Oregon 69 Beltline Highway: River Road – Coburg Road Facility Plan Phase I: Environmental & Land Use Inventory

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Introduction

This memorandum describes the existing environmental and land use inventory in the Oregon 569 Beltline Highway: River Road to Coburg Road Facility Plan (Beltline Facility Plan) study area as identified through a review of city, county, and state data sources. It also identifies factors that may impact or constrain the Beltline Facility Plan.

The study area for this memorandum, shown on Figure 1, lies predominantly inside the jurisdiction of the City of Eugene, with a small section located in unincorporated Lane County.

Hydrology

The study area lies within the Willamette River Basin, in the Upper Willamette Subbasin, in the Muddy Creek Watershed. The study area is dissected by the mainstem upper Willamette River, which is formed by the confluence of the Coast Fork and Middle Fork Willamette Rivers south of the study area. Slightly north of the study area, the McKenzie River confluences the mainstem Willamette River. The study area is crisscrossed by tributary streams and sloughs.

Floodplain / Floodway

As shown on Figure 2, a significant portion of the memo study area is located within the Federal Emergency Management Agency (FEMA) 100-year Floodplain of the Willamette River. Especially notable is that 100-year floodplain exists in every quadrant of the Beltline/Delta Highway interchange.

The City of Eugene regulates development in 100-year floodplain areas through the designation of Special Flood Hazard Areas in its City Code. Any transportation improvements proposed to take place within Special Flood Hazard Areas will be subject to the procedures set forth in Eugene Code Section 9.6707, and in particular to the development standards set forth in Eugene Code Section 9.6709.

The Special Flood Hazard Area regulations in Eugene's Code include special restrictions for transportation improvements proposed to take place within the footprint of the FEMA-delineated Floodway. Development in a Floodway is prohibited unless a demonstration can be made that such development will not result in an increase in flood levels during the occurrence of the base flood discharge. This demonstration of "no net rise" must be made by a certified engineer. If proposed transportation improvements enter the footprint of the 100-Year Floodplain, and if a National Environmental Protection Act (NEPA) process is followed, environmental documentation would be required to explain specific impacts of the project and the resources within the floodplain.

Wetlands

A significant amount of National Wetland Inventory (NWI) and Local Wetland Inventory (LWI – delineated by the City of Eugene) wetlands are present in the study area. NWI wetlands are shown on Figure 3. Maps of City of Eugene LWI wetlands inside the study area are provided in Appendix A.

In relation to study area roadway facilities, NWI and LWI wetlands are present immediately southeast and northwest of the Beltline/Delta Highway Interchange, along both sides of Delta Highway approximately 0.5-miles south of the Beltline/Delta Highway Interchange, immediately south of the I-105/Delta Highway Interchange, along the south side of I-105, and immediately southeast of the Delta Highway/Ayres Road intersection.

Planning for transportation improvements will need to be mindful of existing wetland site protection setbacks; these are shown on the Eugene Goal 5 Protection Designations Map provided in Appendix B. Proposed development inside these wetland setbacks would require a Goal 5 exception.

Any proposed fill or excavation activities in the wetlands will require permits under Section 404 of the Clean Water Act and Oregon's Removal-Fill Law. Requirements for obtaining permits include a preference for avoidance and minimization of impacts to wetlands and waters and compensatory mitigation for authorized impacts.

Fish Habitat[1]

The Willamette River in the study area is relatively wide with a large floodplain. The physical characteristics of the instream habitat in the vicinity of the study area provide moderate diversity consisting of riffles, glide, and pool habitat types. The substrate is primarily composed of cobble in the riffle areas with glide substrate being a mixture of cobble and sand with pool substrate being dominated by sand. The mainstem of the Willamette River in the study area is primarily used for passage purposes but there is limited spawning habitat present. Some rearing occurs in the mainstem in the Eugene-Springfield and downstream areas.

Salmonid Use and Timing in the Upper Willamette River Chinook Salmon

The Willamette River in the vicinity of the study area is primarily used by salmonoids for upstream and downstream migratory purposes, although some rearing and feeding activity

[1] Sources of fisheries information for fisheries include the U.S. Fish and Wildlife Service (USFWS), the Oregon Department of Fish and Wildlife (ODFW), and the U.S. Department of the Interior (USDOI).

by juveniles likely occurs during their downstream migration. Limited salmonid spawning habitat exists in the vicinity of the study area.

- **Bull Trout**. Bull trout in the upper Willamette River belong to the Columbia River bull trout Distinct Population Segment (DPS). In 1998, the United States Fish and Wildlife service (USFWS) determined that the Columbia River bull trout DPS was "threatened" and warranted protection under the Endangered Species Act (ESA). The DPS includes all bull trout occurring in the Columbia River basin and its tributaries within the U.S.
- The Columbia River DPS includes 141 subpopulations within four geographic provinces. The lower Columbia River province includes 20 subpopulations within nine different watersheds. The Willamette River supports three of these populations, all of which are located in the McKenzie River. Two historic bull trout populations are believed to be extirpated in the Middle Fork Willamette and Santiam rivers drainages.

- **Oregon Chub**. The Oregon chub is a small minnow historically recorded in the Willamette River basin in Oregon. The Oregon chub was listed under the ESA in 1993, as endangered because of the decline in its distribution in the Willamette Valley. Historical records note collection of Oregon chub from a number of different rivers throughout the Willamette River drainage. Prior to reintroductions, which began in 1994, there were remnant populations in the Santiam River, Muddy Creek, Camous Creek, and the Middle Fork Willamette River drainages. Oregon chub have since been reintroduced into seven new habitats throughout the Willamette River basin. Currently, there are 23 known locations that contain Oregon chub, including the introduced populations.

Non-Salmonid Use of the Upper Willamette River
The upper Willamette River also supports populations of non-salmonid native and nonnative fish species including largemouth bass, bluegill sunfish, warmouth, black and white crappie, northern pikeminnow, largescale sucker, and peamouth. The bass, bluegill, warmouth, crappie and pikeminnow are major predators of juvenile salmonids as they pass through the river.

Applicable Regulations and Guidelines

- **Endangered Species Act (ESA)**. The ESA mandates that a federal action cannot jeopardize the continued existence of a listed species. The USFWS Lane County list of threatened, endangered and proposed species lists two mammals, five birds, five fish, two invertebrates, and four plant species occurring in Lane County, not specifically in the study area. The Oregon Natural Heritage Information Center (ONHIC) lists two fish species (Chinook salmon and Oregon chub) and one plant species (Willamette daisy) that have been observed in the project vicinity.

  Two species of anadromous salmonids occur at certain times during the year in the upper Willamette River. These species include spring Chinook salmon and winter steelhead trout. However, only spring Chinook salmon are listed under the ESA upstream of the Calapooia River confluence in the upper Willamette River Evolutionarily Significant Unit (ESU). This species is part of the upper Willamette River ESU as defined by National Oceanic and Atmospheric Administration (NOAA)

Fisheries. Currently, Upper Willamette River Chinook salmon are listed under the ESA as threatened species. Listed species under jurisdiction of the USFWS that potentially use the area include two additional fish—the Oregon chub, listed as endangered in 1993, and the bull trout, listed as threatened in 1998.

NOAA Fisheries has proposed designated critical habitat for listed salmonids, which includes the Willamette River. Therefore, the study area is in proposed designated critical habitat for spring Chinook salmon. There has been no designated critical habitat for the Oregon chub DPS. Preferred Oregon chub habitat consists of off-channel habitats such as beaver ponds, oxbows, stable backwater sloughs, and flooded marshes.

- **Magnuson-Stevens Act.** Public Law 104-267, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans and to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The Pacific Fisheries Management Council (PFMC) has recommended an EFH designation for the following fisheries: (1) Pacific coast salmon fishery (coho and Chinook salmon; (2) West Coast groundfish fishery (83 species); and (3) coastal pelagic species (Pacific sardine, Pacific mackerel, northern anchovy, jack mackerel, and market squid). Of the three fisheries managed by PFMC, coho and Chinook salmon (Pacific coast salmon fishery) are the only species with EFH identified in the study area vicinity.

  Salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except those above the impassable barriers identified by PFMC. EFH for some life stages of coho and Chinook salmon is found within the McKenzie River basin and within the study area. The Magnuson-Stevens Act requires consultation for all actions that may adversely affect EFH and it does not distinguish between actions in EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location.

- **Oregon Department of State Lands.** In addition to the previously described federal regulations, the Oregon Department of State Lands (ODSL) in cooperation with the ODFW have designated specific waterways in the upper Willamette River ESU as Essential Indigenous Anadromous Salmonid Habitat under Oregon Administrative Rules (OAR), OAR 141-102-000. Essential indigenous anadromous salmonid habitat, or essential habitat, means the habitat that is necessary to prevent the depletion of indigenous anadromous salmonid species during their life history stages of spawning and rearing. Filling or removal in essential habitat is presumed by ODSL to be detrimental to indigenous anadromous salmonids and authorization of fill or removal will only be authorized if it can be shown that only acceptable adverse impacts to

indigenous anadromous salmonids or their essential habitat will occur or the removal/fill will benefit populations of indigenous salmonids. The Willamette River in Lane County is designated as essential habitat. Therefore, compliance with these policies and guidelines also is mandatory.

Potential fisheries constraints in the study area consist of the presence of ESA listed species (Chinook salmon and Oregon chub) and the potential presence of the ESA listed species bull trout. In addition to the ESA listed species, potential impacts to coho salmon habitat is regulated under the Magnuson-Stevens Act regarding essential fish habitat. Any proposed transportation improvements that would impact Willamette River waters would require, at a minimum, a Clean Water Act 404 Joint Removal/Fill permit from the U.S. Army Corps of Engineers which would be the federal nexus for the ESA consultation.

Assuming Federal Highway Administration (FHWA) funds are used for the project, the FHWA would likely be the lead agency conducting the ESA consultation process with the NMFS and USFWS. Along with environmental documentation of impacts to natural resources, a biological assessment would be required for the ESA consultation. The timeline for an ESA consultation is approximately 9 months and potentially longer depending on agency reviews.

Natural Hazards

Earthquake Hazard

Figure 4, derived from Oregon Department of Geology and Mineral Industries Relative Earthquake Hazard data, shows areas having the greatest tendency to experience damage due to any combination of liquefaction, amplification of ground shaking or slope instability hazard, categorized as earthquake zones B, C or D (A being the highest hazard and D the lowest hazard; there are no zone A areas in the study area). On individual hazard maps, areas are shown as zone 0, 1, 2 or 3, with 3 being the greatest hazard. For every point on the map, the zone rating for each individual hazard is squared, and the resulting numbers are added together. The square root of this sum is calculated and rounded to the nearest whole number. Results of 4 or 5 are assigned to category A, 3 is asigned to category B, 2 is assigned to category C, and 1 or 0 is assigned to category D.

The majority of the study area is classified as “Zone D” (low earthquake hazard risk) with sizeable areas of “Zone C” (low/intermediate earthquake hazard risk) and pockets of “Zone B” (intermediate/high earthquake hazard risk). An area of Zone B risk is located just northeast of the Beltline/Delta Highway interchange. Both the Beltline/Delta Highway and Beltline/I-5 interchanges are located entirely in earthquake zone C areas.

Slopes

According to Lane Council of Governments (LCOG) Slide Hazard data, there are no Landslide Hazard Areas within the study area. However, there are some areas with slopes greater than 20%. These “excessive slope areas” are shown in Figure 5. There are no excessive slope areas adjacent to the Beltline Highway itself, although there are areas of moderately unstable slope in all four quadrants of the Beltline/Delta Highway interchange.

Transportation improvements generally entail earthwork. Cuts and fills located in areas of earthquake hazard risk or moderate-to-excessive slope can be unstable. Further analysis of these potential hazards would need to be conducted during project design, as would the development of applicable avoidance and mitigation techniques.

Terrain

As depicted on Figure 5, the topography of the study area contains mostly flat terrain with some areas of low-to-moderately rolling terrain. The defining feature of the landscape is the Willamette River, which dissects the study area into east and west sections.

Soils

Figure 6 shows existing soils in the study area. In general, the soils on the broad flood plain of the Willamette River in the study area have good to excessive drainage, except for those soils in sediment-filled remnant channels. The soils on terraces adjacent to the flood plain are well drained and have undulating bar-and-channel relief.

The following soil types, listed in Table 1 in order of prevalence in the study area, are described in detail in Appendix C to this memorandum. Applicable soil type descriptions should be referenced during pre-design planning for any proposed improvements in the study area.

Table 1: Study Area Soil Types

Map Unit Symbol	Soil Type
76	Malabon-Urban land complex
119	Salem-Urban land complex
97	Newberg-Urban land complex
31	Coburg silty clay loam
95	Newberg fine sandy loam
75	Malabon silty clay loam
32	Coburg-Urban land complex
118	Salem gravelly silt loam
26	Chehalis silty clay loam
96	Newberg loam
110	Pits
27	Chehalis-Urban land complex
48	Fluvents, nearly level

Table 1: Study Area Soil Types cont.	
22	Camas gravelly sandy loam
5	Awbrig silty clay loam
25	Chapman-Urban land complex
30	Cloquato-Urban land complex
34	Courtney gravelly silty clay loam
106A	Pengra-Urban land complex
79	McBee silty clay loam
28E	Chehulpum slit loam
33	Conser silty clay loam
114	Riverwash
23	Camas-Urban land complex
56	Holcomb silty clay loam
24	Chapman loam
52B	Hazelair silty clay loam
6	Awbrig-Urban land complex
99H	Ochrepts and Umbrepts
8	Bashaw clay
11C	Bellpine silty clay loam
138E	Witzel very cobbly loam
29	Cloquato silt loam
100	Oxley gravelly silt loam

Vegetation

As shown on Figure 7, the study area is predominantly urbanized, with a small area of agricultural land in the far northeast part of the study area on both sides of Game Farm Road.

Land Use/Zoning

Land Use

The study area is predominantly composed of single-family residential neighborhoods with pockets of large retail and office developments in the vicinity of the major interchanges, and smaller-scale retail along local roads such as Willakenzie Road, Crescent Avenue, and Hunsaker Lane.

The following four Eugene neighborhood associations are present in the study area[2]:

- **Cal Young Neighborhood Association –** the Cal Young neighborhood is bounded by the Willamette River, Coburg Road, Beltline Road, and north to the City limits.
- **Harlow Neighbors –** the Harlow neighborhood is bounded by Interstate 5 on the east, the Willamette River on the south, Coburg Road on the west, and Beltline on the north.
- **River Road Community Organization –** the River Road neighborhood is bounded as follows: Begin at the intersection of the centerline of the Willamette River and Beltline. Proceed westerly along the centerline of Beltline to the intersection of Beltline and the Northwest Expressway. Go southeasterly along the Northwest Expressway centerline to the intersection of the Northwest Expressway and River Road. Turn north and go along the River Road centerline to the south boundary of the Capri subdivision extended westerly. Follow the southern boundary of extended Capri to tax lot #1704251302700. Go north along the easterly edge of tax lots #1704251302700 and #1704251300700, then west along the north boundary of the Capri subdivision to the south terminus of Lombard Street. Proceed north along the centerline of Lombard Street to the north boundary of the Briarcliff subdivision. Go east along the Briarcliff subdivision's north boundary, then north on taxlot #1704251201201 to Maurie Jacobs park. Go along the corner of Maurie Jacobs Park to the Willamette River. The Willamette River forms the remaining eastern boundary.
- **Santa Clara Community Organization** - the Santa Clara neighborhood is defined generally as the area encompassed by Beltline on the south, the Southern Pacific Coos Bay Line on the west, on the north: Irvington to Honolulu, Honolulu to Hyacinth, Hyacinth to Carthage, Carthage to River Road, River Road to Beacon, Beacon east to the Willamette River; and the Willamette River on the east.

Consultation with applicable neighborhood associations should be performed during the initial phase of needs analysis and alternatives identification for the Beltline Facility Plan.

As shown on Figure 8, there are several public parks located in the study area. Parks located in close proximity to roadway facilities include:

- Delta Ponds Park (located on both sides of Delta Highway)
- Lone Oak Park (located just north of Division Avenue and the Beltline Highway)
- Cal Young Sports Park (located less than 0.25-miles north of the Beltline Highway off Gilham Road)

Careful planning should be conducted to avoid impacting public parks as a result of transportation improvements. Actions impacting public parks are subject to Section 4(f) regulations[3], which require avoidance of public parks and historical sites whenever feasible

[2] Source of neighborhood boundary descriptions: City of Eugene web page: http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_173499_0_0_18/North%20Neighborhood%20Boundaries.pdf

[3] Section 4(f) of the U.S. Department of Transportation (DOT) Act of 1966 (49 USC 303)

and prudent. If any impacted parks have been funded with Land and Water Conservation Fund (LWCF) grants, Section 6(f) regulations would also apply.[4]

Zoning

City of Eugene

The study area is located almost entirely in the City of Eugene, with a small section in unincorporated Lane County. Any proposed transportation improvement would therefore be subject to the land use planning regulations of the City of Eugene and potentially those of Lane County.

Figure 8 depicts City of Eugene zoning in the study area. The study area is primarily zoned for low-density residential uses with large areas zoned for commercial use at the major interchanges, sizeable pockets of medium-density residential areas (most notably to the southwest of the Delta Highway/Beltline Interchange). There are also several agriculturally zoned areas located outside the city limits but inside the city's urban growth boundary (UGB).

Existing City of Eugene zoning designations in the study area are as follows:

- Low Density Residential Zone (R1)
- Medium Density Residential Zone (R2)
- Limited High Density Residential Zone (R3)
- High Density Residential Zone (R4)
- Neighborhood Commercial Zone (C-1)
- Community Commercial Zone (C-2)
- General Office Zone (GO)
- Campus Industrial Zone (I-1)
- Light-Medium Industrial Zone (I-2)
- Public Land Zone (PL)
- Historic Zone (S-H)
- Agricultural Zone (AG)

Public road improvements in the above zones are either permitted outright or conditionally permitted in accordance with City of Eugene Land Use Code Sections 9.6500 (Public Improvement Standards) and 9.6800 (Street Standards). The Street Standards section addresses where particular improvement standards are differentiated by zoning district.

There are also several City of Eugene overlay zones present in the study area, as shown on Figures 9 and 10. Overlay zones impose restrictions and conditions on development in addition to those in the base zones already discussed.

Existing City of Eugene overlay zones in the study area are as follows:

- Water Resources Conservation Overlay Zone (WR)
- Urbanizable Land Overlay Zone (UL)
- Nodal Development Overlay Zone (ND)

[4] Section 6f of the Land and Water Conservation Fund Act of 1965

- Planned Unit Development Overlay Zone (PD)
- Commercial Airport Safety Overlay Zone (CAS)

Public road improvements in the above overlay zones are permitted subject to Standards Review.

Any proposed improvements that would take place within 150 feet of the ordinary low water line on the channel of the Willamette River, or are adjacent to the river and are publicly owned for park and recreation purposes, would be subject to a compatibility review by the City of Eugene in accordance with Goal 15 (Willamette River Greenway) related state regulations. This review would entail a public hearing on the proposed improvement and a subsequent decision by the City on whether to approve an exception.

Lane County

Part of the study area to the north of the Delta Highway/Beltline Interchange is located outside the Eugene-Springfield UGB in unincorporated Lane County. This area contains significant floodplain and wetlands and is primarily zoned for exclusive farm use (Lane County zone E30) and natural resource protection for sand and gravel (Lane County zone SG and SG/CP). Figure 8b depicts Lane County zoning inside the study area boundary.

New project-related development in the EFU zone is subject to state land use law requirements for Agricultural Lands as implemented in Lane County code. New development on Agriculture Lands frequently requires a state land use goal exception, which is processed under a plan amendment that must be approved by Lane County's Board of Commissioners and acknowledged by the Department of Land Conservation and Development/Land Conservation and Development Commission.

Metro Area

The Metro Plan is a long-range comprehensive plan for Lane County, Eugene, and Springfield that guides general planning policies and land use allocations. It is a framework for jurisdictions to conserve physical resources through coordinated development or redevelopment of the metropolitan area. Metro Plan accommodates the need for further expansion while taking into account the projected population levels of the area in 2015. City of Eugene zoning is in compliance with the Metro Plan. Eugene-Springfield Metropolitan Area General Plan land use designations are provided in Appendix D.

Cultural Resources

Historical

A review of the Oregon National Register List[5], which lists all sites in Oregon on the National Register of Historic Places (NRHP), reveals that there are two properties in the study area currently on the NRHP, as shown on Figure 10:

[5] Source: Oregon State Office of Historical Preservation webpage: < http://www.oregon.gov/OPRD/HCD/NATREG/docs/oregon_nr_list.pdf>

- Harlow, Elmer, House: 2991 Harlow Road, Eugene
- Potter, Wallace and Glenn, House: 120 Fir Lane

In addition to the above properties currently listed on the NRHP, a detailed office and field review by a certified historian would need to be conducted to determine whether other sites in the study area would be deemed eligible for the National Register. Proposed transportation improvements that would directly or indirectly impact a property on or eligible for the NRHP would be required to comply with National Historic Preservation Act[6] procedures and restrictions.

The City of Eugene also utilizes local tools to protect historic homes, including the City Historic Landmark designation and the S-H Historic zoning district, which includes special development requirements when a historic property will be impacted.

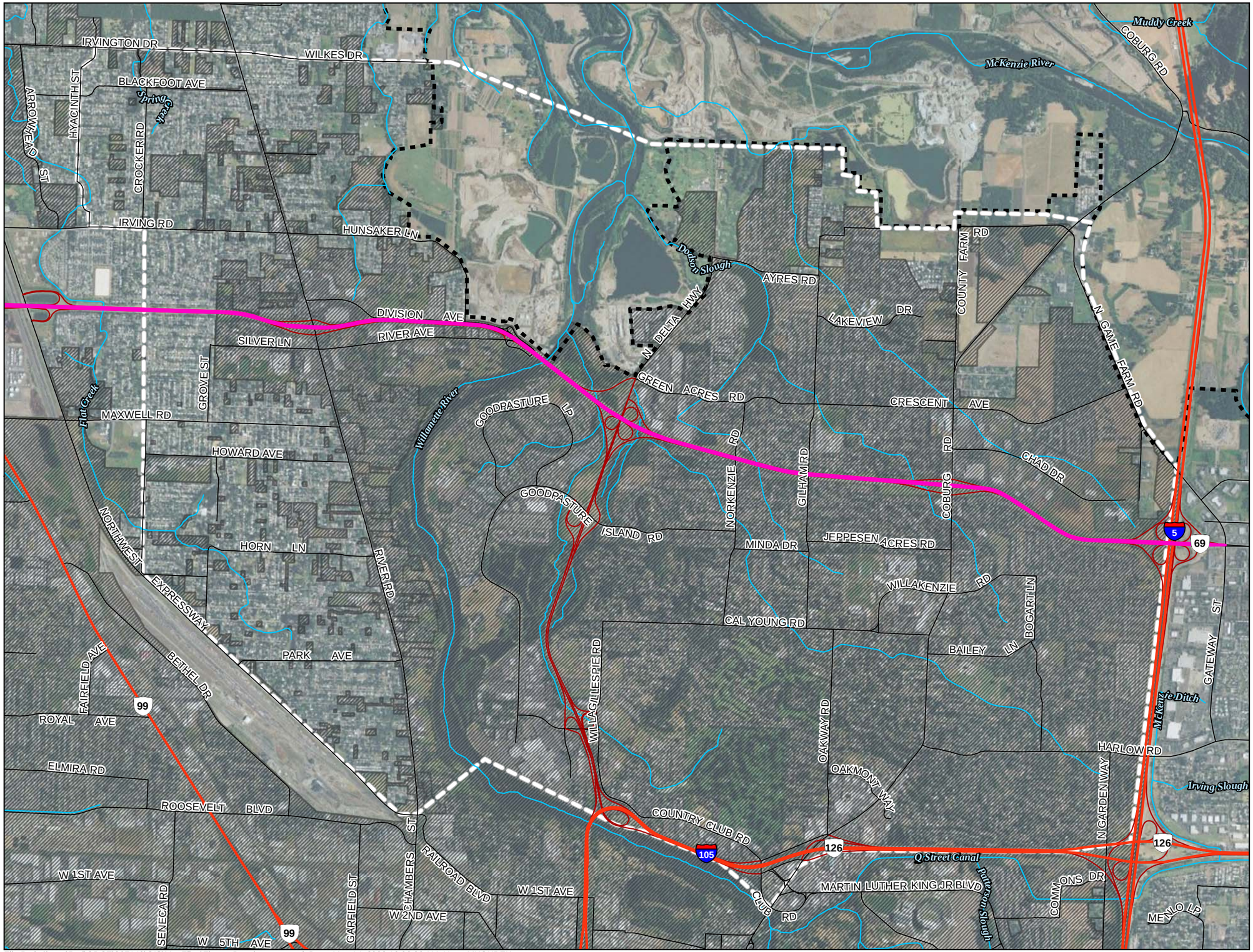
Archaeological

The banks of the Willamette River inside the study area may be archaeologically sensitive. Any planned improvements that will entail excavation in this area will need to be investigated for the presence of archaeological sites. If such sites are present and are unavoidable in terms of project design, they must be evaluated for their eligibility for inclusion in the NRHP. If found to be eligible, implementation of 'data recovery' excavations would likely result in partial (or nearly total) 'mitigation' of the adverse effects of construction. Rarely are archaeological sites considered Section 4(f) properties. Archaeological sites, if present, may be a design constraint but probably not a fatal flaw.

[6] Commonly referred to as "Section 106"

Figures

Figure 1:
OR69/Beltline Highway Study Area



LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary
- Eugene City Limits
- Urban Growth Boundary

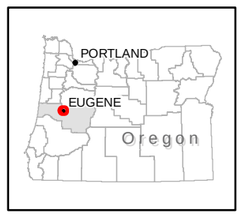


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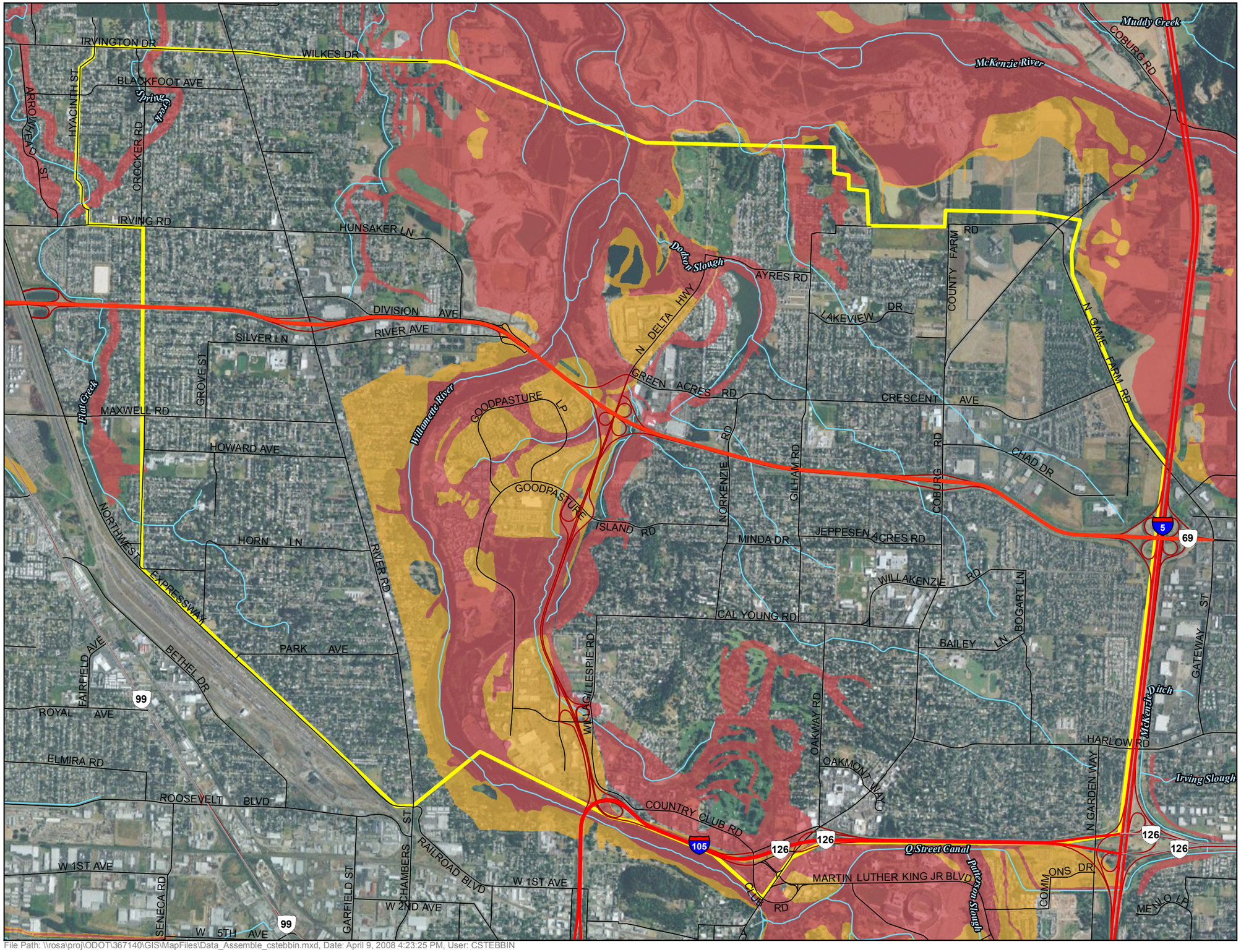
Figure 2
Floodplains



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LEGEND

- Beltline Highway
- Highway Feature
- Major or Minor Collector
- Study_Area_Boundary

FEMA_LaneCo

- 100-Year Flood Zone
- 500-Year Flood Zone

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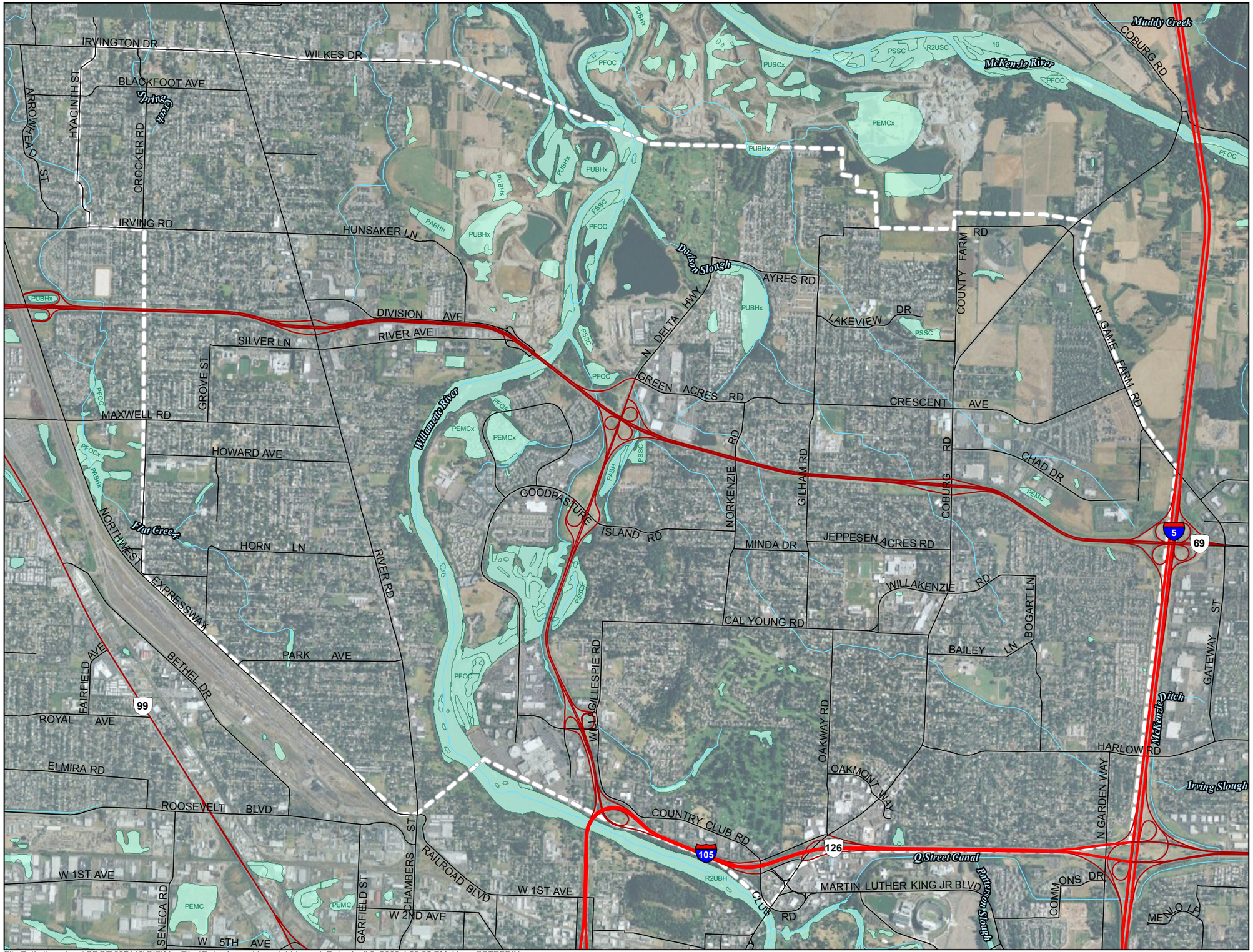
Figure 3:

Wetlands



LEGEND

- Highway Feature
- Major or Minor Collector
- Study_Area_Boundary
- Wetlands (NWI)

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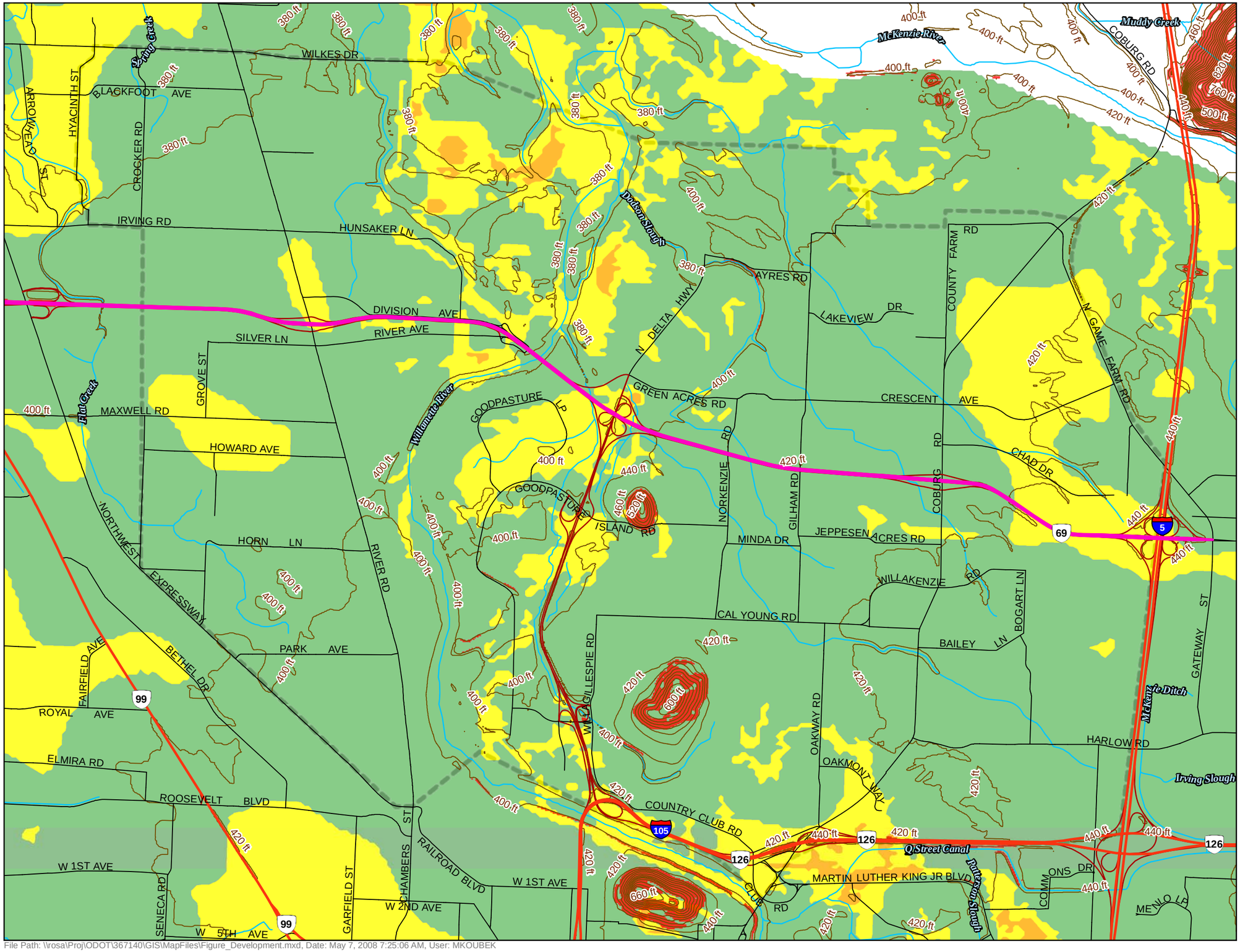

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Figure 4: Earthquake Hazard

LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary
- Contour (20-ft interval)
- Slopes greater than 20%

Earthquake Hazards

- Zone B
- Zone C
- Zone D

Note: Earthquake harzards are categorized A (highest) to D (lowest). There is no Catagory A for the project area.

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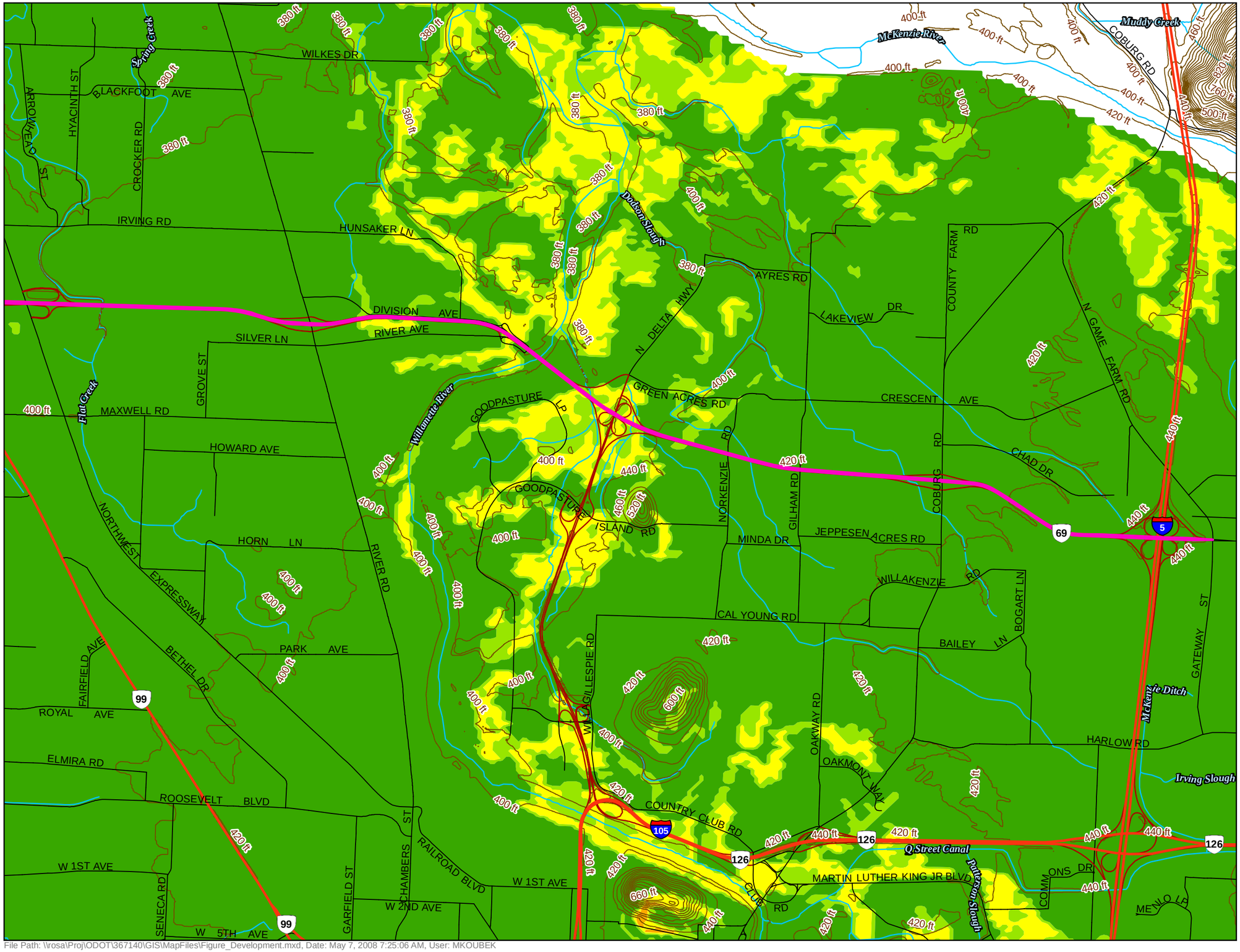

Figure 5: Slopes

LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary
- Contour (20-ft interval)

Slope Instability Hazard

- Category 1 (None)
- Category 2 (Low)
- Category 3 (Moderate)
- Category 4 (High)
- Category 5 (Very High)

Note: DOGAMI Slope data catagorized.

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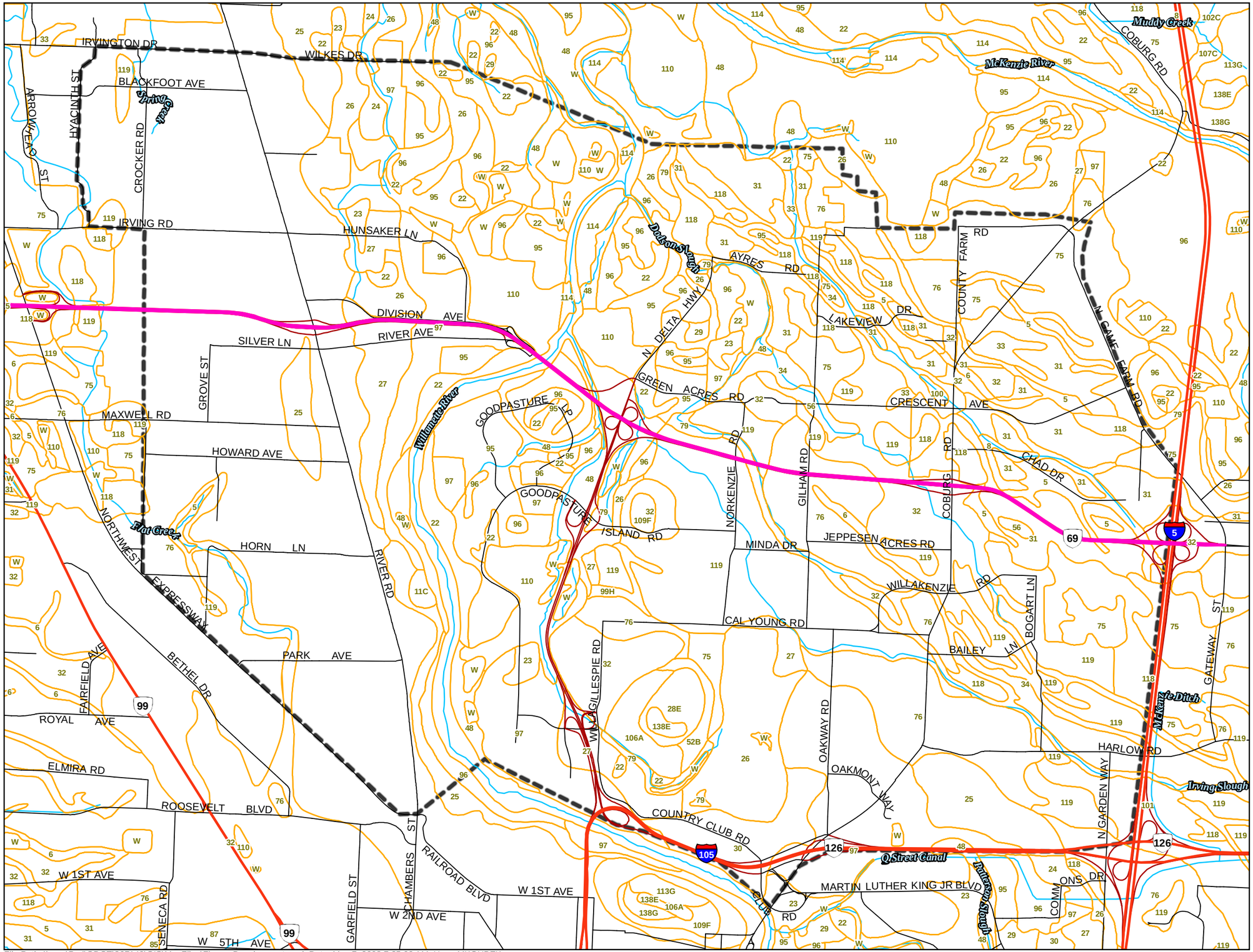

Figure 6: Soils

LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Soil Types (SSURGO)
- Study Area Boundary

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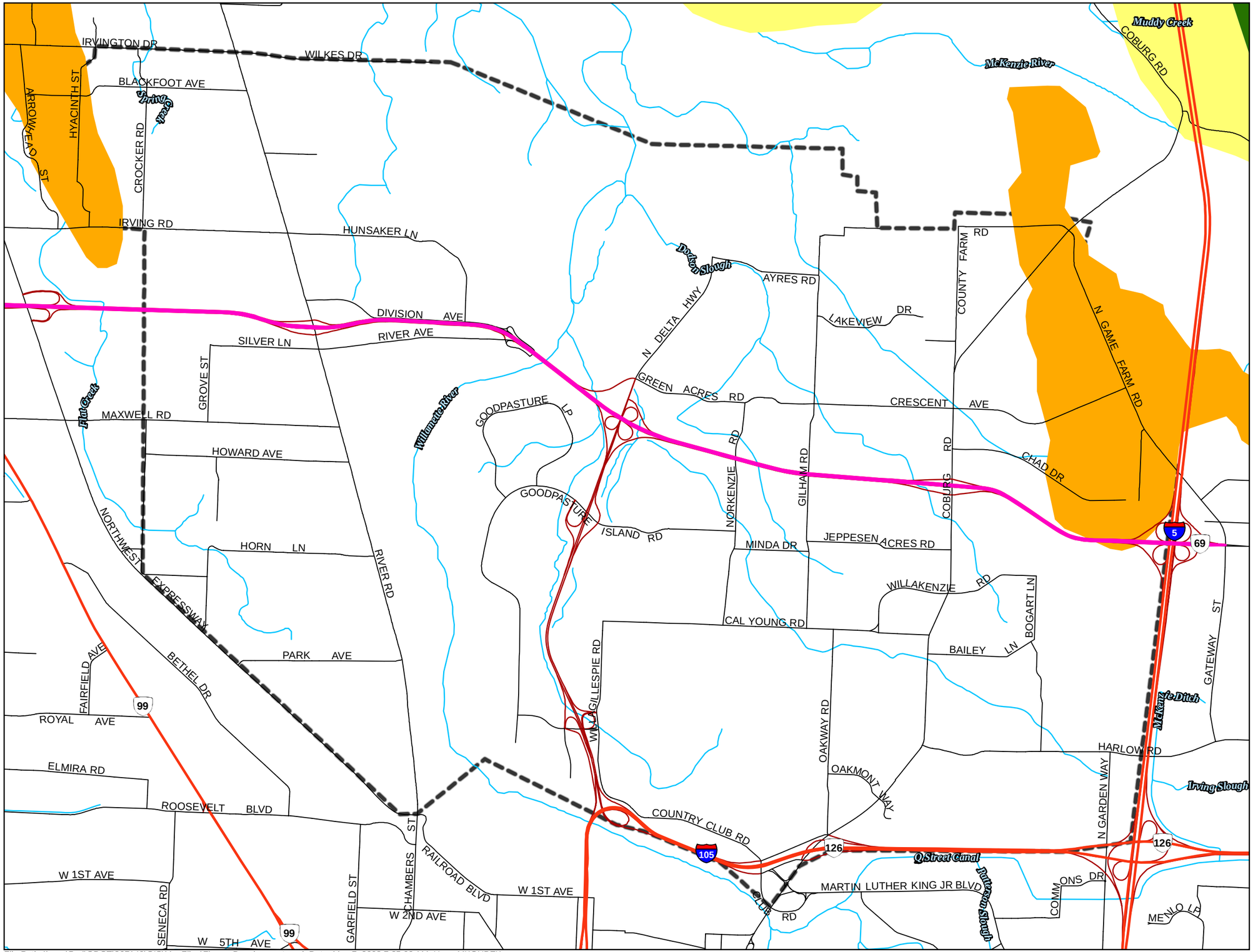
Figure 7:
Vegetation



LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector

Vegetation

- Agricultural cropland and pastureland
- Douglas fir-Oregon white oak forest and woodland
- Oregon ash-black cottonwood-bottomland pasture mosaic
- Study Area Boundary

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Miles

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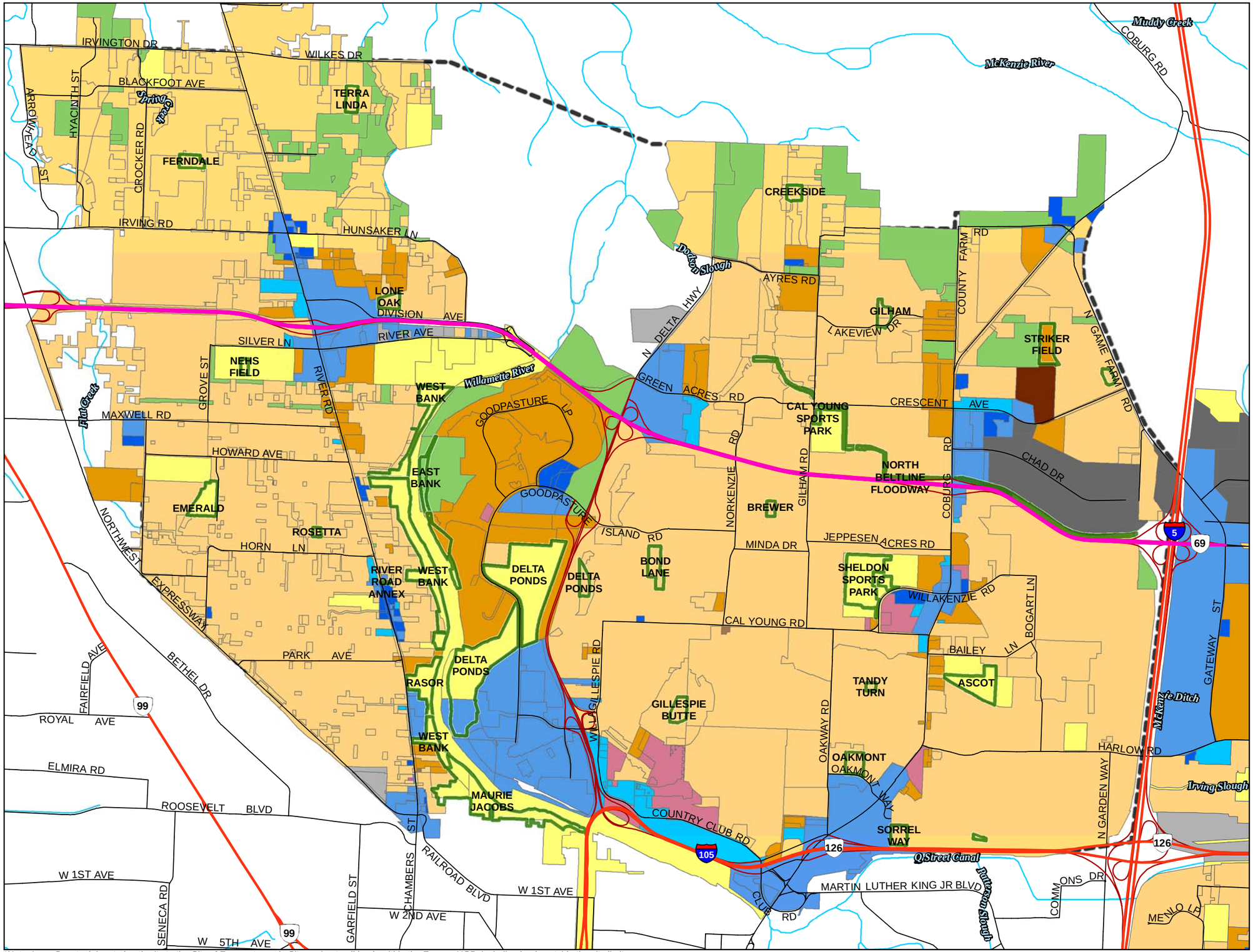

Figure 8: City of Eugene Zoning*

LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary
- Parks

Zoning

- Light-Med Industrial
- Campus Industrial
- General Office
- Community Commercial
- Neighborhood Commercial
- Public Land
- Historic
- S-HJM Historic Johansen-Moody House Spec
- Limited High-Density Residential
- High-Density Residential
- Med-Density Residential
- Low-Density Residential
- Agricultural

N

0 0.5 1
Miles

CH2MHILL

*Note: Lane County delegated authority to the City of Eugene to apply City zoning to all lands within the Eugene UGB, including lands outside the city limits.

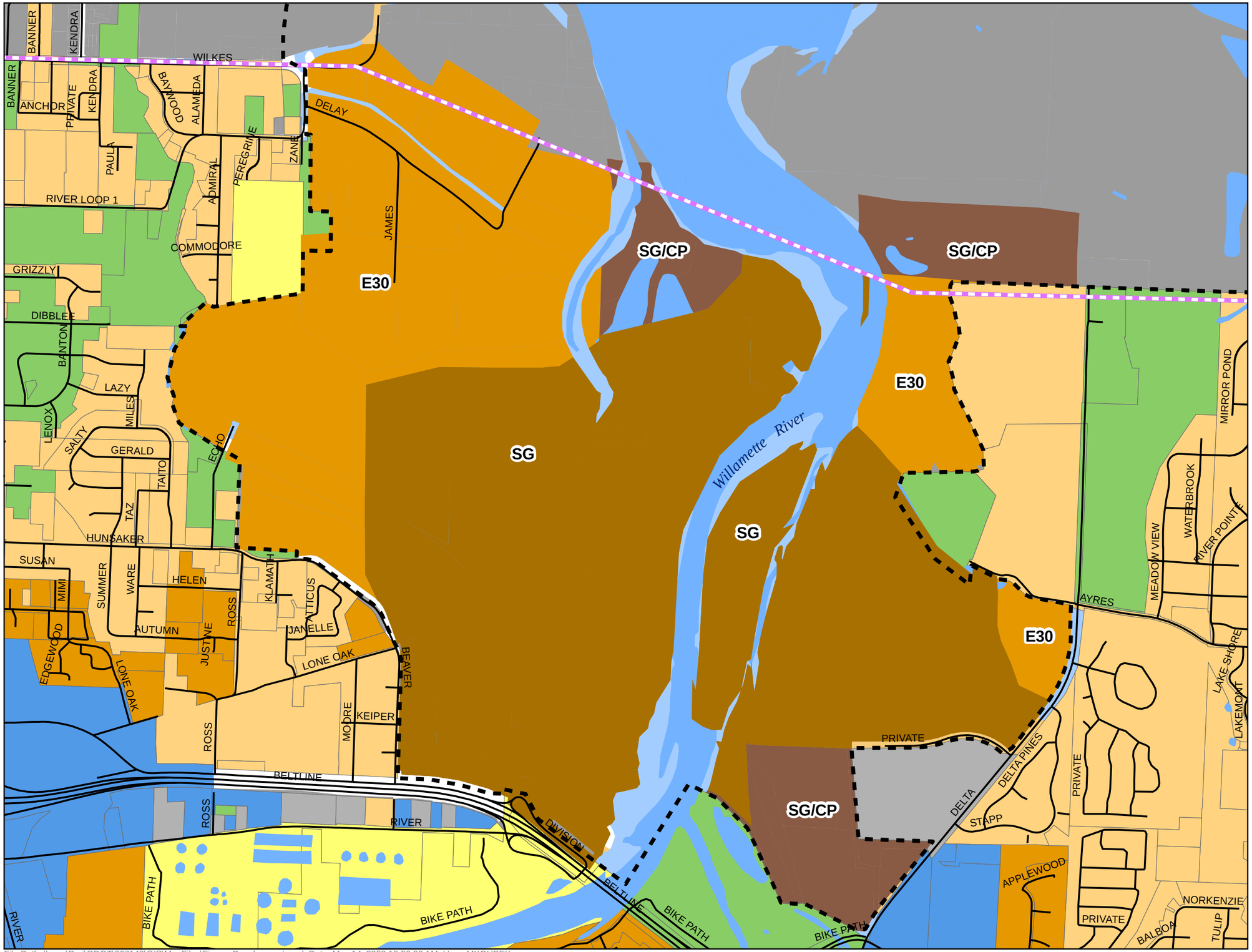

Figure 8b
Lane County Zoning

LEGEND

UGB

Study Area Boundary

Lane County Zoning

SG

SG/CP

E30

0 0.1 0.2 0.3 0.4

Miles

CH2MHILL

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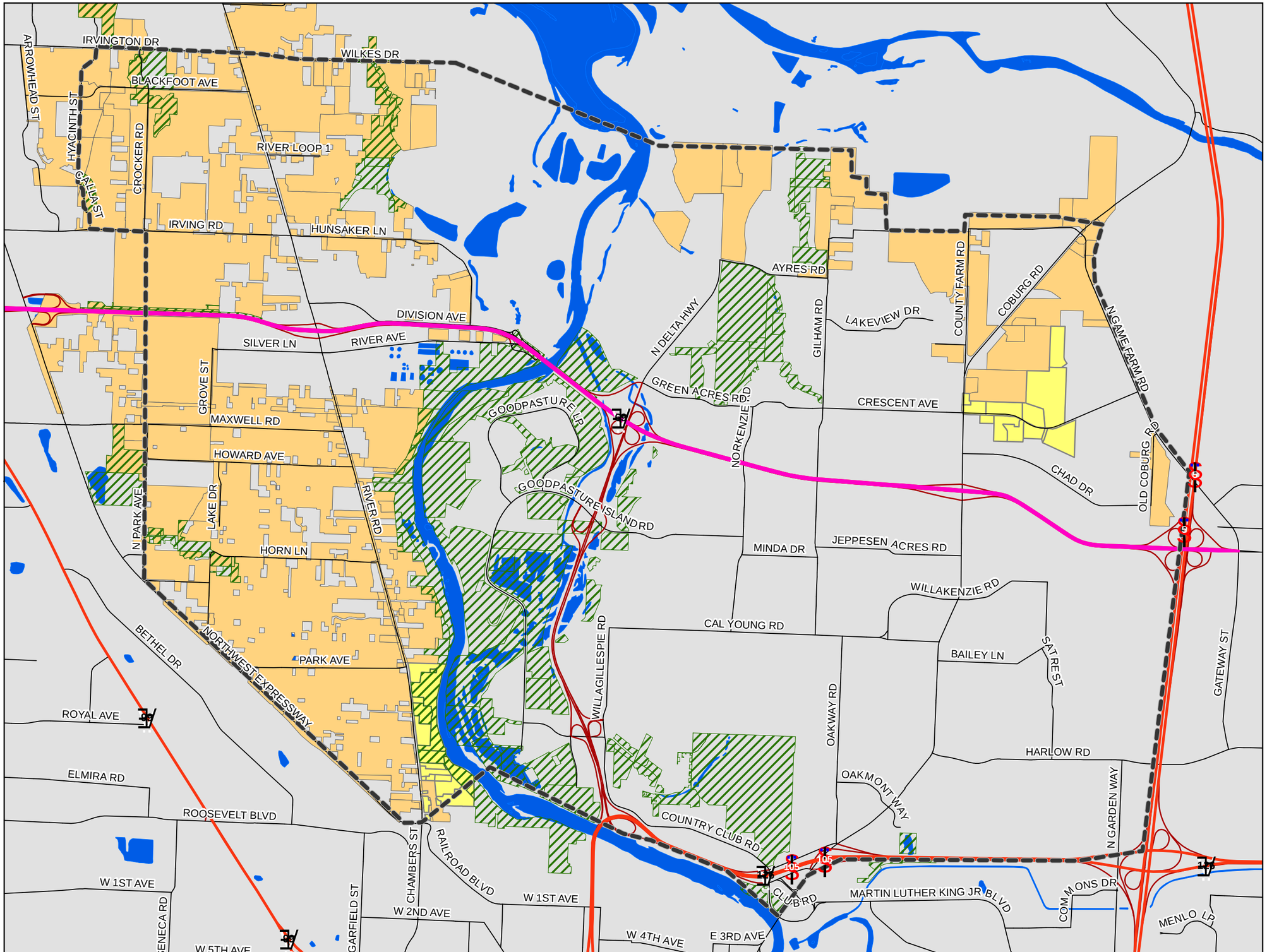


Figure 9: Overlay Zones

LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary

Overlay Zones

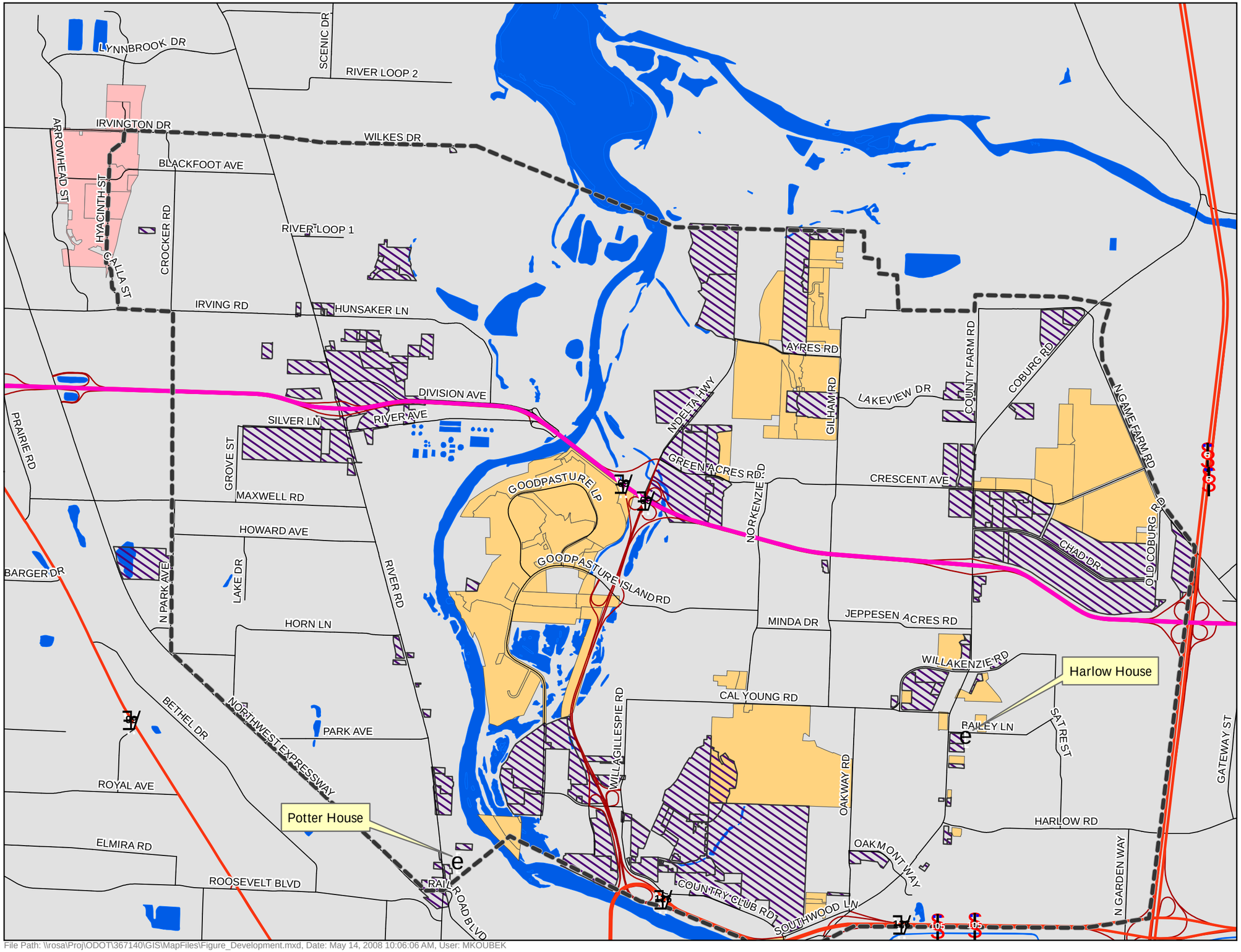
- Nodal Development (ND)
- Urbanizable Land (UL)
- Water Resources Conservation (WR)

0 0.5 1
Miles

CH2MHILL

File Path: \\rosa\Proj\ODOT\367140\GIS\MapFiles\Figure_Development.mxd, Date: May 14, 2008 10:06:06 AM, User: MKOUBEK

Figure 10: Overlay Zones cont.; Historic Sites (NRHP)



LEGEND

- Beltline Highway
- Interstate
- Highway Feature
- Major or Minor Collector
- Study Area Boundary
- e Historical Site (on National Register)

Overlay Zones

- Commercial Airport Safety (CAS)
- Planned Unit Development (PD)
- Site Review (SR)

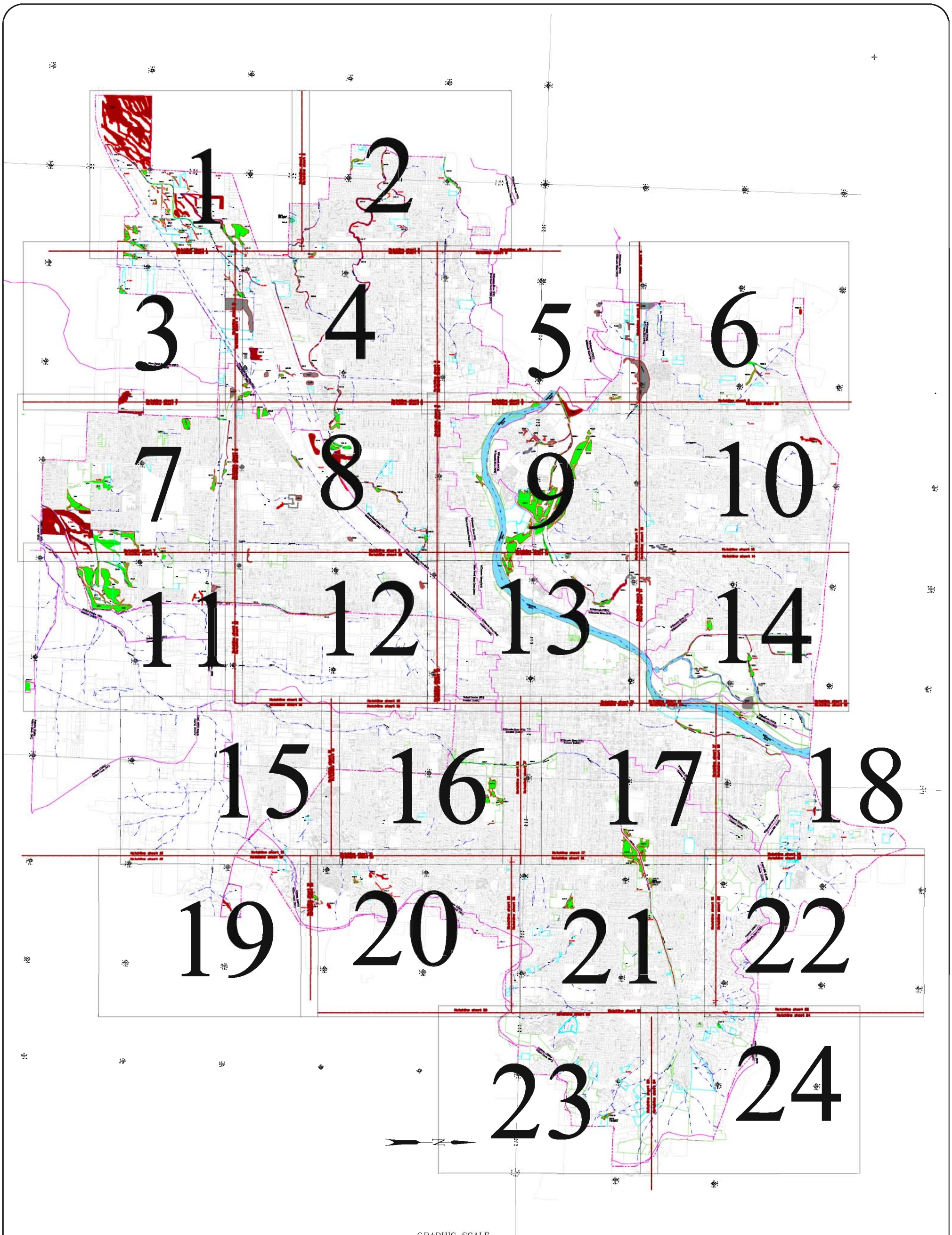
0 0.5 1
Miles

CH2MHILL

File Path: \\rosa\Proj\ODOT\367140\GIS\MapFiles\Figure_Development.mxd, Date: May 14, 2008 10:06:06 AM, User: MKOUBEK

Appendices

Appendix A: Eugene LWI Maps (Maps 4-6, 8-10, 12-14 applicable to study area)



Watershed Boundary		Wetland Field Verified	
Project Boundary/UGB		Wetland Non-Field Verified	
Potentially Jurisdictional Creeks/drainages		Pond	
Sample Point	58	City Owned Parcels	
Wetland Code	RSC-10	Lots Permission Yes	
Probable Wetland	PW	Rivers and Channels	
DSL Determination File	01-0523		

GRAPHIC SCALE

2000 0 1000 2000 4000 8000

Scale in Feet

Funding for this project was provided by a grant from the Oregon Department of Land Conservation and Development

THIS MAP IS FOR PLANNING PURPOSES ONLY
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AND SUBJECT TO CHANGE

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DATE: October, 2003

BASE MAP INFO: Supplied by City of Eugene
Lane Council of Governments

JOB NO.: 2762

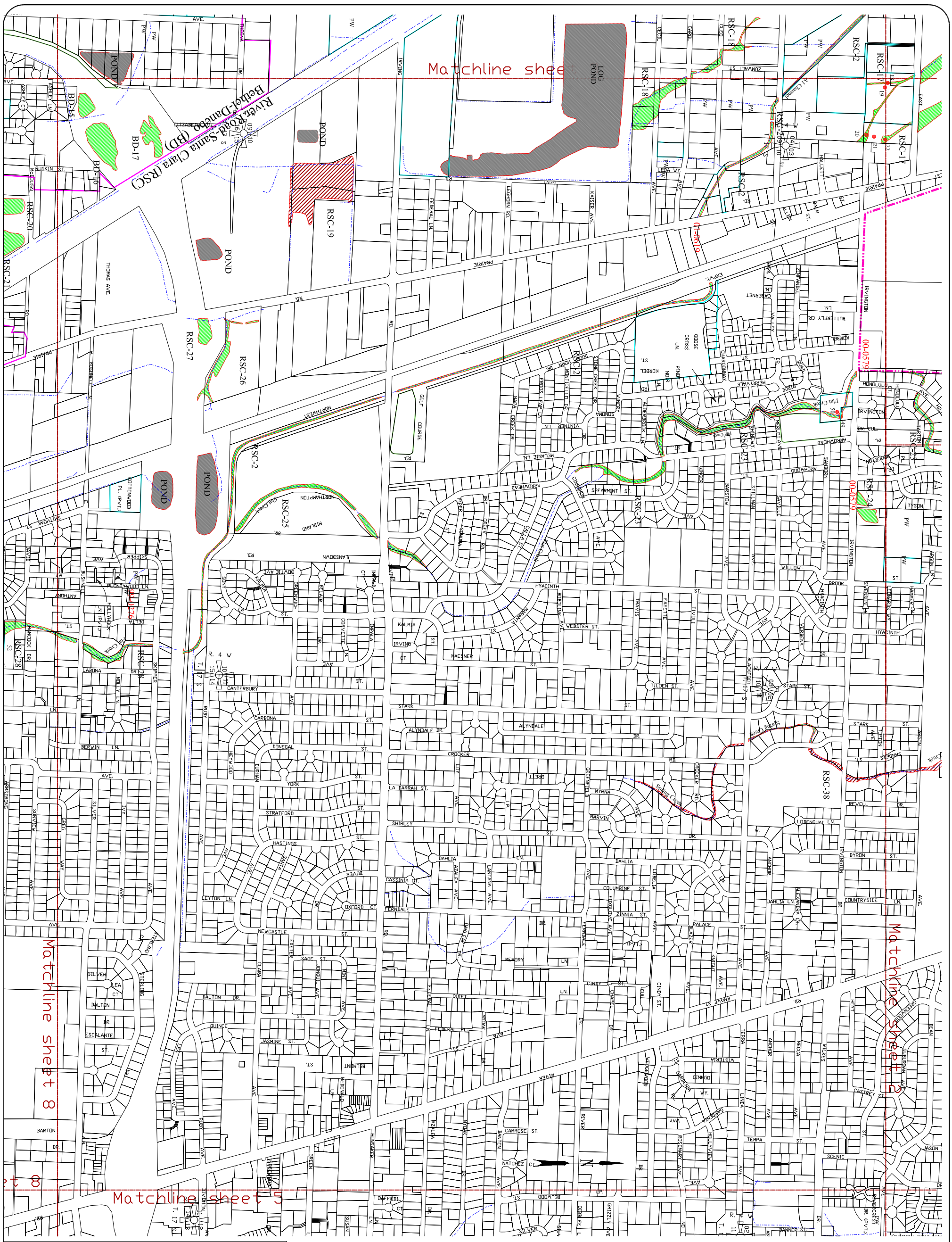
Eugene
Local Wetlands Inventory

Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, Oregon 97070
Phone: (503) 570-0800

PHS

Reference

Sheet:



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Potentially Jurisdictional Creeks/drainages		Pond	
Sample Point	58	City Owned Parcels	
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Probable Wetland	PW	Rivers and Channels	
DSL Determination File	01-0523		

GRAPHIC SCALE

400 0 200 400 800 1600

Scale in Feet

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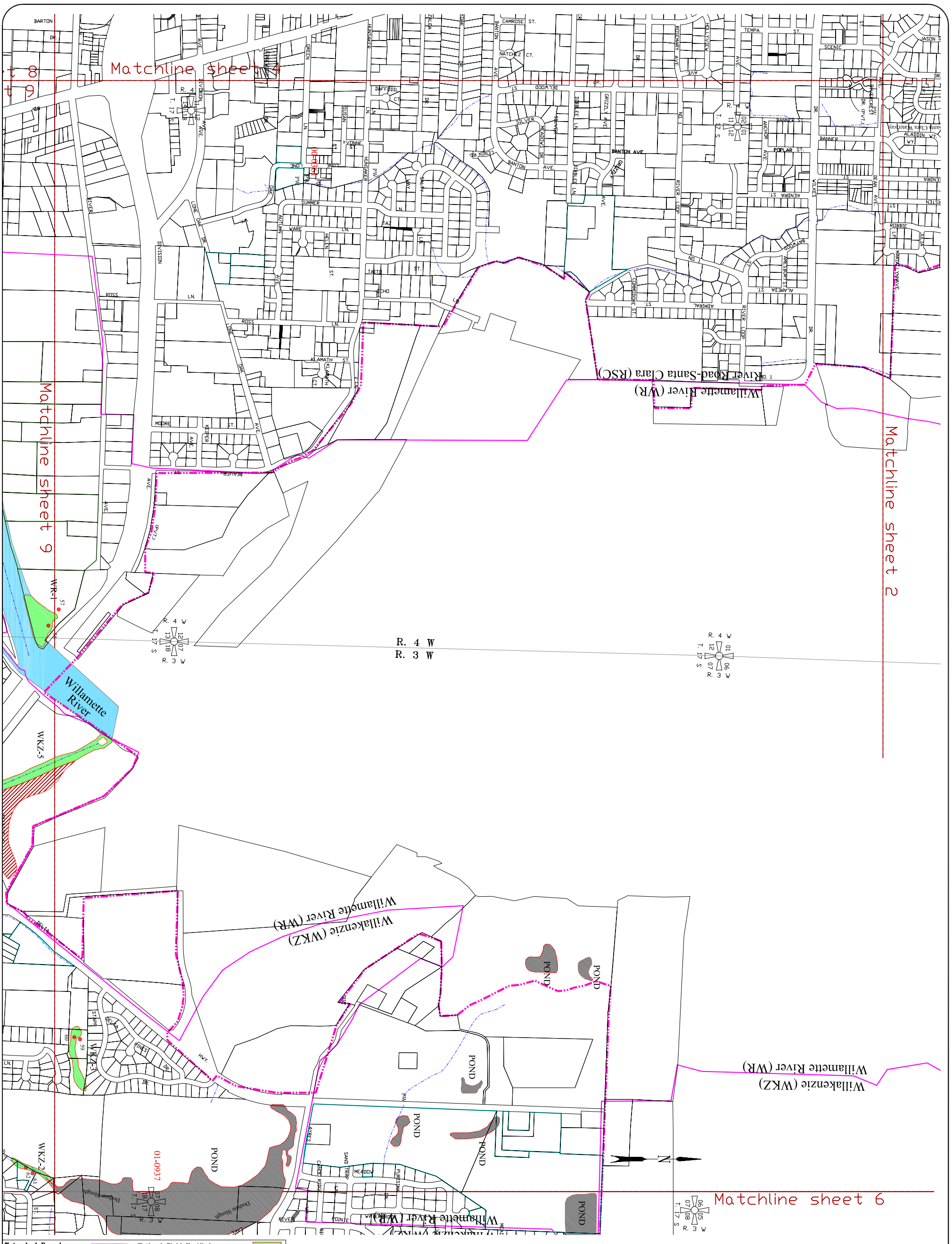
of: 24



Watershed Boundary	
Project Boundary/UGB	
Potentially Jurisdictional Creeks/drainages	
Sample Point	58
Wetland Code	RSC-10
Probable Wetland	PW
DSL Determination File	01-0523
Wetland Field Verified	
Wetland Non-Field Verified	
Pond	
City Owned Parcels	
Lots Permission Yes	
Rivers and Channels	

GRAPHIC SCALE

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Scale in Feet

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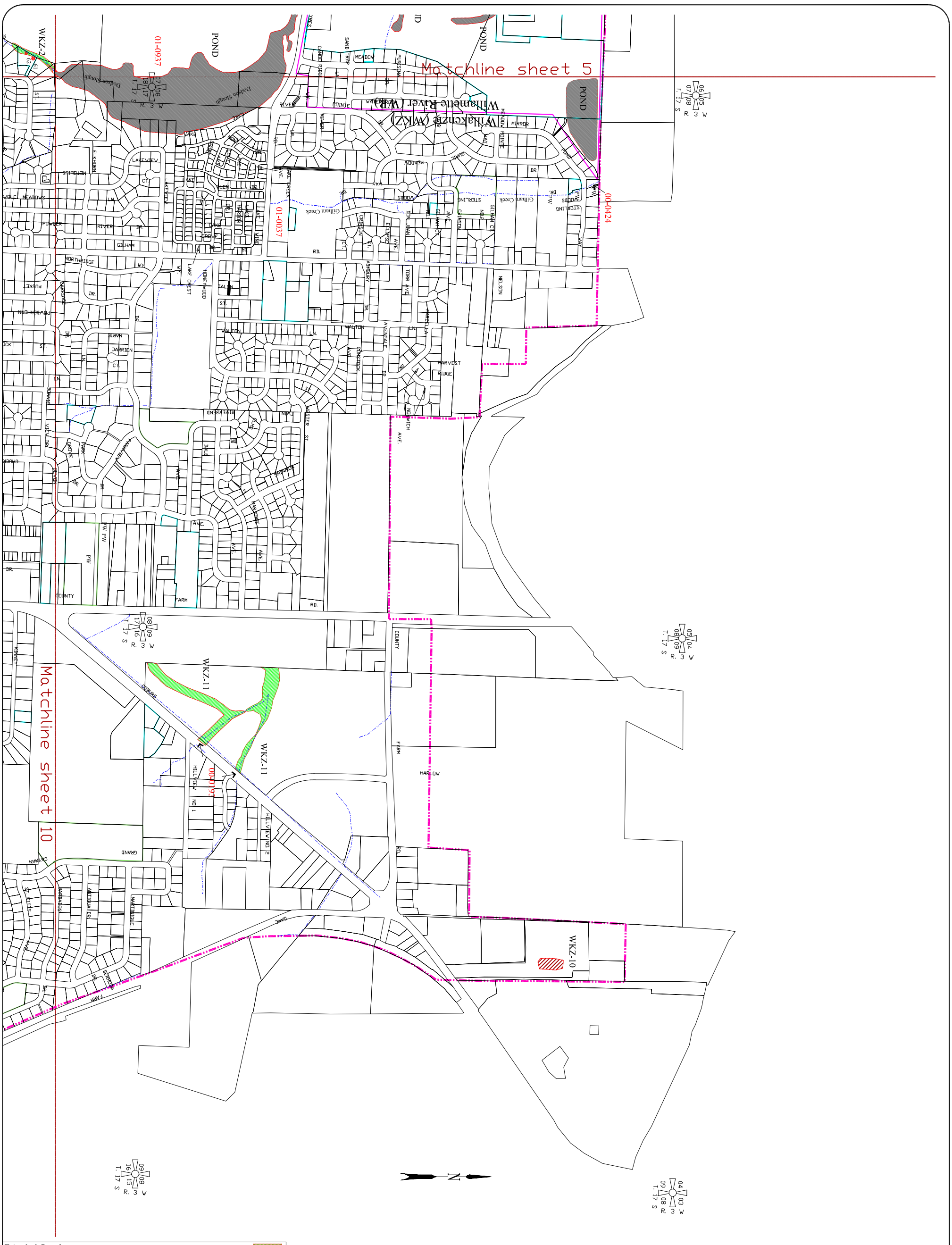
of: 24



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Project Boundary/UGB		Wetland Non-Field Verified	
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Probable Wetland	PW	Rivers and Channels	
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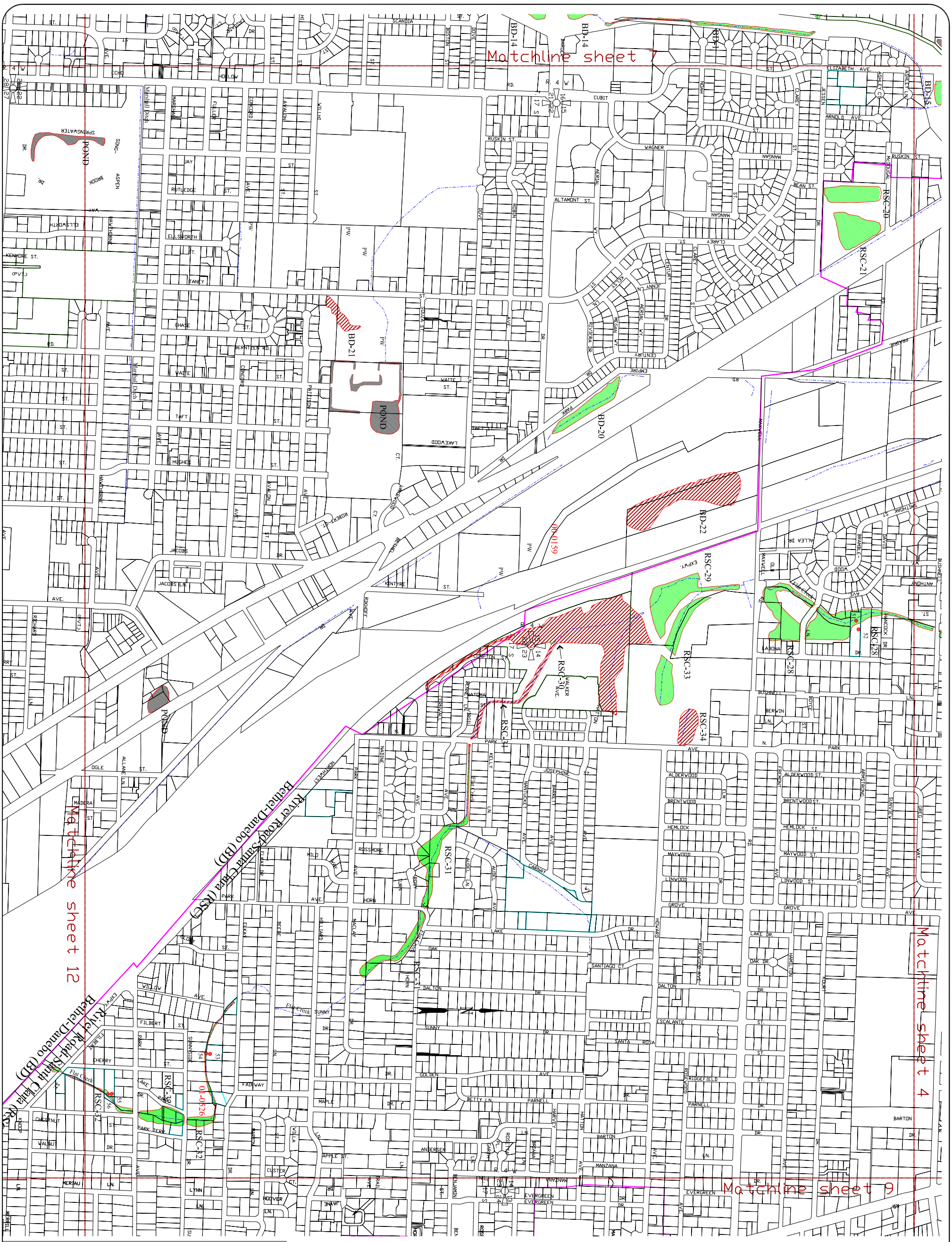

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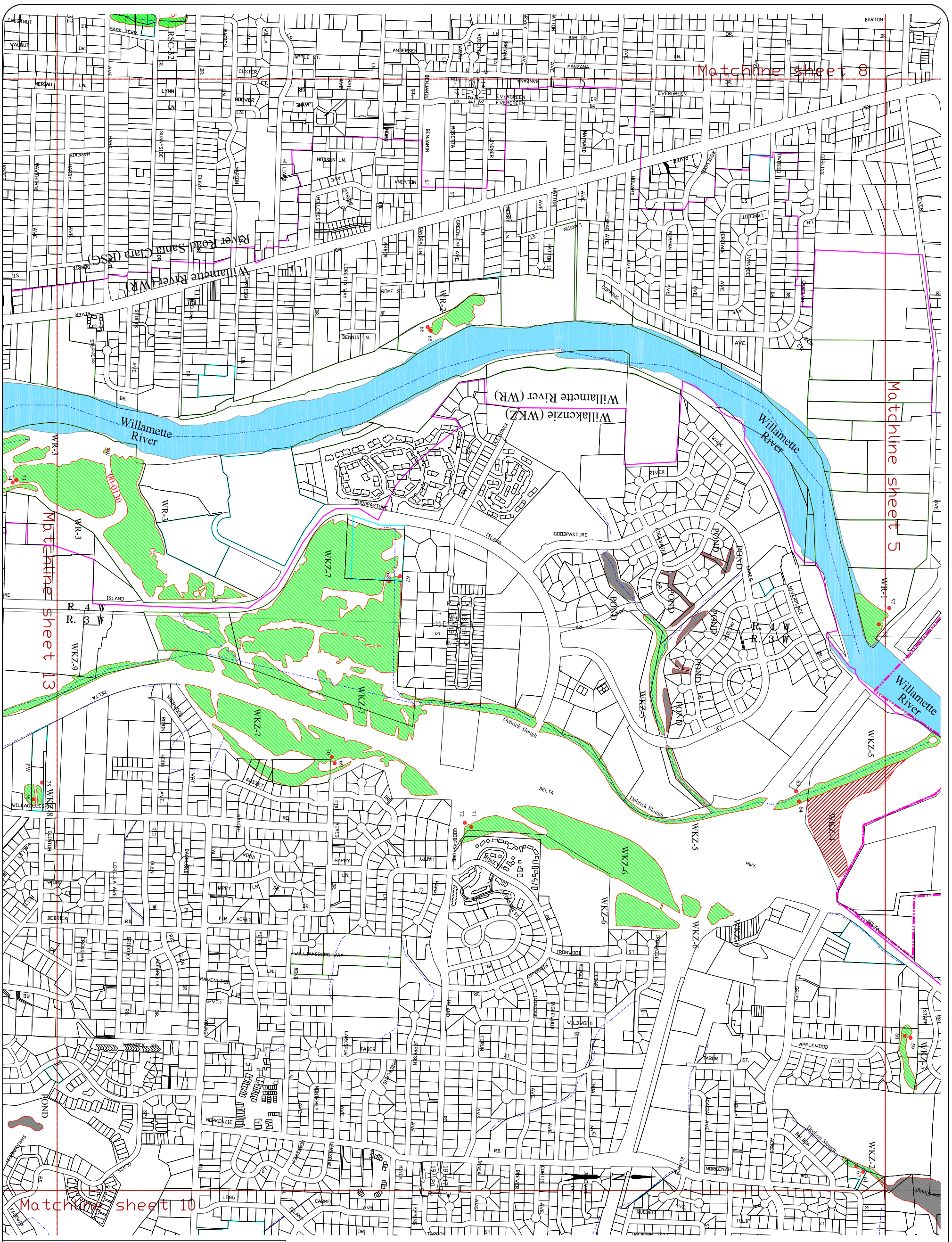

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GRAPHIC SCALE

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Scale in Feet

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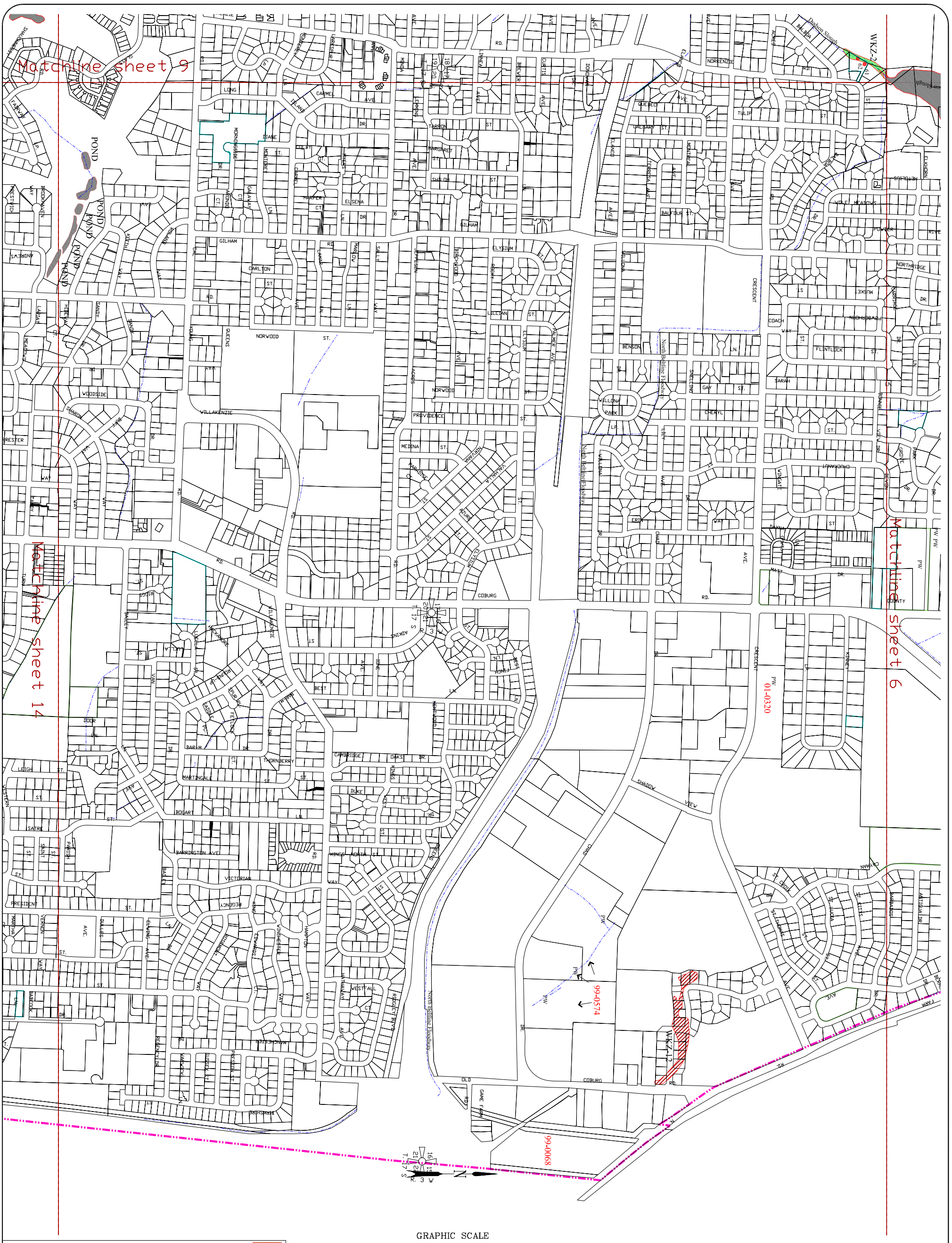

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DSL Determination File	01-0523		

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Scale in Feet

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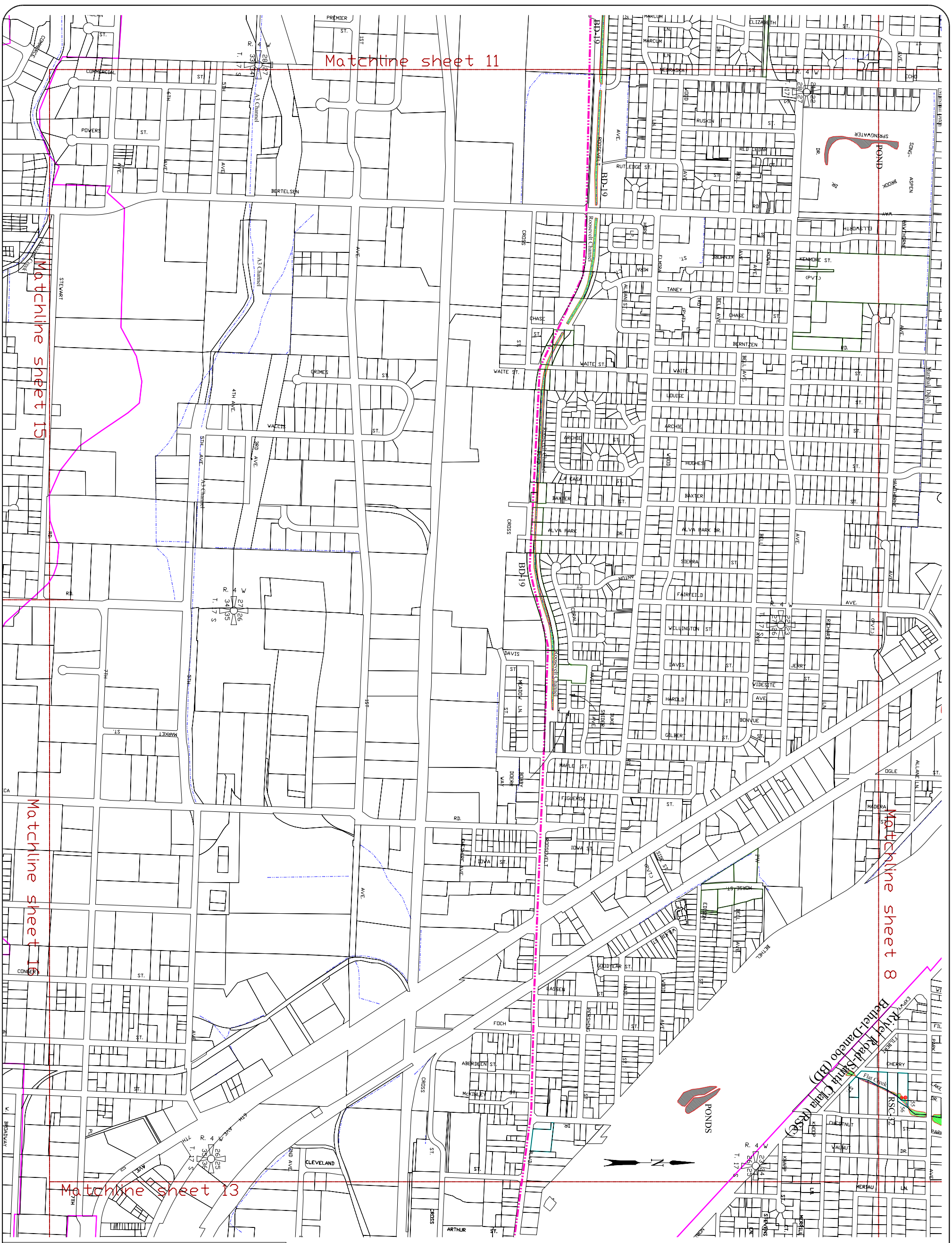

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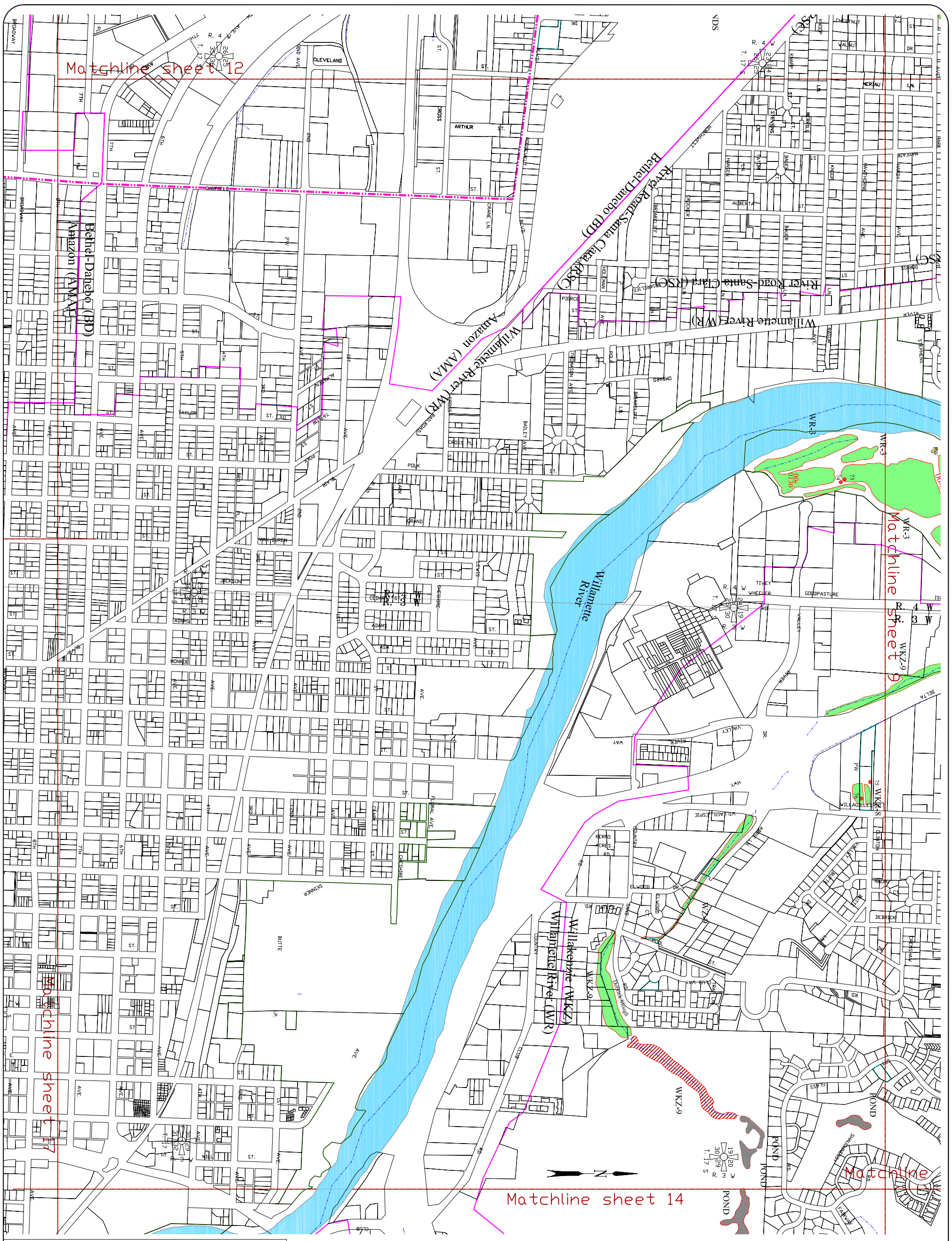

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Project Boundary/UGB	Wetland Non-Field Verified
Potentially Jurisdictional Creeks/drainages	Pond
Sample Point	City Owned Parcels
Wetland Code	Lots Permission Yes
Probable Wetland	Rivers and Channels
DSL Determination File	

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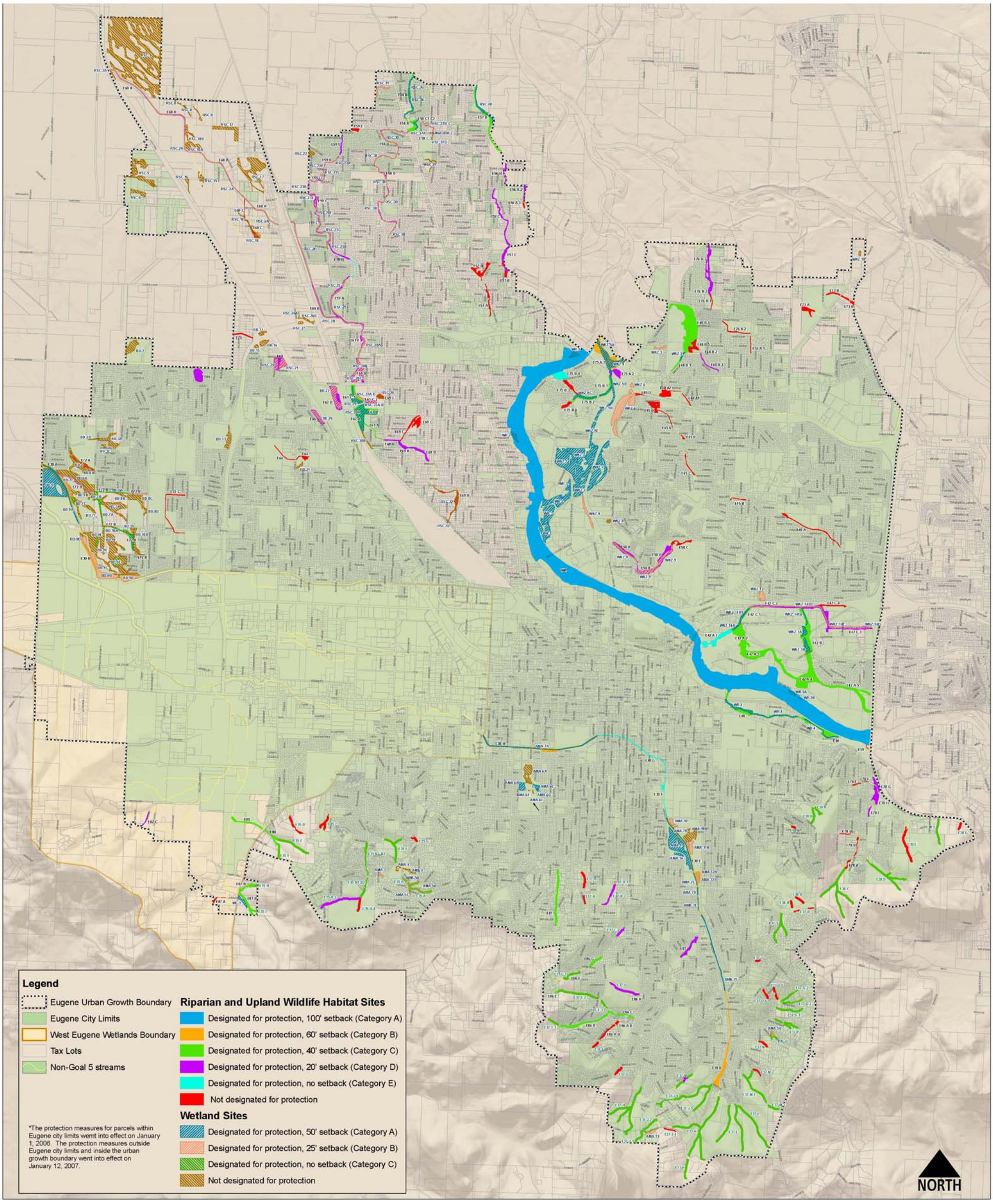
of: 24

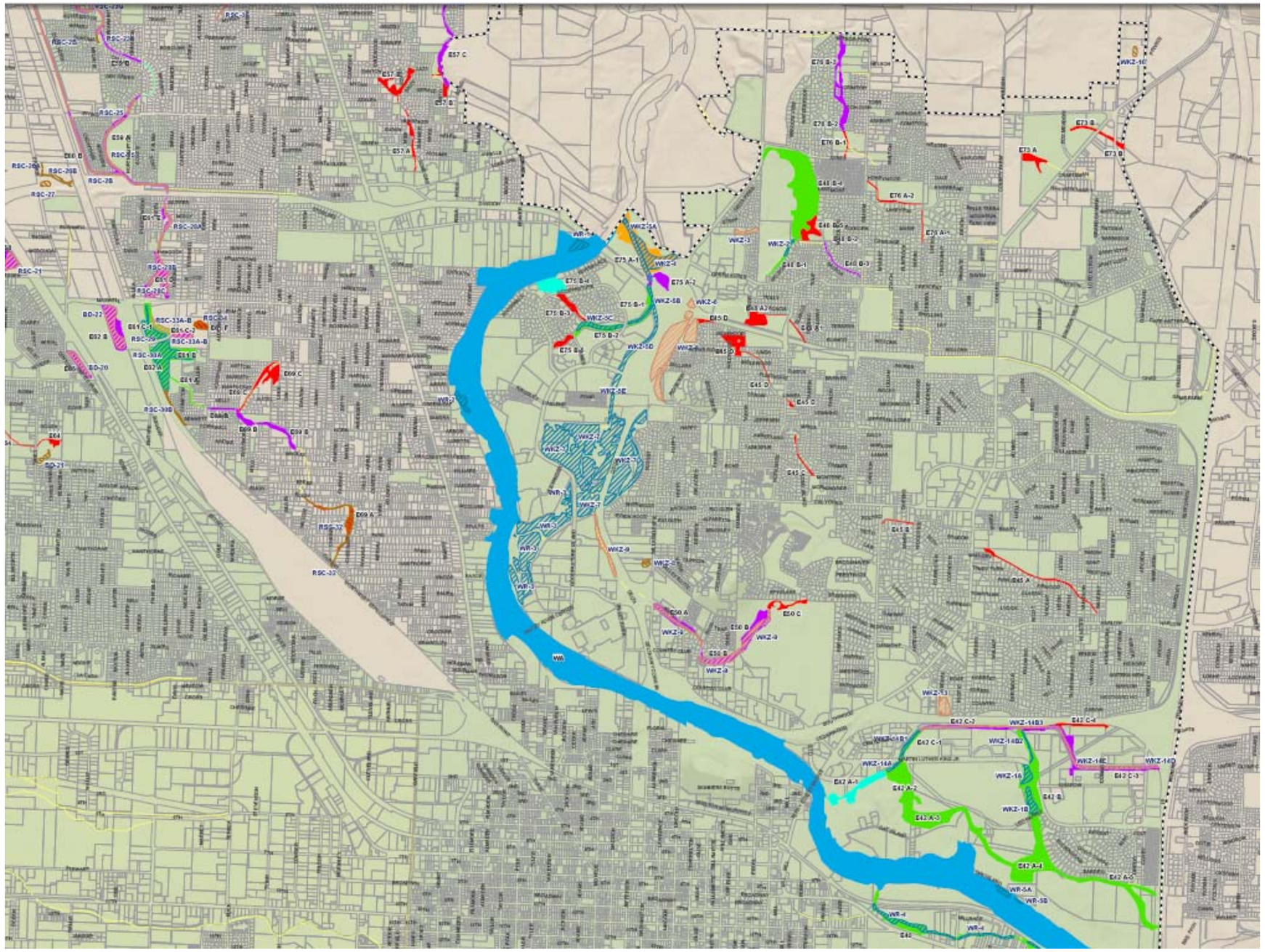
Appendix B: Eugene Goal 5 Protection Designations Map



Adopted* Protection Designations for the Eugene Goal 5 Wetland, Riparian and Upland Wildlife Habitat Inventories

November 14, 2005
Eugene Planning Division

0 0.150.3 0.6 0.9 1.2 Miles



Appendix C: Soil Type Descriptions

The descriptions of soil types provided in this Appendix are excerpted from the Lane County Soil Survey Report prepared by the Natural Resources Conservation Service (formerly Soil Conservation Service) and published in 1987.

5-Awbrig silty clay loam. This deep, poorly drained soil is in plane to concave areas on stream terraces and in drainageways. It formed in mixed clayey and silty alluvium. Slope is 0 to 2 percent. Areas are elongated or irregular in shape and are 3 acres to more than 300 acres in size. The vegetation in areas not cultivated is mainly grasses, sedges, rushes, hawthorn, wild rose, and Oregon ash. Elevation is 290 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The upper part of the subsoil is very dark gray and very dark grayish brown clay and silty clay about 22 inches thick, and the lower part is grayish brown silty clay loam about 19 inches thick. The substratum is dark brown clay loam to a depth of 60 inches or more. In some areas the surface layer is silt loam.

Included in this unit are small areas of Bashaw, Coburg, Conser, Dayton, and Holcomb soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Awbrig soil is very slow. Available water capacity is about 1.5 to 3.0 inches. Effective rooting depth is limited by a high water table that is at a depth of 0 to 12 inches from November to May. Runoff is very slow, and the hazard of water erosion is slight. The soil is subject to rare periods of flooding.

This unit is used mainly for hay, pasture, small grain, and grass seed production.

If this unit is used for hay and pasture, wetness limits the choice of plants and the periods of cutting or grazing and increases the risk of winterkill. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Fertilizer is needed for optimum growth of grasses and legumes.

Where drained, this unit is suited to grass seed production and small grain. It is limited mainly by wetness and the dense clay layer. Drainage of this unit is difficult and expensive because the dense clay layer
requires close spacing of the tile drains; however, long lasting benefits have been observed over a period of 20 years where tiles were properly installed and maintained.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to lime and nitrogen fertilizer. To prevent damage to crops as well as compaction of the soil, vehicles with large, low pressure tires

can be used to apply fertilizer early in spring.
If this unit is used for recreational development, the main limitations are wetness, very slow permeability, and high clay content. Drainage is required if paths and trails are developed.
If this unit is used for homesite development, the main limitations are wetness, high clay content, low soil strength, and high shrink-swell potential. Seasonal wetting and drying can cause foundations and roads to crack and heave. Roads for year-round use need heavy base rock.
This unit is in capability subclass IVw.

8-Bashaw clay. This deep, poorly drained soil is on flood plains, terraces, and fans. It formed in fine textured alluvium. Slope is 0 to 1 percent. Areas are elongated in shape and are 3 to 100 acres in size. The vegetation in areas not cultivated is mainly Oregon ash, hawthorn, rushes, sedges, and grasses. Elevation is 290 to 500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark gray clay about 7 inches thick. The next layer is black and very dark gray clay about 34 inches thick. The substratum to a depth of 63 inches or more is olive brown and light brownish gray silty clay. In some areas the surface layer is silty clay or silty clay loam.
Included in this unit are small areas of Awbrig, Conser, Courtney, Natroy, and Oxley soils. Included areas make up about 15 percent of the total acreage.
Permeability of the Bashaw soil is very slow. Available water capacity is about 2 to 4 inches. Effective rooting depth is limited by a seasonal high water table that is 12 inches above the surface to 6 inches below the surface from November to May. Runoff is very slow to ponded, and the hazard of water erosion is slight. The soil is subject to occasional, long periods of flooding from December to April.
This unit is used mainly for ryegrass seed, hay, pasture, and wildlife habitat. It is also used for recreational and homesite development.
This unit is suited to hay and pasture. Only those plants that tolerate periodic inundation and a seasonal high water table are suitable for use in undrained areas of the unit. Grazing when this unit is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Open drainage or grassed waterways can be used to remove surface water if a suitable outlet is available. Tile drains can be used with gravel backfill where ditches are undesirable. Tile drains are not efficient for lowering the water table because of the very slow permeability. Use of nitrogen fertilizer promotes good growth of forage plants. Late in summer, cracking of the surface is severe.
If this unit is used for recreational development, the main limitations are the high clay content, wetness, the hazard of

flooding, and very slow permeability.
If this unit is used for homesite development, the main limitations are the hazard of flooding, very slow permeability, wetness, high shrink-swell potential, and low soil strength. If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.
This map unit is in capability subclass IVw.

11C-Bellpine silty clay loam, 3 to 12 percent slopes.
This moderately deep, well drained soil is in convex positions on foothills and uplands in the Willamette Valley. It formed in colluvium and residuum derived from sandstone, siltstone, and volcanic tuff and breccia. Areas are irregular in shape and are 3 to 200 acres in size. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, poison-oak, salal, and western swordfern. Elevation is 400 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 52 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is dark reddish brown silty clay loam about 13 inches thick. The subsoil is dark reddish brown and dark red silty clay about 21 inches thick. Weathered tuffaceous sandstone is at a depth of 34 inches. Depth to bedrock ranges from 20 to 40 inches.
Included in this unit are small areas of Dupee, Jory, Nekia, and Ritner soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Bellpine soil is slow. Available water capacity is about 3.5 to 6.0 inches. Water supplying capacity is 17 to 24 inches. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.
This unit is used mainly for timber production, hay and pasture, and homesites. It is also used for Christmas trees, small grain, orchards, recreation, and wildlife habitat.
If this unit is used for hay and pasture, the main limitations are low soil fertility, high acidity, high clay content, susceptibility to compaction when wet, and low precipitation in summer. Use of lime and fertilizer promotes good growth of forage plants. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil in this unit from erosion. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage. In most years, supplemental irrigation is also needed.
This unit is suited to cultivated crops. In summer, irrigation

is needed for maximum production of most crops. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Christmas tree plantings need brush, weed, and rodent control and periodic shearing or shaping to ensure growth of a compact tree of uniform shape.

This unit is suited to the production of Douglas-fir. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 155. The potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old.

The main concerns in producing and harvesting timber are the susceptibility of the soil to compaction and slow permeability, which contribute to a high hazard of erosion during the wet season.

Surface methods of harvesting timber generally are suitable, but the soil may be compacted if heavy equipment is used while the soil is moist. Ripping skid trails and landing areas after logging helps to break up the compacted layer and improves seedling survival and growth.

Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. Competing vegetation can be controlled by properly preparing the site and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Hand planting of nursery stock is usually necessary to establish or improve a stand.

Douglas-fir is suitable for planting.

If this unit is used for recreational development, the main limitations are the high clay content, slow permeability, depth to rock, and slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

If this unit is used for homesite development, the main limitations are the high clay content, slow permeability, and

depth to rock. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Cuts needed to provide essentially level building sites can expose bedrock. Roads for year-round use need heavy base rock.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

If this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field. Absorption lines should be installed on the contour.

This map unit is in capability subclass IIIe.

22-Camas gravelly sandy loam, occasionally flooded.

This deep, excessively drained soil is on bottom lands. It formed in recent sandy and gravelly alluvium. Slopes are 0 to 3 percent. Areas are irregular or elongated in shape and are 3 to 30 acres in size. The vegetation in areas not cultivated is mainly black cottonwood, bigleaf maple, Oregon ash, blackberry, shrubs, and grasses. Elevation is 290 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 14 inches thick. The substratum to a depth of 60 inches or more is dark brown very gravelly sand.

Included in this unit are small areas of Cloquato and Newberg soils, Fluvents, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Camas soil is very rapid. Available water capacity is about 1.5 to 3.5 inches. Water supplying capacity is 10 to 18 inches. Effective rooting depth is 8 to 14 inches. It is limited by the very gravelly substratum. Runoff is slow, and the hazard of water erosion is slight except during periods of overflow from nearby streams. The soil is subject to occasional, brief periods of flooding from November to May.

This unit is used mainly for cereal grain, pasture, hay, and vegetables. It is also used for gravel pits and as homesites.

If this unit is used for crops, the main limitations are low soil fertility, low available water capacity, and the content of gravel. Fertilizer is needed because of the low soil fertility. Irrigation water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Returning all crop residue to the soil and using

a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. The gravel may interfere with the cultivation of intertilled crops.
If this unit is used for hay and pasture, proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.
If this unit is used for homesite development, the main limitations are the hazard of flooding and very rapid permeability. Some areas of this unit that are slightly above the general level of the flood plain are rarely flooded. This unit is a good source of gravel and roadfill for farm roads.
This map unit is in capability subclass IVw.

23-Camas-Urban land complex. This map unit is on the higher lying parts of flood plains. Slope is 0 to 3 percent. Areas are elongated to irregular in shape and are 3 to 30 acres in size. The native vegetation is mainly black cottonwood, bigleaf maple, Oregon ash, blackberry, shrubs, and grasses. Elevation is 400 to 1,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
This unit is 40 percent relatively undisturbed Camas gravelly sandy loam, 10 percent disturbed Camas gravelly sandy loam, and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.
Included in this unit are small areas of Cloquato and Newberg soils. Included areas make up about 10 percent of the total acreage.
The relatively undisturbed Camas soil is deep and excessively drained. It formed in recent sandy and gravelly alluvium. Typically, the surface layer is very dark grayish brown gravelly sandy loam about 14 inches thick. The substratum to a depth of 60 inches or more is dark brown very gravelly sand.
Permeability of this Camas soil is very rapid. Available water capacity is about 1.5 to 3.5 inches. Water supplying capacity is 10 to 18 inches. Effective rooting depth is 8 to 14 inches. It is limited by the very gravelly substratum. Runoff is slow, and the hazard of water erosion is slight except during periods of overflow from flooding of nearby streams. The soil is subject to only rare periods of flooding because of the construction of large dams on the major rivers.
The disturbed Camas soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Camas, Newberg, or Cloquato soils that have been cut or graded. The disturbed areas have highly variable properties.
Urban land consists of areas where the soils are largely

covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.

This unit is used mainly for urban development. It is also used for yards and as open areas around and between buildings.

If this unit is used for urban development, the main limitation is the hazard of rare flooding from prolonged, heavy rainfall and snowmelt that fill the large reservoirs upstream and override the effect of the dams. The chance of such an event occurring is about once in 100 years, although the chance of a storm occurring that might cause minor damage and isolation of some areas by water flowing through some of the lower channels in the unit is once in 50 years.

In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate droughtiness should be selected if irrigation is not provided.

This map unit is not assigned a capability classification.

24-Chapman loam. This deep, well drained soil is on low river terraces. It formed in recent mixed alluvium. Slopes are 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, bigleaf maple, Oregon white oak, blackberry, shrubs, and grasses. Elevation is 300 to 1,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the upper part of the surface layer is dark brown loam about 8 inches thick and the lower part is very dark grayish brown clay loam about 6 inches thick. The subsoil is dark brown and dark yellowish brown loam about 28 inches thick. The upper part of the substratum is brown gravelly sandy loam about 8 inches thick, and the lower part to a depth of 60 inches or more is dark brown very gravelly sandy loam.

Included in this unit are small areas of Chehalis, Malabon, McBee, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Chapman soil is moderate. Available water capacity is about 8 to 12 inches. Water supplying capacity is 19 to 24 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding.

This unit is used mainly for row crops, grass seed, and small grain. It is also used for orchards, recreation, pasture, homesites, and urban development.

This unit is suited to all climatically adapted crops. It is most valued for root crops such as carrots because the surface layer can be easily dug.

In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is suited to pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Flooding can be controlled only by use of major flood control structures. Dikes and channels that have outlets to bypass floodwater can be used to protect buildings and onsite sewage disposal systems from flooding.

In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate droughtiness should be selected if irrigation is not provided.

This unit is in capability class I.

25-Chapman-Urban land complex. This map unit is on low river terraces. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres in size. The native vegetation is mainly Douglas-fir, bigleaf maple, Oregon white oak, blackberry, shrubs, and grasses. Elevation is 300 to 1,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is 40 percent relatively undisturbed Chapman loam, 5 percent disturbed Chapman loam, and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Chehalis, Salem, McBee, and Malabon soils. Included areas make up about 15 percent of the total acreage.

The relatively undisturbed Chapman soil is deep and well drained. It formed in recent mixed alluvium. Typically, the upper part of the surface layer is dark brown loam about 8 inches thick, and the lower part is very dark grayish brown clay loam about 6 inches thick. The subsoil is dark brown and dark yellowish brown loam about 28 inches thick. The upper part of the substratum is brown gravelly sandy loam about 8 inches thick, and the lower part to a depth of 60 inches or

more is dark brown very gravelly sandy loam. Strata of coarse sand and gravel are common below a depth of 40 inches. Permeability of this Chapman soil is moderate. Available water capacity is about 8 to 12 inches. Water supplying capacity is 19 to 24 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding.

The disturbed Chapman soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Chapman, Chehalis, Salem, McBee, or Malabon soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.

Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.

This unit is used mainly for urban development. It is also used for yards and as open areas around and between buildings.

If this unit is used for urban development, the main limitation is the hazard of rare flooding from prolonged, heavy rainfall and snowmelt that fill the large reservoirs upstream and override the effect of the dams.

In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate droughtiness should be selected if irrigation is not provided.

This map unit is not assigned a capability classification.

26-Chehalis silty clay loam, occasionally flooded.

This deep, well drained soil is on flood plains. It formed in recent mixed alluvium. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, bigleaf maple, Oregon white oak, black cottonwood, shrubs, and grasses. Elevation is 290 to 1,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 13 inches thick. The subsoil is dark brown and brown silty clay loam about 42 inches thick. The substratum to a depth of 70 inches is brown silt loam.

Included in this unit are small areas of Chapman, Cloquato, McBee, and Newberg soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Chehalis soil is moderate. Available water capacity is about 11 to 13 inches. Water supplying

capacity is 20 to 26 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November to March.

Most areas of this unit are used for row crops, small grain, hay, pasture, and orchards. A few areas are used as homesites and for recreation.

This unit is suited to all climatically adapted crops. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

In winter and spring, cover crops help to protect the soil from erosion by flooding. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.

This unit is suited to recreational development because of its location near streams. It is limited mainly by the hazard of flooding and the clay content of the surface layer.

If this unit is used for homesite development, the main limitations are the hazard of flooding and the moderate shrink-swell potential. The risk of flooding has been reduced in some areas by the construction of dams and reservoirs on large streams. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

This unit is in capability subclass IIw.

27-Chehalis-Urban land complex. This map unit is on flood plains. Slope is 0 to 3 percent. Areas are elongated in shape and are 2 to 100 acres or more in size. The native vegetation is mainly Douglas-fir, bigleaf maple, Oregon white oak, black cottonwood, shrubs, and grasses. Elevation is 300 to 1,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is 40 percent relatively undisturbed Chehalis silty clay loam, 10 percent disturbed Chehalis silty clay loam, and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Chapman,

Cloquato, McBee, and Newberg soils. Included areas make up about 10 percent of the total acreage.
The relatively undisturbed Chehalis soil is deep and well drained. It formed in recent mixed alluvium. Typically, the surface layer is dark brown silty clay loam about 13 inches thick. The subsoil is dark brown and brown silty clay loam about 42 inches thick. The substratum to a depth of 70 inches is brown silt loam.
Permeability of this Chehalis soil is moderate. Available water capacity is about 11 to 13 inches. Water supplying capacity is 20 to 26 inches. Effective rooting depth is more than 60 inches. This soil is occasionally flooded for brief periods from November to March.
The disturbed Chehalis soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Chehalis, Chapman, Cloquato, and Newberg soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.
Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.
This unit is used mainly for urban development. It is also used for yards and as open areas around and between buildings.
If this unit is used for urban development, the main limitation is the hazard of flooding from prolonged, heavy rainfall and snowmelt that fill the large reservoirs upstream and override the effect of the dams. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.
In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate droughtiness should be selected if irrigation is not provided.
This map unit is not assigned a capability classification.

28E-Chehulpum slit loam, 12 to 40 percent slopes. This shallow, well drained soil is on low foothills in the Willamette Valley. It formed in colluvium derived from sedimentary rock. Areas are irregular in shape and are 3 to 40 acres in size. The vegetation in areas not cultivated is mainly annual grasses, wild rose, Oregon white oak, and poison-oak. Elevation is 400 to 1,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark grayish brown silt

loam about 7 inches thick. The next layer is dark brown clay loam about 6 inches thick. Weathered sedimentary rock is at a depth of 13 inches. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Hazelair, Philomath, Steiwer, Willakenzie, and Witzel soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Chehulpum soil is moderate. Available water capacity is about 2 to 4 inches. Water supplying capacity is 6 to 13 inches. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for wildlife habitat and some livestock grazing.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If this unit is used for recreational development, the main limitations are steepness of slope and shallow depth to rock. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are shallow depth to rock and steepness of slope. Cuts needed to provide essentially level building sites can expose bedrock. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Only the part of the site that is used for construction should be disturbed. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability subclass VIe.

29-Cloquato silt loam. This deep, well drained soil is on flood plains. It formed in recent mixed alluvium. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, black cottonwood, bigleaf maple, Oregon white oak, western swordfern, and creambush oceanspray. Elevation is 290 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The next layer is very dark grayish brown silt loam about 19 inches thick. The upper 17 inches of the substratum is dark brown silt loam, and the lower part to a depth of 60 inches or more is multicolored sand.

Included in this unit are small areas of Chapman,

Chehalis, McBee, and Newberg soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Cloquato soil is moderate. Available water capacity is about 9 to 14 inches. Water supplying capacity is 19 to 26 inches. Effective rooting depth is 40 to 60 inches or more. It is limited by the
sandy substratum. Runoff is slow, and the hazard of water erosion is slight. The soil is subject to occasional, very brief periods of flooding from November to March.
This unit is used mainly for row crops, small grain, hay, and pasture. It is also used as homesites and for recreation.
This unit is suited to all climatically adapted crops. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Streambank cutting, erosion caused by overflow, and sedimentation can be reduced by maintaining adequate plant cover.
This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.
This unit is suited to recreational development.
Protection from flooding is needed.
If this unit is used for homesite development, the main limitation is the hazard of occasional flooding. Roads and streets should be located above the expected flood level.
This unit is in capability subclass IIw.

30-Cloquato-Urban land complex. This map unit is on flood plains. Slopes are 0 to 3 percent. Areas are elongated in shape and are 3 to 50 acres in size. The native vegetation is mainly Douglas-fir, black cottonwood, bigleaf maple, Oregon white oak, western swordfern, and creambush oceanspray. Elevation is 300 to 800 feet. The average annual precipitation is about 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
This unit is 40 percent undisturbed Cloquato, silt loam, 5 percent disturbed Cloquato silt loam, and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.
Included in this unit are small areas of Chapman, Chehalis, McBee, and Newberg soils. Included areas

make up about 15 percent of the total acreage.
The undisturbed Cloquato soil is deep and well drained. It formed in recent mixed alluvium. Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The next layer is very dark grayish brown silt loam about 19 inches thick. The upper 17 inches of the substratum is dark brown silt loam, and the
lower part to a depth of 60 inches or more is
multicolored sand.
Permeability of this Cloquato soil is moderate. Available water capacity is 9 to 14 inches. Water supplying capacity is 19 to 26 inches. Effective rooting depth is 40 to 60 inches or more. It is limited by the sandy substratum. Runoff is slow, and the hazard of water erosion is moderate. This soil is subject to occasional, very brief periods of flooding from November to March.
The disturbed Cloquato soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Cloquato, Chehalis, Chapman, Newberg, or McBee soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.
Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.
This unit is used mainly for urban development. It is also used for yards and as open areas around and between buildings.
If this unit is used for urban development, the main limitation is the hazard of flooding. Roads and streets should be located above the expected flood level.
In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate flooding and droughtiness should be selected if irrigation is not provided.
This map unit is not assigned a capability classification.

31-Coburg silty clay loam. This deep, moderately well drained soil is on low stream terraces. It formed in silty and clayey mixed alluvium. Slope is 0 to 3 percent. Areas are irregular in shape and are 5 to 100 acres in size. The vegetation in areas not cultivated is mainly Oregon ash, Douglas-fir, Oregon white oak, and poison-oak. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark grayish brown silty

clay loam about 18 inches thick. The subsoil is dark brown, mottled silty clay loam and silty clay about 35 inches thick. The substratum to a depth of 65 inches is dark brown, mottled fine sandy loam.

Included in this unit are small areas of Conser, Malabon, Oxley, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Coburg soil is moderately slow. Available water capacity is about 10 to 12 inches. Water supplying capacity is 20 to 26 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. A high water table is at a depth of 1.5 to 2.5 feet from November to May.

This unit is used for small grain, grass seed, pasture, orchards, irrigated vegetable crops, recreation, and urban development.

This unit is suited to many kinds of crops. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Orchards and vegetable crops should have cover crops to help protect the soil. Restricting use of machinery when this unit is wet minimizes compaction.

This unit is suited to pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.

If this unit is used for recreational development, the main limitations are the high content of clay and moderately slow permeability.

If this unit is used for urban development, the main limitations are the seasonal high water table, moderately slow permeability, and low soil strength. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Roads and streets can be built if they are designed to compensate for the instability of the subsoil and if a maximum amount of base rock is used. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.

This unit is in capability subclass IIw.

32-Coburg-Urban land complex. This map unit is on low stream terraces. Slope is 0 to 3 percent. Areas are irregular in shape and are 5 to 100 acres in size. The native vegetation is

mainly Douglas-fir, Oregon white oak, and poison-oak. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is 45 percent relatively undisturbed Coburg silty clay loam, 10 percent disturbed Coburg silty clay loam, and 30 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Conser, Malabon, Oxley, and Salem soils. Included areas make up about 15 percent of the total acreage.

The relatively undisturbed Coburg soil is deep and moderately well drained. It formed in silty and clayey mixed alluvium. Typically, the surface layer is very dark grayish brown silty clay loam about 18 inches thick. The subsoil is dark brown, mottled silty clay loam and silty clay about 35 inches thick. The substratum to a depth of 65 inches or more is dark brown, mottled fine sandy loam.

Permeability of this Coburg soil is moderately slow. Available water capacity is about 10 to 12 inches. Water supplying capacity is 20 to 26 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. A high water table is at a depth of 1.5 to 2.5 feet from November to May.

The disturbed Coburg soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Coburg, Malabon, Salem, Conser, and Oxley soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.

Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.

This unit is used mainly for urban development. It is also used for yards, parks, and open areas around and between buildings.

If this unit is used for urban development, the main limitations are the seasonal high water table, moderately slow permeability, and low soil strength. If buildings are constructed on the unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Roads and streets can be built if they are designed to compensate for the instability of the subsoil and if a maximum of base rock is used. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.

This map unit is not assigned a capability

classification.

33-Conser silty clay loam. This deep, poorly drained soil is in depressional areas along drainageways. It formed in silty and clayey mixed alluvium. Slopes are 0 to 2 percent. Areas are irregular in shape and are 5 to 100 acres in size. The vegetation in areas not cultivated is mainly Oregon ash, Oregon white oak, hawthorn, rose, sedges, rushes, and grasses. Elevation is 300 to 500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silty clay loam about 9 inches thick. The upper 5 inches of the subsoil is very dark grayish brown silty clay, and the lower 27 inches is very dark gray and brown, mottled clay and silty clay. The substratum to a depth of 60 inches or more is dark grayish brown, mottled loam and
sandy loam. In some areas coarse sand and gravel are below a depth of 40 inches.

Included in this unit are small areas of Awbrig, Bashaw, and Coburg soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Conser soil is slow. Available water capacity is about 9 to 12 inches. Water supplying capacity is 15 to 20 inches. Effective rooting depth is limited by a high water table that is at a depth of 0 to 1.5 feet from November to May. Runoff is slow, and the hazard of water erosion is slight. The soil is subject to rare periods of flooding.

This unit is used mainly for hay, pasture, and grass seed. Where drainage is provided, it is also used for corn and other cultivated crops.

This unit is suited to water-tolerant or shallow-rooted crops. Deep-rooted crops are suited to areas where an adequate drainage system has been installed. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Crops respond to nitrogen and phosphorus.

Grazing when this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

If this unit is used for recreational development, the main limitations are wetness, slow permeability, and the content of clay in the surface layer and subsoil.

If this unit is used for homesite development, the main limitations are slow permeability, wetness, the content of clay

in the surface layer and subsoil, high shrink-swell potential, and low soil strength when wet. Perimeter drains and properly designed footings and foundations help to reduce wetness and prevent structural damage from shrinking and swelling. Roads for year-round use need heavy base rock. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.
This map unit is in capability subclass IIIw.

34-Courtney gravelly silty clay loam. This deep, poorly drained soil is in drainageways and other depressional areas of valley terraces. It formed in gravelly and clayey mixed alluvium. Slopes are 0 to 3 percent. Areas are elongated or irregular in shape and are 3 to 100 acres in size. The vegetation in areas not cultivated is mainly grasses, sedges, rose, hawthorn, and Oregon ash. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark brown gravelly silty clay loam about 15 inches thick. The upper part of the subsoil is dark grayish brown gravelly clay about 13 inches thick, and the lower part is brown very gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is multicolored very gravelly sand.
Included in this unit are small areas of Awbrig, Bashaw, Natroy, and Oxley soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Courtney soil is very slow. Available water capacity is about 5.0 to 7.5 inches. Water supplying capacity is 12 to 16 inches. Effective rooting depth is limited by a dense clay layer and a high water table that is at a depth of 0 to 1.5 feet from December to May. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding.
This unit is used mainly for pasture. Where drained, it is also used for hay, grass seed, and spring grain.
If this unit is used for pasture, the main limitations are wetness and the hazard of compaction. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Tile drainage can be used to lower the water table if a suitable outlet is available. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water.
Grain and grasses on this unit respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.
If this unit is used for recreational development, the main limitations are the clay content, shrink-swell potential, poor

drainage, and the pebbles and cobbles in the surface layer. This unit is poorly suited to homesite development. The main limitations are poor drainage; the clayey subsoil, which has low strength when wet; and high shrink-swell potential. Using perimeter tile drains and diverting runoff away from buildings help to reduce wetness. Buildings and roads on this unit should be designed to offset the limited ability of the soil to support a load. Roads for year-round use need heavy base rock.
This map unit is in capability subclass IVw.

48-Fluvents, nearly level. These deep, well drained to poorly drained soils are on islands and low flood plains and in overflow channels, oxbows, and sloughs along major rivers and streams. They formed in recently deposited sediment derived from mixed sources. Areas are elongated in shape and are 2 to 200 acres in size. The native vegetation is mainly cottonwood, Douglas-fir, Oregon white oak, Oregon ash, red alder, bigleaf maple, shrubs, and grasses. Elevation is 5 to 1,500 feet. The average annual precipitation is 40 to 90 inches, the average annual air temperature is 47 to 52 degrees F, and the average frost-free period is 150 to 210 days.
Fluvents are brown and dark brown, highly stratified sand, silt, and gravel to a depth of 40 to 60 inches or more. The substratum is loose, open gravel or gravelly loamy sand. Depth to bedrock is 40 to 60 inches or more.
Included in this unit are small areas of Riverwash. In the Willamette Valley are small areas of Camas, Chehalis, Cloquato, McBee, Wapato, Abiqua, McAlpin, and Waldo soils. In the Cascade Range are small areas of Haflinger and Saturn soils. In the Coast Range are small areas of Meda, Nehalem, Nekoma, Nestucca, and Willanch soils.
Permeability of Fluvents is moderate to very rapid. Available water capacity and water supplying capacity are highly variable. Effective rooting depth is 20 to 60 inches or more. Runoff is slow, and the hazard of water erosion is slight except during periods of flooding of adjacent streams. A fluctuating water table rises and falls with stream levels during periods of heavy runoff.
Most areas of this unit are used for wildlife habitat and recreation. A few areas are used for timber production.
This unit supports limited stands of black cottonwood and red alder. The main concerns in producing and harvesting timber are the hazard of flooding and the hazard of water erosion in areas where the protective vegetation has been removed. Among the trees that are suitable for planting are black cottonwood and red alder. Western hemlock, western redcedar, and Douglas-fir can be planted in some areas.
This map unit is in capability subclass VIIw.

52B-Hazelair silty clay loam, 2 to 7 percent slopes. This moderately deep, moderately well drained soil is on convex foot slopes of the Coast and Cascade Ranges. It formed in colluvium overlying sedimentary rock. Areas are irregular in shape and are 5 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Oregon white oak, poison-oak, Douglas-fir, ponderosa pine, Oregon ash, wild rose, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silty clay loam about 11 inches thick. The subsoil is dark brown silty clay about 4 inches thick. The substratum is dark brown and light olive brown, mottled clay about 21 inches thick. Weathered bedrock is at a depth of 36 inches. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Dixonville, Dupee, Panther, and Philomath soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Hazelair soil is very slow. Available water capacity is about 4 to 7 inches. Water supplying capacity is 18 to 22 inches. Effective rooting depth is limited by a high water table that is at a depth of 1 foot to 2 feet from December to April. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for hay, pasture, small grain, and blackberries. Some areas are used as homesites. If this unit is used for hay and pasture, the main limitations are the clayey surface layer, the seasonal high water table, very slow permeability, and restricted rooting depth. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and

restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from compaction and erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes. In most years, supplemental irrigation is also needed.

If this unit is used for cultivated crops, the main limitations are the clayey surface layer, wetness, and restricted rooting depth. The water table that builds up during the rainy period generally limits the suitability of this unit for deep-rooted crops. Tile systems are not efficient in lowering the water table because of the shallow depth to the claypan. Tile systems can be improved by installing them across the slope, which more efficiently intercepts water moving downslope above the claypan.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of

applying water.
Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.
If this unit is used for recreational development, the main limitations are wetness and slow permeability. Use is limited to picnic areas, paths, and trails during the of the year. Drainage should be provided for paths and trails.
This unit is poorly suited to homesite development. Drainage is needed if roads and building foundations are constructed. Cutbanks are not stable and are subject to slumping. Reinforced retaining walls with proper drainage are needed to minimize slumping.
If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Support and stability of buildings can be provided by placing footings below the claypan. Roads and streets require the maximum amount of base rock. Access roads should be designed to control surface runoff and help stabilize cut slopes. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected unless drainage and irrigation are provided.
This map unit is in capability subclass IIIe.

56-Holcomb silty clay loam. This deep, somewhat poorly drained soil is on valley terraces. It formed in stratified, silty and clayey alluvium. Slope is 0 to 3 percent. Areas are irregular in shape and are 4 to 150 acres in size. The vegetation in areas not cultivated is mainly grasses, shrubs, ash, and Oregon white oak. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark grayish brown and very dark brown silty clay loam about 10 inches thick. The subsurface layer is mottled, very dark grayish brown silty clay loam about 9 inches thick. The upper part of the subsoil is very dark gray and very dark grayish brown clay about 29 inches thick, and the lower part to a depth of 55 inches is dark grayish brown clay. In some small areas the surface layer is gravelly.
Included in this unit are small areas of Awbrig, Coburg, and Dayton soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Holcomb soil is very slow. Available water capacity is about 5 to 8 inches. Water supplying capacity is about 14 to 19 inches. Effective rooting depth is

limited by a high water table that is at a depth of 1 foot to 1.5 feet from November to May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for small grain and grass seed. It is also used for hay and pasture and row crops.

This unit is suited to cultivated crops. Most climatically adapted crops can be grown if artificial drainage is provided; however, providing drainage is difficult because of the very slow permeability of the subsoil and the lack of adequate outlets. In summer, irrigation is required for maximum production of most crops.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan. Vehicles with large, low pressure tires commonly are used to apply fertilizer early in spring to prevent damage to crops and to the soil. Tilth and fertility can be improved by returning crop residue to the soil. Crops respond to lime and nitrogen fertilizer.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.

If this unit is used for recreational development, the main limitations are wetness, the content of clay, and very slow permeability. The unit can be used for trails and paths in summer and fall.

If this unit is used as homesites, the main limitations are wetness, very slow permeability, and low strength when the soil is wet. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load.

This map unit is in capability subclass IIIw.

75-Malabon silty clay loam. This deep, well drained soil is on broad valley terraces. It formed in silty and clayey alluvium. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, ponderosa pine, poison-oak and other shrubs, and grasses. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown and dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and brown silty clay loam and silty clay about 30 inches thick. The substratum is brown clay loam to a depth of 60 inches or more. Stratified sand and gravel are at a depth of 40 inches or more in some areas.

Included in this unit are small areas of Chapman, Coburg, and Salem soils. Included areas make up about 10 percent of the total acreage.

Permeability of this Malabon soil is moderately slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for row crops, small grain, hay and pasture, orchards, and urban development. It is also used for recreation.

This unit is well suited to all climatically adapted crops. It is potentially one of the most productive units in the survey area. The silty clay loam surface layer is subject to compaction if it is worked when moist. It is subject to puddling if it is left barren during the rainy season.

In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Grain and grasses grown on this unit respond to nitrogen; legumes respond to phosphorus and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

If this unit is used for hay and pasture, proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.

This unit is suited to recreational development. It is limited mainly by the content of clay in the soil and the moderately slow permeability.

The main limitations of this unit for homesite and urban development are the moderately slow permeability and moderate shrink-swell potential, which may limit the construction of basements and certain other types of structures. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Septic tank absorption fields are suitable for sewage disposal on this unit.

This map unit is in capability class I.

76-Malabon-Urban land complex. This map unit is on broad valley terraces. Slope is 0 to 3 percent. Areas are irregular in shape and are 3 to 100 acres or more in size. The native vegetation is mainly Douglas-fir, Oregon white oak, ponderosa pine, poison-oak and other shrubs, and grasses. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is 40 percent relatively undisturbed Malabon silty clay loam, 10 percent disturbed Malabon silty clay loam, and

45 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.
Included in this unit are small areas of Chapman, Coburg, and Salem soils. Included areas make up about 5 percent of the total acreage.
The relatively undisturbed Malabon soil is deep and well drained. It formed in silty and clayey alluvium. Typically, the surface layer is very dark brown and dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and brown silty clay loam and silty clay about 30 inches thick. The substratum is brown clay loam to a depth of 60 inches or more. Stratified sand and gravel are at a depth of 40 inches or more in places.
Permeability of the relatively undisturbed Malabon soil is moderately slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.
The disturbed Malabon soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material is commonly from adjacent areas of Malabon, Coburg, Salem, and Chapman soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.
Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.
This unit is used mainly for urban development. It is also used for yards, parks, and open areas around and between buildings.
If this unit is used for urban development, the main limitations are the moderate shrink-swell potential and moderately slow permeability. The moderate shrink-swell potential may limit use of the unit for basements and certain other structures. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Septic tank absorption fields are suited to this unit.
This map unit is not assigned a capability classification.

79-McBee silty clay loam. This deep, moderately well drained soil is on flood plains. It formed in recent mixed alluvium. Slope is 0 to 3 percent. Areas are elongated and commonly occur as stringers along abandoned channels. The areas are 3 to 75 acres in size. The vegetation in areas not cultivated is mainly Douglas-fir, black cottonwood, and willow. Elevation is 290 to 1,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free

period is 165 to 210 days.
Typically, the surface layer is very dark grayish brown silty clay loam about 24 inches thick. The subsoil is dark grayish brown and brown, mottled silt loam about 17 inches thick. The substratum to a depth of 62 inches is dark brown, mottled silt loam.
Included in this unit are small areas of Chehalis, Cloquato, Newberg, and Wapato soils. Included areas make up about 15 percent of the total acreage.
Permeability of this McBee soil is moderate. Available water capacity is about 10 to 12 inches. Water supplying capacity is 18 to 24 inches. Effective rooting depth is limited by a high water table that is at a depth of 2 to 3 feet from November to April. Runoff is slow, and the hazard of water erosion is moderate. The soil is subject to frequent, brief periods of flooding from November to May.
This unit is used mainly for cultivated crops. It is also used for recreation during the dry period in summer.
This unit is suited to most cultivated crops. Deep-rooted, water-sensitive perennial crops such as alfalfa require deep tile drainage. Good outlets commonly are available for tile drainage, which improves the productivity and manageability of the soil.
In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water.
Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.
Streambank cutting, erosion caused by overflow, and sedimentation can be reduced by maintaining adequate plant cover.
If this unit is used for hay and pasture, proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.
If this unit is used for recreational development, the main limitations are wetness and the clay content of the soil.
This unit generally is not suited to homesite development. The main limitations are seasonal flooding and the seasonal high water table. Flooding can be controlled only by use of major flood control structures. Drainage is needed if roads and building foundations are constructed.
This map unit is in capability subclass IIw.

95-Newberg fine sandy loam. This deep, somewhat excessively drained soil is on flood plains and bottom lands. It formed in recent alluvium. Slope is 0 to 3 percent. Areas are

elongated or irregular in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, grand fir, Oregon white oak, bigleaf maple, black cottonwood, shrubs, and grasses. Elevation is 290 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown fine sandy loam about 14 inches thick. The substratum to a depth of 65 inches is dark brown fine sandy loam and coarse sandy loam. In some areas the surface layer is loam.

Included in this unit are small areas of Camas, Chehalis, Cloquato, and McBee soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Newberg soil is moderately rapid. Available water capacity is about 5 to 8 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is occasionally flooded for brief periods from December to March.

This unit is used mainly for row crops, hay and pasture, small grain, and orchards. It is also used for urban development and recreation.

This unit is suited to all climatically adapted crops. It is most valued for root crops such as carrots, because the texture of the surface layer permits easy digging, even when the soil is wet, without excessive compaction of the soil.

In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Grain and grasses grown on this unit respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and increase the available water capacity of the surface layer, which aids the establishment of small-seeded crops.

Streambank cutting, erosion caused by overflow, and sedimentation can be reduced by maintaining adequate plant cover.

If this unit is used for hay and pasture, proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is well suited to recreational development intended for use during the dry season.

If this unit is used for urban development, the main limitations are the hazard of flooding and the moderately rapid

permeability. In some areas flooding can be controlled only by use of major flood control structures.
Septic tank absorption fields are suited to this unit.
This map unit is in capability subclass IIw.

96-Newberg loam. This deep, somewhat excessively drained soil is on flood plains and bottom lands. It formed in recent silty alluvium. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres or more in size. The vegetation in areas not cultivated is mainly Douglas-fir, grand fir, Oregon white oak, bigleaf maple, black cottonwood, shrubs, (orbs, and grasses. Elevation is 290 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is dark brown loam about 14 inches thick. The substratum to a depth of 65 inches is dark brown fine sandy loam and coarse sandy loam. In some areas the surface layer is fine sandy loam, and in some areas layers of very gravelly sand are below a depth of 24 inches.
Included in this unit are small areas of Camas, Chehalis, Cloquato, and McBee soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Newberg soil is moderately rapid. Available water capacity is about 5 to 8 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is occasionally flooded for brief periods from December to March.
This unit is used mainly for row crops, hay, and pasture. It is also used for urban development and recreation.
This unit is suited to all climatically adapted crops. It is most valued for root crops such as carrots, because the texture of the surface layer permits easy digging; however, this soil is subject to severe compaction damage by equipment if these crops are harvested when the soil is wet.
In summer, irrigation is required for maximum production of most crops. Use of the sprinkler method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.
Grain and grasses grown on this unit respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Cover crops are needed to protect the soil from erosion during periods of flooding in winter.
If this unit is used for hay and pasture, proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to

protect soil from erosion.
This unit is well suited to recreational development intended for use during the dry season.
If this unit is used for urban development, the main limitations are the hazard of flooding and the moderately rapid permeability. In some areas flooding can be controlled only by use of major flood control structures.
In areas of this unit that have a gravelly sand substratum, alternative or community sewage systems are needed to prevent contamination of water supplies as a result of seepage.
This map unit is in capability subclass IIw.

97-Newberg-Urban land complex. This map unit is on flood plains. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 100 acres in size. The native vegetation is mainly Douglas-fir, grand fir, Oregon white oak, bigleaf maple, black cottonwood, shrubs, forbs, and grasses. Elevation is 300 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
This unit is 40 percent relatively undisturbed Newberg fine sandy loam, 10 percent disturbed Newberg fine sandy loam, and 35 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.
Included in this unit are small areas of Camas, Chehalis, Cloquato, and McBee soils. Included areas make up about 15 percent of the total acreage.
The relatively undisturbed Newberg soil is deep and somewhat excessively drained. It formed in recent silty alluvium. Typically, the surface layer is dark brown fine sandy loam about 14 inches thick. The substratum to a depth of 65 inches is dark brown fine sandy loam and coarse sandy loam. In some areas the surface layer is dark brown loam about 19 inches thick, and in some areas layers of very gravelly sand are below a depth of 40 inches. Permeability of this Newberg soil is moderately rapid. Available water capacity is 5 to 8 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is occasionally flooded for brief periods from December to March.
The disturbed Newberg soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material commonly is from adjacent areas of Newberg, Chehalis, Cloquato, Camas, and McBee soils that have been cut or graded. The characteristics of the disturbed areas are highly variable.
Urban land consists of areas where the soils are largely

covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.

This unit is used mainly for urban development. It is also used for yards, parks, and open areas around and between buildings. The main limitations are the hazard of flooding and the moderately rapid permeability. Flooding can be controlled only by use of major flood control structures such as dikes or upstream dams. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. This map unit is not assigned a capability classification.

99H-Ochrepts and Umbrepts, very steep. These moderately deep to deep, well drained soils are along streams that have cut into valley terraces and on terrace fronts above the flood plains of major rivers and streams. The soils formed in stratified silty, loamy, or gravelly alluvium and in some weathered bedrock of mixed origin. Slope is mainly 20 to 60 percent. Areas are elongated in shape and are 5 to 30 acres in size. The native vegetation is mainly Douglas-fir, western hemlock, Oregon white oak, snowberry, poison-oak, and grasses. Elevation is 50 to 1,500 feet. The average annual precipitation is 40 to 90 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 210 days.

The soils in this unit generally are gravelly, silty, or loamy and are stratified. Depth ranges from 20 to 60 inches or more.

Included in this unit are small areas of Malabon, Salkum, and Veneta soils on adjacent terraces in valleys that receive 40 to 60 inches of rainfall. Also included are small areas of Blachly, Cupola, Jimbo, and Lint soils in mountainous areas that receive more than 60 inches of rainfall and small areas of Rock outcrop. The percentage varies from one area to another.

Permeability, effective rooting depth, available water capacity, and water supplying capacity of these soils are highly variable. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for wildlife habitat, timber production, and recreation. A few areas are used for pasture. If this unit is used for pasture, the main limitations are slope and the hazard of erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The main concerns in producing and harvesting timber are accessibility and difficulty of operating equipment because of slope. Construction of roads causes slumping, particularly in the steeper areas. Highlead or other cable logging systems

generally should be used in the larger areas of this unit. Tractor methods of harvesting timber are difficult to use because of slope.
If this unit is used for homesite or recreational development, the main limitation is steepness of slope. Cutbanks and foundations may be unstable.
This map unit is in capability subclass VIe.

100-Oxley gravelly silt loam. This deep, somewhat poorly drained soil is in concave areas on terraces. It formed in mixed gravelly alluvium. Slope is 0 to 3 percent. Areas are elongated in shape and are 3 to 200 acres in size. The vegetation in areas not cultivated is mainly Oregon ash, Oregon white oak, hazelnut, western brackenfern, rose, forbs, and grasses. Elevation is 300 to 700 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is very dark brown gravelly silt loam about 17 inches thick. The next layer is dark brown gravelly clay loam about 6 inches thick. The upper 12 inches of the subsoil is dark grayish brown and brown, mottled very gravelly clay loam, and the lower 6 inches is grayish brown, mottled very gravelly loam. The substratum to a depth of 60 inches or more is gray extremely gravelly sandy loam. In small areas near Springfield, the substratum is stratified silty clay loam and fine sandy loam, and in some areas the substratum is gravelly sand and is above a depth of 40 inches.
Included in this unit are small areas of Coburg, Courtney, Salem, and Sifton soils. Included areas make up about 15 percent of the total acreage.
Permeability of this Oxley soil is moderately slow. Available water capacity is about 3.0 to 6.5 inches. Effective rooting depth is 25 to 50 inches. It is limited by the extremely gravelly substratum and a high water table that is at a depth of 6 to 18 inches from November to May. Runoff is slow. The hazard of water erosion generally is slight, but it is moderate along drainageways during periods of heavy runoff from winter storms.
This unit is used mainly for pasture, hay, and grass seed crops. It is also used for small grain, row crops, and homesites. It is used for housing subdivisions in areas where municipal sewers are provided.
If this unit is used for cultivated crops, the main limitations are the gravelly surface layer, which interferes with the close tillage of young row crops, and the seasonal high water table, which limits suitability to shallow-rooted or water-tolerant perennials in undrained areas. Deep open drains or tile drains generally can be used to lower the water table below the root zone quickly enough to permit growth of perennial crops that are less water-tolerant. In some areas, however, the

extremely gravelly substratum restricts deep penetration of roots and creates droughtiness in summer. In summer, irrigation is required for maximum production of most crops. Crops respond to nitrogen.

If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Only those hay and pasture plants that tolerate a seasonal high water table are suitable for use in undrained areas. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from compaction.

If this unit is used for homesite development, the main limitations are the seasonal high water table, moderately slow permeability, and wetness. Because of these limitations, buildings need perimeter drains to prevent the accumulation of water, resulting in structural damage. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability subclass IIIw.

106A-Pengra-Urban land complex, 1 to 4 percent slopes. This map unit is in broad, slightly concave areas on fans and toe slopes. Areas are irregular in shape and are 3 to 30 acres in size. The native vegetation is mainly Oregon white oak, Oregon ash, wild blackberry, wild rose, poison-oak, grasses, and scattered Douglas-fir. Elevation is 350 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is 50 percent relatively undisturbed Pengra silt loam, 10 percent disturbed Pengra silt loam, and 25 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Dupee, Hazelair, Natroy, and Panther soils. Included areas make up about 15 percent of the total acreage.

The relatively undisturbed Pengra soil is deep and somewhat poorly drained. It formed in stratified alluvium. Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is very dark grayish brown and dark grayish brown, mottled silty clay loam about 15 inches thick. The substratum to a depth of 60 inches or more is very dark grayish brown and dark grayish brown, mottled clay. Permeability of the relatively undisturbed Pengra soil is very slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is 18 to 30 inches. It is limited by the clay substratum and by the high water table that is at a depth of 1.5 to 2.5 feet from November to May. Runoff is slow, and the hazard of water erosion is slight.

The disturbed Pengra soil has been covered by as much as

30 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material commonly is from adjacent areas of Pengra, Hazelair, Dupee, Natroy, and Panther soils that have been cut or graded. The characteristics of the disturbed Pengra soil are highly variable.

Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.

This unit is used mainly for urban development. It is also used for yards and parks or for greenbelts that are maintained to facilitate rapid removal of surface water by storm drains or floodway channels during periods of heavy rainfall.

If the relatively undisturbed Pengra soil is used for urban development, the main limitations are the high shrink-swell potential of the highly plastic clay, low soil strength, and the very slow permeability.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Roads for year-round use need heavy base rock. The seasonal high water table is perched above the dense clay substratum, and drainage should be provided if buildings with basements and crawl spaces are constructed. Plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.

This map unit is not assigned a capability classification.

110-Pits. This map unit consists of open excavations, throughout the survey area, from which the soil and commonly some of the underlying material such as hard rock or gravel have been removed. The pits in upland areas are sources of rock. The ones on terraces or flood plains are sources of gravel or topsoil, or both. Many of these pits are currently being used and enlarged for the extraction of gravel, topsoil, and other fill material. Many of the abandoned gravel pits on flood plains and low terraces have been filled at least partially with water and have been stocked with fish. These are shown on the maps as water areas instead of pits. Many other pits are being filled or will be filled by industrial waste or material from roadside cutbank slumps or ditch-cleaning debris.

This map unit is not assigned a capability classification.

114-Riverwash. This map unit consists of deep, excessively drained to poorly drained islands or sand and gravel bars in and along major streams and rivers. Riverwash consists of recent deposits of sand and gravel derived dominantly from mixed sedimentary and igneous

rock. Slope is 0 to 3 percent. Areas generally are elongated in shape and are 2 to 100 acres in size. The native vegetation is mainly occasional bunches of grass and scattered willows. Elevation is 290 to 1,500 feet. The average annual precipitation is 40 to 100 inches, the average annual air temperature is 47 to 52 degrees F, and the average frost-free period is 150 to 210 days.

Typically, Riverwash is highly stratified sand and gravel to a depth of 60 inches or more.

Included in this unit are small areas of Fluvents and Camas soils. Included areas make up about 15 percent of the total acreage.

Permeability of Riverwash is very rapid. Available water capacity and water supplying capacity are very low. Effective rooting depth is 10 to 40 inches. Runoff is slow, and the hazard of water erosion is very high.

Areas of this unit that do not contain an excess amount of fines can be used for roadfill and as a source of sand and gravel.

Riverwash is subject to overflow when the water level of the rivers and streams is high, and it is extremely droughty when the water level is low. During periods of overflow, material is deposited or eroded away.

This map unit is in capability subclass VIIIw.

118-Salem gravelly silt loam. This deep, well drained soil is on stream terraces. It formed in gravelly mixed alluvium. Slope is 0 to 3 percent. Areas are irregular or elongated in shape and are 3 to 100 acres in size. The vegetation in areas not cultivated is mainly Douglas-fir, ponderosa pine, Oregon white oak, bigleaf maple, wild rose, and grasses. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark brown gravelly clay loam and gravelly silty clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is multicolored very gravelly sand. In some areas the subsoil is very gravelly.

Included in this unit are small areas of Coburg, Malabon, and Oxley soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Salem soil is moderate. Available water capacity is about 4 to 6 inches. Effective rooting depth is 15 to 40 inches. It is limited by the very gravelly substratum. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for small grain, grass seed, hay, pasture, orchards, and row crops. It is also used for recreation and homesite development.

This unit is well suited to most climatically adapted crops. For most crops high yields can be expected with proper management. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Proper stocking rates, pasture rotation, and restricted grazing during wet
periods help to keep the pasture in good condition and to protect the soil from erosion and compaction.
Crops respond well to fertilizer. A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.
This unit is suited to recreational development. Coarse fragments in the surface layer limit the unit for use as playgrounds.
This unit is suited to homesite development. The main limitation for septic tanks is the hazard of polluting ground water.
This map unit is in capability subclass IIs.

119-Salem-Urban land complex. This map unit is on stream terraces. Slope is 0 to 2 percent. Areas are irregular or elongated in shape and are 3 to 100 acres in size. The native vegetation is mainly Oregon white oak, ponderosa pine, Douglas-fir, bigleaf maple, wild rose, and grasses. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.
This unit is 40 percent relatively undisturbed Salem gravelly silt loam, 5 percent disturbed Salem gravelly silt loam, and 45 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.
Included in this unit are small areas of Coburg, Malabon, and Oxley soils. Included areas make up about 10 percent of the total acreage.
The relatively undisturbed Salem soil is deep and well drained. It formed in gravelly mixed alluvium. Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark brown gravelly clay loam and gravelly silty clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is multicolored very gravelly sand.
Permeability of the relatively undisturbed Salem soil is moderate. Available water capacity is about 4 to 6 inches. Effective rooting depth is 15 to 40 inches. It is limited by the very gravelly substratum. Runoff is slow, and the hazard of water erosion is slight.

The disturbed Salem soil has been covered by as much as 40 inches of fill material or has had as much as 30 inches of the original profile removed by cutting or grading. The fill material commonly is from adjacent areas of Malabon, Salem, Oxley, or Coburg soils that have been cut or graded. The characteristics of the disturbed Salem soil are highly variable.
Urban land consists of areas where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so that identification is not feasible.
This unit is used mainly as homesites and for urban development. It is also used for yards and open areas between buildings.
In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Plants that tolerate droughtiness should be selected if irrigation is not provided.
This map unit is not assigned a capability classification.

138E-Witzel very cobbly loam, 3 to 30 percent slopes.
This shallow, well drained soil is on foothills adjacent to the Willamette Valley. It formed in colluvium and residuum derived from basic igneous rock. Areas are irregular in shape and are 5 to 160 acres in size. The vegetation in areas not cultivated is mainly scattered Oregon white oak, Douglas-fir, poison-oak, and forbs and grasses. Elevation is 300 to 1,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.
Typically, the surface layer is dark brown very cobbly loam about 4 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 13 inches thick. Fractured basalt is at a depth of 17 inches. Depth to bedrock ranges from 12 to 20 inches.
Included in this unit are small areas of Jory, Nekia, Philomath, and Ritner soils and Rock outcrop. Included areas make up about 15 percent of the total acreage.
Permeability of this Witzel soil is moderately slow.
Available water capacity is about 1 inch to 3 inches. Water supplying capacity is 13 to 15 inches. Effective rooting depth is 12 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is high.
This unit is used mainly for native pasture and wildlife habitat. It is also used for limited timber production.
This unit is suited to native pasture. Cobbles in the surface layer make tillage impractical, even for the planting of improved pasture. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Response

of pasture to nitrogen is fair if it is applied in spring while there is sufficient ' moisture for plant growth.

This unit is poorly suited to the production of Douglas-fir. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 90. The potential production per acre is 4,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 41,030 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old.

The main limitations for the management of timber are stones on the surface, seedling mortality, and the hazard of windthrow. Stones on the surface cause breakage of timber and hinder yarding. Because roots are restricted by the fractured bedrock, trees commonly are subject to windthrow. Reforestation is severely limited because of droughtiness. Undesirable plants limit natural or artificial reforestation. Intensive site preparation and maintenance generally are not needed. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings.

Areas of this unit where sewage systems can be provided are suited to homesite development. The shallow depth to hard bedrock prevents installation of septic tank absorption fields. Blasting generally is required to level areas for foundations and roadways. Such construction is expensive, but foundations and roads are stable after installation.

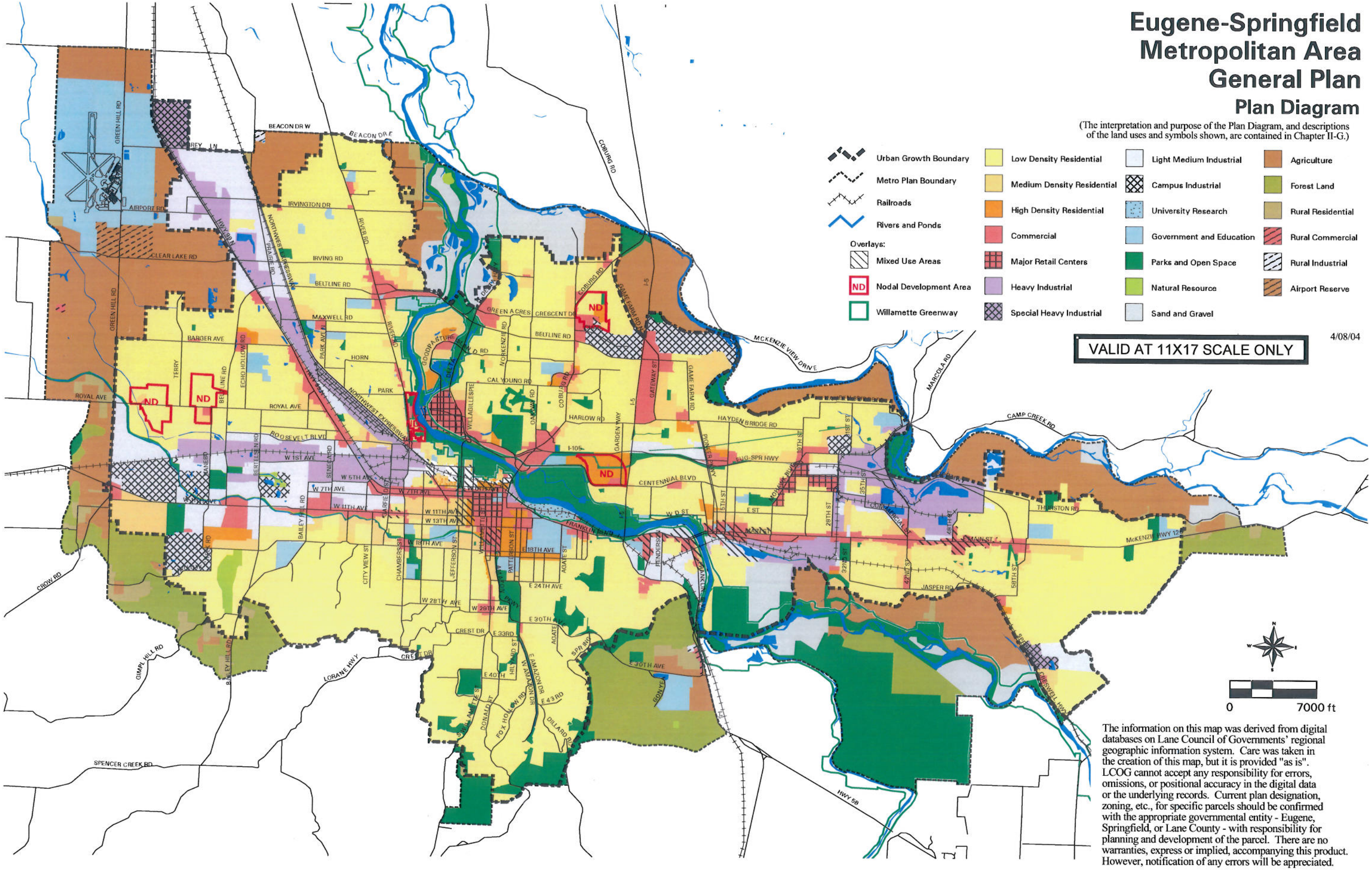
This map unit is in capability subclass Vls.

Appendix D: Metro Plan Map

Eugene-Springfield Metropolitan Area General Plan

Plan Diagram

(The interpretation and purpose of the Plan Diagram, and descriptions of the land uses and symbols shown, are contained in Chapter II-G.)



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