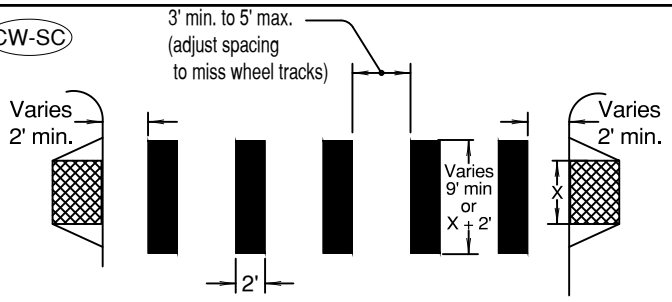
S



STOP BAR
1' WHITE BAR

Install stop bar in Thermoplastic. Install per Standard Drawing R-45

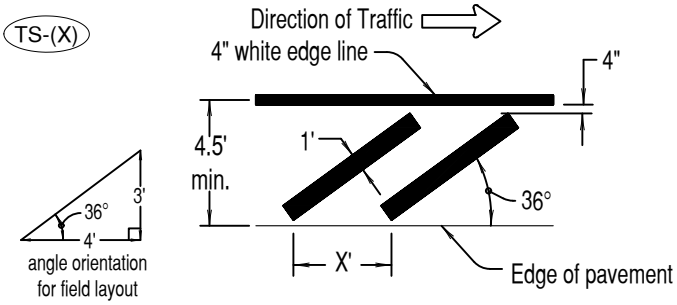
CW-SC



STAGGERED CONTINENTAL CROSSWALK
2' WHITE BARS

Install per standard drawing R-47; Install as Type B-HS preformed thermoplastic

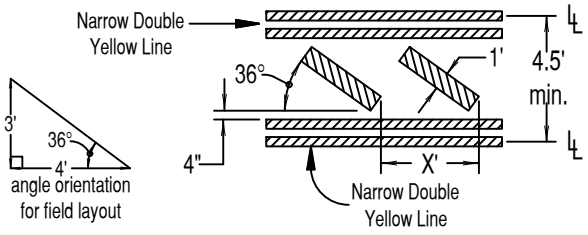
TS-(X)



TRANSVERSE SHOUDER BARS
1' WHITE BARS AT 20' SPACING

X = 20', Typical
(40' spacing may be used where median length exceeds 200')

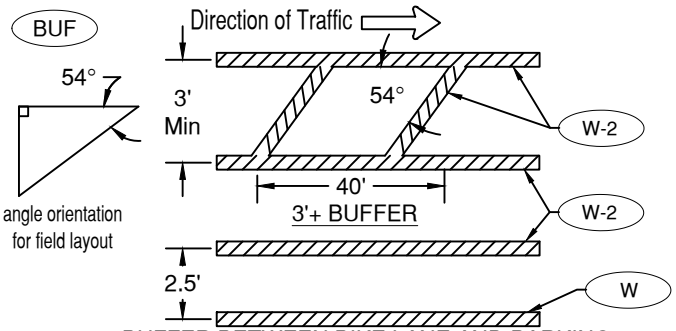
TM-(X)



TRANSVERSE MEDIAN BARS
1' YELLOW BARS AT 20' SPACING

X = 20', Typical
(40' spacing may be used where median length exceeds 200')

BUF

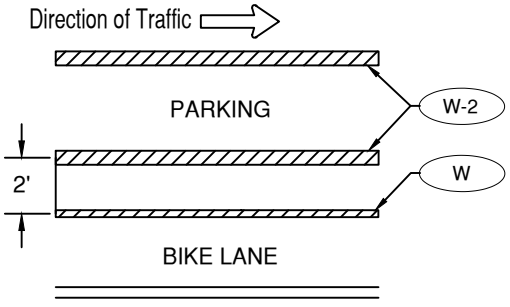


2' BUFFER BETWEEN BIKE LANE AND PARKING

BUFFER STRIPE

Install buffer stripes in thermoplastic / horizontal stripes parallel with traffic in paint

BUFP



PARKING PROTECTED BIKE LANE

DRAWN	AJD
DIV	ROADWAY
REV	DATE

CITY OF BEND

CITY OF BEND

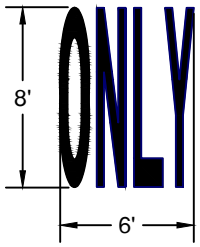
STANDARD DRAWING

710 NW WALL ST., BEND, OREGON 97701

PAVEMENT MARKINGS

SCALE	NTS
DATE	04/16/2026
APPR	
STD DWG	R-42A

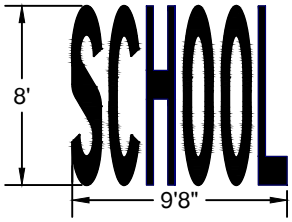
ON



ONLY (white)

Center marking within lane width
Install in Type B - HS Preformed Thermoplastic
For letter proportion details, see current version of FHWA Standard Highway Signs

SCH

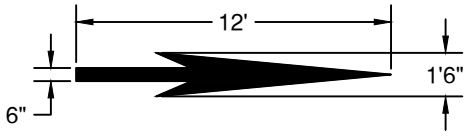


*For travel lanes <11' width, use 6' tall x 8' wide stencil

SCHOOL (white)*

Center marking within lane width
Install in Type B - HS Preformed Thermoplastic
For letter proportion details, see current version of FHWA Standard Highway Signs
Install at school speed zone sign on arterial and collector roads

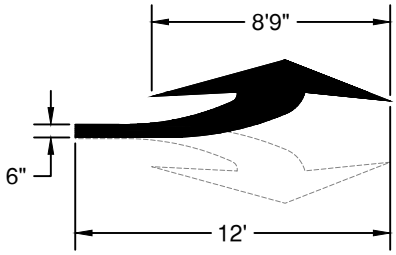
E-SA



ELONGATED STRAIGHT ARROW (white)

For arrow proportion details, see current version of FHWA Standard Highway Signs
Install in Type B - HS Preformed Thermoplastic
Center marking within lane width

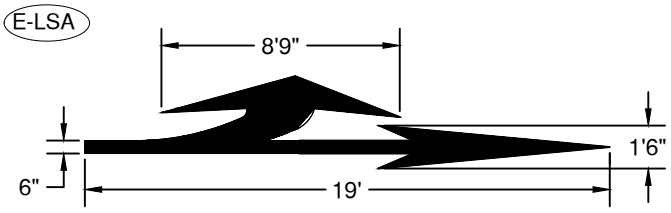
E-LA
E-RA



ELONGATED TURN ARROW (white)

For arrow proportion details, see current version of FHWA Standard Highway Signs
Install in Type B - HS Preformed Thermoplastic
Center marking within lane width
Use E-LA for Left Turn and E-RA for right turn.

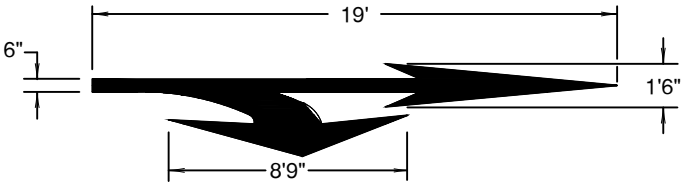
E-LSA



ELONGATED LEFT TURN STRAIGHT ARROW (white)

For arrow proportion details, see current version of FHWA Standard Highway Signs
Install in Type B - HS Preformed Thermoplastic
Center marking within lane width

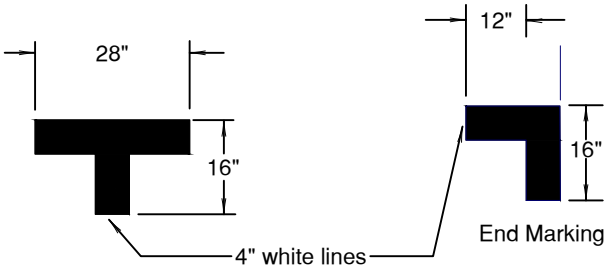
E-RSA



ELONGATED RIGHT TURN STRAIGHT ARROW (white)

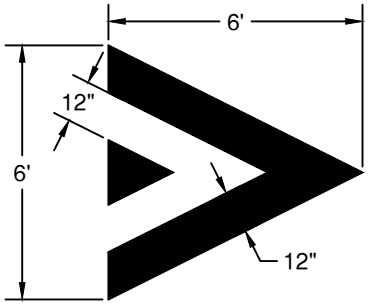
For arrow proportion details, see current version of FHWA Standard Highway Signs
Install in Type B - HS Preformed Thermoplastic
Center marking within lane width

P



ON-STREET PARKING DETAIL (white)

SB

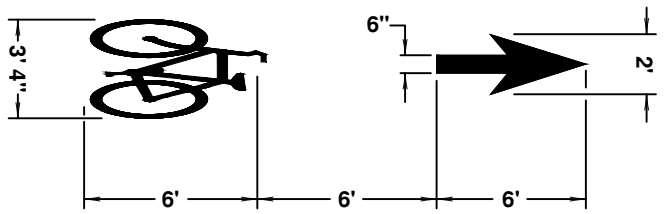


SPEED BUMP MARKING (WHITE)

Install in Type B - HS Preformed Thermoplastic
Center marking within lane width

DRAWN ARI	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 04/16/2026
REV DATE			APPR
		PAVEMENT MARKINGS	STD DWG R-42B

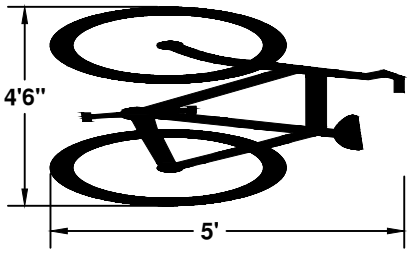
BS



BIKE LANE STANDARD STENCIL (white)

Center marking within lane width
For proportion details, see current version of FHWA Standard Highway Signs

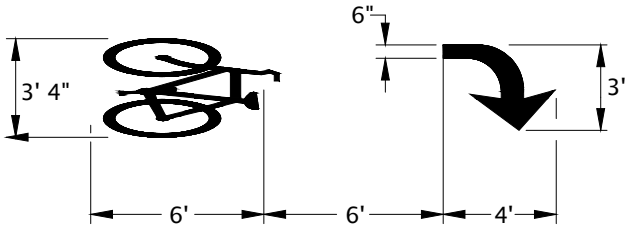
B



BIKE SYMBOL (WHITE)

Install in Type B - HS Preformed Thermoplastic
Center marking within lane width

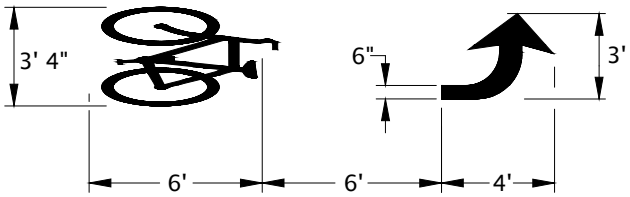
BR



BIKE RIGHT TURN STENCIL (white)

Center marking within lane width
For proportion details, see current version of Standard Highway Signs

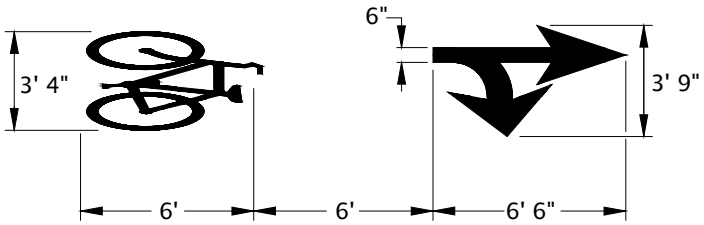
BL



BIKE LEFT TURN STENCIL (white)

Center marking within lane width
For proportion details, see current version of Standard Highway Signs

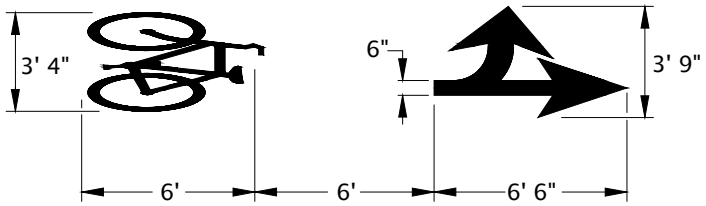
BRS



BIKE RIGHT TURN STRAIGHT STENCIL (white)

Center marking within lane width
For proportion details, see current version of Standard Highway Signs

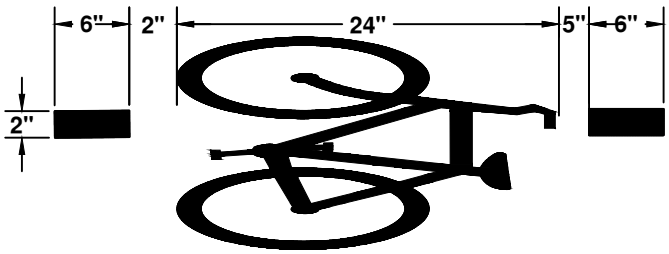
BLS



BIKE LEFT TURN STRAIGHT STENCIL (white)

Center marking within lane width
For proportion details, see current version of Standard Highway Signs

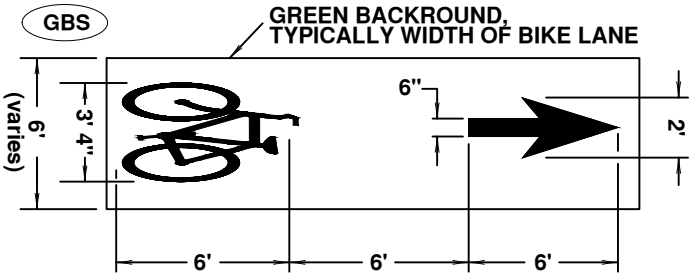
BD



BIKE DETECTOR (WHITE)

Install in Type B - HS Preformed Thermoplastic
Place marking in optimal location for bicycle to actuate the traffic signal.

GBS

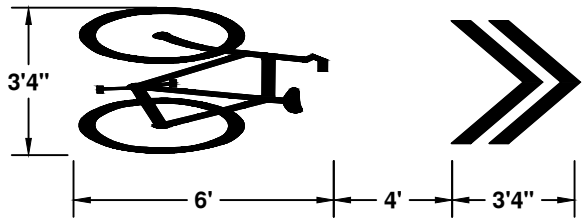


BIKE LANE STANDARD STENCIL (white with green background)

Center marking within lane width
For proportion details, see current version of FHWA Standard Highway Signs

DRAWN ARI	CITY OF BEND	**CITY OF BEND**	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PAVEMENT MARKINGS - BIKE	STD DWG R-43

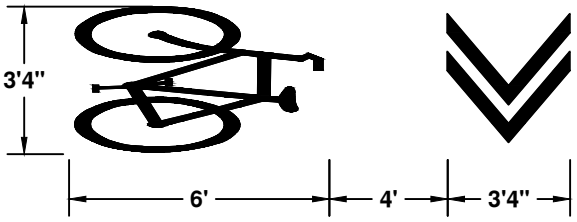
SLM



SHARROWS (WHITE)

Install in Type B - HS Preformed Thermoplastic
Locate marking per R-32
Arrow may be turned in direction of travel.

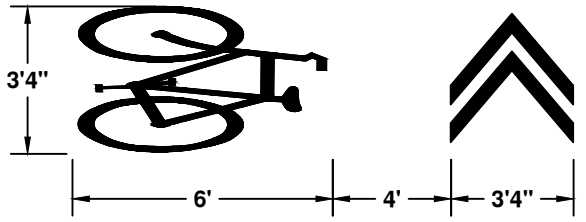
SLM-R



RIGHT TURN SHARROWS (WHITE)

Install in Type B - HS Preformed Thermoplastic
Locate marking per R-32

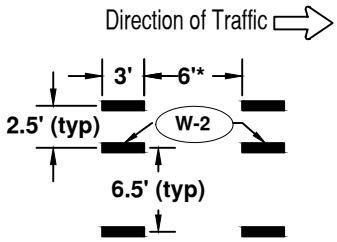
SLM-L



LEFT TURN SHARROWS (WHITE)

Install in Type B - HS Preformed Thermoplastic
Locate marking per R-32

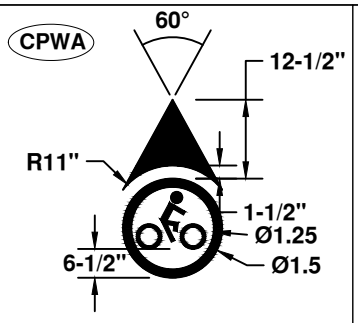
BLE



BIKE MARKING EXTENSION THROUGH INTERSECTION

*** 6' or bike lane width**
Install buffer stripes in Methyl Methacrylate (MMA)

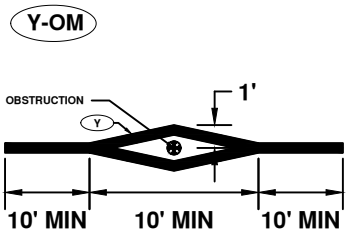
CPWA



COMMON PATH WAYFINDING ARROW

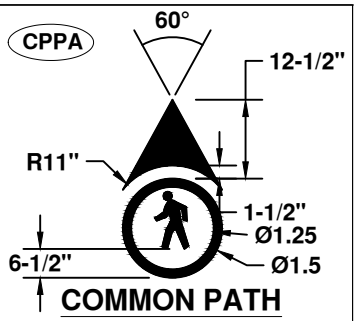
Black inner circle / Green ring / White arrow/bike symbol
Turn arrow in direction of travel.

Y-OM



YELLOW MARKING OBSTRUCTION IN PATH

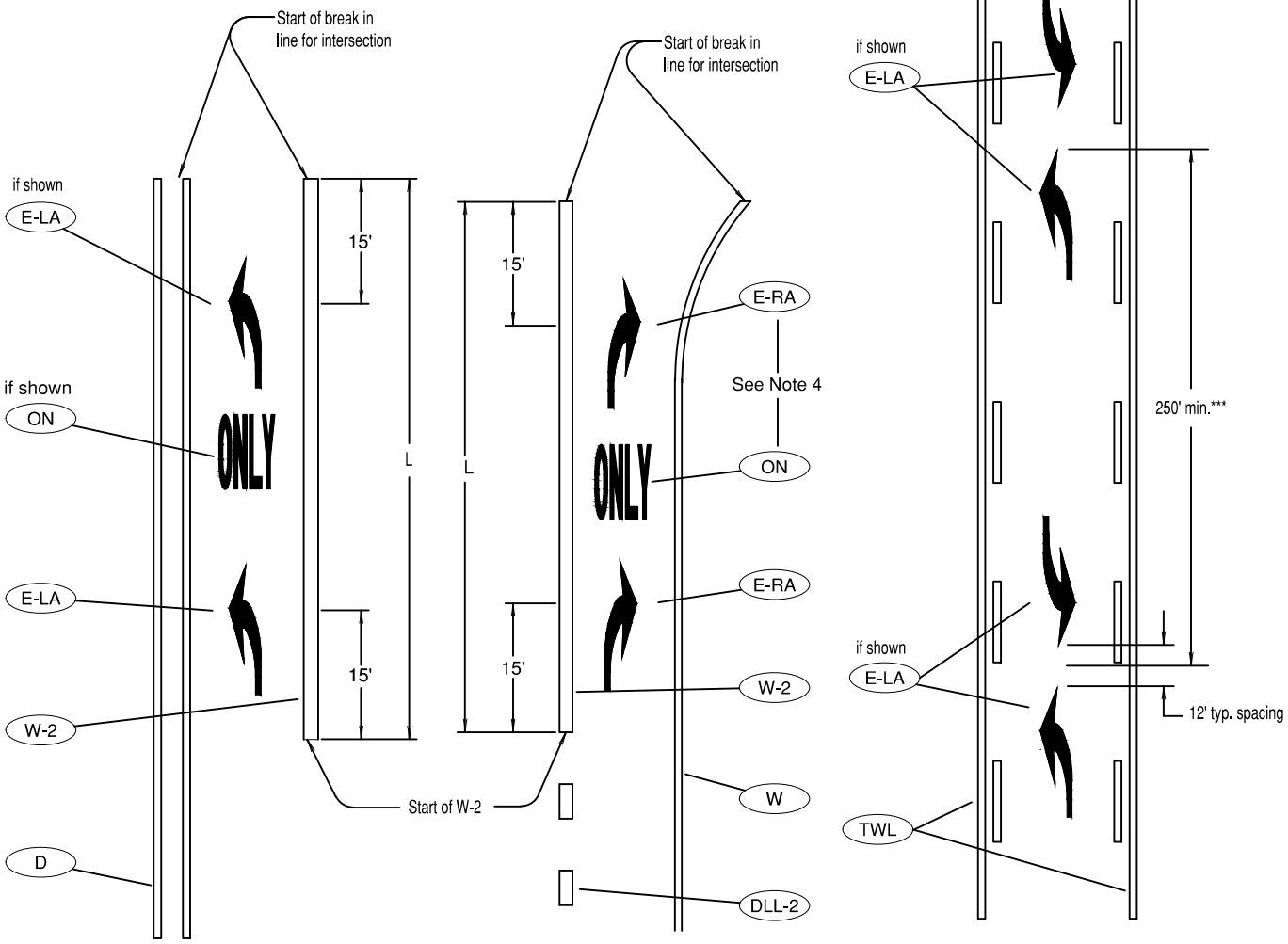
CPPA



COMMON PATH PEDESTRIAN WAYFINDING ARROW

Black inner circle / Yellow ring / White arrow/ped symbol
Turn arrow in direction of travel.

DRAWN ARI	CITY OF BEND	**CITY OF BEND** STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 04/16/2026
REV / DATE			APPR
		PAVEMENT MARKINGS - BIKE	STD DWG R-43A



LANE USE ARROW PLACEMENT (L≤ 400')

DETAIL "A"

LANE USE ARROW PLACEMENT - TRAP LANE

DETAIL "B"

TWO-WAY LEFT TURN LANE ARROW MARKING PLACEMENT

DETAIL "C"

General Notes:

1.) Center pavement marking legends within the lane.

2.) Placement of lane use arrows with respect to the 8" wide white line (W-2) channelization shown in details "A", "B" and "C" apply to both left and right turn lanes.

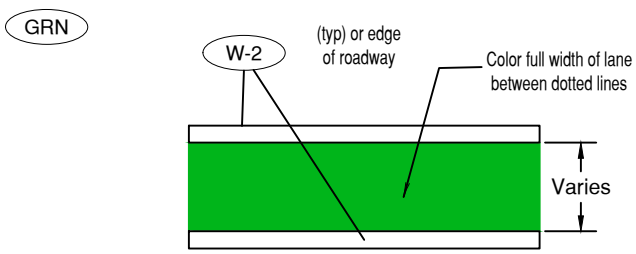
3.) When used for a short turn lane (<40'), the 2nd (downstream) arrow may be omitted.

4.) An ONLY symbol is only required where a through lane approaching an intersection becomes a mandatory turn lane.

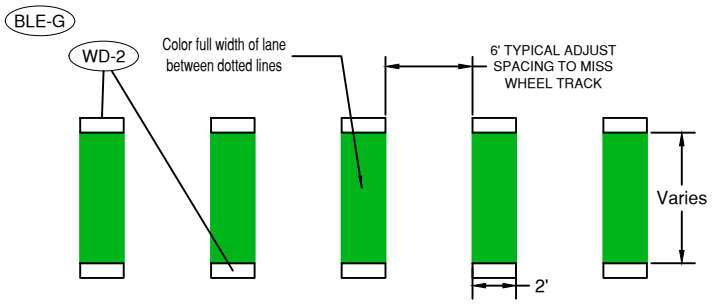
** When L is greater than 200', install 3rd lane use arrow at the midpoint of the turn lane.

To be accompanied by Standard Dwg. Nos. R-40 thru R-43

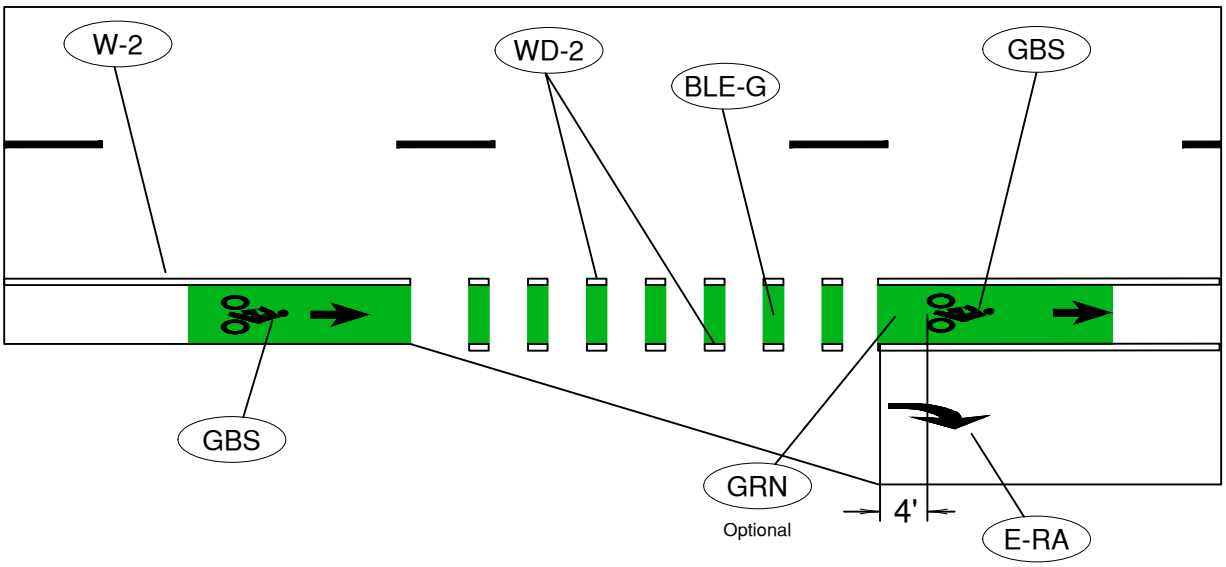
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TURN LANE MARKING LAYOUT	STD DWG R-44



GREEN SUPPLEMENTED BICYCLE LANE
SOLID LANE



GREEN SUPPLEMENTED BICYCLE LANE
DOTTED LINE EXTENSION



TYPICAL GREEN SUPPLEMENTED BICYCLE LANE ACROSS AN ADDED RIGHT TURN LANE TAPER

NOTES:
1. GREEN PAVEMENT MARKING USE PER DESIGN STANDARDS WITH CITY ENGINEER APPROVAL

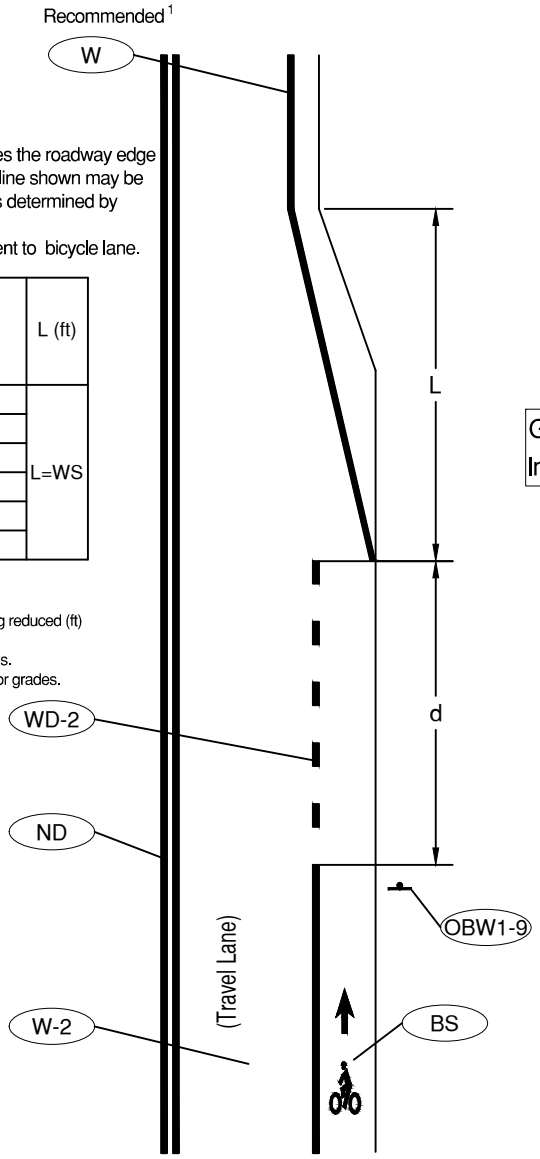
DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 INTERSECTION BIKE SAFETY	SCALE NTS DATE 11/01/2024 APPR STD DWG R-44A

General Notes:

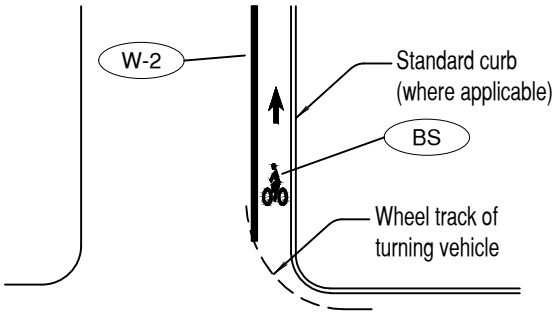
1. Where a curb clearly defines the roadway edge in the taper area, the edge line shown may be omitted in the taper area as determined by engineer judgement.
2. Motor vehicle speed adjacent to bicycle lane.

POSTED OR 85TH PERCENTILE SPEED (MPH) [2]	d (FT)	L (ft)
20	128	L=WS
25	152	
30	176	
35	184	
40	192	
45+	200	

WHERE:
L = taper length
W = width of bicycle lane being reduced (ft)
S = vehicle speed (mph)
"d" distances are for level roads.
Corrections should be made for grades.



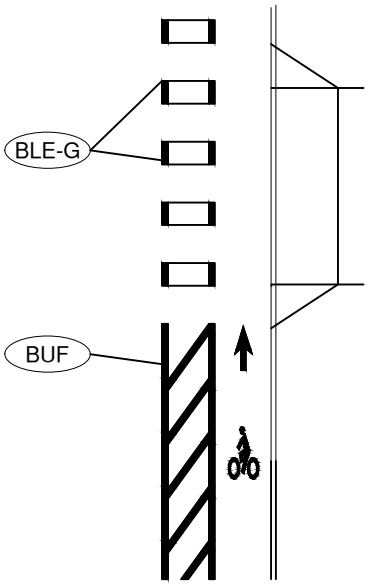
END OF BIKE LANE



SIDE STREET

General Note:
Install bike lane stencil to avoid right turning vehicle wheel tracks.

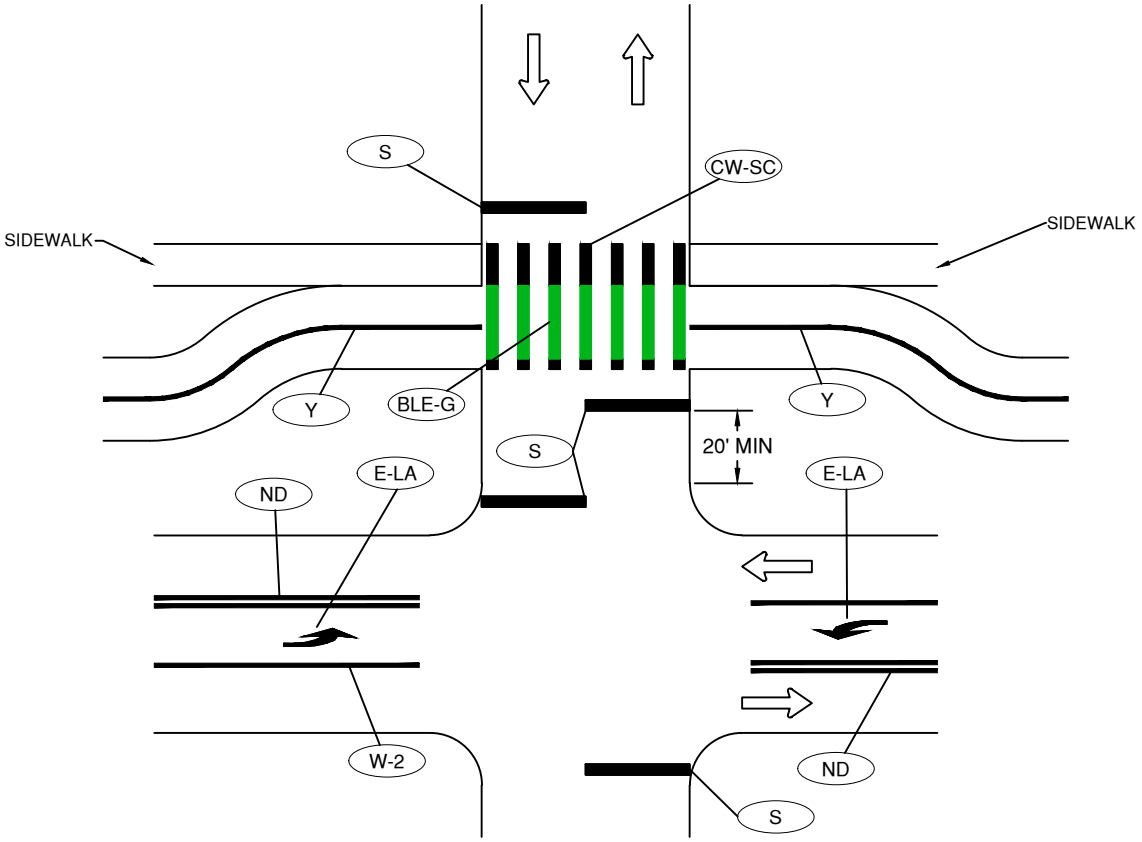
INSTALLATION OF BIKE LANE STENCILS FOLLOWING INTERSECTIONS



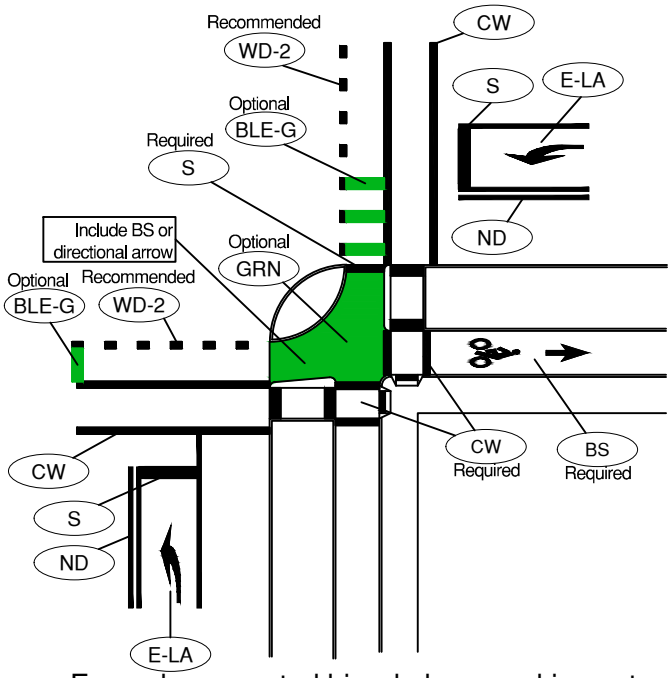
BUFFER BIKE LANE IN CONFLICT AREA
(FOR HIGH VOLUME COMMERCIAL DRIVEWAYS)

To be accompanied by Standard Dwg. Nos. R-40 thru R-43 and R-44A

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		BIKE LANE MARKINGS	STD DWG R-44B



Typical 2-way separated marked bicycle crossing where path offset from street

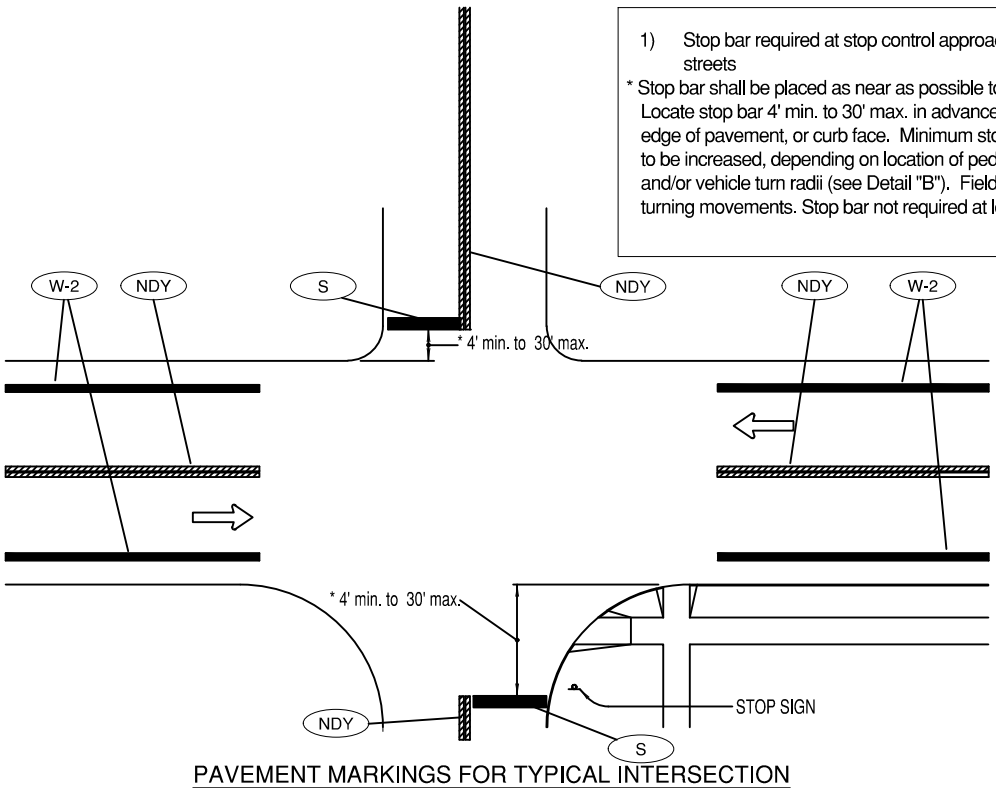


Example separated bicycle lane markings at a signalized intersection

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		BIKE LANE MARKINGS	STD DWG R-44C

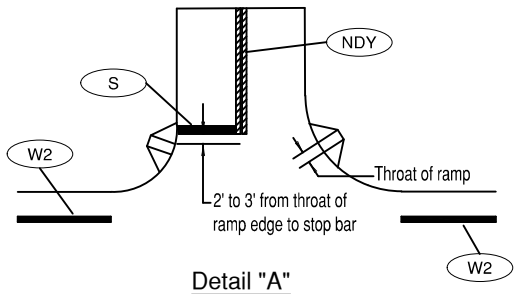
1) Stop bar required at stop control approaches on arterials and collector streets

* Stop bar shall be placed as near as possible to the intersecting traveled way. Locate stop bar 4' min. to 30' max. in advance of the extended fog line, edge of pavement, or curb face. Minimum stop bar distance may need to be increased, depending on location of pedestrian ramps (see Detail "A") and/or vehicle turn radii (see Detail "B"). Field verify sight distance and truck turning movements. Stop bar not required at local/local intersections.

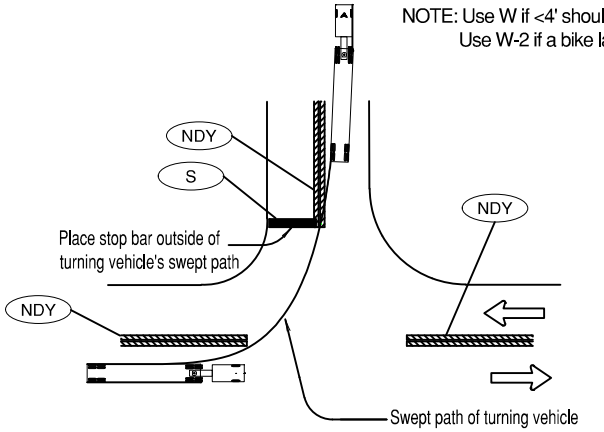


PAVEMENT MARKINGS FOR TYPICAL INTERSECTION

NOTE: Use W if <4' shoulder (no bike lane). Use W-2 if a bike lane exists.



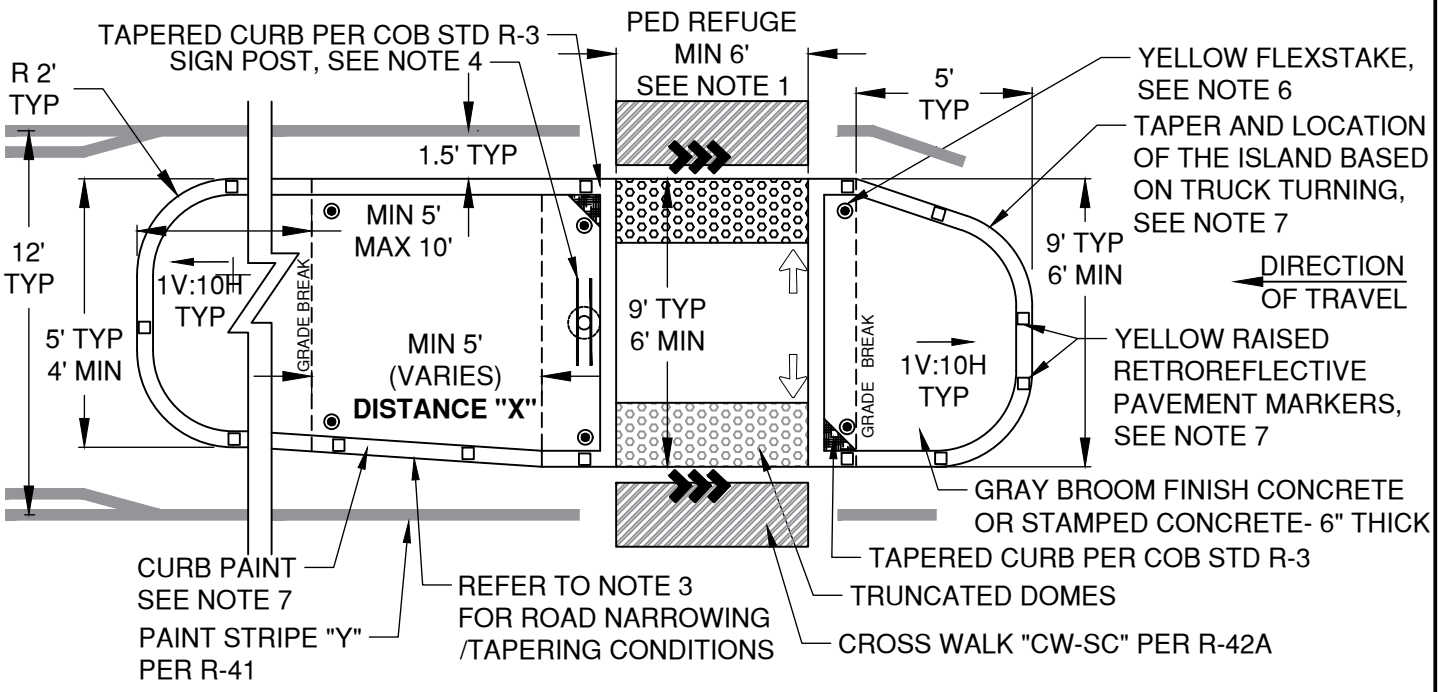
Detail "A"
STOP BAR PLACEMENT WITH RESPECT TO PEDESTRIAN RAMPS



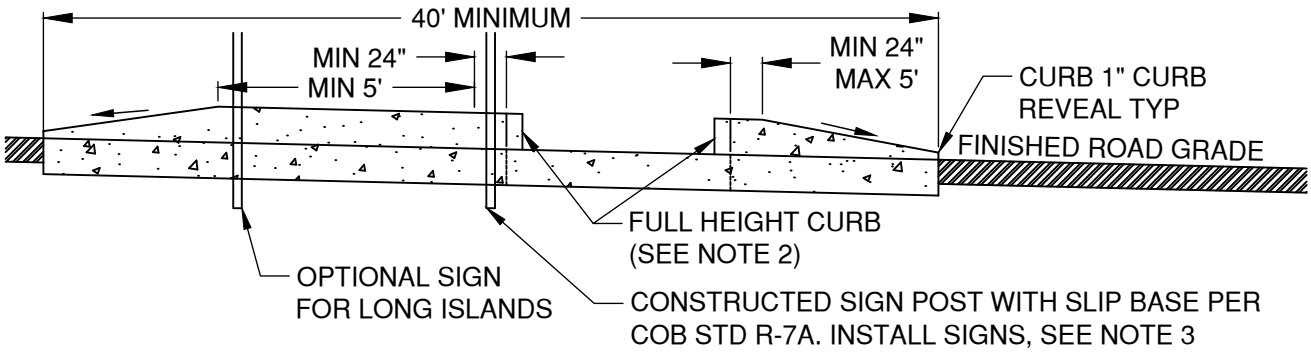
Detail "B"
STOP BAR PLACEMENT WITH RESPECT TO TURN RADII WHERE NO RAMPS

To be accompanied by Standard Dwg. Nos. R-40 thru R-43

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 INTERSECTION PAVEMENT MARKING LAYOUT	SCALE NTS DATE 01/31/2022 APPR STD DWG R-45



5.0% MAX (4.5% DESIGN) AT NON-STOP CONTROLLED INTERSECTION - 0.5% MIN
2.0% TYPICAL

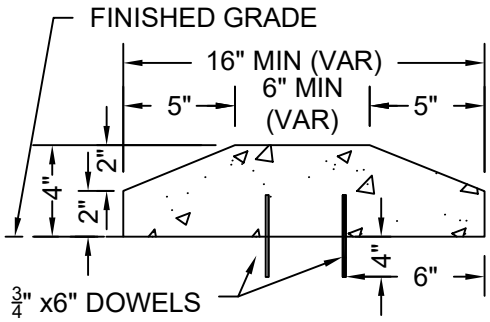


R4-7

R1-6A

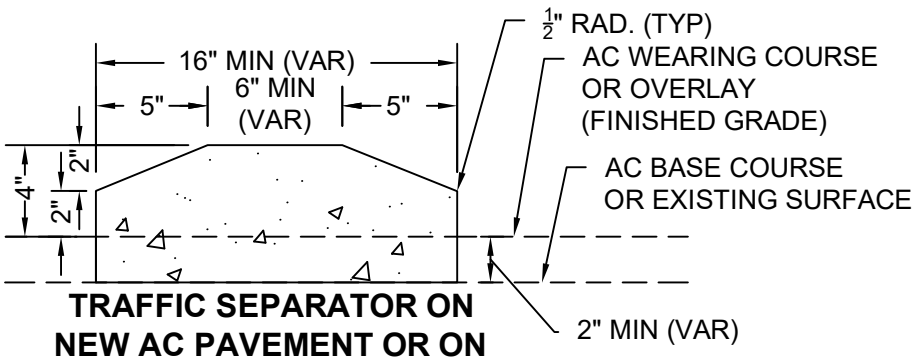
NOTE: SEE STANDARD DRAWING 46.1 FOR PEDESTRIAN REFUGE ISLAND NOTES

DRAWN ARI DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 PEDESTRIAN REFUGE ISLAND	SCALE NTS DATE 04/16/2026 APPR STD DWG R-46

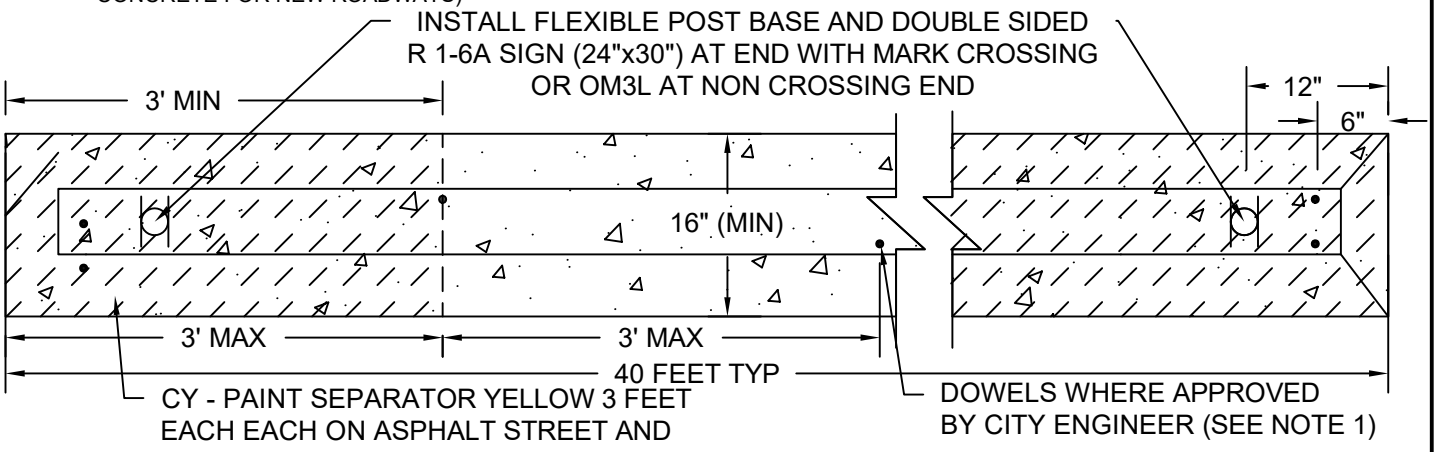


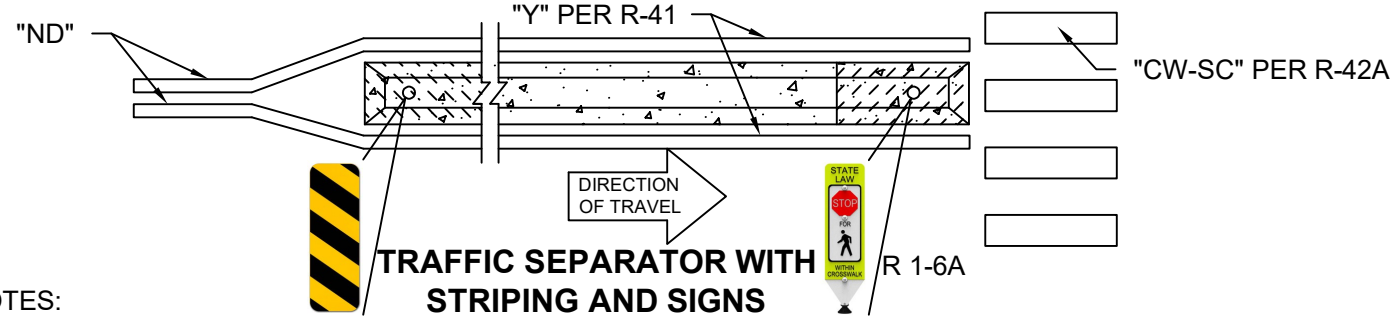
TRAFFIC SEPARATOR ON CONCRETE PAVEMENT

(ONLY USED WITH CITY ENGINEER APPROVAL. SEPARATOR SHOULD BE IMBEDDED WITHIN CONCRETE FOR NEW ROADWAYS)



TRAFFIC SEPARATOR ON NEW AC PAVEMENT OR ON EXISTING AC OVERLAY





TRAFFIC SEPARATOR WITH STRIPING AND SIGNS

NOTES:

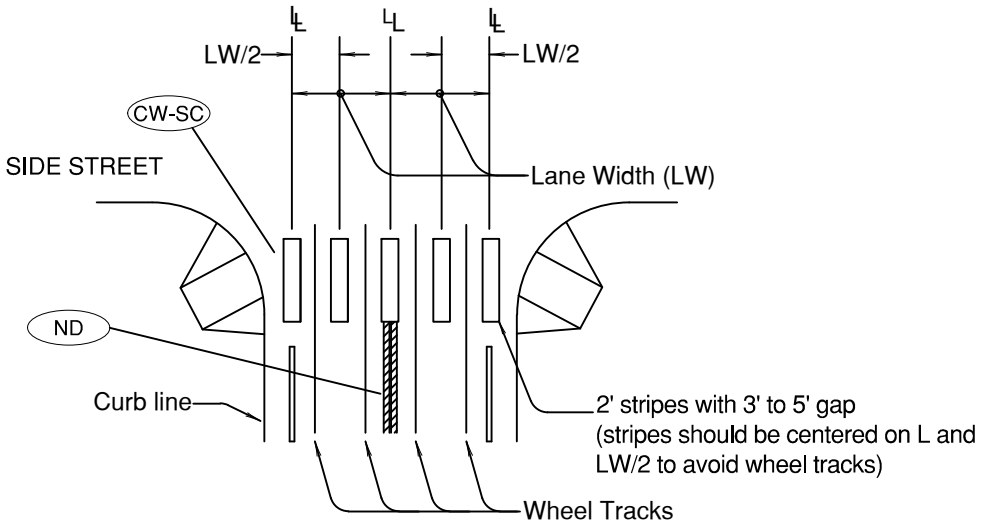
1. DOWELS TO BE USED IN LIMITED CASES WERE APPROVED BY THE CITY ENGINEER (TEMPORARY INSTALLATIONS OR WHERE THE SEPARATOR IS SHORT AND MAY NOT HAVE SUBSTANTIAL WEIGHT TO KEEP IN PLACE). WHEN DOWELS ARE APPROVED, THEY MUST BE 3/4" DIAMETER WITH LENGTH EXTENDING A MINIMUM 6" BELOW THE BOTTOM OF THE SEPARATOR. DOWELS TO BE SET BEFORE CONCRETE HARDENS.
2. TRANSVERSE JOINTS IN CONCRETE TRAFFIC SEPARATORS AND TRANSITIONS TO MATCH JOINTS IN CONCRETE PAVEMENT AND TO BE OF SAME TYPE.
3. SET JOINT SPACING 200' MAX FOR EXPANSION AND 15' MAX FOR CONTRACTION.
4. SITE CONDITIONS MAY REQUIRE A PROJECT SPECIFIC DRAIN OPENING WHICH CONSIDERS ROADWAY CONDITIONS (SHEET FLOW LIMITS, CROSS SLOPE, SUPER ELEVATION, ETC). WHERE BREAKS ARE REQUIRED IN THE SEPARATOR, THE OPENS MUST BE 12".
5. PLACE APPROVED PREFORMED FILLER ALONG ONE SIDE OF THE CONC. TRANSITIONS IN CONCRETE PAVEMENT AND AROUND ALL CURBED POINTS. WHERE SEPARATOR IS INSTALLED WITHIN ASPHALT, APPLY TACK COATS TO CONCRETE PRIOR TO PAVING.

DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 TRAFFIC SEPERATOR	SCALE NTS DATE 11/01/2024 APPR STD DWG R-46A

NOTES:

1. DOWELS TO BE USED IN LIMITED CASES WERE APPROVED BY THE CITY ENGINEER (TEMPORARY INSTALLATIONS OR WHERE THE SEPARATOR IS SHORT AND MAY NOT HAVE SUBSTANTIAL WEIGHT TO KEEP IN PLACE). WHEN DOWELS ARE APPROVED, THEY MUST BE 3/4" DIAMETER WITH LENGTH EXTENDING A MINIMUM 6" BELOW THE BOTTOM OF THE SEPARATOR. DOWELS TO BE SET BEFORE CONCRETE HARDENS.
2. TRANSVERSE JOINTS IN CONCRETE TRAFFIC SEPARATORS AND TRANSITIONS TO MATCH JOINTS IN CONCRETE PAVEMENT AND TO BE OF SAME TYPE.
3. SET JOINT SPACING 200' MAX FOR EXPANSION AND 15' MAX FOR CONTRACTION.
4. SITE CONDITIONS MAY REQUIRE A PROJECT SPECIFIC DRAIN OPENING WHICH CONSIDERS ROADWAY CONDITIONS (SHEET FLOW LIMITS, CROSS SLOPE, SUPER ELEVATION, ETC). WHERE BREAKS ARE REQUIRED IN THE SEPARATOR, THE OPENS MUST BE 12".
5. PLACE APPROVED PREFORMED FILLER ALONG ONE SIDE OF THE CONC. TRANSITIONS IN CONCRETE PAVEMENT AND AROUND ALL CURBED POINTS. WHERE SEPARATOR IS INSTALLED WITHIN ASPHALT, APPLY TACK COATS TO CONCRETE PRIOR TO PAVING.

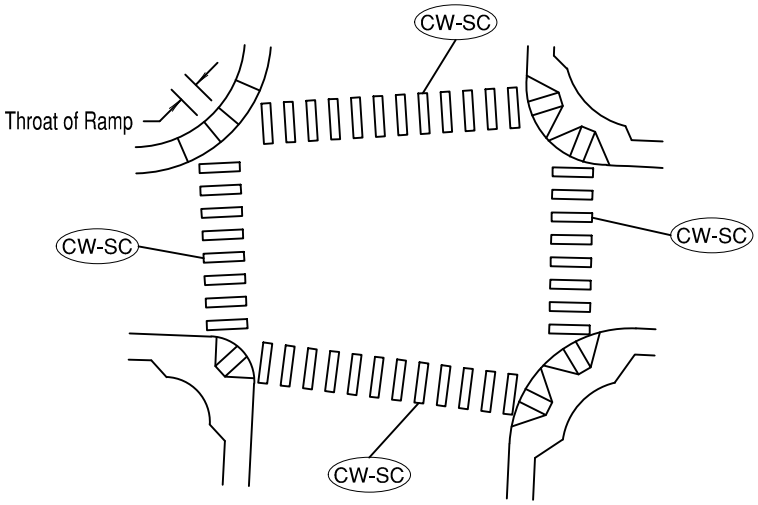
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TRAFFIC SEPARATOR	STD DWG R-46A.1



STAGGERED CONTINENTAL LAYOUT

General Note:

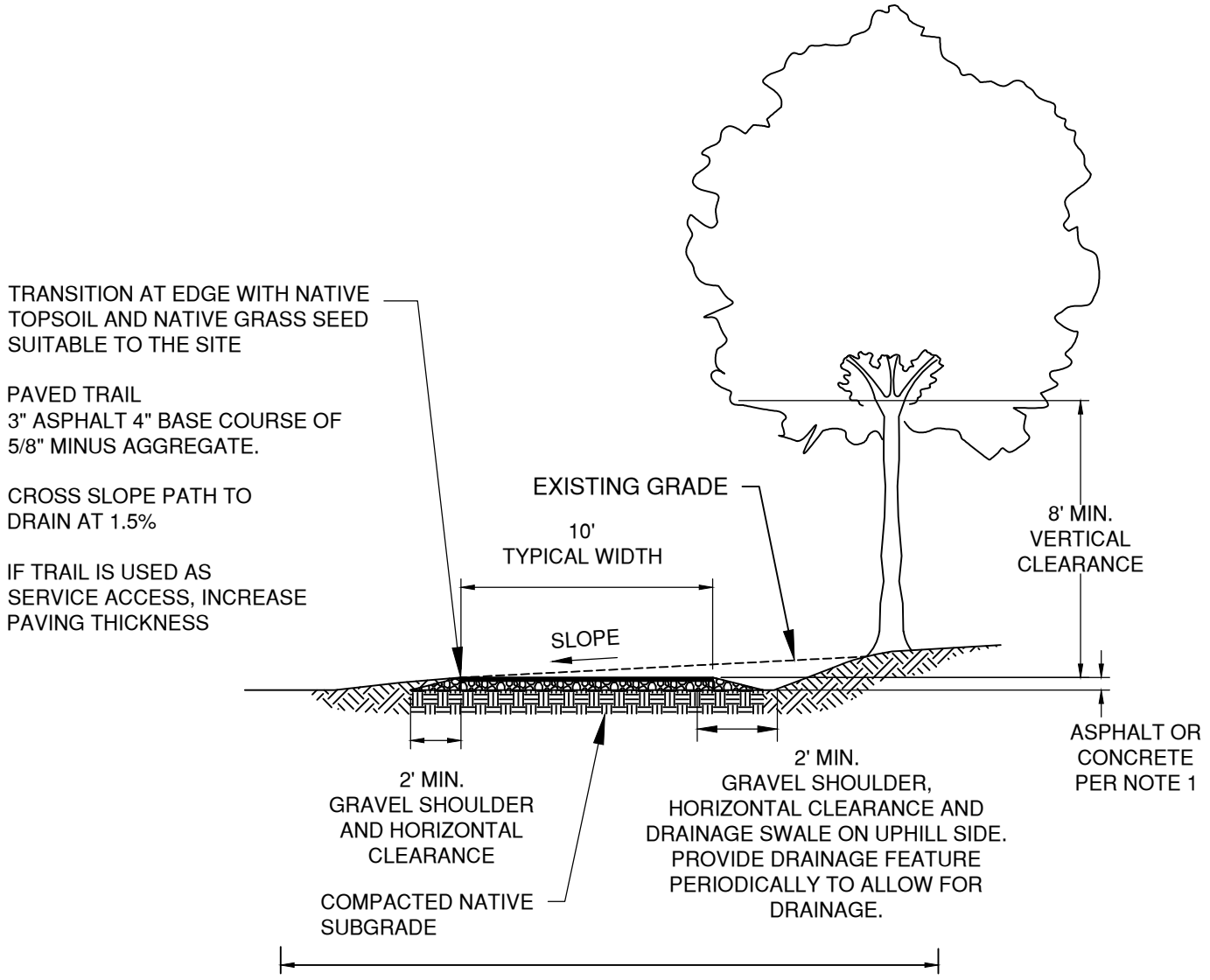
1. Install crosswalk bars such that the throat of the ADA ramp is entirely within crosswalk markings, or 5' back of extended fog line, edge of pavement, or curb face.



STANDARD CROSSWALK MARKING AT 4-WAY CONTROLLED INTERSECTION

To be accompanied by Standard Dwg. Nos. R-40 thru R-43

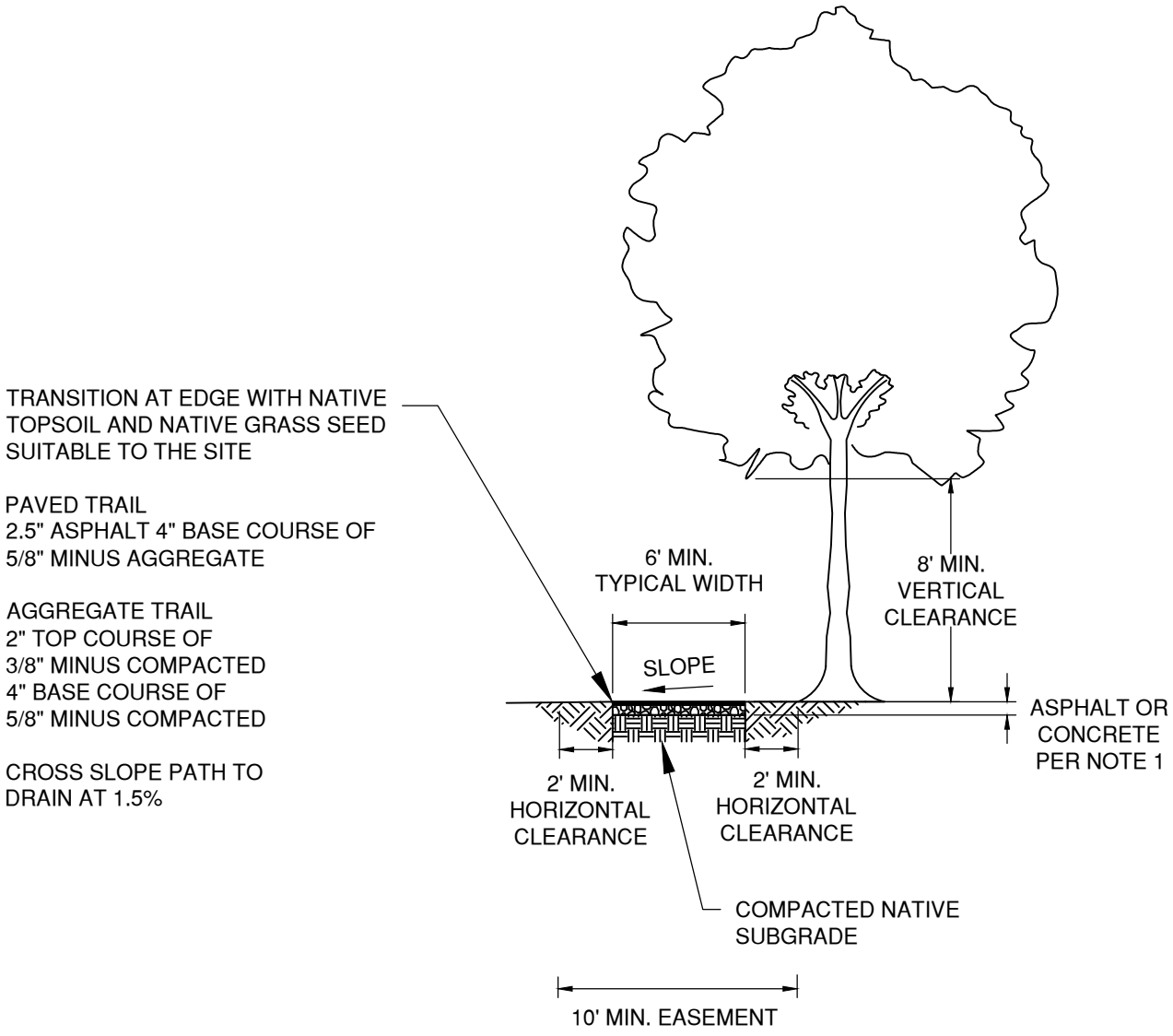
DRAWN ARI	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 04/16/2026
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CROSSWALK MARKINGS	STD DWG R-47



NOTES:

1. PRIMARY TRAIL SHALL BE PAVED WITH ASPHALT OR CONCRETE IN THE RIGHT-OF-WAY OR ADJACENT TO STREETS. OUTSIDE OF THE RIGHT-OF-WAY TRAIL MAY BE AGGREGATE AS APPROVED.
2. PRIMARY TRAILS ARE TYPICALLY FACILITIES OUTSIDE OF THE PUBLIC RIGHT-OF-WAY THAT ARE OWNED AND MAINTAINED BY THE BEND PARKS AND RECREATION DISTRICT OR PRIVATELY. (SEE STANDARD CROSS-SECTIONS FOR CITY SHARED USE PATHS IN THE RIGHT-OF-WAY.)
3. WHERE OUTSIDE OF RIGHT-OF-WAY, TRAIL EASEMENT DEDICATION IS REQUIRED INCLUDING A PUBLIC ACCESS EASEMENT AND UTILITY EASEMENT WHERE APPLICABLE.
4. TRAIL ALIGNMENTS ARE ENCOURAGED TO MEANDER AND NOT BE DESIGNED AS FENCED CANYONS.
5. TRAILS WITHIN RIGHT-OF-WAY SHALL MEET PROWAG REQUIREMENTS. TRAILS OUT OF RIGHT-OF-WAY SHALL MEET THE REQUIREMENTS OF THE UNITED STATES ACCESS BOARD ACCESSIBILITY STANDARDS FOR FEDERAL OUTDOOR DEVELOPED AREAS.

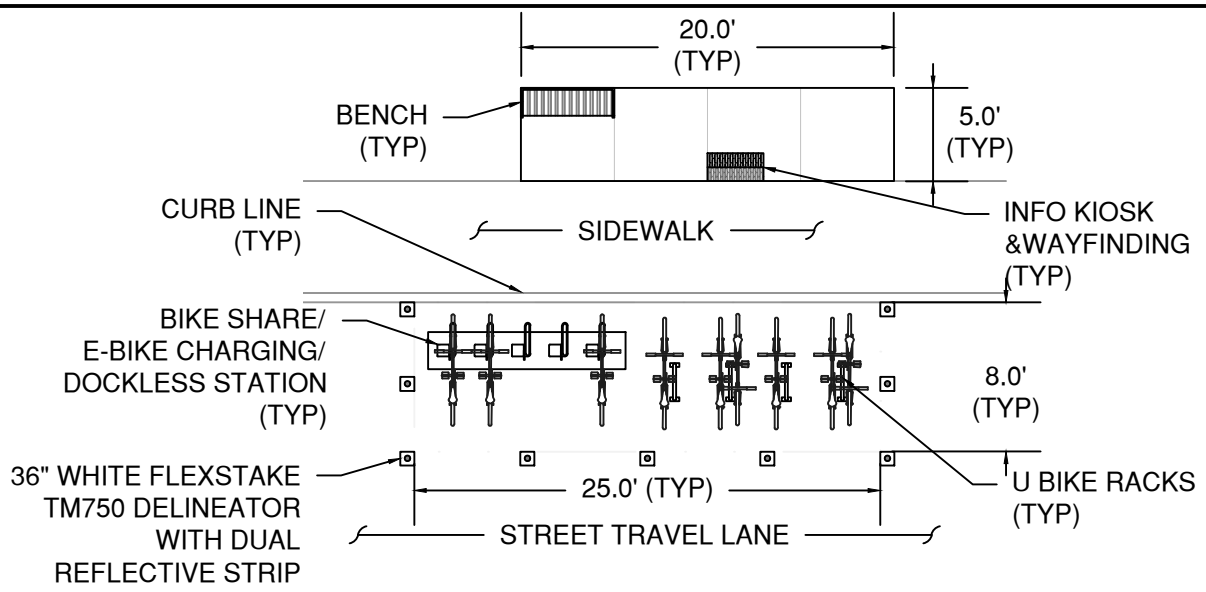
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PRIMARY TRAIL	STD DWG R-48



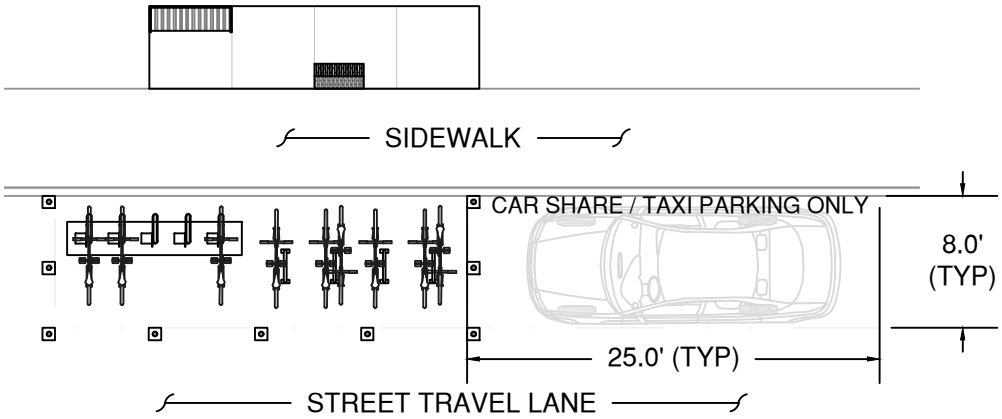
NOTES:

1. CONNECTOR TRAIL SHALL BE PAVED WITH ASPHALT OR CONCRETE IN THE RIGHT-OF-WAY OR ADJACENT TO STREETS. OUTSIDE OF THE RIGHT-OF-WAY TRAIL MAY BE AGGREGATE AS APPROVED.
2. CONNECTOR TRAILS ARE TYPICALLY FACILITIES OUTSIDE OF THE PUBLIC RIGHT-OF-WAY THAT ARE OWNED AND MAINTAINED BY THE BEND PARKS AND RECREATION DISTRICT OR PRIVATELY. (SEE STANDARD CROSS-SECTIONS FOR CITY SHARED USE PATHS IN THE RIGHT-OF-WAY.)
3. WHERE OUTSIDE OF RIGHT-OF-WAY, TRAIL EASEMENT DEDICATION IS REQUIRED INCLUDING A PUBLIC ACCESS EASEMENT AND UTILITY EASEMENT WHERE APPLICABLE.
4. TRAIL ALIGNMENTS ARE ENCOURAGED TO MEANDER AND NOT BE DESIGNED AS FENCED CANYONS.
5. NATIVE SURFACE TRAILS MAY BE USED WITHIN PARKS OR PRIVATE DEVELOPMENTS TO PROVIDE CONNECTIONS TO PRIMARY AND OTHER CONNECTOR TRAILS.
6. TRAILS WITHIN RIGHT-OF-WAY SHALL MEET PROWAG REQUIREMENTS. TRAILS OUT OF RIGHT-OF-WAY SHALL MEET THE REQUIREMENTS OF THE UNITED STATES ACCESS BOARD ACCESSIBILITY STANDARDS FOR FEDERAL OUTDOOR DEVELOPED AREAS AT A MINIMUM.

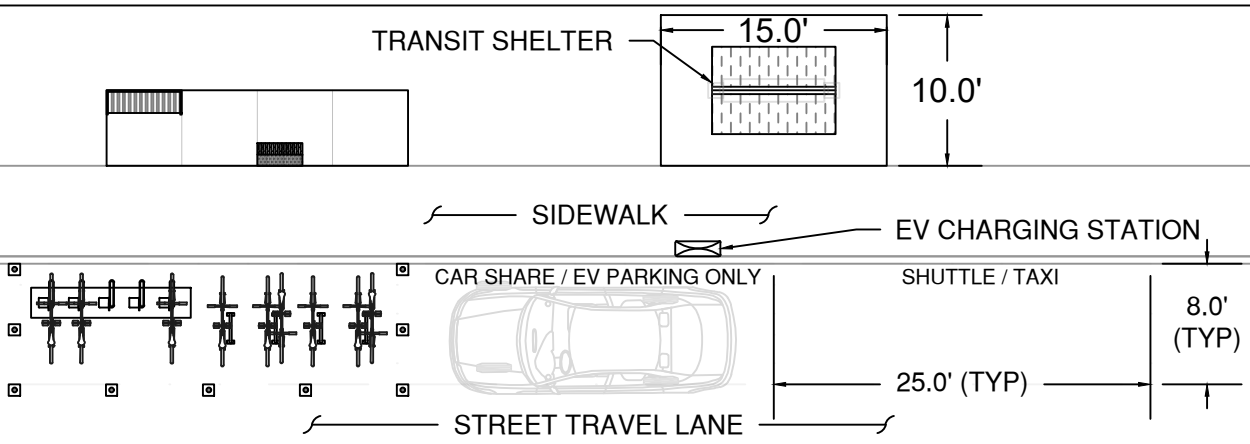
DRAWN AJD DIV ROADWAY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		CONNECTOR TRAIL	STD DWG R-49



SMALL MOBILITY POINT



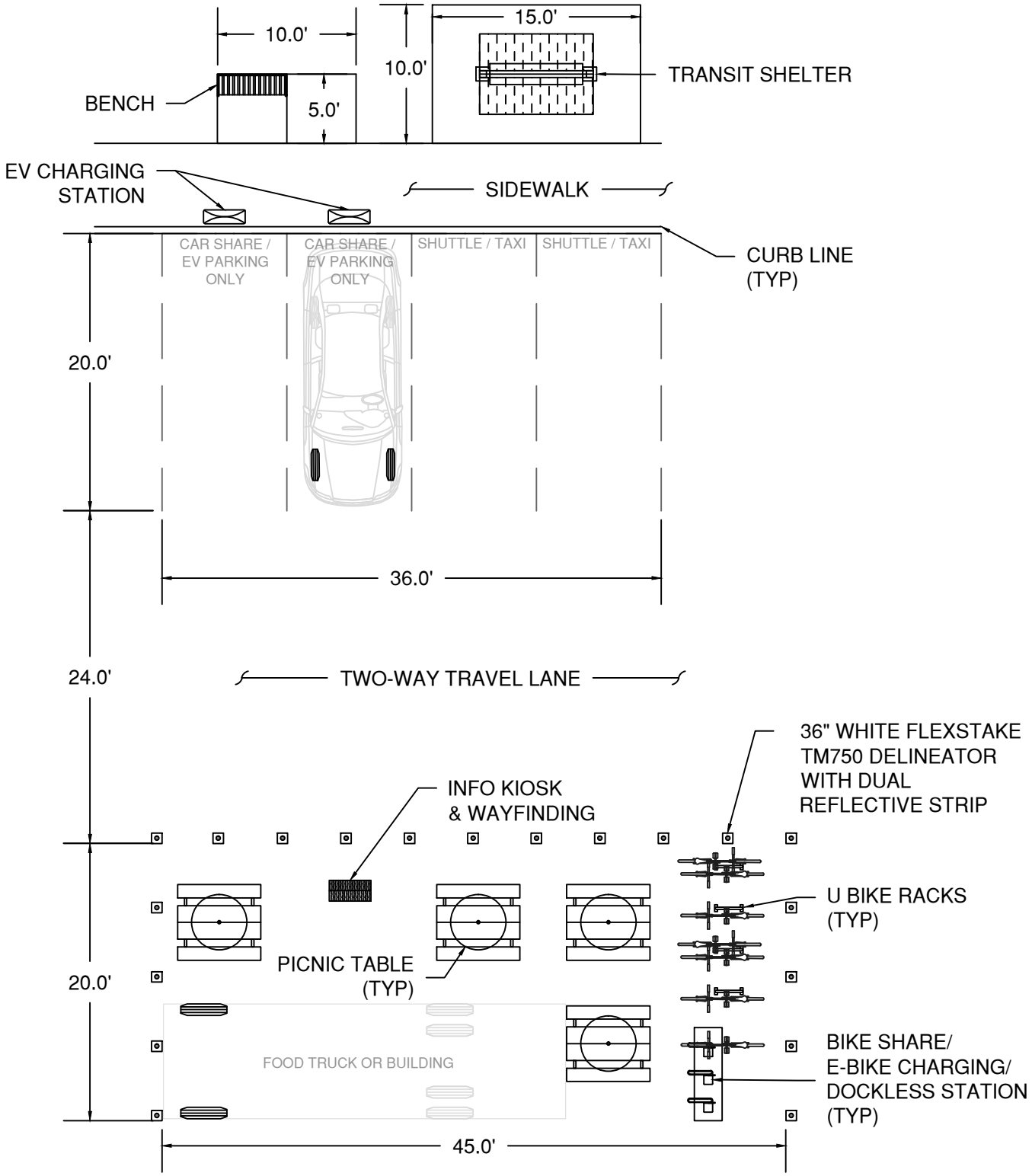
MEDIUM MOBILITY POINT



MEDIUM (+) MOBILITY POINT

NOTES:
1. LOCATION & EXISTING CONDITIONS WILL DETERMINE LAYOUT
2. FINAL LAYOUT MUST MEET MINIMUM ADA STANDARDS FOR ACCESSIBLE DESIGN
3. ALL CONCEPTS SHOWN ARE FOR SPATIAL REPRESENTATION ONLY
4. BICYCLE PARKING STATIONS MAY BE PLACED WITH IN ON-STREET PARKING SPACES OR ON PRIVATE PROPERTY

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV ROADWAY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		MOBILITY POINTS - SMALL/MEDIUM	STD DWG R-50A

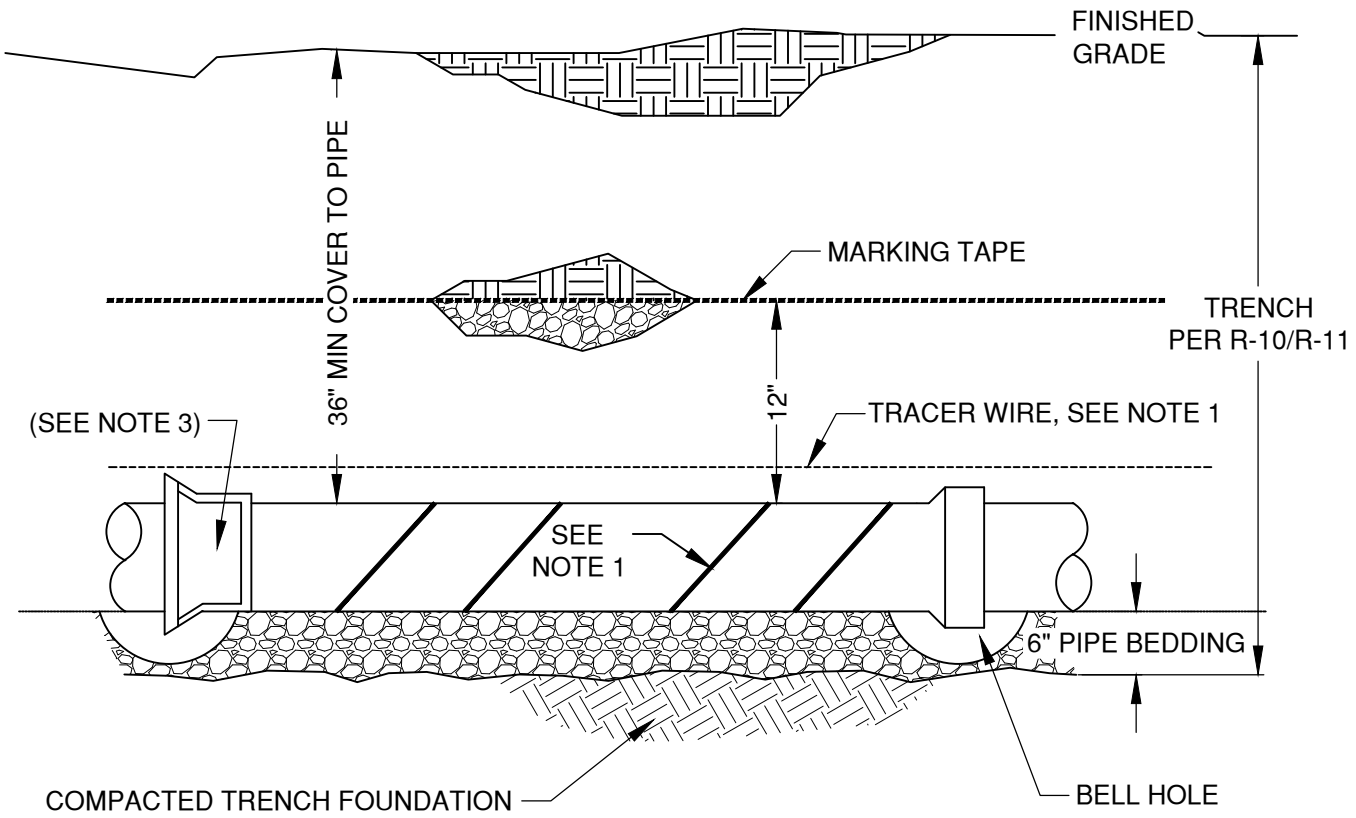


NOTES:
1. LOCATION & EXISTING CONDITIONS WILL DETERMINE LAYOUT
2. FINAL LAYOUT MUST MEET MINIMUM ADA STANDARDS FOR ACCESSIBLE DESIGN
3. ALL CONCEPTS SHOWN ARE FOR SPATIAL REPRESENTATION ONLY

DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV ROADWAY			DATE 11/01/2024
REV / DATE			APPR
		MOBILITY POINTS - LARGE	STD DWG R-50B

CITY OF BEND STANDARD DRAWINGS

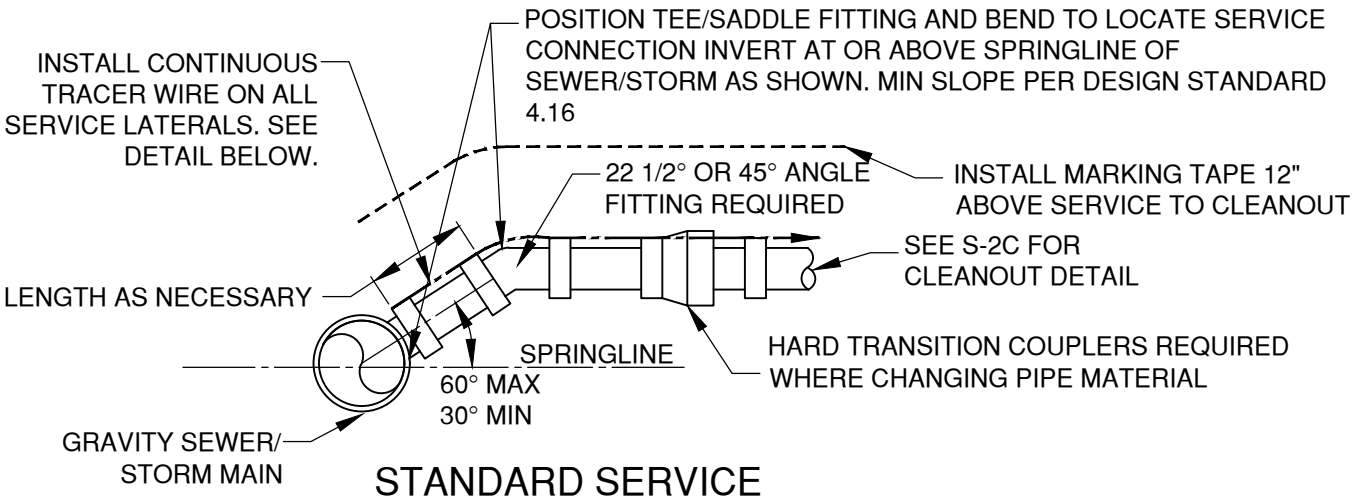
Sanitary (S)



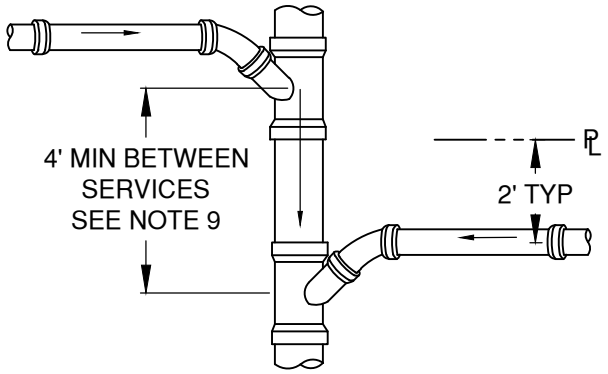
NOTES:

1. FOR PRESSURE AND VACUUM SEWER MAINS ONLY, TRACER WIRE SHALL BE CENTERED ON TOP OF THE MAIN, AS CLOSE TO THE MAIN AS POSSIBLE. THE MAIN SHALL BE WRAPPED WITH MARKING TAPE A MIN OF 4 WRAPS PER 20 FEET OF MAIN. TRACER WIRE IS NOT REQUIRED ON GRAVITY SEWER MAIN.
2. PLACE TRACER WIRE ON GRAVITY, PRESSURE, AND VACUUM SEWER SERVICES. TRACER WIRE AND MARKING TAPE TO BE PER SPECIFICATION SECTION 00445.11.
3. TRANSITION FITTING SHALL BE A HARD COUPLER WHERE CHANGING PIPE MATERIAL
4. WHEN A SEWER LINE IS LOCATED ABOVE OR WITHIN 18" BELOW A WATERLINE, THE SEWER SHALL BE CONSTRUCTED WITH A MIN OF 20 LF OF AWWA C900 OR AWWA C905 PIPE CENTERED AT THE WATERLINE PER OAR 333-061-0050(9) AND BE APPROVED BY CITY/STATE.
5. WHEN INSTALLING A WATER LINE THAT CROSSES BELOW OR WITHIN 18 INCHES ABOVE A NON-POTABLE LINE, FOLLOW OAR 333-061-0050(9). ALL NON-POTABLE LINES SHALL BE TREATED AS "SEWER" LINES AS DESCRIBED IN OAR 333-061-0050(9).
6. COMPACTION SHALL MEET 00405.46(c) PER COB SPECIAL PROVISIONS

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		SEWER MAIN TYPICAL PROFILE	STD DWG S-1

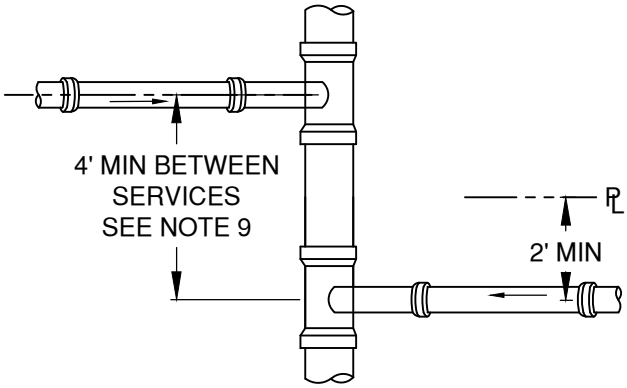


STANDARD SERVICE



WYE SERVICE CONNECTION

(FOR USE ON MAINS 12" AND SMALLER)



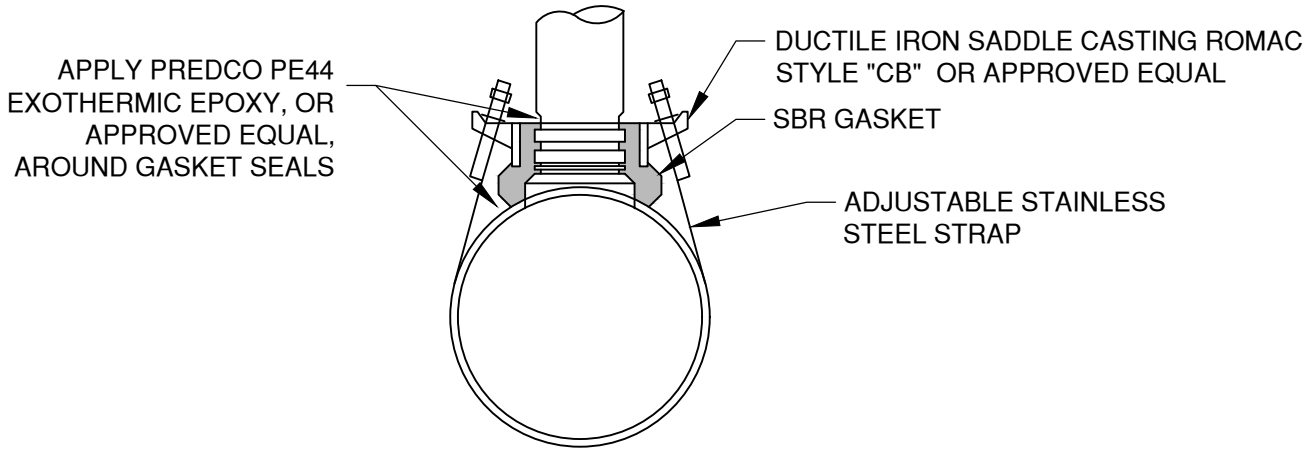
TEE SERVICE CONNECTION

(FOR USE ON MAINS LARGER THAN 12" OR ON EXISTING MAINS FOR INFILL SERVICE CONNECTIONS)

NOTES:

1. ALL TRENCHES TO CONFORM TO STD DWG R-10
2. SERVICES OFF NEW MAINS SHALL BE WYE OR TEE CONNECTIONS. SEE STD DWG S-2B FOR SERVICES OFF EXISTING MAINS
3. TRACER WIRE REQUIRED ON ALL SEWER / STORM SERVICES. MARKING TAPE SHALL BE INSTALLED AS SHOWN.
4. SEWER / STORM CONNECTION FROM THE PROPERTY LINE/ROW LINE TO THE CLEAN OUT NEAR THE BUILDING FOUNDATION REQUIRES A PLUMBING PERMIT.
5. WHEN A SEWER SERVICE IS LOCATED ABOVE OR WITHIN 18" BELOW A WATERLINE, THE SEWER SERVICE SHALL BE CONSTRUCTED WITH A MIN. 20 LF OF AWWA C900 OR AWWA C905 PIPE CENTERED AT THE WATERLINE PER OAR 333-061-0050(9).
6. STANDARD RESIDENTIAL SEWER SERVICES ARE 4"Ø. COMMERCIAL, INDUSTRIAL SEWER SERVICES ARE 6"Ø UNLESS OTHERWISE SIZED LARGER BY THE SITE'S ENGINEER.
7. WHERE A SERVICE CROSSES A NEW CURB, STAMP THE FACE OF CURB PER STD DWG R-3.
8. GRAVITY SEWER STANDARDS APPLY TO STORM SEWER MAINS.
9. MINIMUM 3' SECTIONS OF PIPE ARE REQUIRED BETWEEN FITTINGS.
10. ALL STORM SEWER LATERALS MUST COMPLY WITH CITY SEWER STANDARDS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 03/22/2023
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		GRAVITY SEWER/STORM SERVICES ON NEW MAINS	STD DWG S-2A

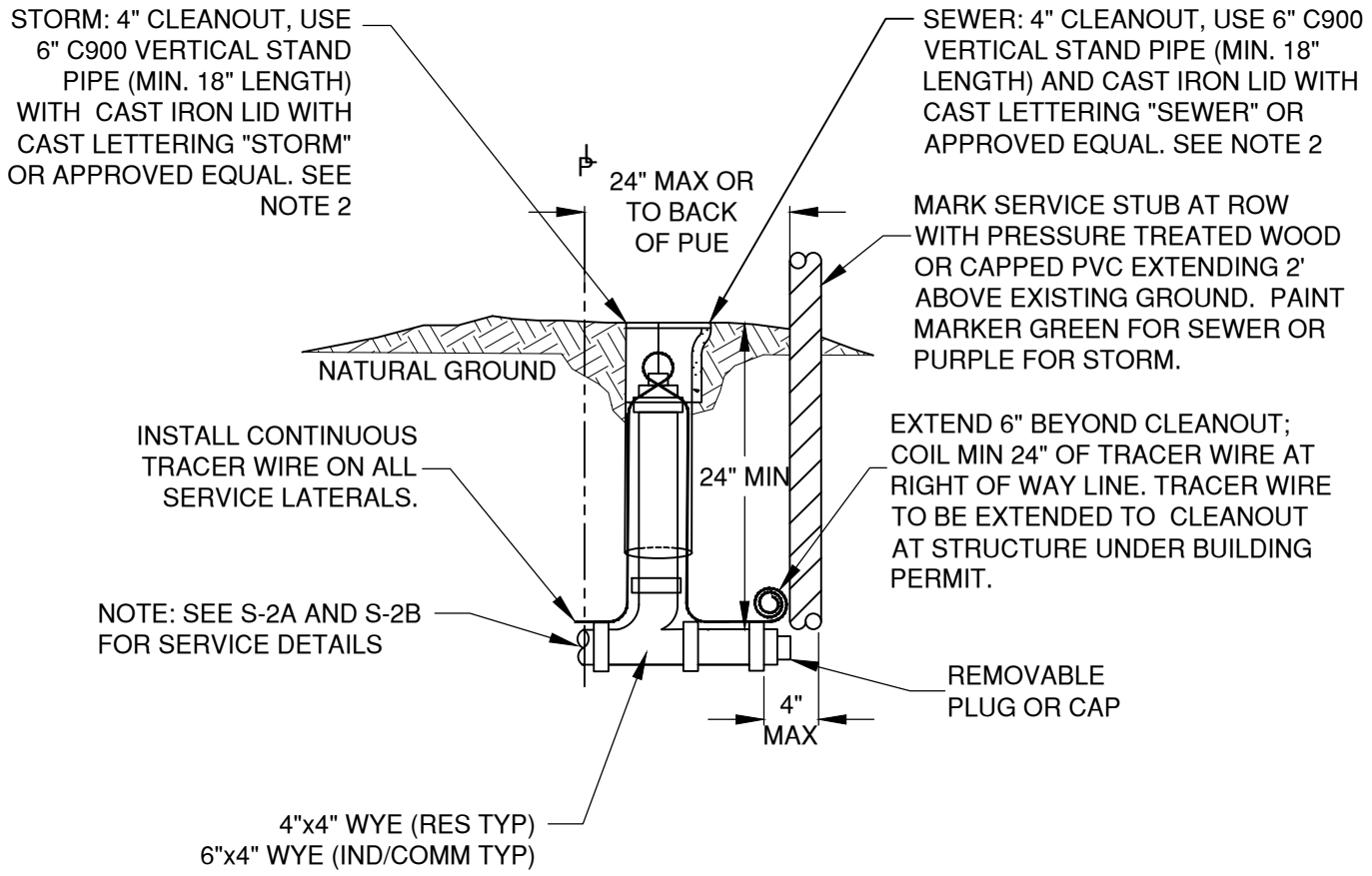


SEWER SADDLE

NOTES:

1. INSTALL SERVICE LATERAL PER STD DWG S-2A
2. CONNECTION TO EXISTING MAINS MAY BE CUT-IN FITTINGS PER STD DWG S-2A OR TAPS PER THIS DETAIL. PVC MAINS TO UTILIZE CUT IN FITTINGS UNLESS APPROVED BY THE CITY ENGINEER.
3. SEWER SADDLE SHALL BE ROMAC STYLE "CB" OR APPROVED EQUAL.
4. INSTALL CONNECTION PER THE MANUFACTURER'S RECOMMENDATIONS.
5. GASKET SEAL EPOXY NOT TO BE INSTALLED ON PVC MAINS.

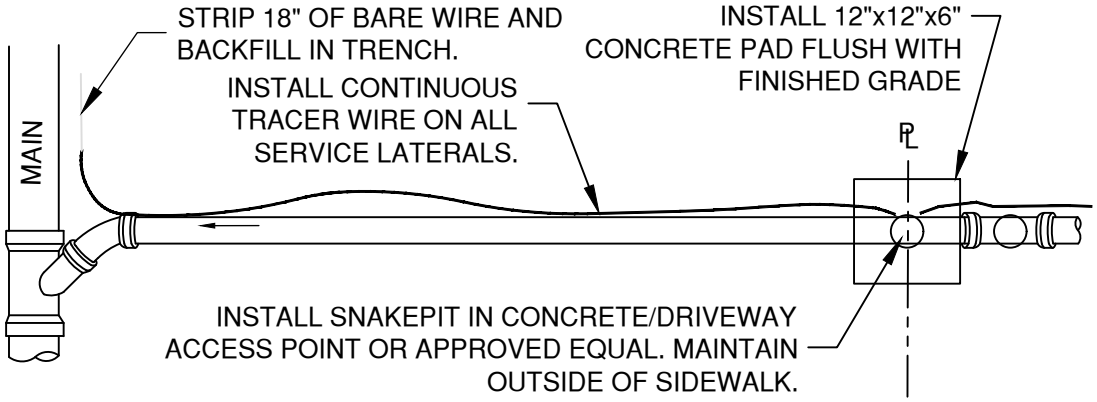
DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV SANITARY			DATE 11/01/2024
REV / DATE			APPR
		GRAVITY SEWER/STORM SERVICE CONNECTION TO EXISTING MAIN	STD DWG S-2B



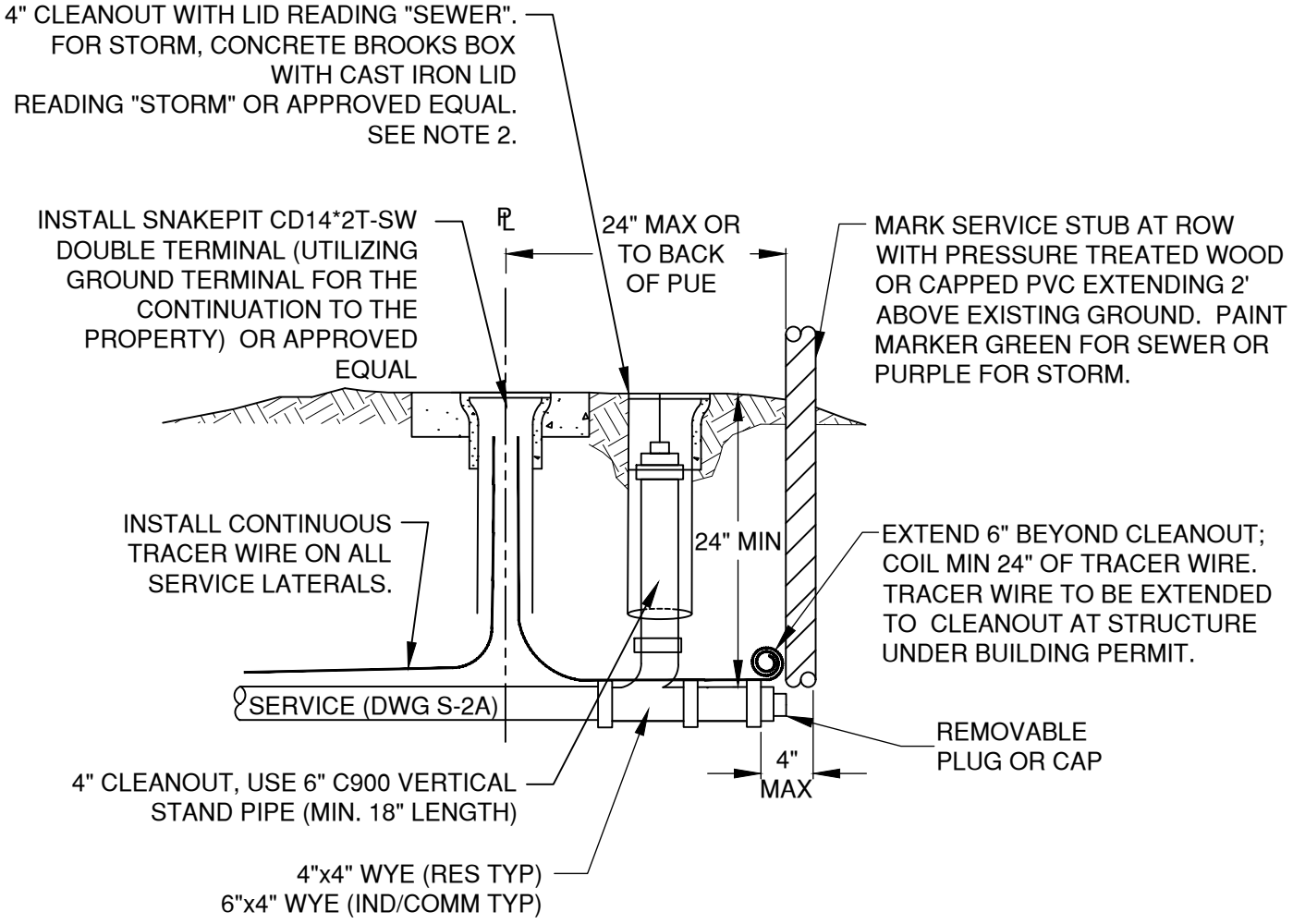
NOTES:

1. SEE STD DWG S-2A FOR GENERAL NOTES.
2. INSTALL CONCRETE BROOKS BOX WITH CAST IRON LID ON ALL CLEANOUTS WITHIN HARDSCAPE.

DRAWN AJD DIV SANITARY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 03/22/2023 APPR
		GRAVITY SEWER/STORM CLEANOUT	STD DWG S-2C



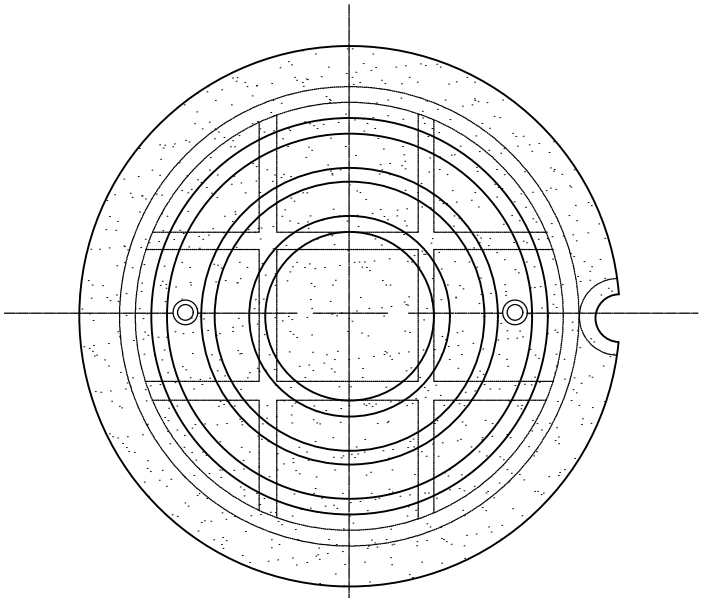
TRACER WIRE GROUNDING



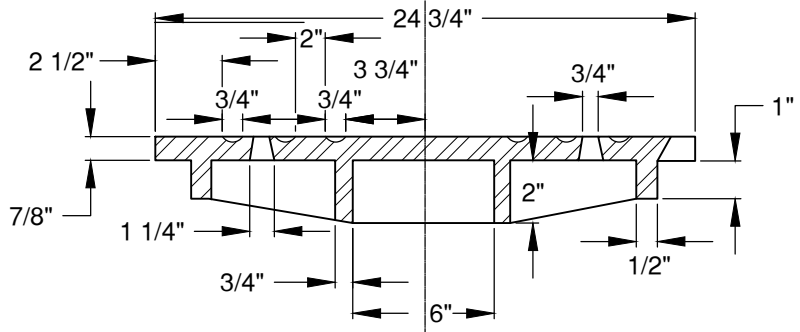
NOTES:

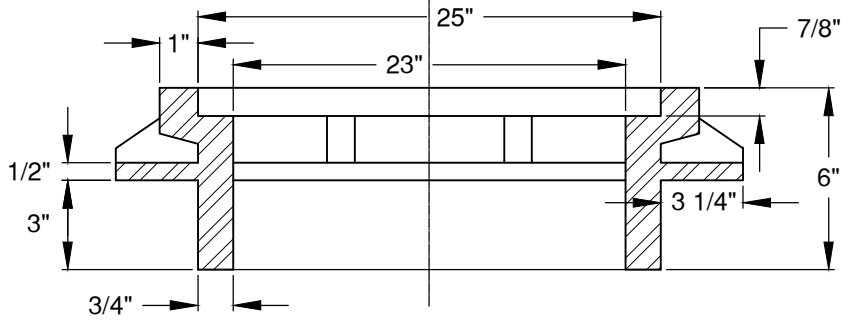
1. SEE STD DWG S-2A FOR GENERAL NOTES.
2. INSTALL CONCRETE BROOKS BOX WITH CAST IRON LID ON ALL CLEANOUT OUTSIDE OF SIDEWALK BUT WITHIN HARDSCAPE.
3. SEE S-2A AND S-2B FOR SERVICE DETAILS.

DRAWN AJD DIV SANITARY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 04/16/2026 APPR
		GRAVITY SEWER/STORM CLEANOUT - SNAKEPIT/	STD DWG S-2D



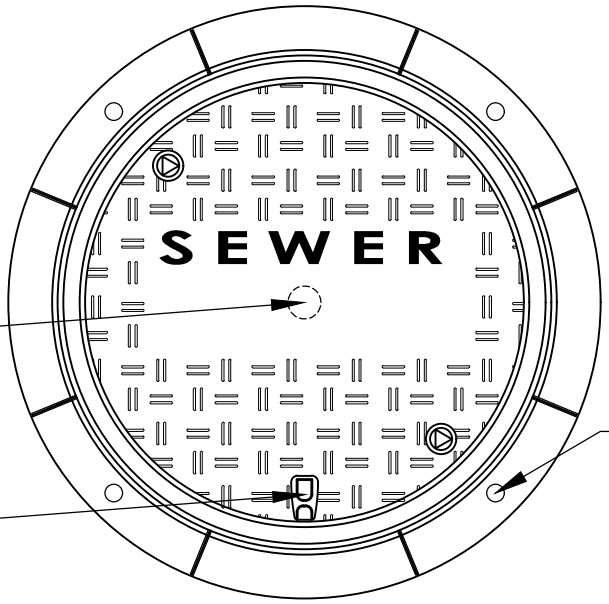
SEWER MANHOLE LID DETAIL
NTS





NOTES:
1. CITY SANITARY SEWER MANHOLE COVERS SHALL HAVE THE WORD "SEWER" CAST IN 2" RAISED LETTERS.
2. PRIVATE MANHOLE LIDS SHOULD NOT USE THE CITY OF BEND MANHOLE LID DETAIL.
3. HINGED MANHOLE LIDS ARE NOT PERMITTED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
4. LOCKS ARE TO BE USED ON THE LID WHEN THE LID IS LOCATED OUTSIDE A ROADWAY IF REQUIRED BY THE CITY ENGINEER.
5. MANHOLE LIDS SHALL BE PLACED OUTSIDE THE PATH OF TRAVEL ON SIDEWALKS AND DRIVEWAY APRONS.

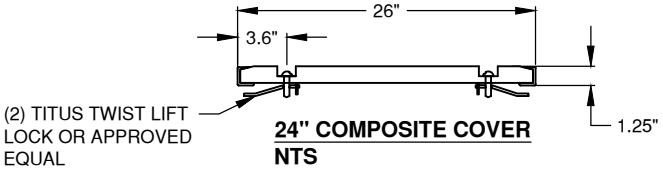
DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV SANITARY			DATE 01/31/2022
REV DATE			APPR
		STANDARD SEWER MANHOLE RING & COVER	STD DWG S-3A



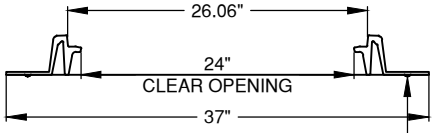
COMPOSITE COVER/FRAME ASSEMBLY

NTS

FOR USE IN NON-TRAFFIC AREAS ONLY

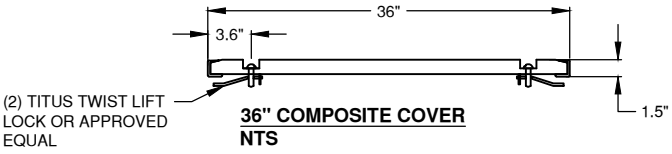


24" COMPOSITE COVER
NTS

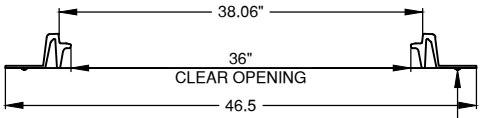


24" COMPOSITE FRAME
NTS

APPLY WATER REPELLANT SEALER AROUND ENTIRE FRAME CIRCUMFERENCE PRIOR TO TIGHTENING THE CONCRETE ANCHORS.



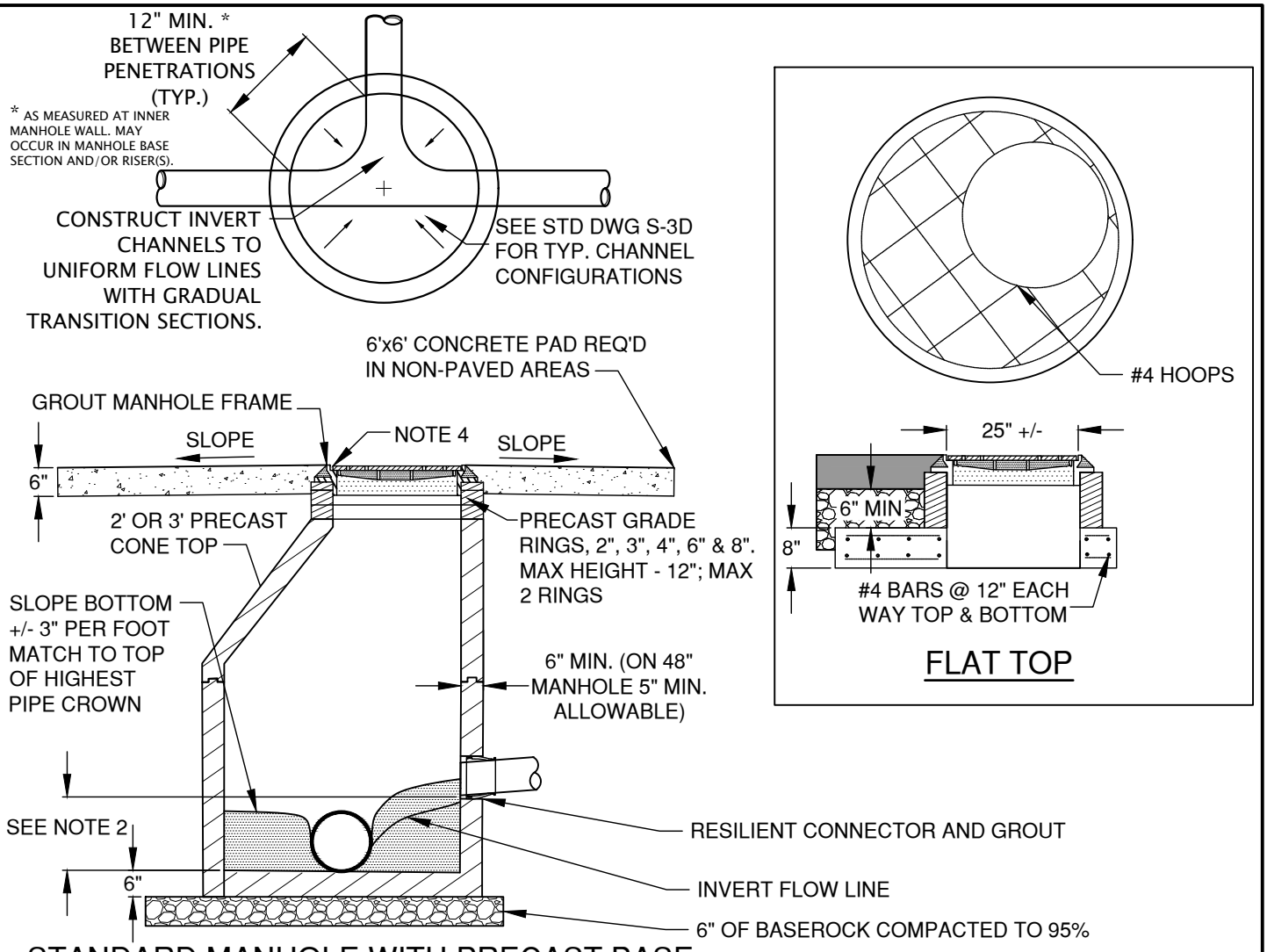
36" COMPOSITE COVER
NTS



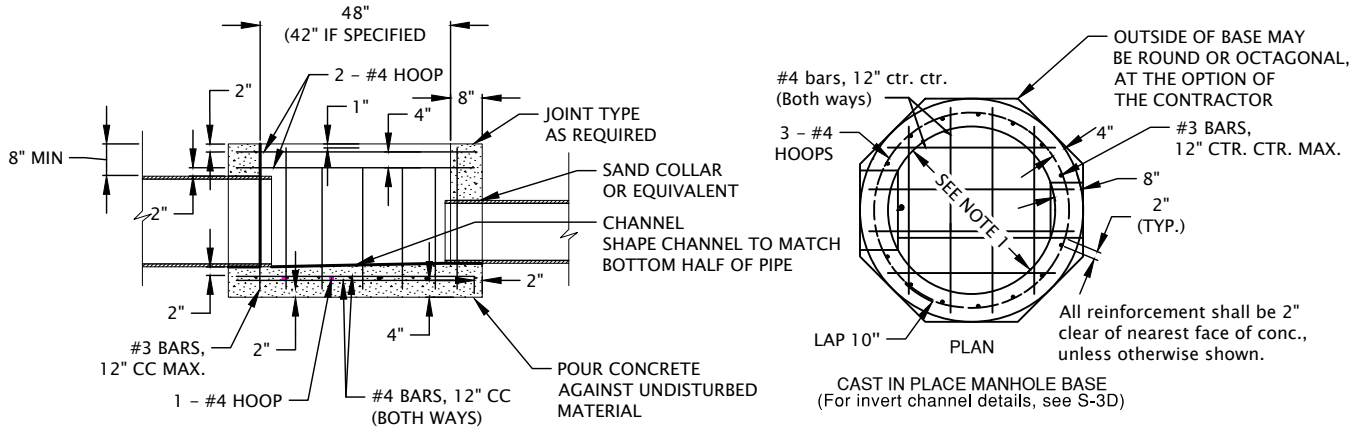
36" COMPOSITE FRAME
NTS

APPLY WATER REPELLANT SEALER AROUND ENTIRE FRAME CIRCUMFERENCE PRIOR TO TIGHTENING THE CONCRETE ANCHORS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		COMPOSITE MANHOLE FRAME AND COVER	STD DWG S-3B



STANDARD MANHOLE WITH PRECAST BASE

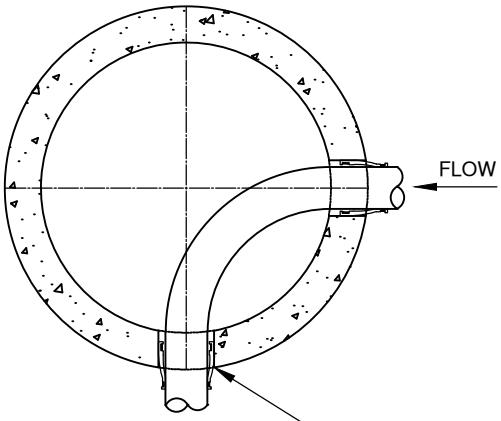


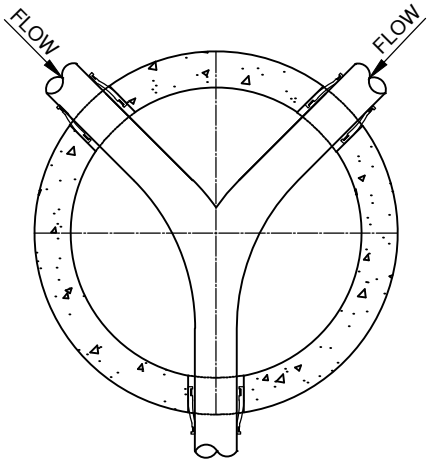
CAST IN PLACE MANHOLE BASE

GENERAL NOTES:

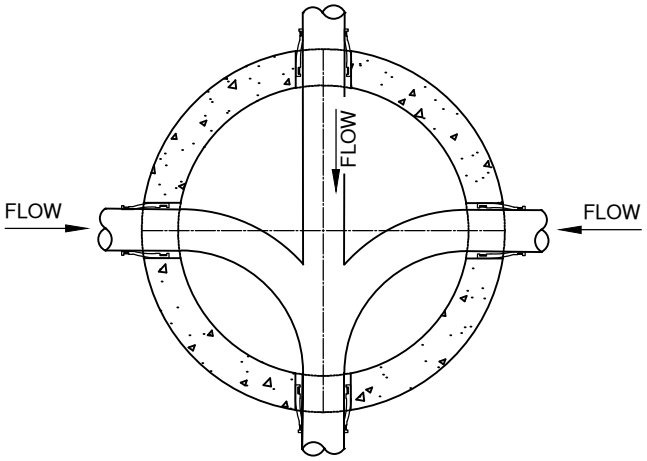
1. MANHOLE DIAMETER PER CITY OF BEND DESIGN STANDARDS.
2. THE MAXIMUM INTERNAL DROP IS 1' FOR PIPES 8" IN DIAMETER OR LESS AND 2' FOR PIPES GREATER THAN 8" IN DIAMETER. SEE DWGS S-4 AND S-4A FOR LARGER DROPS.
3. ALL GROUT USED ON MANHOLES SHALL BE NON-SHRINK CONFORMING 02440.50.
4. A SINGLE RISER RING IS ALLOWED ON INITIAL INSTALLATION.
5. PIPE NOT TO PENETRATE PAST MANHOLE WALL MORE THAN 2".

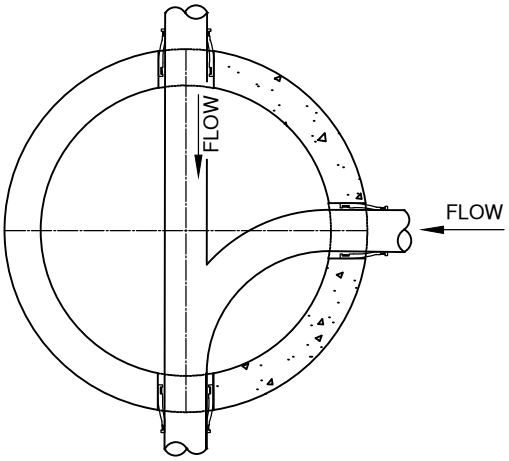
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 12/09/2025
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD SEWER/STORM MANHOLE	STD DWG S-3C





RESILIENT CONNECTOR WITH GROUT
FOR PRECAST BASE. SAND COLLAR OR
EQUIVALENT IN POURED IN PLACE BASE.

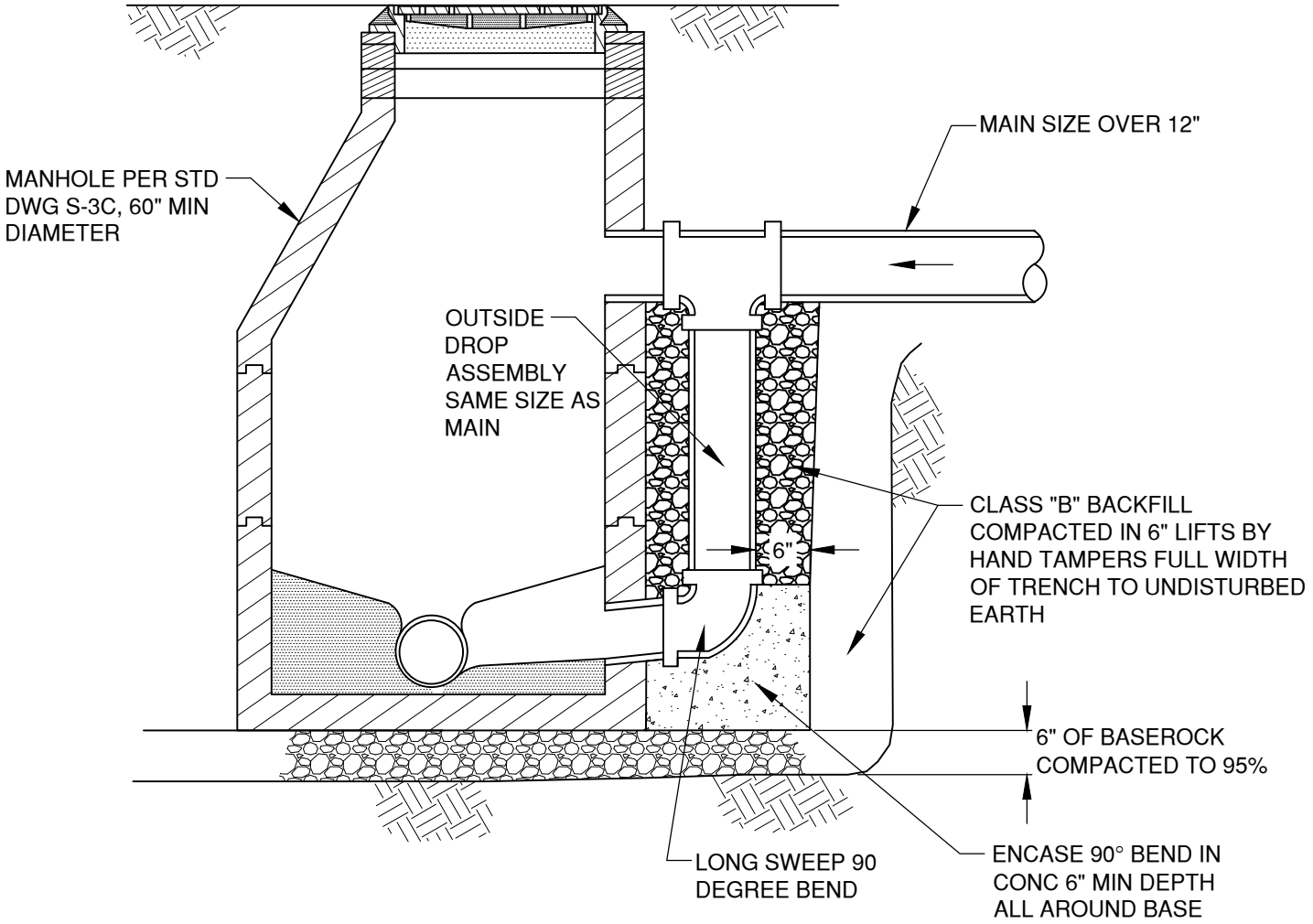


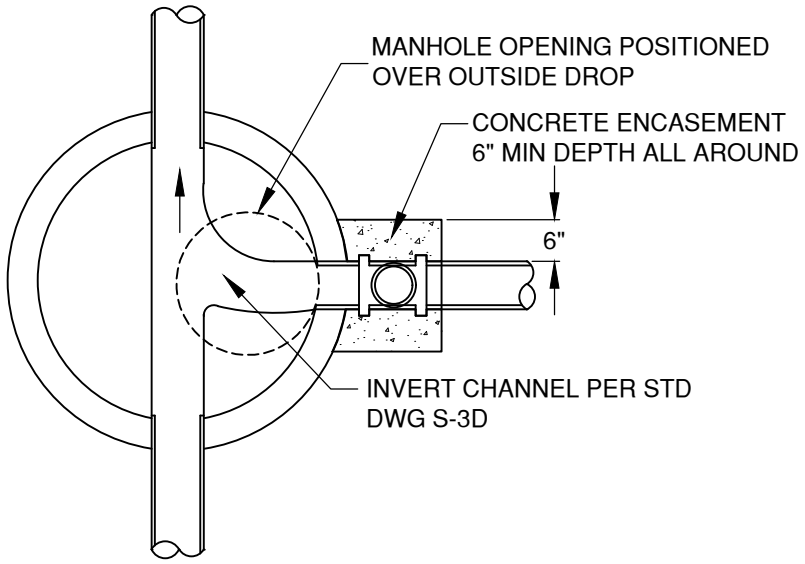


GENERAL NOTES:

1. FLOW CHANNELS DEVIATING FROM THE STANDARD CHANNELS REQUIRE A DETAIL FOR APPROVAL FROM THE ENGINEER
2. WIDTH OF CHANNEL SHOULD MATCH THE INSIDE DIAMETER OF INCOMING AND OUTGOING PIPES.
3. CHANNEL LINING SHALL BE BLENDED FOR SMOOTH CONTOUR BETWEEN PIPES.
4. GROUT CHANNEL TO SMOOTH FINISH.
5. FINISH BOTTOM TO EVEN SLOPE BROOM FINISH TO DRAIN TO CHANNEL.
6. LOCATE MANHOLE OPENING OPPOSITE OUTLET UNLESS OTHERWISE DIRECTED.
7. ALL GROUT USED ON MANHOLES SHALL BE NON-SHRINK CONFORMING 02440.50.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL MANHOLE INVERT LAYOUT	STD DWG S-3D

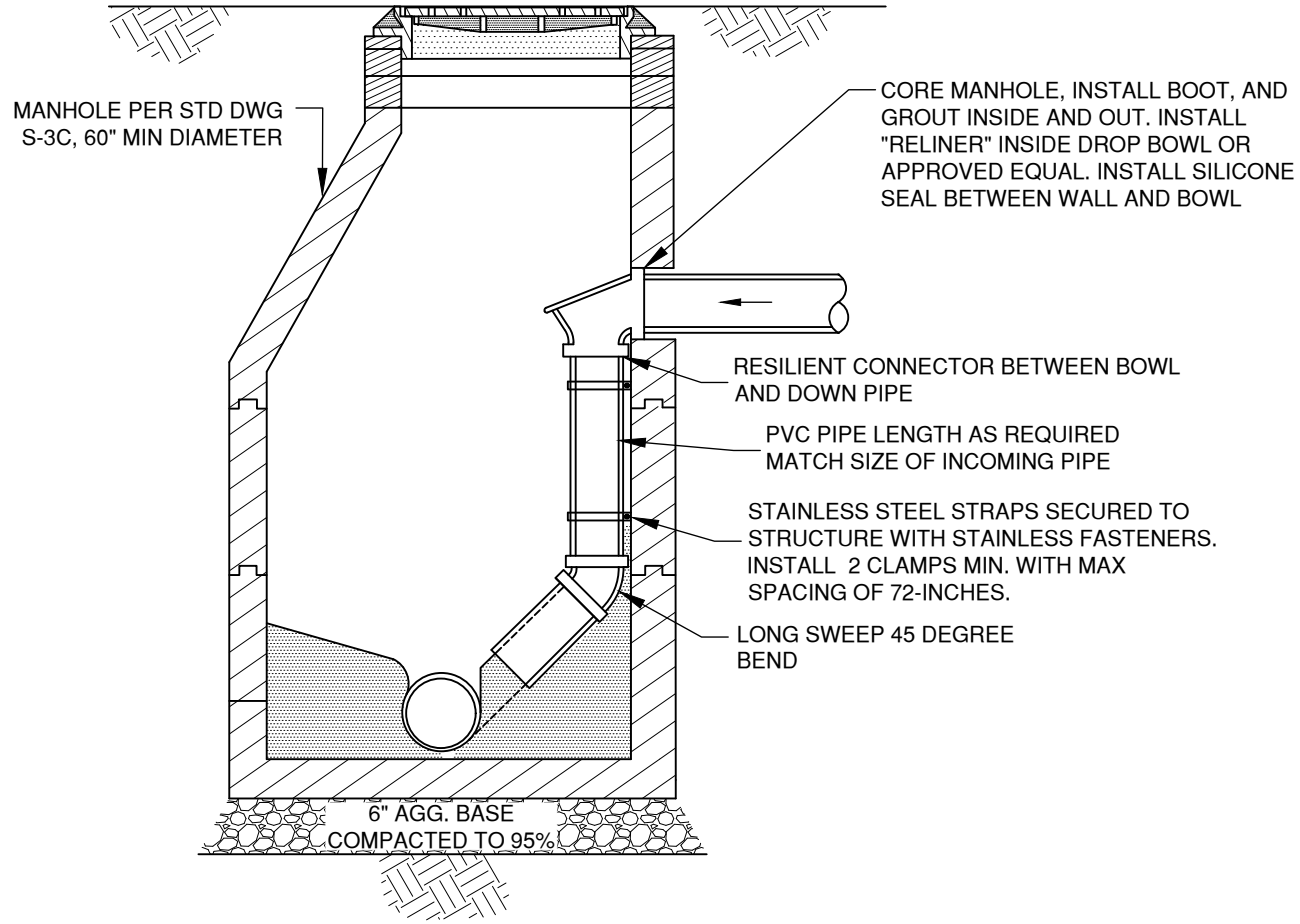


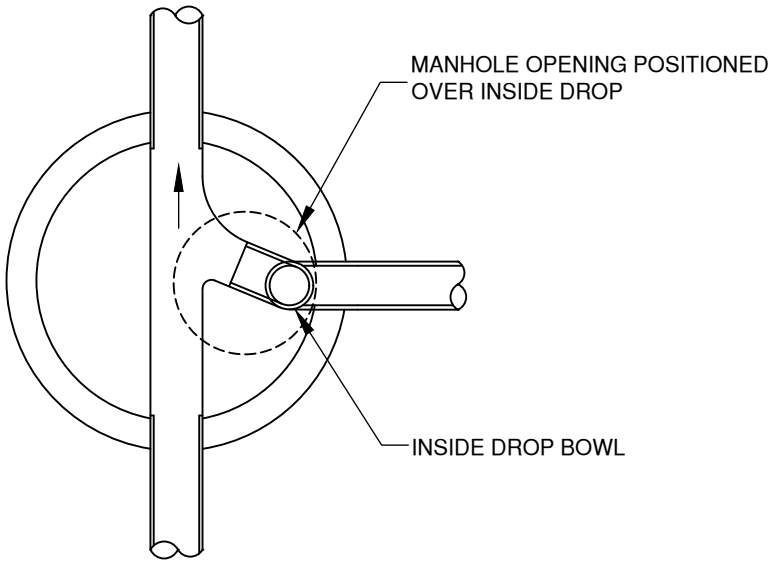


GENERAL NOTES:

1. OUTSIDE DROP MANHOLE FOR USE WITH MAIN SIZE OVER 12" ONLY

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD OUTSIDE DROP - LARGER THAN 12" PIPE	STD DWG S-4

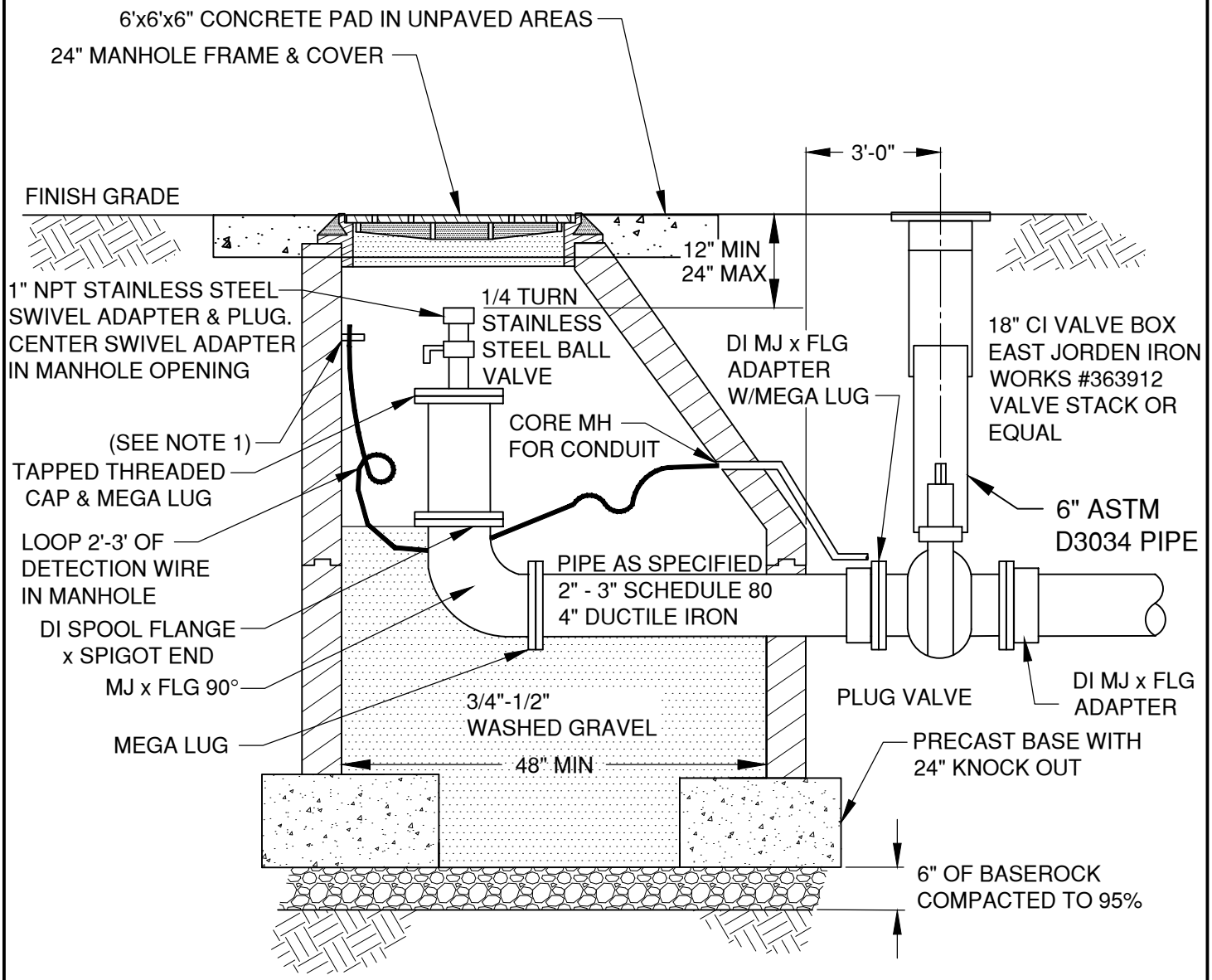




NOTES:

1. INSIDE DROP MANHOLE FOR USE WITH MAIN SIZE 12" AND SMALLER ONLY

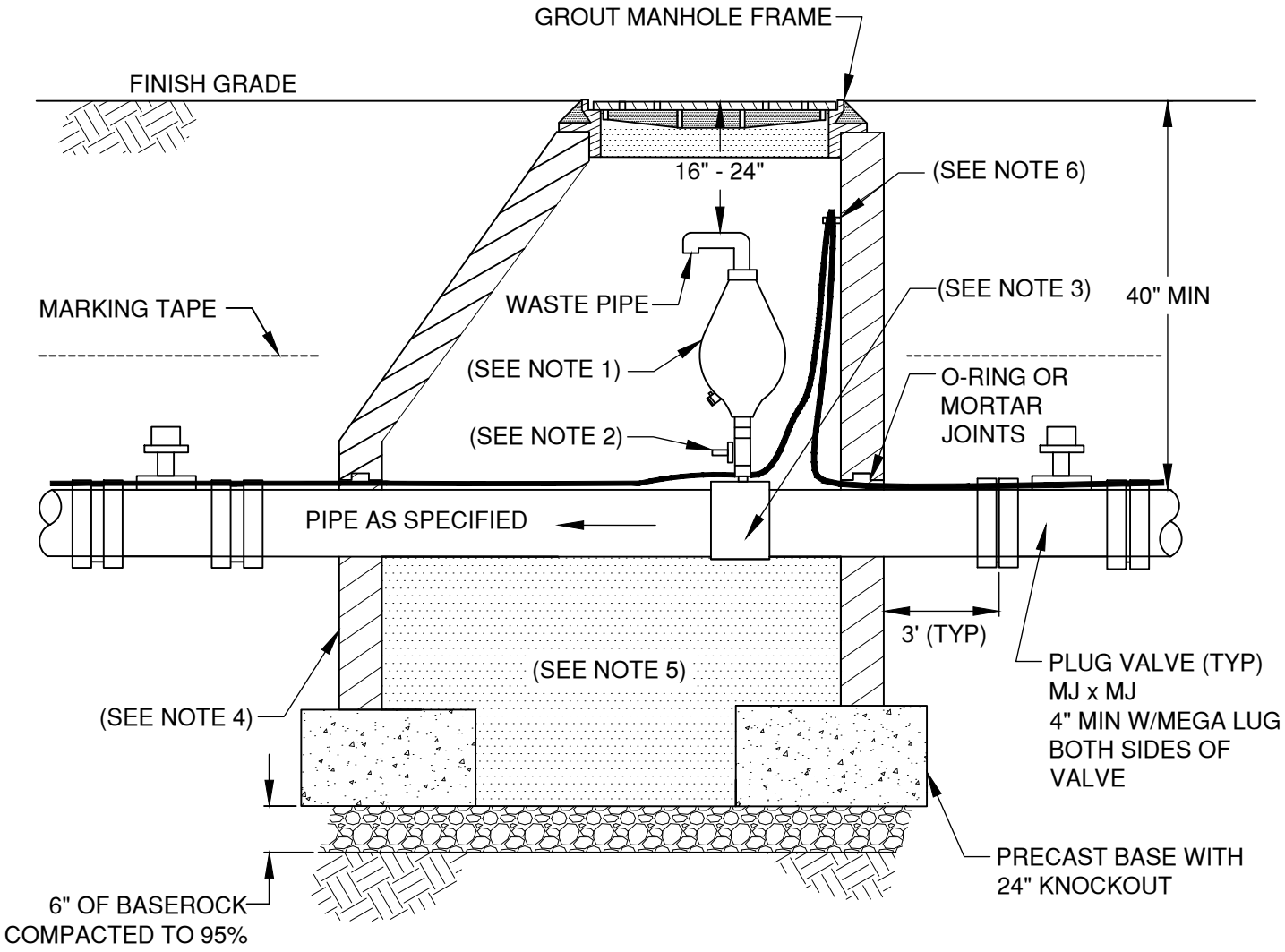
DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD INSIDE DROP - 12" PIPE AND SMALLER	STD DWG S-4A



NOTES:

1. TRACER WIRE SHALL BE EXTENDED WITHIN 18-INCHES OF FINISHED GRADE OR 6" BELOW LOWEST GRADE RING, WHICH EVER IS GREATER, TO A 1.75-INCH STAINLESS STEEL RUBBER CUSHIONED CLAMP MOUNTED TO MANHOLE WITH AS MIN 1/4" X 1-3/4" CONCRETE ANCHOR SCREW.

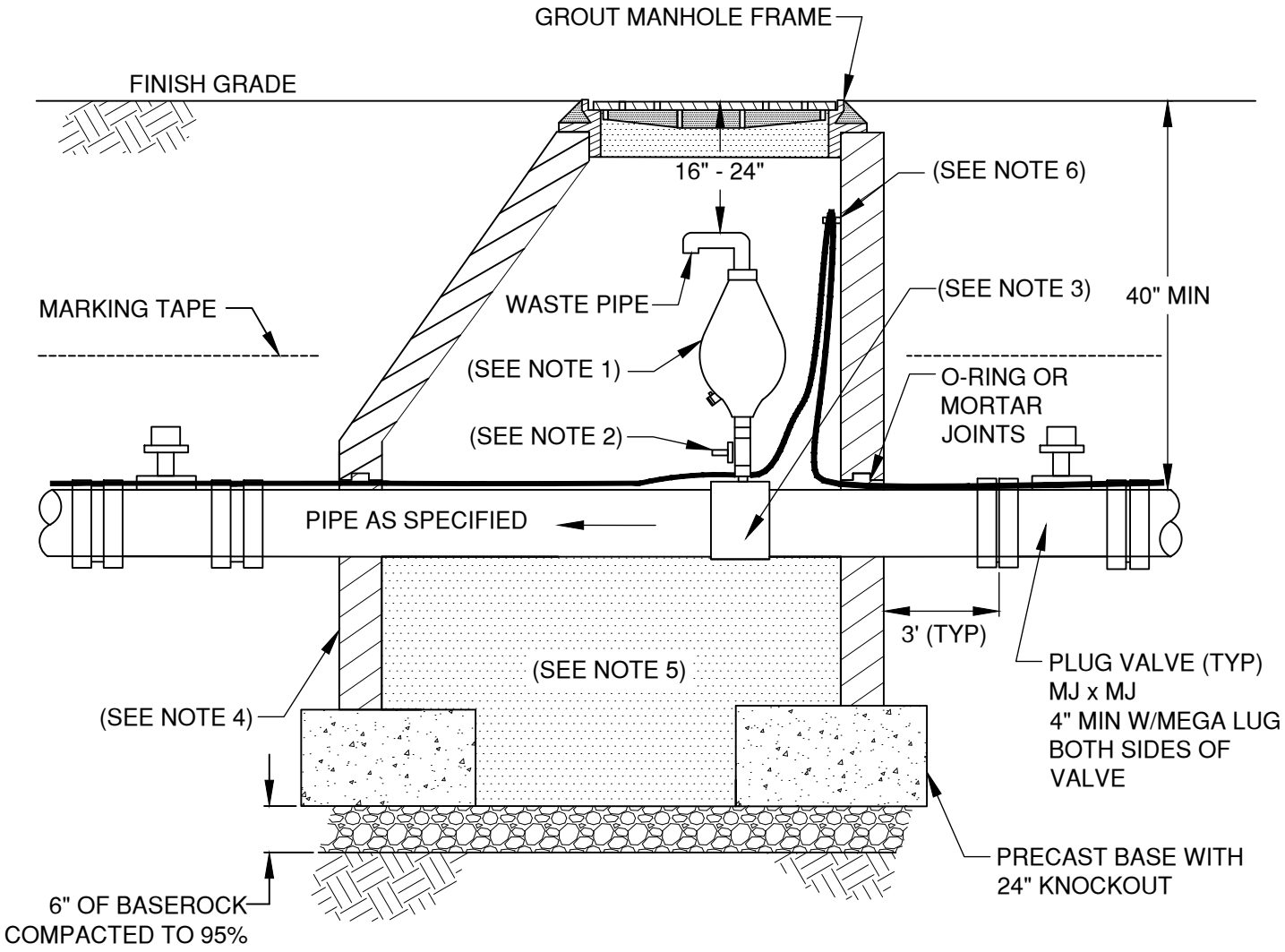
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		3" & 4" PRESSURE SEWER LINE TERMINATION CLEANOUT	STD DWG S-5



NOTES:

1. 2" COMBINATION AIR VALVE(SHORT VERSION) PER. 00445.11(l)(2)(d)
2. 2" STAINLESS STEEL BALL VALVE
3. 2" TEE OR 2" SADDLE TEE AS APPROVED FOR PRESSURE APPLICATIONS
4. 48" DIAMETER FLAT TOP MANHOLE.
5. 3/4"-1/2" WASHED GRAVEL
6. TRACER WIRE SHALL BE EXTENDED WITHIN 18-INCHES OF FINISHED GRADE OR 6" BELOW LOWEST GRADE RING, WHICH EVER IS GREATER, TO A 1.75-INCH STAINLESS STEEL RUBBER CUSHIONED CLAMP MOUNTED TO MANHOLE WITH AS MIN 1/4" X 1-3/4" CONCRETE ANCHOR SCREW.

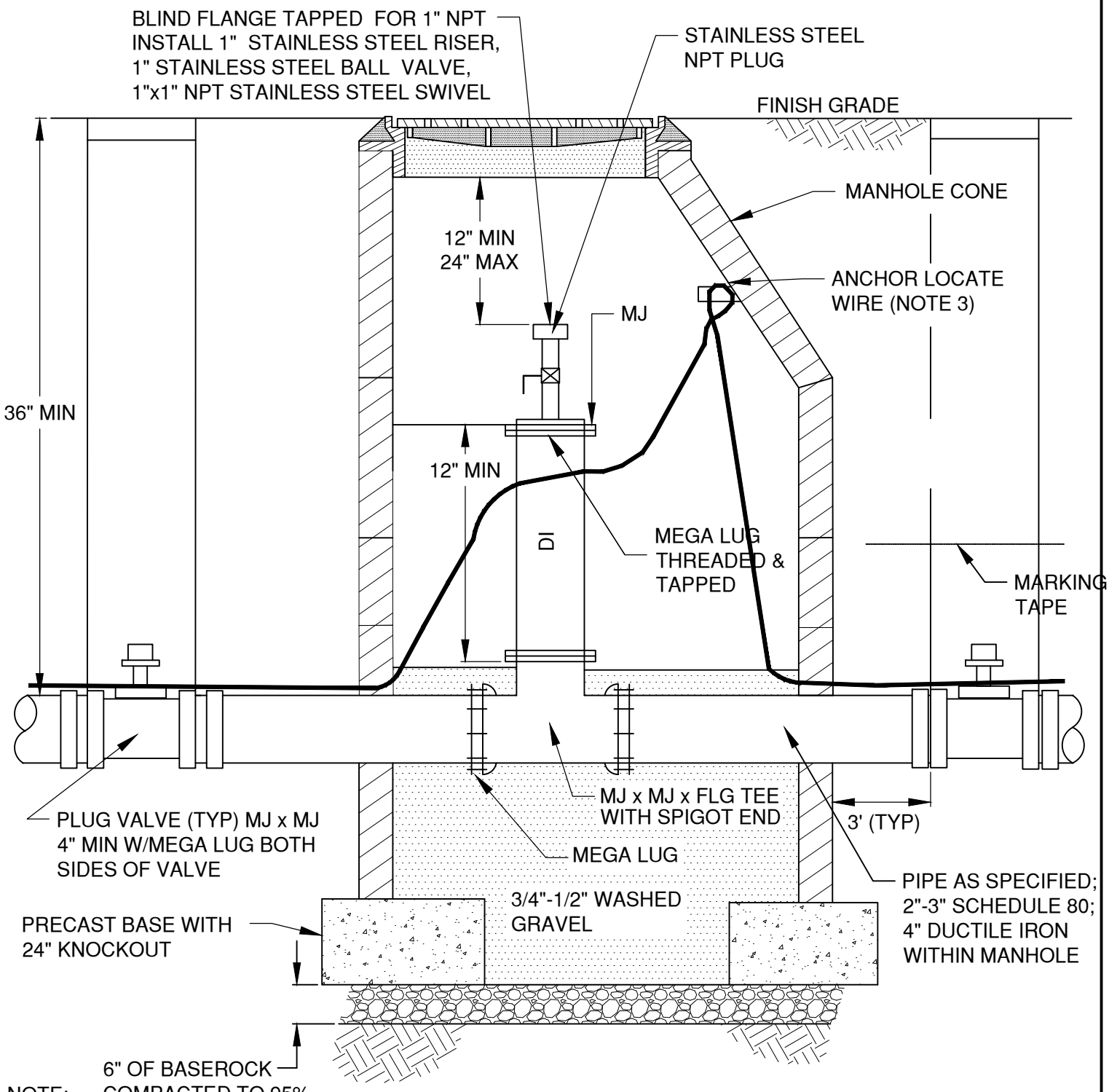
DRAWN AJD DIV SANITARY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 04/16/2026 APPR
		AIR RELEASE/VAC BREAKER PRESSURE SEWER MH	STD DWG S-6



NOTES:

1. 2" COMBINATION AIR VALVE(SHORT VERSION) PER. 00445.11(l)(2)(d)
2. 2" STAINLESS STEEL BALL VALVE
3. 2" TEE OR 2" SADDLE TEE AS APPROVED FOR PRESSURE APPLICATIONS
4. 48" DIAMETER FLAT TOP MANHOLE.
5. 3/4"-1/2" WASHED GRAVEL
6. TRACER WIRE SHALL BE EXTENDED WITHIN 18-INCHES OF FINISHED GRADE OR 6" BELOW LOWEST GRADE RING, WHICH EVER IS GREATER, TO A 1.75-INCH STAINLESS STEEL RUBBER CUSHIONED CLAMP MOUNTED TO MANHOLE WITH AS MIN 1/4" X 1-3/4" CONCRETE ANCHOR SCREW.

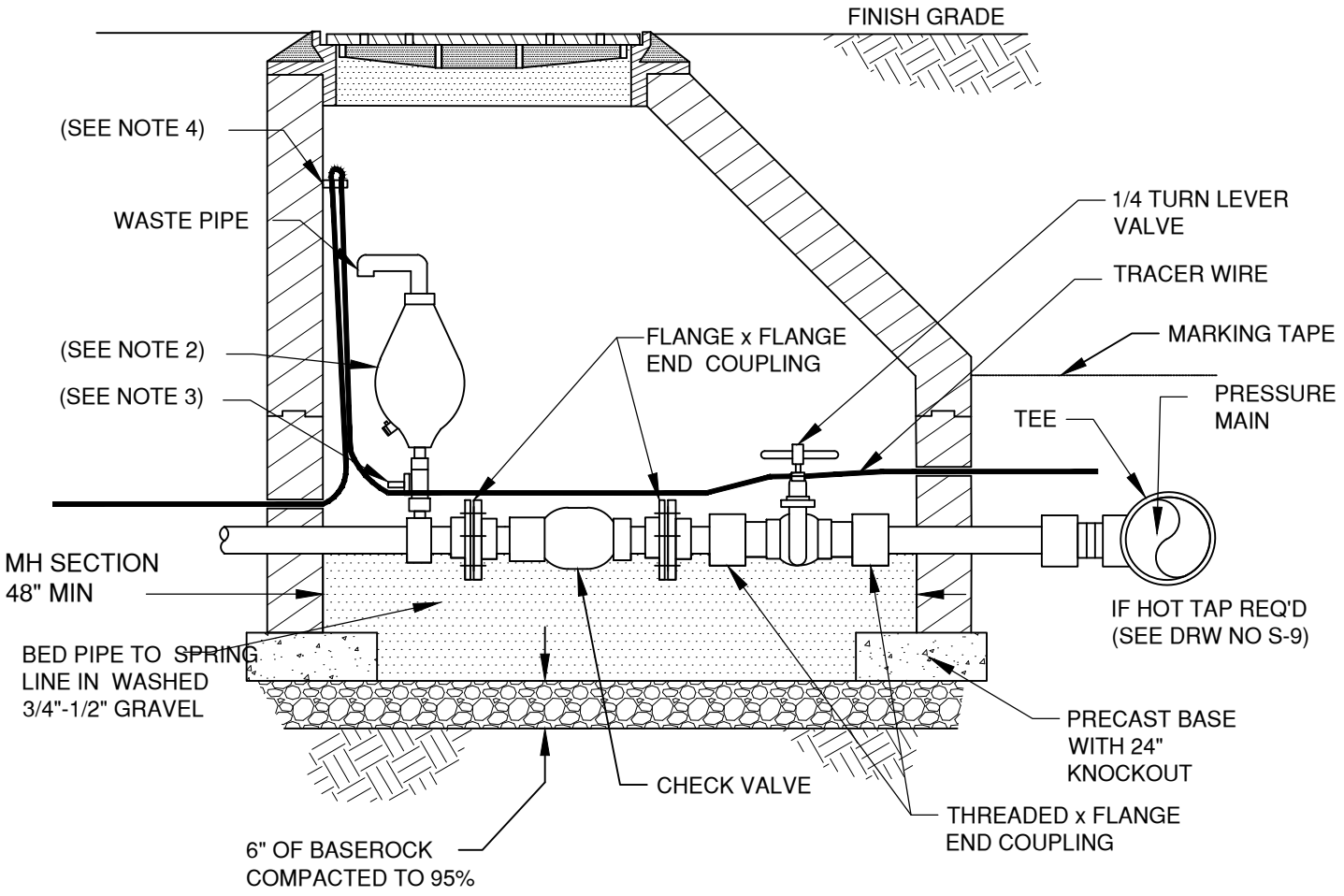
DRAWN AJD DIV SANITARY REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 04/16/2026 APPR
		AIR RELEASE/VAC BREAKER PRESSURE SEWER MH	STD DWG S-6



NOTE:

1. ALL DUCTILE IRON FITTINGS THROUGH MANHOLE
2. 48" MINIMUM DIAMETER MANHOLE
3. TRACER WIRE SHALL BE EXTENDED WITHIN 18-INCHES OF FINISHED GRADE OR 6" BELOW LOWEST GRADE RING, WHICH EVER IS GREATER, TO A 1.75-INCH STAINLESS STEEL RUBBER CUSHIONED CLAMP MOUNTED TO MANHOLE WITH AS MIN 1/4" X 1-3/4" CONCRETE ANCHOR SCREW.

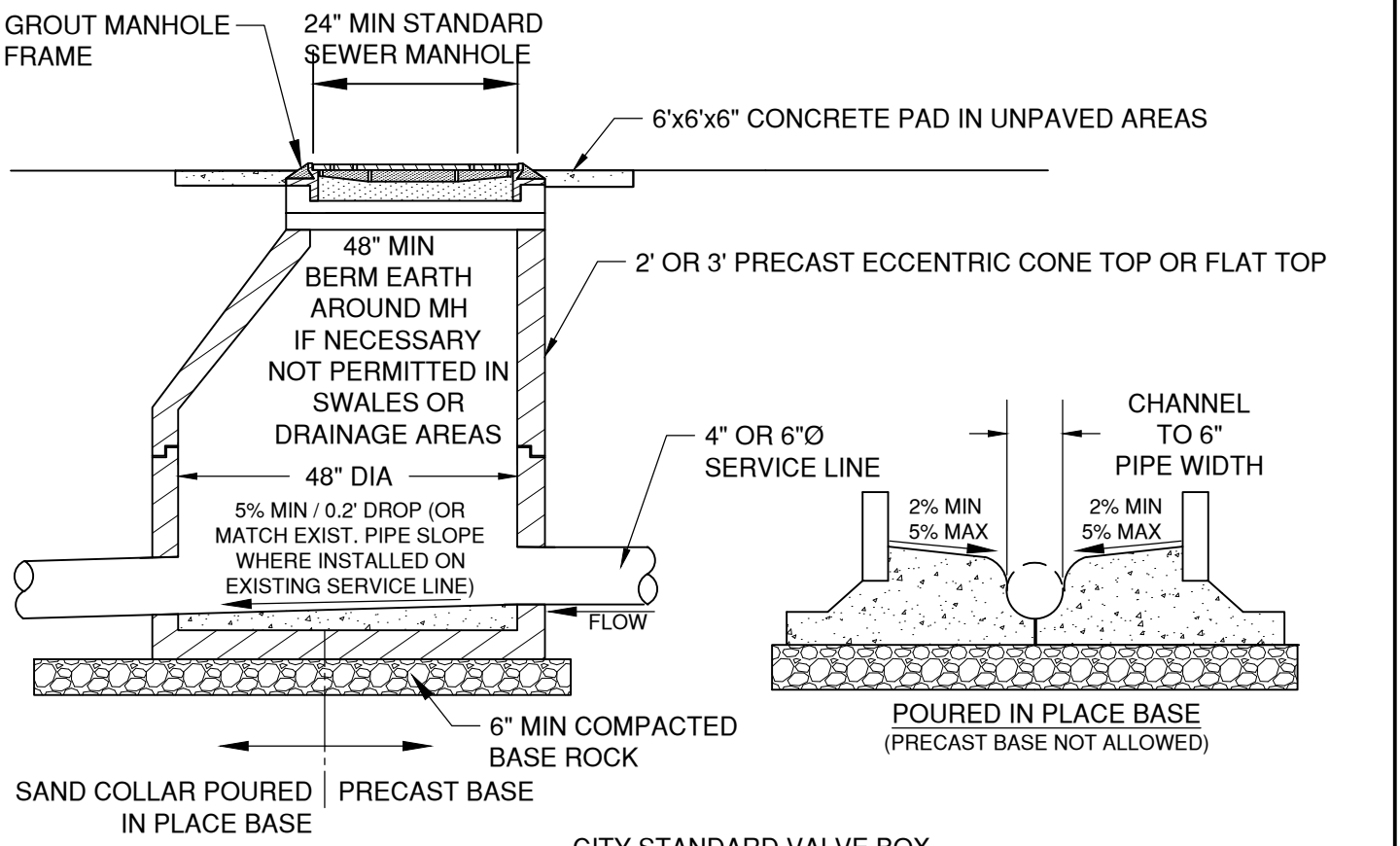
DRAWN AJD	CITY OF BEND		SCALE NTS
DIV SANITARY		CITY OF BEND	DATE 01/31/2022
REV / DATE	STANDARD DRAWING		APPR
	710 NW WALL ST., BEND, OREGON 97701	MAIN LINE CLEANOUT PRESSURE SEWER	STD DWG S-7

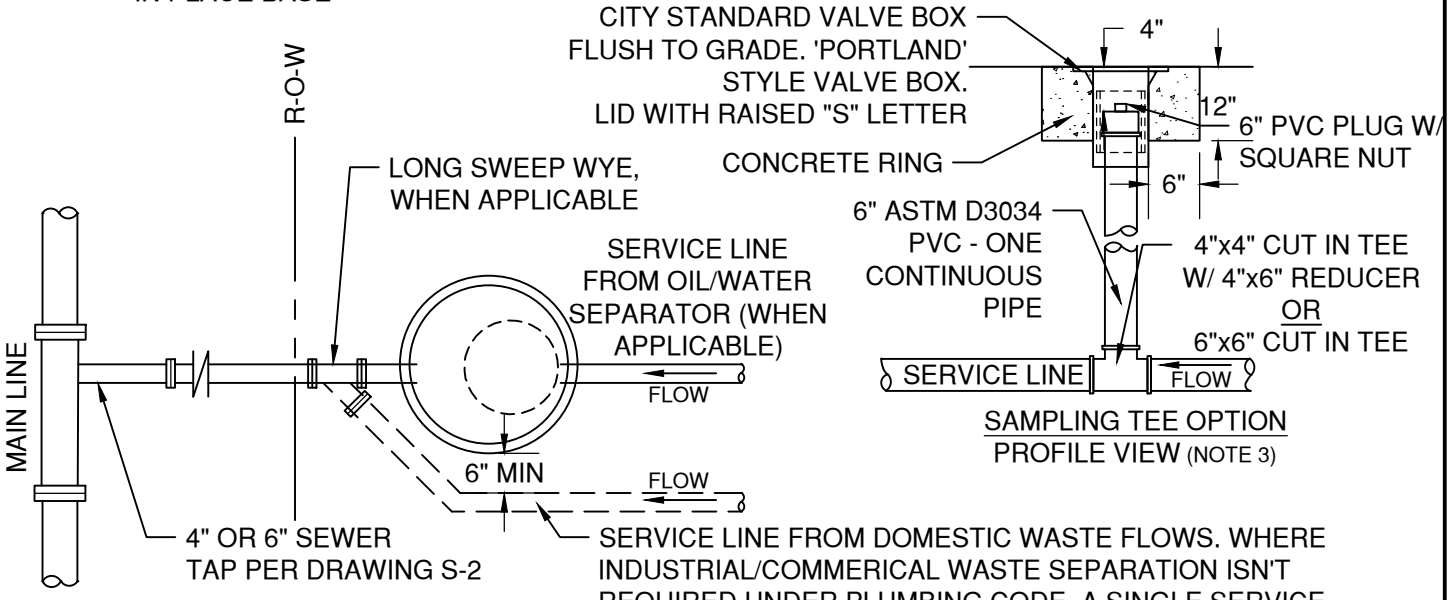


TYPICAL INSTALLATION IN TRAFFIC AREA

NOTE:
1. SHOWN WITH PLUG VALVE IN ENCLOSURE
2. 2" COMBINATION AIR VALVE (SHORT VERSION) PER. 00445.11(I)(2)(d)
3. 2" STAINLESS STEEL BALL VALVE
4. TRACER WIRE SHALL BE EXTENDED WITHIN 18-INCHES OF FINISHED GRADE OR 6" BELOW LOWEST GRADE RING, WHICH EVER IS GREATER, TO A 1.75-INCH STAINLESS STEEL RUBBER CUSHIONED CLAMP MOUNTED TO MANHOLE WITH AS MIN 1/4" X 1-3/4" CONCRETE ANCHOR SCREW.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		PRESSURE SEWER SERVICE - TRAFFIC AREA	STD DWG S-8

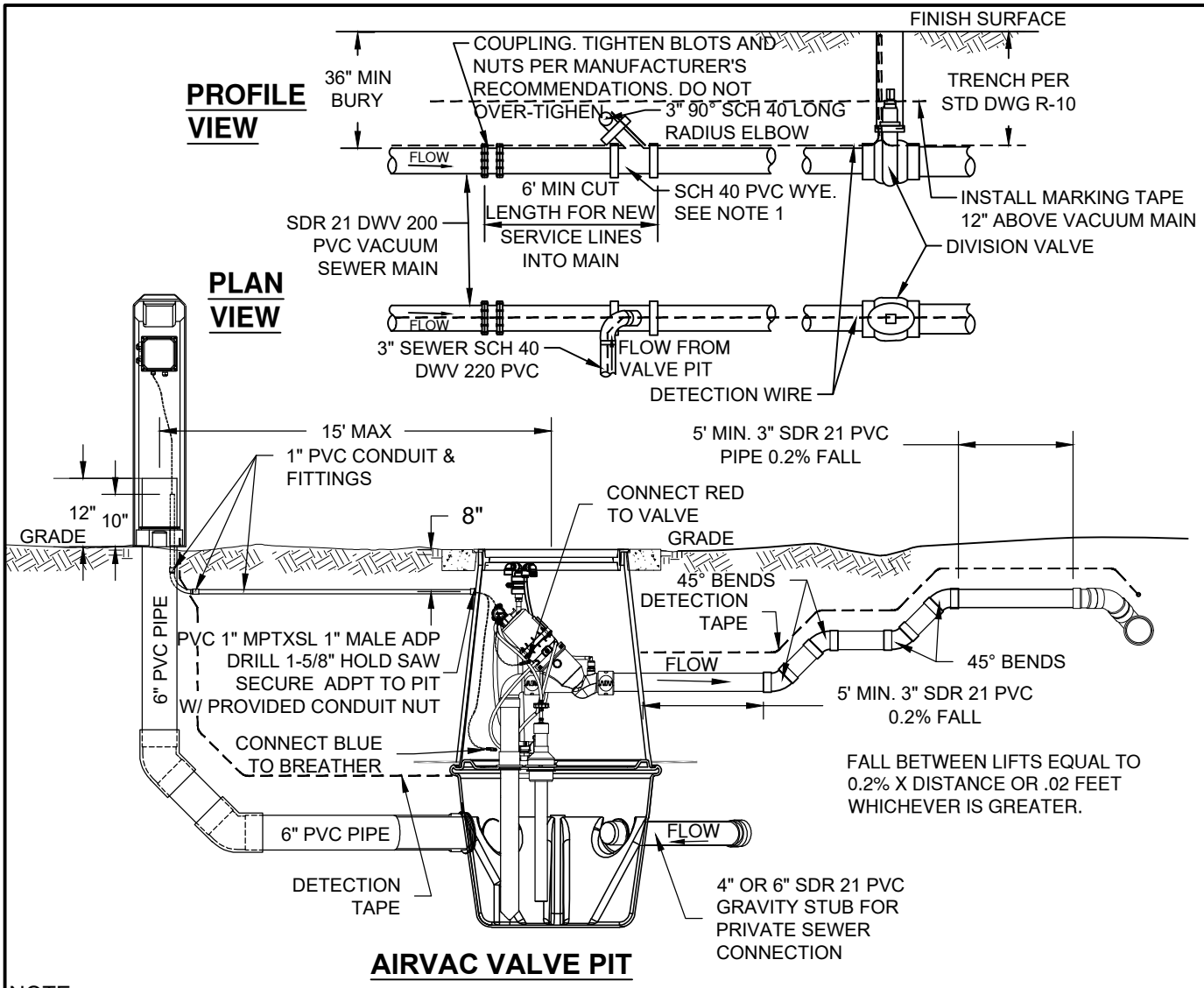




NOTES:

1. MULTIPLE SERVICE LINES SHALL CONNECT UPSTREAM AND OUTSIDE THE SAMPLE MANHOLE
2. SAMPLE MANHOLE TO BE LOCATED ON PRIVATE PROPERTY IN AN ACCESSIBLE AREA.
3. SAMPLING TEE OPTION IS ONLY PERMITTED WHEN APPROVED BY THE CITY ENGINEER AND ARE INTENDED FOR RETROFITS ON EXISTING SYSTEMS ONLY. CONSIDERED IN SITUATIONS WHERE EXISTING UTILITIES OR EASEMENTS PREVENT THE INSTALLATION OF MANHOLE.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
	CITY OF BEND	INDUSTRIAL AND COMMERCIAL SERVICES SAMPLING MH	STD DWG S-15



AIRVAC VALVE PIT

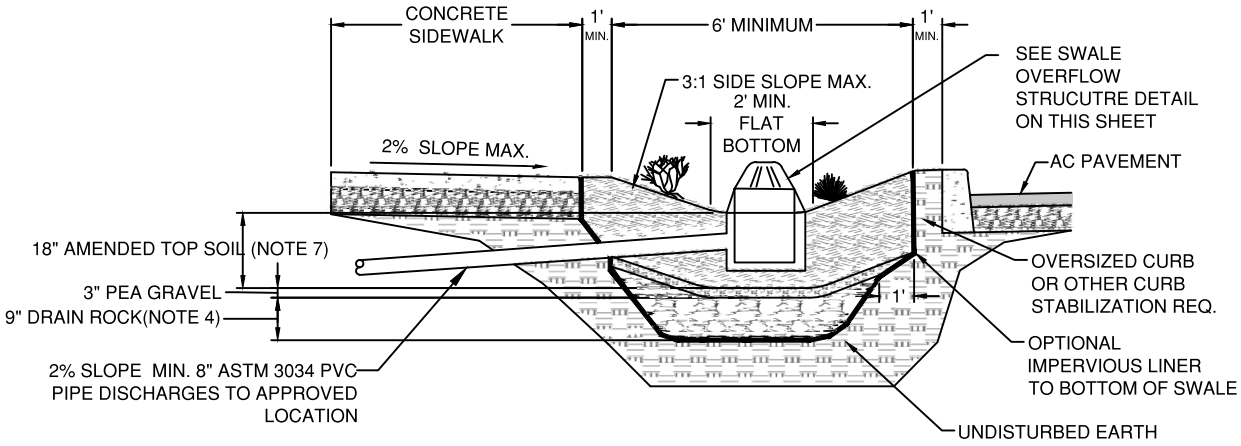
NOTE:

1. ALL WORK DONE ON A VACUUM SEWER SHALL BE COORDINATED WITH PUBLIC WORKS 7 DAYS IN ADVANCE TO COORDINATE VACUUM STATION SHUT DOWN.
2. ALL JOINTS TO BE CONNECTED USING STANDARD PRIMER AND SOLVENT CEMENT. KEEP ALL JOINTS CLEAN AND FREE OF DEBRIS. JOINTS TO BE SCH40 DWV 220 OR APPROVED EQUAL.
3. AFTER INSTALLATION IS COMPLETE, OPEN DIVISION VALVE AND PERFORM VISUAL AND AUDIBLE INSPECTION OF EACH JOINT FOR LEAKS PRIOR TO TRENCH CLOSURE.
4. TRENCH BACKFILL TO BE IN ACCORDANCE TO S-1. MARKING TAPE AND TRACER WIRE TO BE INSTALLED ON ALL MAINS AND SERVICES.
5. INSTALL GRAVITY SEWER LATERALS IN CONFORMANCE WITH PLUMBING CODE. SERVICE LINE FROM THE PIT TO THE HOUSE IS OWNED AND MAINTAINED BY PROPERTY OWNER. CONNECTIONS TO THE AIRVAC VALVE PIT SHALL BE MADE AS PER MANUFACTURER'S SPECIFICATION.
6. AIR-INTAKE SHALL BE INSTALLED IN CONFORMANCE TO THE PLUMBING CODE AND SHALL BE PERMITTED WITH THE BUILDING DEPARTMENT UNDER A PLUMBING PERMIT.
7. PIT TO BE INSTALLED OUTSIDE OF SIDEWALK AND APRON SURFACES IN ROW OR CITY EASEMENT.
8. ALL WORK SHALL CONFORM TO AIR VAC SPECIFICATIONS. NO MORE THAN TWO SERVICES MAY CONNECT TO A ONE VACCUM PIT.
9. CONNECTION AVAILABILITY TO VALVE PIT TO BE DETERMINED BY THE CITY ENGINEER BASED ON MANUFACTURERS ALLOWABLE FLOW INTO PIT AND THE VACUUM SYSTEM.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV SANITARY		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		VACUUM SEWER SERVICE	STD DWG S-16

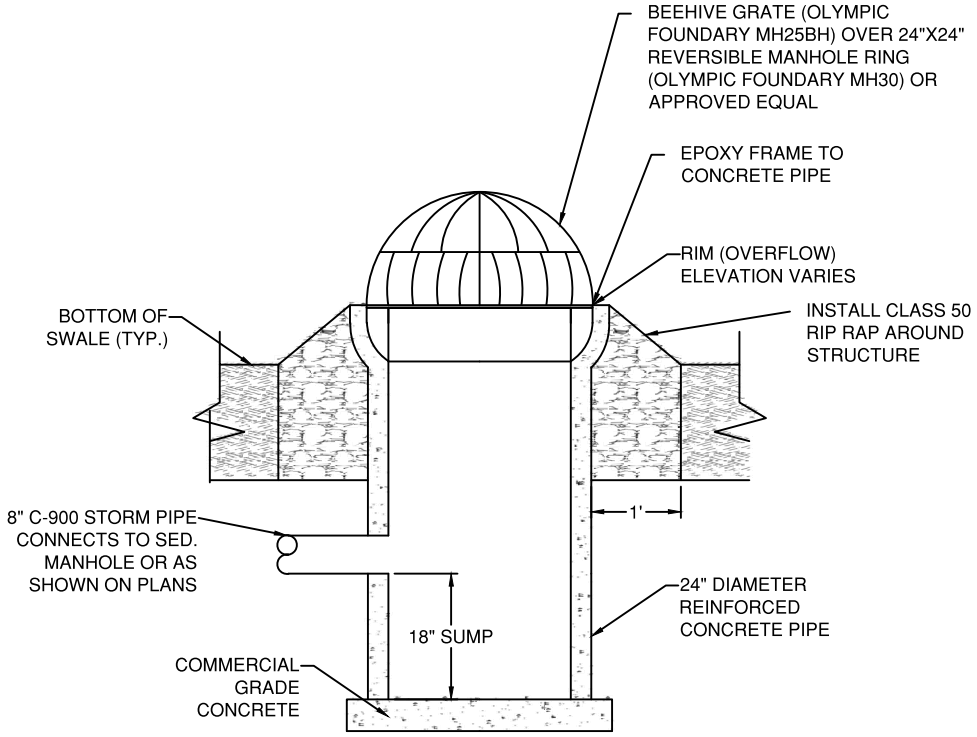
CITY OF BEND STANDARD DRAWINGS

Stormwater (STRM)



VEGETATED SWALE WITH OPTIONAL ROCK STORAGE RESERVOIR

NTS



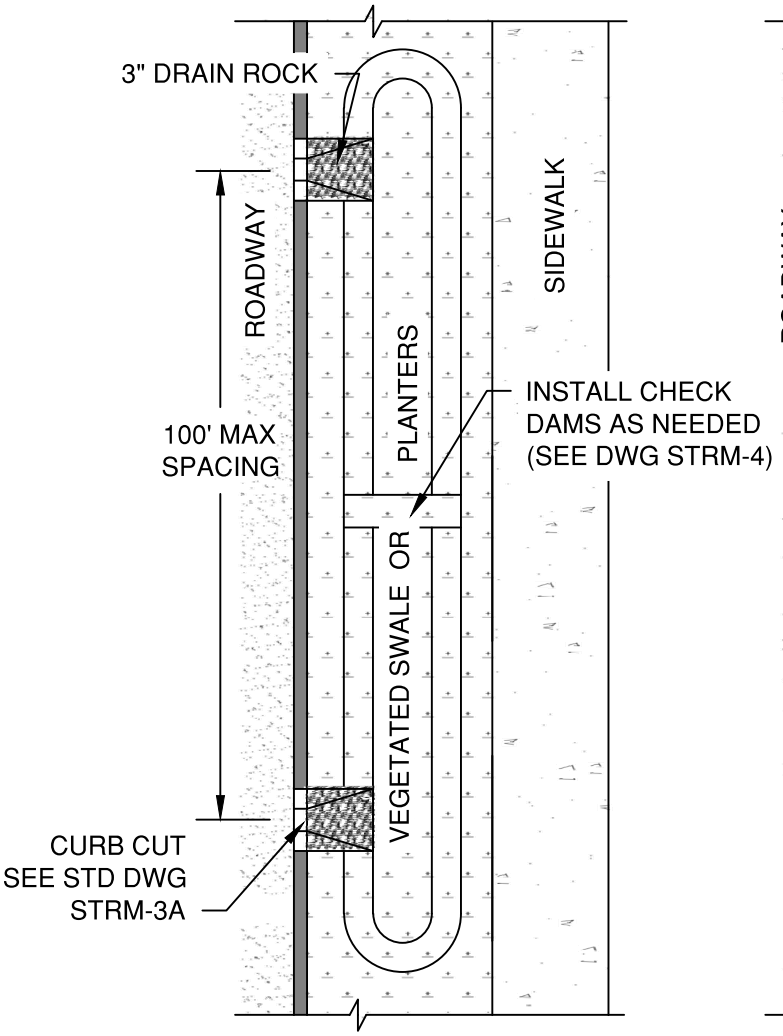
SWALE OVERFLOW STRUCTURE

NTS

NOTES:

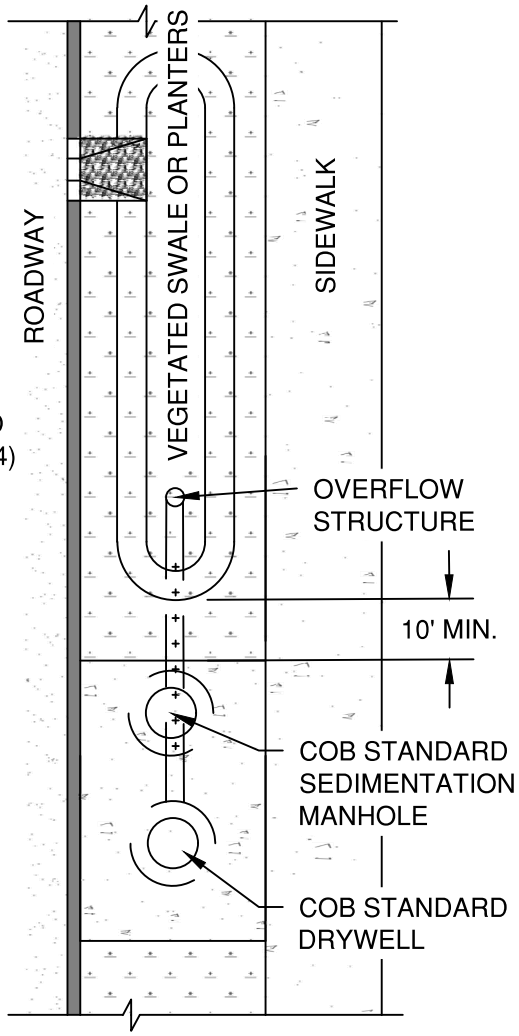
1. AMENDED TOPSOIL SHALL CONTAIN 20-30% TOPSOIL, 50-65% CLEAN SAND AND 5-20% COMPOST OR PEAT MOSS.
2. VOLUME AND DEPTH TO BE DETERMINED BY ENGINEER.
3. DRAIN ROCK AS REQUIRED FOR DRAINAGE CAPACITY. PEA GRAVEL TO BE USED TO PREVENT SOIL MIGRATION INTO DRAINAGE LAYER.
4. OPTIONAL ROCK RESERVOIR TO BE CONSTRUCTED WITH WASHED DRAIN ROCK WITH 40% VOIDS. NOT TO BE USED IN TREE WELLS.
5. AVOID COMPACTING SWALE AREA DURING CONSTRUCTION.
6. ADD HIGH POINT FLOW BYPASS TO AN APPROVED DISPOSAL POINT AS NECESSARY. OVERFLOW SHOULD PASS THROUGH A SEDIMENTATION MANHOLE OR PRE-TREATMENT PRIOR TO DISCHARGING TO A DRYWELL OR UIC.
7. AMENDED TOP SOIL CAN BE REPLACED WITH DRAIN ROCK FOR ROCK SWALES. ROCK SWALES CANNOT BE USED TO MEET PRETREATMENT REQUIREMENTS.
8. INSTALL CHECK DAMS AS REQURED AND PER DWG STRM-4.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		VEGETATED SWALE DETAIL	STD DWG STRM-2



VEGETATED SWALE/ PLANTER

NTS



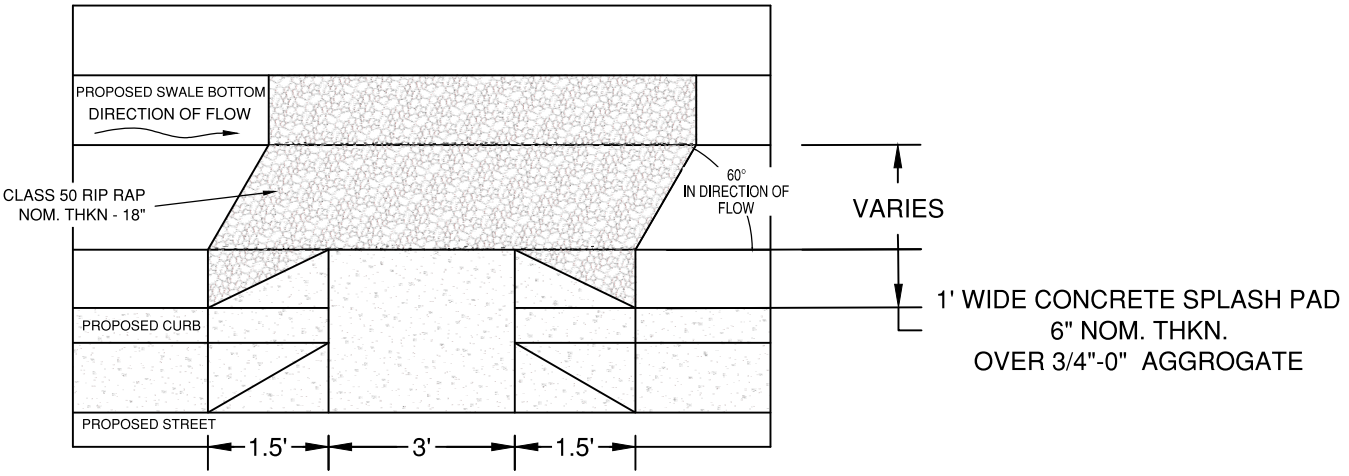
VEGETATED SWALE/ PLANTERS
W/ DRYWELL OVERFLOW

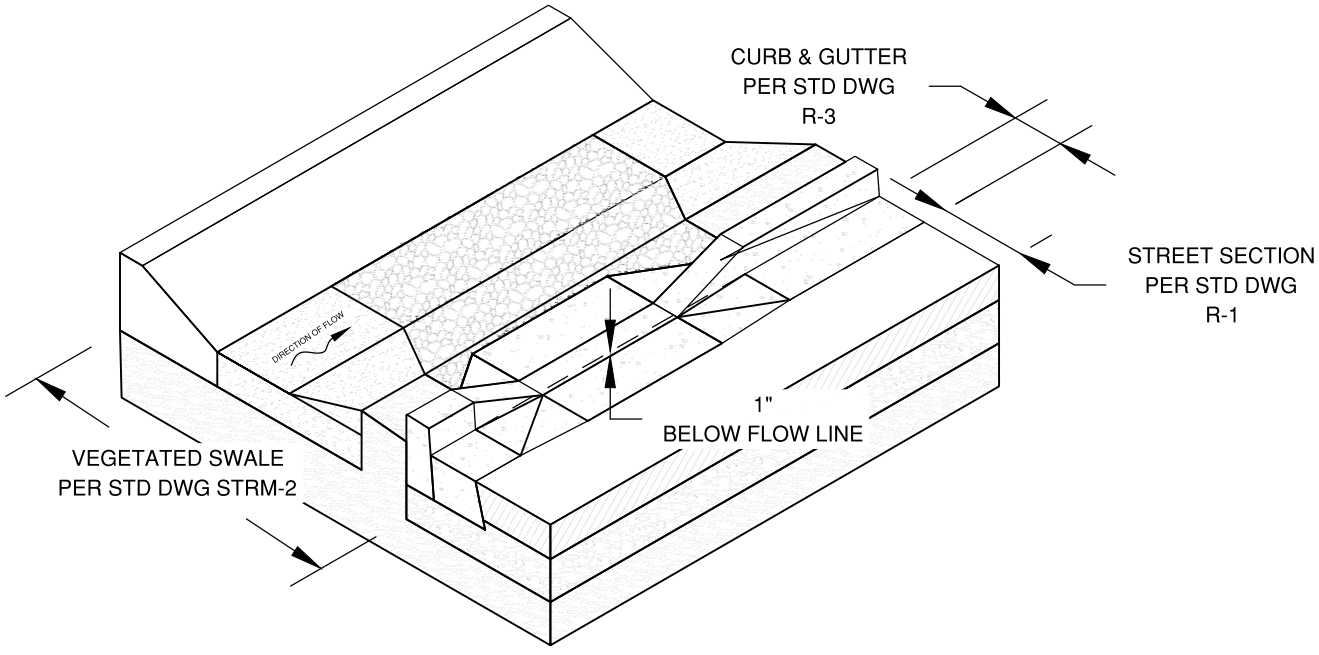
NTS

NOTES:

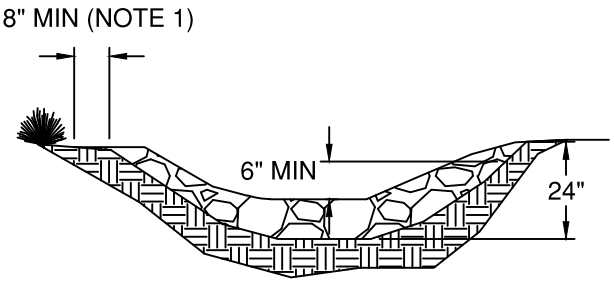
1. SWALE/SURFACE INFILTRATION FACILITIES NOT PERMITTED WITHIN PUES OR OVER FRANCHISE UTILITIES
2. VOLUME AND DEPTH TO BE DETERMINED BY ENGINEER.

DRAWN AJD DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 TYPICAL SWALE LAYOUT	SCALE NTS DATE 01/31/2022 APPR STD DWG STRM-3

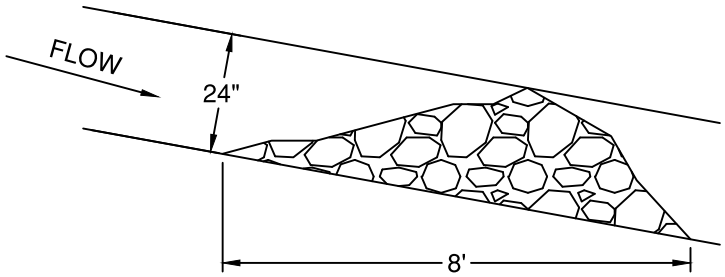




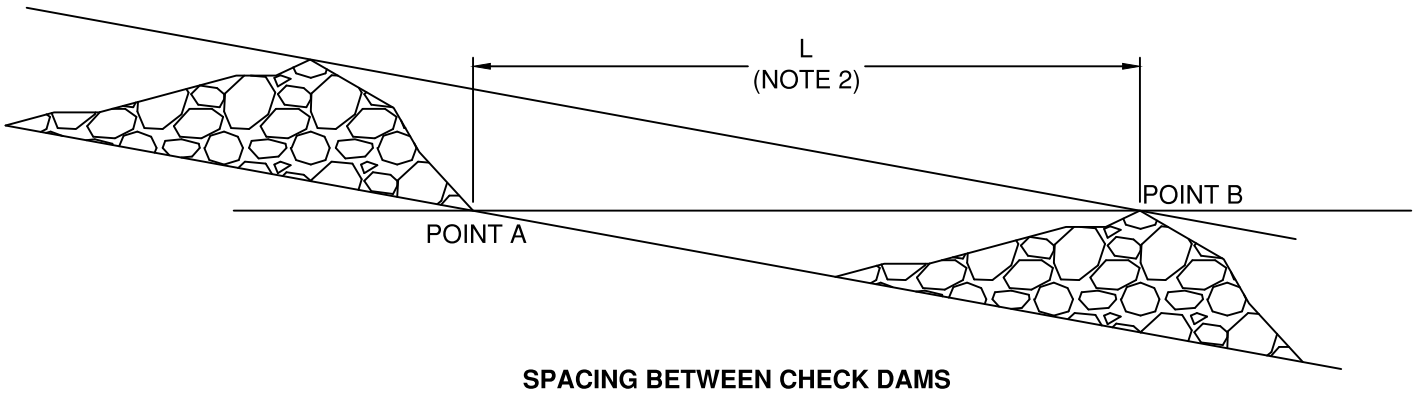
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL CURB CUT	STD DWG STRM-3A



CHANNEL CROSS SECTION



CHECK DAM PROFILE

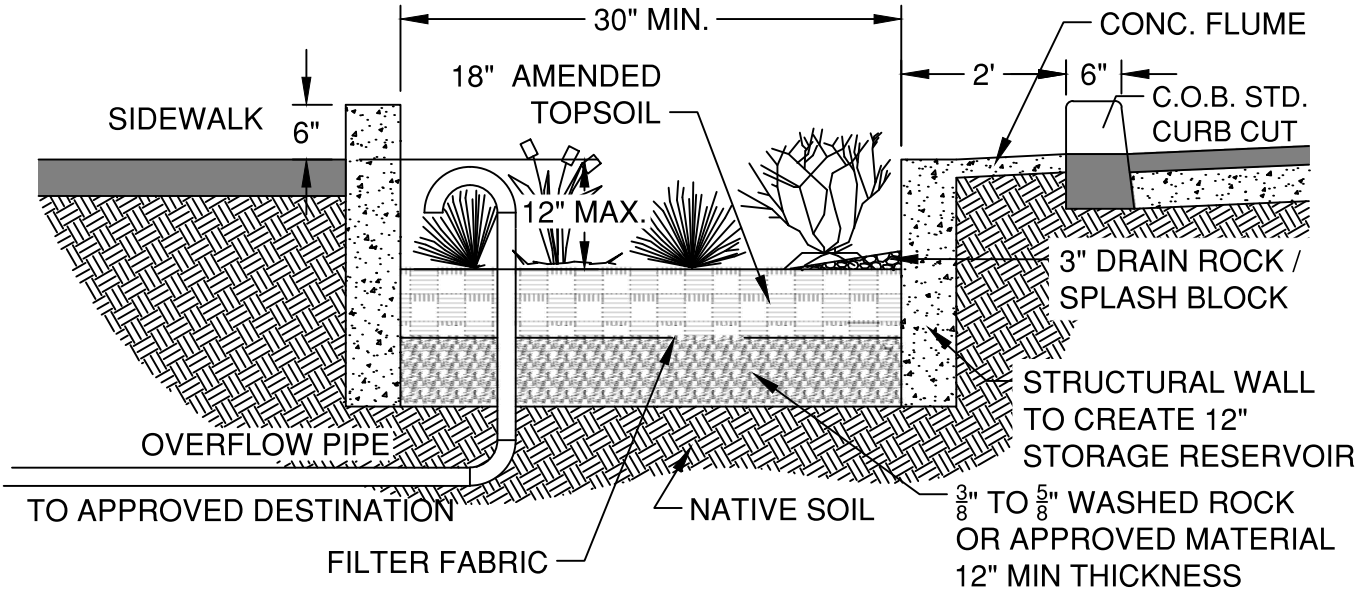


SPACING BETWEEN CHECK DAMS

NOTES:

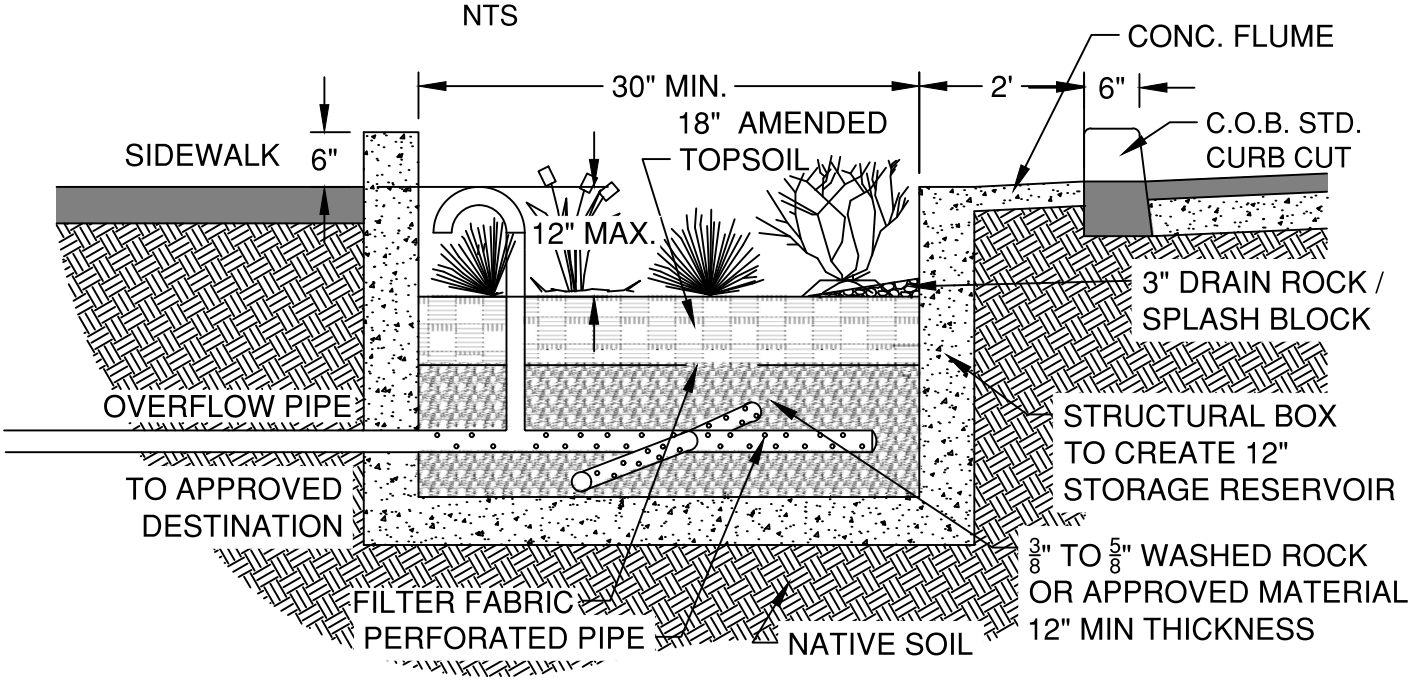
1. KEY STONE INTO THE CHANNEL BANKS AND EXTEND DAM A MINIMUM OF 18" TO PREVENT FLOW AROUND DAM.
2. L IS EQUAL TO THE DISTANCE SUCH THAT 'POINT A' AND 'POINT B' ARE OF EQUAL ELEVATION.
3. CHECK DAMS SHALL BE INSTALLED PER CENTRAL OREGON STORMWATER MANUAL (COSM) REQUIREMENTS.

DRAWN LJC	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 12/1/17
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CHECK DAM DETAIL	STD DWG STRM-4



INFILTRATION PLANTER TYPICAL SECTION

NTS



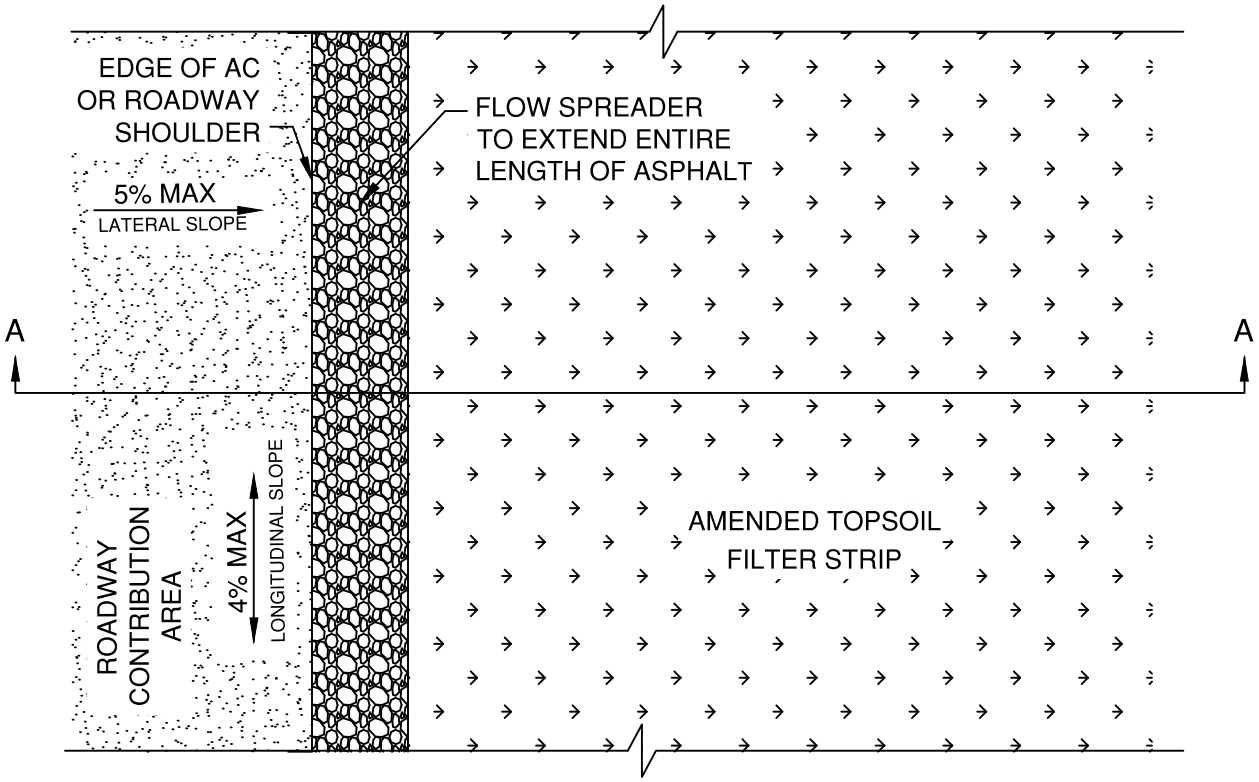
FLOW-THROUGH PLANTER TYPICAL SECTION

NTS

NOTE:

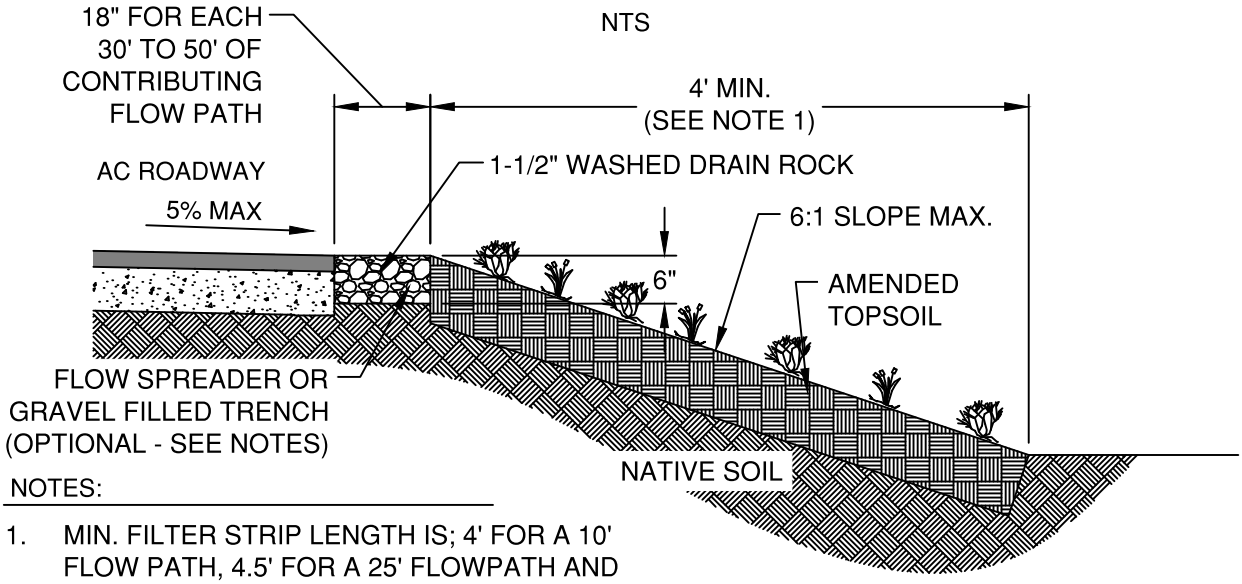
1. NOT FOR USE ALONG STREETS WITH POSTED SPEED ABOVE 25 MPH, UNLESS OUTSIDE THE CLEAR ZONE.
2. AMENDED TOPSOIL PER SPECIFICATION 01040
3. VOLUME AND DEPTH TO BE DETERMINED BY ENGINEER.
4. USE INFILTRATION PLANTER IF EXISTING SITE HAS AN INFILTRATION RATES > 0.5 IN/HR.
5. PLACE OVERFLOW PIPE 2" BELOW TOP OF PLANTER.
6. TO AVOID UIC REGULATION DO NOT USE PERFORATED PIPE OUTSIDE OF THE FLOW-THROUGH PLANTER OR WITH THE INFILTRATION PLANTER.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STORMWATER PLANTER DETAIL	STD DWG STRM-5



PLAN VIEW

NTS



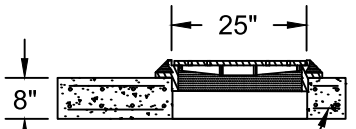
SECTION A-A

NTS

NOTES:

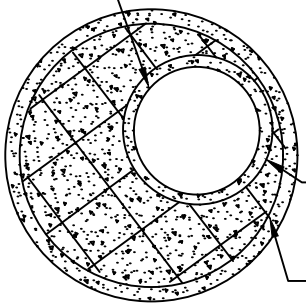
1. MIN. FILTER STRIP LENGTH IS; 4' FOR A 10' FLOW PATH, 4.5' FOR A 25' FLOWPATH AND 5.5' FOR A 30' FLOWPATH
2. AMENDED TOPSOIL PER SPECIFICATION 01040
3. FLOW SPREADER IS OPTIONAL. IF USED THE GRAVEL MUST BE WIDER THAN DEEP TO AVOID UIC REGULATIONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STORMWATER FILTER DETAIL	STD DWG STRM-6

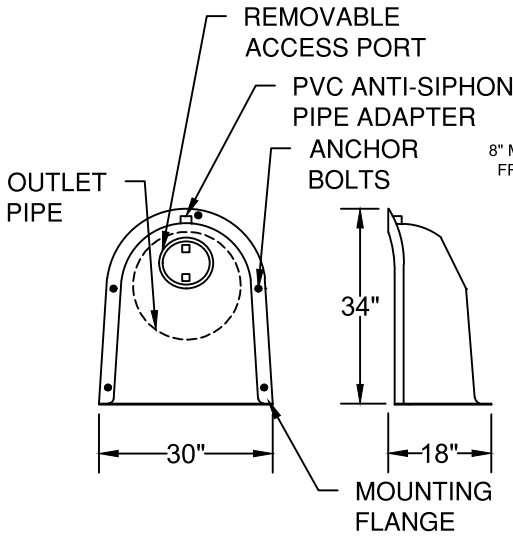


FLAT TOP
NTS

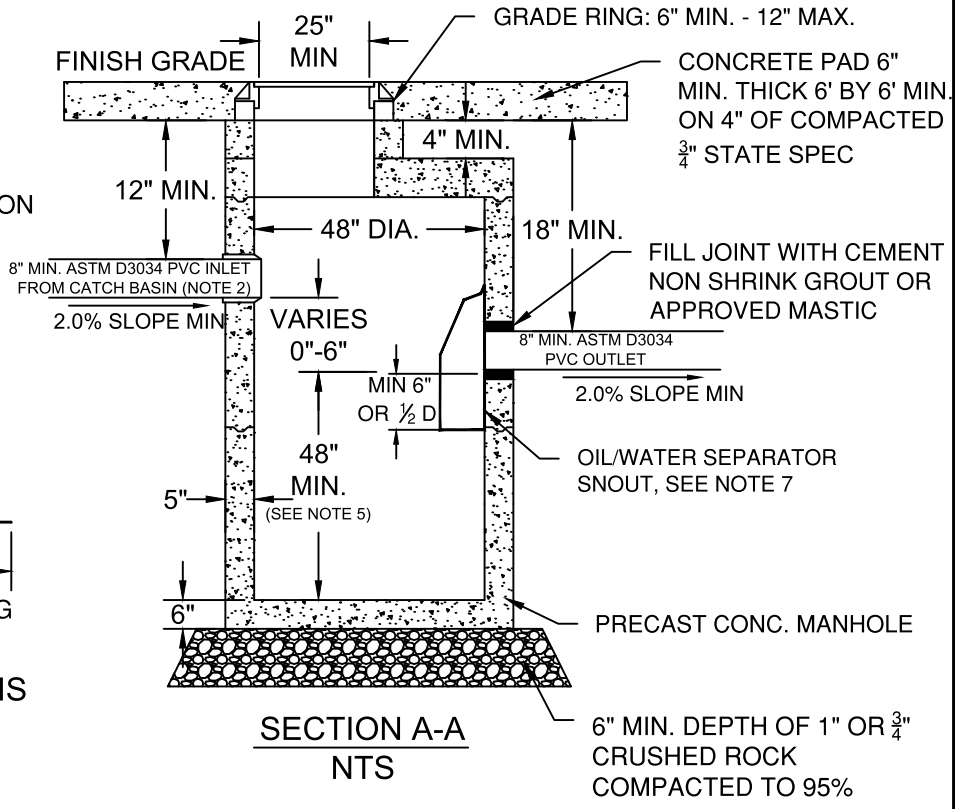
#4 BARS @ 12"
E.W. T. & B.



TOP VIEW



SNOUT OIL-WATER-DEBRIS
SEPARATOR
NTS

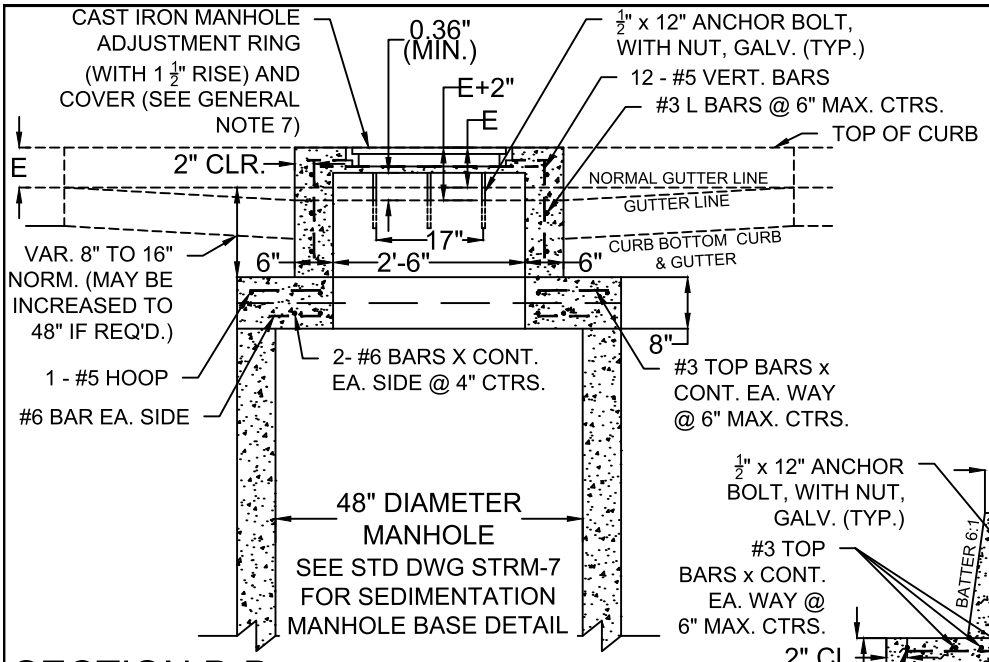


SECTION A-A
NTS

NOTES:

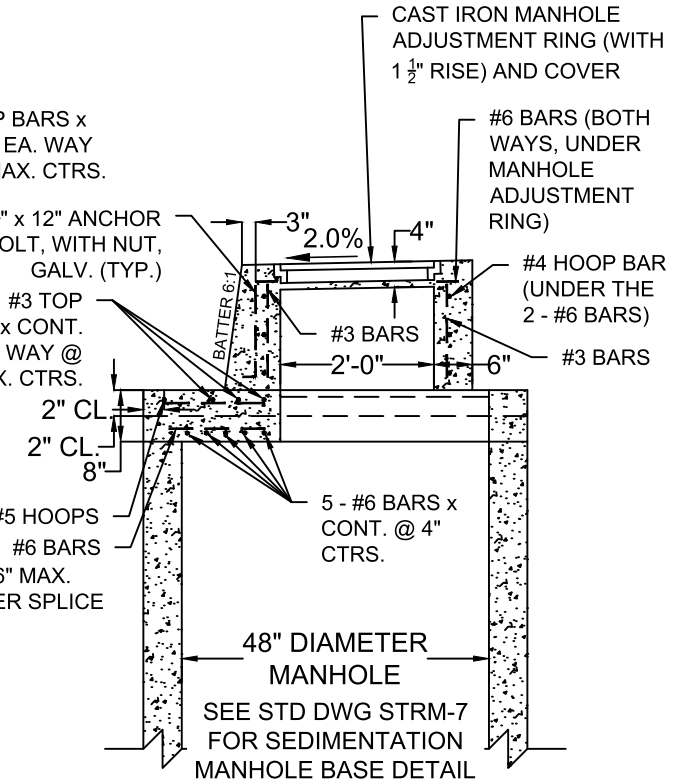
1. ALL PRE-CAST SECTIONS SHALL CONFORM TO REQUIREMENTS OF ASTM C-478.
2. AWWA C900 PIPE SHALL BE USED WITHIN TRAVEL AREAS. ASTM D3034 PIPE WHERE STORM PIPE WILL BE INSTALLED PERSANITARY SEWER REQUIREMENTS OR OUTSIDE OF TRAVEL AREAS.
3. MANHOLES SHALL BE PLACED OUTSIDE SIDEWALK, APRONS & STREET SURFACES UNLESS APPROVED BY THE CITY ENGINEER.
4. A 3 POINT MECHANICAL ADJUSTMENT SYSTEM SUCH AS RAD`S OR APPROVED EQUAL SHALL BE USED TO ADJUST MANHOLE FRAME AND COVER TO FINISH GRADE.
5. SUMP SIZE TO BE DESIGNED IN ACCORDANCE WITH COSM - 20 CF OF SUMP VOLUME FOR EACH 1.0 CFS DESIGN FLOW - NOT LESS THAN 48" DEPTH.
6. MANHOLES WITH MORE THAN 3 CONNECTIONS, OR PIPES 12" OR LARGER TO BE 60" MANHOLES
7. OIL/WATER SEPARATOR SNOUT BMP 24R, OR APPROVED EQUAL. SECURE TO MANHOLE WITH FIVE (5)$\frac{3}{8}$"x1-12" STAINLESS STEEL RED HEAD BOLTS, WASHERS AND NUTS, OR AS APPROVED BY MANUFACTURER.

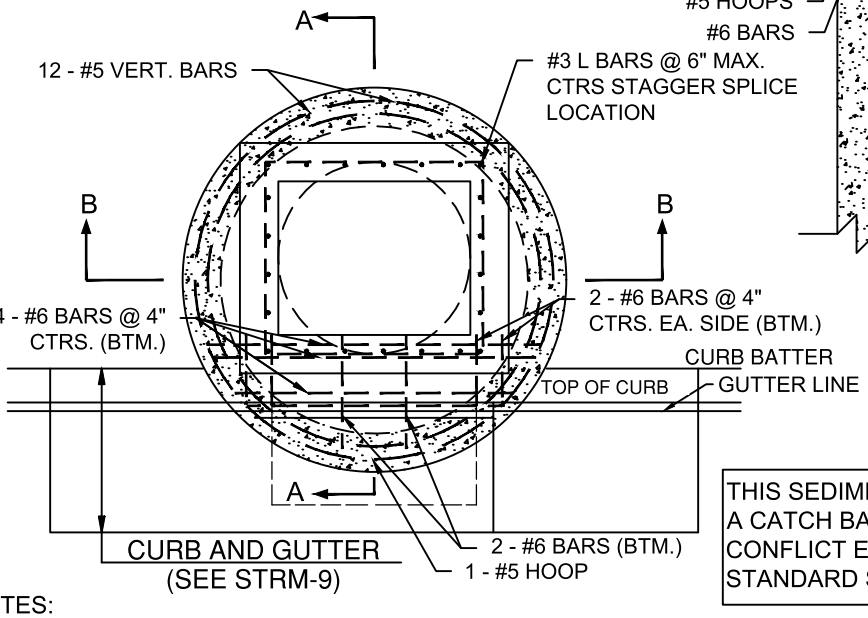
DRAWN AJD DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		STORMWATER SEDIMENTATION MANHOLE	STD DWG STRM-7



SECTION B-B

NTS





SECTION A-A

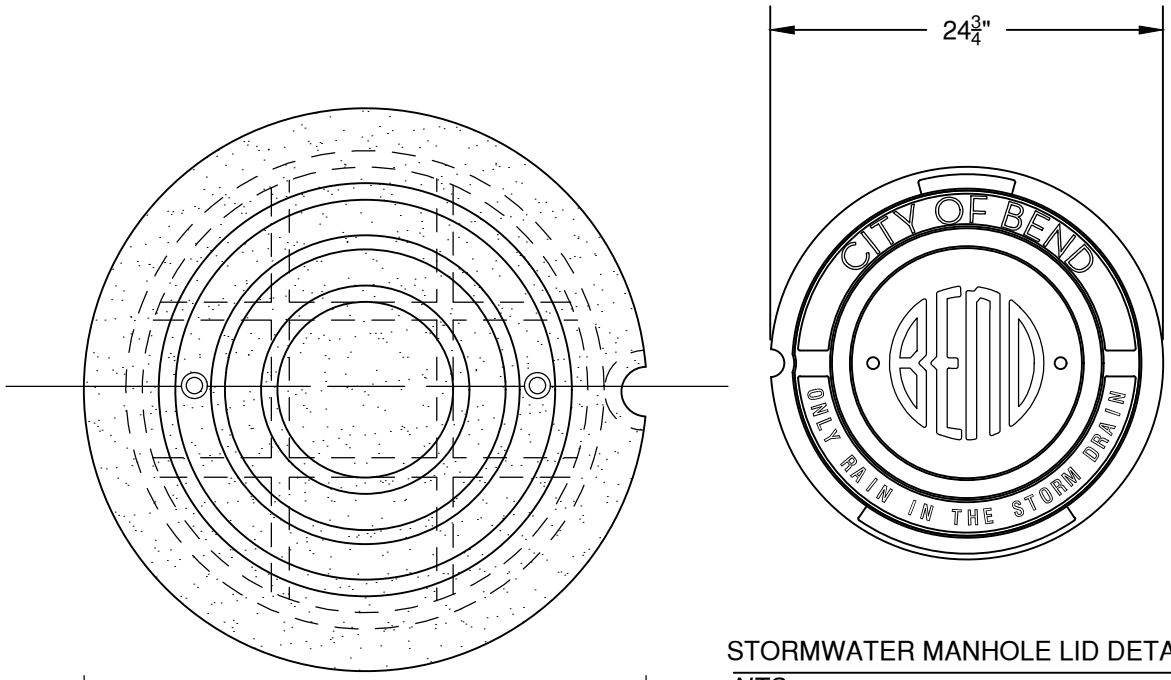
NTS

THIS SEDIMENTATION MANHOLE OPTION IS USED WHEN A CATCH BASIN OR INLET ARE PROPOSED AND A CONFLICT EXISTS PREVENTING INSTALLATION OF THE STANDARD SEDIMENTATION MANHOLE (STRM-7).

NOTES:

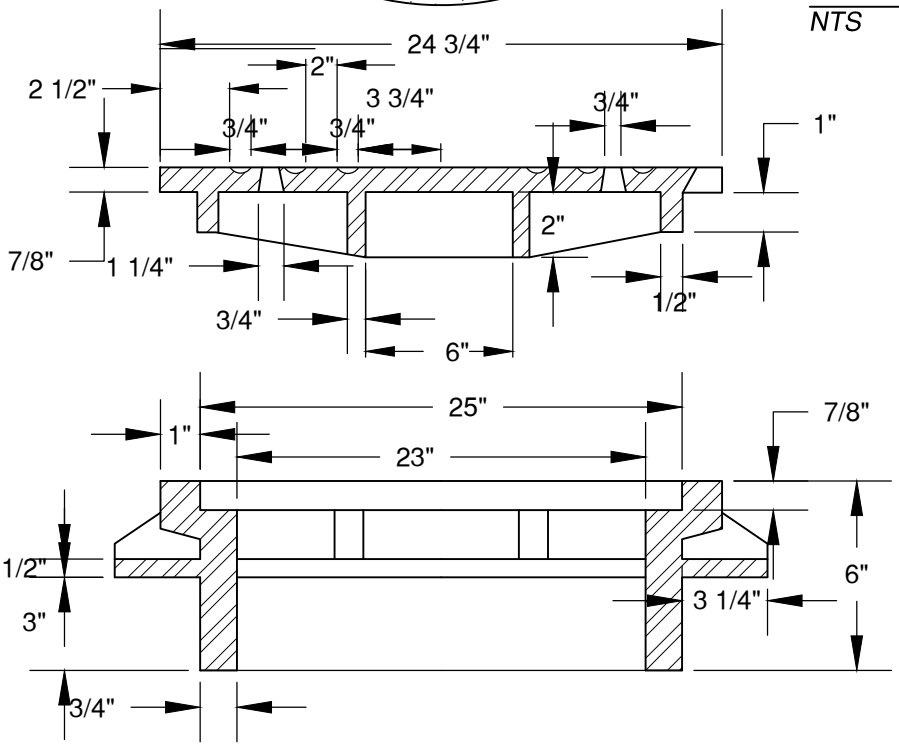
1. ALL REINFORCEMENT TO BE PLACED A MINIMUM OF 2" CLEAR OF NEAREST FACE OF CONCRETE UNLESS OTHERWISE SHOWN OR NOTED.
2. ALL PRECAST PRODUCTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C478.
3. ALL CONCRETE SHALL BE COMMERCIAL GRADE CONCRETE.
4. INLET TOP MAY BE CAST-IN-PLACE OR PRECAST. ALL PRECAST INLETS SHALL CONFORM TO REQUIREMENTS OF ASTM C913.
5. VARY ANCHOR BOLT LENGTH AND REINFORCING BAR PLACEMENT AS REQUIRED BY CURB EXPOSURE E.
6. SEE COB STD DWG R-3 FOR CURB DETAILS.
7. SEE ODOT STD DWG RD356 FOR MANHOLE ADJUSTMENT RING. SEE COB STD DWG STRM-8 FOR CAST IRON MANHOLE ADJUSTMENT RING AND COVER.
8. SUMP SIZE TO BE DESIGNED IN ACCORDANCE WITH COSM - 20 CF OF SUMP VOLUME FOR EACH 1.0 CFS DESIGN FLOW - NOT LESS THAN 48" DEPTH.

DRAWN AJD	CITY OF BEND	SCALE NTS	
DIV STORM	STANDARD DRAWING	DATE 11/01/2024	
REV DATE	710 NW WALL ST., BEND, OREGON 97701	APPR	
CITY OF BEND	STORMWATER SEDIMENTATION MANHOLE - ALTERNATE	STD DWG STRM-7A	



STORMWATER MANHOLE LID DETAIL

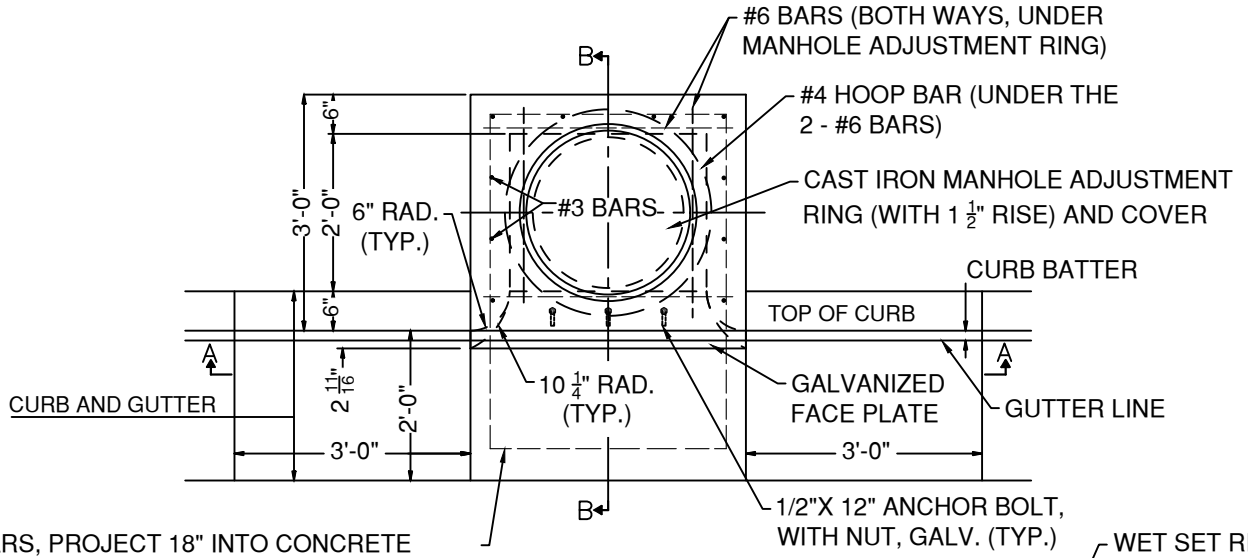
NTS



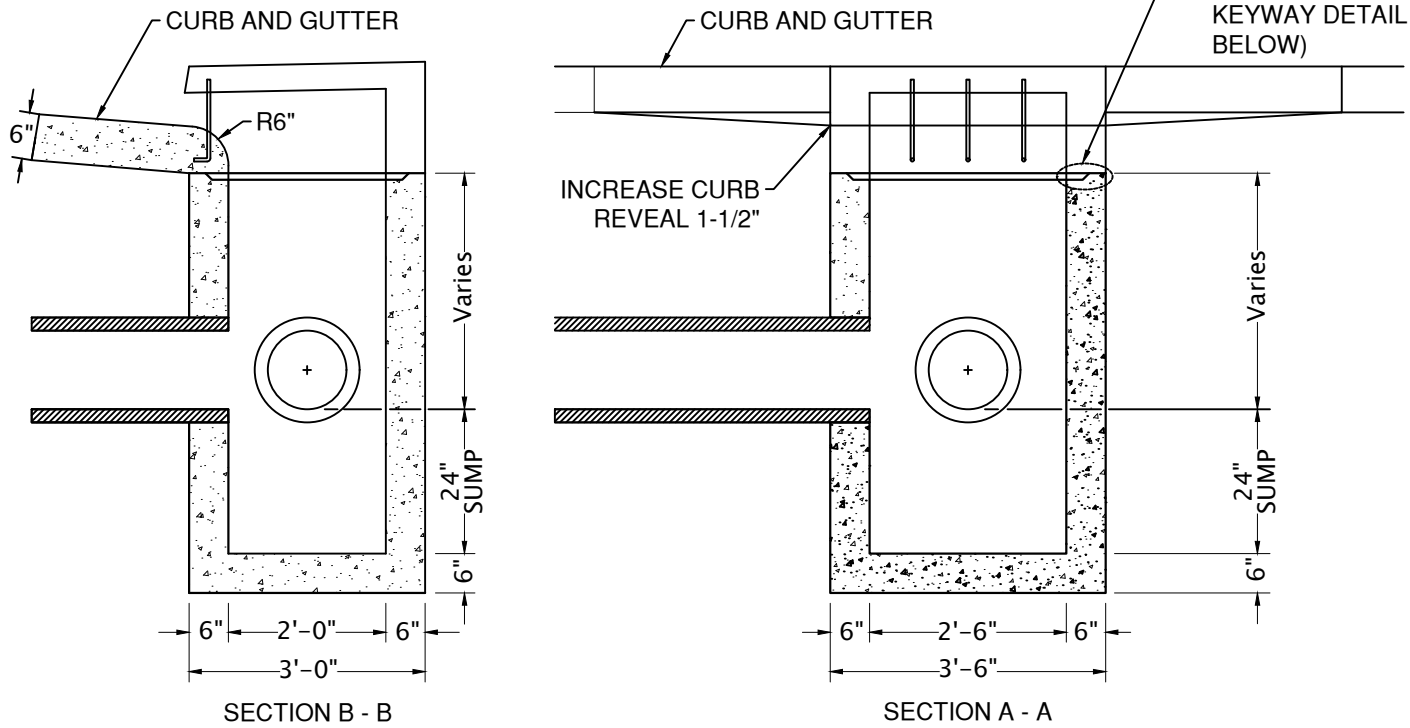
NOTE:

1. MANHOLE LID ONLY TO BE USED ON CITY OF BEND PUBLIC DRYWELLS AND SEDIMENTATION MANHOLES. PRIVATELY OWNED DRYWELLS AND SEDIMENT MANHOLES SHALL NOT USE A CITY OF BEND MANHOLE LID.
2. HINGED MANHOLE LIDS ARE NOT PERMITTED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
3. ALL MANHOLE LIDS SHALL BE PLACED OUTSIDE THE PATH OF TRAVEL OF SIDEWALKS AND DRIVEWAY APRONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STORMWATER MANHOLE LID DETAIL	STD DWG STRM-8



PLAN VIEW

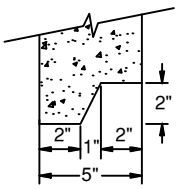


SECTION B - B

SECTION A - A

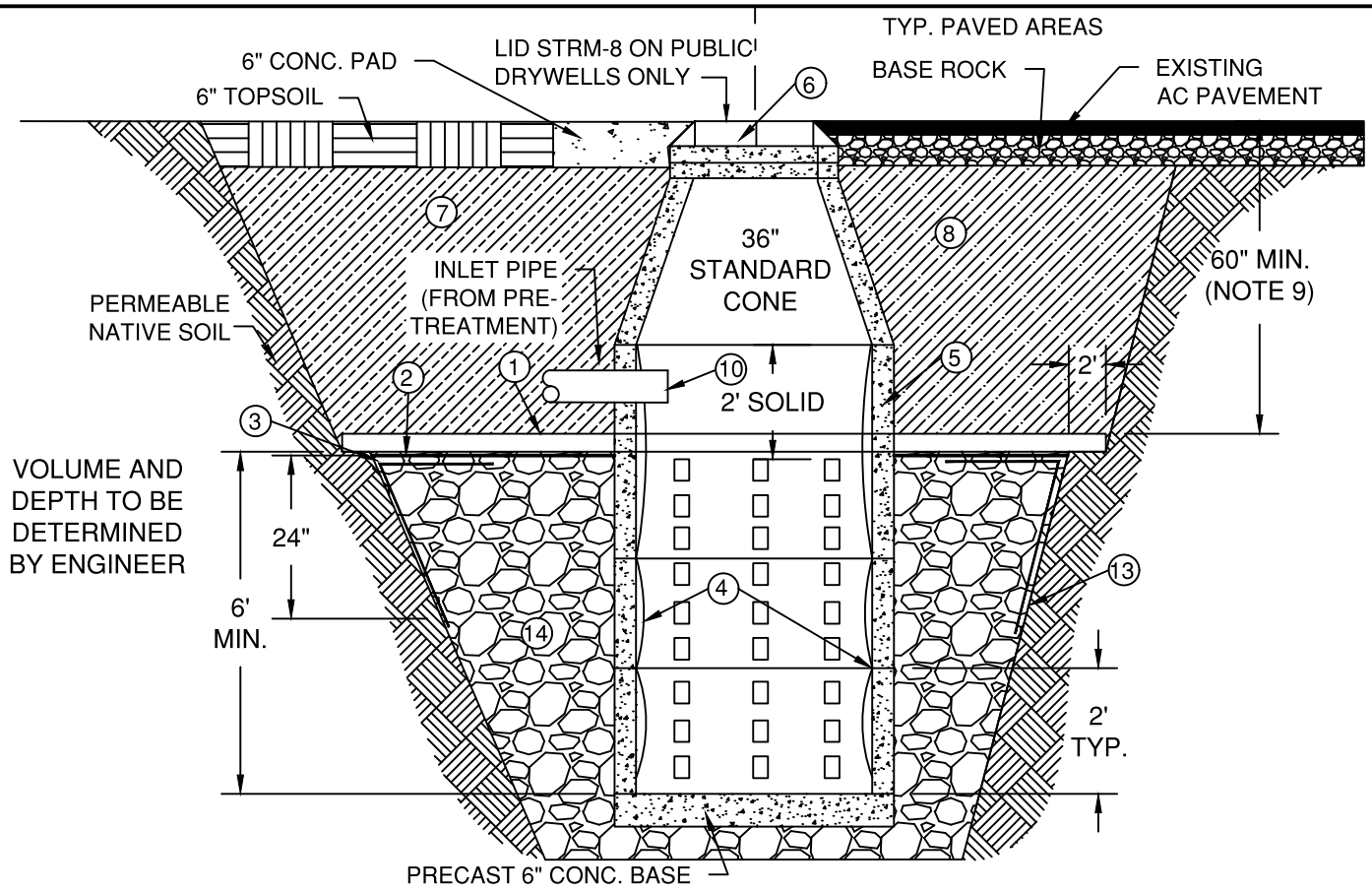
NOTES:

1. REMOVE SUFFICIENT CURB TO POUR BACK WALL. TOP SECTION MAY BE POURED MONOLITHIC WITH SIDEWALK.
2. CURB INLETS TO BE USED ON ARTERIAL AND COLLECTOR ROADWAYS.
3. "E" = CURB EXPOSURE.
4. SEE COB STD DWG STRM-8 FOR CAST IRON MANHOLE ADJUSTMENT RING AND COVER.
5. ALL PIPE CONNECTIONS TO BE GROUTED PER SPECIFICATION SECTION 00470.40.



KEYWAY DETAIL

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 04/16/2026
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD CURB INLET	STD DWG STRM-9

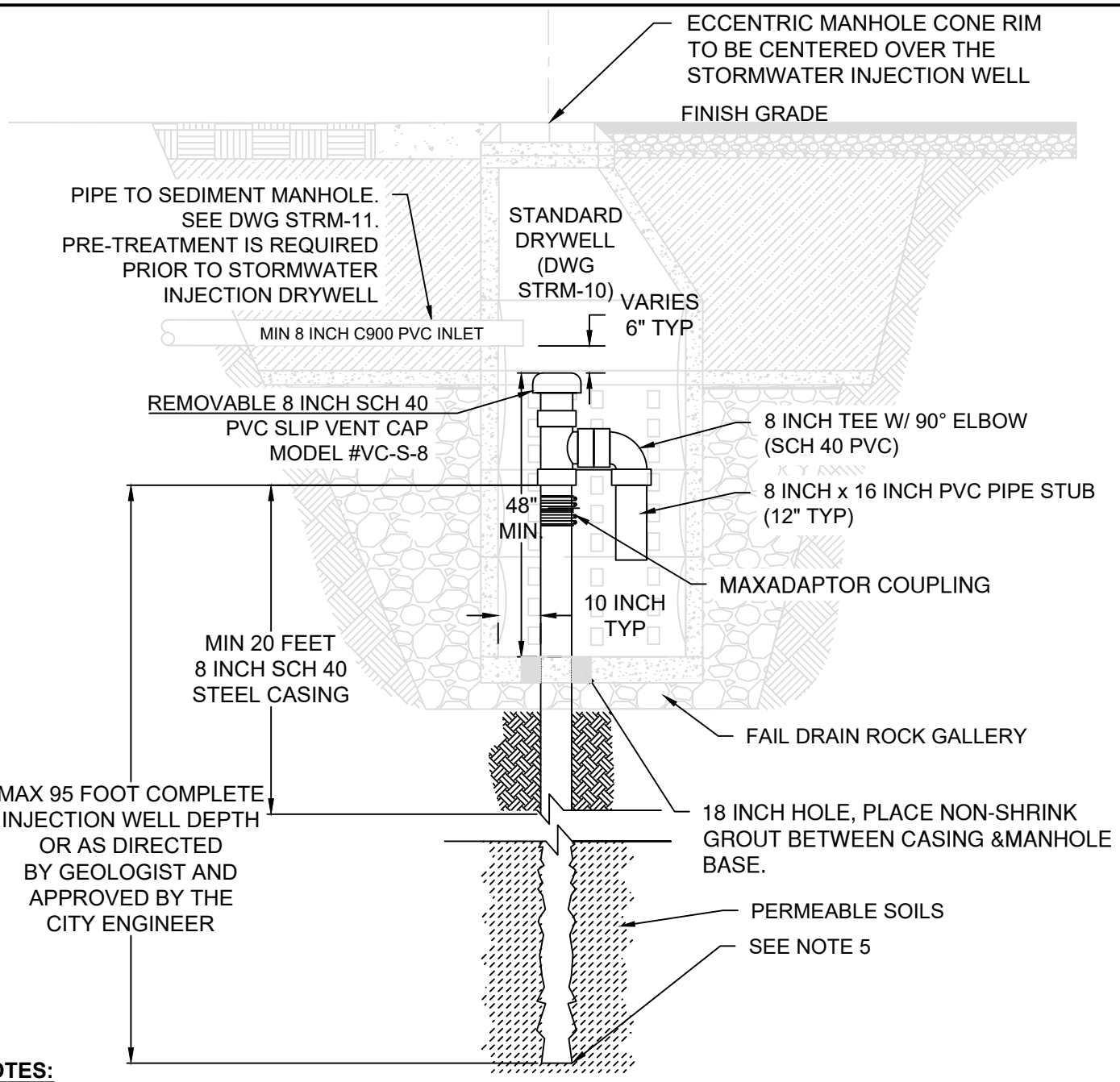


NOTES:

* SEE ALSO THE CITY OF BEND STANDARDS AND SPECIFICATIONS FOR DESIGN CRITERIA

1. 6" CONCRETE CAP, SECTION 00440 COMMERCIAL GRADE CONCRETE, EXTEND TO UNDISTURBED MATERIAL 2' MIN. REQUIRED WITHIN ALL CITY OF BEND RIGHT OF WAY UNLESS NOTED OTHERWISE.
2. MOISTURE BARRIER-2 LAYERS OF 4 MIL POLY. ON ALL ROCK INSTALLATIONS.
3. NONWOVEN GEOFABRIC CONFORMING TO DRAINAGE GEOTEXTILE, OREGON TABLE 02320-1 REQUIRED ON ALL EARTH OR GRAVEL EXCAVATIONS TO 24" INTO ROCK. LAP 24" WITH MOISTURE BARRIER.
4. LINE INSIDE OF PERFORATED BARREL WITH HEAVY WEIGHT VINYL SCREEN, SUCH AS FULL FLOW VINYL SCREEN THAT MEETS THE REQUIREMENTS OF SPECIFICATION SECTION 00470. LINER SHALL BE FULLY AND CONTINUOUSLY ANCHORED, TOP AND BOTTOM OF EACH SECTION. ATTACH BY OVERLAPPING 12" MIN. BETWEEN JOINT OF MANHOLE CONE AND PERFORATED BARREL SECTION. INLET PIPE SHALL BE EXTENDED THROUGH THE SCREEN IF SCREEN IS ATTACHED ABOVE THE PIPE.
5. PRE-CAST SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478. ALL CONCRETE SHALL BE COMMERCIAL GRADE CONCRETE
6. STANDARD RING AND COVER REQUIRED IN RIGHT-OF-WAY AREAS. NO SLOTTED COVERS WILL BE ALLOWED IN LIEU OF A CATCH BASIN.
7. CLASS "A" BACKFILL COMPACTED TO 95.0% OPTIMUM DRY DENSITY (AASHTO T-99).
8. CLASS "B" BACKFILL COMPACTED TO 95.0% OPTIMUM DRY DENSITY (AASHTO T-99).
9. PERFORATIONS TO BE 60" BELOW EXISTING UNDISTURBED GROUND.
10. INLET PIPE MUST BE DESIGNED SO IT CAN BE PLUGGED IN CASE OF SPILL. ALL PIPE PENETRATIONS ARE TO BE GROUTED OR WATER-TIGHT SEALED. PIPE INLETS NOT TO ENTER DRYWELL WITH PERFORATED BARREL.
11. DRYWELL RIMS TO BE PLACED OUTSIDE OF SIDEWALK, APRON & STREET SURFACES UNLESS APPROVED BY THE CITY ENGINEER.
12. PLANS SHALL PROVIDE VOLUME AND AREA OF ROCK PLACEMENT. ROCK PLACEMENT SHALL BE OUTSIDE WATER/SEWER TRENCHES. WHERE ROCK ENTERS PRIVATE PROPERTY, A DRAINAGE EASEMENT SHALL BE RECORDED.
13. GEOFABRIC TO BE EXTENDED FROM THE CONCRETE CAP TO BOTTOM OF DRYWELL STRUCTURE. WHERE THE EXCAVATION IS WITHIN SOLID ROCK (NO SIDEWALL SLOUGHING), GEOFABRIC CAN BE WAIVED AT ENGINEER'S DISCRETION
14. CLEAN 2"-3" CRUSHED OR RIVER RUN DRAIN ROCK PER SECTION 00470.18.

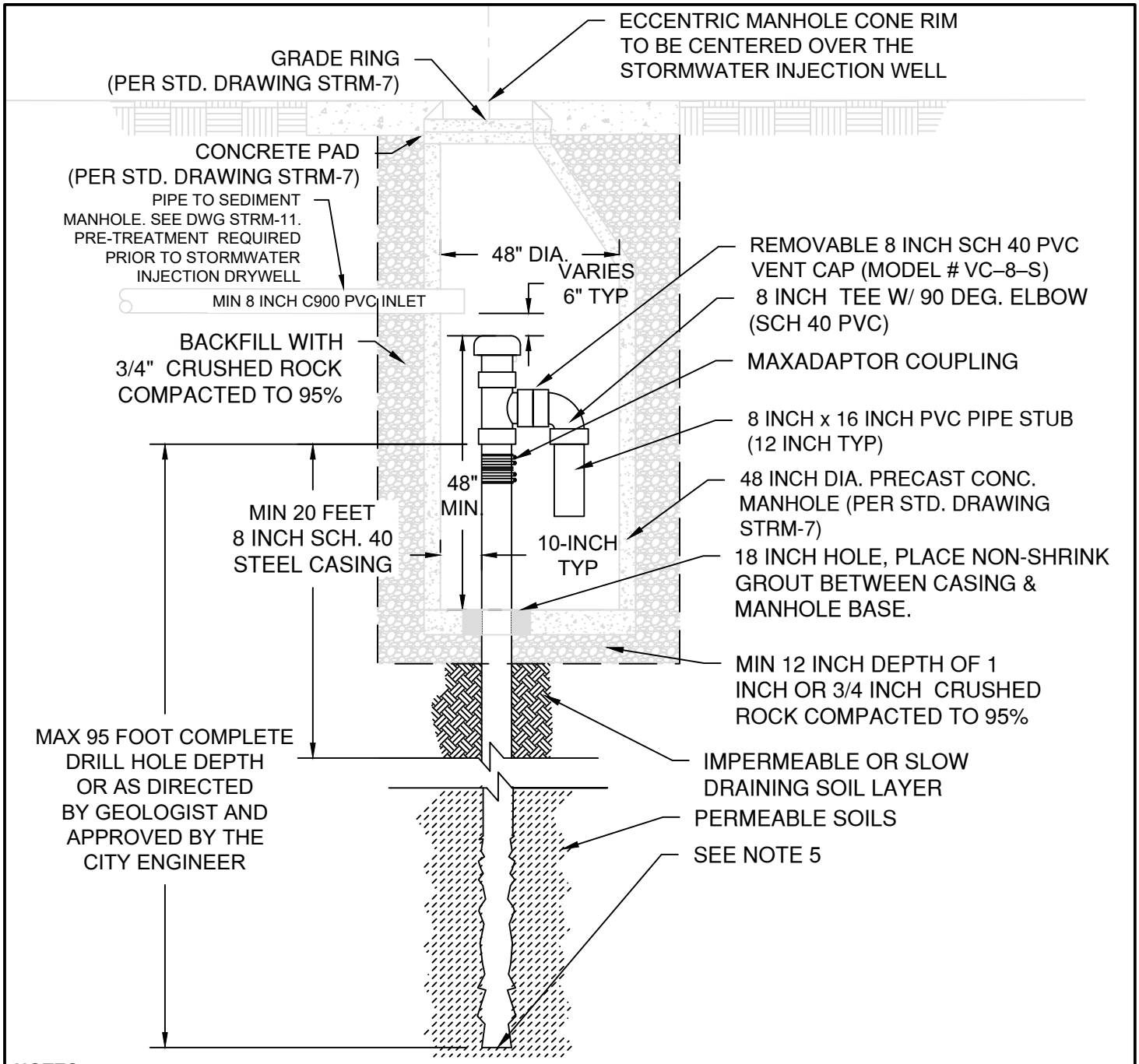
DRAWN AJD DIV STORM REV / DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 STANDARD PRE-CAST DRYWELL	SCALE NTS DATE 03/22/2023 APPR STD DWG STRM-10



NOTES:

1. MODIFIED DRYWELLS SHALL ONLY BE INSTALLED IN LOCATIONS WHERE THE GEOTECHNICAL REPORT AND FIELD EXPLORATION DEMONSTRATE THAT EXISTING DRYWELL HAS FAILED DUE TO POOR-DRAINING SOIL CONDITIONS.
2. STORMWATER INJECTION WELLS ARE ONLY ALLOWED ON ALLEYS, LOCAL ROADS, AND COLLECTOR ROADS WITHIN RESIDENTIAL LAND USE ZONES.
3. STORMWATER INJECTION WELLS ARE PROHIBITED IN 1 AND 2 YEAR DRINKING WATER PROTECTION TIME OF TRAVEL AREAS AND WITHIN 100 FEET OF PRIVATE WATER WELLS.
4. STORMWATER INJECTION WELLS ARE PROHIBITED IN THE OLD MILL AND NORTH BEND'S PERCHED GROUNDWATER AREAS.
5. STORMWATER INJECTION WELLS MUST MAINTAIN A MINIMUM VERTICAL SEPARATION OF 53 FEET FROM THE BOTTOM OF THE INJECTION WELL AND REGIONAL GROUNDWATER AQUIFER. REFER TO THE DIGITAL MAPS FOR GROUNDWATER DEPTH.

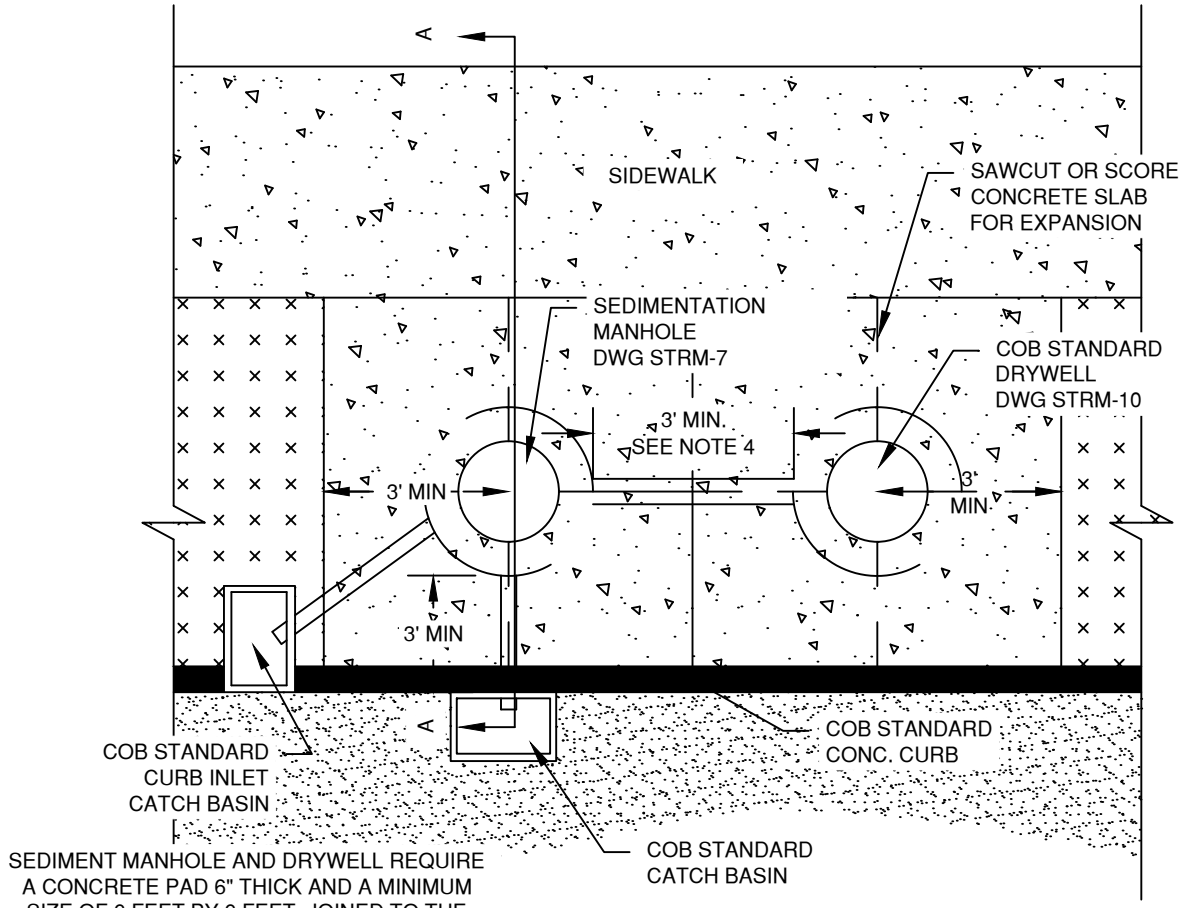
DRAWN CJH DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 MODIFIED DRYWELL W/ STORM INJECTION WELL	SCALE NTS DATE 04/16/2026 APPR STD DWG STRM-10A



NOTES:

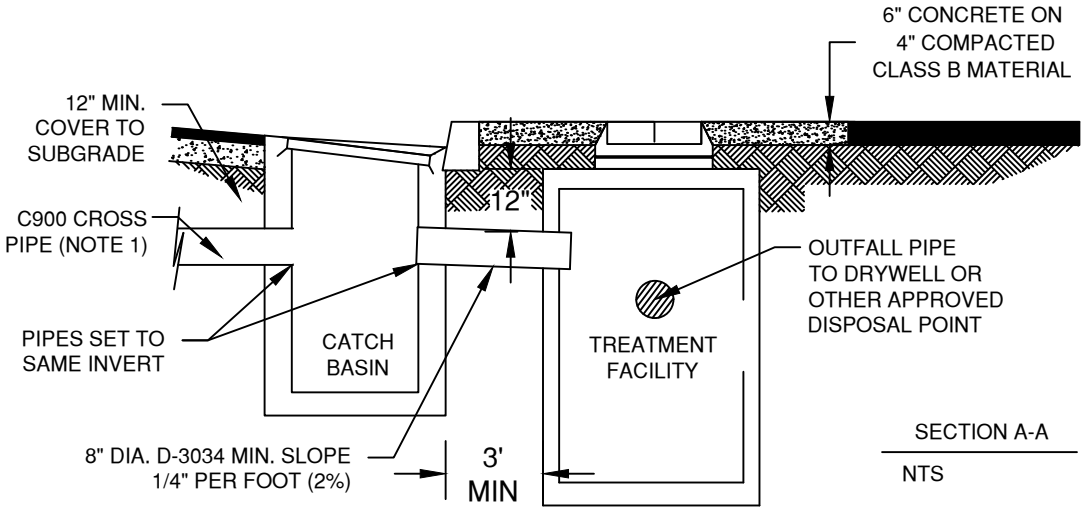
1. STORMWATER INJECTION WELLS SHALL ONLY BE INSTALLED IN LOCATIONS WHERE THE GEOTECHNICAL REPORT AND FIELD EXPLORATION DEMONSTRATE THAT STANDARD DRYWELLS ARE NOT FEASIBLE DUE TO POOR-DRAINING SOIL CONDITIONS.
2. STORMWATER INJECTION WELLS ARE ONLY ALLOWED ON LOCAL ALLEYWAYS, OR COLLECTOR ROADS WITHIN RESIDENTIAL LAND USE ZONES.
3. STORMWATER INJECTION WELLS ARE PROHIBITED IN 1 AND 2 YEAR DRINKING WATER PROTECTION TIME OF TRAVEL AREAS AND WITHIN 100 FEET OF PRIVATE WATER WELLS.
4. STORMWATER INJECTION WELLS ARE PROHIBITED IN THE OLD MILL AND NORTH BEND'S PERCHED GROUNDWATER AREAS.
5. STORMWATER INJECTION WELLS MUST MAINTAIN A MINIMUM VERTICAL SEPARATION OF 53 FEET FROM THE BOTTOM OF THE STORMWATER INJECTION WELL AND REGIONAL GROUNDWATER AQUIFER. REFER TO THE DIGITAL MAPS FOR GROUNDWATER DEPTH.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STORMWATER INJECTION WELL	STD DWG STRM-10B



PLAN VIEW

NTS



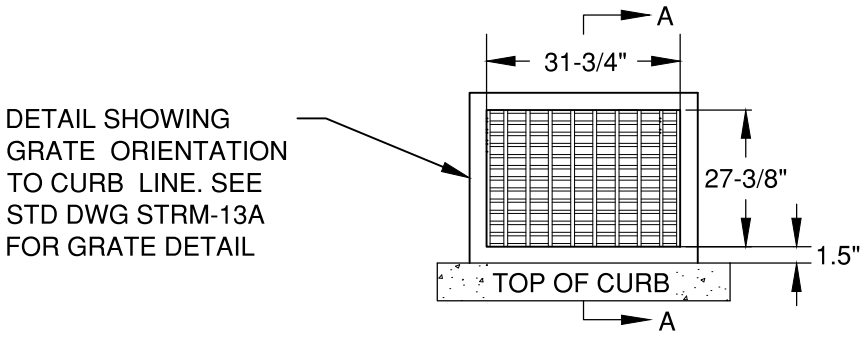
SECTION A-A

NTS

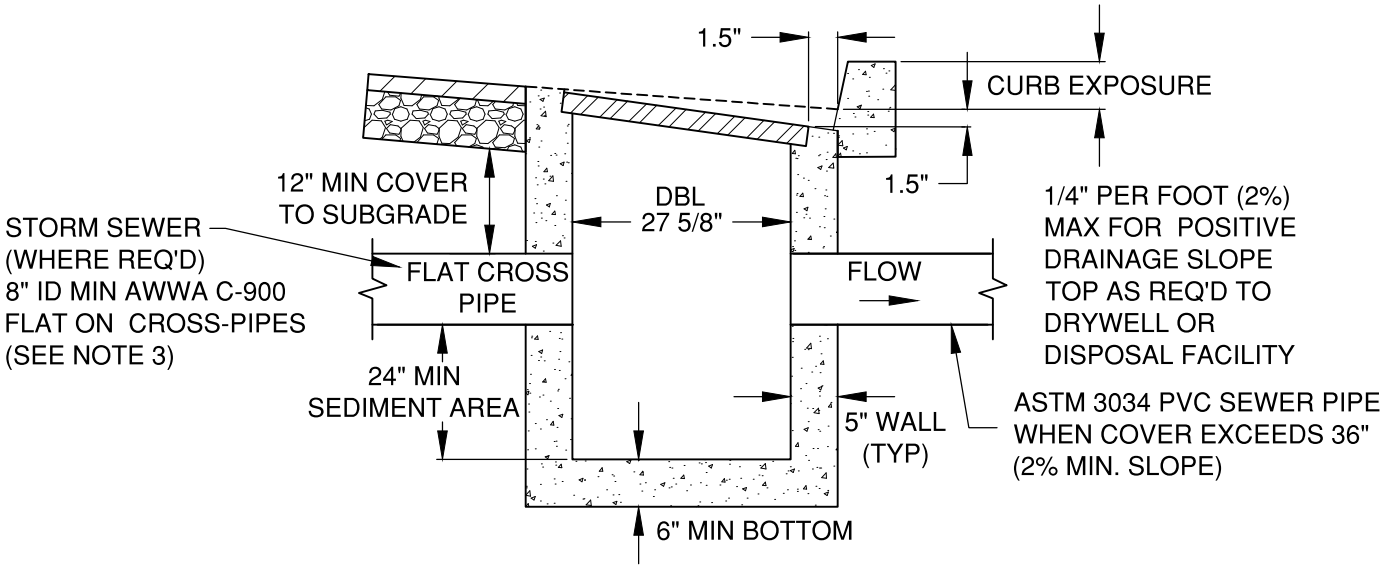
NOTES:

1. CROSS PIPE ELEV MAY REQUIRE OTHER UTILITIES (SEWER, WATER, ETC) TO BE LOWERED TO PROVIDE MINIMUM SEPARATIONS
2. ALL PIPE PENETRATIONS ARE TO BE GROUTED OR WATER TIGHT SEALED.
3. DRYWELL AND TREATMENT FACILITY NOT TO BE PLACED IN DRIVEWAY OR SIDEWALK UNLESS APPROVED BY THE CITY ENGINEER.
4. WHEN DRY UTILITIES OR WATER/SEWER SERVICES ARE TO BE INSTALLED BETWEEN THE SEDIMENTATION MANHOLE AND DRYWELL, UTILITIES MUST MAINTAIN A MIN 3' HORIZONTAL SEPARATION FROM THE OUTSIDE EDGE OF STRUCTURES. STRUCTURES TO BE SEPARATED BY A MIN 5'. UTILITIES MUST NOT BE INSTALLED ABOVE THE DRYWELL DRAINROCK GALLEY SLAB.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 04/16/2026
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		DRYWALL W/ MANUFACTURED TREATMENT LAYOUT	STD DWG STRM-11



PLAN VIEW

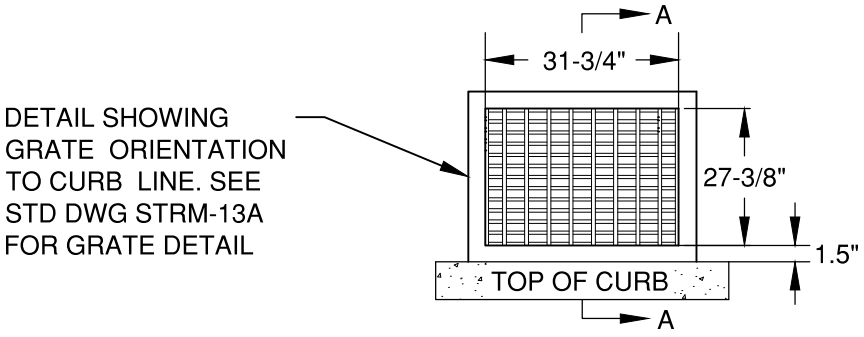


SECTION A-A

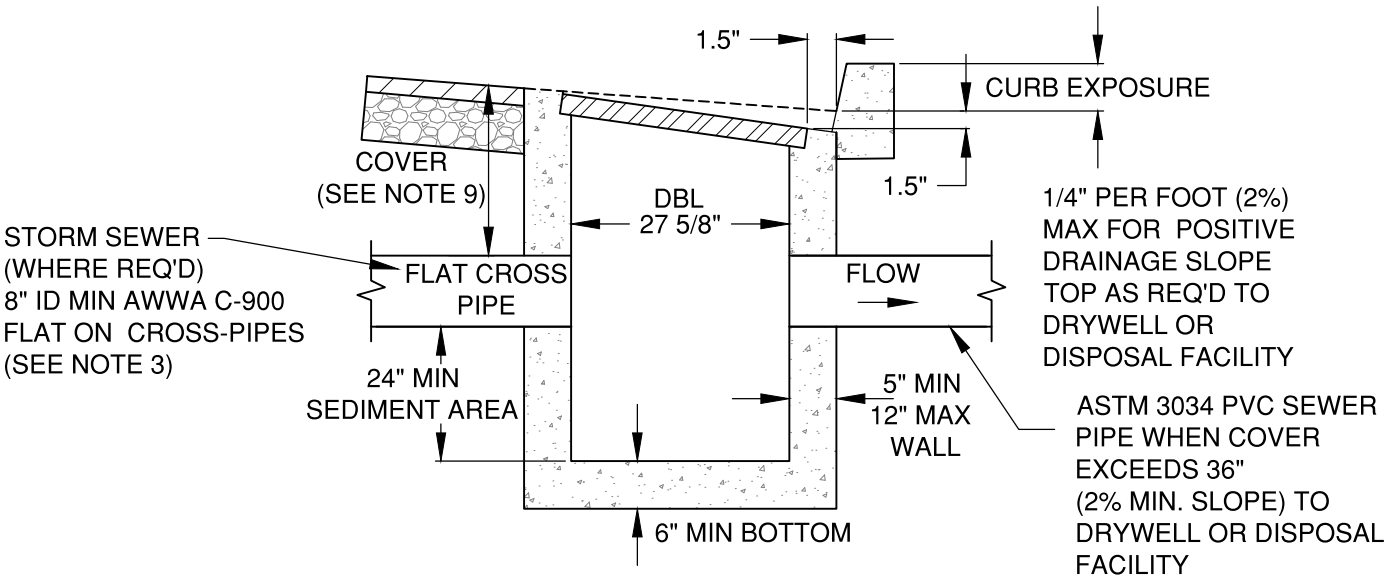
NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL CATCH BASINS TO BE DOUBLE CATCH BASIN
2. BACKFILL TO BE COMPACTED TO 95% OF OPTIMUM PER SPECIFICATION SECTION 00330.43
3. CROSS PIPE ELEV MAY REQUIRE OTHER UTILITIES (SEWER, WATER, ETC) TO BE LOWERED TO PROVIDE MINIMUM SEPARATIONS
4. ALL PIPE CONNECTIONS TO BE GROUTED PER SPECIFICATION SECTION 00470.40
5. CONTRACTOR IS RESPONSIBLE TO KEEP CATCH BASIN CLEAN AND FREE OF SEDIMENT DURING CONSTRUCTION
6. CONTRACTOR IS RESPONSIBLE TO COVER AND BARRICADE ALL CATCH BASINS UNTIL GRATE IS INSTALLED
7. STANDARD CATCH BASINS ARE LIMITED TO LOCAL STREETS AND SHALL NOT BE USED ON ARTERIAL & COLLECTOR ROADWAYS. CURB INLETS ARE TO BE USED ON ARTERIAL & COLLECTOR ROADWAYS.
8. SEE DRG R-11 FOR PAVEMENT RESURFACING

DRAWN AJD DIV STORM REV DATE	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 03/22/2023 APPR	
	STANDARD CATCH BASIN	STD DWG STRM-12	



PLAN VIEW

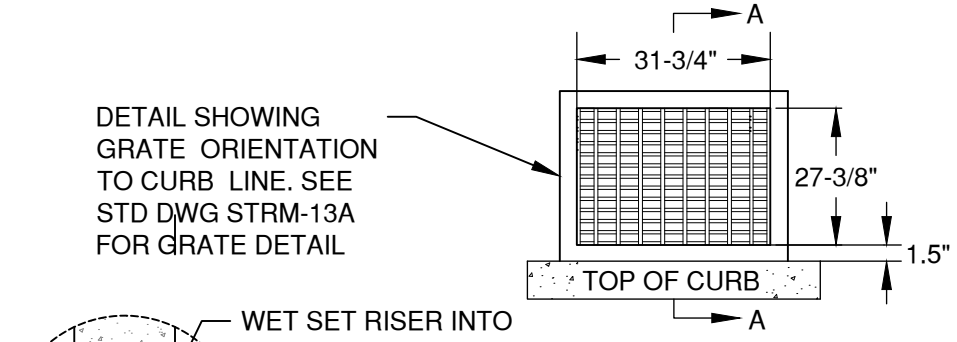


SECTION A-A

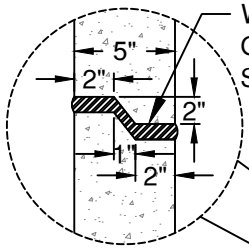
NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL CATCH BASINS TO BE DOUBLE CATCH BASIN
2. BACKFILL TO BE COMPACTED TO 95% OF OPTIMUM PER SPECIFICATION SECTION 00330.43
3. CROSS PIPE ELEVATE MAY REQUIRE OTHER UTILITIES (SEWER, WATER, ETC) TO BE LOWERED TO PROVIDE MINIMUM SEPARATIONS.
4. ALL PIPE CONNECTIONS TO BE GROUTED PER SPECIFICATION SECTION 00470.40. GROUT SHOULD BE LEVELED TO ALIGN FLUSH WITH THE INTERIOR WALL WITH NO EXTENSION OF GROUT ONTO THE INTERNAL SURFACE AREA OF THE CATCH BASIN.
5. CONTRACTOR IS RESPONSIBLE TO KEEP CATCH BASIN CLEAN AND FREE OF SEDIMENT DURING CONSTRUCTION
6. CONTRACTOR IS RESPONSIBLE TO COVER AND BARRICADE ALL CATCH BASINS UNTIL GRATE IS INSTALLED
7. STANDARD CATCH BASINS ARE LIMITED TO LOCAL STREETS AND SHALL NOT BE USED ON ARTERIAL & COLLECTOR ROADWAYS. CURB INLETS ARE TO BE USED ON ARTERIAL & COLLECTOR ROADWAYS.
8. SEE DRG R-11 FOR PAVEMENT RESURFACING
9. ON LOCAL ROADS, PIPE COVER IS TO BE 22-INCH FROM FINISHED GRADE TO TOP OF PIPE. ON COLLECTORS AND ARTERIAL STREET SECTIONS (STD DWG R-1), MAINTAIN MIN COVER OF 24-INCHES FROM GUTTER FINISHED GRADE.

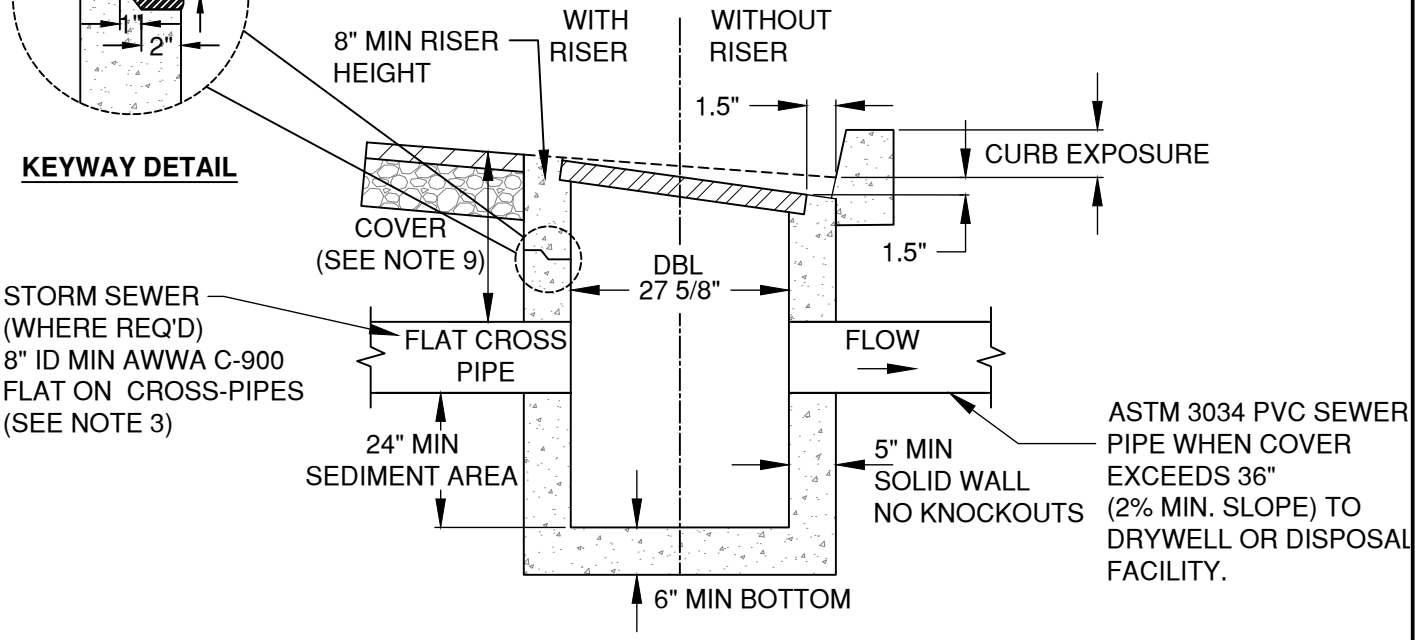
DRAWN AJD		CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD CATCH BASIN	STD DWG STRM-12A



PLAN VIEW



KEYWAY DETAIL

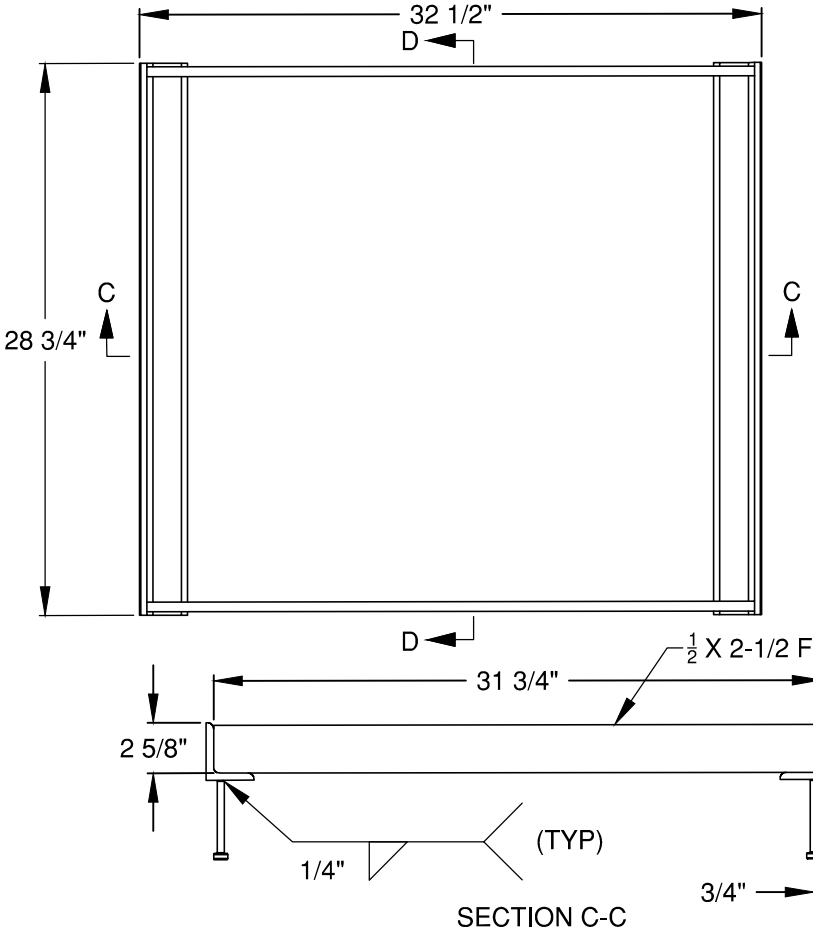


SECTION A-A

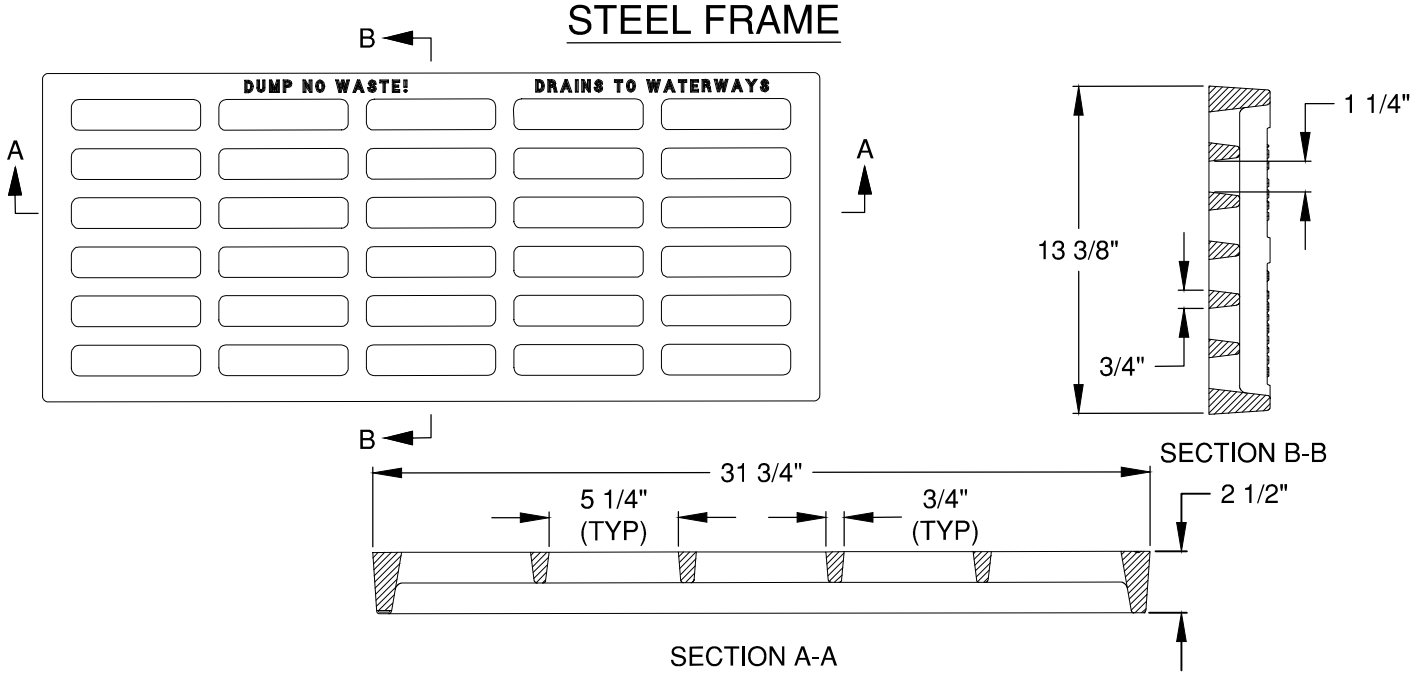
NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL CATCH BASINS TO BE DOUBLE CATCH BASIN
2. BACKFILL TO BE COMPACTED TO 95% OF OPTIMUM PER SPECIFICATION SECTION 00330.43
3. CROSS PIPE ELEVATE MAY REQUIRE OTHER UTILITIES (SEWER, WATER, ETC) TO BE LOWERED TO PROVIDE MINIMUM SEPARATIONS.
4. CONTRACTOR IS RESPONSIBLE TO KEEP CATCH BASIN CLEAN AND FREE OF SEDIMENT DURING CONSTRUCTION
5. CONTRACTOR IS RESPONSIBLE TO COVER AND BARRICADE ALL CATCH BASINS UNTIL GRATE IS INSTALLED
6. STANDARD CATCH BASINS ARE LIMITED TO LOCAL STREETS AND SHALL NOT BE USED ON ARTERIAL & COLLECTOR ROADWAYS. CURB INLETS ARE TO BE USED ON ARTERIAL & COLLECTOR ROADWAYS.
7. SEE DWG R-11 FOR PAVEMENT RESURFACING.
8. PRE-CAST BASINS SHALL NOT CONTAIN KNOCKOUTS. SAW-CUT OR CORE DRILL ALL PIPE PENETRATIONS AND GROUT PER SPECIFICATION SECTION 00470.40. GROUT SHOULD BE LEVELED TO ALIGN FLUSH WITH THE INTERIOR WALL WITH NO EXTENSION OF GROUT ONTO THE INTERNAL SURFACE AREA OF THE CATCH BASIN.
9. ON LOCAL ROADS, PIPE COVER IS TO BE 22-INCH FROM FINISHED GRADE TO TOP OF PIPE. ON COLLECTORS AND ARTERIAL STREET SECTIONS (STD DWG R-1), MAINTAIN MIN COVER OF 24-INCHES FROM GUTTER FINISHED GRADE.

DRAWN CJH DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 STANDARD CATCH BASIN (PRE-CAST)	SCALE NTS DATE 04/16/2026 APPR STD DWG STRM-12B

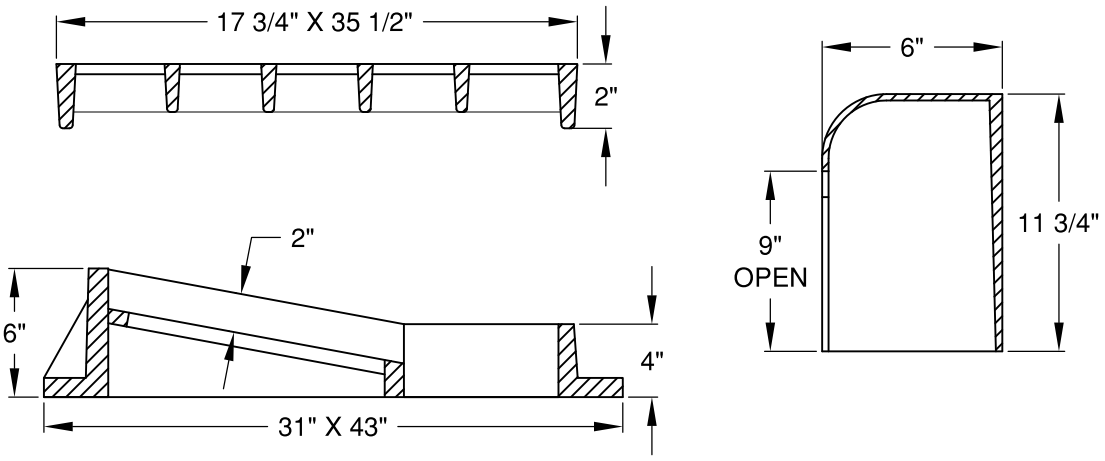


STEEL FRAME

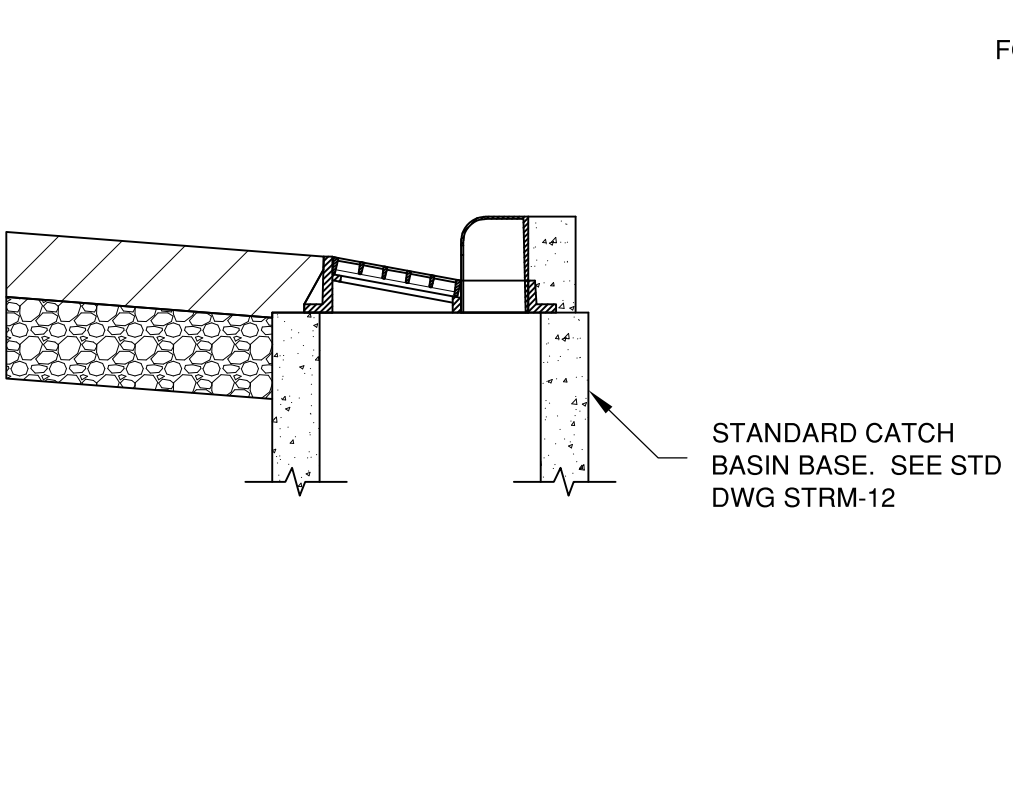


DUCTILE IRON GRATE

DRAWN AJD DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 STORMWATER GRATE	SCALE NTS DATE 01/31/2022 APPR STD DWG STRM-13A



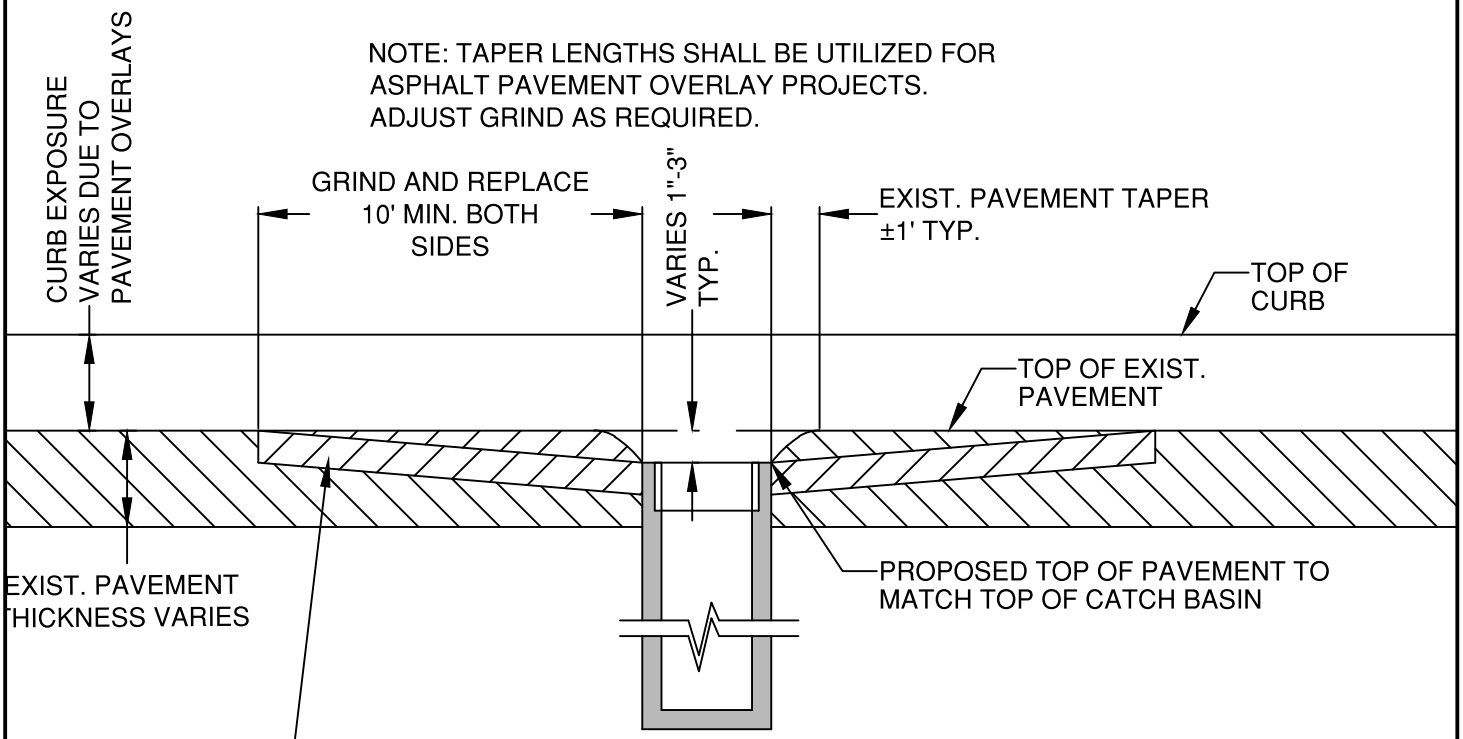
CAST IRON COMBINATION CATCH BASIN INLET



NOTES:
1. SEE NOTES ON STD DWG STRM-12
2. COMBINATION CATCH BASIN INLET TO BE USED ON COLLECTOR AND LOCAL STREETS WHEN THE ROAD GRADE EXCEED 6%

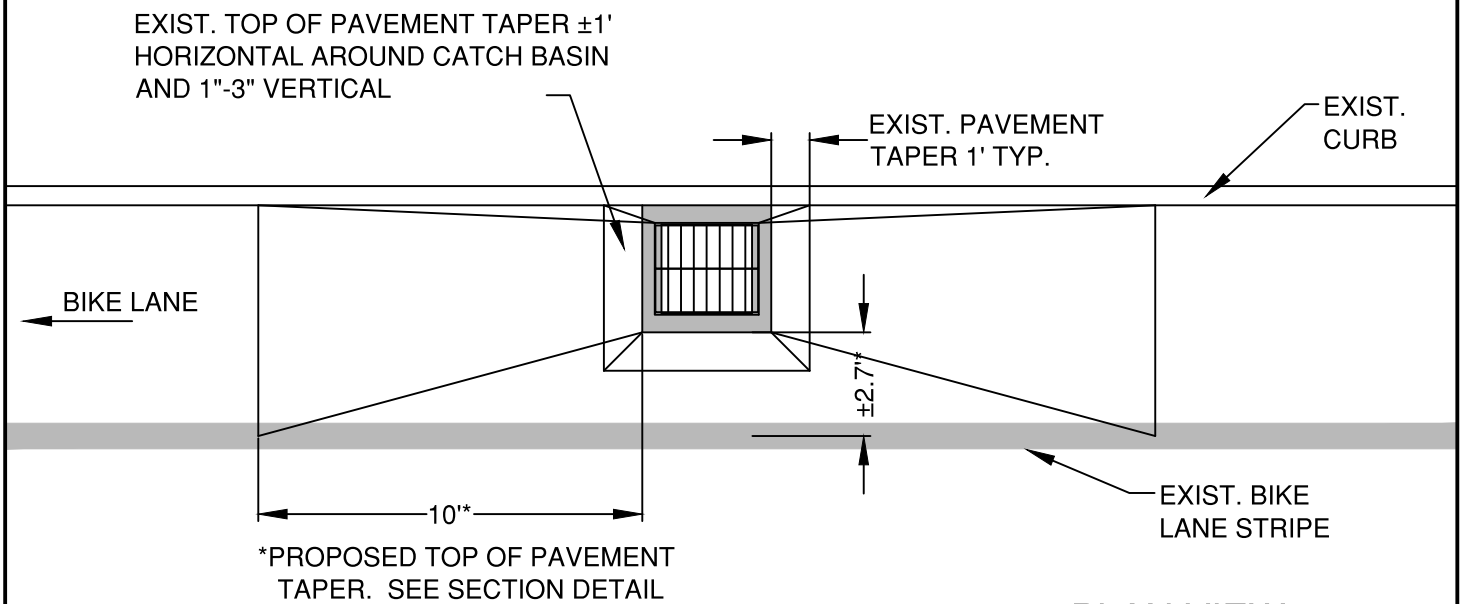
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		COMBINATION CATCH BASIN INLET	STD DWG STRM-13B

NOTE: TAPER LENGTHS SHALL BE UTILIZED FOR ASPHALT PAVEMENT OVERLAY PROJECTS. ADJUST GRIND AS REQUIRED.



SECTION VIEW

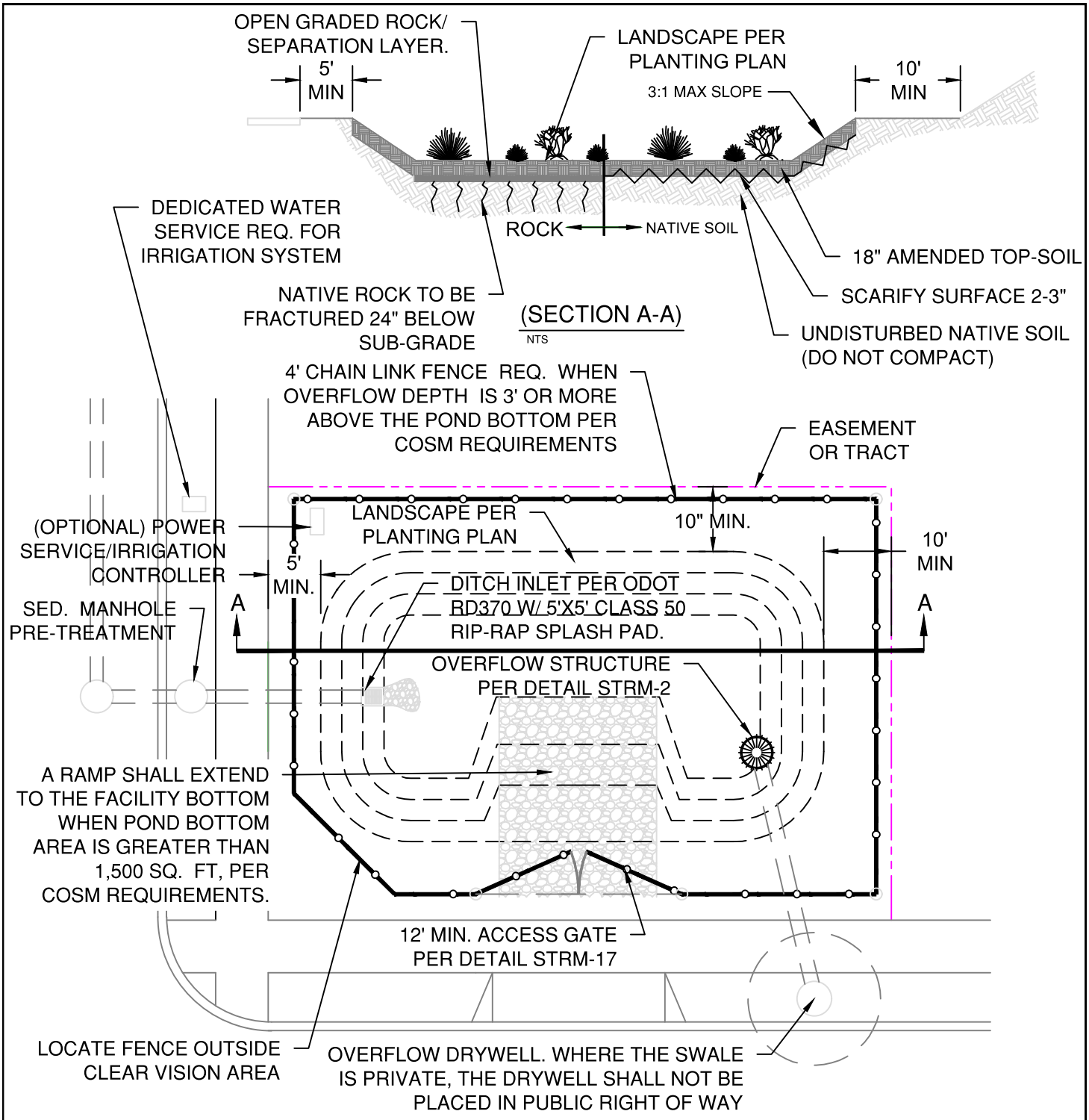
SCALE:
HORIZONTAL: 1"=5'
VERTICAL: 1"=1'



PLAN VIEW

SCALE:
HORIZONTAL: 1"=5'

DRAWN LJC DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 EXISTING CATCH BASIN PAVEMENT RESURFACING	SCALE NTS DATE 3/31/19 APPR STD DWG STRM-14

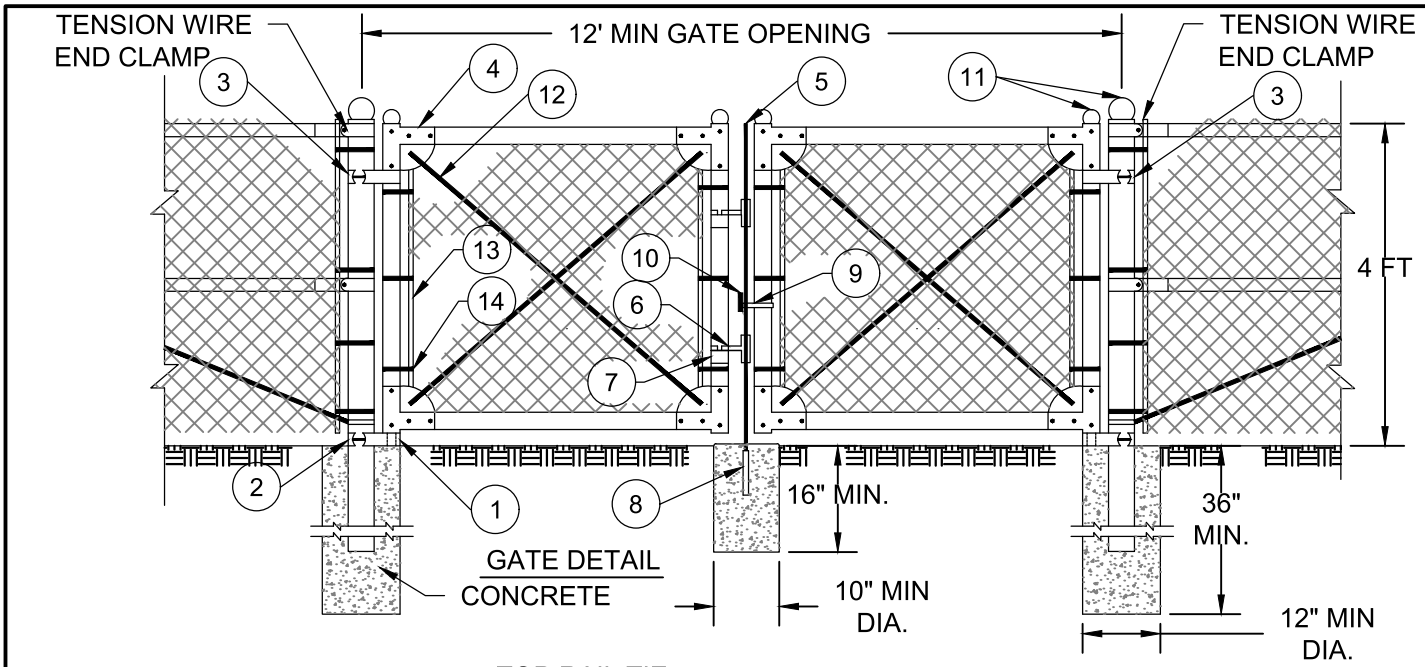


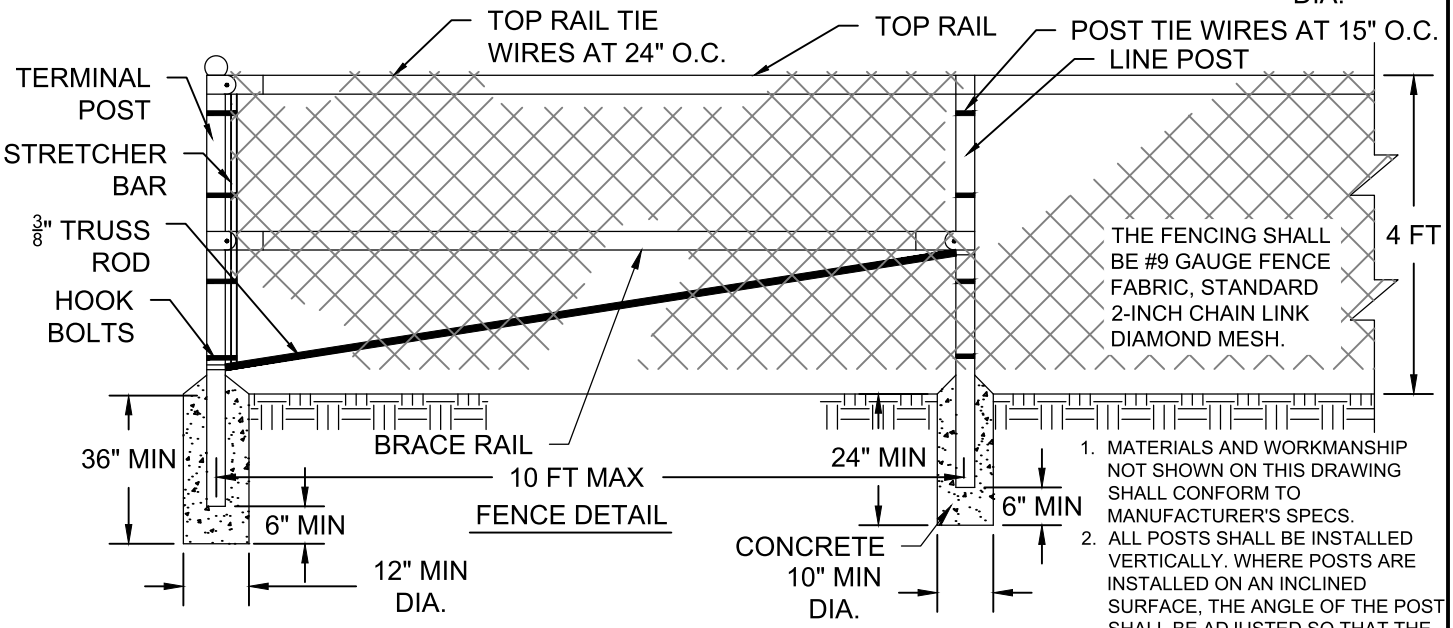
(SECTION A-A)
NTS

EXTENDED DETENTION DRY POND (PLAN VIEW)
NTS

NOTE:
THE WATER QUALITY TREATMENT STORM SHOULD DRAIN WITHIN 48 HOURS. IF ADDITIONAL STORAGE IS INCLUDED IN THE POND FOR LARGER STORM EVENTS, THE TOTAL FACILITY SHOULD DRAIN WITHIN 72 HOURS FOLLOWING THE PEAK DESIGN STORM EVENT.

DRAWN CJH DIV STORM REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 INFILTRATION POND DETAIL	SCALE NTS DATE 1/2021 APPR STD DWG STRM-16





1. MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO MANUFACTURER'S SPECS.
2. ALL POSTS SHALL BE INSTALLED VERTICALLY. WHERE POSTS ARE INSTALLED ON AN INCLINED SURFACE, THE ANGLE OF THE POST SHALL BE ADJUSTED SO THAT THE POST WILL BE VERTICAL.

PART NO.	DESCRIPTION
1	STRAIGHT PLUG
2	BOTTOM HINGE
3	TOP HINGE
4	CORNER ELBOW
5	PLUNGER ROD
6	LATCH FORK
7	FORK CATCH
8	PLUNGER ROD CATCH
9	LOCK KEEPER GUIDE
10	LOCK KEEPER W/ CITY LOCK
11	ORNAMENTAL TOPS
12	TRUSS RODS
13	STRETCHER BAR
14	HOOK BOLTS

GATE FRAME MEMBERS SIZE & WEIGHT		
GATE LEAF WIDTH OF 6 FT OR LESS	OUTSIDE DIMENSIONS INCHES	WEIGHT LBS/FT
ROUND	1.66	2.27
*ROUND	1.66	1.84
* GRADE B HIGH STRENGTH STEEL		

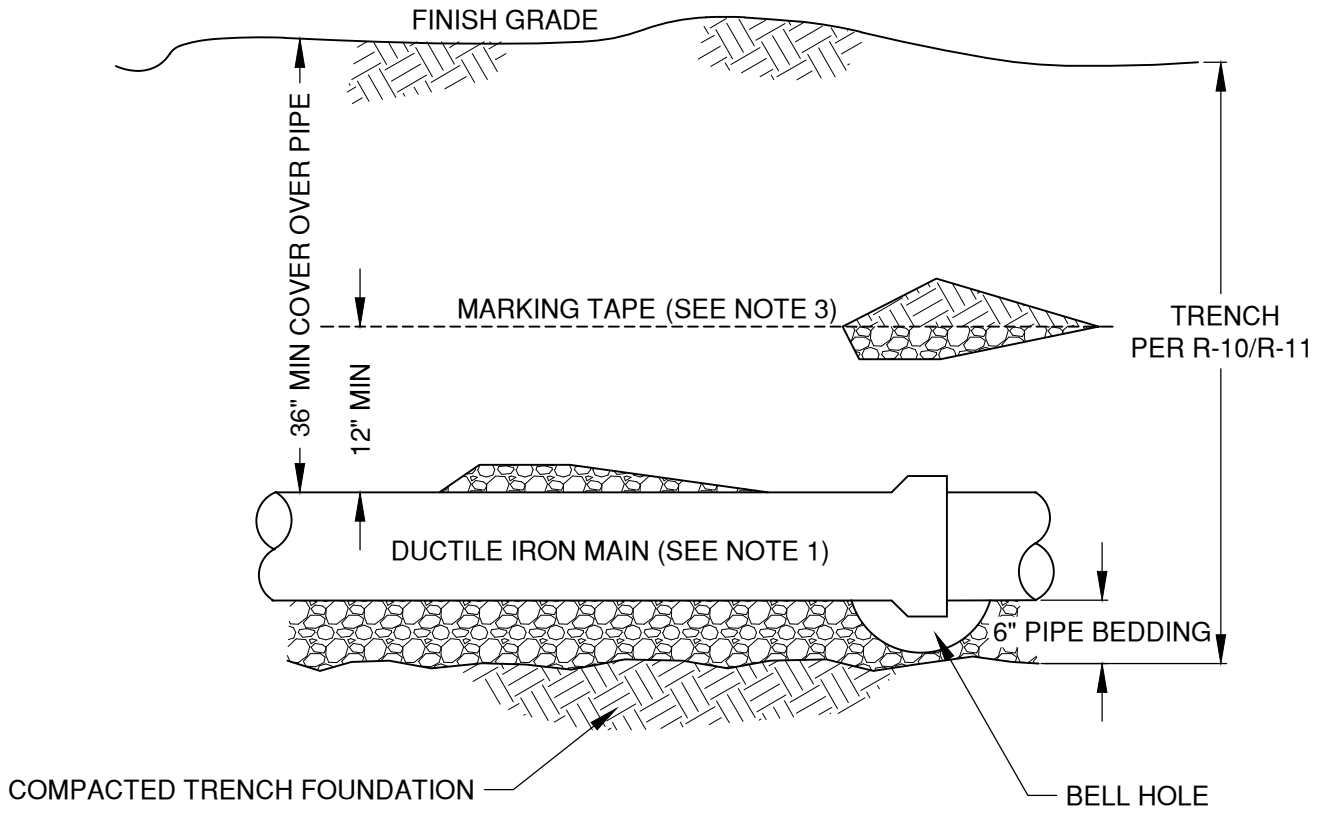
GATE POST SIZE AND WEIGHT		
GATE LEAF WIDTH OF 6 FT OR LESS	OUTSIDE DIMENSIONS INCHES	WEIGHT LBS/FT
ROUND	2.875	5.79
*ROUND	2.875	4.64
* GRADE B HIGH STRENGTH STEEL		

SHAPE, SIZE AND WEIGHT REQUIREMENTS FOR FENCE POSTS AND RAILS			
ITEM	SHAPE	OUTSIDE DIMENSIONS INCHES	WEIGHT LBS/FT.
** TERMINAL POST	ROUND	2.375	3.65
	*ROUND	2.375	3.12
LINE POSTS	ROUND	1.90	2.72
	*ROUND	1.90	2.28
TOP & BRACE RAILS	ROUND	1.66	2.27
	*ROUND	1.66	1.84
* GRADE B HIGH STRENGTH STEEL			
** INCLUDES END, CORNER, ANGLE, INTERSECTION AND INTERMEDIATE BRACED POSTS			

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV STORM		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		CHAINLINK FENCE DETAIL	STD DWG STRM-17

CITY OF BEND STANDARD DRAWINGS

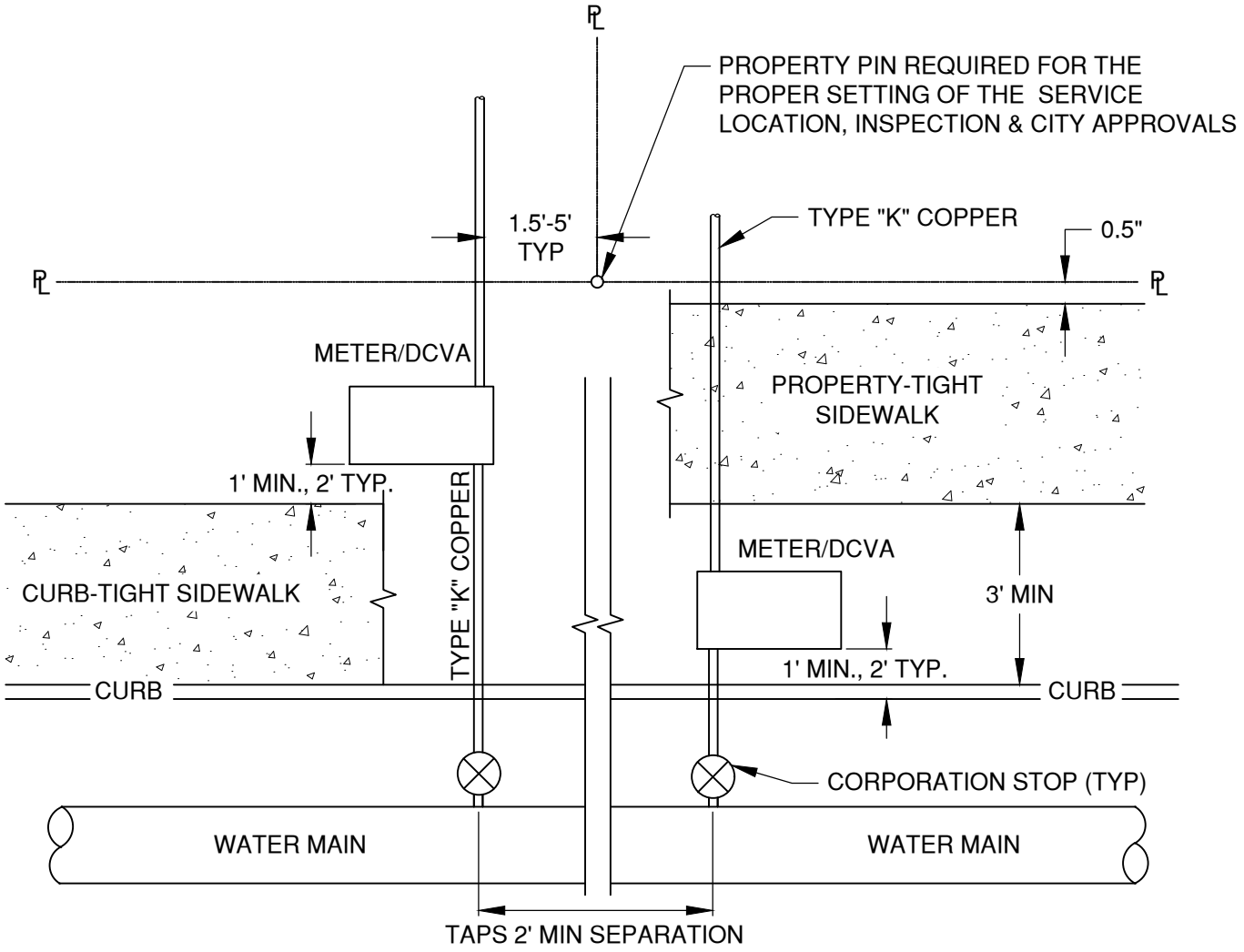
Water (W)



NOTES:

1. REFER TO SPECIFICATION SECTION 01140.41 FOR APPROVED PUSH-ON AND MECHANICAL JOINT RESTRAINT SYSTEMS.
2. WOOD BLOCKING IS NOT PERMITTED IN THE BACKFILLED TRENCH.
3. INSTALL MARKING TAPE ON ALL MAINS AND SERVICES PER SPECIFICATION SECTION 01140.10 AND 01140.45.
4. WHEN INSTALLING A WATER LINE THAT CROSSES BELOW OR WITHIN 18 INCHES ABOVE A NON-POTABLE LINE, FOLLOW OAR 333-061-0050(9). ALL NON-POTABLE LINES SHALL BE TREATED AS "SEWER" LINES AS DESCRIBED IN OAR 333-061-0050(9).
5. COMPACTION SHALL MEET REQUIREMENTS OF SPECIFICATION SECTION 00405.46(c)

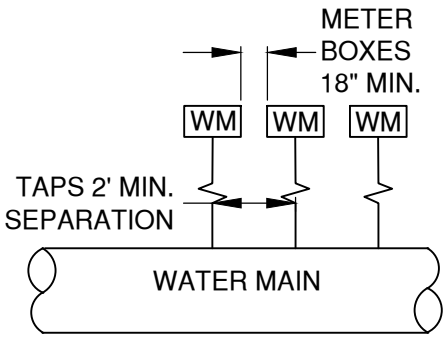
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		WATER MAIN TYPICAL PROFILE	STD DWG W-1



TWO SERVICES SHARING ONE DITCH AT PROPERTY LINE

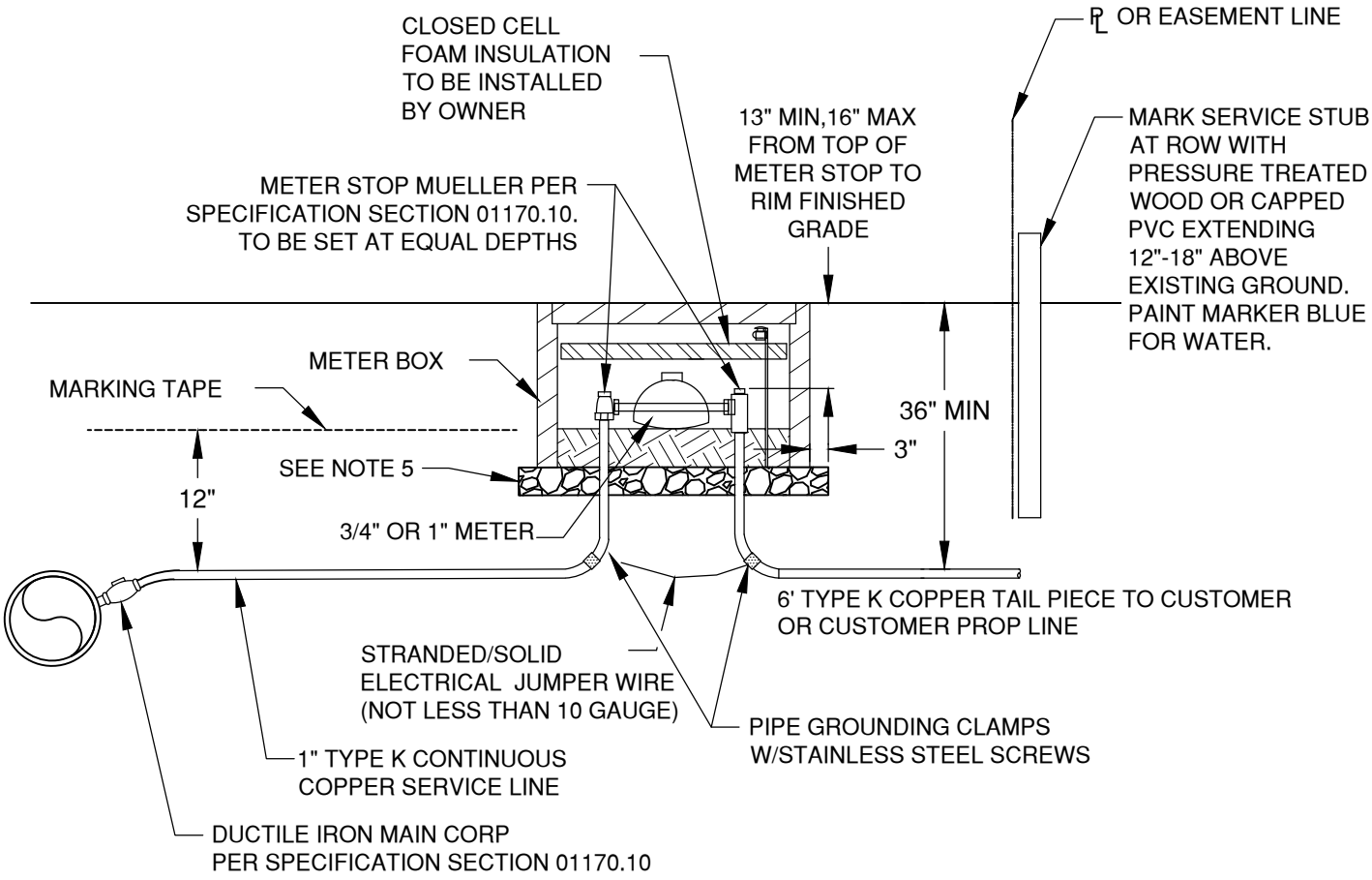
NOTE:

1. WATER METER BOXES SHALL BE LOCATED IN LANDSCAPE AREAS, NOT IN HARDSCAPE (I.E. SIDEWALKS& DRIVEWAYS). EXCEPTIONS REQUIRE APPROVAL OF CITY ENGINEER
2. SET WATER SERVICES A MINIMUM OF 10' FROM ALL SANITARY, FRANCHISE, STORM, AND ELECTRICAL SERVICES.
3. METER SHALL MATCH SERVICE LINE SIZE OR ONE SIZE SMALLER.
4. A 1" TAP NEAR A BELL SECTION SHALL BE SEPARATED FROM THE BELL BY A MINIMUM OF 2'. TAPS LARGER THAN 1" IN SIZE SHALL BE SEPARATED FROM THE BELL BY A MINIMUM OF 3'.
5. WHERE METERS ARE PLACED IN METER BANKS, A PERMANENT ADDRESS TAG PROVIDED BY THE CONTRACTOR SHALL BE PLACED ON THE METER BOX PRIOR TO 1 YEAR WARRANTY RELEASE.
6. IF AN EXISTING METER BOX, METER, OR HARDWARE WITHIN THE METER BOX DOES NOT MEET CURRENT CITY STANDARDS, CORRECTIONS OR REPAIRS SHALL BE MADE PRIOR TO THE METER BEING SET.
7. METER BOX SHALL BE SET ON 6" MIN CLASS B MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY.



MULTIPLE METER BANK

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		RESIDENTIAL WATER SERVICE INSTALLATION	STD DWG W-4

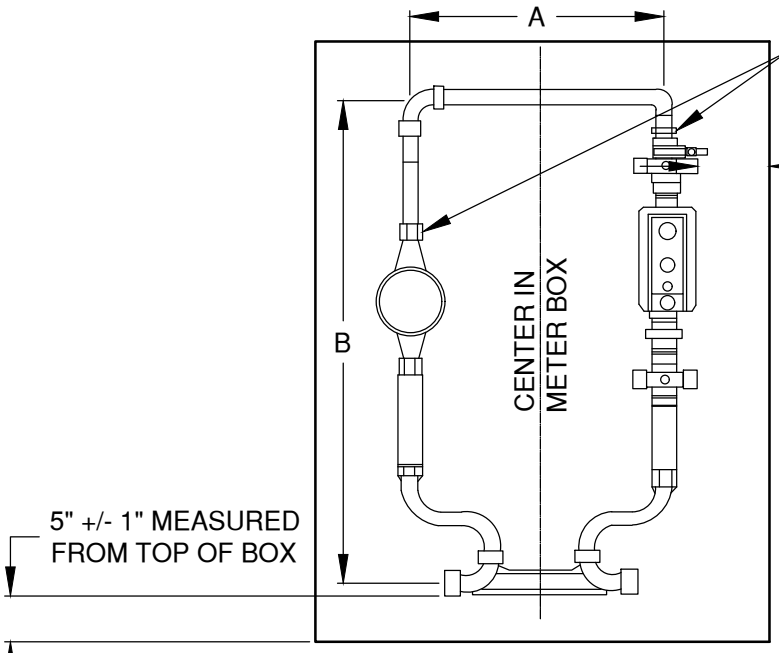


TYPICAL SERVICE

NOTES:

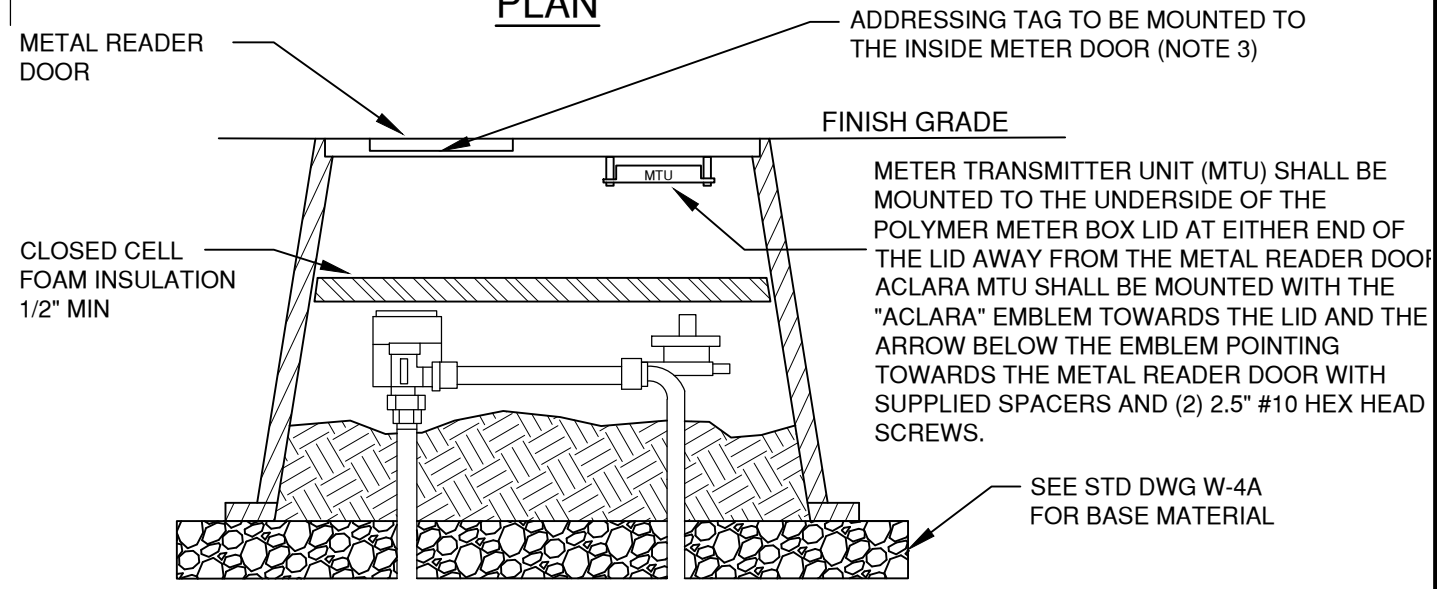
1. RESIDENTIAL METER BOXES SHALL BE SET PARALLEL W/THE CURB LINE AND SHALL NOT BE INSTALLED WITHIN SIDEWALK OR PAVED AREAS
2. JUMPER SIZE 1" METER SETTER - 1 1/4"x11" SCHEDULE 80 THREADED NIPPLE (DOMESTIC) DRILLED TO PREVENT FLOW
3. METERS ARE TO BE THE SAME SIZE AS THE SERVICE LINE OR ONE SIZE SMALLER.
4. IF AN EXISTING BOX, METER, OR HARDWARE WITHIN THE METER BOX DOES NOT MEET CURRENT CITY STANDARDS, CORRECTIONS OR REPAIRS SHALL BE MADE TO THE EXISTING SERVICE TO MEET CURRENT CITY STANDARDS PRIOR TO THE METER BEING SET.
5. METER SHALL BE SET ON 6" MIN CLASS B MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY.

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		3/4"-1" RESIDENTIAL METER SERVICE INSTALLATION	STD DWG W-4A



	A	B
3/4"	5"	19 1/4"
1"	6"	22"

PLAN



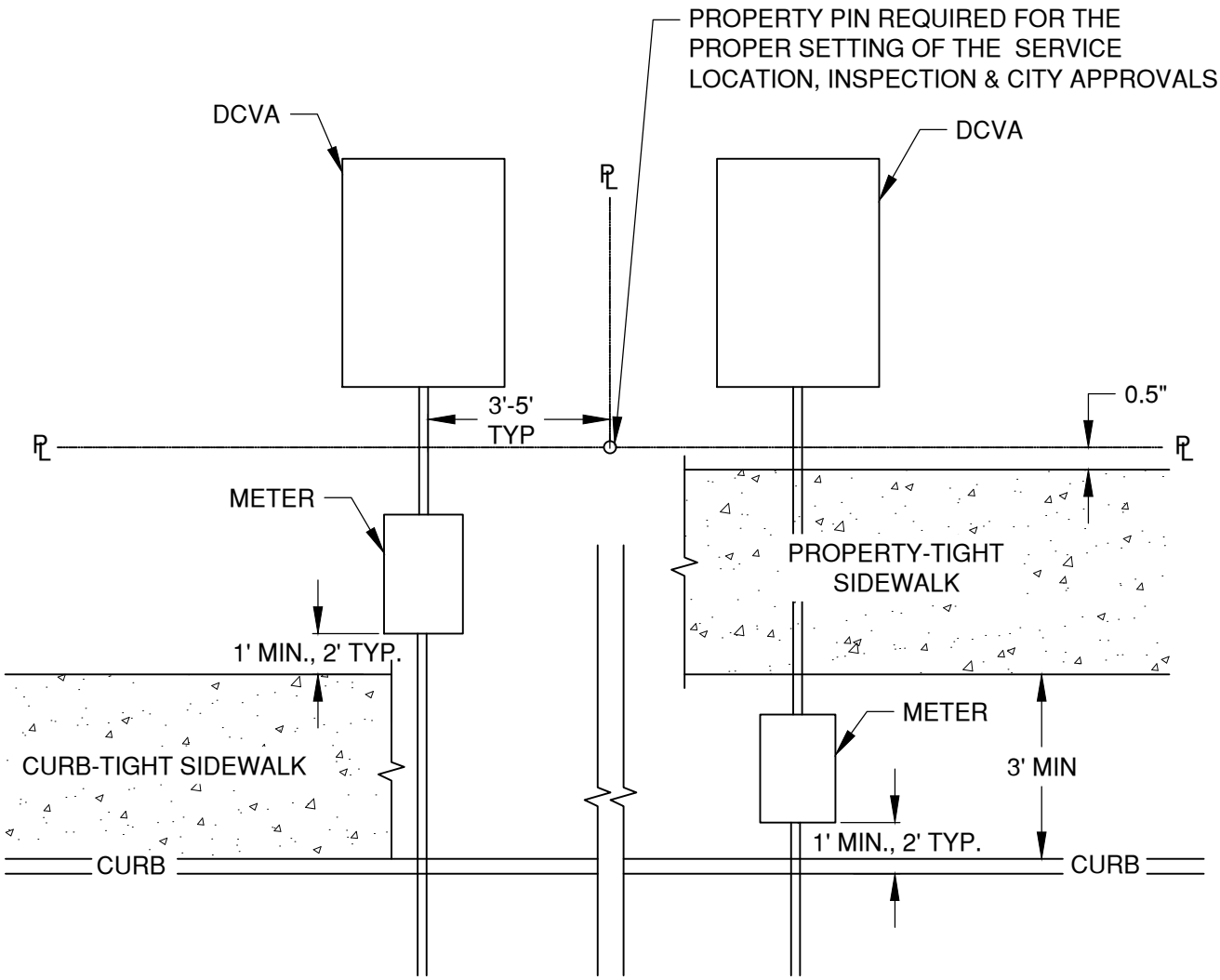
SECTION

OFFSET METER "LOOP" WITH BACKFLOW PREVENTION ASSEMBLY

NOTES:

1. RESIDENTIAL METER BOXES SHALL BE SET PARALLEL W/THE CURB LINE AND SHALL NOT BE INSTALLED WITHIN SIDEWALK OR PAVED AREAS
2. JUMPER SIZE 1" METER SETTER - 1 1/4"x11" SCHEDULE 80 THREADED NIPPLE (DOMESTIC) DRILLED TO PREVENT FLOW
3. WHERE METER BOXES ARE INSTALLED IN A METER BANK, A BRASS OR STAINLESS STEEL TAG/PLAQUE SHALL BE MOUNTED TO THE INSIDE METER DOOR WITH THE LOT ADDRESS STAMPED PRIOR TO 1 YEAR WARRANTY RELEASE.
4. IF THE METER ASSEMBLY/BOX OR SERVICE LINE IS DAMAGED DURING CONSTRUCTION/SITE IMPROVEMENT ACTIVITIES, DURING THE WARRANTY PERIOD, OR IF THE EXISTING METER BOX OR SERVICE LINE DOES NOT MEET CURRENT CITY STANDARDS, THE DEVELOPER/PROPERTY OWNER SHALL UPGRADE THE COMPONENTS OF THE SERVICE THAT IS OUT OF CONFORMANCE.

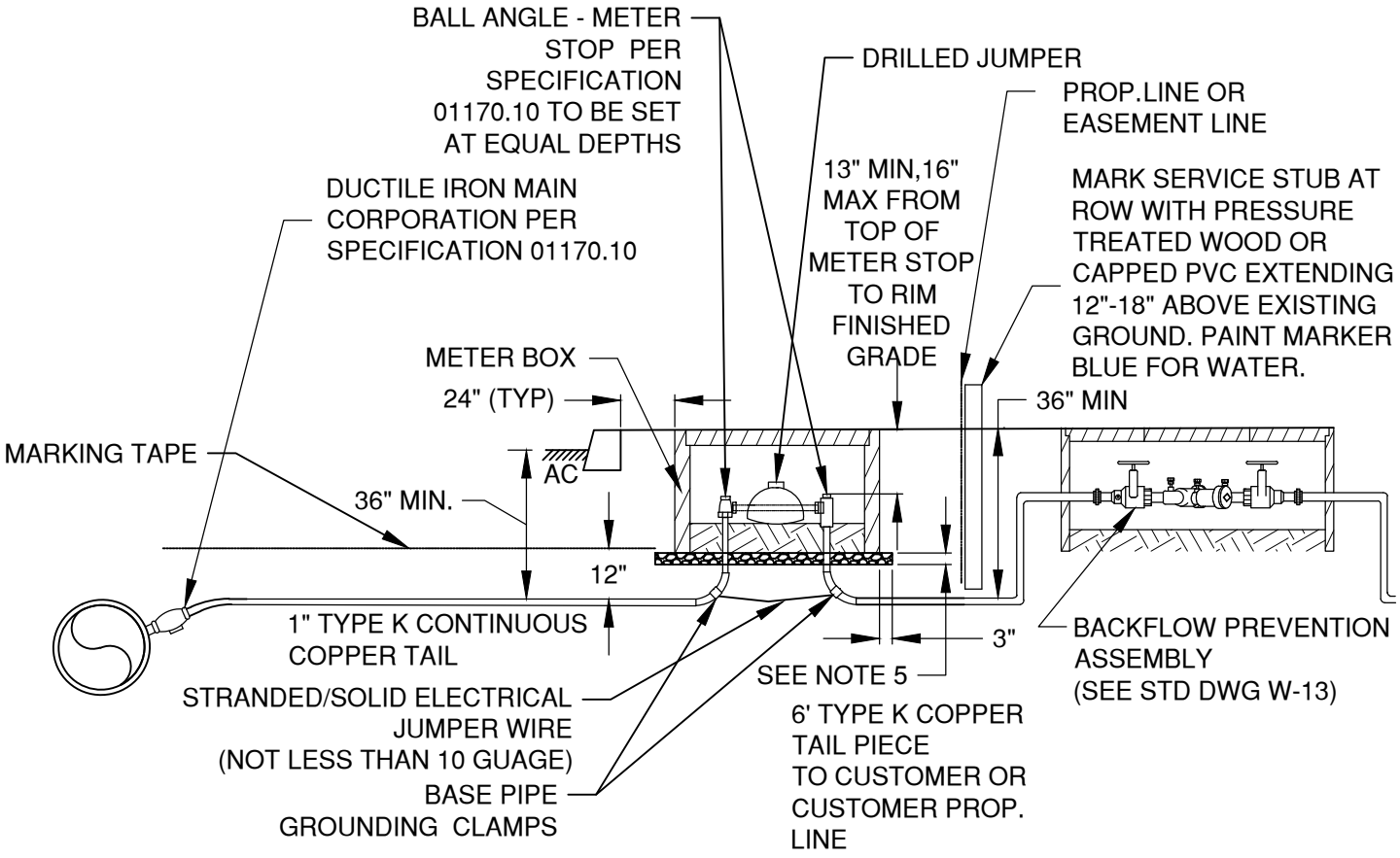
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		3/4"-1" RESIDENTIAL METER SERVICE INSTALLATION	STD DWG W-4B



NOTES:

1. COMMERCIAL METER BOXES SHALL BE INSTALLED PERPENDICULAR TO THE CURB LINE WITH DOUBLE CHECK VALVE ASSEMBLY TO BE LOCATED ON PRIVATE PROPERTY.
2. WATER METER BOXES SHALL BE LOCATED IN LANDSCAPE AREAS WHEN POSSIBLE, SEE STD DWG W-5E FOR LOCATING METER BOX IN HARD SURFACE.
3. SET WATER SERVICES A MINIMUM OF 10' FROM ALL SANITARY, FRANCHISE, STORM, AND ELECTRICAL SERVICES. ALL TREE WELLS SHALL BE A MINIMUM 6 FEET FROM THE METER BOX INSTALLATION.
4. BACKFLOW PREVENTION DEVICES SHALL BE INSTALLED ON PRIVATE PROPERTY.
5. IF AN EXISTING METER BOX, METER, OR HARDWARE WITHIN THE METER BOX DOES NOT MEET CURRENT CITY STANDARDS, CORRECTIONS OR REPAIRS SHALL BE MADE TO THE EXISTING SERVICE TO MEET CURRENT CITY STANDARDS PRIOR TO THE METER BEING SET.
6. METER BOX SHALL BE SET ON 6" MIN CLASS B MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY.

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		COMMERCIAL & IRR METER SERVICE INSTALLATION	STD DWG W-5

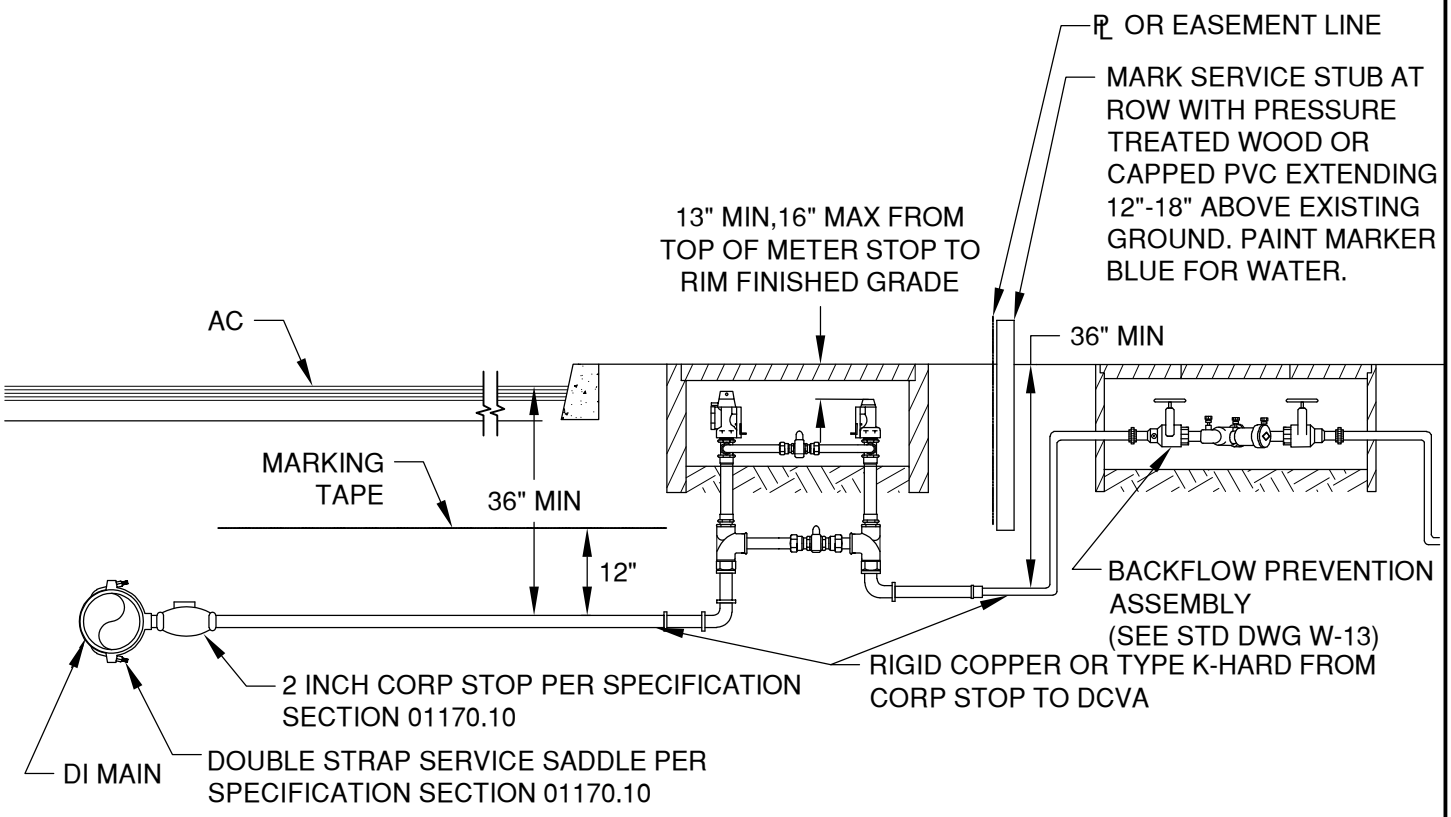


TYPICAL 1" SERVICE WITH METER

NOTES:

1. COMMERCIAL METERS NOT TO BE LESS THAN 1-INCH. METER SIZE TO MATCH SERVICE LINE SIZE.
2. COMMERCIAL METER BOXES SHALL BE INSTALLED PERPENDICULAR TO THE CURB LINE WITH DOUBLE CHECK VALVE ASSEMBLY TO BE LOCATED ON PRIVATE PROPERTY PER STD DWG W-5.
3. COMMERCIAL METERS WILL NOT BE SET UNTIL BACKFLOW PREVENTION ASSEMBLY IS IN PLACE.
4. IF AN EXISTING METER BOX, METER, OR HARDWARE WITHIN THE METER BOX DOES NOT MEET CURRENT CITY STANDARDS, CORRECTIONS OR REPAIRS SHALL BE MADE TO THE EXISTING SERVICE TO MEET CURRENT CITY STANDARDS PRIOR TO THE METER BEING SET.
5. METER BOX SHALL BE SET ON 6" MIN CLASS B MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY.

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		1" COMMERCIAL & IRR METER SERVICE INSTALLATION	STD DWG W-5A



TYPICAL 2" SERVICE WITH 1-1/2" AND 2" METER

NOTES:

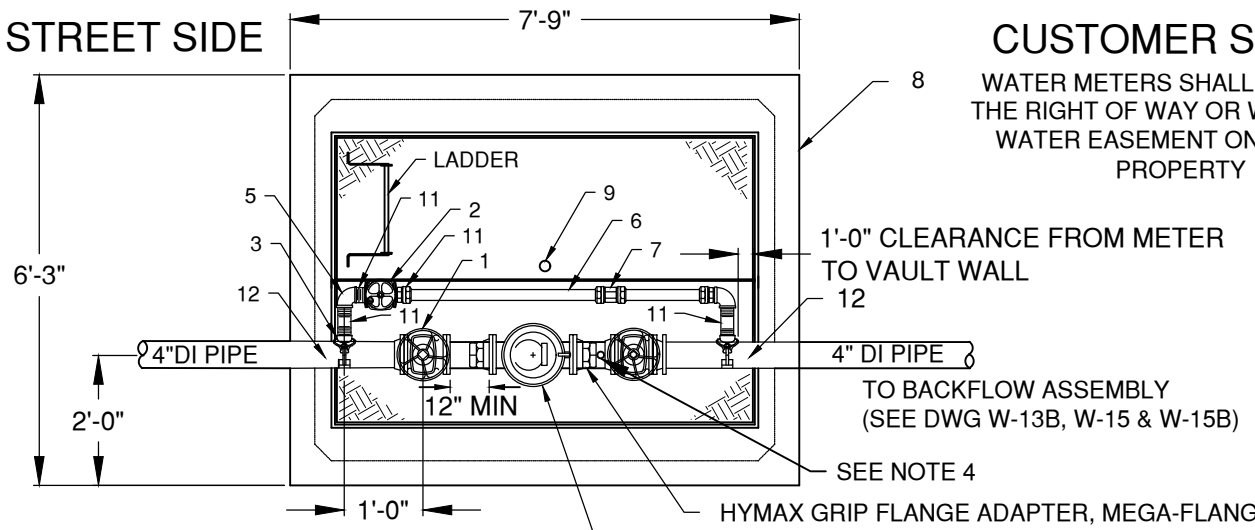
1. COMMERCIAL METERS WILL NOT BE SET UNTIL BACKFLOW PREVENTION ASSEMBLY IS IN PLACE
2. COMMERCIAL METER BOXES SHALL BE INSTALLED PERPENDICULAR TO THE CURB LINE WITH DOUBLE CHECK TO BE LOCATED ON PROPERTY
3. ALL METERS LESS THAN 2" WHEN USING A 2" SERVICE LINE ARE TO BE REDUCED WITHIN THE 2" METER SETTER
4. IF AN EXISTING METER BOX, METER, OR HARDWARE WITHIN THE METER BOX DOES NOT MEET CURRENT CITY STANDARDS CORRECTIONS OR REPAIRS SHALL BE MADE TO THE EXISTING SERVICE TO MEET CURRENT CITY STANDARDS PRIOR TO THE METER BEING SET.
5. DOUBLE CHECK ASSEMBLY SHALL BE INSTALLED USING THE UNIFORM BUILDING CODE (UBC) AND SHALL BE LOCATED ON A PRIVATE PROPERTY. THE ABOVE DIAGRAM IS FOR REFERENCE ONLY AND IS SUBJECT TO CHANGE BASED ON A REVIEW BY THE UBC PLANS EXAMINER.
6. METER BOX SHALL BE SET ON 6" MIN CLASS B MATERIAL COMPACTED TO 95% OF MAXIMUM DENSITY

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 1 1/2" & 2" COMMERCIAL AND IRRIGATION METER SERVICE INSTALLATION	SCALE NTS DATE 11/01/2024 APPR STD DWG W-5B

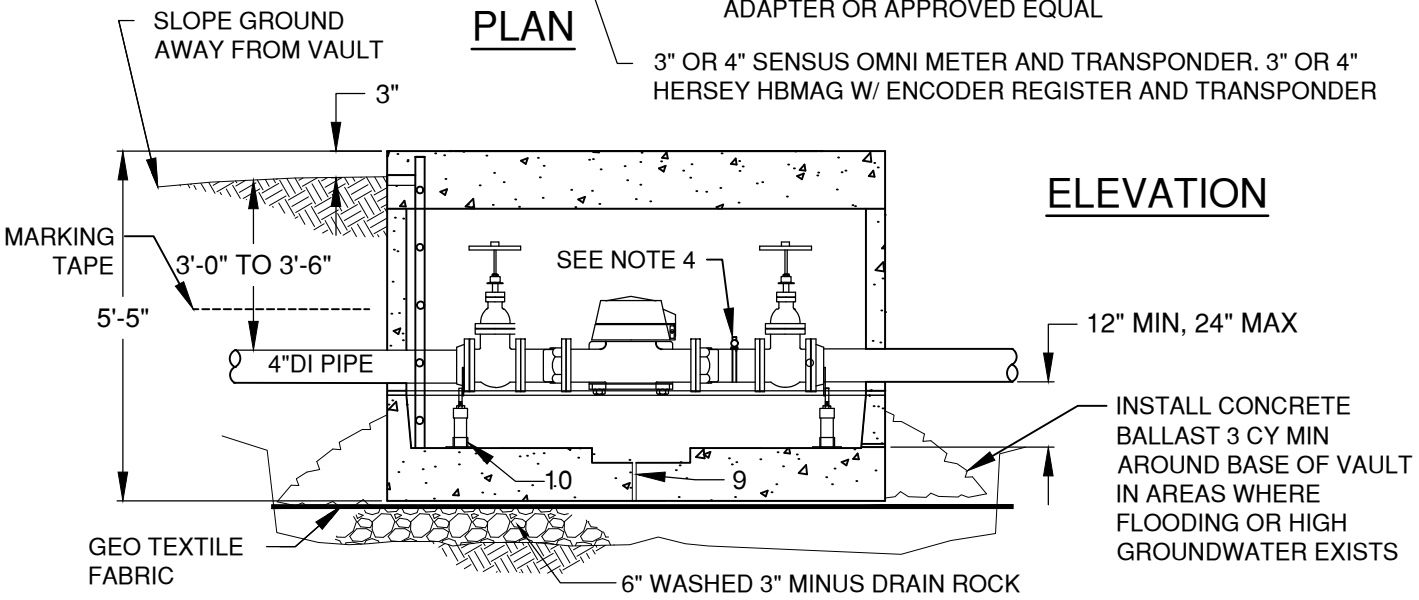
STREET SIDE

CUSTOMER SIDE

WATER METERS SHALL BE WITHIN THE RIGHT OF WAY OR WITHIN CITY WATER EASEMENT ON PRIVATE PROPERTY



PLAN

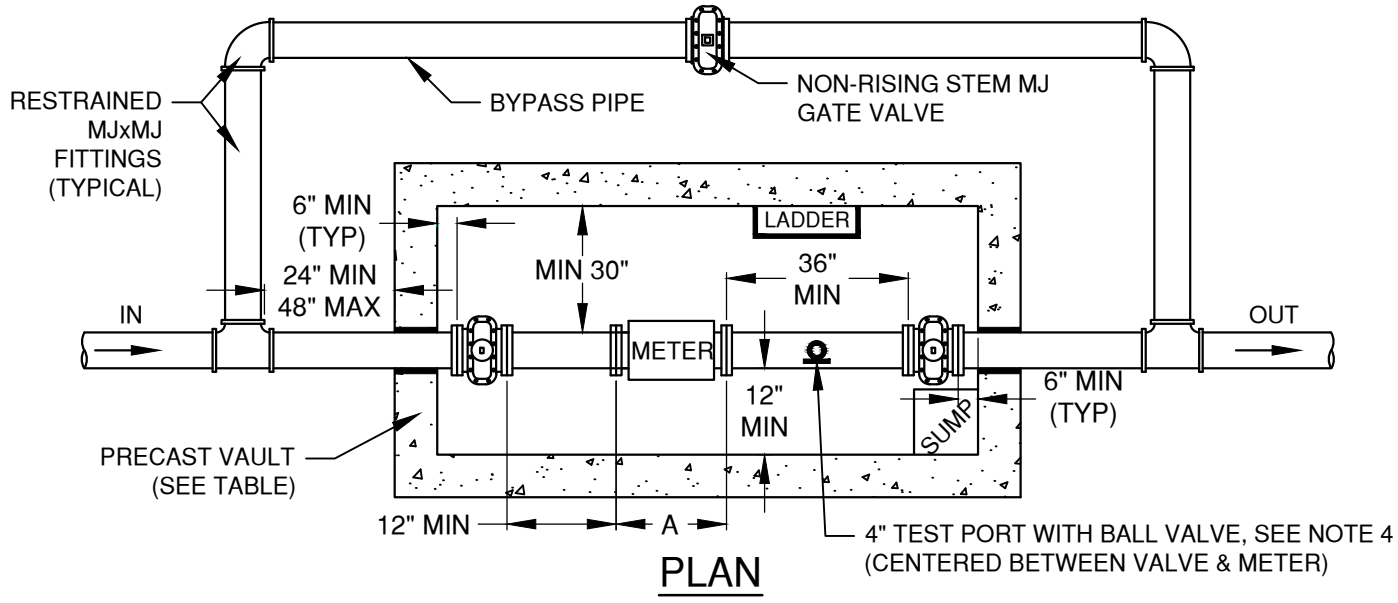


ELEVATION

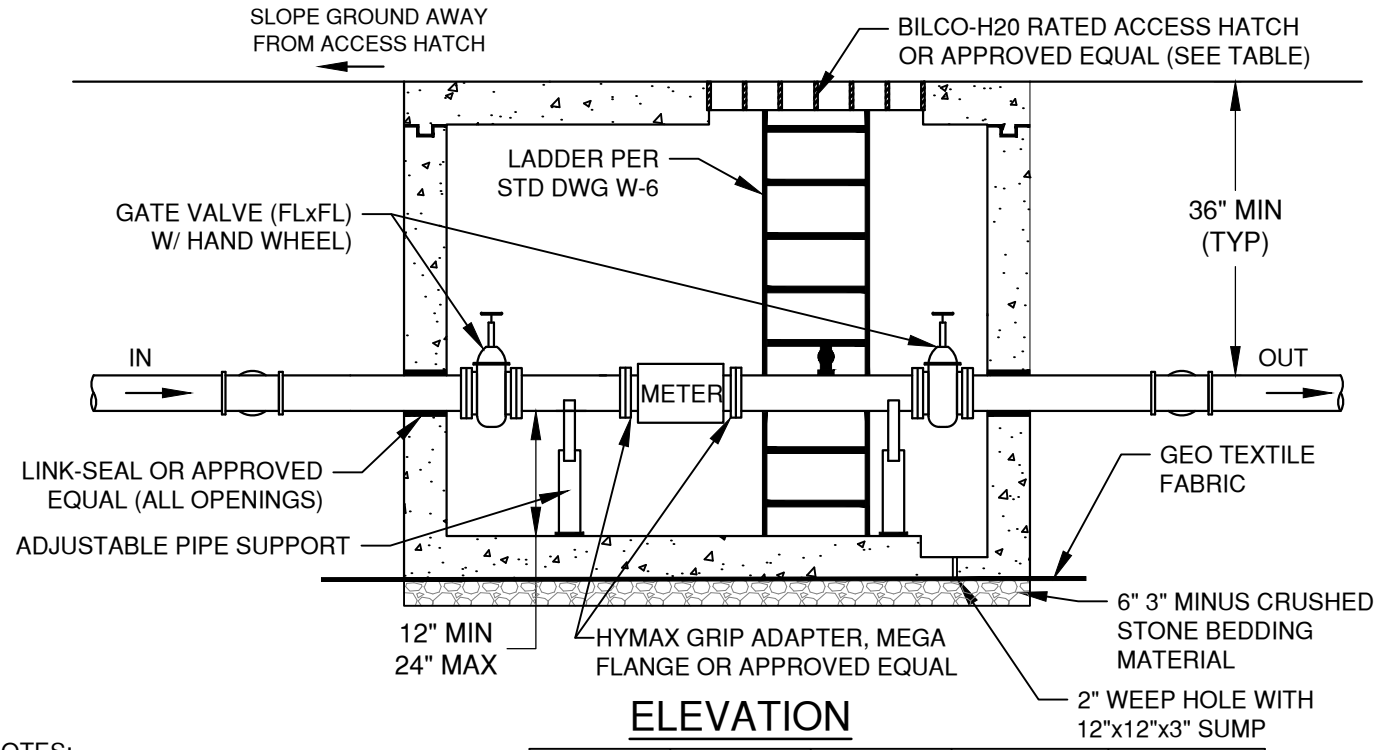
ITEM	QTY	DESCRIPTION
1	2 EA	4"x3" FLG x FLG REDUCER & 3" FLG GATE VALVE WITH HANDWHEEL OR
	2	4"x4" FLG GATE VALVE WITH HANDWHEEL
2	1	2" SE GATE VALVE AWWA C509
3	2	DOUBLE STRAP SERVICE SADDLE PER SPECIFICATION SECTION 01170.10
5	2	2" BRASS 90° COMP x COMP
6	2	2" TYPE K HARD COPPER PIPE
7	1	2" COMP UNION
8	1	OLD CASTLE 675-WA WITH OPENING FOR BILCO DOOR JD-3AL AND OSHA APPROVED LADDER (SEE STD DWG W-6)
9	1	WEEP HOLE (12"x12"x3" SUMP)
10	2	2" PIPE STAND "STANDON"
11	4	2" MPT x COMP ADAPTER
12	2	4"x3" REDUCER (WHERE 3" METER IS INSTALLED)

NOTES:
1. SEAL ALL OPENINGS IN VAULT WITH NON SHRINK GROUT
2. ENGINEER TO PROVIDE PIPE RESTRAINT DETAIL ENTERING & EXITING VAULT
3. METER SIZE TO MATCH SERVICE SIZE OR ONE SIZE SMALLER.
4. WHERE THE METER DOES NOT PROVIDE A TEST PORT, A 2" TEST PORT SHALL BE INSTALLED WITH 2" TAP SADDLE, 2" BRASS BALL VALVE, AND 2" BRASS NIPPLE.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		3" & 4" COMMERCIAL METER INSTALLATION	STD DWG W-5C



PLAN



ELEVATION

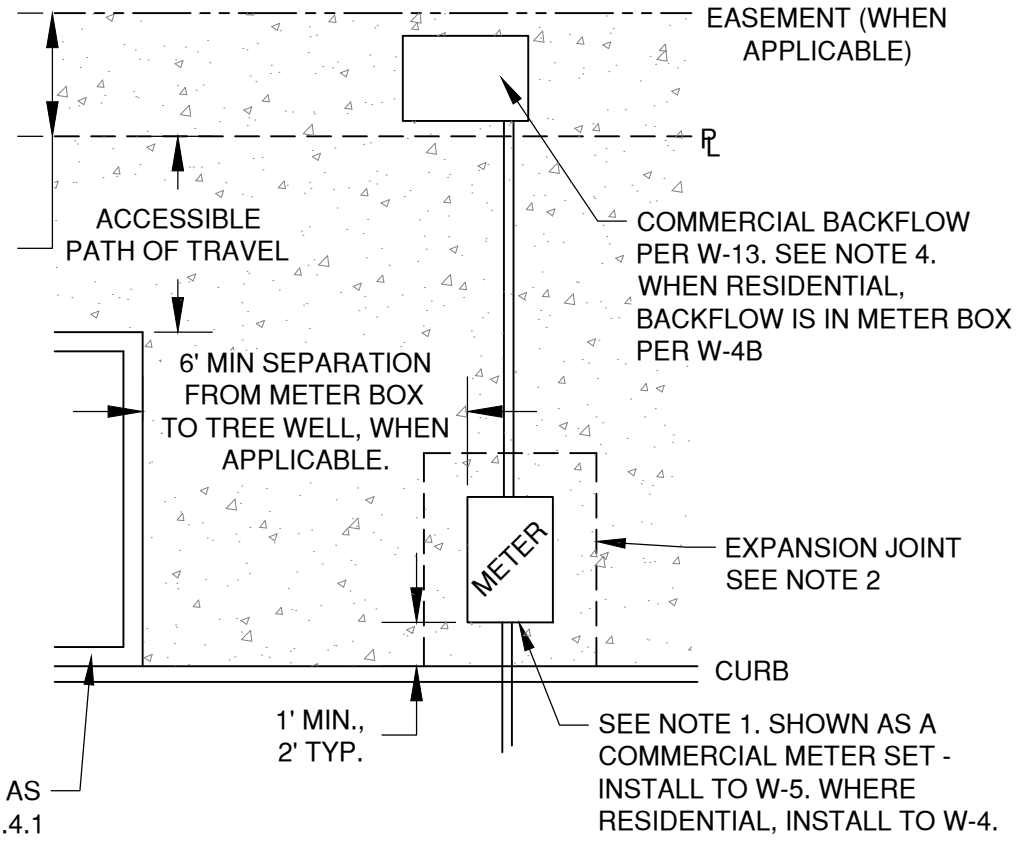
NOTES:

1. CONTRACTOR TO BRING ERT'S TO PUBLIC WORKS FOR INSTALLATION AND INSPECTION
2. ENGINEER TO PROVIDE PIPE RESTRAINT DETAIL ENTERING & EXITING VAULT
3. METER SIZE TO MATCH SERVICE SIZE OR ONE SIZE SMALLER.
4. WHERE THE METER DOES NOT PROVIDE A TEST PORT, A 4" TEST PORT SHALL BE INSTALLED WITH 4" TAPPING SADDLE, 4" BRASS BALL VALVE, AND 4" BRASS NIPPLE.

METER (INCH)	BYPASS (INCHES)	VAULT*	BILCO DOOR	A (INCHES)
6"	4"	810-LA	J-5AL	15"±
8"	6"	810-LA	JD-3AL	17"±
10"	8"	612-LA	JD-3AL	20"±
12"	12"	612-LA	JD-3AL	24"±

* VAULT SIZES MAY VARY BY ENGINEER DESIGN PROVIDE MIN DIMENSIONS ARE MAINTAINED

DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV WATER			DATE 01/31/2022
REV / DATE			APPR
		6" AND LARGER COMMERCIAL METER INSTALLATION	STD DWG W-5D



SIDEWALK INSTALLATION WITHIN 5' PUBLIC ACCESS EASEMENT AS REQUIRED BY BEND CENTRAL DISTRICT. MAY NOT BE APPLICABLE FOR ALL PROJECTS.

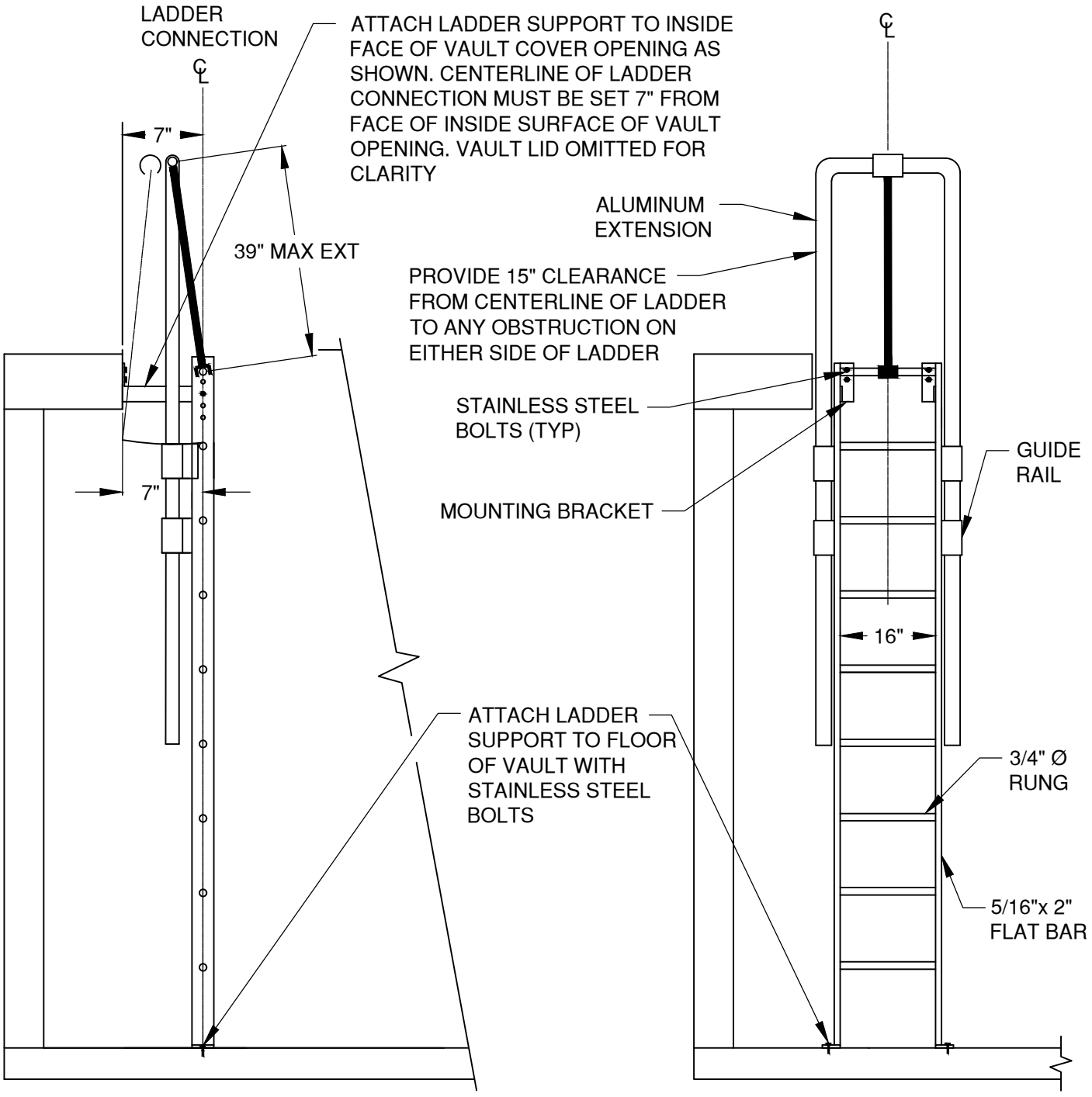
TREE WELL, MIN 4'X9' AS APPLICABLE. REFER TO 12.2.4.1 OF THE CONSTRUCTION DESIGN STANDARDS

TYPICAL INSTALLATION IN THE BEND CENTRAL DISTRICT OR WHERE WIDENED SIDEWALKS ARE REQUIRED BY DEVELOPMENT CODE. METERS TO BE PERMITTED WITHIN HARDSCAPE ONLY WHEN APPROVED BY THE CITY ENGINEER.

NOTE:

1. WATER METER BOXES SHALL BE LOCATED IN LANDSCAPE AREAS WHEN POSSIBLE. IF WATER METER BOX CAN BE LOCATED ON PRIVATE PROPERTY TO REMOVE IT FROM SIDEWALK, A UTILITY EASEMENT SHALL BE GRANTED TO THE CITY TO MAINTAIN THE METER.
2. AN EXPANSION JOINT IN THE SIDEWALK SHALL BE INSTALLED 12-INCH AROUND THE ENTIRE PERIMETER OF THE METER BOX.
3. STATE SPEC BASE ROCK SHALL BE COMPACTED TO 95% IMMEDIATELY BELOW AND FOR A MINIMUM OF 3 FEET AROUND THE METER BOX.
4. BACKFLOW DEVICE SHALL BE INSTALLED ON PRIVATE PROPERTY. WHERE BACKFLOW DEVICES CANNOT BE PLACED WITHIN LANDSCAPE, THE BOX SHALL BE INSTALLED OUTSIDE THE RIGHT OF WAY AND OUTSIDE A PUBLIC UTILITY EASEMENT. INSTALLATION OF BACKFLOW DEVICES WITHIN A BUILDING WILL BE GRANTED ON A CASE BY CASE BASIS BY THE CITY ENGINEER ONLY WHERE IT CAN BE ADEQUATELY SHOWN NOT TO FIT OUTSIDE THE BUILDING (EXAMPLE, THE BACKFLOW DEVICE, AND THEREFORE THE VAULT, IS TOO LARGE TO FIT)
5. SET WATER SERVICES A MINIMUM OF 10' FROM ALL SANITARY, FRANCHISE, STORM, AND ELECTRICAL SERVICES. ALL TREE WELLS SHALL BE A MINIMUM 6 FEET FROM THE METER BOX INSTALLATION.
6. WATER METERS SHALL NOT BE PLACED WITHIN VEHICULAR SURFACES (DRIVEWAYS) WITHOUT CITY ENGINEER APPROVAL.
7. COMMERCIAL WATER METER BOXES TO BE INSTALLED PERPENDICULAR TO THE CURB LINE, SEE STD DWG W-5. RESIDENTIAL WATER METER BOXES TO BE INSTALLED PARALLEL TO THE CURB LINE PER STD DWG W-4

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		METER INSTALLATION IN SIDEWALKS	STD DWG W-5E



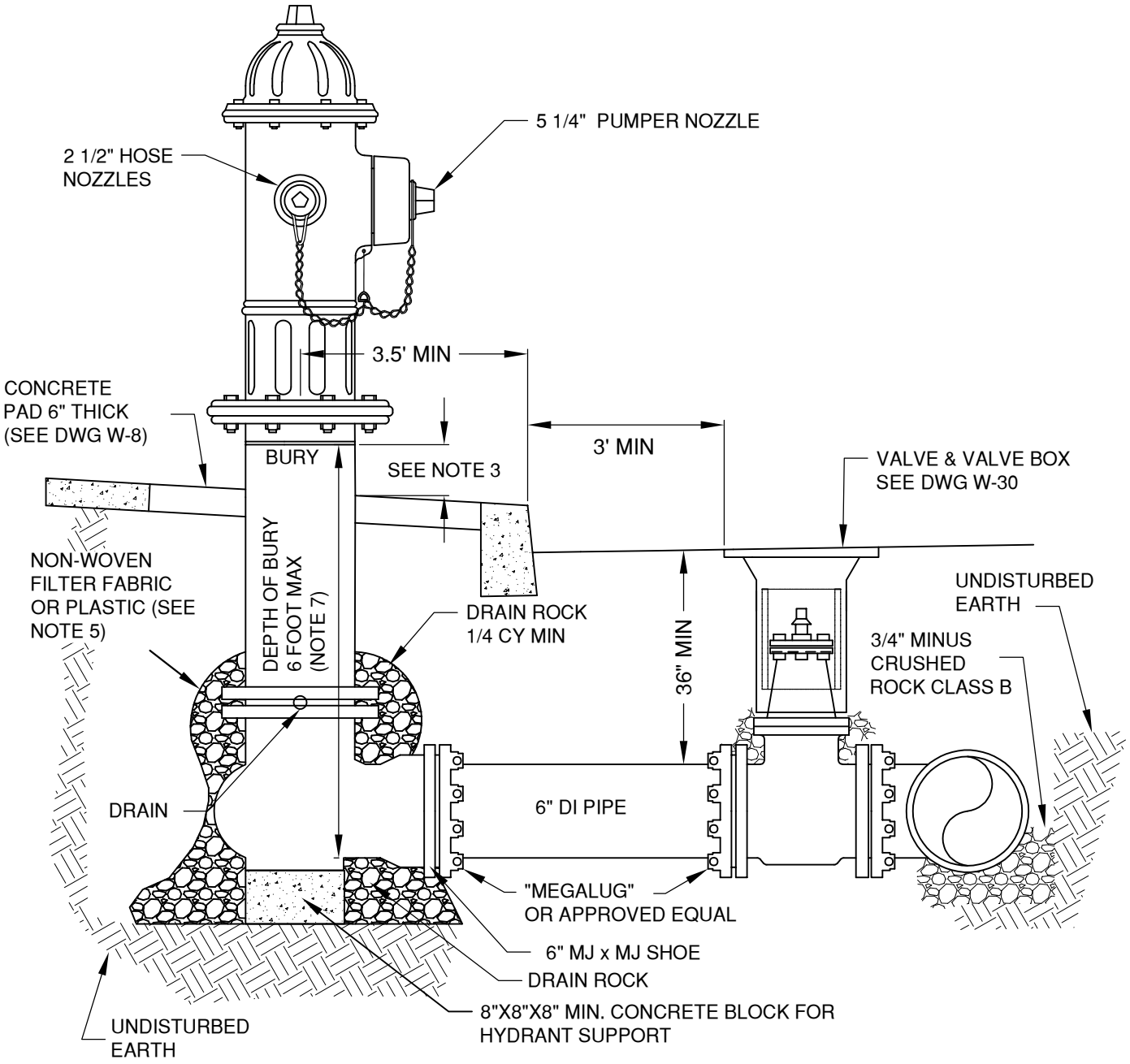
SIDE VIEW

FRONT VIEW

NOTES:

1. GALVANIZED LADDER W/AN ALUMINUM EXTENSION BY OLDCASTLE (OR APPROVED EQUAL) (PER OAR 437, DIV 2, CODE OF FEDERAL REGULATIONS, TITLE 29, CHAPTER XVII PART 1910.27)
2. 5'-4" GALVANIZED LADDER FROM OLDCASTLE TO BE CUT DOWN TO 4'-7" BY CONTRACTOR FOR USE IN VAULT 675-WA. OLDCASTLE TO SUPPLY 49 1/2" ALUMINUM EXTENSION

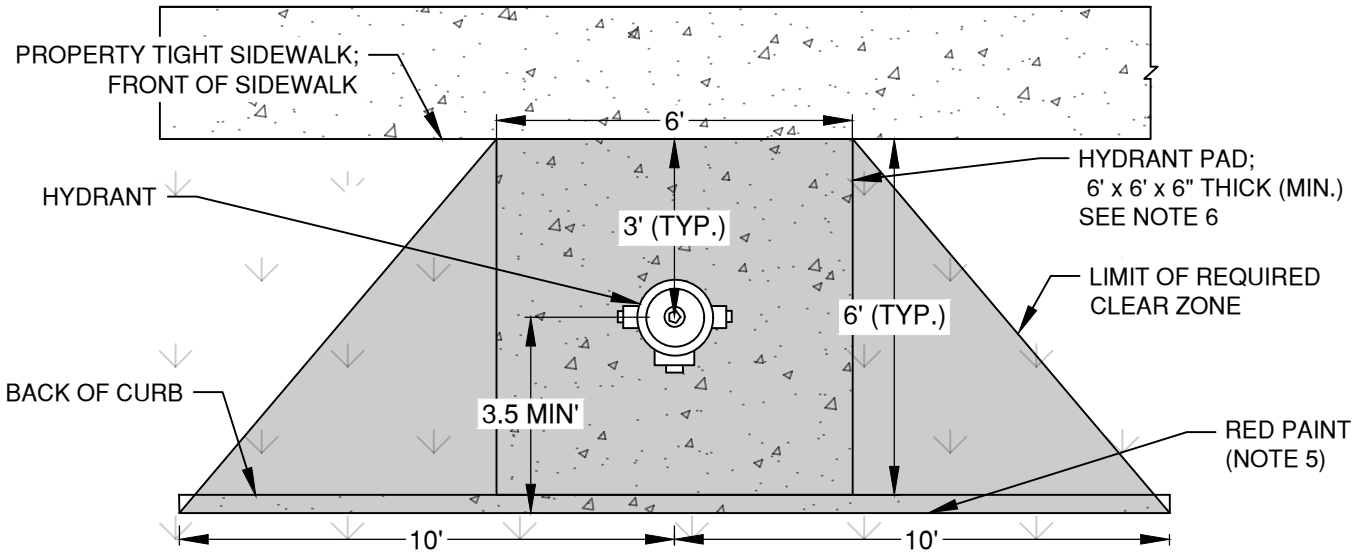
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		GALV. LADDER W/ ALUM EXT FOR WATER VAULTS	STD DWG W-6



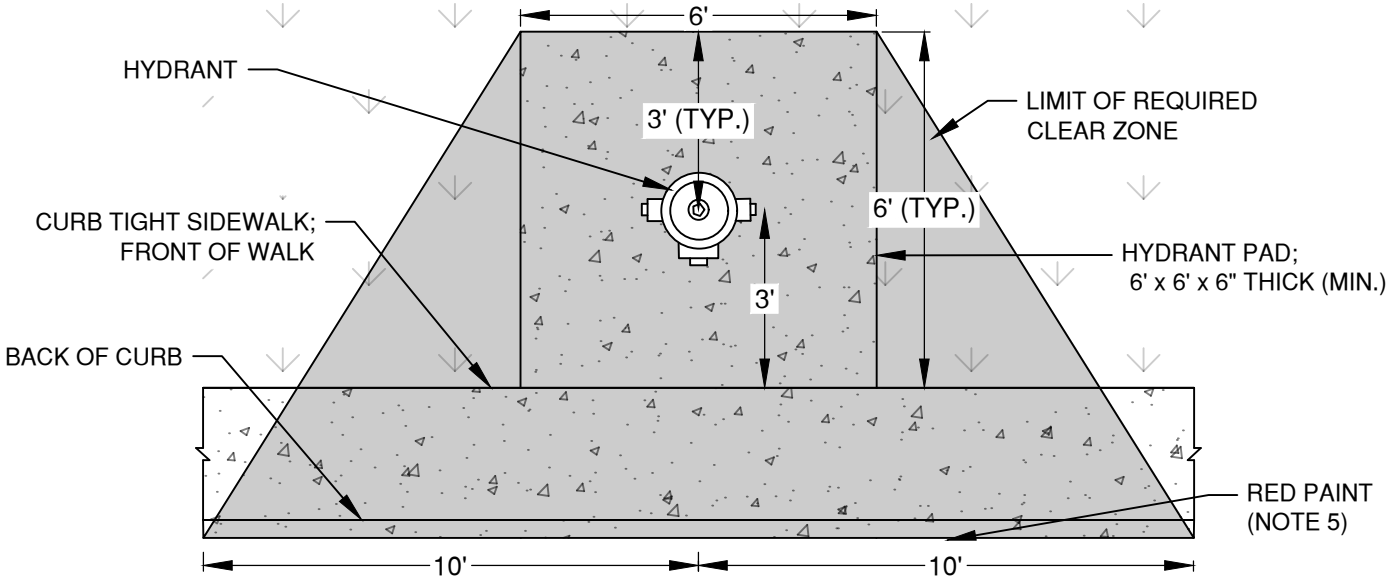
NOTES:

1. ALL PIPES SHALL HAVE RESTRAINED JOINTS.
2. MJ x MJ TEE OR MJxMJxSWIVEL (REQUIRES ENGINEER APPROVAL) WITH 6-INCH VALVE AT THE MAINLINE.
3. FINISH GRADE OF HYDRANT SHALL BE SET AT BURY LINE TO A MAXIMUM OF 3" BELOW BURY LINE FOR NEW INSTALLATION AND MAX OF 6" FOR RETROFITS. NO HYDRANT EXTENSIONS PERMITTED ON NEW INSTALLATIONS.
4. SET HYDRANT PLUMB. COMPACT ALL BACKFILL PER SPECIFICATIONS.
5. NON-WOVEN SEPARATION FILTER FABRIC OR PLASTIC (OSS TABLE 02320-4) INSTALLED BETWEEN UNDISTURBED EARTH AND DRAINROCK PRIOR TO BACKFILL.
6. HYDRANTS SHALL BE MANUFACTURER'S RED. NO OTHER COLOR IS PERMITTED.
7. USE 45 DEGREE OR 22.5 DEGREE BENDS TO ADJUST ACCORDINGLY TO ACHIEVE MAX DEPTH REQUIREMENT.

DRAWN CJH	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		TYPICAL HYDRANT	STD DWG W-7



PROPERTY TIGHT SIDEWALK HYDRANT LOCATION AND CLEAR ZONE
PLAN VIEW

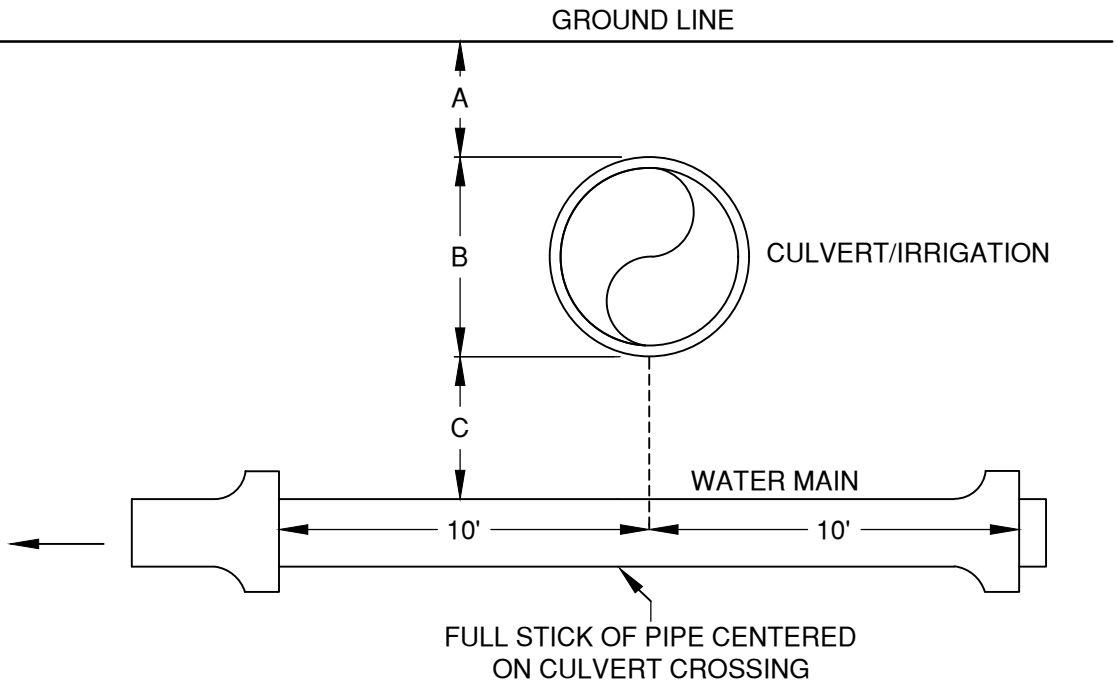


CURB TIGHT SIDEWALK HYDRANT LOCATION AND CLEAR ZONE
PLAN VIEW

NOTES:

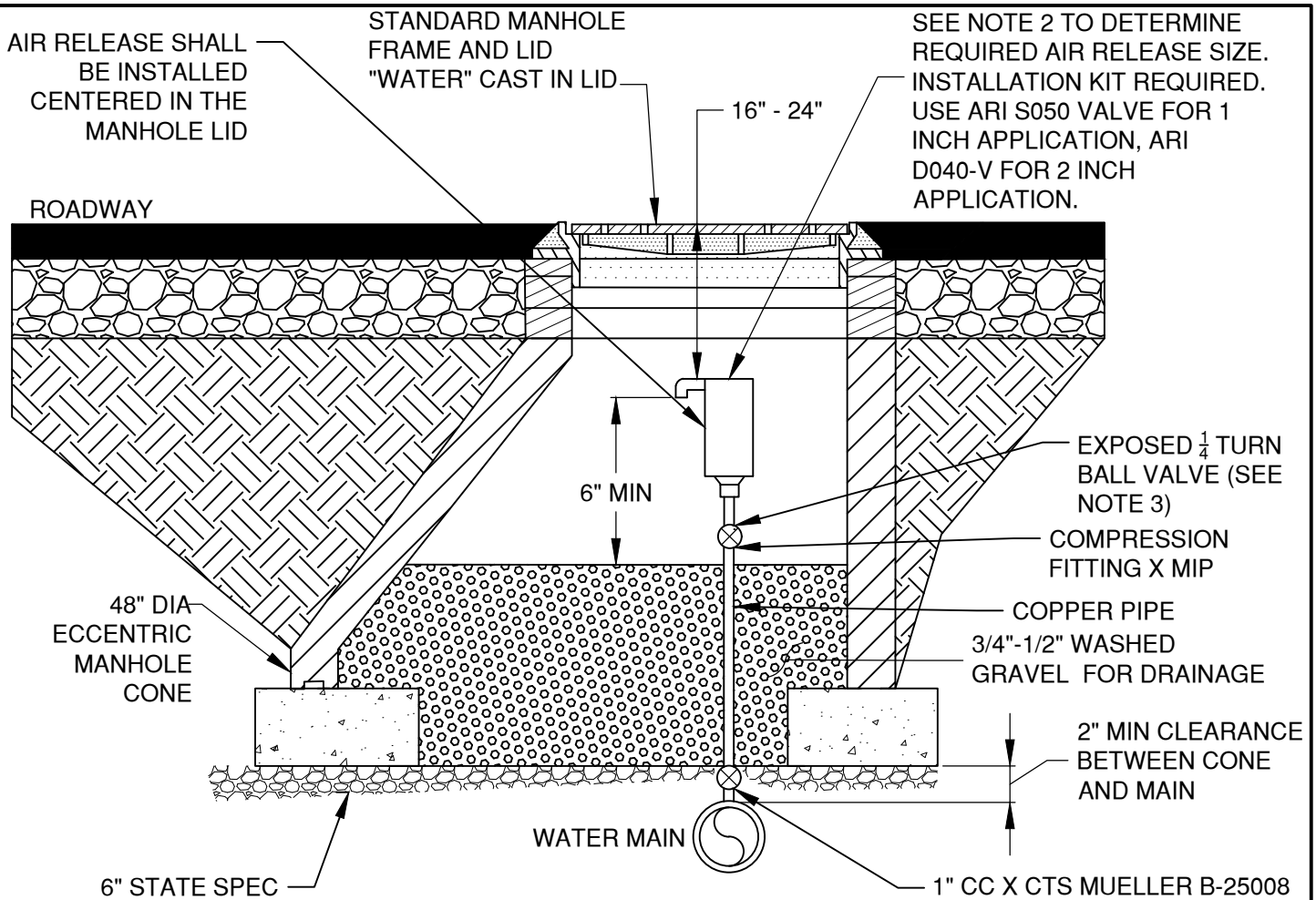
1. THE CLEAR ZONE PROHIBITS PARKING, FENCES, TREES, RETAINING WALLS, OR OTHER STRUCTURES THAT COULD INTERFERE WITH OPERATION OF HYDRANT. GRASS, MULCH, BARKDUST, AND GROUND COVER IS PERMITTED.
2. PROPERTY OWNERS SHOULD BE AWARE THAT GROUND COVER COULD BE DAMAGED WHEN THE HYDRANT IS USED OR WHEN HYDRANT MAINTENANCE IS PERFORMED.
3. CONCRETE PADS ARE TO BE A MINIMUM OF 6" THICK AND BE POURED AND PLACED ON 2" MIN. COMPACTED BASE ROCK PER SECTION OSS 00405.00
4. THERE SHALL BE A MINIMUM 4 FOOT CLEAR TRAVEL WIDTH ON SIDEWALKS ADJACENT TO HYDRANTS.
5. THE CURB SHALL BE PAINTED RED FOR A TOTAL OF 20 FEET, CENTERED ON THE HYDRANT.
6. HYDRANT PAD TO EXTEND FROM CURB TO SIDEWALK WITH NO LANDSCAPE GAP UNLESS 5 FOOT MINIMUM LANDSCAPE WIDTH CAN BE PROVIDED.

DRAWN CJH DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 HYDRANT LOCATION AND CLEAR ZONE	SCALE NTS DATE 11/01/2024 APPR STD DWG W-8

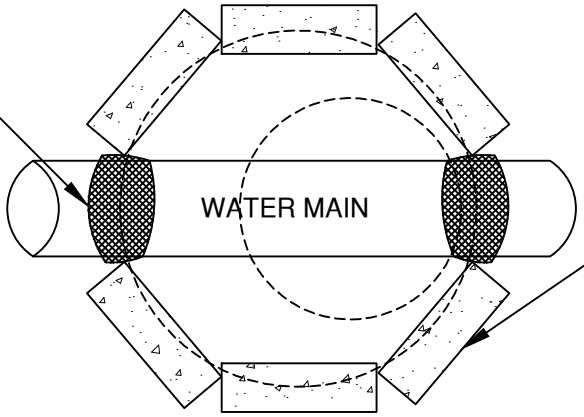


A	B	C
COVER FROM CULVERT TO FINISH GRADE	CULVERT SIZE	SEPARATION CULVERT TO MAIN
12" OR LESS	6" THRU 12"	NOT LESS THAN 18"
12" OR MORE	6" THRU 12"	NOT LESS THAN 12"
12" OR LESS	14" THRU 24"	NOT LESS THAN 30"
12" OR MORE	14" THRU 24"	NOT LESS THAN 24"
	GREATER THAN 24"	NOT LESS THAN 36"

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 SEPARATION OF WATER LINE TO IRRIGATION CULVERTS	SCALE NTS DATE 01/31/2022 APPR STD DWG W-9



PROFILE VIEW

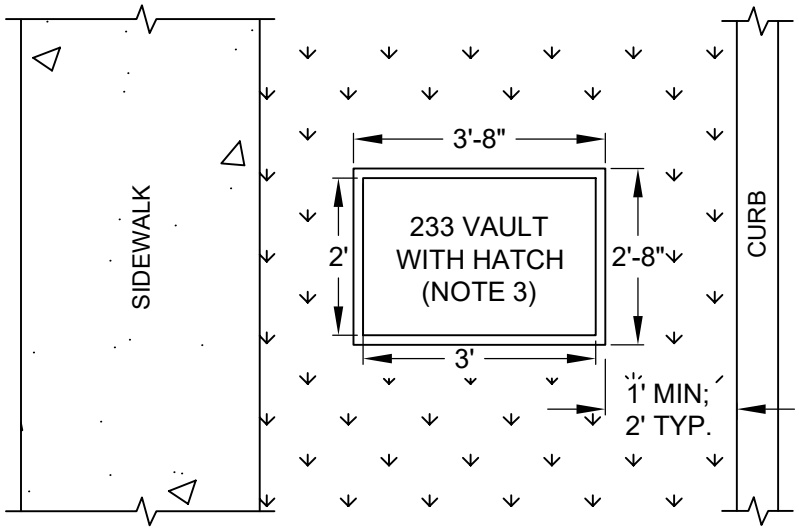


PLAN VIEW

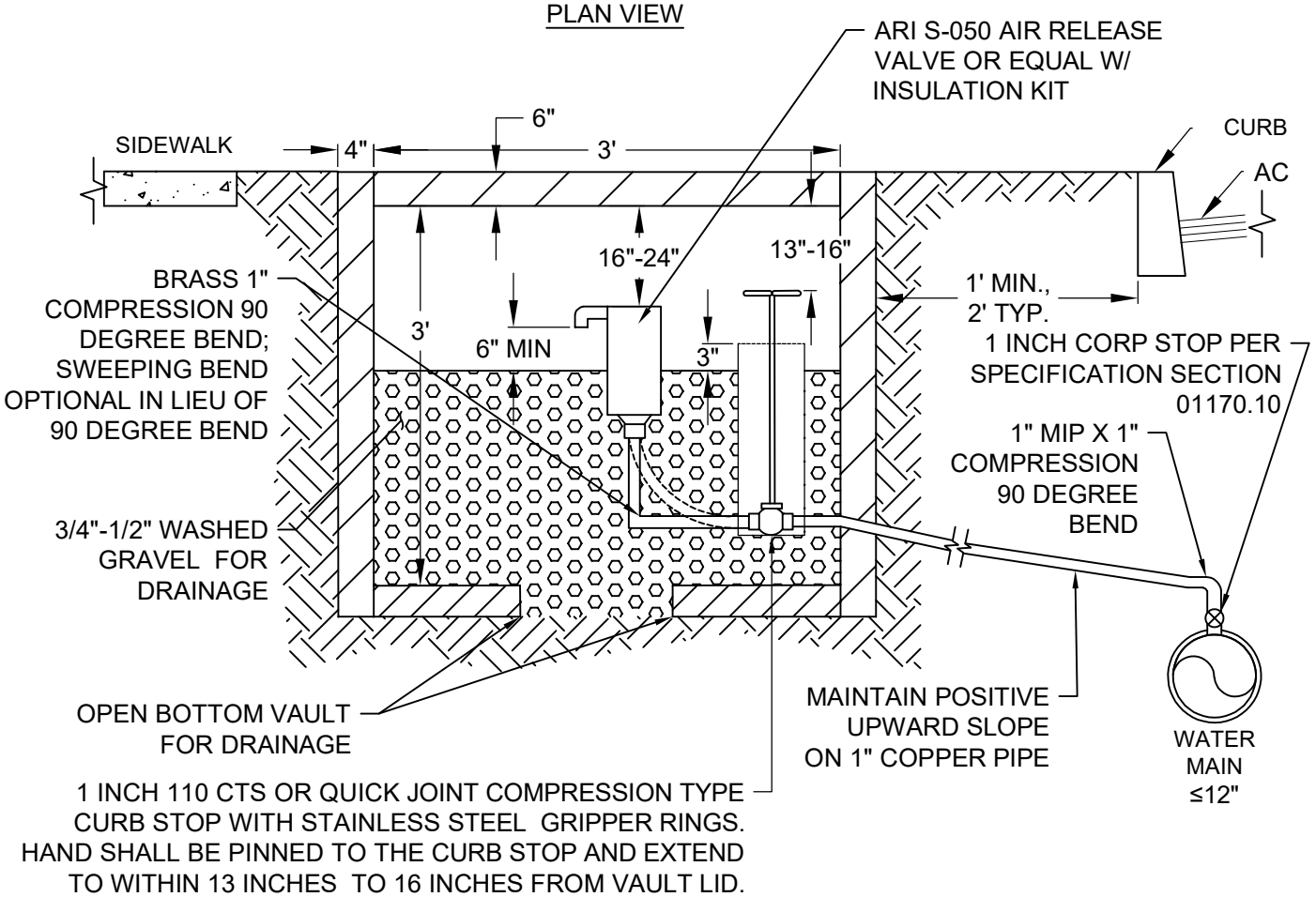
GENERAL NOTES:

1. AIR RELEASE OR COMBINATION VALVES SHALL BE INSTALL AT ALL HIGH POINTS. WHERE THE HIGH POINT IS AT THE TOP OF A LONG ASCENT (1,250 FEET+) A COMBINATION AIR/VACUUM VALVE SHALL BE INSTALLED.
2. 1-INCH AIR RELEASE VALVE TO BE USED ON WATER MAINS LESS THAN OR EQUAL TO 12-INCH DIAMETER. 2-INCH AIR RELEASE VALVE TO BE USED ON WATER MAINS GREATER THAN 12-INCH DIAMETER.
3. WHEN THE DISTANCE BETWEEN THE AIR VALVE AND THE CORP AT THE MAIN IS LESS THAN 18 INCHES, THE BALL VALVE MAY BE OMITTED.

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 11/01/2024 APPR
		1" & 2" STANDARD AIR RELEASE VALVE - TRAFFIC AREA	STD DWG W-10



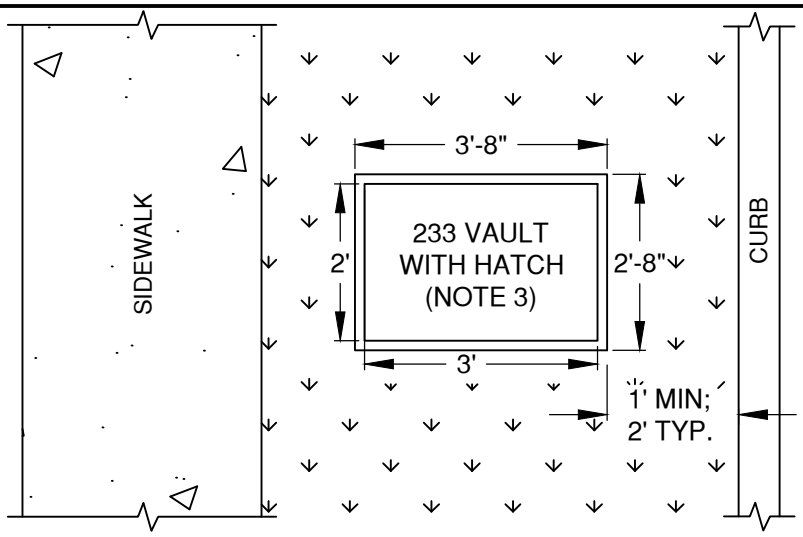
AIR RELEASE VALVE LOCATION
PLAN VIEW



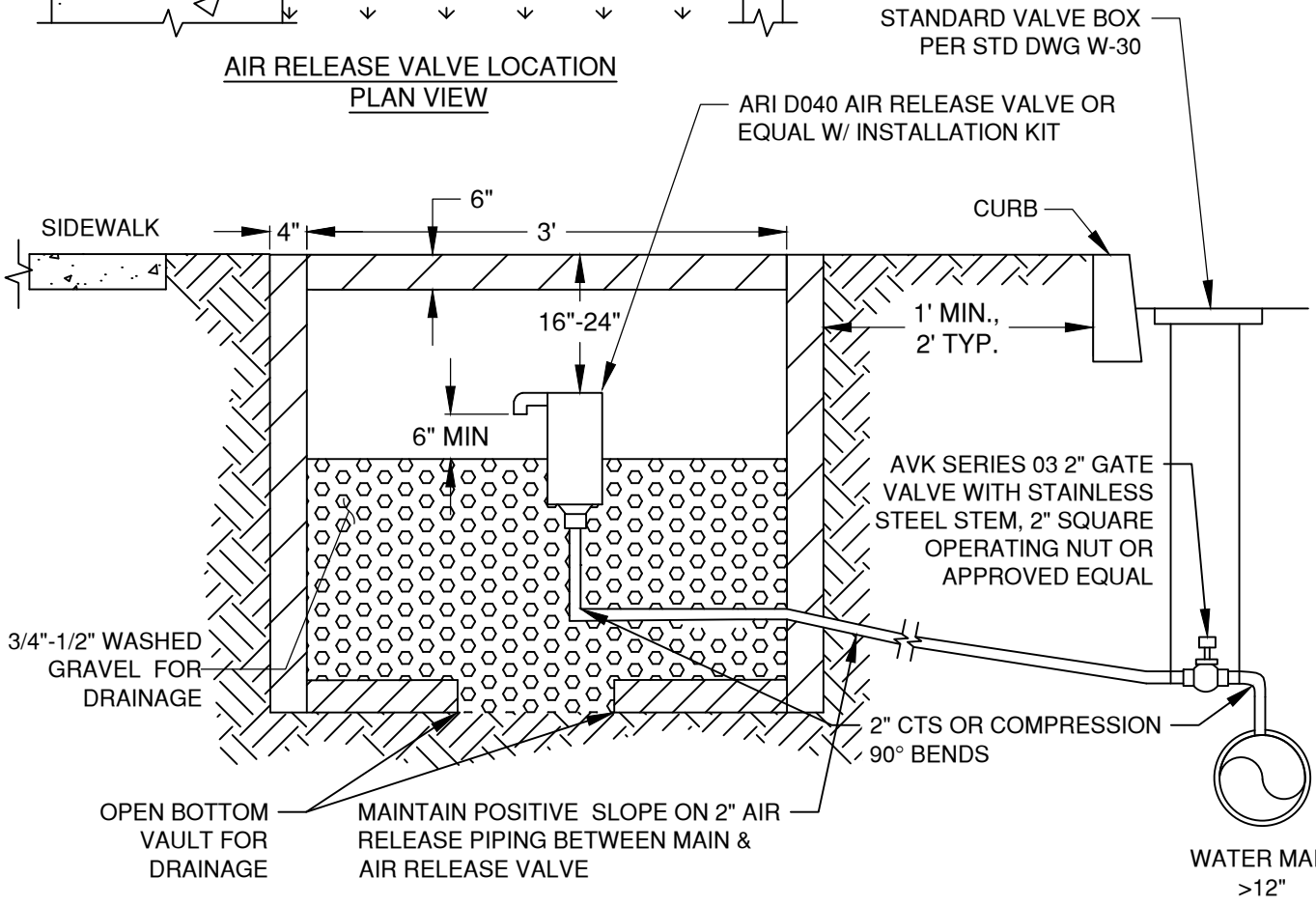
GENERAL NOTES:

1. AIR RELEASE OR COMBINATION VALVES SHALL BE INSTALL AT ALL HIGH POINTS. WHERE THE HIGH POINT IS AT THE TOP OF A LONG ASCENT (1,250 FEET+) A COMBINATION AIR/VACUUM VALVE SHALL BE INSTALLED.
2. IF 1" AIR RELEASE VALVE IS INSTALLED IN TRAFFIC AREA, INSTALL PER STD DWG W-10.
3. VAULT SHALL BE PRECAST VAULT WITH 2'X3' HATCH AND OPEN BOTTOM, OR APPROVED EQUAL.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		1" STANDARD AIR RELEASE VALVE	STD DWG W-10A



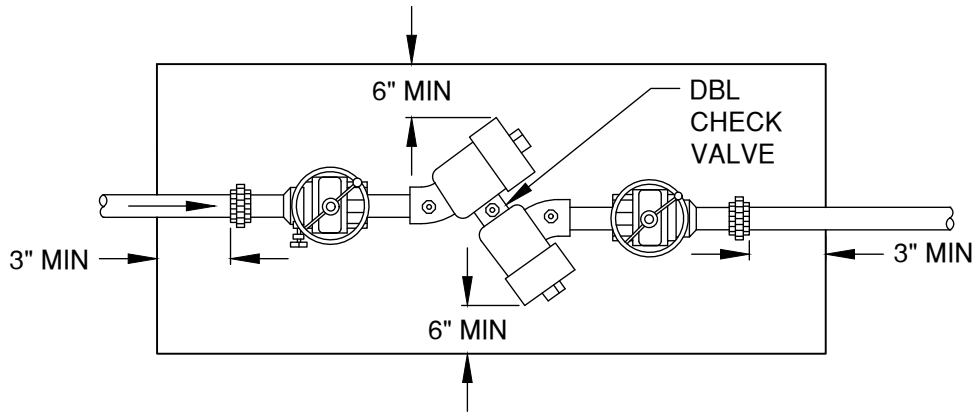
AIR RELEASE VALVE LOCATION
PLAN VIEW



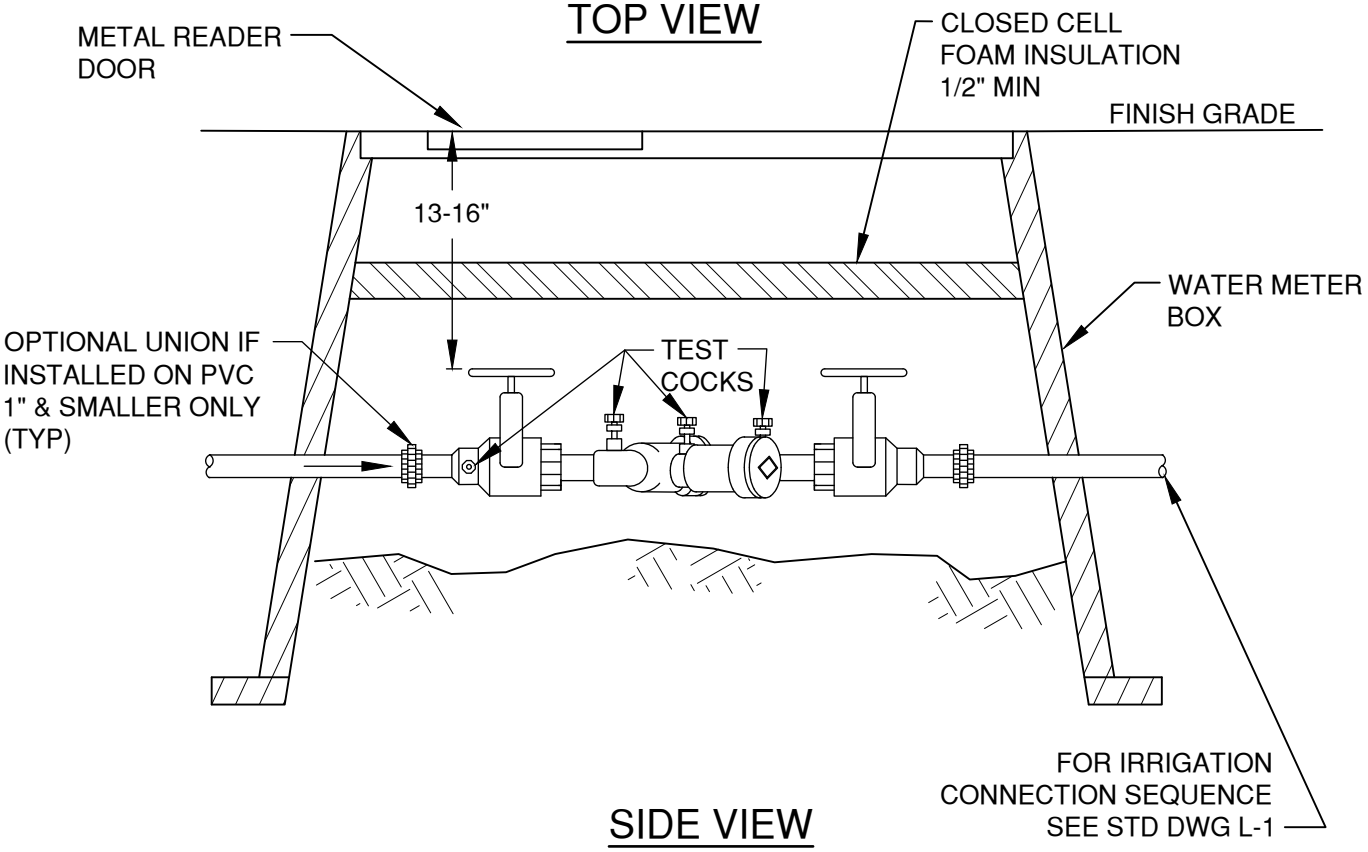
GENERAL NOTES:

1. AIR RELEASE OR COMBINATION VALVES SHALL BE INSTALL AT ALL HIGH POINTS. WHERE THE HIGH POINT IS AT THE TOP OF A LONG ASCENT (1,250 FEET+) A COMBINATION AIR/VACUUM VALVE SHALL BE INSTALLED.
2. SEE STD DWG W-10 FOR 2" AIR RELEASE VALVES LOCATED IN TRAFFIC AREAS.
3. VAULT SHALL BE ADVANCED PRECAST PRODUCT 233 VAULT WITH 2'X3' HATCH AND OPEN BOTTOM, OR APPROVED EQUAL.

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701 2" STANDARD AIR RELEASE VALVE	SCALE NTS DATE 11/01/2024 APPR STD DWG W-10B



TOP VIEW

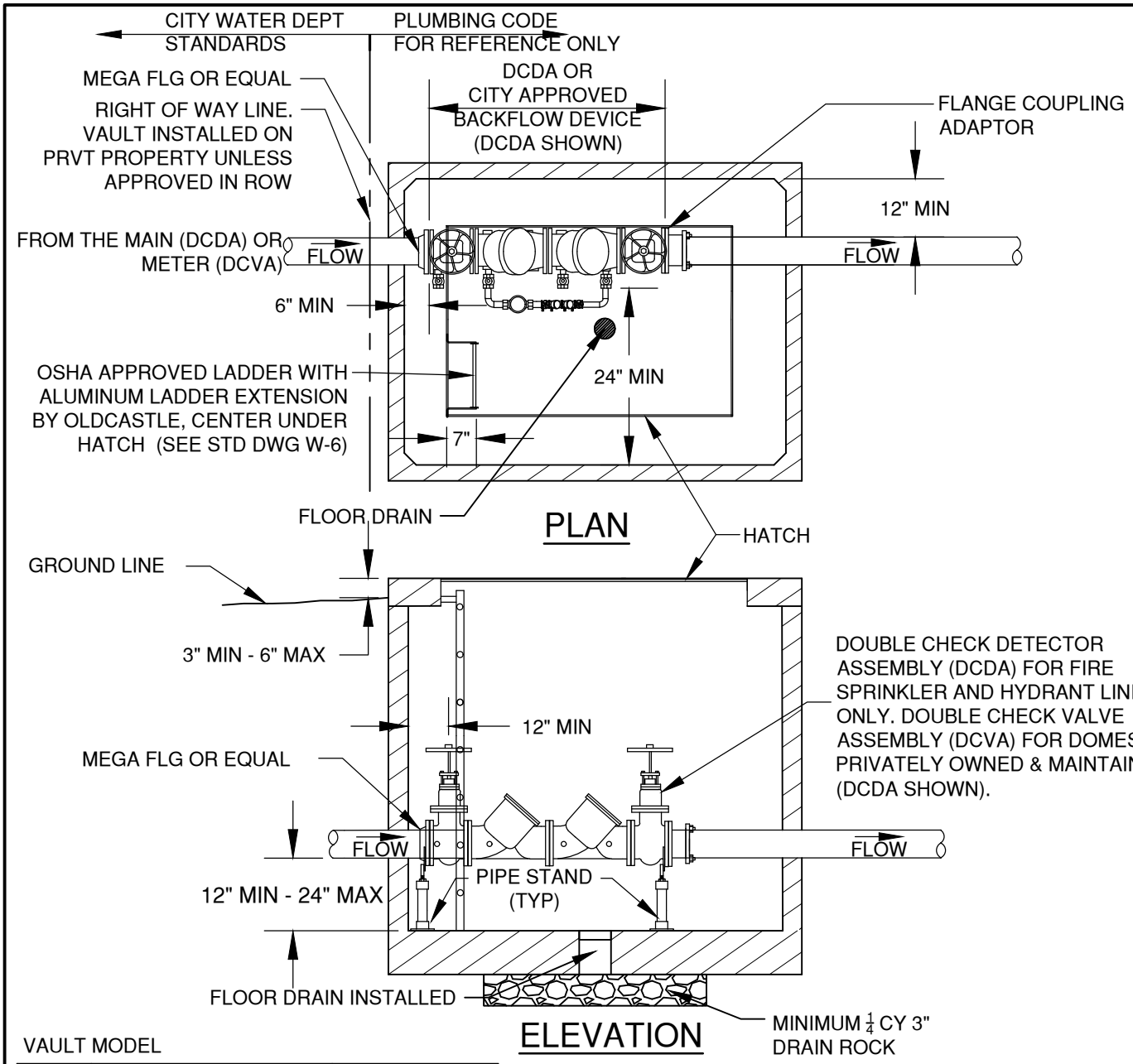


SIDE VIEW

NOTES:

1. DOUBLE CHECK VALVE ASSEMBLIES (DCVAs) MAY BE INSTALLED VERTICAL AS WELL AS HORIZONTAL PROVIDED THAT THE ASSEMBLY IS APPROVED FOR VERTICAL INSTALLATIONS
2. DCVAs MAY BE INSTALLED BELOW GRADE IN A VAULT PROVIDED WATER TIGHT, THREADED PLUGS ARE INSTALLED IN THE TEST COCKS, BUT THE ASSEMBLY SHALL NOT BE SUBJECT TO CONTINUOUS IMMERSION
3. BLOWOUT PORTS, WHEN REQUIRED MUST BE INSTALLED DOWNSTREAM OF LAST ASSEMBLY SHUTOFF

DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 04/16/2026 APPR
		TYPICAL DCVA INSTALLATIONS 2" AND SMALLER	STD DWG W-13



VAULT MODEL

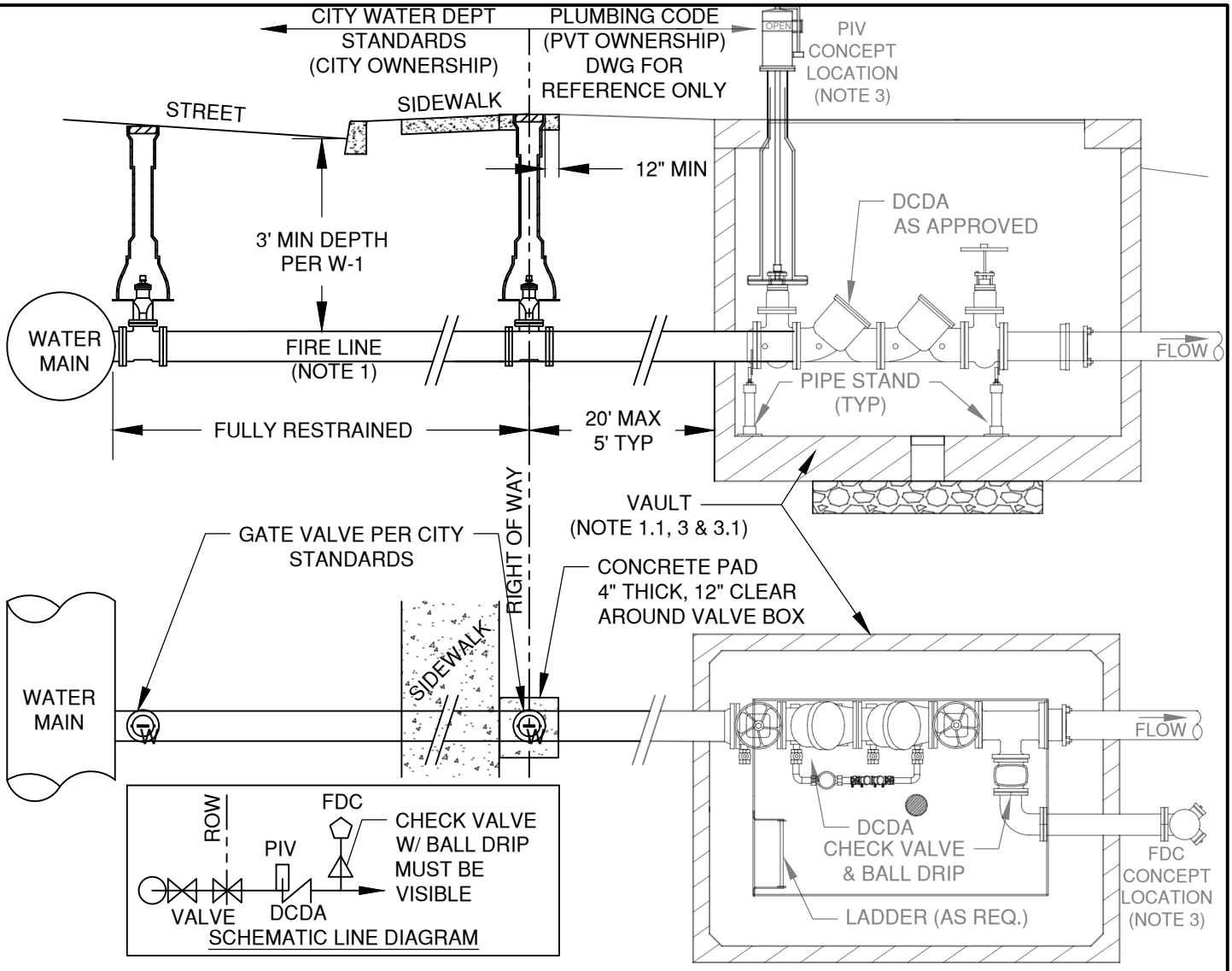
PIPE SIZE	UTILITY VAULT OR EQUAL		BILCO DOOR OR EQUAL
	W/ FDC*	W/O FDC	
3		660-WA	J-5AL
4	676-WA	577-WA	J-5AL
6	687-WA	676-WA	J-5AL
8	5106-LA	687-WA	JD-3AL
10	5106-LA	5106-LA	JD-3AL

* FOR FIRE SPRINKLER VAULTS, REFER TO W-13B. FIRE SPRINKLER VAULTS INSTALLED IN RIGHT OF WAY OR UTILITY EASEMENT ONLY WHEN APPROVED BY CITY ENGINEER.

NOTES:

1. ENGINEER TO PROVIDE RESTRAIN DETAIL FOR ALL PIPE ENTERING & EXITING VAULT
2. CONTRACTOR TO SEAL ALL OPENINGS IN VAULT WITH NON-SHRINK GROUT PRIOR TO BACKFILLING
3. CONDUIT BROUGHT TO VAULT FOR PUMP POWER AND DETECTOR WIRING.
4. ENGINEERED DESIGN TO BE PROVIDED WITH PERMIT.
5. VAULT AND LID TO BE TRAFFIC RATED
6. ALL FIRE LINES SHALL HAVE THE VAULT & DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) INSTALLED CONCURRENTLY FOR TESTING & DISINFECTION TO THE CITY MAIN.
7. PIPE SHALL MEET CITY ROW SPECIFICATIONS FROM MAIN TO DCDA

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		2" & LARGER DOUBLE CHECK VALVE ASSEMBLY	STD DWG W-13A

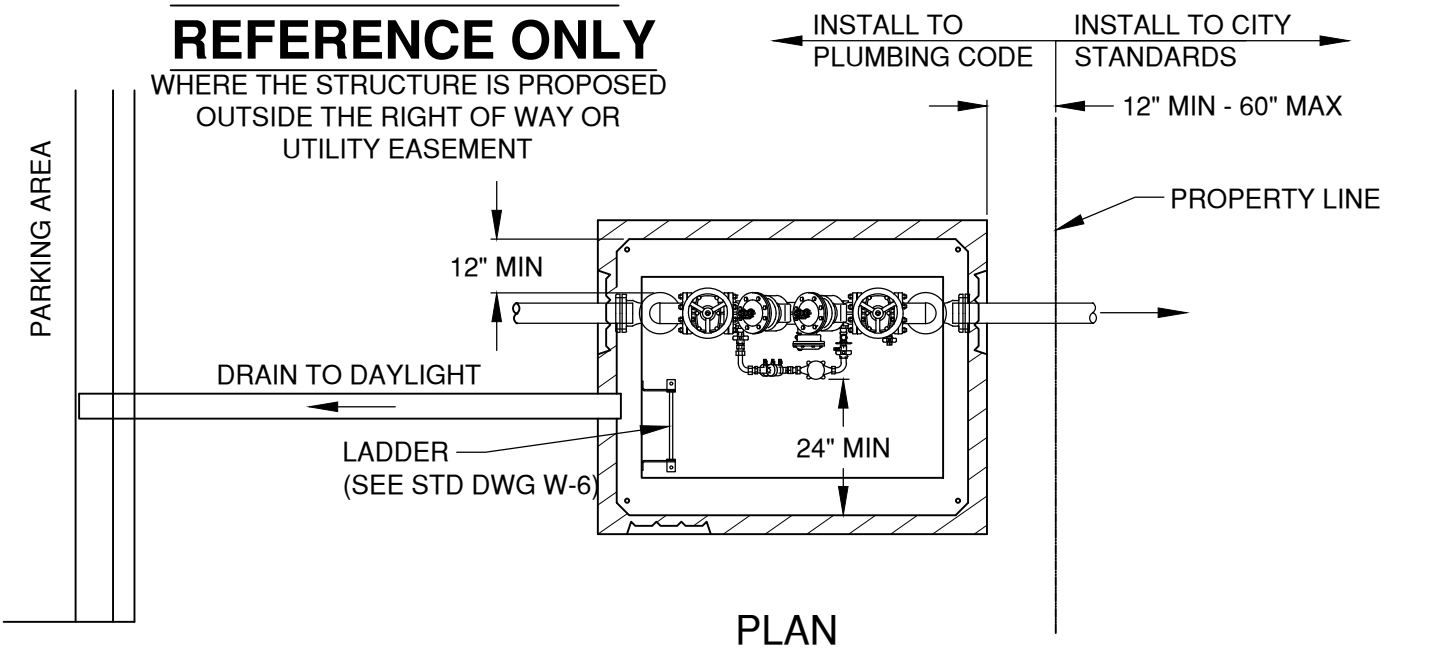


NOTES:

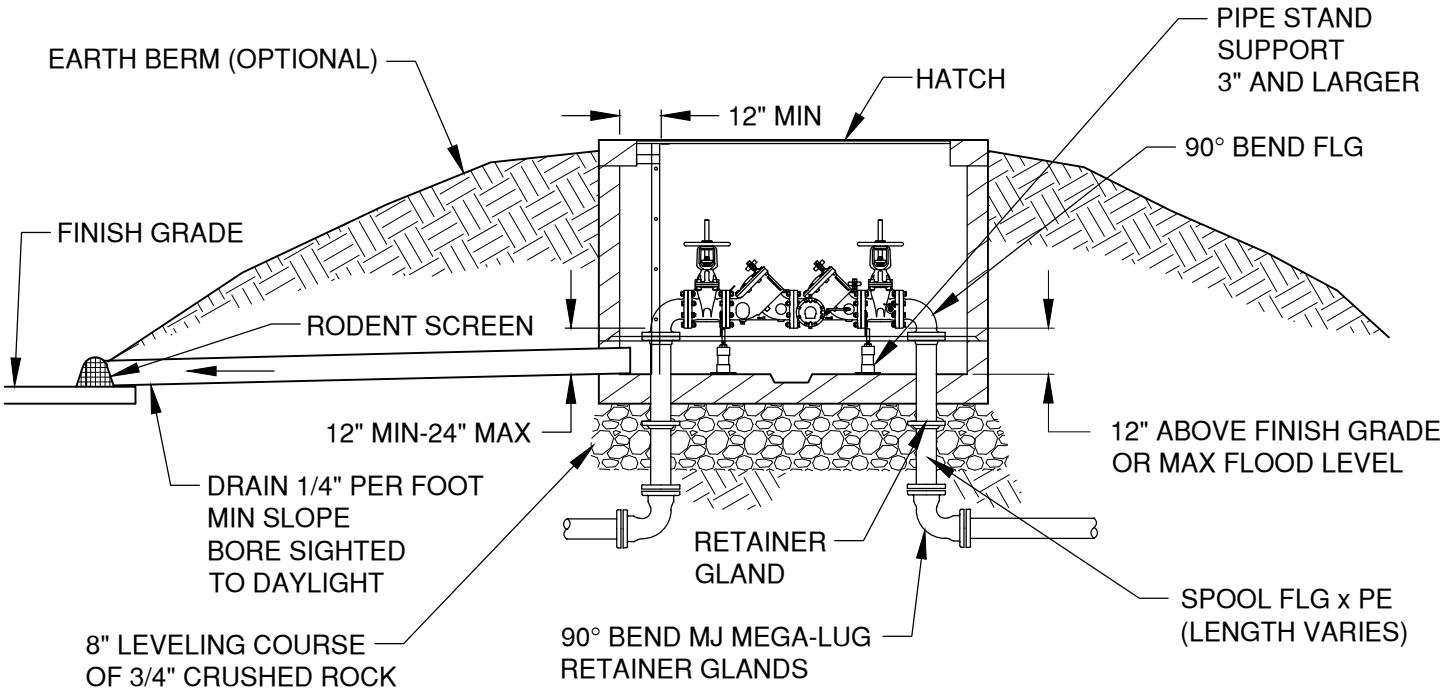
1. FIRE VAULT AND DCDA IS SHOWN FOR REFERENCE ONLY. VAULT AND PLUMBING BEYOND THE GATE VALVE SHALL BE INSTALLED PER PLUMBING CODE AND INSPECTED BY THE BUILDING DEPARTMENT.
   1.1. WHERE FIRE VAULT IS APPROVED BY CITY ENGINEER TO BE WITHIN THE ROW OR PUBLIC EASEMENT, VAULT SIZES ON STD DWG W-13A SHALL APPLY AND "FOR REFERENCE NOTES" ON THIS SHEET WOULD APPLY.
2. FIRE LINE TO BE 4" MIN DUCTILE IRON WATER MAIN PER CITY OF BEND SPECIFICATIONS. FIRE LINE TO BE SIZED BY ENGINEER UNDER A RIGHT OF WAY PERMIT.
3. VAULT TO BE SIZED BY ENGINEER IN CONFORMANCE TO BUILDING/FIRE/PLUMBING CODE, MEETING THE DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) MANUFACTURER'S INSTALLATION SPECIFICATIONS. DESIGN SHALL ACCOUNT FOR ANY FREEZE PROTECTION REQUIRED TO MEET FIRE CODE.
   3.1. WHERE BUILDING IS WITHIN 20 FEET OF THE RIGHT OF WAY LINE, THE DCDA CAN BE WITHIN THE BUILDING'S MECHANICAL ROOM AS APPROVED BY THE CITY ENGINEER. THE DCDA MUST BE LOCATED FRONTING THE ROW AND LOCATED AT THE BUILDING PENETRATION. THE FDC MUST BE VISIBLE FROM ROW. ACCESS TO THE MECHANICAL ROOM TO BE PROVIDED BY AN EXTERIOR DOOR WITH KNOX BOX UNLESS OTHERWISE APPROVED.
   3.2. VAULTS ARE TO BE PLACED OUT OF HARD SURFACES (SIDEWALKS, DRIVEWAYS/ROADWAYS,ECT.)
4. POST INDICATOR VALVE (PIV) AND FIRE DEPARTMENT CONNECTION (FDC) TO BE LOCATED IN CLEAR VIEW OF THE FRONTAGE STREET, WITH THE FDC LOCATED WITHIN AN ALLOWABLE DISTANCE FROM A HYDRANT. PIV AND FDC MAY BE MOUNTED ON THE BUILDING IN CONFORMANCE WITH THE FIRE CODE AND AS APPROVED. PIV AND FDC CAN BE MOUNTED OUTSIDE THE VAULT OR THROUGH THE VAULT LID PROVIDED THEY DON'T INTERFERE WITH VAULT ACCESS AND THE PENETRATIONS ARE GROUTED AND DON'T NEGATE THE STRUCTURAL INTEGRITY OF THE VAULT. PIV NOT TO BE USED IN-LIEU OF ISOLATION GATE VALVE AT PROPERTY LINE.
5. ALL ELECTRICAL TO VAULT AND PIV TO BE INSTALLED PER BUILDING AND FIRE CODE AS REQUIRED.
6. PIPE SHALL MEET CITY ROW SPECIFICATIONS FROM MAIN TO DCDA.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 03/22/2023
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		FIRE SPRINKLER LINE	STD DWG W-13B

DRAWING IS FOR REFERENCE ONLY



PLAN



PROFILE

NOTES:

1. THIS DRAWING IS FOR REFERENCE ONLY. INSTALL PER PLUMBING CODE AND BUILDING DEPARTMENT REQUIREMENTS.
2. ENGINEER TO PROVIDE RESTRAINT DETAIL FOR ALL PIPE ENTERING & EXITING VAULT
3. CONTRACTOR TO SEAL ALL OPENINGS IN VAULT WITH NON-SHRINK GROUT PRIOR TO BACKFILLING
4. HIGH OR LOW HAZARD CONNECTIONS SHALL BE IDENTIFIED AND VERIFIED WITH CITY CROSS CONNECTION SPECIALIST
5. PIPE SHALL MEET CITY ROW SPECIFICATIONS FROM MAIN TO DCDA

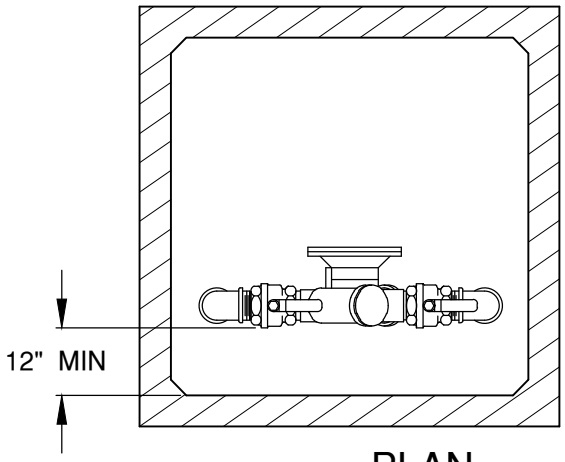
DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		2 1/2"-10" REDUCED PRESSURE BACKFLOW ASSEMBLY	STD DWG W-15

DRAWING IS FOR REFERENCE ONLY

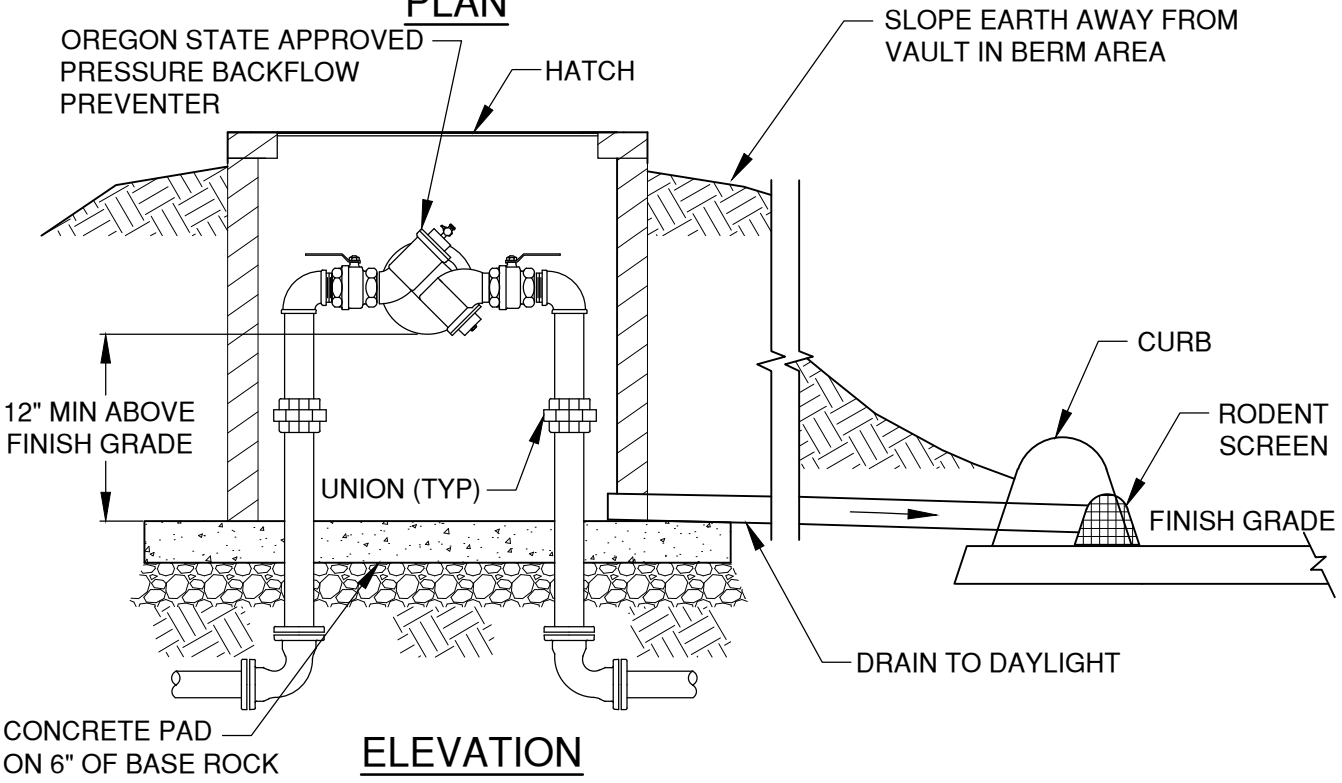
WHERE THE STRUCTURE IS PROPOSED OUTSIDE THE RIGHT OF WAY OR UTILITY EASEMENT

VAULT SPECIFICATIONS

WATER LINE DIAMETER	MODEL
1"	OLDCASTLE 3030-LA (OR EQUAL)
1-1/2" - 2"	OLDCASTLE 3642-PUT (OR EQUAL)



PLAN



ELEVATION

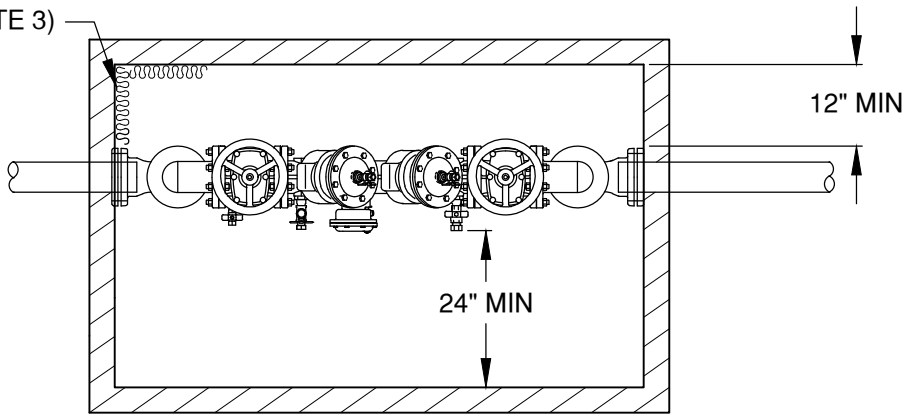
NOTES:

1. THIS DRAWING IS FOR REFERENCE ONLY. INSTALL PER PLUMBING CODE AND BUILDING DEPARTMENT REQUIREMENTS.
2. REDUCED PRESSURE BACKFLOW ASSEMBLY TO BE LOCATED DIRECTLY DOWN STREAM OF WATER METER
3. BRASS, STAINLESS, OR PLASTIC PLUGS TO BE INSTALLED IN TEST COCKS IF BELOW GROUND INSTALLATION
4. HIGH OR LOW HAZARD CONNECTIONS SHALL BE IDENTIFIED AND VERIFIED WITH CITY CROSS CONNECTION SPECIALIST

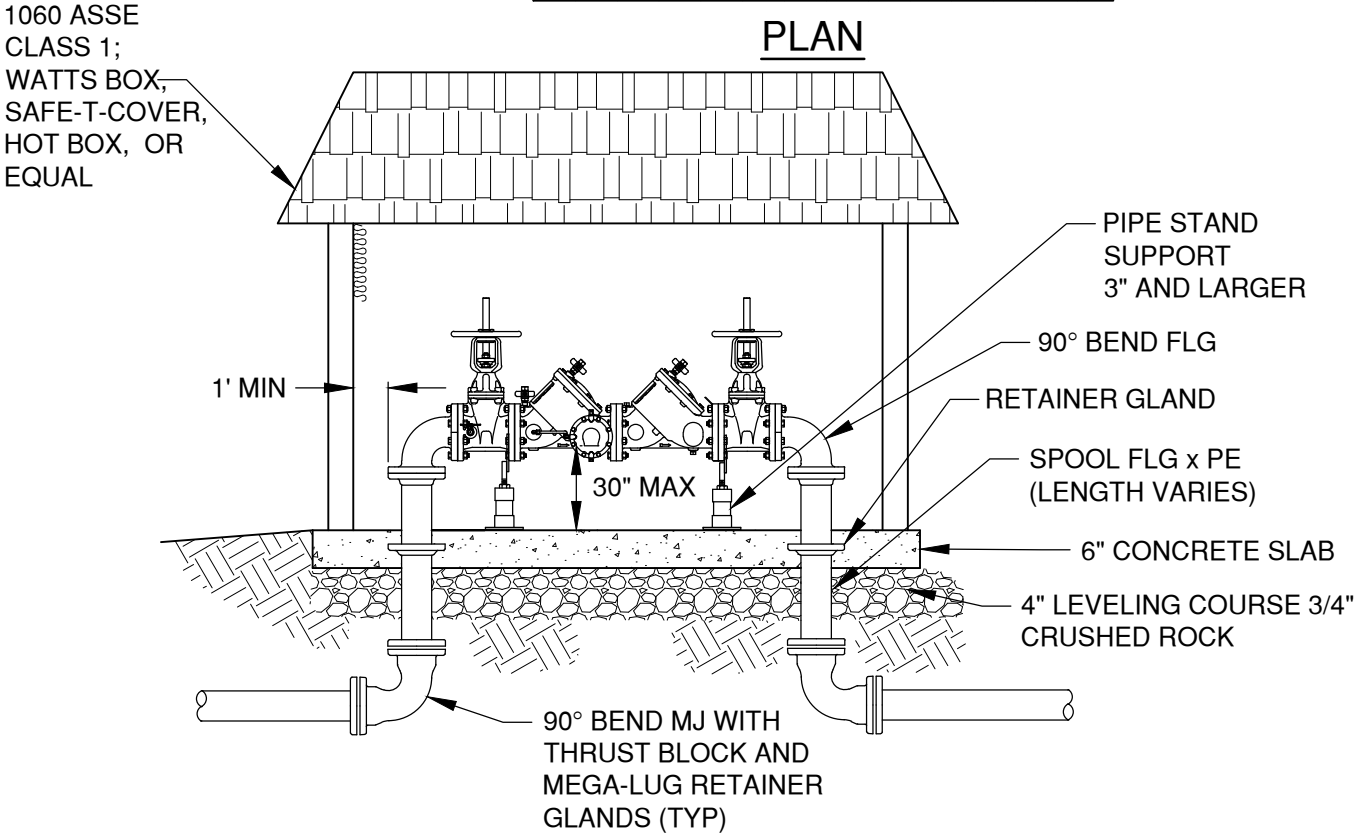
DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		1"-2" REDUCED PRESSURE BACKFLOW ASSEMBLY	STD DWG W-15A

DRAWING IS FOR REFERENCE ONLY

WHERE THE STRUCTURE IS PROPOSED OUTSIDE THE RIGHT OF WAY OR UTILITY EASEMENT



PLAN



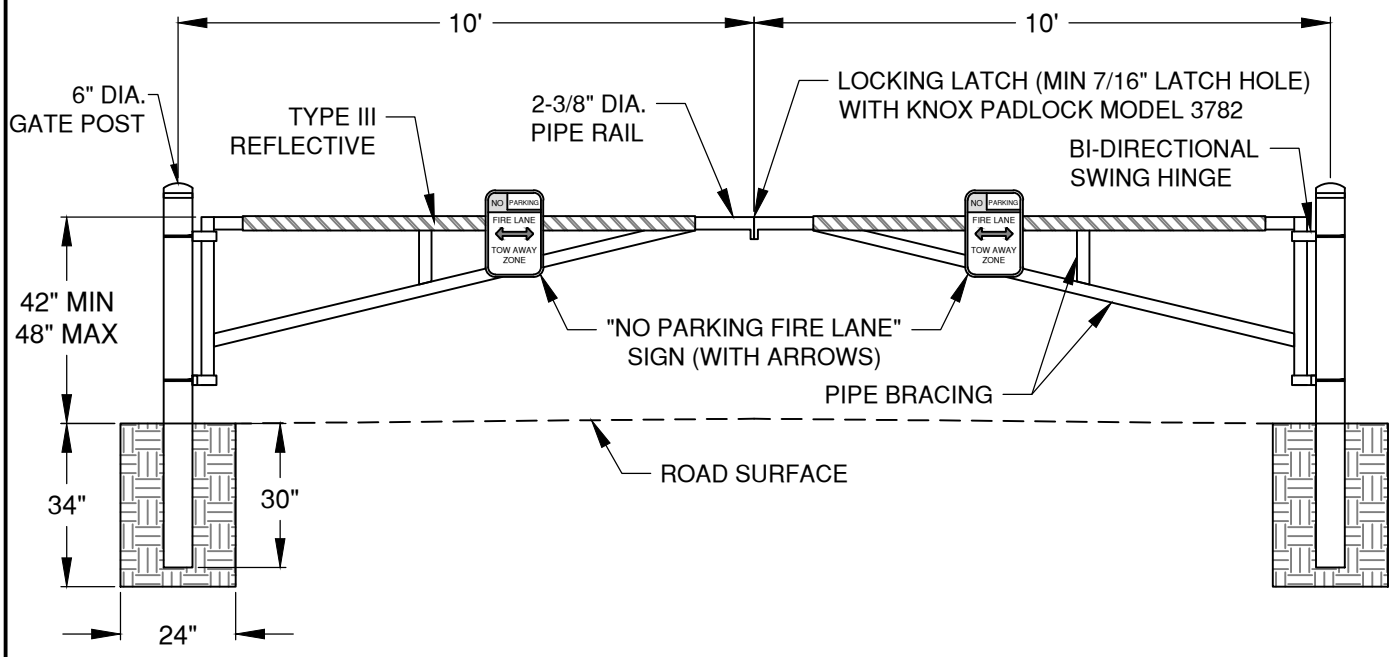
PROFILE

NOTES:

1. THIS DRAWING IS FOR REFERENCE ONLY. INSTALL PER PLUMBING CODE AND BUILDING DEPARTMENT REQUIREMENTS OR AS BY MANUFACTURER'S REQUIREMENTS.
2. REDUCED PRESSURE BACKFLOW ASSEMBLY SHALL BE INSTALLED HORIZONTALLY UNLESS APPROVED FOR OTHER ORIENTATION
3. ALL CLEARENCES APPLY TO OUTSIDE, IN-BUILDING, AND VAULT INSTALLATIONS
4. STRUCTURE TO BE INSULATED AND HAVE A HEAT SOURCE TO KEEP ENCLOSURE AT40°F (NFPA 13-4-5.4.1.1)
5. ENCLOSURE SHALL INCLUDE A BORE SIGHTED DRAIN TO DAYLIGHT CAPABLE OF DRAINING A FULL RELIEF VALVE DISCHARGE. MAKE/MODEL/SIZE WILL DICTATE THE SIZE OF THE ENCLOSURE.
6. ALL ASSEMBLIES 2 1/2" AND LARGER SHALL BE FLANGED
7. HIGH OR LOW HAZARD CONNECTIONS SHALL BE IDENTIFIED AND VERIFIED WITH CITY CROSS CONNECTION SPECIALIST

DRAWN AJD		CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV	DATE	710 NW WALL ST., BEND, OREGON 97701	APPR
		2 1/2" + REDUCED PRESSURE BACKFLOW ASSEMBLY	STD DWG W-15B

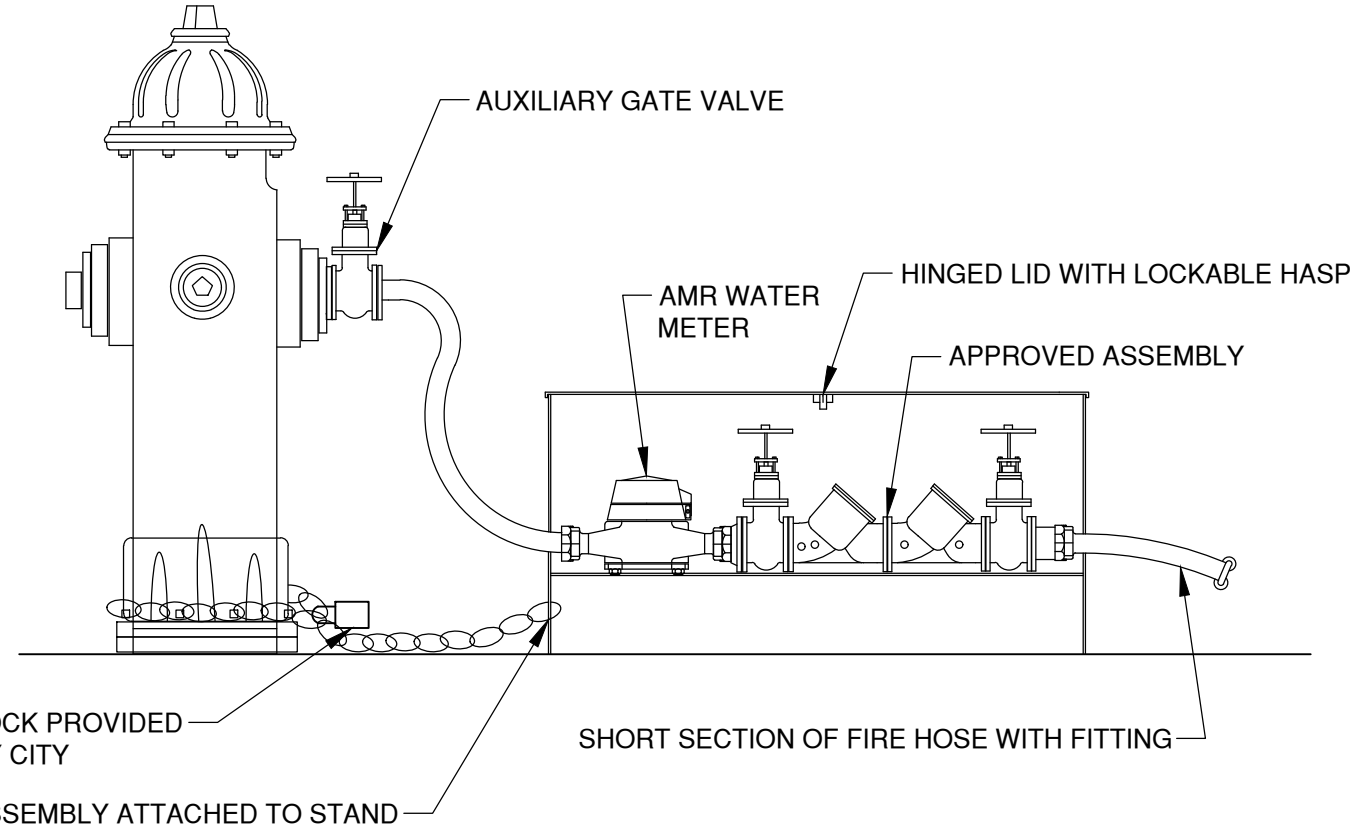
CITY OF BEND



NOTES:

1. ALL MATERIAL SHALL BE SCHEDULE 40, GALVANIZED STEEL PIPE.
2. PROTECTIVE FINISH SHALL BE HOT-DIPPED, GALVANIZED GRAY.
3. CONTRACTOR TO INSTALL NO PARKING, FIRE LANE SIGN ON EACH SIDE OF GATE MEETING THE REQUIREMENTS OF OFC D103.6.
4. CONTRACTOR TO INSTALL TYPE III REFLECTIVE STRIPING ON BOTH SIDES OF GATE. STRIPING SHALL BE ALTERNATING RED/WHITE STRIPES, 6" WIDE AT 45 DEGREE ANGLE.
5. CONCRETE SHALL BE COMMERCIAL GRADE CONCRETE PER SPECIFICATION SECTION 00440.
6. GATE POSTS SHALL BE LOCATED OUTSIDE OF THE ROADWAY. IF PAVEMENT AND CURBS ARE PRESENT, GATE POSTS SHALL BE LOCATED BEHIND CURB.
7. COORDINATE INSTALLATION OF KNOX PADLOCK WITH CITY OF BEND FIRE DEPARTMENT.

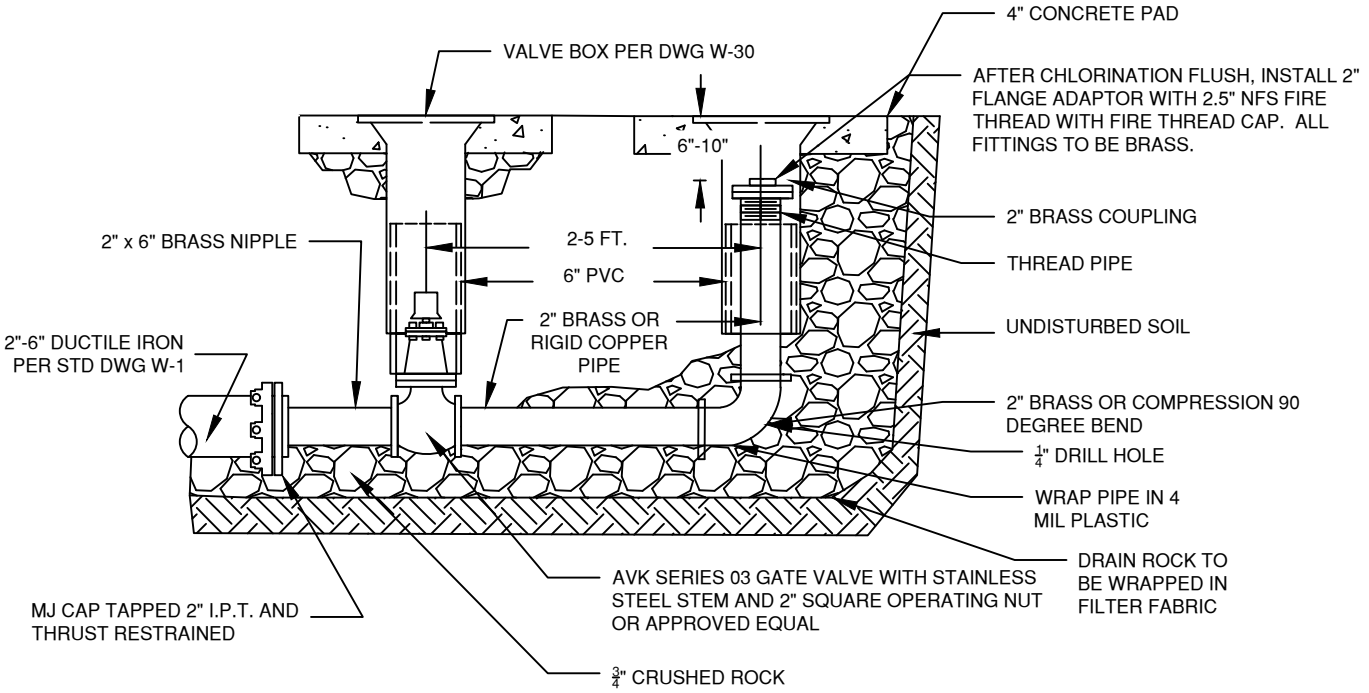
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		FIRE GATE	STD DWG W-21



NOTES:

1. GATE VALVE, METER, REDUCED PRESSURE BACKFLOW ASSEMBLY & DOUBLE CHECK VALVE ASSEMBLY, & BOX WILL BE SUPPLIED & SET UP BY THE CITY WATER DEPT @ THE CONTRACTORS REQUEST AFTER OBTAINING A CITY HYDRANT PERMIT
2. HYDRANT PERMIT HOLDER TO PROTECT THE ENTIRE UNIT FROM FREEZING
3. BACKFLOW ASSEMBLY MUST BE TESTED IF UNIT IS MOVED TO ANOTHER LOCATION.

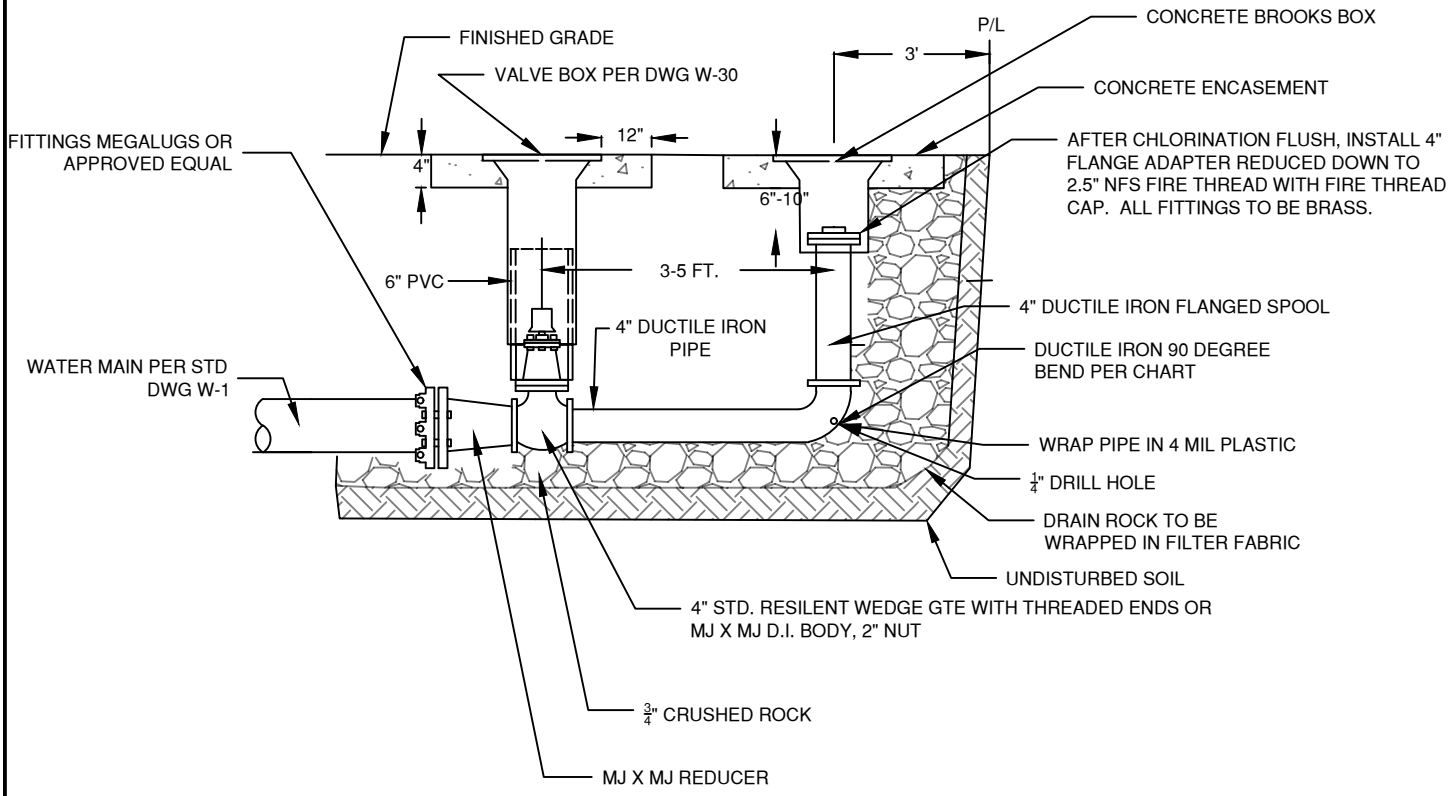
DRAWN AJD DIV WATER REV DATE	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS DATE 01/31/2022 APPR
		HYDRANT PERMIT/FILLING TANKER TRUCK	STD DWG W-22



NOTES:

1. USE CITY STANDARD VALVE BOXES, LIDS, AND 6" PVC EXTENSION.
2. BLOW-OFF UNIT SHALL BE BACKFILLED WITH 3/4" MINUS CRUSHED ROCK. ALL COMPACTION TO COMPLY WITH SPECIFICATION SECTION 00330.43 AND 00405.46(C).
3. TEMPORARY BLOW-OFF IS ONE REMOVED AT THE END OF WATER LINE TESTING AND INSTALLATION AND PRIOR TO PROJECT PAVING. A PERMANENT BLOW-OFF REMAINS ON THE PROJECT AFTER ACCEPTANCE.
4. PLACE BLOW-OFF STANDPIPE 3' INSIDE ROW LINE AT THE END OF STREET (2' FROM BARRICADE).
5. USE CITY STANDARD VALVE BOX, LID, AND 6" PVC EXTENSION FOR BLOW-OFF VALVE.
6. BLOW OFF RISER TO BE ONE CONTINUOUS PIECE.
7. USE EBAA IRON "MEGALUG" OR APPROVED EQUAL RETAINER GLAND ON MJ CAP. RESTRAIN PER ENGINEER.
8. 2" PVC PLUG WITH SQUARE NUT TO BE HAND TIGHTENED ONLY.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD 2" BLOW-OFF ASSEMBLY	STD DWG W-23



BLOW OFF SIZES REQUIRED	
MAIN SIZE	BLOW OFF SIZE
6" AND BELOW	2" (SEE DWG W-23)
8" - 12"	4"
ABOVE 12"	HYDRANT

NOTES:

1. USE CITY STANDARD VALVE BOXES, AND LIDS.
2. BLOW-OFF UNIT SHALL BE BACKFILLED WITH 3/4" MINUS CRUSHED ROCK. ALL COMPACTION TO COMPLY WITH SPECIFICATION SECTION 00330.43 AND 00405.46(C).
3. TEMPORARY BLOW-OFF IS ONE REMOVED AT THE END OF WATER LINE TESTING AND INSTALLATION AND PRIOR TO PROJECT PAVING. A PERMANENT BLOW-OFF REMAINS ON THE PROJECT AFTER ACCEPTANCE.
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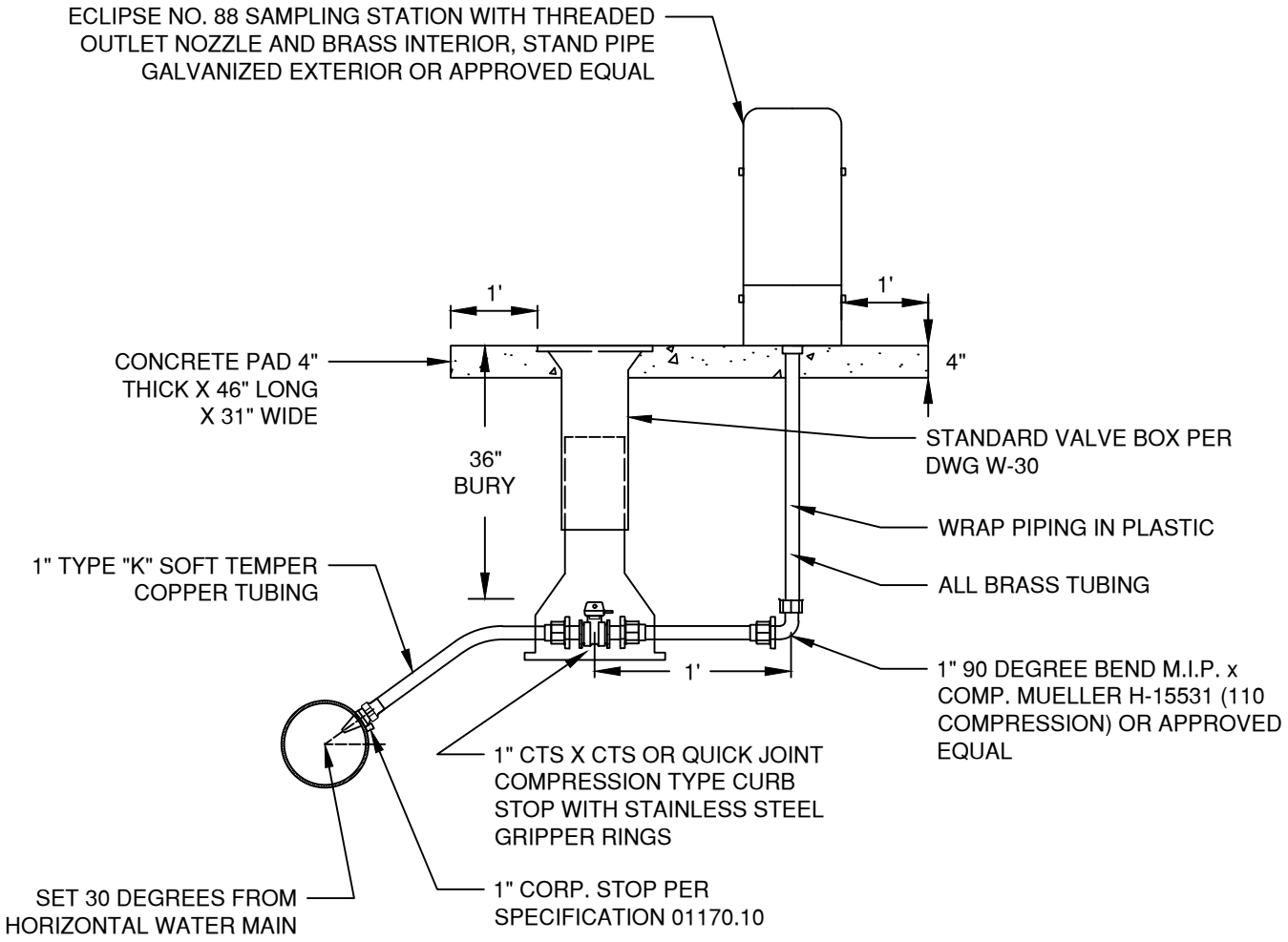
6. BLOW OFF RISER TO BE ONE CONTINUOUS PIECE.
7. USE EBAA IRON "MEGALUG" OR APPROVED EQUAL RETAINER GLAND ON MJ CAP. RESTRAIN PER ENGINEER.

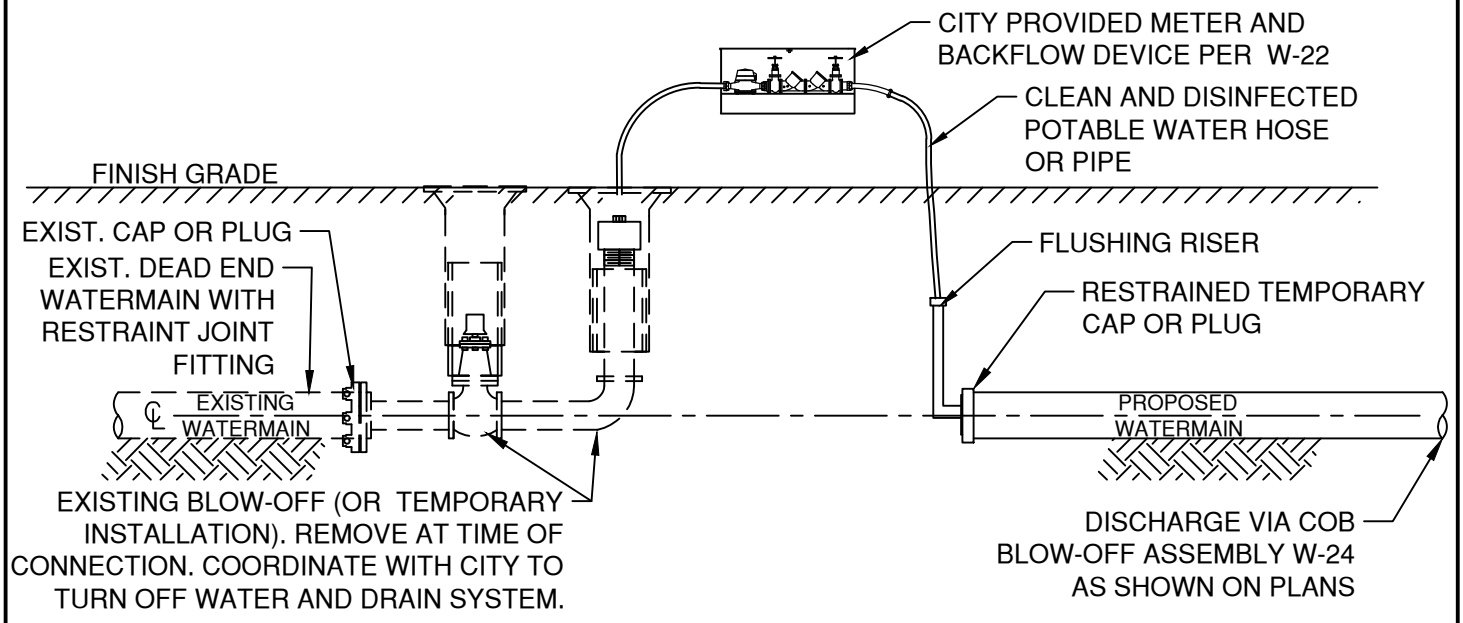
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 01/31/2022
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		4" BLOW-OFF DETAIL	STD DWG W-24



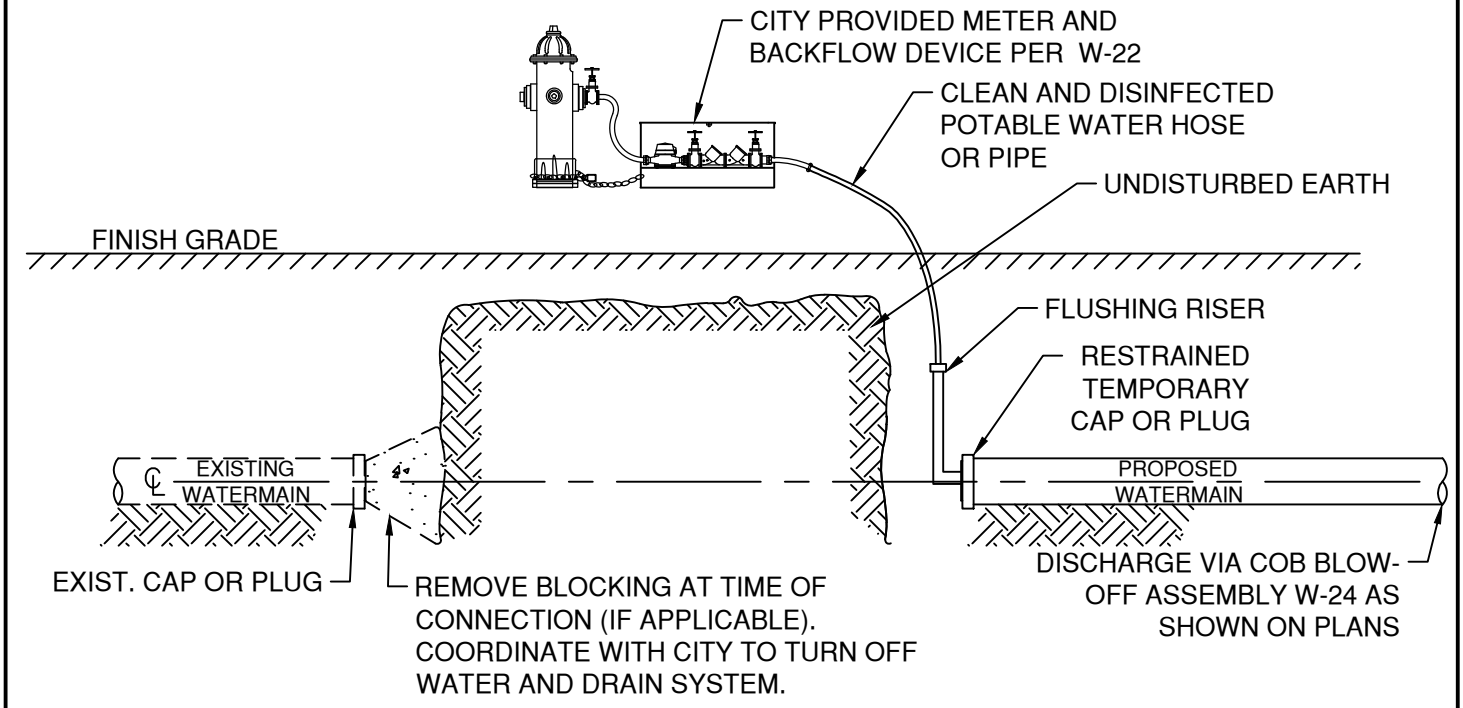
NOTES:

1. ALL PIPE AND STRUCTURES SHALL BE BACKFILLED WITH SCREENED MAX $\frac{3}{4}$" MINUS CRUSHED ROCK. ALL COMPACTION TO COMPLY WITH SPECIFICATION SECTION 00330.43 AND 00405.46(C).
2. SET STATION AT LOT LINE UNLESS OTHERWISE SPECIFIED.
3. WHEN CROSSING, CATHODICALLY PROTECTED SYSTEM, INSTALL COPPER IN PVC SLEEVE FOR 5' EACH SIDE OF THE CROSSING.
4. WHERE NO SIDEWALK EXISTS, PLACE CONC. PAD AS SHOWN. WHERE SIDEWALKS EXIST, PLACE MIN. 12" AROUND BACK OF SAMPLE STA. AND INCORPORATE INTO NEW SIDEWALK POUR.

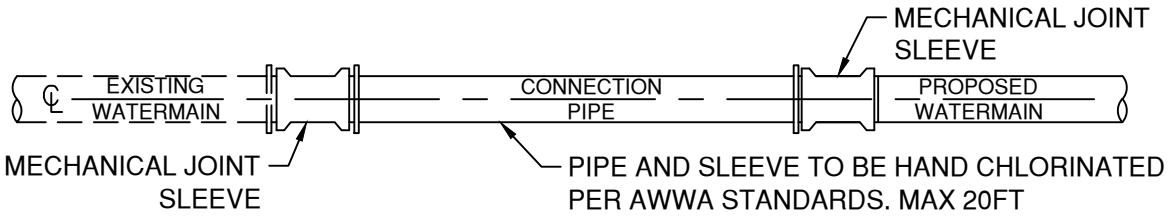
DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		STANDARD WATER SAMPLING STATION	STD DWG W-25



OPTION 1: TESTING AND FLUSHING USING A BLOW OFF ASSEMBLY

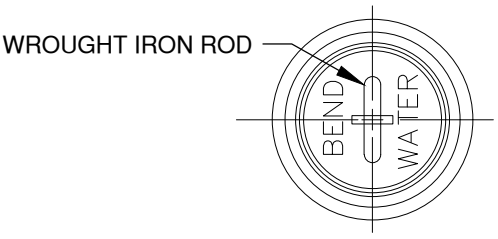


OPTION 2: TESTING AND FLUSHING USING NEARBY HYDRANT

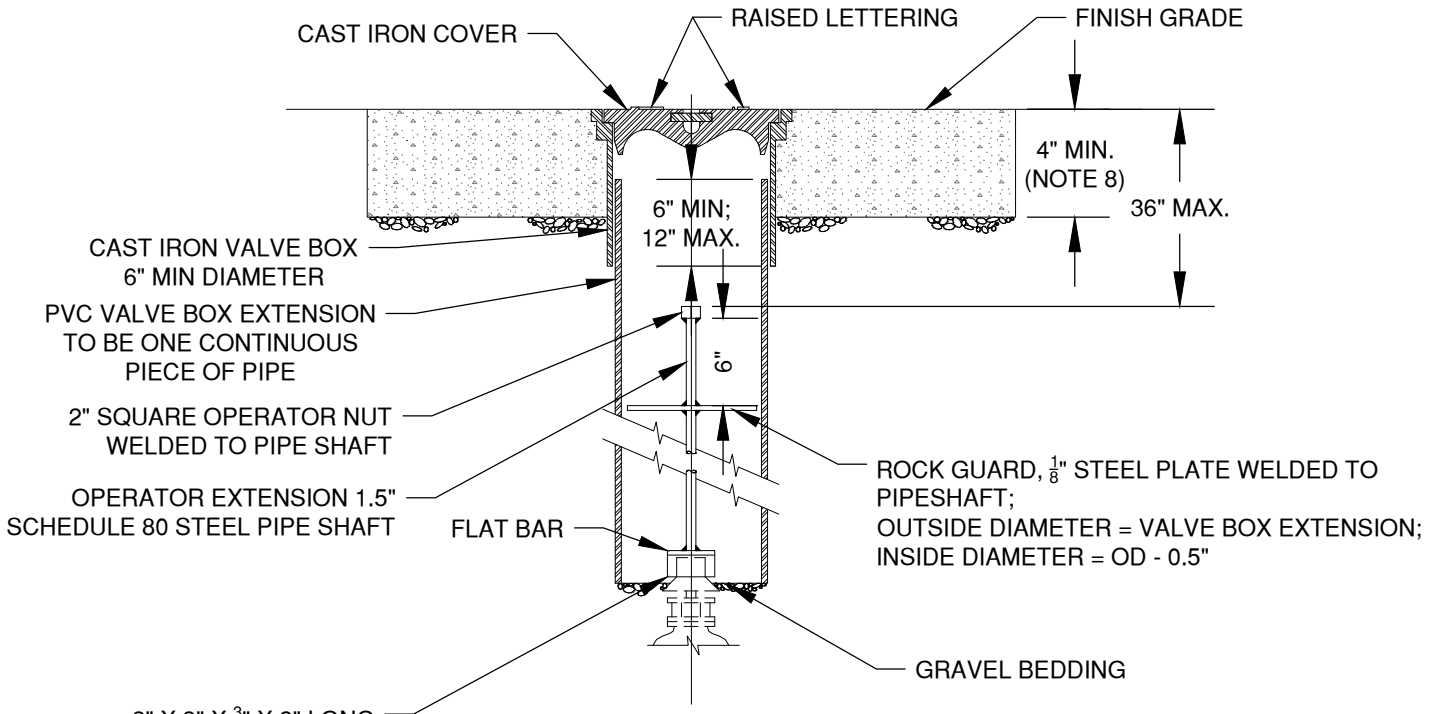


CONNECTION AFTER TESTING, FLUSHING AND APPROVAL

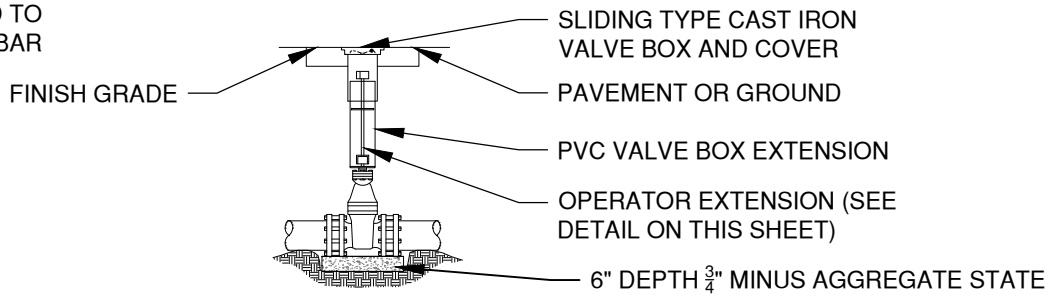
DRAWN AJD	CITY OF BEND	CITY OF BEND STANDARD DRAWING 710 NW WALL ST., BEND, OREGON 97701	SCALE NTS
DIV WATER			DATE 01/31/2022
REV DATE			APPR
		CROSS CONNECTION DETAIL	STD DWG W-29



COVER PLAN



VALVE BOX EXTENSION SECTION



VALVE BOX ASSEMBLY DETAIL

NOTES:
1. VALVE BOX NOT TO REST ON OPERATING ASSEMBLY.
2. OPERATOR EXTENSION REQUIRED WHEN VALVE NUT IS DEEPER THAN 6' FROM FINISH GRADE.
3. CENTER VALVE BOX ON AXIS OF OPERATOR NUT.
4. VALVES TO BE INSTALLED WITH COMPACTED AGGR. BASE ON UNDISTURBED GROUND.
5. WELDS SHALL BE MINIMUM 0.5" ALL AROUND.
6. HOT DIP GALVANIZE OPERATOR EXTENSION AFTER FABRICATION.
7. CASTING SHALL MEET H20 LOAD REQUIREMENT.
8. PROVED 24"x24"x4" CONCRETE PAD WITH EXPANSION JOINT AROUND VALVE BOX WHEN INSTALLED OUTSIDE OF ROADWAY.
9. SEE PROJECT PLANS FOR DETAILS NOT SHOWN.
10. ALL VALVE BOXES SHALL BE PLACED OUTSIDE THE PATH OF TRAVEL ON SIDEWALK AND DRIVEWAY APRONS.

DRAWN AJD	CITY OF BEND	CITY OF BEND	SCALE NTS
DIV WATER		STANDARD DRAWING	DATE 11/01/2024
REV / DATE		710 NW WALL ST., BEND, OREGON 97701	APPR
		VALVE BOX AND OPERATOR EXTENSION ASSEMBLY	STD DWG W-30