

Landscape Architecture and Irrigation Systems

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12 Landscape Architecture and Irrigation Systems

The purpose of these guidelines is to promote community health, safety and welfare by protecting natural vegetation, set development standards for landscaping and street trees, and reduce water consumption through the use of appropriate site design, plant materials, and irrigation technologies.

These standards are in addition to and complement the Bend Development Code Chapter 3.2.

12.1 Applicability

The City shall require submittal of Landscape and Irrigation plans for any system that is located within City right-of-way (ROW) and/or will become owned, operated and maintained by the City of Bend and when required by the Bend Development Code. All landscape and/or irrigation plans for work within all public ROW shall be stamped and signed by a licensed landscape architect defined by the Oregon Revised Statutes. Minimum general specifications for construction shall be set forth in the Oregon Standard Specifications (OSS) for Construction and these City of Bend Standards and Specifications.

The design standards include tree and existing plant habitat protection, removal of trees and landscaping materials, plant selection, tree spacing, as well as the safety of the public and City maintenance staff.

12.2 Landscape Plan Submittals

A landscape plan is required to include the following submittals per Bend Development Code Chapter 4.2.300:

- a. A planting schedule containing the location, size, and species of the existing and proposed plant materials (at time of planting)
- b. Existing and proposed building and pavement outlines
- c. Irrigation plans, written soil specifications at time of planting, and anticipated plant installation time line
- d. The location of existing and proposed terraces, retaining walls, decks, patios, shelters, and play areas
- e. Existing and proposed abutting street right-of-way landscaping
- f. Other information as deemed appropriate by the Development Services Director. An arborist's report may be required for sites with mature trees that are protected under Bend Development Code Chapter 3.2.
- g. Also include the location of existing and proposed signs to prevent conflict with trees and sign visibility

12.2.1 Design Parameters

The design criteria for public ROW projects shall conform to the current City of Bend 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 projects unless a variance is approved in writing from the City of Bend.

12.2.1.1 Stormwater Source Control Principles

The landscape plan shall 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 shall 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 shall 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 four hydrozone classifications as outlined in the Oregon State University Extension Service publication Water-wise Gardening in Central Oregon. The four hydrozones are:

- 1) Very Low - Most natives / may require supplemental water for plant 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)
- 4) High - Turfgrass and vegetable gardens / regular amounts of supplemental water required during the growing season (Apr - Oct)

In addition, the following site-specific situations shall 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

12.2.2 Landscape Conservation

Landscape conservation prevents the indiscriminate removal of significant trees and other vegetation, including vegetation and features associated with streams, riparian areas, wetlands and other protected natural resource areas. Landscape conservation standards

apply to all development sites that contain significant vegetation, as defined in the Bend Development Code.

12.2.2.1 Tree Protection Plan

A Tree Protection Plan is required per Bend Development Code Chapter 3.2.200. Significant trees shall be inventoried during the site design process and protected during construction unless otherwise approved for removal through the site plan review process. Significant trees are defined as individual trees with a specific trunk diameter as measured four feet above the ground (known as DBH, "diameter at breast height"). Deciduous trees measuring 6 inches or greater and coniferous trees measuring 10 inches or greater shall be considered significant.

Significant trees shall be retained unless approved by the City to be removed for development. Preservation will be considered impracticable when it would prevent development of public streets, public utilities, needed housing, or land uses permitted by the applicable land use district.

A protection area shall be defined around the edge of all branches of each tree (drip-line) or strand of trees. Drip-lines may overlap between trees.

The tree protection plan shall include the following:

- a. Inventory of Significant Vegetation. Depict all significant vegetation by DBH and species, showing property lines, two-foot contours and rock outcroppings.
- b. Building Envelopes. The developer shall depict the buildable area of a lot that is consistent with the lot coverage area of the zone.
- c. Barriers. The developer shall depict protection barriers on the site plan and locate and mark with flagging and/or signs for all construction roads, parking places for workers, and areas for the storage of building materials, gravel and soil; stake out the exact locations of all utility trenches; erect physical barriers around all trees to be retained or groups of trees around the work site. Barriers that extend beyond the drip-line of the tree are preferred.
- d. Soil Compaction. The Tree Protection Plan shall depict typical details of methods for protecting the critical root zone. If barriers are not feasible to keep away vehicles and foot traffic, use six to eight inches of wood chips spread over the root zone or bridge root area overlaid by plates of steel or other suitable material.
- e. Grade Changes. If a grade change is unavoidable, retaining walls shall be used to protect the root system.
- f. Severing Roots. Avoid cutting anchoring roots if possible. Tunneling for smaller household utility lines may be an option for tree preservation. When root cuts are unavoidable, the cuts shall be made with a pruning saw.
- g. Above-Ground Injuries to Trees. Do not use trees for posting signs, electrical wires and pulleys. Keep trees free of nails, screws, and other fastening devices. Prevent trunk injuries by surrounding trunk with one-inch by four-inch wooden slats and securing in place with gauge wire around slats.

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- h. **Soil Contamination.** Altering the soil chemistry can result in weakened trees, making them more susceptible to insects and disease. Prevent adverse effects on soil chemistry by spreading heavy plastic tarping where concrete is to be mixed or sheet rock cut; do not clean paintbrushes and tools over tree roots; dispose of chemical wastes properly and do not drain onto soil.
 - i. **Altering the Natural Drainage Course.** When the natural drainage of a site is altered, watering for existing trees must be augmented by an irrigation system. Prior to site grading, prepare a site drainage plan. Sometimes surface water containment can sustain existing stands of trees without artificial irrigation.

Landscape plans or specifications shall 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 shall employ a certified arborist to determine whether the damage may be repaired or the tree replaced according to City standard mitigation procedures.

12.2.2.2 Tree Removal and Relocation

Trees shall not be removed or relocated within the public ROW without approval from the City Engineer. The applicant shall 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 shall require approval from the City Engineer based on the following criteria:

- 1) The site cannot feasibly be developed, either by alternative site design or construction methods without removing or relocating existing trees
- 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 shall be clearly identified on the landscape plan. The City shall be notified 48 hours in advance of any approved tree removal activity.

12.2.3 Street Trees and Plants

Street trees shall be required to be located and planted with all public ROW projects. They may be located per [12.2.3.5 - Street Tree Location and Spacing](#) and the requirements of Bend Development Code Chapter 3.2.400. Deviation from this standard shall require approval from the City Engineer.

Trees and plant species selected for use in non-paved public ROW projects shall be selected for their durability, drought tolerance, proportionality to site circumstances, low maintenance,

and clearance standards for pedestrian, bicycle, and vehicular traffic safety. The use of native plantings should be prioritized over non-native plantings.

The publication titled “Water-wise Gardening in Central Oregon” by the Oregon State University Extension Service is recommended as a guidebook for plant selection. Copies of the publication are available at the City of Bend Utility Department and OSU Extension Service.

All trees and plants considered shall be hardy to USDA Zone 3 – 5 or 6b.

12.2.3.1 Approved Street Tree List

Proposed street trees shall be selected from Bend Development Code Chapter 3.2.400, unless otherwise approved by the Planning Director.

12.2.3.2 Non-approved Street Trees and Plants

Turf and artificial turf is prohibited in public ROW projects, but will be assessed by the City of Bend on a case-by-case basis.

12.2.3.3 Height Standards for Street Trees and Plants

On public ROW landscape projects without existing sidewalks, trees shall be located to accommodate future sidewalk locations with consideration for existing and future utility corridors.

Plants that will attain a mature height of two feet or more in height should 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 shall include the adjacent curb height and any earthwork or grading within the plant bed.

Trees are not permitted to be planted within the Clear Vision Area, Intersection Sight Triangles, nor Sight Distance Areas. Existing trees shall be limbed to a minimum of 8 feet above the adjacent curb. This applies to center medians as well as roadside areas.

Only trees, 25 feet high or less, at maturity, shall be considered for planting under or within 10 lateral feet of any overhead utility lines.

12.2.3.4 Size of Street Trees and Plants

Minimum plant and tree sizes are to be determined by the Bend Development Code Chapter 3.2.300.

Shrubs shall be planted from two-gallon containers or larger.

The minimum caliper size of street trees at planting shall be two inches DBH (diameter at breast height, or four feet above ground), based on the American Association of Nurserymen Standards. If the required caliper is not available, the Planning Director/Review Authority may accept replacement trees with an extended maintenance guarantee of two additional years depending on substituted size.

12.2.3.5 Street Tree Location and Spacing

Street trees must be planted within existing and proposed planting strips or in City-approved sidewalk tree wells on streets without planting strips. Street trees planted within sidewalk tree wells shall be installed with a City-approved tree grate.

Where the landscape strip and/or sidewalk is not wide enough to accommodate street trees, the Planning Director may allow the street trees to be planted within five feet from the back of the sidewalk.

Where practical, small stature trees must be planted no closer to the curb or sidewalk than three feet, medium trees – three feet and large trees – four feet. Root barriers may be required with street tree planting to protect the City's curb and sidewalk.

Street tree spacing must be based upon the type of tree(s) selected and the canopy size at maturity. Small canopy trees and columnar shaped trees must be planted no further than 25 feet apart; medium and large canopy trees must be planted no further than 35 feet apart, except where planting a tree would conflict with existing trees, retaining walls, utilities and similar physical barriers. A random spacing of street trees 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
- Water meters or sampling manholes: 5 feet
- Driveways, sidewalks, curbs, or alleys: 3 feet for small and medium trees, 4 feet for large trees
- Traffic signs: 20'
- Bus benches and shelters: 5'

Trees shall not be planted within the following areas:

- Clear vision areas
- Intersection sign triangles
- Sight distance areas
- City water or sewer easements, unless approved by the City Engineer
- Public utility easements, unless written approval is obtained from the applicable agency(ies)
- Medians less than 4 feet wide

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 Director.

12.2.4 Standard Materials and Equipment

Designs shall incorporate materials and equipment that comply with the City of Bend Standards and Specifications. Alternative materials shall 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 tree wells shall be installed within a pedestrian rated tree grate or surrounded by permeable pavers or pavement appropriate for pedestrian circulation. The minimum tree pit dimensions shall 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. An agricultural soil analysis shall be required for all public works projects. Soil analysis shall include pH, N-P-K, SAR, ECe, boron levels, percolation rates and soil particle evaluation. The report shall include recommendations for amendments, fertilizers, application rates, and procedures for conditioning the soil. Soil amendments shall be tilled to an appropriate depth for the planting in order to prevent a layering of soil types. Existing native shrub zones shall not be disturbed by soil amendment processes.

12.2.4.3 Mulches

Organic mulch such as shredded bark or composted bark shall be applied to all planting areas for moisture retention, weed control, and moderation of soil temperatures.

Impermeable weed barriers made of plastic are prohibited under any mulches. Geotextile products are allowed under gravel or rock mulches.

The landscape plan shall identify the proposed type and recommended depth of installation for all proposed mulch materials.

12.2.4.4 Fertilizers

The landscape plan or specifications shall specify any additional fertilization requirements that may be necessary for the establishment of new plant material.

The landscape plan shall 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 shall 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 shall utilize appropriate equipment and components that meet the City of Bend Codes, Standards and Specifications. Irrigation designs should strive to design projects that are aesthetically pleasing, conserve water resources, and reduce required maintenance by City staff.

For capital improvement and development projects, the following design requirements shall be implemented in all design deliverables and submittals presented to the City of Bend for review.

An irrigation plan shall 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 shall 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 shall 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 shall be based on information supplied by the water utility, field-verified and noted on the drawings.

Irrigation systems shall 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 shall be inset 3 to 5 inches from hardscape, curbs and sidewalks 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 shall not mix rotary, fixed spray, bubblers, microsprays, drip, or subsurface irrigation methods on the same zone.

Provide separate irrigation zones for trees shrubs & groundcovers, and turf.

Fixed spray or rotary head irrigation 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 shall 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 shall be eliminated from streets and sidewalks 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 shall 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, shall 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 shall 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

Use drip irrigation when practical and where potential for irrigation overspray and/or runoff is likely to occur. Drip irrigation systems shall 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 is required where dimensions are less than six feet in any direction. Overhead irrigation in areas greater than six feet in dimension shall utilize low-precipitation rate sprinkler nozzles and have a precipitation rate of less than 1.0 inch per hour.

Drip irrigation systems shall be designed so that the drip emitters have an 'Emission Uniformity' (relative flow rate between like emitters) of at least 80 percent at time of installation.

12.3.3 Standard Materials and Equipment

Designs shall incorporate materials and equipment that comply with Specification Section 01120. Alternative materials shall 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 shall be EPA WaterSense labeled smart irrigation controllers that automatically adjust irrigation run times in response to environmental conditions.

12.3.3.2 Automatic Control Valves

Automatic electric solenoid remote control valves shall be slow acting diaphragm-type, as per Specification Section 01120.17 (h)(2) Automatic Control Valves.

12.3.3.3 Sprinkler Heads

Sprinkler heads shall provide coverage as specified in the manufacturer's design literature. The use of high efficiency sprinklers or nozzles is encouraged wherever practicable.

12.3.3.4 Pipe

ROW projects shall 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 shall be installed to facilitate winterization by use of compressed air. Locate blowout connection immediately downstream from backflow device.

Electrical Systems

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