

# TECHNICAL MEMORANDUM



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## TM 3.2 – Potential UAR Wastewater Service Areas

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**To:** Heidi Lansdowne, P.E.  
City of Bend, Oregon  
Engineering Division

**Date:** Final March 14, 2007

**From:** R. Dale Richwine, P.E. – MWH

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## INTRODUCTION

A meeting was held with City planning and Public Works staff, the Residential Study consultant Angelo-Eaton & Associates, the water system planning consultant Murray, Smith & Associates, Inc. and the wastewater collection system planning consultant MWH to discuss the planning work that is being performed by the City. The critical planning element that will have a long-term impact on the water, wastewater and transportation master plans is the redefinition of the Urban Growth Boundary (UGB) and the areas that are to be established as the Urban Area Reserve (UAR).

MWH was asked to evaluate the existing UGB reserve area and the proposed UAR area and perform the following tasks:

- Subdivide the UAR area into study areas based on how wastewater service can be provided to these areas
- Evaluate the options for providing wastewater service to each of the identified study areas in the UGB. Provide a prioritized list of the study areas identifying the areas that wastewater service can be provided in the most feasible manner to provide the most available lands to develop at the estimated least cost

The goal of this analysis is *not* to provide a detailed evaluation of sewer service options, but to identify the relative advantages and disadvantages of each. The following analysis does not include a cost analysis of each option. The areas have been prioritized from the best to the most difficult to provide sewer service.

## UAR EXPANSION STUDY AREA

The Urban Area Reserve (UAR) Expansion Study Area was defined by the City Planning Department for this study. The planning areas as developed by the City are shown in **Attachment A**. These planning areas have been expanded over time with the original area shown on the map dated Nov. 28, 2005, the second area Jan. 17, 2006 and the final UAR Expansion Study Area shown on the map figure dated Jan 20, 2006. This analysis was performed on the January 20, 2006 map.

This planning area was then plotted with 10-foot contour lines for the development of probable wastewater service areas. The planning area overlaid on the 10-foot contours is shown in **Figure 1**. The contour lines were obtained from the USGS.

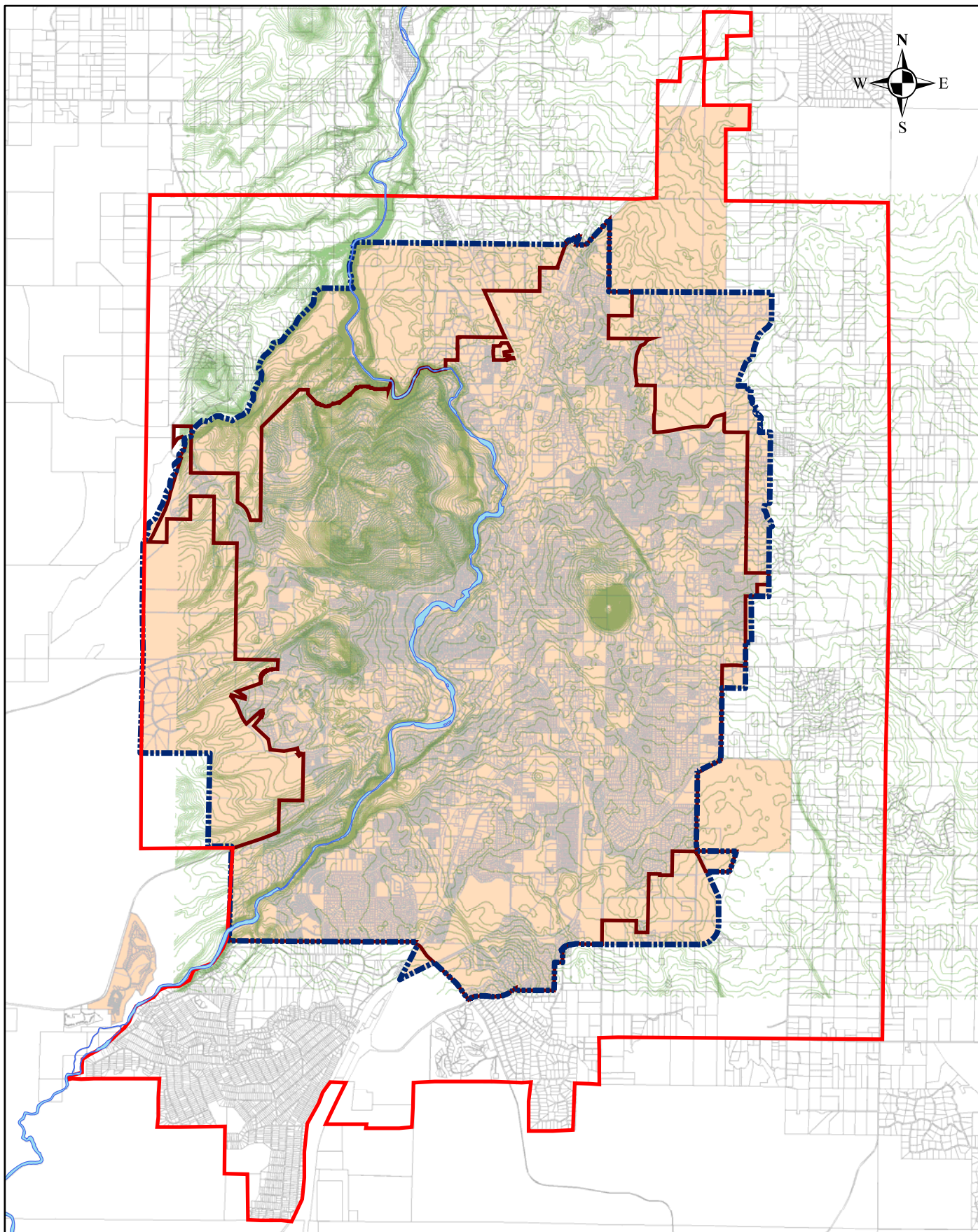
## UAR STUDY AREA DEFINITIONS

The UAR Study Area was defined as the existing Urban Reserve and the proposed UAR Expansion Study Area. These areas were divided into 15 study areas based on the potential opportunities to provide wastewater service to the areas. The rationale that went into the subdividing of the wastewater service areas was: topography available for gravity sewers, potential sewer basins requiring separate trunk sewers linked to a major interceptor, potential sewer basins requiring pumping and potential basins that will link to the existing collection system. These expansion study areas are shown in **Figure 2**. The current Bend Area Zoning Map showing the current Urban Reserve is shown in **Attachment B**. A map of current Bend Neighborhoods has also been provided in **Attachment C** to provide a reference to the study areas that will be defined in this TM.

The 15 study areas have been numbered in the priority in which the potential to easily and cost-effectively provide wastewater service was assumed from this evaluation. This prioritization needs to be used in a manner based on the level of study that was done. The relative priority between two areas differing by one or two values is basically the same, but it can be assumed that the difference between a 1 and a 5 are great enough that the 1 priority will be the preferred area for development.

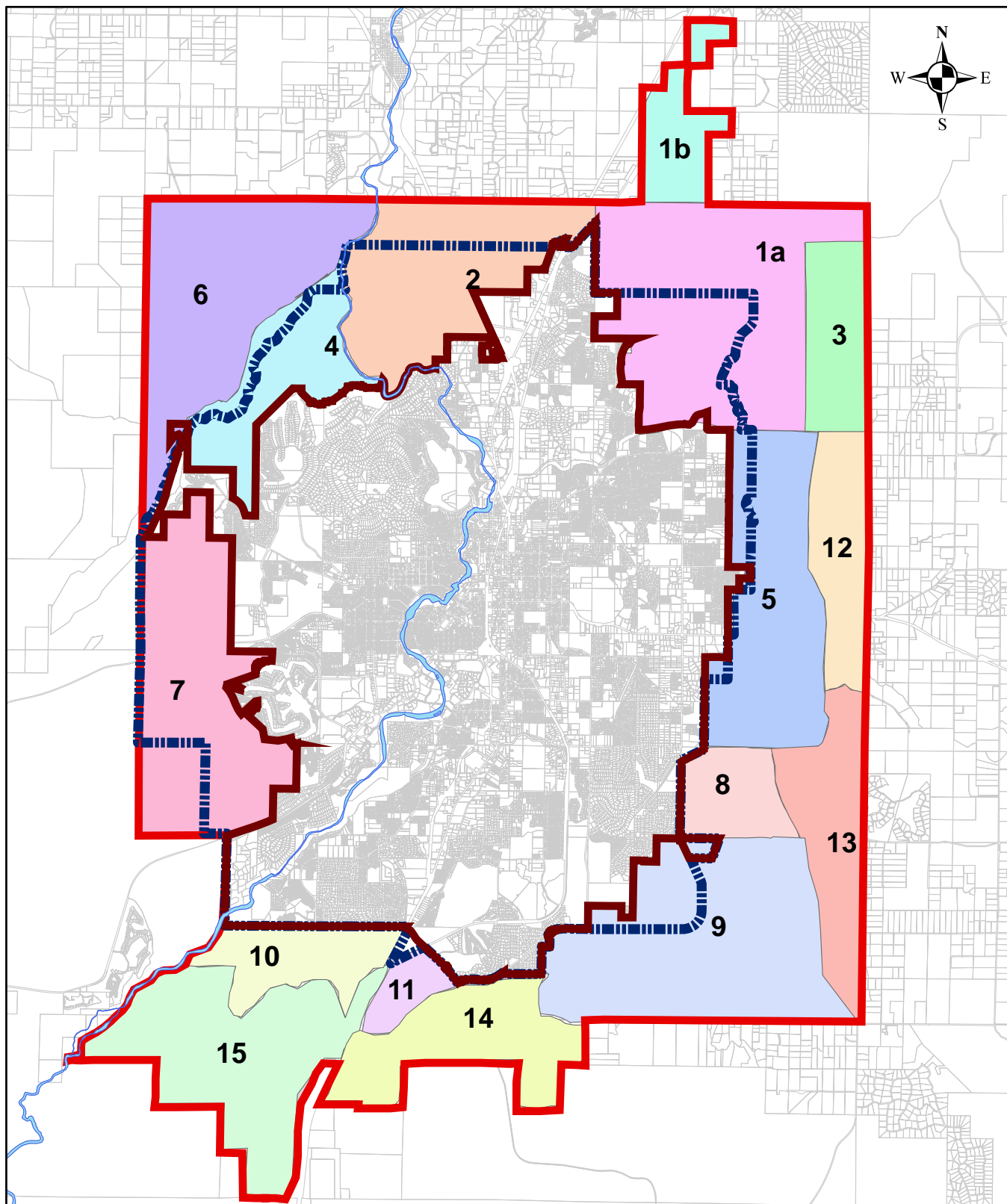
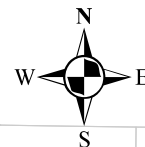
### Study Area 1

Study Area 1 has been divided into two areas. Area 1a includes the existing urban area reserve located east of the Boyd Acres and north of the Mtn. View neighborhoods. In addition, Area 1a includes additional lands that can easily be served by a new gravity sewer system that will flow to a North Interceptor located along the north end of the area. This area includes Phase I of the Juniper Ridge Area and portions of Phase II. This system is closest to the treatment plant which allows for service to be provided at a relatively low cost. The first phase of a SE Interceptor can also be constructed with the development of this area.



**FIGURE 1**  
**UAR EXPANSION STUDY AREA**





**FIGURE 2**  
**EXPANSION STUDY AREAS**



Area 1b includes the portions of the planned Juniper Ridge Area not included in Area 1a. Sewer service can be provided to this area by gravity to the northeast corner of the area. A pump station will then need to pump this flow to a North Interceptor.

### **Study Area 2**

Study Area 2 is located on the north end of the city. This area is bordered on the west side by the Deschutes River. A large portion of this area also includes the existing Urban Area Reserve. This area can be served by a gravity system flowing to a North Interceptor.

### **Study Area 3**

Study Area 3 is located on the east side of Area 1a. There is a natural ridge that isolates Area 3 into its own drainage basin. This area will need to be served by its own gravity system that will flow into a North Interceptor.

### **Study Area 4**

Study Area 4 is located on the northwest end of the city. This is the area west of the Deschutes River that is in the current Urban Area Reserve. This area can be served by a gravity system flowing to an interceptor located at the north end of the area. This interceptor will end at a pump station located on the west side of the river that can either pump the flow across the river to the North Interceptor or to a new wastewater treatment plant located on the west side of the city.

### **Study Area 5**

Study Area 5 is located on the east side of town east of the Mtn. View and Larkspur neighborhoods. This area can be served by a gravity system flowing to the north. The main line for providing service to this area will be a second phase of the SE Interceptor that will connect with the first phase constructed in area 1a.

### **Study Area 6**

Study Area 6 is an area to the northwest of the current urban growth area. This area is divided by a ridge near the north end of the area. Most of this area can be served by a gravity system flowing south to the interceptor described in Study Area 4. The northern portion of this area can be served by a gravity sewer flowing east along the north end of the area.

This area also provides an excellent opportunity for the construction of a new Westside WWTP. A WWTP located in the northwest corner of this parcel can serve all of the current and future areas on the west side of the Deschutes River. A diagram showing proposed trunk sewers and force mains from the existing Westside Pump Station and a new North Interceptor Pump Station is shown in **Figure 3**. This option will be evaluated in Task 3 of the Collection System Master Plan. Inclusion of Area 6 into the urban area will be required to make this alternative feasible if it is recommended in the study.

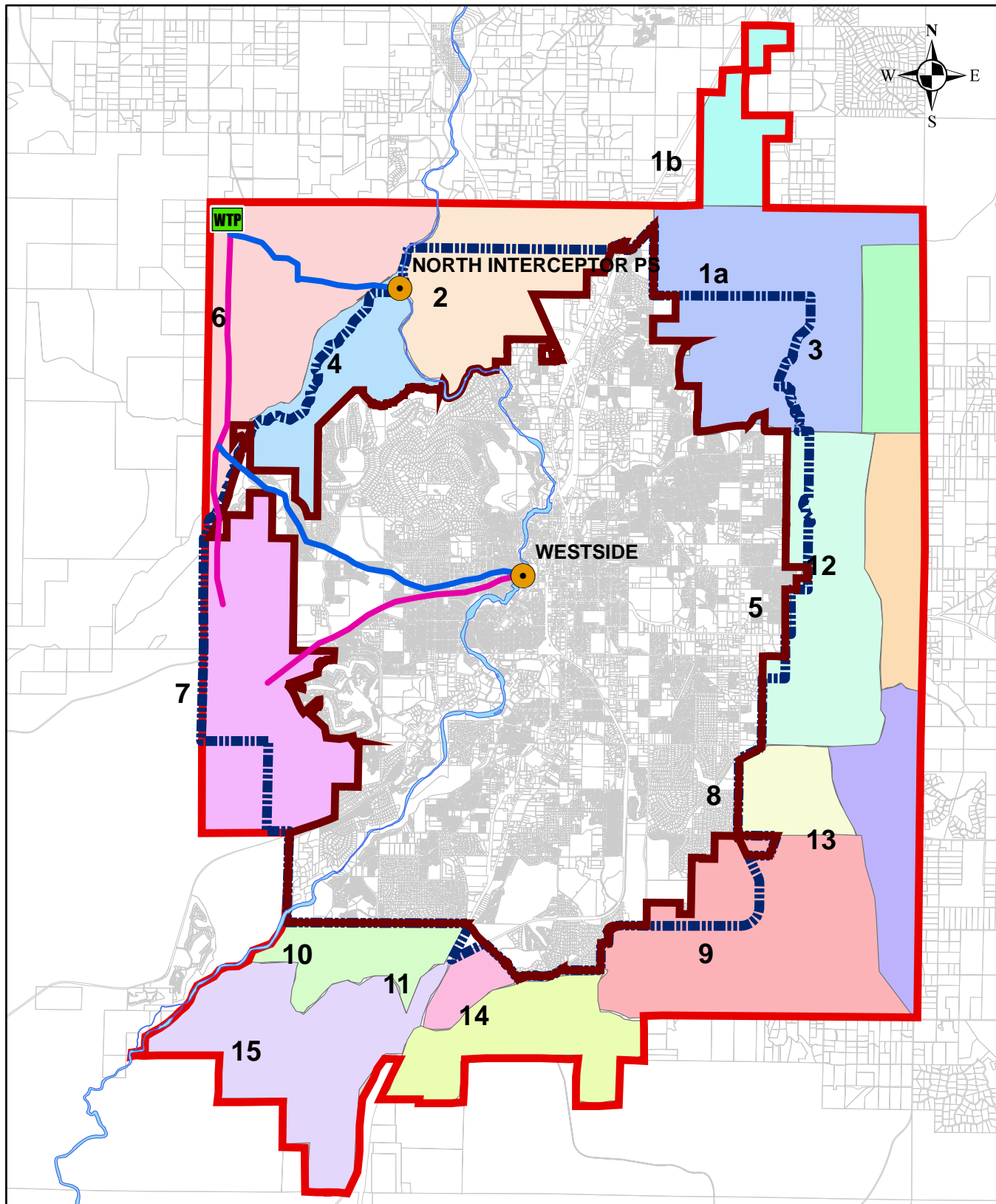


FIGURE 3  
NORTHWEST WWTP OPTION

## Study Area 7

Study Area 7 is the area on the west side of the City west of the River West and Century neighborhoods. This area includes the parcel being considered for a new destination resort. This area can be served by gravity with gravity sewers connecting to the existing system flowing to the Westside Pump Station. Expansion to this area will impose additional flows on the already limited system downstream of the Westside Pump Station discharge.

Another option for the routing of flows from this system is to have the flows in the southern portion of this area flow by gravity, connecting to the existing gravity system to the Westside Pump Station. A new force main will then be constructed for the Westside Pump Station to pump flow to the west. This flow can then flow to the treatment plant through the North Interceptor serving Areas 1, 2 and 4. The northern portion of this area can flow by gravity through a new Westside interceptor by gravity to the North Interceptor.

Another alternative for treatment is for a West Interceptor to be constructed to a new treatment plant located in the northwest corner of Area 6. The flow from the Westside Pump Station can then be pumped to this interceptor for treatment at the Westside WWTP. The flows generated in Areas 4 and 6 can also be sent to this new WWTP through a new pump station. This alternative was shown in *Figure 3*.

## Study Area 8

Study Area 8 is the section of land currently owned by the State located on the west side of the city west of the Old Farm neighborhood. This area is very flat and is south of the proposed SE Interceptor alignment. It is difficult to access if this system can be sewered completely by gravity or will require a pump station due to the lack in slope based on the 10-foot contours. This system can be sewered. A final decision on whether a pump station would be needed can be made when 2-foot contours are available.

## Study Area 9

Study Area 9 is located on the southeast end of the city, southeast of the landfill. This is a large area that can be sewered by gravity. A regional pump station may be required at the northern end of this area to pump this flow to the SE Interceptor. It is possible, that if this pump station is installed, that this station could also serve the southern portion of Area 8.

## Study Area 10

Study Area 10 is located on the south end of the city south of the Southwest neighborhood. This area can be served by a gravity system that would connect to the existing system serving the southwest bend area. The flow from this area will flow through an existing system that is already limited on capacity. Upgrades to the existing system will need to be made or other flows diverted before wastewater generated in this area can be adequately transported to the treatment plant. Due to the existing capacity limitations in the system and the small relative area that would be served, this area was not given a priority for future service.



### **Study Area 11**

Study Area 11 is located on the south end of the city. There was no topography data available for this area. Based on canal routing, it appears that this area can be served by gravity and tied into the existing collection system to the north. In fact, it appears that a small portion of this area already receives sewer service. This area was given a low priority, because the collection system downstream of this area has many capacity limitations. If the SE Interceptor project is completed and the flows from the SE area are not sent to the downtown core area, then this area can easily be served. Therefore, providing service to this area will depend on upgrades and/or modifications to the existing system and/or construction of the complete SE Interceptor.

### **Study Area 12**

Study Area 12 is located on the east side of the city. There is a natural ridge that isolates Area 12 from Area 5 requiring its own drainage basin. This area can be served in two ways. The first will be to provide service by gravity and connect this system to the gravity system provided in Area 3. The second will be to provide a gravity system that flows to a pump station on the north end of the area and pumping the flow over the ridge to the SE Interceptor located on the west side of the ridge. This alternative has received a low priority because of the probable high cost that will be required for the lower amount of acres served.

### **Study Area 13**

Study Area 13 is located on the southeast side of the city. There is a natural ridge that isolates Area 13 from the rest of the service areas. This area can be served by gravity flowing to the north end of the parcel. The gravity system serving this area will need to tie into the gravity system serving Area 12 or flow to a regional pump station that will pump over the ridge to the system serving Area 9. This alternative has received a low priority because of the probable high cost that will be required for the lower amount of acres served.

### **Study Area 14**

Area 15 is located on the south end of the city. No topography was available for this area, but based on the irrigation canals, it appears that this area can be drained by gravity to the north and tie into the existing collection system. The existing system currently does not have adequate capacity to handle the flows that will be generated in this area. Providing service to this area will depend on upgrades and/or modifications to the existing system and/or construction of the complete SE Interceptor.

### **Study Area 15**

Study Area 15 is located on the southeast end of the city on the west side of Highway 97. No topography was available for this area. Wastewater generated in this area would need to be transported through the existing collection system which does not have the capacity to accept the volume of flows that can be generated in this area. Therefore, it will be difficult to provide sewer service to this area unless substantial modifications and upgrades are made to the existing system.

## STUDY AREA EVALUATION

A summary of the available land in each of the defined service areas and the potential number of dwelling units is shown in **Table 1**. The basis used to determine the number of “Net Acres” for development was a factor of 0.7 on the Total Available Acres. The number of dwelling units (DU) was then determined for two scenarios: 5.3 DU/Acre and 7.0 DU/Acre. The value of 5.3 DU/Acre is the average density that the City is currently experiencing. The value of 7.0 DU/Acre is the value that is being proposed for development of currently undeveloped areas in the future.

In addition, the potential average wastewater flow in million gallons per day was developed for each of the densities. The average wastewater flow that was used was 250 gallons/day per DU. This assumed that the areas were to be developed as residential properties. Some of these areas will have commercial uses, such as Juniper Ridge, but this estimate is appropriate for the level of effort provided in this analysis.

Table 1  
Study Area Areas and Potential Flow

| Study Area   | Total Acres   | Net Acres     | 5.3 DU/Acre    |                | 7.0 DU/Acre    |                |
|--------------|---------------|---------------|----------------|----------------|----------------|----------------|
|              |               |               | Dwelling Units | Ave Flow (MGD) | Dwelling Units | Ave Flow (MGD) |
| 1a           | 3,565         | 2,495         | 13,226         | 3.31           | 17,468         | 4.37           |
| 1b           | 757           | 530           | 2,809          | 0.70           | 3,710          | 0.93           |
| 2            | 2,209         | 1,546         | 8,195          | 2.05           | 10,824         | 2.71           |
| 3            | 906           | 634           | 3,362          | 0.84           | 4,440          | 1.11           |
| 4            | 1,269         | 888           | 4,707          | 1.18           | 6,217          | 1.55           |
| 5            | 2,328         | 1,630         | 8,638          | 2.16           | 11,409         | 2.85           |
| 6            | 2,745         | 1,922         | 10,184         | 2.55           | 13,451         | 3.36           |
| 7            | 2,774         | 1,942         | 10,292         | 2.57           | 13,593         | 3.40           |
| 8            | 700           | 490           | 2,597          | 0.65           | 3,430          | 0.86           |
| 9            | 3,384         | 2,369         | 12,555         | 3.14           | 16,582         | 4.15           |
| 10           | 840           | 588           | 3,116          | 0.78           | 4,116          | 1.03           |
| 11           | 329           | 230           | 1,219          | 0.30           | 1,610          | 0.40           |
| 12           | 1,004         | 703           | 3,725          | 0.93           | 4,920          | 1.23           |
| 13           | 1,331         | 932           | 4,937          | 1.23           | 6,521          | 1.63           |
| 14           | 1,389         | 972           | 5,152          | 1.29           | 6,805          | 1.70           |
| 15           | 2,442         | 1,709         | 9,060          | 2.27           | 11,966         | 2.99           |
| <b>Total</b> | <b>27,972</b> | <b>19,581</b> | <b>103,777</b> | <b>25.94</b>   | <b>137,064</b> | <b>34.27</b>   |

Another important variable that needs to be considered when determining the areas that are most feasible to develop is the potential funding opportunities for planning, design and construction of the collection system and treatment systems. A brief analysis of potential funding through connection fees was performed. This analysis was done to obtain a low and a high potential for

funding. The low funding level was determined by taking the number of dwelling units and multiplying by a connection fee of \$3,000 per DU. The high funding level was determined by multiplying by a connection fee of \$4000 per DU. The results of this analysis are shown in *Table 2*.

Table 2  
Potential Revenue by Study Area

| Study Area   | Total Acres   | Net Acres     | 5.3 DU/Acre    |                      | 7.0 DU/Acre    |                      |
|--------------|---------------|---------------|----------------|----------------------|----------------|----------------------|
|              |               |               | Dwelling Units | \$3000 per DU        | Dwelling Units | \$4000 per DU        |
| 1a           | 3,565         | 2,495         | 13,226         | \$39,677,671         | 17,468         | \$69,872,628         |
| 1b           | 757           | 530           | 2,809          | \$8,427,948          | 3,710          | \$14,841,669         |
| 2            | 2,209         | 1,546         | 8,195          | \$24,586,348         | 10,824         | \$43,296,714         |
| 3            | 906           | 634           | 3,362          | \$10,086,173         | 4,440          | \$17,761,814         |
| 4            | 1,269         | 888           | 4,707          | \$14,121,655         | 6,217          | \$24,868,323         |
| 5            | 2,328         | 1,630         | 8,638          | \$25,915,281         | 11,409         | \$45,636,973         |
| 6            | 2,745         | 1,922         | 10,184         | \$30,552,696         | 13,451         | \$53,803,490         |
| 7            | 2,774         | 1,942         | 10,292         | \$30,875,555         | 13,593         | \$54,372,046         |
| 8            | 700           | 490           | 2,597          | \$7,791,902          | 3,430          | \$13,721,588         |
| 9            | 3,384         | 2,369         | 12,555         | \$37,664,209         | 16,582         | \$66,326,910         |
| 10           | 840           | 588           | 3,116          | \$9,349,378          | 4,116          | \$16,464,314         |
| 11           | 329           | 230           | 1,219          | \$3,656,606          | 1,610          | \$6,439,306          |
| 12           | 1,004         | 703           | 3,725          | \$11,175,210         | 4,920          | \$19,679,615         |
| 13           | 1,331         | 932           | 4,937          | \$14,811,147         | 6,521          | \$26,082,524         |
| 14           | 1,389         | 972           | 5,152          | \$15,457,277         | 6,805          | \$27,220,362         |
| 15           | 2,442         | 1,709         | 9,060          | \$27,181,029         | 11,966         | \$47,865,964         |
| <b>Total</b> | <b>27,972</b> | <b>19,581</b> | <b>103,777</b> | <b>\$311,330,085</b> | <b>137,064</b> | <b>\$548,254,238</b> |

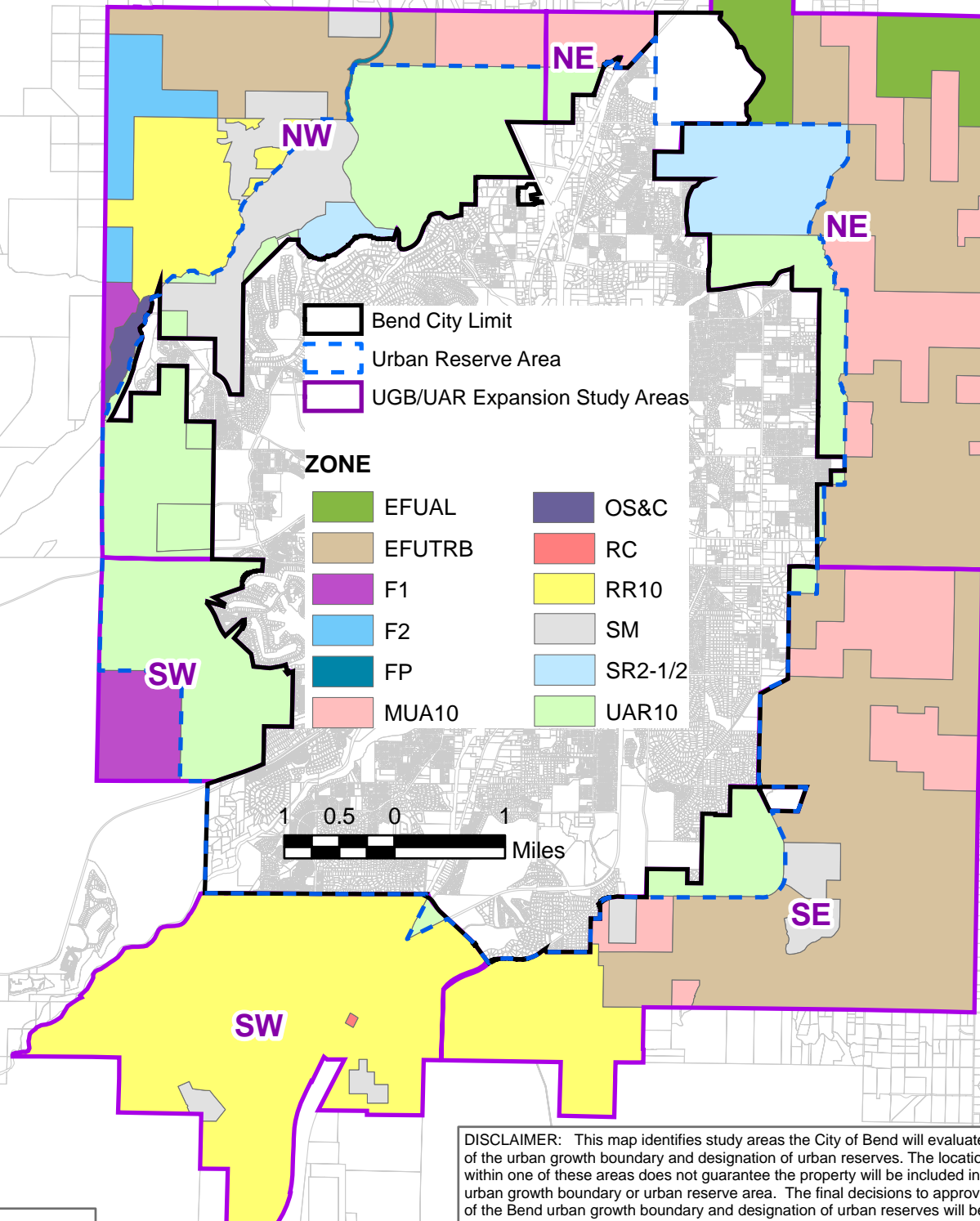


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## **Attachment A UAR Expansion Study Areas**



# UGB/UAR Expansion Study Areas - Taxlots by Zone



**DISCLAIMER:** This map identifies study areas the City of Bend will evaluate for expansion of the urban growth boundary and designation of urban reserves. The location of property within one of these areas does not guarantee the property will be included in either the urban growth boundary or urban reserve area. The final decisions to approve any expansion of the Bend urban growth boundary and designation of urban reserves will be made by the City Council, the Deschutes County Board of Commissioners, and the Oregon Land Conservation and Development Commission. For more information, please visit City's website - [http://www.ci.bend.or.us/depts/community\\_development/residential\\_lands\\_study.html](http://www.ci.bend.or.us/depts/community_development/residential_lands_study.html).

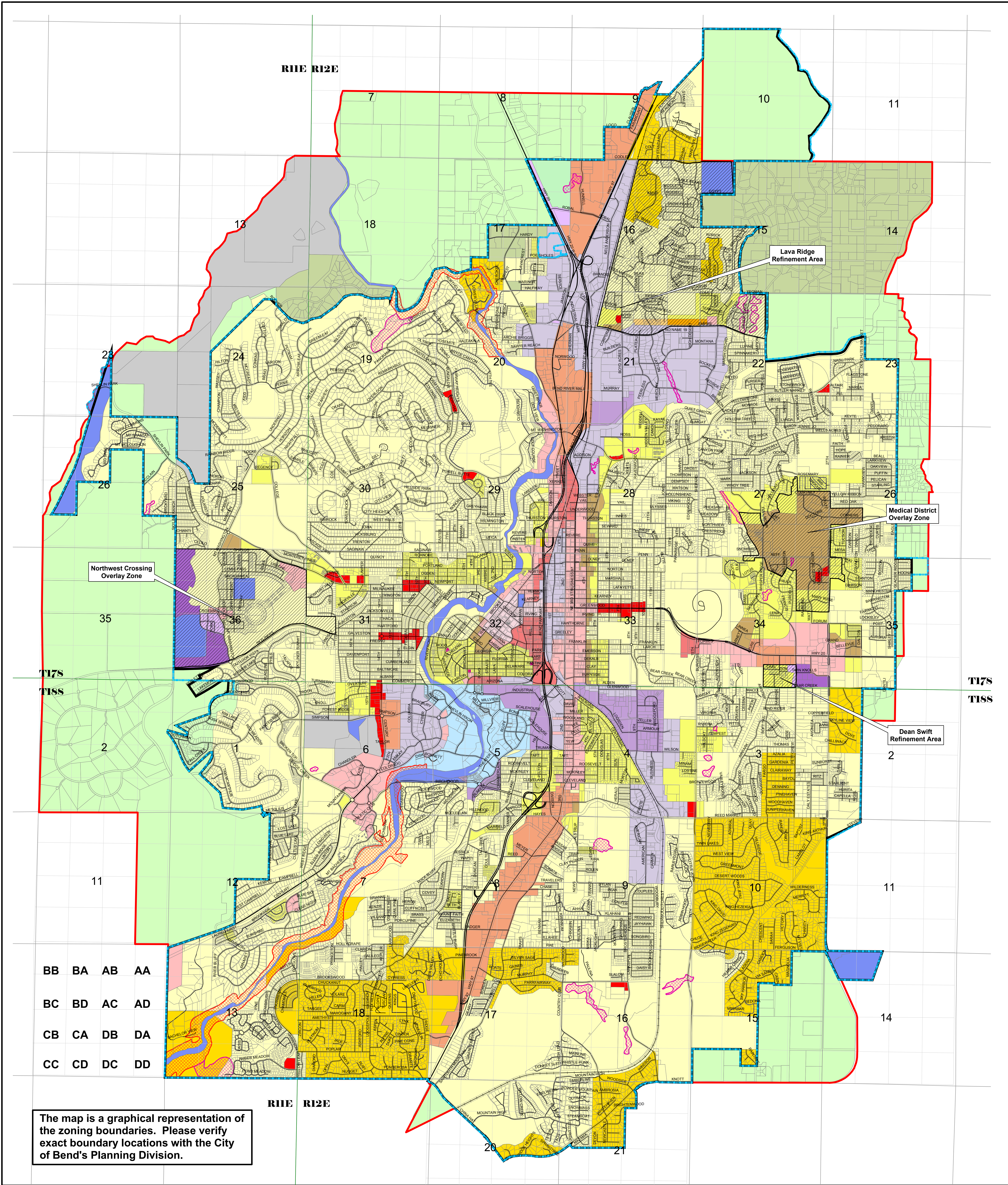
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## **Attachment B Bend Area Zoning Map**







# BEND AREA ZONING MAP

**LEGEND**

- City Limits
- Urban Area Reserve
- Urban Growth Boundary
- Township Lines
- Section Lines
- Railroads
- Upland Areas of Special Interest
- River Corridor A.S.I.
- Special Districts

**Zoning**

|                               |  |
|-------------------------------|--|
| CB- CENTRAL BUSINESS DISTRICT | PF- PUBLIC FACILITIES                    |
| CC- COMMERCIAL CONVENIENCE    | PO- PROFESSIONAL OFFICE                  |
| CG- COMMERCIAL GENERAL        | PO/RM/RS                                 |
| CH- COMMERCIAL HIGHWAY        | RH- RESIDENTIAL URBAN HIGH DENSITY       |
| CL- COMMERCIAL LIMITED        | RL- RESIDENTIAL URBAN LOW DENSITY        |
| CN- COMMERCIAL NEIGHBORHOOD   | RM- RESIDENTIAL URBAN MEDIUM DENSITY     |
| IG- INDUSTRIAL GENERAL        | RS- RESIDENTIAL URBAN STANDARD DENSITY   |
| IL- INDUSTRIAL LIGHT          | SM- SURFACE MINING                       |
| IP- INDUSTRIAL PARK           | SR2-12- RESIDENTIAL SUBURBAN LOW DENSITY |
| ME- MIXED EMPLOYMENT          | UAR- URBAN AREA RESERVE                  |
| MR- MIXED RIVERFRONT          |  |

0 900 1,800 3,600 Feet

**DISCLAIMER:** The information on this map was derived from digital databases on Deschutes County's G.I.S. and City of Bend land records. Care was taken in the creation of this map, but it is provided "AS IS". There are no warranties, express or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying this product.

Map prepared by City of Bend  
Print Date: January 2006  
v:\public maps\zoning map



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## **Attachment C Bend Neighborhoods**

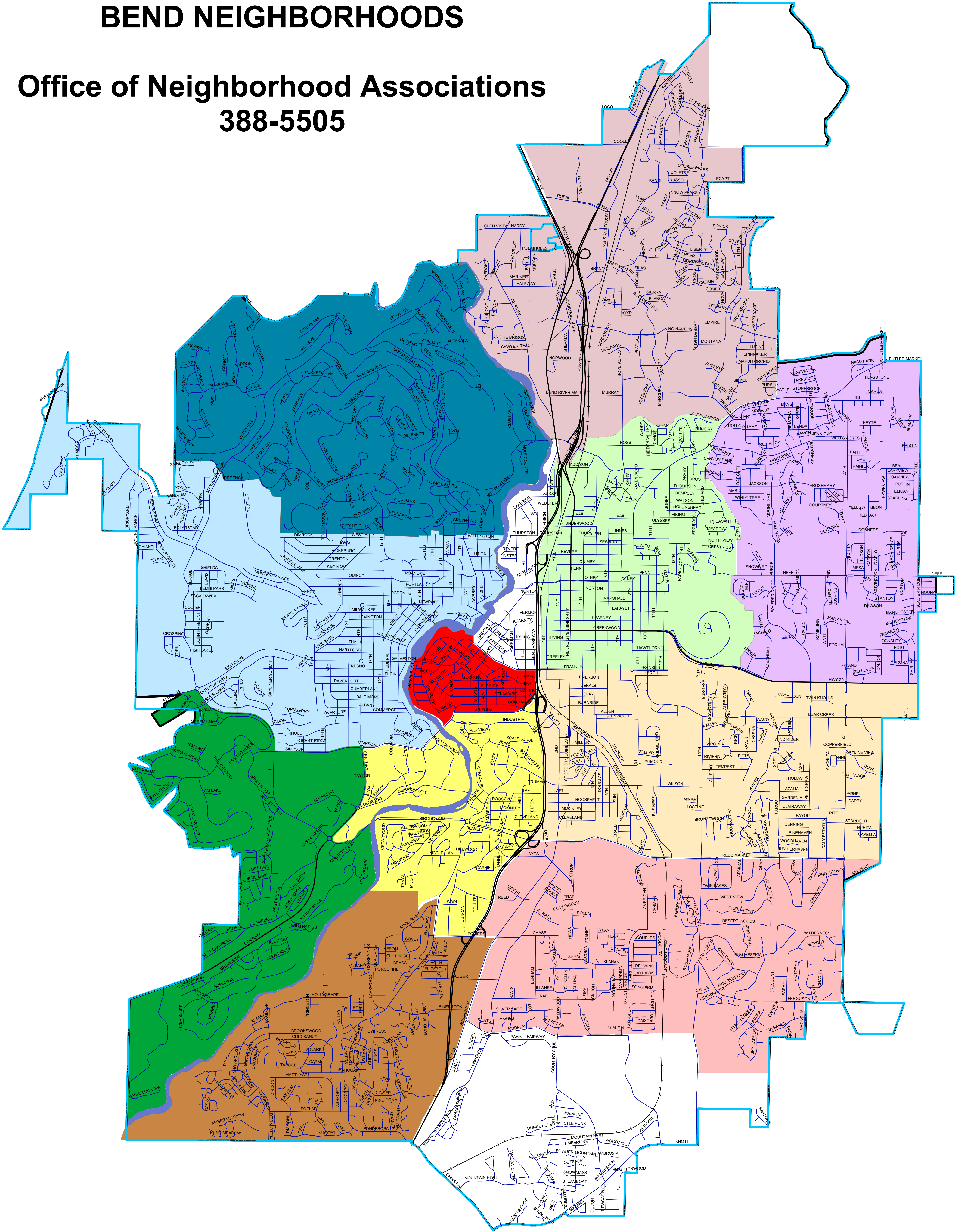




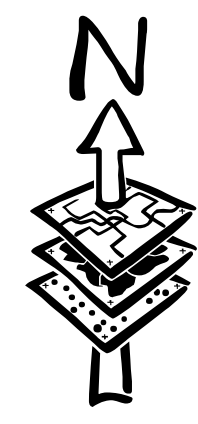
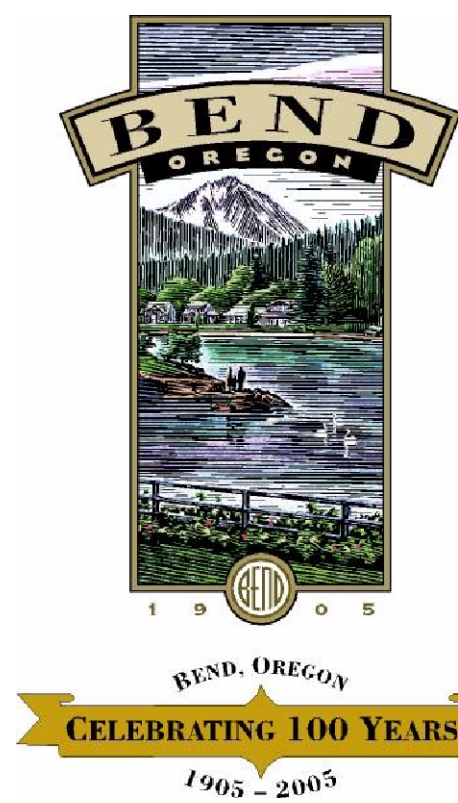
# BEND NEIGHBORHOODS

## Office of Neighborhood Associations

388-5505



- City Limits
- Bend UGB
- Boyd Acres
- Southern Crossing
- Century
- Larkspur
- Mtn View
- NW Awbrey
- Old Bend
- Old Farm
- Orchard
- River West
- Southwest



0 900 1,800 3,600 Feet

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