West Linn Land Use Application

ODOT | K19786 I-205: I-5 – OR 213

I-205 Improvements Project

ODOT EA: PE003013
HDR Project # 10063137

February 19, 2021

Contents

Part 1

Attachments

City of West Linn

Planning & Development • 22500 Salamo Rd #1000 • West Linn, Oregon 97068
Telephone 503.656.4211 • Fax 503.656.4106 • westlinnoregon.gov

DEVELOPMENT REVIEW APPLICATION

For Office Use Only		
STAFF CONTACT Wyss	PROJECT NO(S). WAP-21-01 WRG-21-01 MISC-21-02	PRE-APPLICATION NO. PA-19-15
NON-REFUNDABLE FEE(S)	REFUNDABLE DEPOSIT(S) $1,850 + $1,700 + $1,050	TOTAL $4,600

Type of Review (Please check all that apply):

- ☐ Annexation (ANX)
- ☐ Appeal and Review (AP)
- ☐ Conditional Use (CUP)
- ☐ Design Review (DR)
- ☐ Easement Vacation
- ☐ Extraterritorial Ext. of Utilities
- ☐ Final Plat or Plan (FP)
- ☒ Flood Management Area
- ☐ Hillside Protection & Erosion Control
- ☐ Historic Review
- ☐ Legislative Plan or Change
- ☐ Lot Line Adjustment (LLA)
- ☐ Minor Partition (MIP) (Preliminary Plat or Plan)
- ☐ Non-Conforming Lots, Uses & Structures
- ☐ Planned Unit Development (PUD)
- ☐ Pre-Application Conference (PA)
- ☐ Street Vacation
- ☐ Subdivision (SUB)
- ☐ Temporary Uses
- ☐ Time Extension
- ☐ Variance (VAR)
- ☐ Water Resource Area Protection/Single Lot (WAP)
- ☒ Water Resource Area Protection/Wetland (WAP)
- ☒ Willamette & Tualatin River Greenway (WRG)
- ☐ Zone Change

Home Occupation, Pre-Application, Sidewalk Use, Sign Review Permit, and Temporary Sign Permit applications require different or additional application forms, available on the City website or at City Hall.

Site Location/Address: I-205 Corridor: Abernethy Bridge to west of 10th Street

Assessor's Map No.: **21E35C, 21E36D, 22E31BB, 22E31, 22E31BA, 22E30CD, 22E30DC, 22E30DB**

Tax Lot(s):

Total Land Area:

Brief Description of Proposal: This Project will widen I-205 through West Linn to add a third general purpose travel lane in each direction and conduct a Phase II seismic retrofit of the Abernethy Bridge. To conform to the new I-205 widths, the OR 43 Interchange ramps will be modified. The bridges over West A Street, Sunset Avenue will be replaced, and the Broadway Street overcrossing will be permanently removed.

Proposed structural upgrades to Abernethy Bridge include replacement of piers, adding columns, increasing foundation sizes, enlarging columns and beams, and other substructure improvements. A drill rig will be used to strengthen subsurface soils with deep soil mixing and jet grouting. A temporary work bridge will be installed to facilitate construction activities at Abernethy Bridge. The project includes work in the floodplain.

Applicant Name: (please print) Mandy Putney, Oregon Department of Transportation
Phone: 503.731.8356
Address: 123 NW Flanders Street
Email: Mandy.Putney@odot.state.or.us
City State Zip: Portland, OR 97209

Owner Name (required): (please print) SAME AS ABOVE
Phone:
Address:
Email:
City State Zip:

Consultant Name: (please print) Brian Bauman, HDR
Phone: 503-727-3908
Address: 1050 SW 6th Ave, Suite 1800
Email: Brian.Bauman@hdrinc.com
City State Zip: Portland, OR 97204

1. All application fees are non-refundable (excluding deposit). **Any overruns to deposit will result in additional billing.**
   a. $1,050 deposit for the FMA permit
   b. $1,700 for the WRG review
   c. $1,850 deposit for the WRA permit
2. The owner/applicant or their representative should be present at all public hearings.

3. A decision may be reversed on appeal. No permit will be in effect until the appeal period has expired.
4. **One complete hard-copy set of application materials must be submitted with this application.**
One complete digital set of application materials must also be submitted electronically in PDF format.
If large sets of plans are required in application please submit one set.

The undersigned property owner(s) hereby authorizes the filing of this application, and authorizes on site review by authorized staff. I hereby agree to comply with all code requirements applicable to my application. Acceptance of this application does not infer a complete submittal. All amendments to the Community Development Code and to other regulations adopted after the application is approved shall be enforced where applicable. Approved applications and subsequent development is not vested under the provisions in place at the time of the initial application.

Marty Putry	2/22/2021	Marty Putry	2/22/2021
Applicant's signature	Date	Owner's signature ***(required)***	Date

RECEIVED
lschroder , 2/24/2021 ,3:13:25 PM

West Linn Development Review Application

I-205 Improvements: Stafford Road – OR 213

ODOT EA: PE003013
HDR Project # 10063137

City of West Linn
February 19, 2021

DEVELOPMENT REVIEW APPLICATION
Applicant's Submittal
February 19, 2021

APPLICANT:	Name: Mandy Putney, Oregon Department of Transportation Address: 123 NW Flanders Street Portland OR 97209
OWNER:	Name: Mandy Putney, Oregon Department of Transportation Address: 123 NW Flanders Street Portland OR 97209
REQUEST:	Land use review, including Flood Management Area review, Water Resource Area review, and Willamette & Tualatin River Protection Area review
LOCATION:	I-205 ODOT right-of-way from 10th Street to the Willamette River

I. PROJECT DESCRIPTION

There is a 30 percent chance that a Magnitude 8.0+ earthquake will occur in Oregon within the next 50 years. Transportation infrastructure resilience is one of the primary components required for an effective recovery following this significant natural disaster. In the event of the earthquake, I-205 may be the only connection between Oregon and Washington. ODOT designated I-205 as a Phase 1 statewide north-south lifeline route, which means it must be operational quickly after a disaster renders other roadways unusable or impassable. This critical route will provide supplies and services to the region. Upgrading the Abernethy Bridge is part of the effort to maintain I-205 in the event of a Cascadia Seismic Event. The I-205 Improvements: Stafford Road – OR 213Project (Project) will widen I-205 in West Linn to add a third general purpose travel lane in each direction and conduct a Phase II seismic retrofit of the Abernethy Bridge. To conform to the new I-205 widths, the OR 43 Interchange ramps will be reconfigured. Bridges over West A Street and Sunset Avenue will be replaced, and the Broadway Street overcrossing will be permanently removed. Specific elements of the project include:

- Adding a third northbound (NB) and southbound (SB) lane to I-205
- Abernethy Bridge widening and seismic retrofit
- Broadway Street overcrossing bridge removal
- West A Street and Sunset Avenue overcrossing bridge replacements

- I-205 NB rock blasting operations (West A Street to Sunset Avenue)
- OR43 interchange ramp reconfiguration, shared use path improvements, and roundabout installation
- Removal of redundant OR43 NB entrance ramp
- Constructing new sign structures (sign bridge and cantilever)
- Installation of new high mast lighting from OR213 to 10th Street
- Construction of stormwater management facilities

Roadway improvements are planned to occur within the existing right-of-way. Proposed improvements are designed to minimize modifications of entrance and exit ramps at interchanges, retaining walls, illumination relocations, and the amount of freeway construction work. They are also designed to minimize impacts to environmentally sensitive features.

Three general purpose lanes in each direction of I-205 will extend just west of 10th Street. The additional SB lane will become an exit only lane at 10th Street, and the third NB lane will be added as the "A" lane immediately north of the 10th Street Overcrossing.

The Abernethy Bridge will be widened to provide an additional through lane and a wider outside shoulder, resulting in an additional 16 feet of roadway width in both directions. The river span widenings consist of steel member cantilevers from the existing main span box girders and the approach span widenings are achieved through the addition of multiple steel girder lines. The bridge seismic retrofit includes nearly all existing columns and crossbeams. These elements require enlargement or alternative seismic retrofit measures to resolve seismic deficiencies. Additional foundation elements, including drilled shafts and micropiles, will be needed at a number of bents to resolve seismic deficiencies. Ground improvement consisting of deep soil mixing or jet grouting is also needed under the Abernethy Bridge to reduce the potential effects of liquefaction and lateral spreading that may occur in the alluvium and gravel soils during a seismic event. For the work within the Willamette River, a temporary work bridge will be constructed from both banks from both upstream and downstream of the existing piers and will remain in place for up to 4 years (Attachment A, Figures 5-7 to 5-9). A contractor access road from OR 43 immediately adjacent to the bridge will be used to access the work bridge on the west bank, north of the bridge.

Widening of the bridge lanes also requires modification to the approach spans and ramps on either end of the bridge. The I-205 southbound exit ramp to OR 43 (Attachment A, Figure 5-3C) will be widened to provide standard shoulders on the ramp structure and to shift the exit ramp over by the width of the additional lane and shoulder being added to the mainline portion of the bridge. The widening will be accomplished on the outside edge of the structure.

Rock blasting will occur south of I-205 NB from West A Street to Sunset Avenue to accommodate lane widening. Approximately 30-40 feet of rock cut is proposed from the existing face.

The I-205 bridge overcrossings of Broadway Street, West A Street, and Sunset Avenue conflict with the proposed mainline widening. To eliminate the conflict, the West A Street Bridge and the Sunset Avenue Bridge will be replaced and the Broadway Street Bridge will be removed.

II. DEVELOPMENT REVIEW PROCESS

A pre-application conference was held for the Project on June 20, 2019. The meeting notes are included as Attachment B. The proposal requires a flood management area permit (FMA), a water resource area permit (WRA), and a Willamette and Tualatin River protection review (WRG). The land use process for all three reviews is performed by the City of West Linn Planning Manager. No public hearing is required. In this document, the Applicant has addressed the submittal requirements and standards for decision-making in Community Development Code (CDC) Chapters 27, 28, and 32.

Chapter 27 Flood Management Areas

27.050 APPLICATION

A. A pre-application conference as a prerequisite to the filing of the application.

Applicant Response: See Attachment B

B. An application initiated by the property owner, or the owner's authorized agent, and accompanied by the appropriate fee.

Applicant Response: A completed application form and fee are provided in introductory materials for this submittal.

C. An application submittal that includes the completed application form, one copy of written responses addressing CDC 27.060, 27.070, 27.080 (if applicable), and 27.090 (if applicable), one copy of all maps and plans at the original scale, one copy of all maps and plans reduced to a paper size not greater than 11 inches by 17 inches, and a copy in a digital format acceptable to the City.

Applicant Response: A completed application form is provided in introductory materials for this submittal. This document includes written responses addressing CDC 27.060, 27.070, 27.090, and 27.120. CDC 27.080 is not applicable because the project does not involve residential construction. Copies of the project site plan are included in Attachment C as specified.

D. A map of the property indicating the nature of the proposed alteration and its relationship to property zones, structures, trees, and any other pertinent features.

Applicant Response: See Attachment C for a map of the project area that includes property zones (tax lots), structures, trees, and other pertinent features, as well as the Project footprint. The proposed alteration is described as follows:

The I-205: I-5 – OR 213, Phase I Sec. Project (Project) proposes to add a northbound and southbound travel lane to I-205 between just west of the 10th Street Interchange and the OR 99E Interchange and an I-205 northbound auxiliary lane between OR 99E and OR 213. The I-205 George Abernethy Bridge (Abernethy Bridge) across the Willamette River will be seismically retrofitted to withstand the Cascadia Seismic Event.

Seismic retrofits will require new or improved foundations. The Project will achieve the seismic design criteria at the Abernethy Bridge through a series of structural upgrades including replacement of the substructure, adding columns, increasing foundation sizes, enlarging columns and beams, and other substructure improvements. The pier replacements will impact the West Linn Flood Management Area. The Project will not increase flood elevations, since proposed work will result in net removal within the floodplain.

Within the Flood Management Area, the Abernethy Bridge will be widened to include an additional through-lane and a wider outside shoulder in both the northbound and southbound directions resulting in an additional 16 feet of roadway width in both directions. The main spans of the Abernethy Bridge will be widened by sliding the existing bridge girders toward the outside of the bridge and construction of cantilever supports to the inside of the bridge. The additional lane width will be constructed between the northbound and southbound lanes and over the new cantilever sections. This widening will be supported by larger, seismically stable in-water support piers to be located upstream and downstream of the existing piers. Existing piers and a portion of the associated riprap will be removed. Widening of the bridge lanes also requires modification to the approach spans and ramps at either end of the bridge.

E. Information regarding the elevation of the site prior to development, the base flood elevation data for subdivisions (if applicable), and a description of water course alterations, if proposed.

Applicant Response: Attachment D provides the flood management area, including elevations prior to development. The proposed project is not a subdivision. McLoughlin Creek will be temporarily diverted into a pipe to facilitate construction (no more than 18 months) and restored to preconstruction conditions. See Attachment V for McLoughlin Creek site plans. Attachment E describes project elements within the Willamette River floodplain and flood management area and how construction will balance cut and fill to avoid alteration of the water course.

F. A topographic map of the site at contour intervals of five feet or less showing a delineation of the flood management area, which includes, but is not limited to, areas shown on the Flood Management Area map. The City Engineer or Building Official, as applicable, may, at his/her discretion, require the map to be prepared by a registered land surveyor to ensure accuracy. A written narrative explaining the reason why the owner wishes to alter the floodplain shall accompany the site plan map.

Applicant Response: See Attachment D for a topographic map showing a delineation of the flood management area and the Project area. The floodplain under the Abernethy Bridge must be altered to construct the substructure and foundation retrofits as part of the seismic improvements and additional lane capacity. Specifically within the Flood Management Area of West Linn, ODOT needs to construct new columns at Piers 5, 6, 7, and 8 to strengthen and widen the bridge.

G. The elevation in relation to mean sea level, of the lowest floor (including basement) of all structures.

Applicant Response: The proposed project is construction of a transportation facility that does not include building floors or basements. The locations of project elements within the flood management area in West Linn are shown in Figure 1 in Attachment D. These project elements are Piers 5, 6, 7, and 8 of the Abernethy Bridge. Piers 5 and 6 are in the river and extend below mean sea level and below the channel surface floor. Pier 7 will have columns constructed at 11 and 22 feet above ordinary high water, and Pier 8 will have columns constructed at 33 and 51 feet above ordinary high water.

H. The elevation in relation to mean sea level to which any structure has been flood-proofed (non-residential only). (Ord. 1622 § 10, 2014; Ord. 1636 § 24, 2014)

Applicant Response: The proposed construction is a transportation facility that does not include flood-proofed structures. Structural elements subject to water flow are designed for purposes of maintaining their integrity during high flood events.

27.060 APPROVAL CRITERIA

The Planning Director shall make written findings with respect to the following criteria when approving, approving with conditions, or denying an application for development in flood management areas:

A. Development, excavation, and fill shall be performed in a manner to maintain or increase flood storage and conveyance capacity and not increase design flood elevations.

Applicant Response: Development, excavation, and fill will be balanced to maintain flood storage and conveyance capacity. The project involves replacement of four bridge piers within the flood management area of West Linn: a total of ten columns associated with the existing piers would be replaced with a total of eight new columns. The total volume of fill required for the new columns is 120 cubic yards greater than the volume for the existing columns. To mitigate the loss of floodplain storage, 120 cubic yards of material will be excavated (cut) adjacent to the Pier 8 to balance the fill. See Attachment E for a detailed description of the proposed cut/fill work within the floodplain. The project will not increase design flood elevations as evidenced by the No-rise Memorandum in Attachment F.

B. No net fill increase in any floodplain is allowed. All fill placed in a floodplain shall be balanced with an equal amount of soil material removal. Excavation areas shall not exceed fill areas by more than 50 percent of the square footage. Any excavation below the ordinary high water line shall not count toward compensating for fill.

Applicant Response: No net fill increase is proposed. All proposed cut/fill will be balanced in the floodplain, excluding excavation below the ordinary high water line. See Attachment E.

C. Excavation to balance a fill shall be located on the same lot or parcel as the fill unless it is not reasonable or practicable to do so. In such cases, the excavation shall be located in the same drainage basin and as close as possible to the fill site, so long as the proposed excavation and fill will not increase flood impacts for surrounding properties as determined through hydrologic and hydraulic analysis.

Applicant Response: Proposed cut and excavation will take place within ODOT right-of-way, and will be balanced within the same drainage basin and as close as possible to the fill site. No increase in flood impacts are anticipated. Attachment F (No-rise Memorandum) describes hydrologic and hydraulic analysis used to determine the project will not increase flood impacts.

D. Minimum finished floor elevations must be at least one foot above the design flood height or highest flood of record, whichever is higher, for new habitable structures in the flood area.

Applicant Response: No habitable structures in the flood area are proposed.

E. Temporary fills permitted during construction shall be removed.

Applicant Response: Permitted temporary fills for purposes of construction will be removed after construction has been completed.

F. Prohibit encroachments, including fill, new construction, substantial improvements, and other development in floodways unless certification by a professional civil engineer licensed to practice in the State of Oregon is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

Applicant Response: The Applicant has prepared a No-Rise Memorandum (Attachment F) to demonstrate there will not be an increase in flood levels.

G. All proposed improvements to the floodplain or floodway which might impact the flood-carrying capacity of the river shall be designed by a professional civil engineer licensed to practice in the State of Oregon.

Applicant Response: All proposed work within the floodplain has been designed by professional civil engineers licensed in Oregon.

H. New culverts, stream crossings, and transportation projects shall be designed as balanced cut and fill projects or designed not to significantly raise the design flood elevation. Such projects shall be designed to minimize the area of fill in flood management areas and to minimize erosive velocities. Stream crossings shall be as close to perpendicular to the stream as practicable. Bridges shall be used instead of culverts wherever practicable.

Applicant Response: No new stream crossings are proposed. All bridge work is replacing or removing existing bridges in the same locations. No new culverts are proposed. See Attachment E for proposed balanced cut/fill work within the floodplain.

I. Excavation and fill required for the construction of detention facilities or structures, and other facilities, such as levees, specifically shall be designed to reduce or mitigate flood impacts and improve water quality. Levees shall not be used to create vacant buildable land.

Applicant Response: To meet stormwater design criteria, water quality facilities and detention facilities are proposed along the length of the proposed project. The Preliminary Stormwater Design Report, provided as Attachment G, describes the design criteria and analysis used to determine the appropriate design for water quality and stormwater facilities associated with the project.

J. The applicant shall provide evidence that all necessary permits have been obtained from those federal, State, or local governmental agencies from which prior approval is required. (Ord. 1522, 2005; Ord. 1635 § 15, 2014; Ord. 1636 § 25, 2014)

Applicant Response: The Applicant has included documentation of necessary permit applications. See Attachment H for DSL, DEQ, and USACE permit applications.

27.070 CONSTRUCTION MATERIALS AND METHODS

A. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage using methods and practices that minimize flood damage.

Applicant Response: The transportation improvements will be constructed with materials and utility equipment resistant to flood damage. The temporary work bridge will be constructed above the typical 2-year flow elevation and will be constructed to withstand high water flows. Mobile equipment will be required to be staged at least 150 feet from the ordinary high water elevation. Should high flows be anticipated, the contractor will relocate equipment above the anticipated flood elevation.

B. Electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or otherwise elevated or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Applicant Response: No service facilities are included in the proposal.

C. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.

Applicant Response: The existing water supply system traversing the Abernethy Bridge will be maintained during construction. It is currently designed to eliminate infiltration of flood waters.

D. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharge from the systems into flood waters.

Applicant Response: No new or replacement sanitary sewage systems are proposed.

E. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

Applicant Response: No waste disposal systems will be constructed as part of the proposed development. Managing construction waste will be the responsibility of the construction contractor. The Applicant would require the construction contractor to locate temporary waste collection areas to avoid impairment to them or contamination from them during flooding.

F. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

Applicant Response: The new facilities are designed to withstand major seismic events and flooding. Structural elements subject to water flow are designed for purposes of maintaining their integrity during high flood events.

27.080 RESIDENTIAL CONSTRUCTION – NOT APPLICABLE

27.090 NON-RESIDENTIAL CONSTRUCTION

New construction and substantial improvement of any commercial, industrial, or other non-residential structure shall either have the lowest floor, including basement, elevated to at least one foot above the level of the base flood elevation; or, together with attendant utility and sanitary facilities, shall:

A. Be flood-proofed so that below the base flood level the structure is watertight with walls impermeable to the passage of water;

> **Applicant Response:** The proposed construction is a transportation facility that does not include walls. There is no expectation the transportation surfaces and related facilities would be water tight.

B. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;

> **Applicant Response:** The new facilities are designed to withstand major seismic events and flooding. Structural elements subject to water flow are designed for purposes of maintaining their integrity during high flood events.

C. Be certified by a professional civil engineer licensed to practice in the State of Oregon that the design and methods of construction shall prevent seepage, collapse or cracking of basement walls, prevent buckling of basement floors, prevent backup of water from sewer lines, and have all openings located one foot above the base flood elevation. In addition, all protective features must operate automatically without human intervention;

> **Applicant Response:** All proposed work has been designed by professional civil engineers licensed in Oregon. No structures are proposed that would have basements, floors, or sewer lines.

D. Non-residential construction that is elevated, but not flood-proofed (i.e., the foundation is not at least one foot above the 100-year flood elevation) shall also comply with the standards set forth in CDC 27.080. (Ord. 1522, 2005)

> **Applicant Response:** This section is not applicable. The Applicant's proposal does not include construction that would require flood-proofing.

27.120 ALTERATION OF WATERCOURSES

A. The applicant shall meet the requirements of Chapter 28 CDC, Willamette and Tualatin River Protection, or Chapter 32 CDC, Water Resource Area Protection, as applicable, in addition to this chapter's requirements.

> **Applicant Response:** The Applicant's responses to the requirements of CDC Chapters 28 and 32 are included in this submittal under separate heading.

B. A comparison by a professional civil engineer licensed to practice in the State of Oregon shall be made between the existing channel capacity and the proposed capacity and the changes assessed. The *alteration or modification must maintain the carrying capacity of the watercourse and not increase the base flood elevation.*

Applicant Response: Piers 5, 6, 7, and 8 of the Abernethy Bridge, which are in the flood management area of the Willamette River, will be replaced, each with two new columns. The footing for Abernethy Bridge Pier 10 that extends under McLoughlin Creek will be retrofitted to allow the bridge to meet seismic standards. A professional civil engineer licensed to practice in the State of Oregon has compared the existing channel capacity of the Willamette River and McLoughlin Creek to the proposed project changes in these watercourses and determined that their carrying capacities will be maintained and the base flood elevation will not increase. In the case of the Willamette River, the No-rise Memorandum in Attachment F and the cut/fill memo in Attachment E provide detailed descriptions of the proposed project and the means of avoiding an increase in base flood elevation and maintaining the river's carrying capacity. To minimize impacts to McLoughlin Creek the project will temporarily relocate the creek during construction. The temporary alteration of McLoughlin Creek, would place creek flow into a 48-inch diameter diversion pipe for a maximum of 18 months. This diameter pipe will meet the pipe sizes on either end of the temporarily diverted portion of the creek. Once the bridge pier footing is complete, the stream will be placed back to the original location and restored to pre-construction conditions. There will be no change to carrying capacity of the creek.

C. The Planning Director shall notify adjacent communities and the State of Oregon Department of Land Conservation and Development prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Insurance Administration.

Applicant Response: The Applicant accepts and supports this notification process.

D. The Planning Director shall require that maintenance be provided within the altered or relocated portion of said watercourse so that the flood-carrying capacity is not diminished.

Applicant Response: The Applicant will comply with the conditions of the permit. The diversion pipe would be maintained during the period it is in place (no more than 18 months). Following construction, the creek would be restored to pre-construction conditions and the flood-carrying capacity of McLoughlin Creek would not be diminished as a result of the proposed project. Creek restoration would be monitored with other areas of site restoration when construction is complete.

E. The Planning Director shall require that alterations of watercourses must allow fish passage and preserve fish habitat.

Applicant Response: According to McLoughlin Creek does not provide fish habitat, as noted in Attachment I (email from Tom Murtagh, ODFW Fish Biologist). No preservation of fish habitat or fish passage would be required.

F. The applicant shall submit a copy of a permit from the Oregon Division of State Lands and U.S. Army Corps of Engineers that allows the alteration, or states that it is exempt.

Applicant Response: See Attachment H for a copy of a permit from the Oregon Division of State Lands and U.S. Army Corps of Engineers.

Chapter 28 Willamette and Tualatin River Protection

28.110 APPROVAL CRITERIA

No application for development on property within the protection area shall be approved unless the decision-making authority finds that the following standards have been met or can be met by conditions of approval. The development shall comply with the following criteria as applicable:

A. Development: All sites.

1. Sites shall first be reviewed using the HCA Map to determine if the site is buildable or what portion of the site is buildable. HCAs shall be verified by the Planning Director per CDC 28.070 and site visit. Also, "tree canopy only" HCAs shall not constitute a development limitation and may be exempted per CDC 28.070(A). The municipal code protection for trees and Chapters 55 and 85 CDC tree protection shall still apply.

Applicant Response: The applicant reviewed the HCA Map determined where HCAs exist within the project area. There are multiple HCAs within the project area, including low and high designations, as well as habitat and impact areas not designated as HCA (Attachment J). Some of the HCAs in the project area have mapping errors, which the applicant has created an HCA Map Amendment Narrative (Attachment L) documenting the errors.

2. HCAs shall be avoided to the greatest degree possible and development activity shall instead be directed to the areas designated "Habitat and Impact Areas Not Designated as HCAs," consistent with subsection (A)(3) of this section.

Applicant Response: The project was designed to have the least possible impact on HCAs by avoiding and minimizing development activities in HCAs to the extent possible. Given the proximity of HCAs to the I-205 corridor and the Abernethy Bridge, some impacts from the proposed project were unavoidable if the purpose and need of the project is to be met. The purpose of the project is to improve traffic safety, relieve traffic congestion within the corridor, and provide an earthquake resilient route capable of being operational after a Cascadia seismic event. ODOT designated I-205 as a Phase 1 statewide north-south lifeline route, which means it must be operational quickly after a disaster renders other roadways unusable or impassable. To reduce congestion, an additional lane will be added in each direction contiguous with the existing lanes, thereby making some impacts to those HCAs located near roadways unavoidable. See applicant responses to D.1, D.2, and S below.

3. If the subject property contains no lands designated "Habitat and Impact Areas Not Designated as HCAs" and development within HCA land is the only option it shall be directed towards the low HCA areas first, then medium HCA areas and then to high HCA as the last choice. The goal is to, at best, avoid or, at least, minimize disturbance of the HCAs. (Water-dependent uses are exempt from this provision.)

Applicant Response: Where development activities in HCAs cannot be avoided, impacts were minimized to the extent possible by designing the project to disturb "low" HCAs before "high" HCAs. Only one area of proposed work is within a "high" HCA, which is the area underneath the Abernethy Bridge directly west of the Willamette River. No feasible options were available that would avoid the high HCA and seismically upgrade the Abernethy Bridge which requires modifications to the substructure. See Table 1 in applicant response to D.1 below.

4. All development, including exempted activities of CDC 28.040, shall have approved erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, in place prior to site disturbance and be subject to the requirements of CDC 32.070 and 32.080 as deemed applicable by the Planning Director.

Applicant Response: The Applicant has prepared an Erosion and Sediment Control Plan that includes erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, which meets the requirements of CDC 32.070 and 32.080 (See Attachment Z).

B. Single-family or attached residential. Development of single-family homes or attached housing shall be permitted on the following HCA designations and in the following order of preference with "a" being the most appropriate and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

1. Development of land classifications in "b," "c" and "d" shall not be permitted if at least a 5,000-square-foot area of buildable land ("a") exists for home construction, and associated impermeable surfaces (driveways, patios, etc.).

2. If 5,000 square feet of buildable land ("a") are not available for home construction, and associated impermeable surfaces (driveways, patios, etc.) then combinations of land classifications ("a," "b" and "c") totaling a maximum of 5,000 square feet shall be used to avoid intrusion into high HCA lands. Development shall emphasize area "a" prior to extending construction into area "b," then "c" lands.

3. The underlying zone FAR shall also apply as well as allowable lot coverage.

4. Development may occur on legal lots and non-conforming lots of record located completely within the HCA areas or that have the majority of the lot in the HCA to the extent that the applicant has less than 5,000 square feet of non-HCA land.

Development shall disturb the minimum necessary area to allow the proposed use or activity, shall direct development to any available non-HCA lands and in any situation shall create no more than 5,000 square feet of impervious surface. (Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will not count in calculating the 5,000-square-foot lot coverage.) The underlying zone FAR and allowable lot coverage shall also apply and may result in less than 5,000 square feet of lot coverage.

When only HCA land is available then the structure shall be placed as far away from the water resource area or river as possible. To facilitate this, the front setback of the structure or that side which is furthest away from the water resource or river may be reduced to a five-foot setback from the front property line without a variance. Any attached garage must provide a 20-foot by 20-foot *parking pad or driveway so as to provide off-street parking exclusive of the garage. The setbacks of subsection C of this section shall still apply.*

5. Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will be exempt from the lot coverage calculations of subsections (B)(1) through (4) of this section and the underlying zone.

6. Table showing development allowed by land classification:

	Development Allowed
Non-HCA ("a")	*Yes*
Low-Medium HCA ("b" and "c")	*Yes, if less than 5,000 sq. ft. of non-HCA land available. Avoid "d."*
High HCA ("d")	*Yes, but only if less than 5,000 sq. ft. of "a," "b" and "c" land available.*
Non-conforming Structures (structures on HCA land)	*Yes: vertically, laterally and/or away from river.* *Avoid "d" where possible.*

(The underlying zone FAR and allowable lot coverage shall also apply.)

Applicant Response: This section (B) is not applicable. The Applicant's proposal does not include single-family or attached residential development.

C. <u>Setbacks from top of bank</u>.

1. Development of single-family homes or attached housing on lands designated as "Habitat and Impact Areas Not Designated as HCAs" shall require a structural setback of 15 feet from any top of bank that represents the edge of the land designated as "Habitat and Impact Areas Not Designated as HCAs."

2. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback but must keep five feet from top of bank and cannot cantilever over the top of bank or into the five-foot setback area.

3. For properties that lack a distinct top of bank the applicant shall identify the boundary of the area designated as "Habitat and Impact Areas Not Designated as HCAs" which is closest to the river. A structural setback of 15 feet is required from that boundary line. That 15-foot measurement extends from the boundary line away from the river. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback 10 feet but must keep five feet from the boundary and cannot cantilever into the five-foot setback area. For vacant lots of record that comprise no lands with "Habitat and Impact Areas Not Designated as HCAs" designation or insufficient lands with those designations so that the above setbacks cannot be

met, the house shall be set back as far from river as possible to accommodate house as part of the allowed 5,000 square feet of impermeable surfaces.
Applicant Response: This section is not applicable. The Applicant's proposal does not include single-family or attached residential development, or patios or decks.

D. <u>Development of lands designated for industrial, commercial, office, public and other non-residential uses</u>.

1. Development of lands designated for industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential uses shall be permitted on the following land designations and in the following order of preference with "a" being the most appropriate for development and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

Applicant Response: Table 1 below shows the breakdown of proposed development within a, b, c, and d lands, showing that permanent impacts were avoided or minimized to the extent feasible to the High HCA designated areas in accordance with the preferred order of development. Permanent impacts to HCAs are only proposed in two areas, along I-205 NB near 10th Street (HCA 1) and under the Abernethy Bridge (HCA 4). HCA 2 and HCA 3 do not have proposed permanent impacts to the HCA itself; impacts are proposed to the Habitat and Impact Areas Not Designated as HCAs. See Attachment M, HCA Impacts for areas of proposed permanent impacts in HCAs and non-HCAs.

Table 1. Proposed development on a-d designated lands

HCA #	"a" lands		"b" lands		"c" lands		"d" lands	
	Temp.	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**
1	23,967 sq. ft.	75,322 sq. ft.	3,760 sq. ft.	10,726 sq. ft.	0	0	0	0
2	5,559 sq. ft.	27,922 sq. ft.	0	0	0	0	0	0
3	4,026 sq. ft.	20,096 sq. ft.	0	0	0	0	0	0
4	520 sq. ft.	12,370 sq. ft.	0	0	44,602 sq. ft.	9,975 sq. ft.	199,340 sq. ft.	1,425 sq. ft.
Total	**34,072 sq. ft.**	**135,710 sq. ft**	**3,760 sq. ft.**	**10,726 sq. ft.**	**44,602 sq. ft.**	**9,975 sq. ft.**	**199,340 sq. ft.**	**1,425 sq. ft.**

2. *Developing HCA land.*

a. Where non-HCA or areas designated as "Habitat and Impact Areas Not Designated as HCAs" are lacking or are in such limited supply as to render uses allowed by the underlying zone (e.g., general industrial) functionally impractical, the HCA may be utilized and built upon but shall emphasize "b" and "c" designations.

Applicant Response: The Applicant will utilize "b" and "c" designations in areas without non-HCAs or areas designated as Habitat and Impact Areas Not Designated as HCAs (See Attachment M, HCA Impacts). Unavoidable proposed permanent impacts to "b" and "c" designations are along the I-205 corridor in HCA 1 and under the Abernethy Bridge in HCA 4.

b. Where it is proposed that a "d" or high HCA classification be used, the property owner must demonstrate that the proposed use is clearly a water-dependent use. Proximity to the river for the purpose of views is not valid grounds. However, public interpretive facilities of historic facilities such as the government locks will be permitted as well as wildlife interpretive facilities and ADA-accessible platforms.

Applicant Response: Development is proposed in areas classified as high HCA under the Abernethy Bridge in HCA 4. The proposed work includes replacing the existing bridge supports to provide a seismically stable Abernethy Bridge able to withstand the Cascadia Subduction Zone earthquake. The Abernethy Bridge will carry the I-205 lifeline traffic over the Willamette River and McLoughlin Creek after the earthquake allowing for emergency response and a more speedy recovery of the critical infrastructure within the region. The project was designed to have the least impact possible to HCAs, but some impacts are required in order to meet the project's objective.

All other proposed impacts to HCAs are within a, b, or c classifications along the I-205 corridor. See Attachment M for proposed HCA impacts.

E. Hardship provisions and non-conforming structures.

1. For the purpose of this chapter, non-conforming structures are existing structures whose building footprint is completely or partially on HCA lands. Any additions, alterations, replacement, or rehabilitation of existing non-conforming non-water-related structures (including decks), roadways, driveways, accessory uses and accessory structures shall avoid encroachment upon the HCAs, especially high HCAs, except that:

a. A 10-foot lateral extension of an existing building footprint is allowed if the lateral extension does not encroach any further into the HCA or closer to the river or water resource area than the portion of the existing footprint immediately adjacent.

Applicant Response: No building extensions are proposed.

b. An addition to the existing structure on the side of the structure opposite to the river or water resource area shall be allowed. There will be no square footage limitation in this direction except as described in subsection (E)(1)(c) of this section.

Applicant Response: No additions to structures are proposed. The Abernethy Bridge has several piers located within multiple HCA designations, and those piers must be replaced or upgraded to allow the bridge to withstand the anticipated earthquake. The replacement of these piers will result in permanent impacts to HCA 4.

c. The same allowance for the use of, and construction of, 5,000 square feet of total impervious surface for sites in HCAs per subsections (B)(2) through (4) of this section shall apply to lots in this section.

Applicant Response: No impervious surfaces are proposed in HCAs, only excavation, fill, and bridge piers are proposed as permanent impacts to HCAs.

d. Vertical additions are permitted including the construction of additional floors.

Applicant Response: No construction of additional floors is proposed.

e. The provisions of Chapter 66 CDC, Non-conforming Structures, shall not apply.

Applicant Response: The Applicant acknowledges that CDC Chapter 66 do not apply.

F. Access and property rights.

1. Private lands within the protection area shall be recognized and respected.

Applicant Response: The Applicant's proposal does not include private lands.

2. Where a legal public access to the river or elsewhere in the protection area exists, that legal public right shall be recognized and respected.

Applicant Response: All areas of public access in the protection area will be recognized and respected.

3. To construct a water-dependent structure such as a dock, ramp, or gangway shall require that all pre-existing legal public access or similar legal rights in the protection area be recognized and

respected. Where pre-existing legal public access, such as below the OLW, is to be obstructed by, for example, a ramp, the applicant shall provide a reasonable alternate route around, over or under the obstruction. The alternate route shall be as direct as possible. The proposed route, to include appropriate height clearances under ramps/docks and specifications for safe passage over or around ramps and docks, shall be reviewed and approved by the Planning Director for adequacy.
Applicant Response: No water-dependent structures are proposed.

4. Any public or private water-dependent use or facility shall be within established DSL-authorized areas.
Applicant Response: No water-dependent uses or facilities are proposed.

5. Legal access to, and along, the riverfront in single-family residential zoned areas shall be encouraged and pursued especially when there are reasonable expectations that a continuous trail system can be facilitated. The City recognizes the potential need for compensation where nexus and proportionality tests are not met. Fee simple ownership by the City shall be preferred. The trail should be dimensioned and designed appropriate to the terrain it traverses and the user group(s) it can reasonably expect to attract. The City shall be responsible for signing the trail and delineating the boundary between private and public lands or access easements.
Applicant Response: The Applicant does not propose to restrict access to the riverfront.

G. <u>Incentives to encourage access in industrial, multi-family, mixed use, commercial, office, public and non-single-family residential zoned areas</u>.

1. For all industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential zones, this section encourages the dedication or establishment of access easements to allow legal public access to, and along, the river. Support for access may be found in the Parks Master Plan, a neighborhood plan or any applicable adopted sub-area plans. The emphasis will be upon locating paths where there is a reasonable expectation that the path can be extended to adjacent properties to form a connective trail system in the future, and/or where the trail will provide opportunities for appreciation of, and access to, the river.
Applicant Response: The Applicant's proposal is intended to improve the safety and reliability of vehicular travel on I-205, and is not a development that would impede or enhance river access. Although there is no formal designated trail, the ODOT right-of-way under the Abernethy Bridge is utilized as a connection between the McLean House and Park and West Bridge Park. Trail connectivity will be maintained during and after construction of the project.

2. Height or density incentives may be available to developers who provide public access. Specifically, commercial, industrial, multi-family, mixed use, and public projects may be constructed to a height of 60 feet. No variance is required for the 60-foot height allowance regardless of the underlying zone height limitations; however, the following conditions must be met:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and *b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way.*

c. Fencing may be required near steep dropoffs or grade changes.

Applicant Response: The applicant is not seeking height or density incentives to upgrade the seismic resiliency and mobility of the I-205 corridor.

H. <u>Partitions, subdivisions and incentives</u>.

1. When dividing a property into lots or parcels, an applicant shall verify the boundaries of the HCA on the property.

2. Applicant shall partition or subdivide the site so that all lots or parcels have a buildable site or envelope available for home construction located on non-HCA land or areas designated "Habitat and Impact Areas Not Designated as HCAs" per the HCA Map.

3. Development of HCA-dominated lands shall be undertaken as a last resort. A planned unit development (PUD) of Chapter 24 CDC may be required.

4. Incentives are available to encourage provision of public access to, and/or along, the river. By these means, planned unit developments shall be able to satisfy the shared outdoor recreation area requirements of CDC 55.100(F). Specifically, for every square foot of riverfront path, the applicant will receive credit for two square feet in calculating the required shared outdoor recreation area square footage. Applicants shall also be eligible for a density bonus under CDC 24.150(B). To be eligible to receive either of these incentives, applicants shall:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and

b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way;

c. Fencing may be required near steep dropoffs or grade changes.

Applicant Response: The Applicant does not propose partition or subdivide any properties and therefore does not seek any incentives to do so. Work will be completed within State or City right-of-way.

I. <u>Docks and other water-dependent structures</u>.

1. Once the preference rights area is established by DSL, the property owner identifies where the water-dependent use will be located within the authorized portion of the preference rights area. The water-dependent use should be centered or in the middle of the preference rights/authorized area or meet the side yard setbacks of the underlying zone.

Private and public non-commercial docks are permitted where dredging is required so long as all applicable federal and State permits are obtained. Dredging is encouraged if deposits silt up under an existing dock. Dredging is seen as preferable to the construction of longer docks/ramps.

2. Both joint and single use docks shall not extend into the water any further than necessary to provide four feet between the ship's keel or fixed propeller/rudder and the bottom of the water at any time during the water's lowest point.

3. In no case except as provided in this section shall a private ramp and private dock extend more than 100 feet from OLW towards the center of the river or slough. In the case of L-shaped docks, the 100 feet shall be measured from the OLW to the furthest part of the private dock closest to the center of the river.

4. Docks on sloughs and similar channels shall not extend more than 30 percent of the distance between two land masses at OHW, such as between the mainland and an island or peninsula, measured in a lineal manner at right angle to the dominant shoreline. In no way shall a dock impede existing public usage or block navigation of a channel.

5. Boat storage associated with a rail launch facility shall be located above the OHW, either vertically raised above the ordinary high water line or set back behind the OHW. Such boat storage structure will be natural wood colors or similar earth tones. Private railed launch facilities are permitted for individual boat owners. The onshore setback of the storage structure is equal distance on both sides as extended perpendicular to the thread of the stream, or seven and one-half feet, whichever is the greater setback.

6. The width of each deck section shall be no more than 12 feet wide.

7. For only single-user and joint-user docks, pilings shall not exceed a maximum height of eight feet above the 100-year flood elevation.

8. A single user non-commercial dock shall not exceed 400 square feet in deck area. The boat slip is not included in the calculation of this square footage limitation.

9. Private non-commercial boat houses are allowed but only if they are within 50 feet of OLW and/or in locations sufficiently screened from view so that they do not have a significant visual impact on views from adjacent and nearby homes. Building and roof colors shall be brown, gray, beige, natural or similar earth tones. Non-commercial boat houses shall not exceed 12 feet in height measured from the boat house deck level to the roof peak. The size of the boat house shall be sized to accommodate one boat only and shall not exceed a footprint greater than 500 square feet. Boatlifts are permitted within the boat house. The above provisions also apply to open-walled boat shelters with or without boatlifts.

Applicant Response: No dock or other water-dependent structures are proposed. This section (I) does not apply to the proposed Project.

J. <u>Joint docks</u>.

1. Joint use boat docks may be permitted by the reviewing authority where the applicants are riverfront property owners, ideally owners of adjacent lots of record.
2. Co-owners of the joint dock use shall be prohibited from having their own non-joint dock.

3. A joint use agreement shall be prepared which will be included in the application for review by the reviewing authority and subsequently recorded. A copy of the recorded document with the County Recorder's stamp shall be submitted to the City.
4. A condition of approval for any joint use permit shall be that the dock must be used to serve the same lots of record for which the dock permit was issued. Joint use cannot be transferred to, or used by, any party other than the original applicants or the future owners of those properties.
5. Joint docks may go on the common property line between the two landowners who are sharing the dock. Unless agreed to by the adjoining owner, joint docks not being shared with the adjacent property owner must be at least 15 feet from the preference rights area side lines or centered in the middle of the preference rights area.
Applicant Response: No joint docks are proposed. This section does not apply to the proposed Project.

K. <u>Non-conforming docks and other water-related structures</u>. Pre-existing non-conforming structures, including docks, ramps, boat houses, etc., as defined in this chapter may remain in place. Replacement in kind (e.g., replacement of decking and other materials) will be allowed provided the replacement meets the standards of this chapter. However, if any non-conforming structure that is damaged and destroyed or otherwise to be replaced to the extent that the rebuilding or replacing (including replacement in kind) would exceed 50 percent of the current replacement cost of the entire structure, the owner shall be required to meet all the standards of this chapter.

Applicant Response: No work is proposed to any pre-existing non-conforming docks or other water-related structures.

L. <u>Roads, driveways, utilities, or passive use recreation facilities</u>. Roads, driveways, utilities, public paths, or passive use recreation facilities may be built in those portions of HCAs that include wetlands, riparian areas, and water resource areas when no other practical alternative exists but shall use water-permeable materials unless City engineering standards do not allow that. Construction to the minimum dimensional standards for roads is required. Full mitigation and revegetation is required, with the applicant to submit a mitigation plan pursuant to CDC <u>32.070</u> and a revegetation plan pursuant to CDC <u>32.080</u>. The maximum disturbance width for utility corridors is as follows:

1. For utility facility connections to utility facilities, no greater than 10 feet wide.
Applicant Response: No utility facility connections to utility facilities are proposed.

2. For upgrade of existing utility facilities, no greater than 15 feet wide.
Applicant Response: No upgrades of existing utility facilities are proposed.

3. For new underground utility facilities, no greater than 25 feet wide, and disturbance of no more than 200 linear feet of water quality resource area, or 20 percent of the total linear feet of water quality resource area, whichever is greater.
Applicant Response: No new underground utility facilities are proposed.

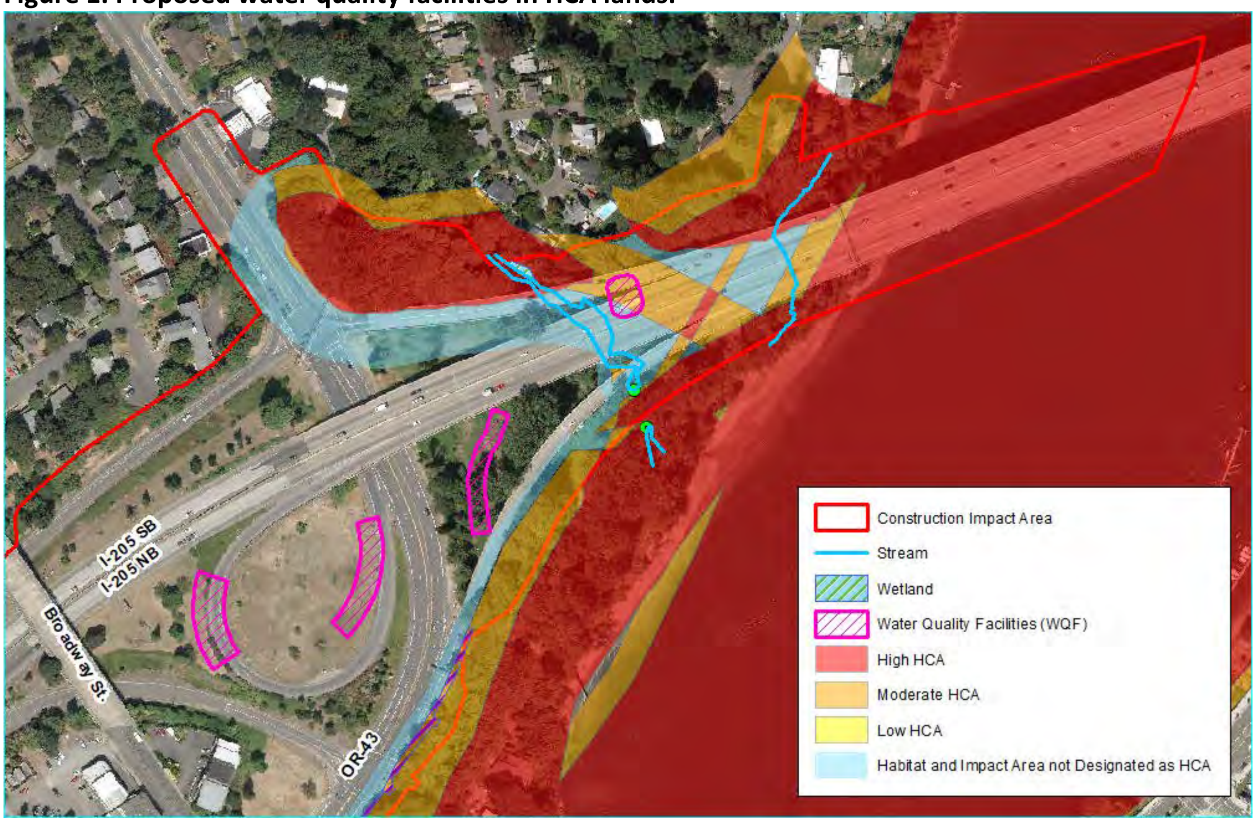
M. <u>Structures</u>. All buildings and structures in HCAs and riparian areas, including all exterior mechanical equipment, should be screened, colored, or surfaced so as to blend with the riparian environment. Surfaces shall be non-polished/reflective or at least expected to lose their luster within a year. In addition to the specific standards and criteria applicable to water-dependent uses (docks), all other provisions of *this chapter shall apply to water dependent uses, and any structure shall be no larger than necessary to accommodate the use.*

Applicant Response: The only structures proposed in HCAs and riparian areas are supports for the Abernethy Bridge, which will match the existing structure to maintain the same visual quality as currently exists.

N. <u>Water-permeable materials for hardscapes</u>. The use of water-permeable materials for parking lots, driveways, patios, and paths as well as flow-through planters, box filters, bioswales and drought tolerant plants are strongly encouraged in all "a" and "b" land classifications and shall be required in all "c" and "d" land classifications. The only exception in the "c" and "d" classifications would be where it is demonstrated that water-permeable driveways/hardscapes could not structurally support the axle weight of vehicles or equipment/storage load using those areas. Flow through planters, box filters, bioswales, drought tolerant plants and other measures of treating and/or detaining runoff would still be required in these areas.

Applicant Response: No impervious parking lots, driveways, patios, or paths are proposed in HCAs. All impervious surfaces created from the project will be treated. A water quality swale is proposed in HCA 4 that will capture and treat runoff from the project area. It is located mostly in "c" lands with a small portion that falls within "a" lands (see Figure 1 below).

Figure 1. Proposed water quality facilities in HCA lands.



O. <u>Signs and graphics</u>. No sign or graphic display inconsistent with the purposes of the protection area shall have a display surface oriented toward or visible from the Willamette or Tualatin River. A limited number of signs may be allowed to direct public access along legal routes in the protection area.

Applicant Response: Several signs are proposed to be installed in the protection area, however, the intent of the signs is to direct public access along I-205 and are required for safety. The proposed signed will be located along I-205 and will be consistent with the existing aesthetic corridor feel. In accordance with FHWA design standards, approximately 11 signs are proposed on the Abernethy Bridge, which may be visible from the Willamette River. See Attachment X, Signing Plan.

P. Lighting. Lighting shall not be focused or oriented onto the surface of the river except as required by the Coast Guard. Lighting elsewhere in the protection area shall be the minimum necessary and shall not create off-site glare or be omni-directional. Screens and covers will be required.

Applicant Response: No lighting is proposed to be focused or oriented onto the surface of the river.

Q. Parking. Parking and unenclosed storage areas located within or adjacent to the protection area boundary shall be screened from the river in accordance with Chapter 46 CDC, Off-Street Parking, Loading and Reservoir Areas. The use of water-permeable material to construct the parking lot is either encouraged or required depending on HCA classification per CDC 28.110(N)(4).

Applicant Response: No parking lots or storage areas are proposed.

R. Views. Significant views of the Willamette and Tualatin Rivers shall be protected as much as possible as seen from the following public viewpoints: Mary S. Young Park, Willamette Park, Cedar Oak Park, Burnside Park, Maddox Park, Cedar Island, the Oregon City Bridge, Willamette Park, and Fields Bridge Park.

Where options exist in the placement of ramps and docks, the applicant shall select the least visually intrusive location as seen from a public viewpoint. However, if no options exist, then the ramp, pilings and dock shall be allowed at the originally proposed location.

Applicant Response: Views of the Willamette River will be protected to the extent possible while still meeting project objectives, which includes seismically retrofitting the Abernethy Bridge. The proposed replacement bridge piers have been designed to be visually consistent with the existing bridge. No proposed work from the project will affect the Tualatin River or its views.

S. Aggregate deposits. Extraction of aggregate deposits or dredging shall be conducted in a manner designed to minimize adverse effects on water quality, fish and wildlife, vegetation, bank stabilization, stream flow, visual quality, noise and safety, and to promote necessary reclamation.

Applicant Response: No extraction of aggregate deposits is proposed. The retrofit of the Abernethy Bridge will require excavation in the Willamette River. Removal and fill activities in the river have been designed to have the least amount of impact possible to water quality, fish and wildlife, vegetation, bank stabilization, and streamflow. The applicant consulted with the National Marine Fisheries Service (NMFS) and the Oregon Department of Fish and Wildlife (ODFW) regarding proposed impacts that may affect water quality, fish and wildlife habitat, and vegetation (Attachment U, NMFS Consultation). Several mitigation measures were identified to be implemented during construction. In-water work will be conducted during the in-water work window to reduce potential impacts to aquatic species. Best management practices will be implemented to prevent water quality impacts such as sedimentation and turbidity during excavation, including the use of cofferdams and erosion control measures. The existing piers will be cut off below the mud line to avoid and minimize potential effects to natural fluvial geomorphic processes. Vegetation removed on the bank for construction access will be restored after construction is complete.

T. *<u>Changing the landscape/grading</u>.*

1. Existing predominant topographical features of the bank line and escarpment shall be preserved and maintained except for disturbance necessary for the construction or establishment of a water related or water dependent use. Measures necessary to reduce potential bank and escarpment erosion, landslides, or flood hazard conditions shall also be taken.

Any construction to stabilize or protect the bank with rip rap, gabions, etc., shall only be allowed where there is clear evidence of erosion or similar hazard and shall be the minimum needed to stop that erosion or to avoid a specific and identifiable hazard. A geotechnical engineer's stamped report shall accompany the application with evidence to support the proposal.
Applicant Response: Riprap is not proposed within the ordinary high water or along the banks of the Willamette River, following replacement of the in-water shafts. See Attachment O for the Geotechnical Report.

2. The applicant shall establish to the satisfaction of the approval authority that steps have been taken to minimize the impact of the proposal on the riparian environment (areas between the top of the bank and the low water mark of the river including lower terrace, beach and river edge).
Applicant Response: The project has been designed to have the least impact possible to riparian areas. In areas where proposed work could not be avoided or minimized, mitigation through revegetation is proposed. Work in riparian areas includes replacement and upgrades of bridge columns, including excavation, fill, and foundation stabilization. Jet grouting is proposed around the pier footings to meet seismic criteria. The combination of these activities requires large areas of excavation at each foundation. Construction access and staging are needed for large equipment and concrete trucks to access the repair sites. After construction is complete, temporary access and staging areas will be restored at grade and revegetated. Areas of permanent impact, including the foundation impacts, will be mitigated according to CDC 32.100.

3. The applicant shall demonstrate that stabilization measures shall not cause subsequent erosion or deposits on upstream or downstream properties.
Applicant Response: The proposed work will not cause erosion or deposits on upstream or downstream properties. See Attachment O for the Geotechnical Report.

4. Prior to any grading or development, that portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be protected with an anchored chain link fence (or approved equivalent) at its perimeter and shall remain undisturbed except as specifically allowed by an approved Willamette and Tualatin River Protection and/or water resource area (WRA) permit. Such fencing shall be maintained until construction is complete. That portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be identified with City-approved permanent markers at all boundary direction changes and at 30- to 50-foot intervals that clearly delineate the extent of the protected area.
Applicant Response: Areas of HCAs that include wetlands, creeks, and riparian areas that are not to be impacted by the project will be fenced off and marked along the orange construction fencing. Fencing will be maintained for the duration of the project.

5. Full erosion control measures shall be in place and approved by the City Engineer prior to any grading, development or site clearing.

Applicant Response: An Erosion and Sediment Control Plan (Attachment Z) has been developed and will be implemented prior to any grading, development, or site clearing. The Erosion and Sediment control plan has been developed in accordance with ODOT's NPDES 1200-CA permit issued by ODEQ.

U. <u>Protect riparian and adjacent vegetation</u>. Vegetative ground cover and trees upon the site shall be preserved, conserved, and maintained according to the following provisions:

1. Riparian vegetation below OHW removed during development shall be replaced with indigenous vegetation, which shall be compatible with and enhance the riparian environment and approved by the approval authority as part of the application.

Applicant Response: A revegetation plan (Attachment W) and a Mitigation Plan (Attachment K) have been developed that would restore functions of riparian vegetation removed during development.

2. Vegetative improvements to areas within the protection area may be required if the site is found to be in an unhealthy or disturbed state by the City Arborist or his or her designated expert. "Unhealthy or disturbed" includes those sites that have a combination of native trees, shrubs, and groundcover on less than 80 percent of the water resource area and less than 50 percent tree canopy coverage in the primary and secondary habitat conservation area to be preserved. "Vegetative improvements" will be documented by submitting a revegetation plan meeting CDC <u>28.160</u> criteria that will result in the primary and secondary habitat conservation area to be preserved having a combination of native trees, shrubs, and groundcover on more than 80 percent of its area, and more than 50 percent tree canopy coverage in its area. The vegetative improvements shall be guaranteed for survival for a minimum of two years. Once approved, the applicant is responsible for implementing the plan prior to final inspection.

Applicant Response: The City Arborist has not designated any vegetative improvements in the project.

3. Tree cutting shall be prohibited in the protection area except that:

a. Diseased trees or trees in danger of falling may be removed with the City Arborist's approval; and

b. Tree cutting may be permitted in conjunction with those uses listed in CDC <u>28.030</u> with City Arborist approval; to the extent necessary to accommodate the listed uses;

c. Selective cutting in accordance with the Oregon Forest Practices Act, if applicable, shall be permitted with City Arborist approval within the area between the OHW and the greenway boundary provided the natural scenic qualities of the greenway are maintained. (Ord. 1576, 2008; Ord. 1590 § 1, 2009; Ord. 1604 §§ 29 – 36, 2011; amended during July 2014 supplement; Ord. 1635 § 17, 2014; Ord. 1636 § 27, 2014)

Applicant Response: Tree removal is proposed under the Abernethy Bridge along the Willamette River. See Attachment T for a map of proposed tree removal within the riparian area. Any trees proposed to be cut will be submitted to the City Arborist for approval prior to cutting.

Chapter 28 Willamette and Tualatin River Protection

28.110 APPROVAL CRITERIA

No application for development on property within the protection area shall be approved unless the decision-making authority finds that the following standards have been met or can be met by conditions of approval. The development shall comply with the following criteria as applicable:

A. Development: All sites.

1. Sites shall first be reviewed using the HCA Map to determine if the site is buildable or what portion of the site is buildable. HCAs shall be verified by the Planning Director per CDC 28.070 and site visit. Also, "tree canopy only" HCAs shall not constitute a development limitation and may be exempted per CDC 28.070(A). The municipal code protection for trees and Chapters 55 and 85 CDC tree protection shall still apply.

Applicant Response: The applicant reviewed the HCA Map determined where HCAs exist within the project area. There are multiple HCAs within the project area, including low and high designations, as well as habitat and impact areas not designated as HCA (Attachment J). Some of the HCAs in the project area have mapping errors, which the applicant has created an HCA Map Amendment Narrative (Attachment L) documenting the errors.

2. HCAs shall be avoided to the greatest degree possible and development activity shall instead be directed to the areas designated "Habitat and Impact Areas Not Designated as HCAs," consistent with subsection (A)(3) of this section.

Applicant Response: The project was designed to have the least possible impact on HCAs by avoiding and minimizing development activities in HCAs to the extent possible. Given the proximity of HCAs to the I-205 corridor and the Abernethy Bridge, some impacts from the proposed project were unavoidable if the purpose and need of the project is to be met. The purpose of the project is to improve traffic safety, relieve traffic congestion within the corridor, and provide an earthquake resilient route capable of being operational after a Cascadia seismic event. ODOT designated I-205 as a Phase 1 statewide north-south lifeline route, which means it must be operational quickly after a disaster renders other roadways unusable or impassable. To reduce congestion, an additional lane will be added in each direction contiguous with the existing lanes, thereby making some impacts to those HCAs located near roadways unavoidable. See applicant responses to D.1, D.2, and S below.

3. If the subject property contains no lands designated "Habitat and Impact Areas Not Designated as HCAs" and development within HCA land is the only option it shall be directed towards the low HCA areas first, then medium HCA areas and then to high HCA as the last choice. The goal is to, at best, avoid or, at least, minimize disturbance of the HCAs. (Water-dependent uses are exempt from this provision.)

Applicant Response: Where development activities in HCAs cannot be avoided, impacts were minimized to the extent possible by designing the project to disturb "low" HCAs before "high" HCAs. Only one area of proposed work is within a "high" HCA, which is the area underneath the Abernethy Bridge directly west of the Willamette River. No feasible options were available that would avoid the high HCA and seismically upgrade the Abernethy Bridge which requires modifications to the substructure. See Table 1 in applicant response to D.1 below.

4. All development, including exempted activities of CDC 28.040, shall have approved erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, in place prior to site disturbance and be subject to the requirements of CDC 32.070 and 32.080 as deemed applicable by the Planning Director.
Applicant Response: The Applicant has prepared an Erosion and Sediment Control Plan that includes erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, which meets the requirements of CDC 32.070 and 32.080 (See Attachment Z).

B. Single-family or attached residential. Development of single-family homes or attached housing shall be permitted on the following HCA designations and in the following order of preference with "a" being the most appropriate and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

1. Development of land classifications in "b," "c" and "d" shall not be permitted if at least a 5,000-square-foot area of buildable land ("a") exists for home construction, and associated impermeable surfaces (driveways, patios, etc.).
2. If 5,000 square feet of buildable land ("a") are not available for home construction, and associated impermeable surfaces (driveways, patios, etc.) then combinations of land classifications ("a," "b" and "c") totaling a maximum of 5,000 square feet shall be used to avoid intrusion into high HCA lands. Development shall emphasize area "a" prior to extending construction into area "b," then "c" lands.
3. The underlying zone FAR shall also apply as well as allowable lot coverage.
4. Development may occur on legal lots and non-conforming lots of record located completely within the HCA areas or that have the majority of the lot in the HCA to the extent that the applicant has less than 5,000 square feet of non-HCA land.

Development shall disturb the minimum necessary area to allow the proposed use or activity, shall direct development to any available non-HCA lands and in any situation shall create no more than 5,000 square feet of impervious surface. (Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will not count in calculating the 5,000-square-foot lot coverage.) The underlying zone FAR and allowable lot coverage shall also apply and may result in less than 5,000 square feet of lot coverage.

When only HCA land is available then the structure shall be placed as far away from the water resource area or river as possible. To facilitate this, the front setback of the structure or that side which is furthest away from the water resource or river may be reduced to a five-foot setback from the front property line without a variance. Any attached garage must provide a 20-foot by 20-foot

parking pad or driveway so as to provide off-street parking exclusive of the garage. The setbacks of subsection C of this section shall still apply.
5. Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will be exempt from the lot coverage calculations of subsections (B)(1) through (4) of this section and the underlying zone.
6. Table showing development allowed by land classification:

	Development Allowed
Non-HCA ("a")	*Yes*
Low-Medium HCA ("b" and "c")	*Yes, if less than 5,000 sq. ft. of non-HCA land available. Avoid "d."*
High HCA ("d")	*Yes, but only if less than 5,000 sq. ft. of "a," "b" and "c" land available.*
Non-conforming Structures (structures on HCA land)	*Yes: vertically, laterally and/or away from river.* *Avoid "d" where possible.*

(The underlying zone FAR and allowable lot coverage shall also apply.)

Applicant Response: This section (B) is not applicable. The Applicant's proposal does not include single-family or attached residential development.

C. <u>Setbacks from top of bank</u>.

1. Development of single-family homes or attached housing on lands designated as "Habitat and Impact Areas Not Designated as HCAs" shall require a structural setback of 15 feet from any top of bank that represents the edge of the land designated as "Habitat and Impact Areas Not Designated as HCAs."
2. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback but must keep five feet from top of bank and cannot cantilever over the top of bank or into the five-foot setback area.
3. For properties that lack a distinct top of bank the applicant shall identify the boundary of the area designated as "Habitat and Impact Areas Not Designated as HCAs" which is closest to the river. A structural setback of 15 feet is required from that boundary line. That 15-foot measurement extends from the boundary line away from the river. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback 10 feet but must keep five feet from the boundary and cannot cantilever into the five-foot setback area. For vacant lots of record that comprise no lands with "Habitat and Impact Areas Not Designated as HCAs" designation or insufficient lands with those designations so that the above setbacks cannot be

met, the house shall be set back as far from river as possible to accommodate house as part of the allowed 5,000 square feet of impermeable surfaces.

Applicant Response: This section is not applicable. The Applicant's proposal does not include single-family or attached residential development, or patios or decks.

D. *<u>Development of lands designated for industrial, commercial, office, public and other non-residential uses</u>.*

1. Development of lands designated for industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential uses shall be permitted on the following land designations and in the following order of preference with "a" being the most appropriate for development and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

Applicant Response: Table 1 below shows the breakdown of proposed development within a, b, c, and d lands, showing that permanent impacts were avoided or minimized to the extent feasible to the High HCA designated areas in accordance with the preferred order of development. Permanent impacts to HCAs are only proposed in two areas, along I-205 NB near 10th Street (HCA 1) and under the Abernethy Bridge (HCA 4). HCA 2 and HCA 3 do not have proposed permanent impacts to the HCA itself; impacts are proposed to the Habitat and Impact Areas Not Designated as HCAs. See Attachment M, HCA Impacts for areas of proposed permanent impacts in HCAs and non-HCAs.

Table 1. Proposed development on a-d designated lands

HCA #	"a" lands		"b" lands		"c" lands		"d" lands	
	Temp.	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**
1	23,967 sq. ft.	75,322 sq. ft.	3,760 sq. ft.	10,726 sq. ft.	0	0	0	0
2	5,559 sq. ft.	27,922 sq. ft.	0	0	0	0	0	0
3	4,026 sq. ft.	20,096 sq. ft.	0	0	0	0	0	0
4	520 sq. ft.	12,370 sq. ft.	0	0	44,602 sq. ft.	9,975 sq. ft.	199,340 sq. ft.	1,425 sq. ft.
Total	**34,072 sq. ft.**	**135,710 sq. ft**	**3,760 sq. ft.**	**10,726 sq. ft.**	**44,602 sq. ft.**	**9,975 sq. ft.**	**199,340 sq. ft.**	**1,425 sq. ft.**

2. Developing HCA land.

   a. *Where non-HCA or areas designated as "Habitat and Impact Areas Not Designated as HCAs" are lacking or are in such limited supply as to render uses allowed by the underlying zone (e.g., general industrial) functionally impractical, the HCA may be utilized and built upon but shall emphasize "b" and "c" designations.*

Applicant Response: The Applicant will utilize "b" and "c" designations in areas without non-HCAs or areas designated as Habitat and Impact Areas Not Designated as HCAs (See Attachment M, HCA Impacts). Unavoidable proposed permanent impacts to "b" and "c" designations are along the I-205 corridor in HCA 1 and under the Abernethy Bridge in HCA 4.

   b. *Where it is proposed that a "d" or high HCA classification be used, the property owner must demonstrate that the proposed use is clearly a water-dependent use. Proximity to the river for the purpose of views is not valid grounds. However, public interpretive facilities of historic facilities such as the government locks will be permitted as well as wildlife interpretive facilities and ADA-accessible platforms.*

Applicant Response: Development is proposed in areas classified as high HCA under the Abernethy Bridge in HCA 4. The proposed work includes replacing the existing bridge supports to provide a seismically stable Abernethy Bridge able to withstand the Cascadia Subduction Zone earthquake. The Abernethy Bridge will carry the I-205 lifeline traffic over the Willamette River and McLoughlin Creek after the earthquake allowing for emergency response and a more speedy recovery of the critical infrastructure within the region. The project was designed to have the least impact possible to HCAs, but some impacts are required in order to meet the project's objective.

All other proposed impacts to HCAs are within a, b, or c classifications along the I-205 corridor. See Attachment M for proposed HCA impacts.

E. *Hardship provisions and non-conforming structures.*

1. For the purpose of this chapter, non-conforming structures are existing structures whose building footprint is completely or partially on HCA lands. Any additions, alterations, replacement, or rehabilitation of existing non-conforming non-water-related structures (including decks), roadways, driveways, accessory uses and accessory structures shall avoid encroachment upon the HCAs, especially high HCAs, except that:

a. A 10-foot lateral extension of an existing building footprint is allowed if the lateral extension does not encroach any further into the HCA or closer to the river or water resource area than the portion of the existing footprint immediately adjacent.

Applicant Response: No building extensions are proposed.

b. An addition to the existing structure on the side of the structure opposite to the river or water resource area shall be allowed. There will be no square footage limitation in this direction except as described in subsection (E)(1)(c) of this section.

Applicant Response: No additions to structures are proposed. The Abernethy Bridge has several piers located within multiple HCA designations, and those piers must be replaced or upgraded to allow the bridge to withstand the anticipated earthquake. The replacement of these piers will result in permanent impacts to HCA 4.

c. The same allowance for the use of, and construction of, 5,000 square feet of total impervious surface for sites in HCAs per subsections (B)(2) through (4) of this section shall apply to lots in this section.

Applicant Response: No impervious surfaces are proposed in HCAs, only excavation, fill, and bridge piers are proposed as permanent impacts to HCAs.

d. Vertical additions are permitted including the construction of additional floors.

Applicant Response: No construction of additional floors is proposed.

e. The provisions of Chapter 66 CDC, Non-conforming Structures, shall not apply.

Applicant Response: The Applicant acknowledges that CDC Chapter 66 do not apply.

F. Access and property rights.

1. Private lands within the protection area shall be recognized and respected.

Applicant Response: The Applicant's proposal does not include private lands.

2. Where a legal public access to the river or elsewhere in the protection area exists, that legal public right shall be recognized and respected.

Applicant Response: All areas of public access in the protection area will be recognized and respected.

3. To construct a water-dependent structure such as a dock, ramp, or gangway shall require that all pre-existing legal public access or similar legal rights in the protection area be recognized and *respected. Where pre-existing legal public access, such as below the OLW, is to be obstructed by, for example, a ramp, the applicant shall provide a reasonable alternate route around, over or under the obstruction. The alternate route shall be as direct as possible. The proposed route, to include appropriate height clearances under ramps/docks and specifications for safe passage over or around ramps and docks, shall be reviewed and approved by the Planning Director for adequacy.*

Applicant Response: No water-dependent structures are proposed.

4. Any public or private water-dependent use or facility shall be within established DSL-authorized areas.

Applicant Response: No water-dependent uses or facilities are proposed.

5. Legal access to, and along, the riverfront in single-family residential zoned areas shall be encouraged and pursued especially when there are reasonable expectations that a continuous trail system can be facilitated. The City recognizes the potential need for compensation where nexus and proportionality tests are not met. Fee simple ownership by the City shall be preferred. The trail should be dimensioned and designed appropriate to the terrain it traverses and the user group(s) it can reasonably expect to attract. The City shall be responsible for signing the trail and delineating the boundary between private and public lands or access easements.

Applicant Response: The Applicant does not propose to restrict access to the riverfront.

G. <u>Incentives to encourage access in industrial, multi-family, mixed use, commercial, office, public and non-single-family residential zoned areas</u>.

1. For all industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential zones, this section encourages the dedication or establishment of access easements to allow legal public access to, and along, the river. Support for access may be found in the Parks Master Plan, a neighborhood plan or any applicable adopted sub-area plans. The emphasis will be upon locating paths where there is a reasonable expectation that the path can be extended to adjacent properties to form a connective trail system in the future, and/or where the trail will provide opportunities for appreciation of, and access to, the river.

Applicant Response: The Applicant's proposal is intended to improve the safety and reliability of vehicular travel on I-205, and is not a development that would impede or enhance river access. Although there is no formal designated trail, the ODOT right-of-way under the Abernethy Bridge is utilized as a connection between the McLean House and Park and West Bridge Park. Trail connectivity will be maintained during and after construction of the project.

2. Height or density incentives may be available to developers who provide public access. Specifically, commercial, industrial, multi-family, mixed use, and public projects may be constructed to a height of 60 feet. No variance is required for the 60-foot height allowance regardless of the underlying zone height limitations; however, the following conditions must be met:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and *b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way.*

c. Fencing may be required near steep dropoffs or grade changes.

Applicant Response: The applicant is not seeking height or density incentives to upgrade the seismic resiliency and mobility of the I-205 corridor.

H. <u>Partitions, subdivisions and incentives</u>.

1. When dividing a property into lots or parcels, an applicant shall verify the boundaries of the HCA on the property.

2. Applicant shall partition or subdivide the site so that all lots or parcels have a buildable site or envelope available for home construction located on non-HCA land or areas designated "Habitat and Impact Areas Not Designated as HCAs" per the HCA Map.

3. Development of HCA-dominated lands shall be undertaken as a last resort. A planned unit development (PUD) of Chapter <u>24</u> CDC may be required.

4. Incentives are available to encourage provision of public access to, and/or along, the river. By these means, planned unit developments shall be able to satisfy the shared outdoor recreation area requirements of CDC <u>55.100</u>(F). Specifically, for every square foot of riverfront path, the applicant will receive credit for two square feet in calculating the required shared outdoor recreation area square footage. Applicants shall also be eligible for a density bonus under CDC <u>24.150</u>(B). To be eligible to receive either of these incentives, applicants shall:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and

b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way;

c. Fencing may be required near steep dropoffs or grade changes.

Applicant Response: The Applicant does not propose partition or subdivide any properties and therefore does not seek any incentives to do so. Work will be completed within State or City right-of-way.

I. <u>Docks and other water-dependent structures</u>.

1. Once the preference rights area is established by DSL, the property owner identifies where the water-dependent use will be located within the authorized portion of the preference rights area. The water-dependent use should be centered or in the middle of the preference rights/authorized area or meet the side yard setbacks of the underlying zone.

Private and public non-commercial docks are permitted where dredging is required so long as all applicable federal and State permits are obtained. Dredging is encouraged if deposits silt up under an existing dock. Dredging is seen as preferable to the construction of longer docks/ramps.

2. Both joint and single use docks shall not extend into the water any further than necessary to provide four feet between the ship's keel or fixed propeller/rudder and the bottom of the water at any time during the water's lowest point.

3. In no case except as provided in this section shall a private ramp and private dock extend more than 100 feet from OLW towards the center of the river or slough. In the case of L-shaped docks, the 100 feet shall be measured from the OLW to the furthest part of the private dock closest to the center of the river.

4. Docks on sloughs and similar channels shall not extend more than 30 percent of the distance between two land masses at OHW, such as between the mainland and an island or peninsula, measured in a lineal manner at right angle to the dominant shoreline. In no way shall a dock impede existing public usage or block navigation of a channel.

5. Boat storage associated with a rail launch facility shall be located above the OHW, either vertically raised above the ordinary high water line or set back behind the OHW. Such boat storage structure will be natural wood colors or similar earth tones. Private railed launch facilities are permitted for individual boat owners. The onshore setback of the storage structure is equal distance on both sides as extended perpendicular to the thread of the stream, or seven and one-half feet, whichever is the greater setback.

6. The width of each deck section shall be no more than 12 feet wide.

7. For only single-user and joint-user docks, pilings shall not exceed a maximum height of eight feet above the 100-year flood elevation.

8. A single user non-commercial dock shall not exceed 400 square feet in deck area. The boat slip is not included in the calculation of this square footage limitation.

9. Private non-commercial boat houses are allowed but only if they are within 50 feet of OLW and/or in locations sufficiently screened from view so that they do not have a significant visual impact on views from adjacent and nearby homes. Building and roof colors shall be brown, gray, beige, natural or similar earth tones. Non-commercial boat houses shall not exceed 12 feet in height measured from the boat house deck level to the roof peak. The size of the boat house shall be sized to accommodate one boat only and shall not exceed a footprint greater than 500 square feet. Boatlifts are permitted within the boat house. The above provisions also apply to open-walled boat shelters with or without boatlifts.

Applicant Response: No dock or other water-dependent structures are proposed. This section (I) does not apply to the proposed Project.

J. Joint docks.

1. Joint use boat docks may be permitted by the reviewing authority where the applicants are riverfront property owners, ideally owners of adjacent lots of record.
2. Co-owners of the joint dock use shall be prohibited from having their own non-joint dock.

3. A joint use agreement shall be prepared which will be included in the application for review by the reviewing authority and subsequently recorded. A copy of the recorded document with the County Recorder's stamp shall be submitted to the City.

4. A condition of approval for any joint use permit shall be that the dock must be used to serve the same lots of record for which the dock permit was issued. Joint use cannot be transferred to, or used by, any party other than the original applicants or the future owners of those properties.

5. Joint docks may go on the common property line between the two landowners who are sharing the dock. Unless agreed to by the adjoining owner, joint docks not being shared with the adjacent property owner must be at least 15 feet from the preference rights area side lines or centered in the middle of the preference rights area.

Applicant Response: No joint docks are proposed. This section does not apply to the proposed Project.

K. <u>Non-conforming docks and other water-related structures</u>. Pre-existing non-conforming structures, including docks, ramps, boat houses, etc., as defined in this chapter may remain in place. Replacement in kind (e.g., replacement of decking and other materials) will be allowed provided the replacement meets the standards of this chapter. However, if any non-conforming structure that is damaged and destroyed or otherwise to be replaced to the extent that the rebuilding or replacing (including replacement in kind) would exceed 50 percent of the current replacement cost of the entire structure, the owner shall be required to meet all the standards of this chapter.

Applicant Response: No work is proposed to any pre-existing non-conforming docks or other water-related structures.

L. <u>Roads, driveways, utilities, or passive use recreation facilities</u>. Roads, driveways, utilities, public paths, or passive use recreation facilities may be built in those portions of HCAs that include wetlands, riparian areas, and water resource areas when no other practical alternative exists but shall use water-permeable materials unless City engineering standards do not allow that. Construction to the minimum dimensional standards for roads is required. Full mitigation and revegetation is required, with the applicant to submit a mitigation plan pursuant to CDC <u>32.070</u> and a revegetation plan pursuant to CDC <u>32.080</u>. The maximum disturbance width for utility corridors is as follows:

1. For utility facility connections to utility facilities, no greater than 10 feet wide.

Applicant Response: No utility facility connections to utility facilities are proposed.

2. For upgrade of existing utility facilities, no greater than 15 feet wide.

Applicant Response: No upgrades of existing utility facilities are proposed.

3. For new underground utility facilities, no greater than 25 feet wide, and disturbance of no more than 200 linear feet of water quality resource area, or 20 percent of the total linear feet of water quality resource area, whichever is greater.

Applicant Response: No new underground utility facilities are proposed.

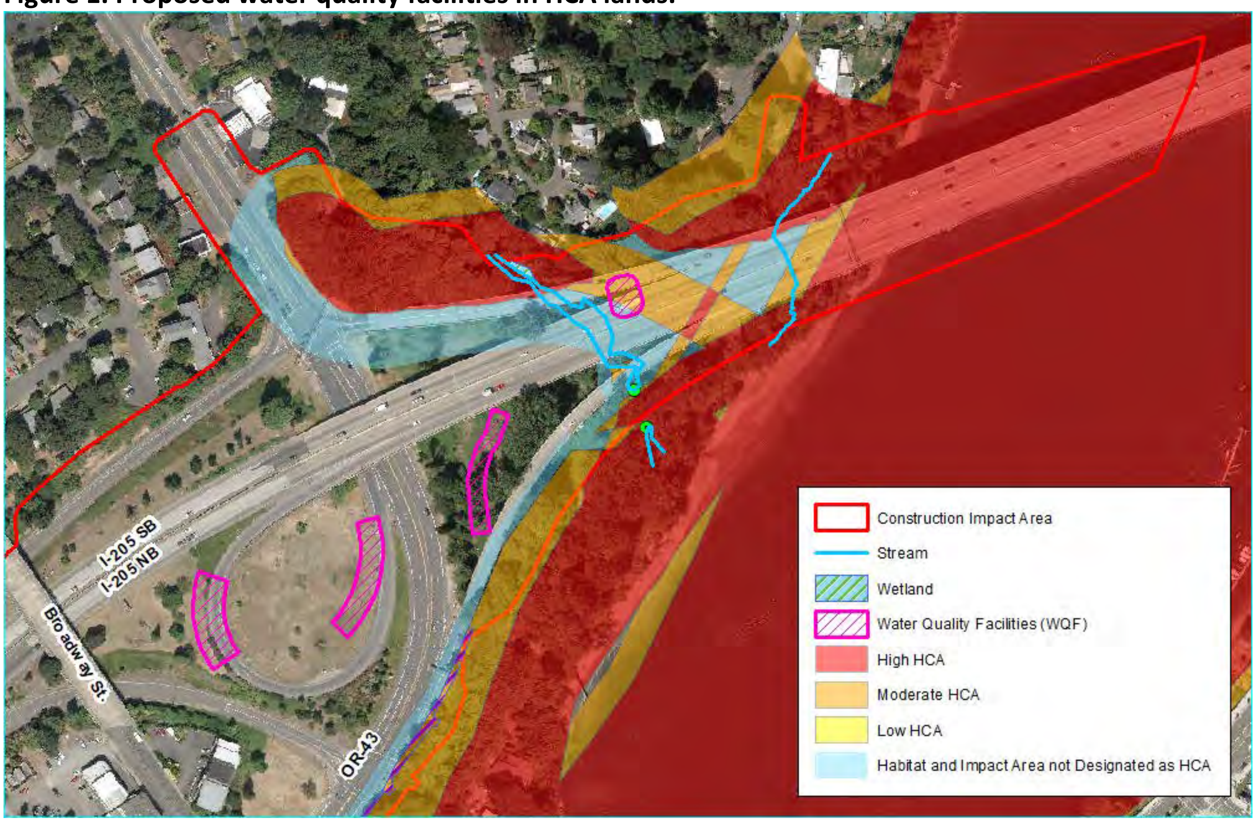
M. <u>Structures</u>. All buildings and structures in HCAs and riparian areas, including all exterior mechanical equipment, should be screened, colored, or surfaced so as to blend with the riparian environment. Surfaces shall be non-polished/reflective or at least expected to lose their luster within a year. In addition to the specific standards and criteria applicable to water-dependent uses (docks), all other provisions of *this chapter shall apply to water dependent uses, and any structure shall be no larger than necessary to accommodate the use.*

Applicant Response: The only structures proposed in HCAs and riparian areas are supports for the Abernethy Bridge, which will match the existing structure to maintain the same visual quality as currently exists.

N. <u>Water-permeable materials for hardscapes</u>. The use of water-permeable materials for parking lots, driveways, patios, and paths as well as flow-through planters, box filters, bioswales and drought tolerant plants are strongly encouraged in all "a" and "b" land classifications and shall be required in all "c" and "d" land classifications. The only exception in the "c" and "d" classifications would be where it is demonstrated that water-permeable driveways/hardscapes could not structurally support the axle weight of vehicles or equipment/storage load using those areas. Flow through planters, box filters, bioswales, drought tolerant plants and other measures of treating and/or detaining runoff would still be required in these areas.

Applicant Response: No impervious parking lots, driveways, patios, or paths are proposed in HCAs. All impervious surfaces created from the project will be treated. A water quality swale is proposed in HCA 4 that will capture and treat runoff from the project area. It is located mostly in "c" lands with a small portion that falls within "a" lands (see Figure 1 below).

Figure 1. Proposed water quality facilities in HCA lands.



O. <u>Signs and graphics</u>. No sign or graphic display inconsistent with the purposes of the protection area shall have a display surface oriented toward or visible from the Willamette or Tualatin River. A limited number of signs may be allowed to direct public access along legal routes in the protection area.

Applicant Response: Several signs are proposed to be installed in the protection area, however, the intent of the signs is to direct public access along I-205 and are required for safety. The proposed signed will be located along I-205 and will be consistent with the existing aesthetic corridor feel. In accordance with FHWA design standards, approximately 11 signs are proposed on the Abernethy Bridge, which may be visible from the Willamette River. See Attachment X, Signing Plan.

P. Lighting. Lighting shall not be focused or oriented onto the surface of the river except as required by the Coast Guard. Lighting elsewhere in the protection area shall be the minimum necessary and shall not create off-site glare or be omni-directional. Screens and covers will be required.

Applicant Response: No lighting is proposed to be focused or oriented onto the surface of the river.

Q. Parking. Parking and unenclosed storage areas located within or adjacent to the protection area boundary shall be screened from the river in accordance with Chapter 46 CDC, Off-Street Parking, Loading and Reservoir Areas. The use of water-permeable material to construct the parking lot is either encouraged or required depending on HCA classification per CDC 28.110(N)(4).

Applicant Response: No parking lots or storage areas are proposed.

R. Views. Significant views of the Willamette and Tualatin Rivers shall be protected as much as possible as seen from the following public viewpoints: Mary S. Young Park, Willamette Park, Cedar Oak Park, Burnside Park, Maddox Park, Cedar Island, the Oregon City Bridge, Willamette Park, and Fields Bridge Park.

Where options exist in the placement of ramps and docks, the applicant shall select the least visually intrusive location as seen from a public viewpoint. However, if no options exist, then the ramp, pilings and dock shall be allowed at the originally proposed location.

Applicant Response: Views of the Willamette River will be protected to the extent possible while still meeting project objectives, which includes seismically retrofitting the Abernethy Bridge. The proposed replacement bridge piers have been designed to be visually consistent with the existing bridge. No proposed work from the project will affect the Tualatin River or its views.

S. Aggregate deposits. Extraction of aggregate deposits or dredging shall be conducted in a manner designed to minimize adverse effects on water quality, fish and wildlife, vegetation, bank stabilization, stream flow, visual quality, noise and safety, and to promote necessary reclamation.

Applicant Response: No extraction of aggregate deposits is proposed. The retrofit of the Abernethy Bridge will require excavation in the Willamette River. Removal and fill activities in the river have been designed to have the least amount of impact possible to water quality, fish and wildlife, vegetation, bank stabilization, and streamflow. The applicant consulted with the National Marine Fisheries Service (NMFS) and the Oregon Department of Fish and Wildlife (ODFW) regarding proposed impacts that may affect water quality, fish and wildlife habitat, and vegetation (Attachment U, NMFS Consultation). Several mitigation measures were identified to be implemented during construction. In-water work will be conducted during the in-water work window to reduce potential impacts to aquatic species. Best management practices will be implemented to prevent water quality impacts such as sedimentation and turbidity during excavation, including the use of cofferdams and erosion control measures. The existing piers will be cut off below the mud line to avoid and minimize potential effects to natural fluvial geomorphic processes. Vegetation removed on the bank for construction access will be restored after construction is complete.

T. <u>Changing the landscape/grading</u>.

1. Existing predominant topographical features of the bank line and escarpment shall be preserved and maintained except for disturbance necessary for the construction or establishment of a water related or water dependent use. Measures necessary to reduce potential bank and escarpment erosion, landslides, or flood hazard conditions shall also be taken.

Any construction to stabilize or protect the bank with rip rap, gabions, etc., shall only be allowed where there is clear evidence of erosion or similar hazard and shall be the minimum needed to stop that erosion or to avoid a specific and identifiable hazard. A geotechnical engineer's stamped report shall accompany the application with evidence to support the proposal.
Applicant Response: Riprap is not proposed within the ordinary high water or along the banks of the Willamette River, following replacement of the in-water shafts. See Attachment O for the Geotechnical Report.

2. The applicant shall establish to the satisfaction of the approval authority that steps have been taken to minimize the impact of the proposal on the riparian environment (areas between the top of the bank and the low water mark of the river including lower terrace, beach and river edge).
Applicant Response: The project has been designed to have the least impact possible to riparian areas. In areas where proposed work could not be avoided or minimized, mitigation through revegetation is proposed. Work in riparian areas includes replacement and upgrades of bridge columns, including excavation, fill, and foundation stabilization. Jet grouting is proposed around the pier footings to meet seismic criteria. The combination of these activities requires large areas of excavation at each foundation. Construction access and staging are needed for large equipment and concrete trucks to access the repair sites. After construction is complete, temporary access and staging areas will be restored at grade and revegetated. Areas of permanent impact, including the foundation impacts, will be mitigated according to CDC 32.100.

3. The applicant shall demonstrate that stabilization measures shall not cause subsequent erosion or deposits on upstream or downstream properties.
Applicant Response: The proposed work will not cause erosion or deposits on upstream or downstream properties. See Attachment O for the Geotechnical Report.

4. Prior to any grading or development, that portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be protected with an anchored chain link fence (or approved equivalent) at its perimeter and shall remain undisturbed except as specifically allowed by an approved Willamette and Tualatin River Protection and/or water resource area (WRA) permit. Such fencing shall be maintained until construction is complete. That portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be identified with City-approved permanent markers at all boundary direction changes and at 30- to 50-foot intervals that clearly delineate the extent of the protected area.
Applicant Response: Areas of HCAs that include wetlands, creeks, and riparian areas that are not to be impacted by the project will be fenced off and marked along the orange construction fencing. Fencing will be maintained for the duration of the project.

5. Full erosion control measures shall be in place and approved by the City Engineer prior to any grading, development or site clearing.

Applicant Response: An Erosion and Sediment Control Plan (Attachment Z) has been developed and will be implemented prior to any grading, development, or site clearing. The Erosion and Sediment control plan has been developed in accordance with ODOT's NPDES 1200-CA permit issued by ODEQ.

U. <u>Protect riparian and adjacent vegetation</u>. Vegetative ground cover and trees upon the site shall be preserved, conserved, and maintained according to the following provisions:

1. Riparian vegetation below OHW removed during development shall be replaced with indigenous vegetation, which shall be compatible with and enhance the riparian environment and approved by the approval authority as part of the application.

Applicant Response: A revegetation plan (Attachment W) and a Mitigation Plan (Attachment K) have been developed that would restore functions of riparian vegetation removed during development.

2. Vegetative improvements to areas within the protection area may be required if the site is found to be in an unhealthy or disturbed state by the City Arborist or his or her designated expert. "Unhealthy or disturbed" includes those sites that have a combination of native trees, shrubs, and groundcover on less than 80 percent of the water resource area and less than 50 percent tree canopy coverage in the primary and secondary habitat conservation area to be preserved. "Vegetative improvements" will be documented by submitting a revegetation plan meeting CDC <u>28.160</u> criteria that will result in the primary and secondary habitat conservation area to be preserved having a combination of native trees, shrubs, and groundcover on more than 80 percent of its area, and more than 50 percent tree canopy coverage in its area. The vegetative improvements shall be guaranteed for survival for a minimum of two years. Once approved, the applicant is responsible for implementing the plan prior to final inspection.

Applicant Response: The City Arborist has not designated any vegetative improvements in the project.

3. Tree cutting shall be prohibited in the protection area except that:

a. Diseased trees or trees in danger of falling may be removed with the City Arborist's approval; and

b. Tree cutting may be permitted in conjunction with those uses listed in CDC <u>28.030</u> with City Arborist approval; to the extent necessary to accommodate the listed uses;

c. Selective cutting in accordance with the Oregon Forest Practices Act, if applicable, shall be permitted with City Arborist approval within the area between the OHW and the greenway boundary provided the natural scenic qualities of the greenway are maintained. (Ord. 1576, 2008; Ord. 1590 § 1, 2009; Ord. 1604 §§ 29 – 36, 2011; amended during July 2014 supplement; Ord. 1635 § 17, 2014; Ord. 1636 § 27, 2014)

Applicant Response: Tree removal is proposed under the Abernethy Bridge along the Willamette River. See Attachment T for a map of proposed tree removal within the riparian area. Any trees proposed to be cut will be submitted to the City Arborist for approval prior to cutting.

Chapter 32 Water Resource Area Protection

There are six water resource areas (WRAs) present within the proposed Project area. As instructed by City of West Linn Planning Department, the Applicant is applying for a WRA permit under the alternate review process for two of these WRAs (WRA 3 and WRA 5) due to the locations of the WRAs. WRAs within the Project area overlap with existing roadway engineered facilities; therefore, the size of the buffers prescribed under the standard review process are larger than necessary to protect the existing functions of the water resources. The remaining four WRAs (1, 2, 4, and 6) are addressed under the standard process. Responses to West Linn Community Development Code (CDC) Chapter 32 approval criteria are included below.

32.080 APPROVAL CRITERIA (ALTERNATE REVIEW PROCESS)

Applications reviewed under the alternate review process shall meet the following approval criteria:

A. The proposed WRA shall be, at minimum, qualitatively equal, in terms of maintaining the level of functions allowed by the WRA standards of CDC 32.060(D).

Applicant Response: There are six WRAs within the project area, numbered as WRA 1–6 in Attachment Q (see Table 1 below). The applicant proposes reductions to WRA 3 and 5) because the standard width determined by following the guidance in Table 32-2 results in roads and road prisms being included within the calculated WRAs that would not enhance or protect the functions of the associated water resources, as outlined in CDC 32.070 (see Table 2 below). In addition to proposed reductions, the work proposed within the calculated WRA 1 and WRA 2 is exempt based on CDC 32.040.B.1 (maintenance), as the proposed roadway improvements are not expanding outside of the existing roadway prism into the WRA, as well as exemption 32.040.F.2, where streams are enclosed within culverts and development is proposed at right angles to those culverts (WRA 4). The width of WRA 6 was determined via Table 32-2 and no reductions or exemptions are proposed. Additional features are located on the West Linn WRA map, including a stream labeled as CA-01 north of I-205 near Sunset Avenue, and one stream labeled as CA-02 in between Sunset Avenue and Broadway Street. The CA-02 stream and riparian corridor are entirely outside of the Project area and are not included in this application. The CA-01 stream was delineated during the wetland delineation that occurred for the Project, which was determined to be a non-jurisdictional ditch (see Attachment S, DSL Concurrence and Wetland Delineation). Ditches are not counted as WRAs (as defined in CDC Chapter 2); therefore, the ditch is not included in this application.

Table 1. WRAs in the Project area

WRA #	Exemption	Reduction	Attachment Q, Figure #
1	32.040.B.1	-	1
2	32.040.B.1	-	1
3	-	Yes	2
4	32.040.F.2	-	3
5	-	Yes	3
6	-	No	4

Table 2. WRA Function Assessment for Road Prisms

Ecological Function	Landscape Features Potentially Providing the Function	Road Prism Functions
Stream flow moderation and/or water storage	A wetland or other water body with a hydrologic connection to a stream or flood area, the presence of fallen trees and density of vegetation in the WRA that slows the flow of storm water and increases its ability to retain sediment and infiltrate storm water, and the porosity of the WRA's surface to enable it to infiltrate storm water.	Roads lack vegetation and road prisms have sparse vegetation and neither have fallen trees. Roadways and road prisms do not store water or sediment and do not moderate stream flows.
Sediment or pollution control	Vegetation within 100 feet of a WRA on gentle slopes and up to 200 feet of a WRA if the slope is greater than 25%. The presence of fallen trees and other material that slows the flow of water and increase the ability to retain sediment, absorb pollutants and infiltrate stormwater; the composition and density of vegetation; slope; and soils.	Roads lack vegetation and the outside edges of roadway prisms have sparse vegetation that is routinely mowed. Neither the roads nor road prisms have fallen trees. Roads and roadway prisms do not retain or store sediments and pollutants.
Bank stabilization	Root masses, existing large rocks or anchored large wood along the stream bank.	No streams or stream banks are present in roads or road prisms, as they are mostly made up of impervious surfaces and roadway fill. No root masses, existing large rocks, or anchored word is present. Roads and road prisms do not provide bank stabilization functions.
Large wood recruitment for a fish bearing section of stream	Forest canopy within 50 to 150 feet of a fish bearing stream.	No forest canopy or fish-bearing streams are located within roads or road prisms. This function is not provided.
Organic material sources	Forest canopy or woody vegetation within 100 feet of a water resource; or within a flood area.	No forest canopy or woody vegetation are present in roads or road prisms. Some vegetation may be present on the outside edges of the roadway prism but it is mowed regularly for maintenance purposes. No organic material sources are provided by roads or road prisms.
Shade (water temperature moderation) and microclimate	Forest canopy or woody vegetation within 100 feet of the water resource. Roughly 300 feet of continuous canopy for microclimate.	No forest canopy or woody vegetation is present within roads or roadway prisms. No shade and microclimate functions are being provided.
Stream flow that sustains in-stream and adjacent habitats	Seasonal or perennial flow.	No streams with seasonal or perennial flow are present in roads or roadway prisms. This function is not being provided.
Other terrestrial habitat	Forest canopy natural vegetation contiguous to and within 100 to 300 feet of the water resource.	Forest canopy is not present in roads or roadway prisms. Roads are dangerous for terrestrial species and do not provide any habitat.

WRA 1 is located west of 10th Street, north of I-205 southbound (SB) and is associated with a stream and two wetlands (W-33 and W-34; Attachment Q, Figure 1). According to Table 32-2, the calculated WRA surrounding the stream is 15 feet as the stream is ephemeral, and the calculated WRA surrounding wetland W-33 is 65 feet, because the surrounding average slope is less than 25%, and the calculated WRA surrounding wetland W-34 is 150 feet, since the adjacent slope is at least 25% to the top of the slope located approximately 100 feet from the delineated edge, plus an additional 50 feet. This calculated WRA 1 overlaps with the existing roadway. No impacts are proposed to WRA 1 outside of the existing engineered roadway prism; therefore, the proposed Project activities within WRA I are exempt under 32.040.B.1, as the proposed work falls under maintenance of existing roads.

WRA 2 is located both east and west of 10th Street, south of I-205 northbound (NB) and is associated with a stream and two wetlands (W-15 and W-17) at the toe of the slope (Attachment Q, Figure 1). According to Table 32-2, the calculated WRA 2 surrounding the wetland and stream is 200 feet wide, which would extend onto the engineered roadway prism, including overlapping existing roadway surfaces of I-205. No impacts are proposed to WRA 2 that would disturb the WRA beyond the footprint of the existing roadway prism, making it exempt under CDC 32.040.B.1 (maintenance of existing roads).

WRA 3 is located north of I-205 SB at the existing ODOT maintenance yard and is associated with two wetlands and an intermittent stream (Attachment Q, Figure 2). According to Table 32-2, the calculated WRA width would be 65 feet for the wetlands and 200 feet for the stream. However, this width leads to the WRA overlapping with the existing lanes of I-205 SB as well as the road entrance to the ODOT maintenance yard. These overlapping areas are proposed to be excluded from the WRA, as they are currently not providing any functions or values to the water resources. The wetlands and stream provide a low level of functions given their previous disturbance from their natural state and proximity to the freeway. The current functions provided by the water resources in this location include sediment and pollutant control. Due to the proximity of the freeway to the water resources do not provide high quality wildlife habitat; however, the wetlands and stream likely provide some habitat to birds and wildlife as there is forest canopy within 300 feet of the water resources. The existing roadway facilities do not provide functions, therefore, the functional WRA stops at the roadway prism, which varies from 3-65 feet from the edge of the delineated wetland.

WRA 4 is located approximately 600 feet east of WRA 3 north of I-205 SB and south of Imperial Drive near Radcliffe Court (Attachment Q, Figure 3). The WRA is associated with a small wetland and Tanner Creek. Using the guidance in Table 32-2, the wetland would have a 65-foot wide WRA (no significant slope) and the stream would have a 100-foot wide WRA, both based on the surrounding slope, which is less than 25%. Tanner Creek, which has presence of coastal cutthroat trout, according to StreamNet Mapper data, is contained within a culvert that extends underneath both lanes of I-205 and daylights again just south of I-205 NB. There is a short daylighted portion of the creek, approximately 80 feet long north of the culvert entrance. As outlined in CDC 32.040.F.2, piped sections of streams including development at right angles to the piped sections are exempt from WRA regulations. WRA 4 overlapping the culvert at a right angle from the inlet is excluded from the WRA.

WRA 5 is located immediately east of WRA 4 and is associated with three separate wetlands (Attachment Q, Figure 3). Following the guidance outlined in Table 32-2 results in the calculated WRA 5 being 65 feet wide. However, this width overlaps with approximately 10 feet of the existing roadway of I-205 SB, which is not providing the functions intended by the WRA chapter. Water quality functions currently being provided at the three wetlands include sediment and pollution control, since the proximity to the freeway results in sediment and pollutant runoff. The existing vegetation provides water quality functions by slowing and retaining sediments and stormwater runoff from I-205, although there are areas of bare ground and a gravel road that traverses the WRA. Other terrestrial habitat is provided due to the presence of forest canopy within 100 to 300 feet of the wetlands (as noted in Table 32-4). Because the calculated WRA overlaps with the roadway for 10 feet, the width required to protect the existing functions of the wetlands includes a 55-foot buffer that stops at the existing roadway. The reduction of the overlapping freeway lanes does not change the functions of the existing water resources, as those impervious surfaces are not currently providing any benefits. The Project will maintain water quality of the existing wetlands in WRA 4 due to the construction of additional stormwater facilities that will receive and treat runoff from I-205, thereby improving water quality functions.

B. If a WRA is already significantly degraded (e.g., native forest and ground cover have been removed or the site dominated by invasive plants, debris, or development), the approval authority may allow a reduced WRA in exchange for mitigation, if:

1. The proposed reduction in WRA width, coupled with the proposed mitigation, would result in better performance of functions than the standard WRA without such mitigation. The approval authority shall make this determination based on the applicant's proposed mitigation plan and a comparative analysis of ecological functions under existing and enhanced conditions (see Table 32-4).

Applicant Response: The reduction in WRA width has no result on the performance of functions of water resources since the areas proposed to be removed overlap with existing roadway or other engineered facilities within the roadway prism. These areas that would normally be part of the WRA boundary if following the guidance in Table 32-2 are currently not contributing any functions or values listed in Table 32-4., as described in the applicant response above. The water quality of the receiving waters will be improved by the applicant by implementing engineered water quality facilities that will provide treatment for all stormwater generated from impacted impervious surfaces that currently do not receive any treatment. Mitigation is proposed for all permanent impacts to WRAs in compliance with CDC 32.090. Temporarily impacted WRAs will be restored and revegetated in compliance with CDC 32.100. See Attachment W for the Landscaping Plan, which shows proposed WRA mitigation.

2. The mitigation project shall include all of the following components as applicable. It may also include other forms of enhancement (mitigation) deemed appropriate by the approval authority.

a. Removal of invasive vegetation.

b. Planting native, non-invasive plants (at minimum, consistent with CDC 32.100) that provide improved filtration of sediment, excess nutrients, and pollutants. The amount of enhancement (mitigation) shall meet or exceed the standards of CDC 32.090(C).

c. Providing permanent improvements to the site hydrology that would improve water resource functions.

d. Substantial improvements to the aquatic and/or terrestrial habitat of the WRA.

Applicant Response: Invasive vegetation and noxious weeds will be removed within the mitigation area prior to planting. This will include species listed as noxious weeds by the State of Oregon as well as species listed on the City of Portland nuisance plant list. The mitigation proposed is in compliance with CDC 32.100 and includes native, non-invasive plants that will provide improved filtration of sediment, excess nutrients, and pollutants, among other functions (see Attachment K, Mitigation Plan or Attachment W, Landscaping Plan for a list of proposed plants). Proposed species were chosen specifically for their ability to provide these functions, as well as survivability. The proposed WRA mitigation will take place underneath and adjacent to the Abernethy Bridge, which currently is dominated by invasive species. Mitigation will remove these invasive species and replace with native species, improving habitat and resources for wildlife in the area. Proposed trees and shrubs will provide organic material sources to wetlands and waters in and adjacent to the mitigation site. In addition to the proposed plants that will absorb and filter stormwater runoff from impervious surfaces upland of the WRA, several water quality facilities are proposed near the bridge that will also reduce the amount of sediment and pollutants that enter McLoughlin Creek and the Willamette River. A large upland biofiltration swale is proposed near OR 43 that will treat 1.309 acres of non-Project area, providing additional stormwater treatment. A biofiltration swale is proposed within WRA 5, which will treat 12.393 acres of contributing impervious area. Full treatment of the ODOT facility as well as treatment of non-Project stormwater will improve water quality for native and resident fish in the Willamette River, some of which are listed under the Endangered Species Act as threatened or endangered. Newly planted vegetation will also help to prevent erosion, providing bank stabilization. The proposed mitigation at the bridge has been reviewed and approved by both DSL and USACE for a shorter version of the I-205 Project extending from OR 213 to OR 43. The Applicant is currently in progress with a revision to the permits to expand the Project to just west of 10th Street and account for impacts to wetland W-32.

C. Identify and discuss site design and methods of development as they relate to WRA functions.

Applicant Response: The mitigation site under and adjacent to the Abernethy Bridge will mitigate for all proposed permanent WRA impacts and was designed to benefit McLoughlin Creek, the wetland adjacent to McLoughlin Creek, and the Willamette River, since these are the water resources currently providing the most and highest quality functions in the Project area. In total, 190,732 square feet of mitigation is proposed in the form of restoration planting, which will provide the functions listed in Table 32-4, including stream flow moderation from the increase in density of vegetation that will increase stormwater infiltration, and sediment and pollution retention. Stormwater facilities are proposed, as described in the applicant response above, that would absorb and filter stormwater from impervious upland surfaces. Once the restoration plants mature, they will be a source of both large wood recruitment and organic material sources to the Willamette River. The mature shrubs and trees will also provide shade to both McLoughlin Creek and the Willamette River, helping to regulate in-stream temperatures. Before any plants are planted, all invasive species will be removed from the mitigation site. The removal of invasive species and addition of native species will improve the quality and amount of habitat for birds and wildlife.

D. Address the approval criteria of CDC 32.060, with the exception of CDC 32.060(D).

Applicant Response: See applicant responses to CDC 32.060 below.

32.060 APPROVAL CRITERIA (STANDARD PROCESS)

No application for development on property containing a WRA shall be approved unless the approval authority finds that the proposed development is consistent with the following approval criteria, or can satisfy the criteria by conditions of approval:

A. <u>WRA protection/minimizing impacts</u>.

1. Development shall be conducted in a manner that will avoid or, if avoidance is not possible, minimize adverse impact on WRAs.

Applicant Response: Attachment P identifies the WRAs in the Project area, and there are six WRAs present (see Table 3 below). The Applicant avoided and minimized impacts on WRAs to the extent possible, but some disturbance is necessary in order to meet the Project's objectives and as required by accepted engineering practices. The purpose of the Project is to improve traffic safety, provide an earthquake safety route, and to seismically upgrade the Abernethy Bridge to withstand a Cascadia seismic event. ODOT designated I-205 as a Phase I statewide north-south lifeline route, which means it must be operational quickly after a disaster renders other roadways unusable or impassable. To avoid congestion and associated pollution, an additional lane will be added, which needs to be contiguous with the existing lanes, thereby making some impacts to those HCAs located near roadways unavoidable. Attachment Q identifies impacts to WRAs.

Table 3. WRAs in the Project area.

WRA #	Width (feet)	Rationale
1	15-150	The stream has a 15-ft WRA due to being ephemeral and the surrounding slopes are less than 25%. Wetland W-33 has a 65-ft buffer (less than 25% slopes), which extends up to the existing roadway (I-205 SB). Wetland W-34 is adjacent to slopes over 25%, creating a 150-ft buffer. The work proposed at this WRA is exempt according to CDC 32.040.B.1, since the Project consists of maintenance of existing roadways that will not expand beyond the previously disturbed area at grade.
2	200	The water resources are all located at the toe of slope, which is more than 25%. The slope is over 25% for more than 30 feet and has no distinct top of slope for at least 150 feet, creating a 200-ft wide buffer. The work proposed at this WRA is exempt according to CDC 32.040.B.1, since the Project consists of maintenance of existing roadways that will not expand beyond the previously disturbed area at grade.
4	65-100	Based on the slopes adjacent to wetland W-30 and Tanner Creek, the WRA width according to Table 32-2 would be 65 feet around the wetland and 100 feet around Tanner Creek. However, Tanner Creek is partially contained within a culvert and is exempt under CDC 32.040.F.2.
6	65-200	The water resources located within WRA include McLoughlin Creek, the Willamette River, and one wetland (W-37). The WRA associated with McLoughlin Creek varies from 65 to 200 feet, based on the adjacent slope. The slope on the left bank of the creek is less than 25%, so a 65-foot buffer was determined. The slope on the right bank is more than 25% for more than 150 feet, so a 200-foot buffer was determined. The slope adjacent to the Willamette River is less than 25%, resulting in a 100-foot buffer, as it is a fish bearing stream. The slopes adjacent to wetland W-37 are more than 25% for at least 150 feet, resulting in a 200-foot buffer.

2. Mitigation and re-vegetation of disturbed WRAs shall be completed per CDC 32.090 and 32.100, respectively.

Applicant Response: The Applicant proposes mitigation and re-vegetation for all disturbed WRAs compliant with CDC 32.090 and 32.100. See Attachment Q for WRA Impacts, Attachment K for the Mitigation Plan, and Attachment W for the Revegetation Plan. Proposed impacts to WRA are as follows:

WRA 1 is located west of 10th Street, north of I-205 SB and is associated with two wetlands and a stream. No temporary or permanent impacts are proposed to WRA 1, as it is exempt under CDC 32.040.B.1.

WRA 2 is located both east and west of 10th Street, south of I-205 NB and is associated with a stream and two wetlands at the toe of the slope. No temporary or permanent impacts are proposed to WRA 2, as it is exempt under CDC 32.040.B.1.

WRA 3 is located within the existing ODOT maintenance yard north of I-205. Two wetlands (Wetlands W-31 and W-32) and a stream are present that require the WRA. WRA 2 will be permanently impacted due to widening of the roadway and its associated excavation and fill. In addition to impacts to the WRA, permanent wetland impacts to Wetland W-32 are proposed totaling 6,875 square feet. Impacts to wetland W-32 are under the jurisdiction of the Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers (USACE);. no impacts are proposed to Wetland W-31. Proposed impacts to the WRA include 6,432 square feet of permanent impacts and 1,839 square feet of temporary impacts. All proposed impacts are adjacent to the existing I-205 SB roadway. See Attachment Q, Figure 2. Mitigation for impacts to WRA 3 will take place underneath and adjacent to the Abernethy Bridge. See Attachment W, Landscaping Plan for proposed mitigation areas. Mitigation banking credits will be used for impacts to Wetland W-32, pending approval from USACE and DSL.

WRA 4 is located north of I-205 SB and south of Imperial Drive near Radcliffe Court. WRA 4 is associated with a stream that is located within a culvert, which is exempt from WRA regulations according to CDC 32.040.F. No permanent or temporary impacts are proposed from the Project, as WRA 4 is located outside of the construction impact area and because it is exempt due to the stream being located within a culvert.

WRA 5 surrounds an existing wetland east of WRA 4 (Attachment Q, Figure 3). Permanent impacts are proposed to the edge of the WRA closest to I-205 SB caused by fill associated with widening of I-205, in the amount of 948 square feet. 1,686 square feet of temporary impacts are proposed adjacent to permanent impacts and will be revegetated after construction is complete. Mitigation is proposed for permanent impacts to WRA 5 and will be located underneath and adjacent to the Abernethy Bridge. See Attachment W, Landscaping Plan for proposed mitigation areas.

WRA 6 will have both temporary and permanent impacts due to removal and replacement of piers supporting the Abernethy Bridge. The WRA buffer surrounds the Willamette River, McLoughlin Creek, and Wetland-37. No reductions in the WRA are proposed. Permanent impacts proposed to WRA 6 are equal to 10,538 square feet and result from excavation and fill associated with drilled shafts and piers for the bridge, excavation to balance fill in the floodplain, and construction of a stormwater facility. Although impacts are avoided and minimized to the extent possible, permanent impacts are proposed to WRA 6 that are necessary in order to seismically upgrade the bridge so it can withstand a Cascadia subduction zone earthquake. Temporary impacts in the amount of 159,831 square feet are proposed from construction access and staging, temporary excavation and fill associated with removal and replacement of shafts, all of which will be revegetated upon completion of construction in that area. Mitigation for permanent impacts will take place on-site in the existing WRA. See Attachment Q, Figure 4 for WRA impacts and Attachment W, Landscaping Plan for proposed mitigation areas.

B. *Storm water and storm water facilities.*

1. Proposed developments shall be designed to maintain the existing WRAs and utilize them as the primary method of storm water conveyance through the project site unless:

a. The surface water management plan calls for alternate configurations (culverts, piping, etc.); or

b. Under CDC 32.070, the applicant demonstrates that the relocation of the water resource will not adversely impact the function of the WRA including, but not limited to, circumstances where the WRA is poorly defined or not clearly channelized.

Re-vegetation, enhancement and/or mitigation of the re-aligned water resource shall be required as applicable.

Applicant Response: The WRAs would be maintained at current locations. See Attachment R for the WRA and water quality facility (WQF) map.

2. Public and private storm water detention, storm water treatment facilities and storm water outfall or energy dissipaters (e.g., rip rap) may encroach into the WRA if:

a. Accepted engineering practice requires it;

b. Encroachment on significant trees shall be avoided when possible, and any tree loss shall be consistent with the City's Tree Technical Manual and mitigated per CDC 32.090;

c. There shall be no direct outfall into the water resource, and any resulting outfall shall not have an erosive effect on the WRA or diminish the stability of slopes; and

d. There are no reasonable alternatives available.

A geotechnical report may be required to make the determination regarding slope stability.

Applicant Response: 11 water quality facilities (WQFs) are proposed for the Project, one of which encroaches a WRA. As shown on Attachment R, Figure 3, WQF A is located entirely within WRA 6. WQF A is a water quality swale 3,740 square feet in area. It will be vegetated if there are species that can survive in the shade, since the WQF is located underneath the bridge and will not receive any sunlight. The proposed WQFs have been designed according to current engineering practices by a registered professional engineer. No trees associated with construction of WQFs will be removed, no direct outfall into the water resources is proposed, and the WQF will not cause erosion within the WRA. See Attachment Y for the Stormwater Site Plan and Attachment R for a map of WQFs relative to WRAs.

3. Roadside storm water conveyance swales and ditches may be extended within rights-of-way located in a WRA. When possible, they shall be located along the side of the road furthest from the water resource. If the conveyance facility must be located along the side of the road closest to the water resource, it shall be located as close to the road/sidewalk *as possible and include habitat friendly design features (treatment train, rain gardens, etc.).*

Applicant Response: Roadside stormwater conveyance swales are proposed in the right-of-way, but none will encroach WRAs. The swales were designed to be located as far as possible from the WRA while meeting accepted engineering practice. See Attachment Y for the Stormwater Site Plan and Attachment R for a map of WRAs and WQFs.

4. Storm water detention and/or treatment facilities in the WRA shall be designed without permanent perimeter fencing and shall be landscaped with native vegetation.

Applicant Response: See Attachment Y for the Stormwater Site Plan and See Attachment W for the Revegetation Plan. Storm water detention and/or treatment facilities in the WRA are proposed to be landscaped with native vegetation in accordance with ODOT standard practices with a water quality vegetation mix, which is comprised of a mix of the following species: California oatgrass (*Danthonia califonica*), tufted hairgrass (*Deschampsia cespitosa*), slender hairgrass (*Deschampsia elongata*), red fescue (*Festuca rubra var. rubra*), meadow barley (*Hordeum brachyantherum*), dense sedge (*Carex densa*), slough sedge (*Carex obnupta*), slender rush (*Juncus patens*), spreading rush (*Juncus tenuis*), broadleaf lupine (*Lupinus latifolis*), and graceful cinquefoil (*Potentilla gracilis*). No perimeter fencing is proposed.

5. Access to public storm water detention and/or treatment facilities shall be provided for maintenance purposes. Maintenance driveways shall be constructed to minimum width and use water permeable paving materials. Significant trees, including roots, shall not be disturbed to the degree possible. The encroachment and any tree loss shall be mitigated per CDC 32.090. There shall also be no adverse impacts upon the hydrologic conditions of the site.

Applicant Response: Access to public stormwater detention and treatment facilities will be provided. Access roads will be made of gravel and will be 16 feet in width. The facilities shown on the following sheets in Attachment Y (Stormwater Plan) are proposed to have gravel access roads: HA06, HA11, HA12, and HA13. The remaining facilities will be accessed by sidewalks, multiuse trails, or from the roadway shoulder.

6. Storm detention and treatment and geologic hazards. Per the submittals required by CDC 32.050(F)(3) and 92.010(E), all proposed storm detention and treatment facilities must comply with the standards for the improvement of public and private drainage systems located in the West Linn Public Works Design Standards, there will be no adverse off-site impacts caused by the development (including impacts from increased intensity of runoff downstream or constrictions causing ponding upstream), and the applicant must provide sufficient factual data to support the conclusions of the submitted plan.

Applicant Response: All facilities were designed to meet both ODOT and West Linn Standards. Adverse impacts will be avoided through detention for the basins that don’t discharge to the Willamette River. Details supporting stormwater data can be found in Attachment G, Stormwater Report.

C. *Repealed by Ord. 1647.*

Applicant Response: The Applicant acknowledges the repeal of this section.

D. WRA width. Except for the exemptions in CDC 32.040, applications that are using the alternate review process of CDC 32.070, or as authorized by the approval authority consistent with the provisions of this chapter, all development is prohibited in the WRA as established in Table 32-2 below:

Table 32-2. Required Width of WRA

Protected WRA Resource (see Chapter 2 CDC, Definitions)	***Slope Adjacent to Protected Water Resource[1, 3]***	***Starting Point for Measurements from Water Resource[1, 3]***	***Width of WRA on Each Side of the Water Resource***
A. Water Resource	*0% - 25%*	*OHW or delineated edge of wetland*	*65 feet*
B. Water Resource (Ravine)	*over 25% to a distinct top of slope[2]*	*OHW or delineated edge of wetland*	*From water resource to top of slope[2] (30-foot minimum), plus an additional 50 feet[4]*
C. Water Resource	*Over 25% for more than 30 feet, and no distinct top of slope for at least 150 feet*	*OHW or delineated edge of wetland*	*200 feet*
D. Riparian Corridor	*Any*	*OHW*	*100 feet*
E. Formerly Closed Drainage Channel Reopened	*Any*	*OHW*	*15 feet*
F. Ephemeral Stream	*Any*	*Stream thread or centerline*	*15 feet with treatment or vegetation (see CDC 32.050(G)(1))*
G. Fish Bearing Streams per Oregon Department of Fish and Wildlife (ODFW) or 2003-2004 Survey	*Applies to all that stream section where fish were inventoried and upstream to the first known barrier to fish passage.*	*OHW or delineated edge of wetland*	*100 feet when no greater than 25% slope. See B or C above for steeper slopes*
H. Re-aligned Water Resource	*See A, B, C, D, F, or G, above*	*OHW or delineated edge of wetland*	*See A, B, C, D, F, or G, above*

1 The slope is the average slope in the first 50 feet as measured from bankfull stage or OHW.

[2] Where the protected water resource is confined by a ravine or gully, the top of slope is the location (30-foot minimum) where the slope breaks to less than 15 percent for at least 50 feet.

[3] At least three slope measurements along the water resource, at no more than 100-foot increments, shall be made for each property for which development is proposed. Depending upon topography, the width of the protected corridor may vary.

[4] The 50-foot distance may be reduced to 25 feet if a geotechnical study by a licensed engineer or similar accredited professional demonstrates that the slope is stable and not prone to erosion.

Applicant Response: The Applicant has determined the width of four WRAs (WRA 1, 2, 4, and 6) within the Project area based on Table 32-2. The other two WRA widths (WRA 3 and 5) were determined using the alternate review process (CDC 32.070-32.080). See Table 1 above for widths and rationales for each WRA. See applicant responses to CDC 32.070 above and Attachment P for the WRA map.

E. Per the submittals required by CDC 32.050(F)(4), the applicant must demonstrate that the proposed methods of rendering known or potential hazard sites safe for development, including proposed geotechnical remediation, are feasible and adequate to prevent landslides or other damage to property and safety. The review authority may impose conditions, including limits on type or intensity of land use, which it determines are necessary to mitigate known risks of landslides or property damage.

Applicant Response: Geotechnical reports were written for the Project which demonstrate that the proposed site is safe for development. See Attachment O, Geotechnical Report.

F. Roads, driveways and utilities.

1. New roads, driveways, or utilities shall avoid WRAs unless the applicant demonstrates that no other practical alternative exists. In that case, road design and construction techniques shall minimize impacts and disturbance to the WRA by the following methods:

a. New roads and utilities crossing riparian habitat areas or streams shall be aligned as close to perpendicular to the channel as possible.

b. Roads and driveways traversing WRAs shall be of the minimum width possible to comply with applicable road standards and protect public safety. The footprint of grading and site clearing to accommodate the road shall be minimized.

c. Road and utility crossings shall avoid, where possible:

1) Salmonid spawning or rearing areas;

2) Stands of mature conifer trees in riparian areas;

3) Highly erodible soils;

4) Landslide prone areas;

5) Damage to, and fragmentation of, habitat; and

6) Wetlands identified on the WRA Map.

Applicant Response: A temporary construction access road is proposed from Willamette Drive (OR 43) to the bridge pier construction area (see Attachment V). This temporary access road will be constructed to a minimum width that will allow for bidirectional construction traffic necessary to complete the Abernethy Bridge foundation improvements. Proposed widening of existing I-205 roadway to current FHWA standards is proposed, which will impact portions of several WRAs. Foundation improvements necessary to support the I-205 widening and meet current seismic standards were designed to minimize impacts to WRAs. For example, new foundations will be constructed using drilled shafts as opposed to spread footings, which will drastically reduce the permanent impacts to WRAs. Those WRAs with proposed impacts will have construction techniques and best management practices implemented to further minimize impacts to the WRA. Mitigation is proposed for impacts to WRA; See Attachment K for the Mitigation Plan and Attachment W for the Revegetation Plan.

2. Crossing of fish bearing streams and riparian corridors shall use bridges or arch-bottomless culverts or the equivalent that provides comparable fish protection, to allow passage of wildlife and fish and to retain the natural stream bed.

Applicant Response: All proposed development activities crossing of fish bearing streams and riparian corridors are bridges. No new crossings are proposed.

3. New utilities spanning fish bearing stream sections, riparian corridors, and wetlands shall be located on existing roads/bridges, elevated walkways, conduit, or other existing structures or installed underground via tunneling or boring at a depth that avoids tree roots and does not alter the hydrology sustaining the water resource, unless the applicant demonstrates that it is not physically possible or it is cost prohibitive. Bore pits associated with the crossings shall be restored upon project completion. Dry, intermittent streams may be crossed with open cuts during a time period approved by the City and any agency with jurisdiction.

Applicant Response: No new utilities are proposed.

4. No fill or excavation is allowed within the ordinary high water mark of a water resource, unless all necessary permits are obtained from the City, U.S. Army Corps of Engineers and Oregon Department of State Lands (DSL).

Applicant Response: All proposed work within the ordinary high water mark of any water resources has been approved by DSL and the Corps. See Attachment H for permits.

5. Crossings of fish bearing streams shall be aligned, whenever possible, to serve multiple properties and be designed to accommodate conduit for utility lines. The applicant shall, to the extent legally permissible, work with the City to provide for a street layout and crossing location that will minimize the need for additional stream crossings in the future to serve surrounding properties.

Applicant Response: No new crossings of fish bearing streams are proposed. Proposed work on existing crossings will follow the existing alignment. The Abernethy Bridge will continue to support existing utilities, include the West Linn water supply line.

G. <u>Passive recreation</u>. Low impact or passive outdoor recreation facilities for public use including, but not limited to, multi-use paths and trails, not exempted per CDC <u>32.040</u>(B)(2), viewing platforms, historical or natural interpretive markers, and benches in the WRA, are subject to the following standards:

1. Trails shall be constructed using non-hazardous, water permeable materials with a maximum width of four feet or the recommended width under the applicable American Association of State Highway and Transportation Officials (AASHTO) standards for the expected type and use, whichever is greater.

Applicant Response: No trails are proposed within WRAs.

2. Paved trails are limited to the area within 20 feet of the outer boundary of the WRA, and such trails must comply with the storm water provisions of this chapter.

Applicant Response: No paved trails are proposed within WRAs.

3. All trails in the WRA shall be set back from the water resource at least 30 feet except at stream crossing points or at points where the topography forces the trail closer to the water resource.

Applicant Response: No trails are proposed within WRAs.

4. Trails shall be designed to minimize disturbance to existing vegetation, work with natural contours, avoid the fall line on slopes where possible, avoid areas with evidence of slope failure and ensure that trail runoff does not create channels in the WRA.

Applicant Response: No trails are proposed within WRAs.

5. Foot bridge crossings shall be kept to a minimum. When the stream bank adjacent to the foot bridge is accessible (e.g., due to limited vegetation or topography), where possible, fences or railings shall be installed from the foot bridge and extend 15 feet beyond the terminus of the foot bridge to discourage trail users and pets from accessing the stream bank, disturbing wildlife and habitat areas, and causing vegetation loss, stream bank erosion and stream turbidity. Bridges shall not be made of continuous impervious materials or be treated with toxic substances that could leach into the WRA.

Applicant Response: No foot bridge crossings are proposed within WRAs.

6. Interpretive facilities (including viewpoints) shall be at least 10 feet from the top of the water resource's bankfull flow/OHW or delineated wetland edge and constructed with a fence between users and the resource. Interpretive signs may be installed on footbridges.

Applicant Response: No interpretive facilities are proposed or exist within the Project area.

H. <u>Daylighting Piped Streams</u>.

1. As part of any application, covered or piped stream sections shown on the WRA Map are encouraged to be "daylighted" or opened. Once it is daylighted, the WRA will be limited to 15 feet on either side of the stream. Within that WRA, water quality measures are required which may include a storm water treatment system (e.g., vegetated *bioswales), continuous vegetative ground cover (e.g., native grasses) at least 15 feet in width that provides year round efficacy, or a combination thereof.*

Applicant Response: No impacts to piped streams are proposed, including daylighting piped streams.

2. The re-opened stream does not have to align with the original piped route but may take a different route on the subject property so long as it makes the appropriate upstream and downstream connections and meet the standards of subsections (H)(3) and (4) of this section.

Applicant Response: No daylighting of piped streams is proposed.

3. A re-aligned stream must not create WRAs on adjacent properties not owned by the applicant unless the applicant provides a notarized letter signed by the adjacent property owner(s) stating that the encroachment of the WRA is permitted.

Applicant Response: No streams are proposed to be permanently re-aligned that would create WRAs on adjacent properties.

4. The evaluation of proposed alignment and design of the reopened stream shall consider the following factors:

a. The ability of the reopened stream to safely carry storm drainage through the area without causing significant erosion.

b. Continuity with natural contours on adjacent properties, slope on site and drainage patterns.

c. Continuity of adjacent vegetation and habitat values.

d. The ability of the existing and proposed vegetation to filter sediment and pollutants and enhance water quality.

e. Provision of water temperature conducive to fish habitat.

Applicant Response: No reopened streams are proposed.

5. Any upstream or downstream WRAs or riparian corridors shall not apply to, or overlap, the daylighted stream channel.

Applicant Response: No daylighting of piped streams is proposed.

6. When a stream is daylighted the applicant shall prepare and record a legal document describing the reduced WRA required by subsections (H)(1) and (5) of this section. The document will be signed by a representative of the City and recorded at the applicant's expense to better ensure long term recognition of the reduced WRA and reduced restrictions for the daylighted stream section.

Applicant Response: No daylighting of piped streams is proposed.

I. The following habitat friendly development practices shall be incorporated into the design of any improvements or projects in the WRA to the degree possible:

1. Restore disturbed soils to original or higher level of porosity to regain infiltration and storm water storage capacity.

Applicant Response: The landscaping plan proposes an application of compost blanket and hydroseed on top of disturbed soils throughout the Project area. For mitigation areas, replanting efforts will inoculate the soil with mycorrhizae and beneficial bacteria by including PermaMatrix in backfill on bare root stock. The shrub and tree plantings will be individually mulched with arbor chips to prevent compaction, naturally suppress weeds, and develop the soil to encourage root growth and porosity. Soil roughness will be achieved by using ODOT Method D: Rough Areas for Seeded Revegetation or Erosion Control (ODOT standard Specifications). The mitigation areas will have a rough treatment of the surface of all future planted areas. Downed wood is also proposed in restoration areas to interrupt water and provide ecological benefit.

2. Apply a treatment train or series of storm water treatment measures to provide multiple opportunities for storm water treatment and reduce the possibility of system failure.

Applicant Response: The applicant has designed a series of stormwater treatment swales. Where possible, when swales are near WRAs, vegetation plantings will be brought up to the swales in case of overflow in storm events. See Attachment R for a map of WRAs and proposed stormwater facilities.

3. Incorporate storm water management in road rights-of-way.

Applicant Response: Stormwater treatment swales are proposed in the I-205 right-of-way spanning from the Abernethy Bridge west to 10th Street.

4. Landscape with rain gardens to provide on-lot detention, filtering of rainwater, and groundwater recharge.

Applicant Response: Only stormwater swales and detention ponds are proposed. No rain gardens are proposed.

5. Use multi-functional open drainage systems in lieu of conventional curb-and-gutter systems.

Applicant Response: The applicant proposes several swales as opposed to conventional curb-and-gutter systems where feasible. In some areas, such as along the Abernethy Bridge, conventional curb-and-gutter systems are necessary to direct stormwater to treatment facilities.

6. Use green roofs for runoff reduction, energy savings, improved air quality, and enhanced aesthetics.

Applicant Response: The Applicant's proposal does not include any structure with a roof.

7. Retain rooftop runoff in a rain barrel for later on-lot use in lawn and garden watering.

Applicant Response: The Applicant's proposal does not include any structure with a roof.

8. Disconnect downspouts from roofs and direct the flow to vegetated infiltration/filtration areas such as rain gardens.

Applicant Response: The Applicant's proposal does not include any structure with a roof.

9. Use pervious paving materials for driveways, parking lots, sidewalks, patios, and walkways.

Applicant Response: The Applicant's proposal does not include driveways, parking lots, sidewalks, patios, and walkways within WRAs.

10. Reduce sidewalk width to a minimum four feet. Grade the sidewalk so it drains to the front yard of a residential lot or retention area instead of towards the street.

Applicant Response: The Applicant's proposal does not include sidewalks within WRAs.

11. Use shared driveways.

Applicant Response: The Applicant's proposal does not include driveways within WRAs.

12. Reduce width of residential streets and driveways, especially at WRA crossings.

Applicant Response: The Applicant's proposal does not include residential streets or driveways.

13. Reduce street length, primarily in residential areas, by encouraging clustering.

Applicant Response: The Applicant's proposal does not include residential streets.

14. Reduce cul-de-sac radii and use pervious and/or vegetated islands in center to minimize impervious surfaces.

Applicant Response: The Applicant's proposal does not include cul-de-sac development.

15. Use previously developed areas (PDAs) when given an option of developing PDA versus non-PDA land.

Applicant Response: The Applicant's proposal is a transportation improvement Project in an existing transportation corridor. Where possible, the Project has widened I-205 to the center to minimize impacts to non-PDA areas located outside the roadway prism.

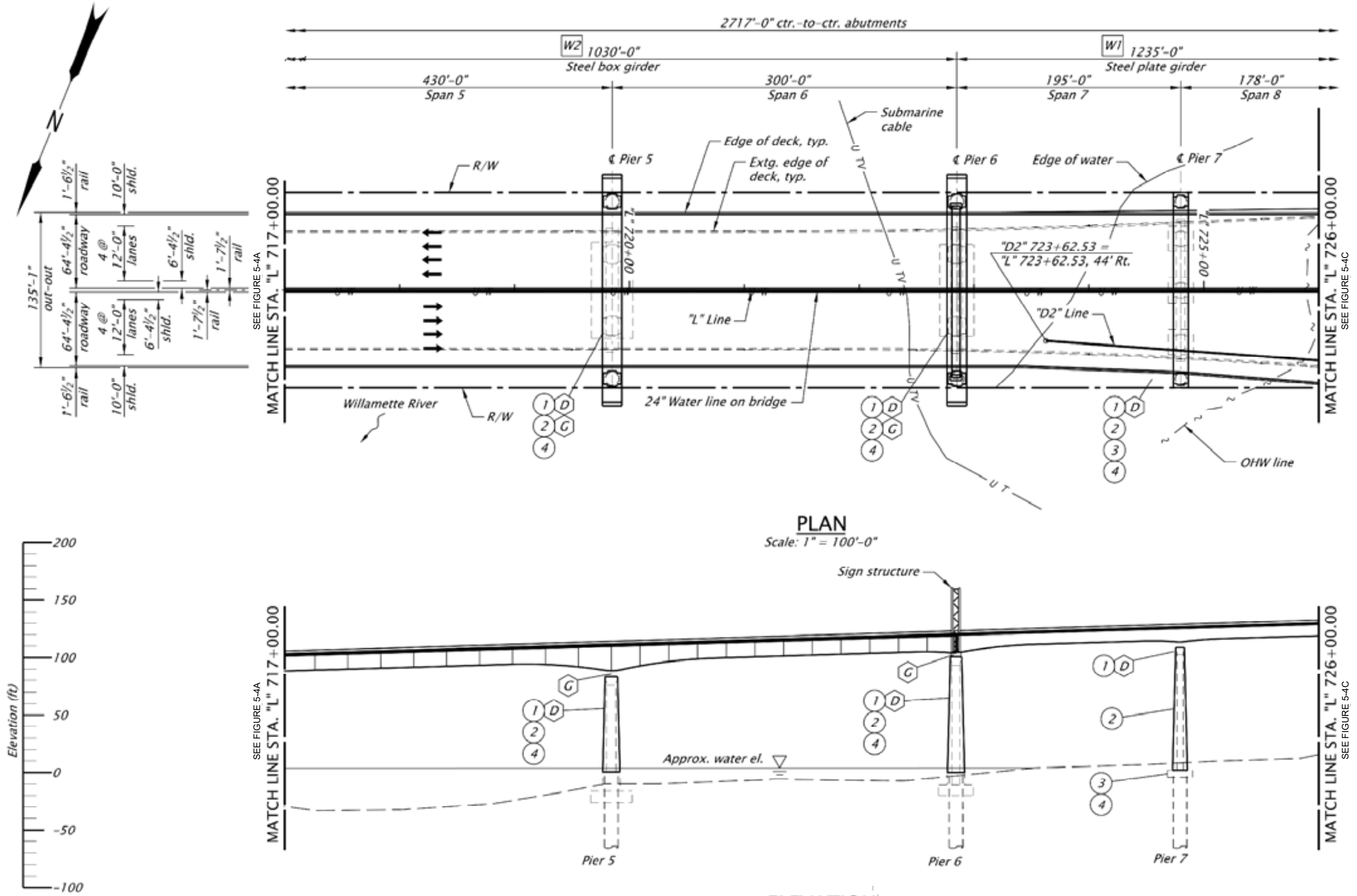
16. Minimize the building, hardscape and disturbance footprint.

Applicant Response: The Applicant's proposal is designed to minimize the disturbance footprint in the WRA to the extent practicable.

17. Consider multi-story construction over a bigger footprint. (Ord. 1623 § 1, 2014; Ord. 1635 § 19, 2014; Ord. 1647 § 5, 2016; Ord. 1662 § 7, 2017)

Applicant Response: To reduce the construction footprint by stacking highway lanes would require extensive reconstruction of the existing highway, resulting in greater environmental impacts and prohibitive costs.

Attachment A. Figures



ELEVATION
Scale: 1" = 100'-0"

Notes:
1. Elevations shown are based on North American Vertical Datum (1988).

SEISMIC DEFICIENCY

1. Crossbeam flexural/shear strength (LL)
2. Column flexural/shear strength (LL)
3. Lack of top mat pile cap reinforcing (LL)
4. Insufficient pile anchorage (LL)
5. Spread footing overturning/strength (LL)

SEISMIC RETROFIT

- A Crossbeam enlargement
- B Column enlargement
- C Pile cap enlargement
- D Substructure replacement
- E Micropiles
- F Spread footing enlargement
- G Bearing replacement
- H Diaphragm replacement
- J Large diameter drilled shafts

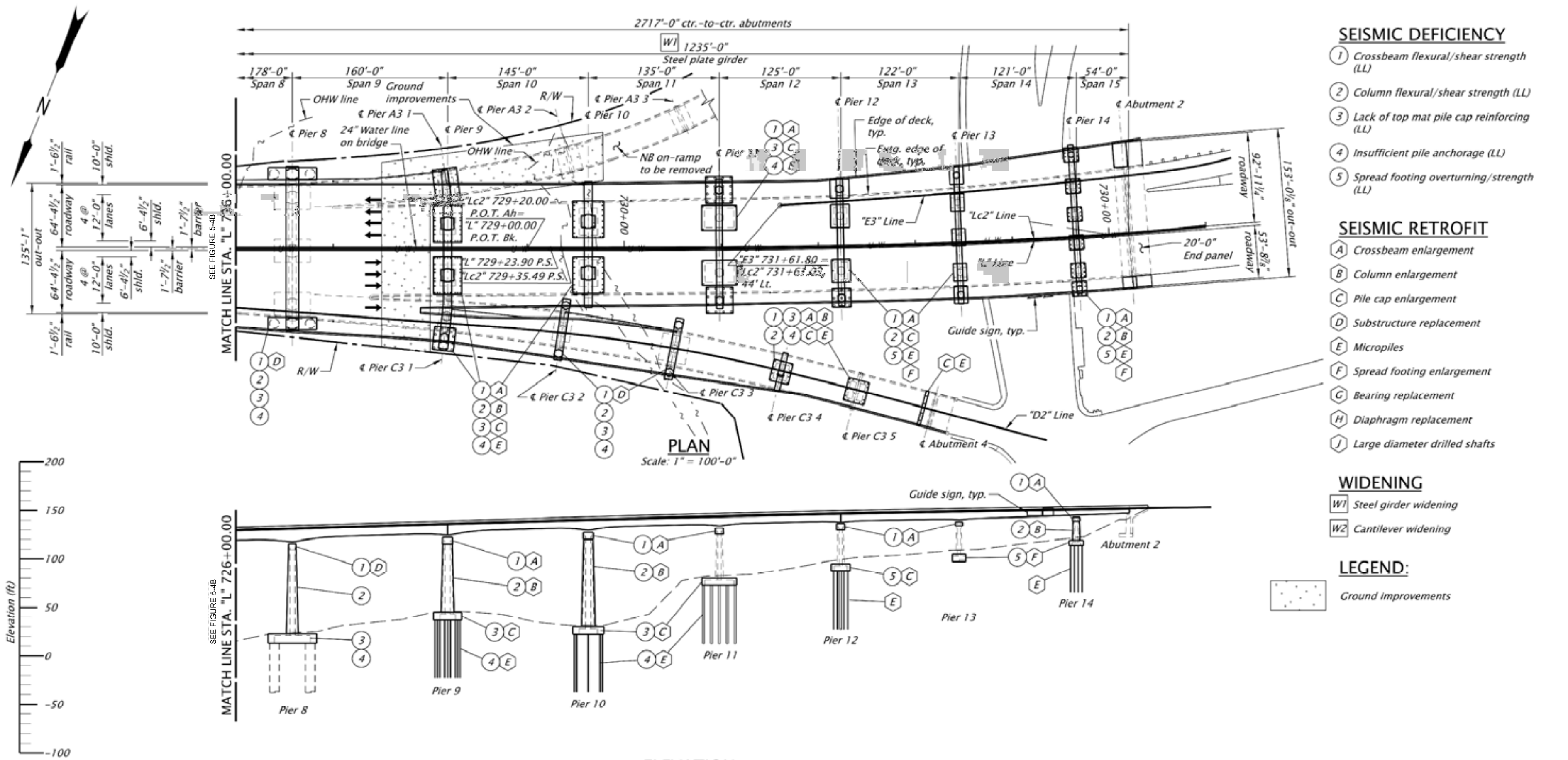
WIDENING

- W1 Steel girder widening
- W2 Cantilever widening

DATA SOURCE: HDR 2019

I-205 ABERNETHY
WIDENING AND SEISMIC RETROFIT
FIGURE 5-3B

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET5_3B.MXD - USER: JBEARD - DATE: 4/16/2019



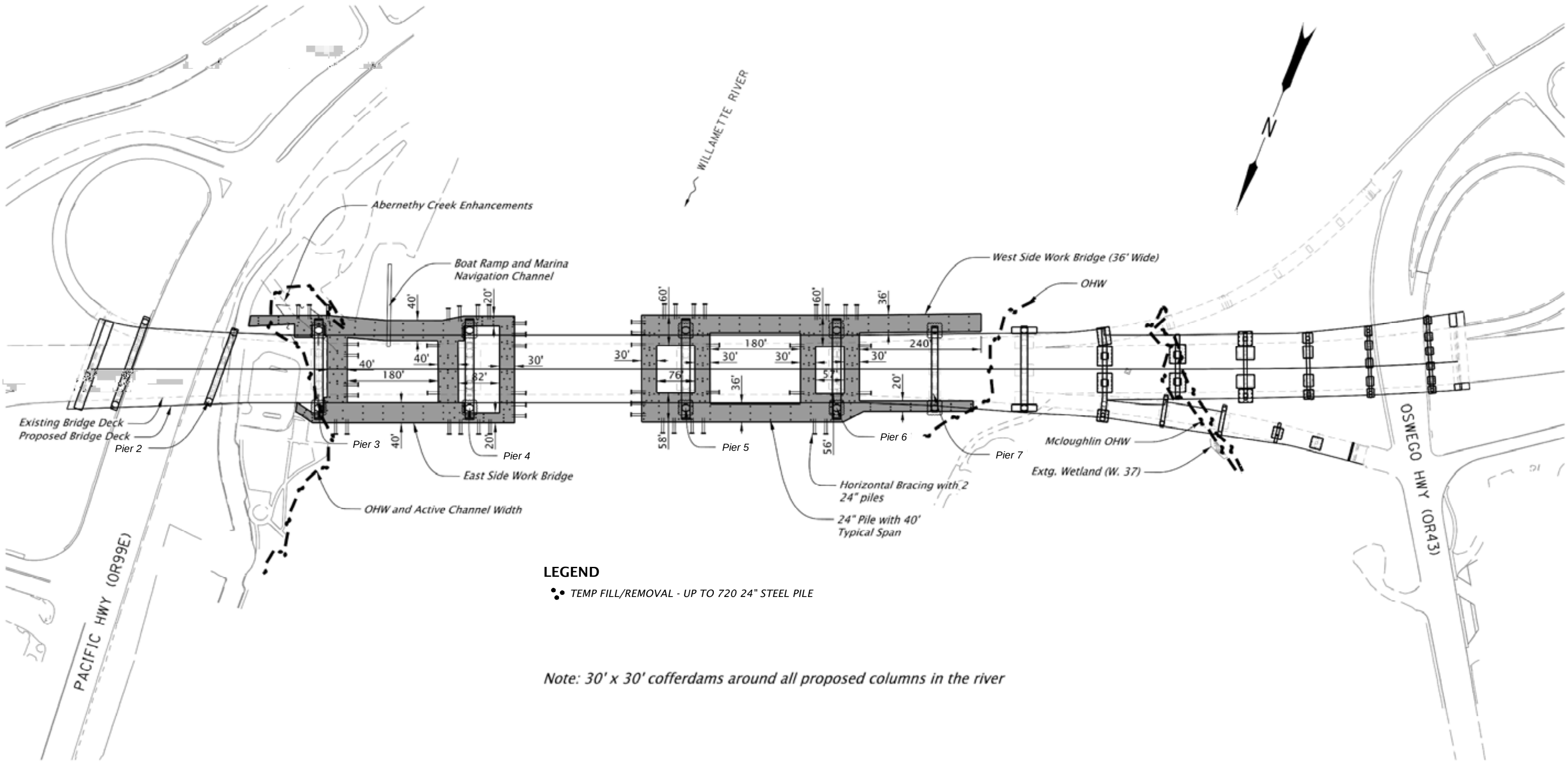
ELEVATION
Scale: 1" = 100'-0"

Notes:
1. *Elevations shown are based on North American Vertical Datum (1988).*

I-205 ABERNETHY
WIDENING AND SEISMIC RETROFIT
FIGURE 5-3C

DATA SOURCE: HDR 2019

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET5_3C.MXD - USER: JBEARD - DATE: 4/16/2019



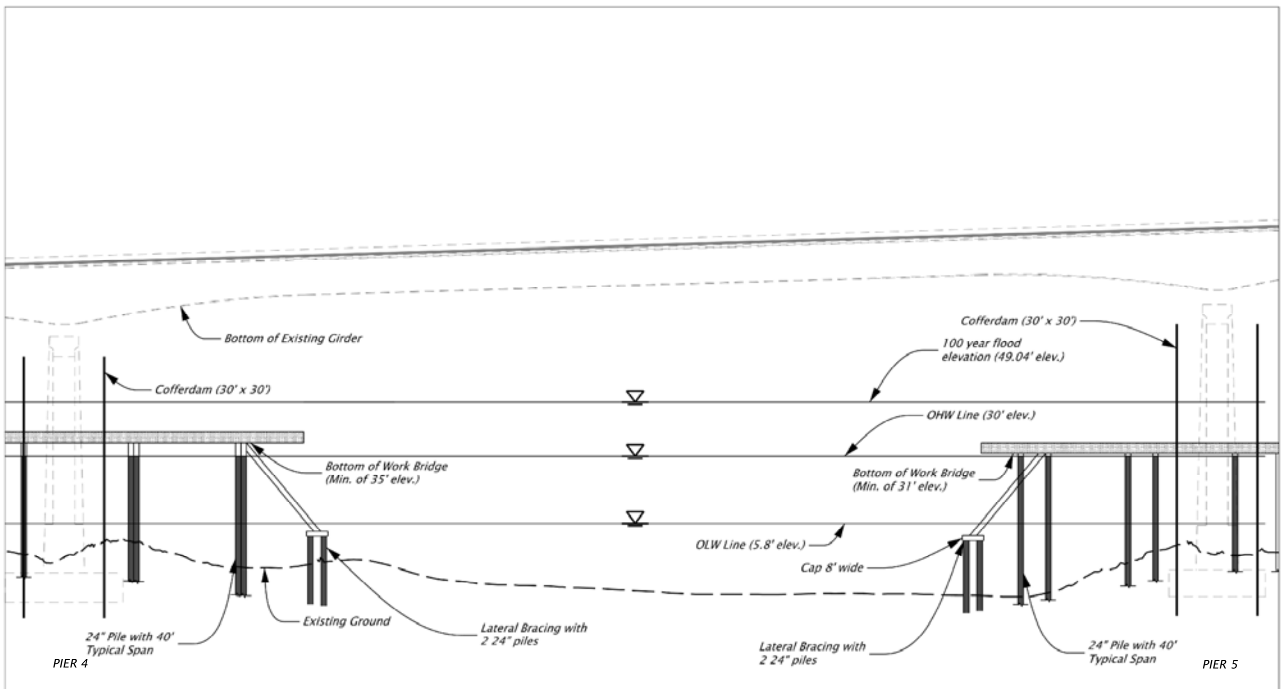
I-205 ABERNETHY

TEMPORARY WORK BRIDGE

FIGURE 5-7

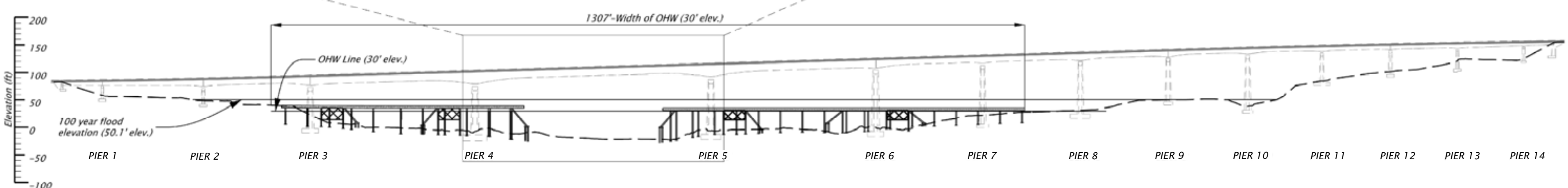
DATA SOURCE: HDR 2019

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET_5_7.MXD - USER: JBEARD - DATE: 4/16/2019



INSET ELEVATION AT BENTS 4 AND 5

Scale: 1" = 50'-0"



ELEVATION

Scale: 1" = 200'-0"

LEGEND

TEMP FILL/REMOVAL

HDR

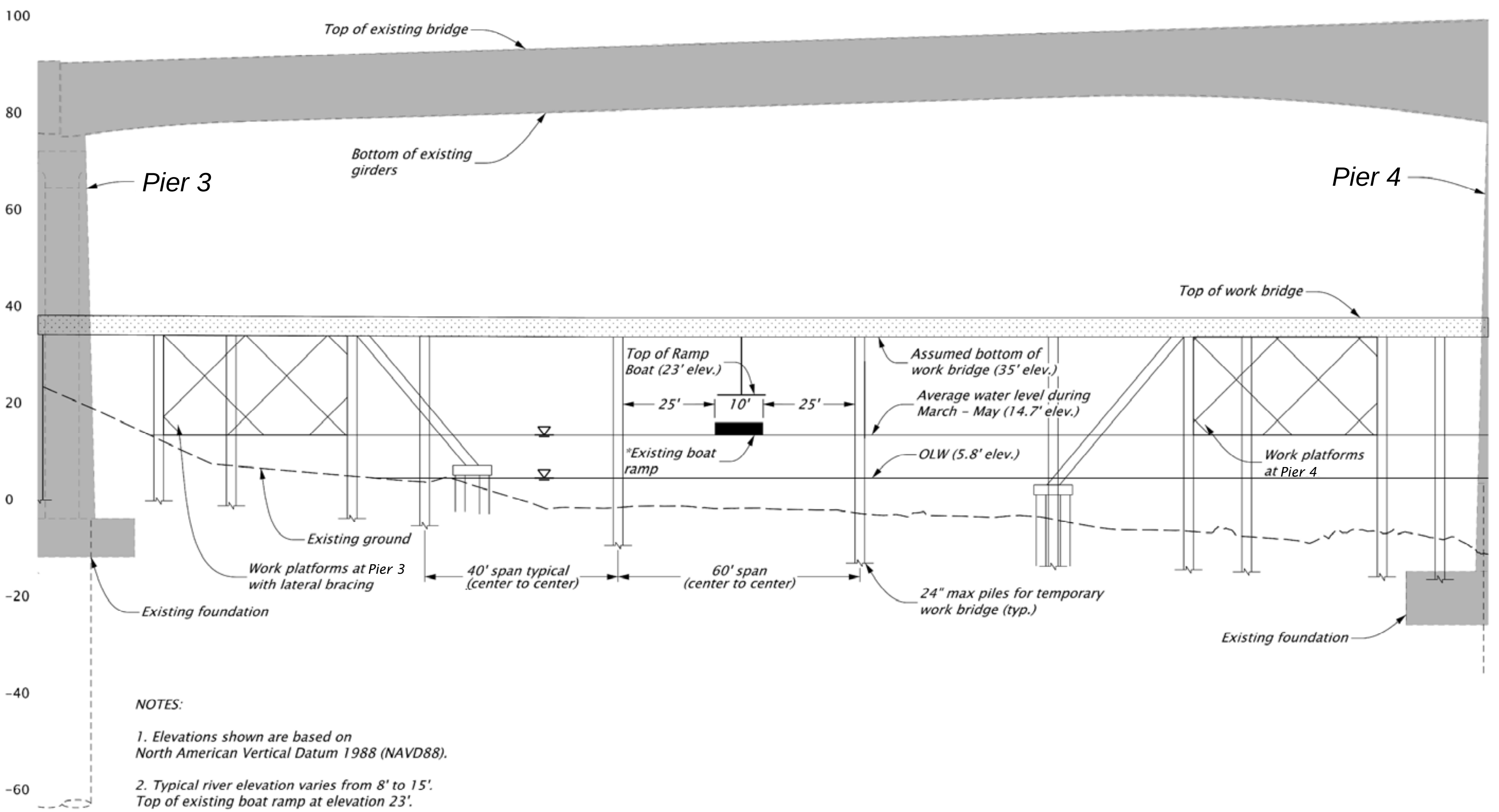
DATA SOURCE: HDR 2019

I-205 ABERNETHY

TEMPORARY WORK BRIDGE

FIGURE 5-8

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET_5_8.MXD - USER: JBEARD - DATE: 4/16/2019



I-205 ABERNETHY

TEMPORARY CLEARANCE CONSTRAINT OVER SPORTSCRAFT LANDING BOAT RAMP

FIGURE 5-9

DATA SOURCE: HDR 2019

Attachment B. Pre-App Notes

City of West Linn

PRE-APPLICATION CONFERENCE MEETING
SUMMARY NOTES

June 20, 2019

SUBJECT: Proposed I-205 Widening and Seismic Improvements to Abernethy Bridge

FILE: PA-19-15

ATTENDEES: Applicant: Tom Hamstra, Scott Turnoy (ODOT), Karen Tatman (Quincy Eng.), Michael Bertram, Rachel Barksdale, Brian Bauman (HDR)
Public: Kathie Halicki (WNA), Andrew Robins (WES)
Staff: Darren Wyss (Planning), Amy Pepper (Engineering)

The following is a summary of the meeting discussion provided to you from staff meeting notes. Additional information may be provided to address any "follow-up" items identified during the meeting. <u>These comments are PRELIMINARY in nature</u>. Please contact the Planning Department with any questions regarding approval criteria, submittal requirements, or any other planning-related items. Please note disclaimer statement below.

<u>Site Information</u>

Site Address:	I-205 Corridor
Tax Not No.:	ODOT Right-of-Way
Site Area:	~3.5 miles
Neighborhood:	Bolton, Sunset, and Willamette Neighborhood Associations
Comp. Plan:	NA
Zoning:	NA
Applicable code:	CDC Chapter 27: Flood Management Areas CDC Chapter 28: Willamette and Tualatin River Protection CDC Chapter 32: Water Resource Area Protection

<u>Project Details</u>

The applicant proposes to widen I-205 to add a third general purpose travel lane in each direction and conduct a seismic retrofit of the Abernethy Bridge. The project will also modify the OR 43 Interchange ramps and replace the Sunset Ave., West A St., and Woodbine Rd. bridges. Seismic upgrades will be performed on the 10^{th} St. and Blankenship Rd. bridges. The Broadway St. Bridge will be permanently removed. Proposed structural upgrades to the Abernethy Bridge include replacement of piers, adding columns, increasing foundation sizes, enlarging columns and beams, and other substructure improvements. A drill rig will be used to strengthen subsurface soils. A temporary bridge will be installed to facilitate construction activities. The project includes work in the floodplain and water resource areas. There are existing sanitary sewer, stormwater, and municipal water infrastructure traversing the I-205 right-of-way.

<u>Public Comments</u>

Concern about getting freight through the roundabouts, particularly trucks with double and triple trailer loads (ODOT staff responded that triples are not allowed on Willamette Falls Drive and the roundabout is designed to accommodate doubles with rolled curbs/wide inside lanes). Questions about the sound wall voting process and contention in the neighborhood.

Clackamas County Water Environment Services wanted to ensure the project located the sanitary sewer line running under the Abernethy Bridge on the West Linn side of river and provided a contact for stormwater review.

Engineering Division Comments
Contact Amy Pepper at apepper@westlinnoregon.gov or 503-722-3437 for engineering requirements.

Tualatin Valley Fire & Rescue Comments
Contact Jason Arn at jason.arn@tvfr.com or 503-259-1510

Process
The proposal requires a flood management area permit (FMA), a water resource area permit (WRA), and a Willamette and Tualatin River protection review (WRG). The land use process for all three reviews is performed by the Planning Manager. No public hearing is required. For the proposal, address the submittal requirements and standards for decision-making in Community Development Code (CDC) Chapters 27, 28, and 32. N/A is not an acceptable response to the approval criteria.

The submittal requirements may be waived under CDC 99.035.B, but the applicant must first identify the specific submittal requirement and request, in letter form, that it be waived by the Planning Manager and must identify the specific grounds for that waiver.

There is a deposit of $1,700 for the WRG review, $1,850 deposit for the WRA permit, and $1,050 deposit for the FMA permit.

You may access the West Linn Community Development Code (CDC) online at http://westlinnoregon.gov/cdc.

A neighborhood meeting is not required per CDC 99.038.

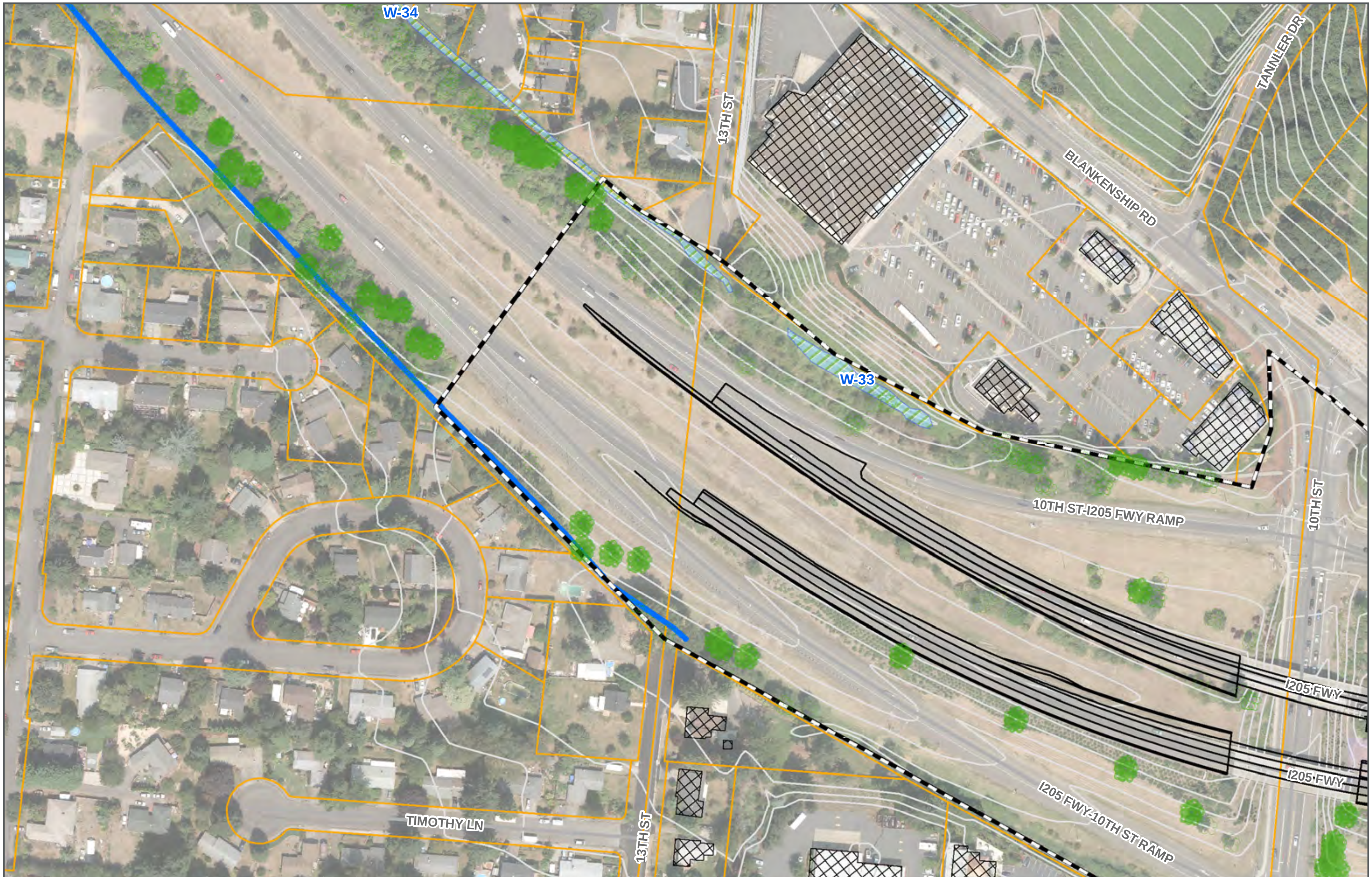
Once the application and deposit/fee is submitted, the City has 30 days to determine if the application is complete or not. If the application is not complete, the applicant has 180 days to make it complete or provide written notice to staff that no other information will be provided.

Once the submittal is deemed complete, staff will provide notice per CDC Chapter 99 and schedule a decision date. Appeals are heard by City Council.

Typical land use applications can take 6-10 months from beginning to end.

DISCLAIMER: This summary discussion covers issues identified to date. It does not imply that these are the only issues. The burden of proof is on the applicant to demonstrate that all approval criteria have been met. These notes do not constitute an endorsement of the proposed application ***or provide any assurance of potential outcomes***. Staff responses are based on limited material presented at this pre-application meeting. New issues, requirements, etc. could emerge as the application is developed. Pre-application notes are void after 18 months. After 18 months with no application approved or in process, a new pre-application conference is required. Any changes to the CDC standards may require a different design or submittal. Substantive changes to the design may require a new pre-application conference.

Attachment C. Site Plan Overview

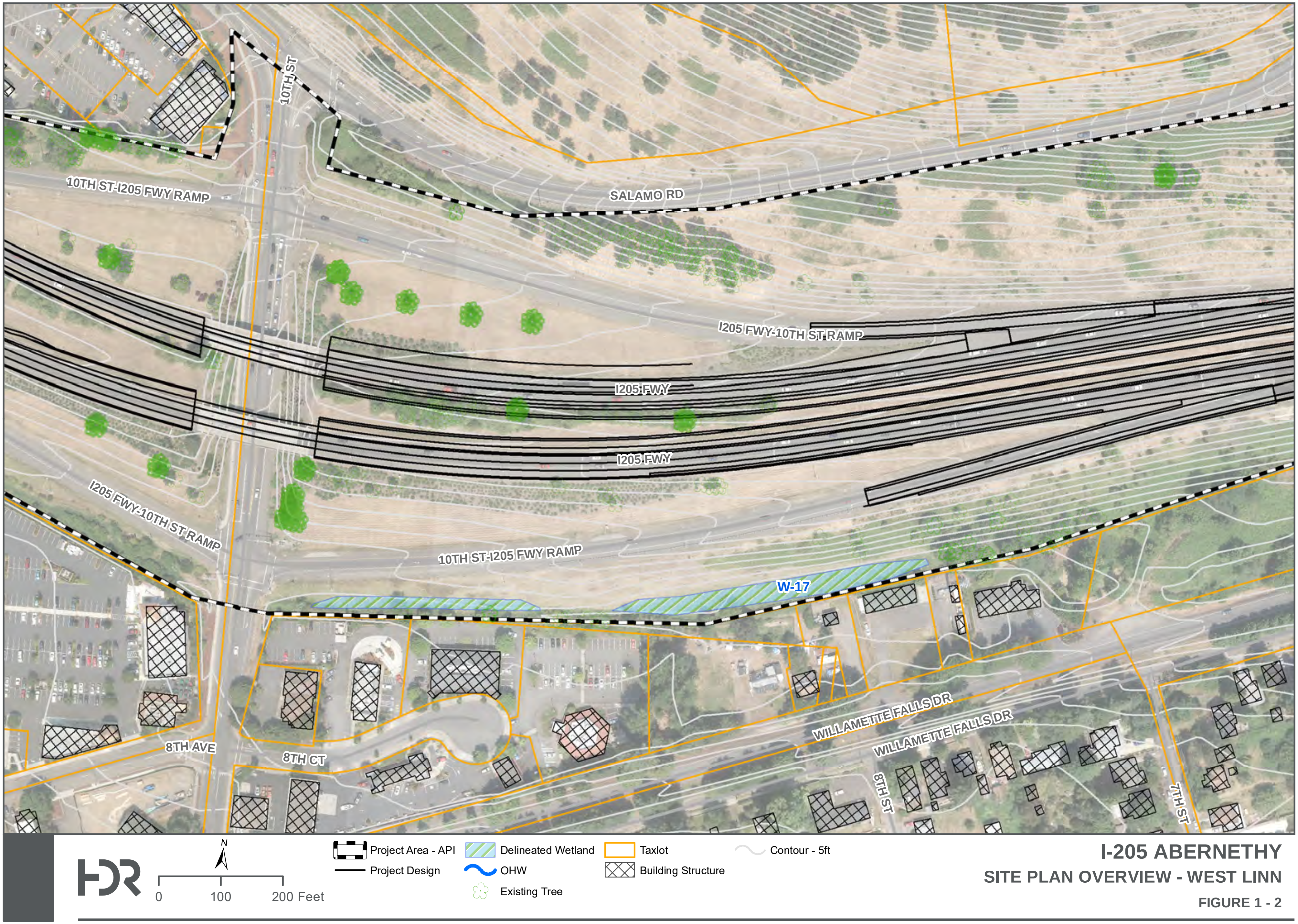


I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 1

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021



I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 2

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021

N

0 100 200 Feet

Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 3

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021

HDR

N

0 100 200 Feet

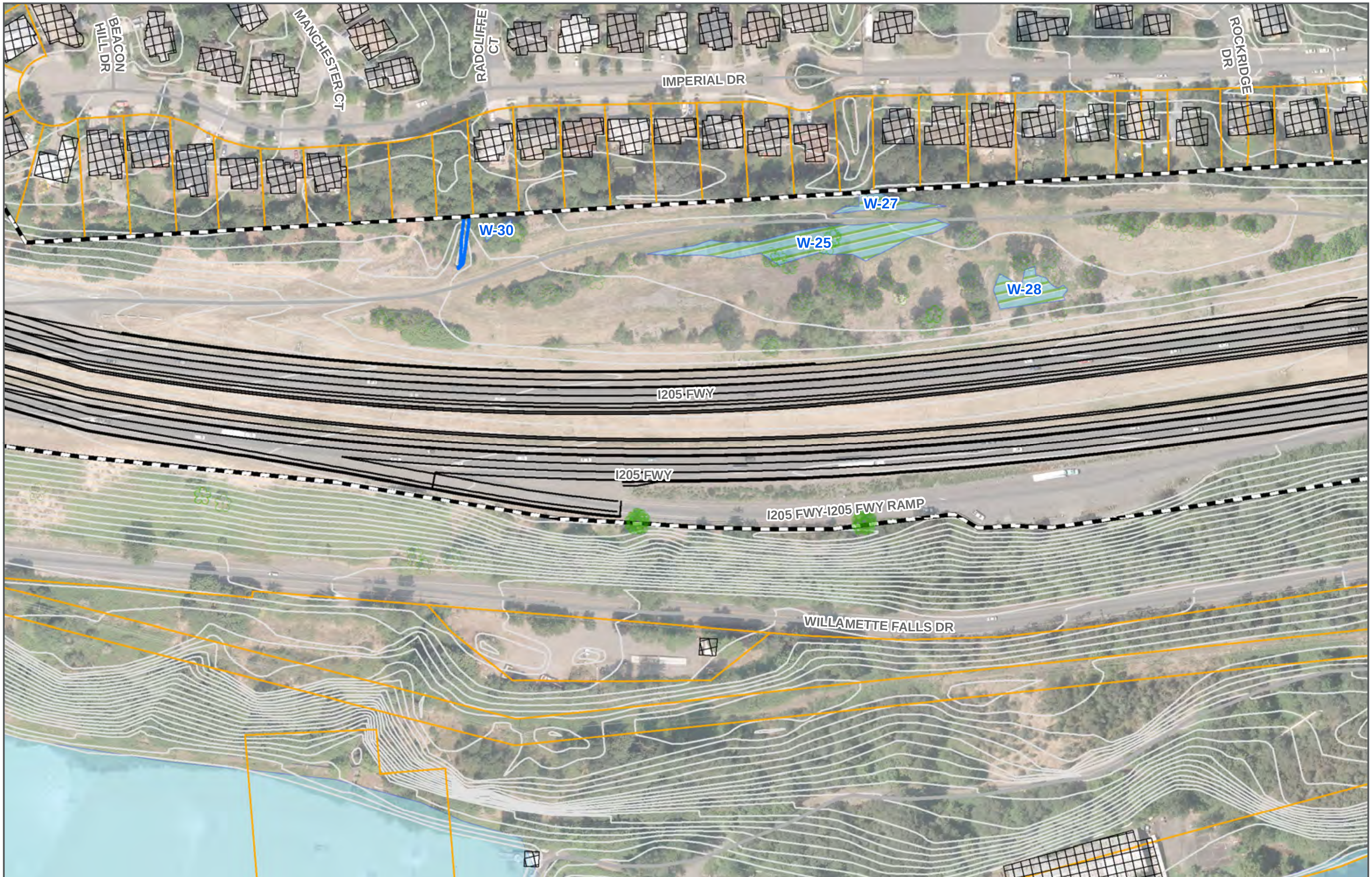
Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

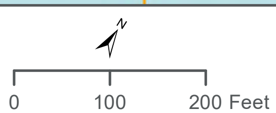
I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 4

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021





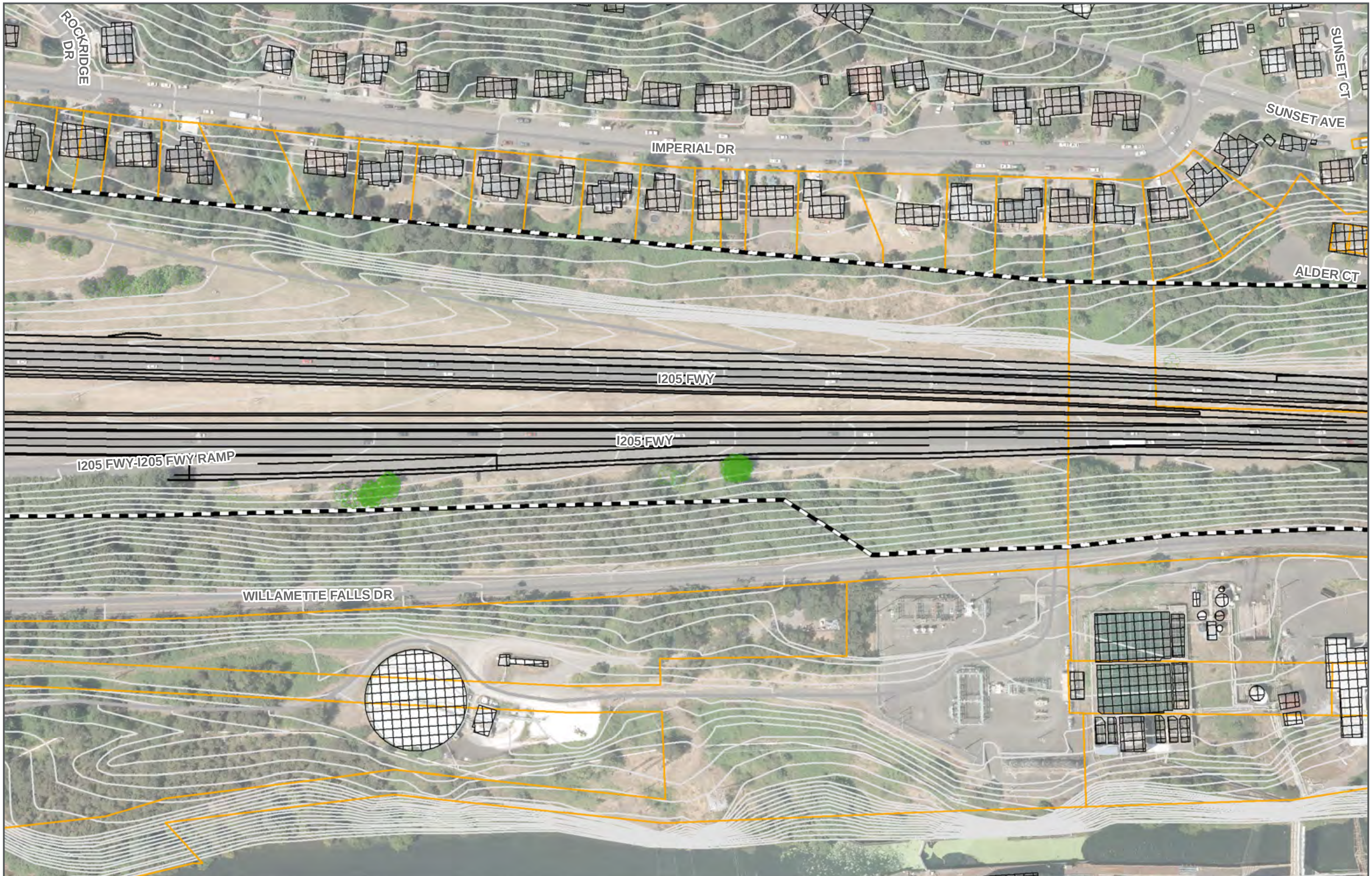
Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 5

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021



HDR

0 100 200 Feet

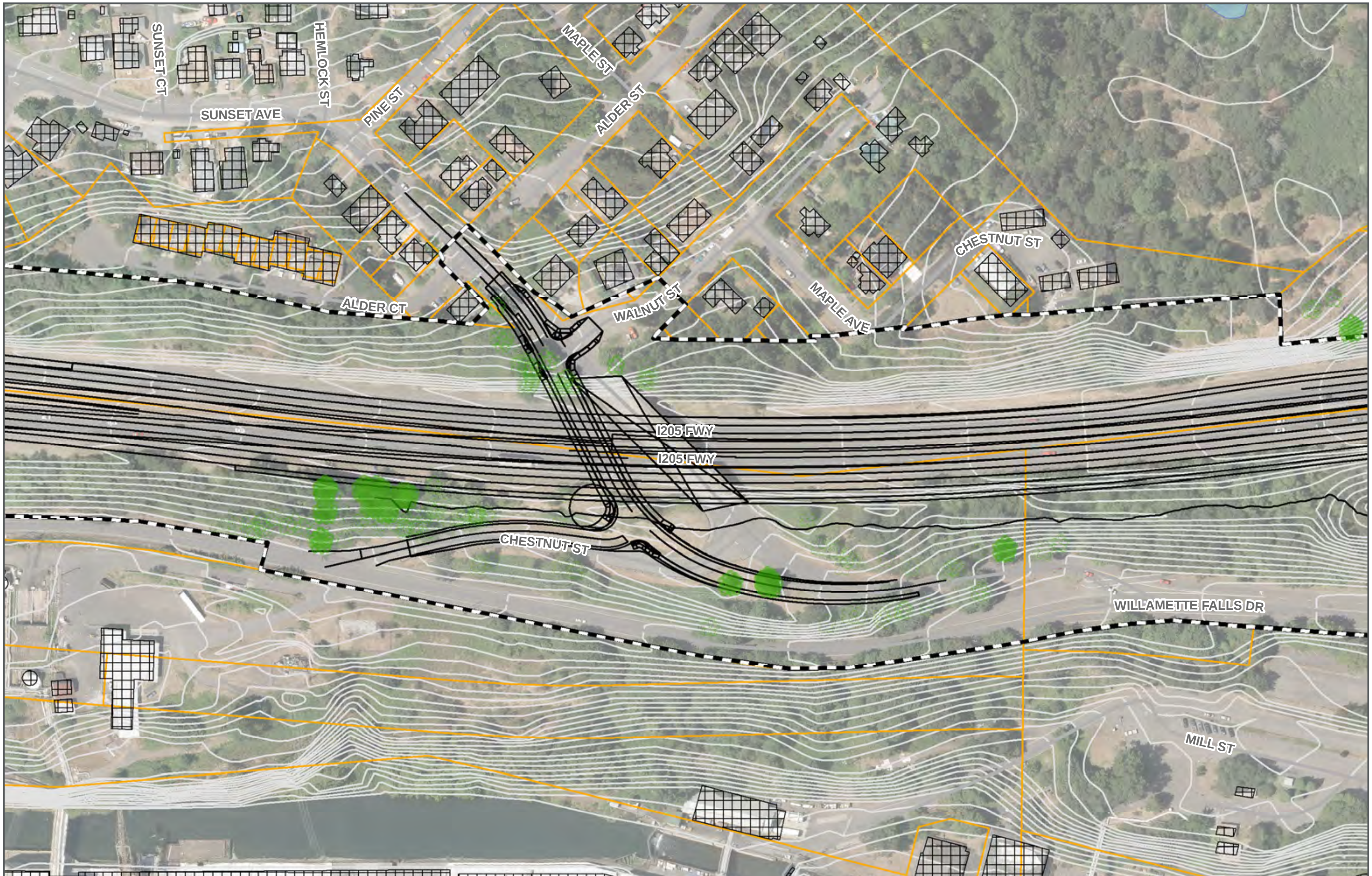
Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

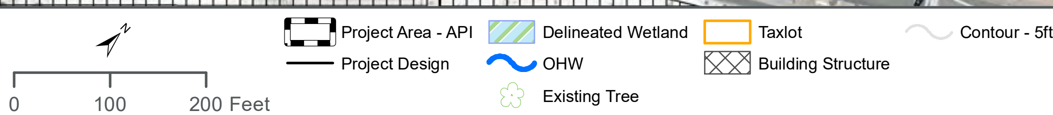
I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 6

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021



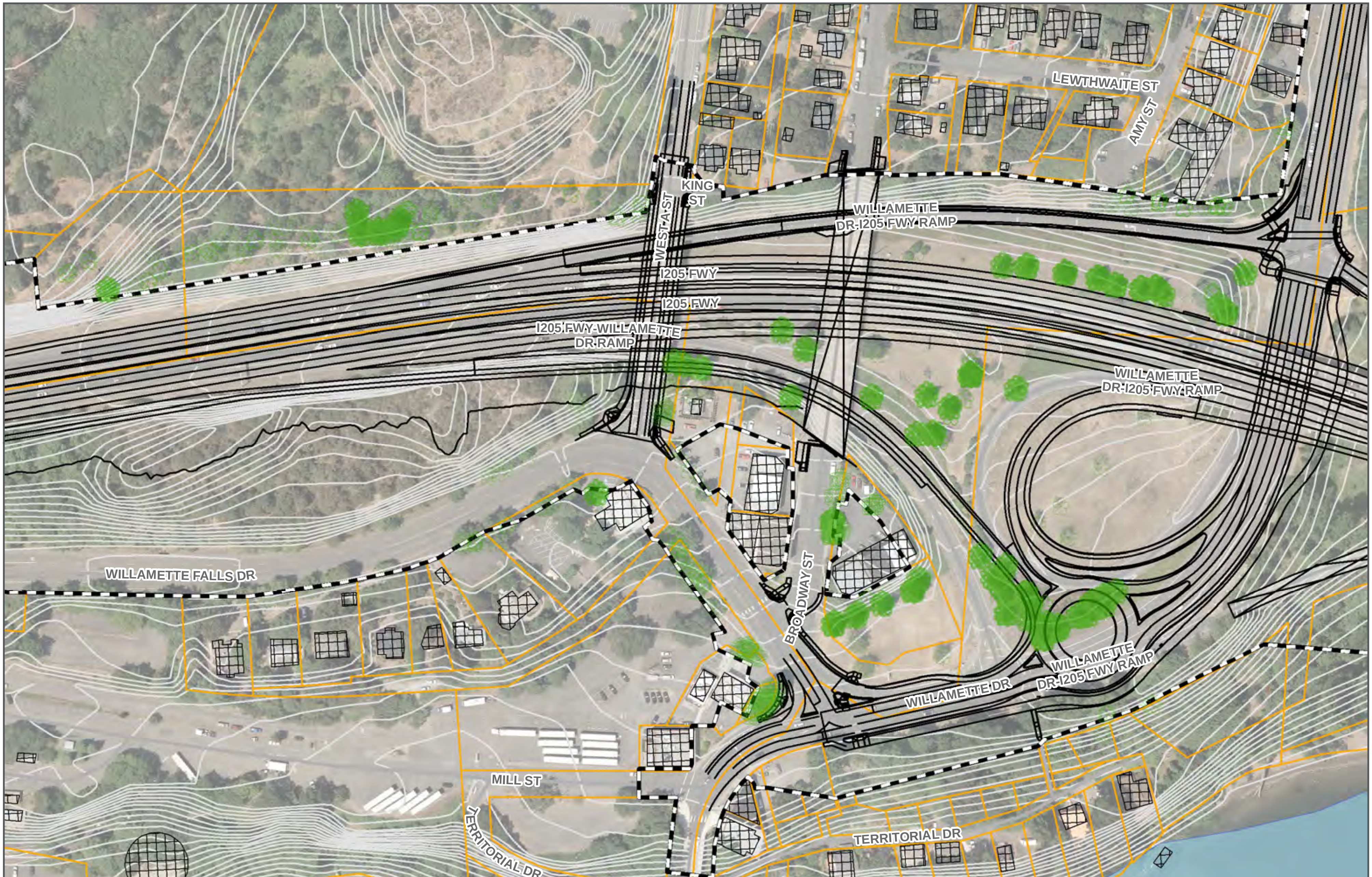


I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 7

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021



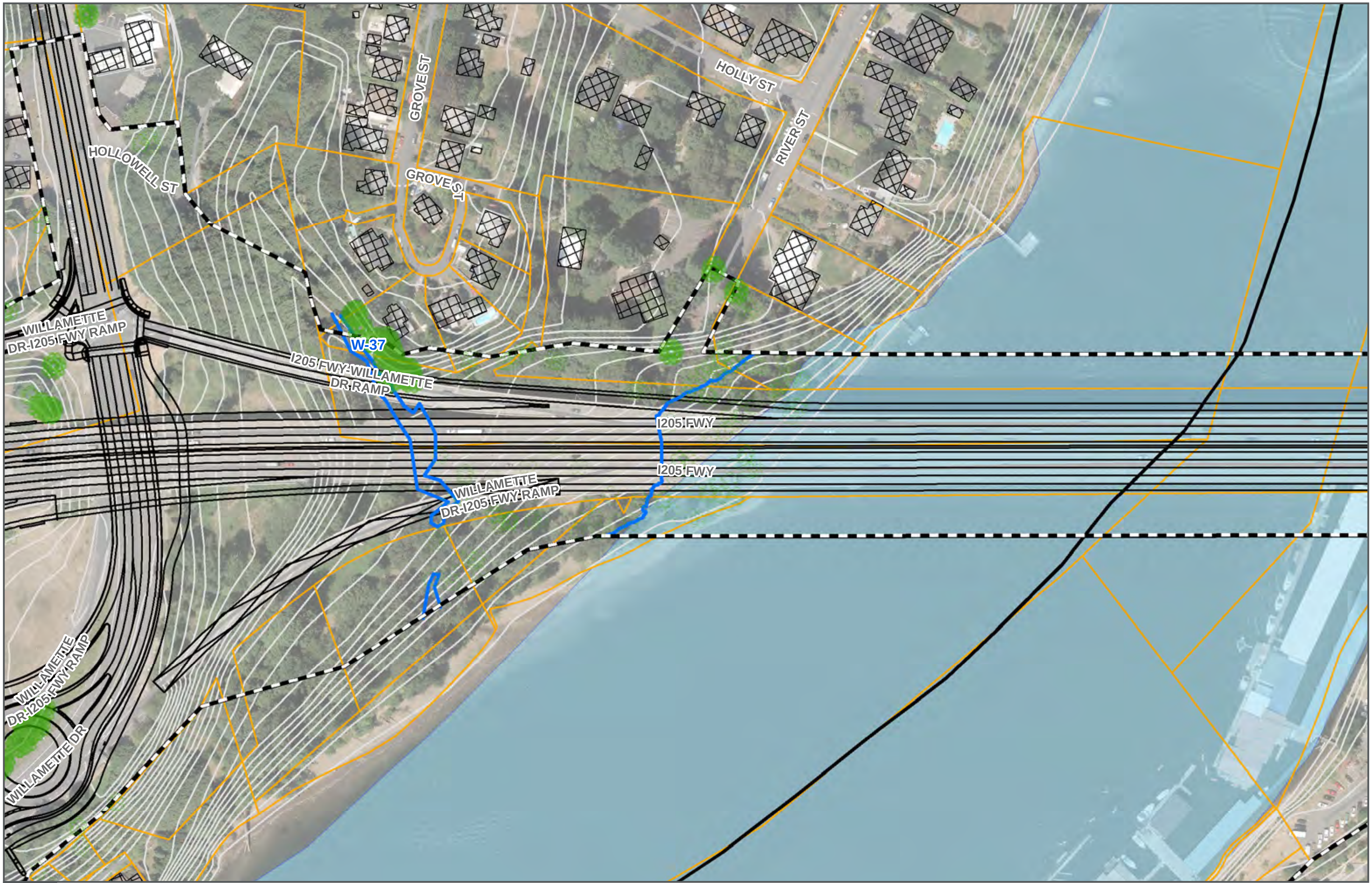
0 100 200 Feet

Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 8



HDR

0 100 200 Feet

Project Area - API
Project Design
Delineated Wetland
OHW
Existing Tree
Taxlot
Building Structure
Contour - 5ft

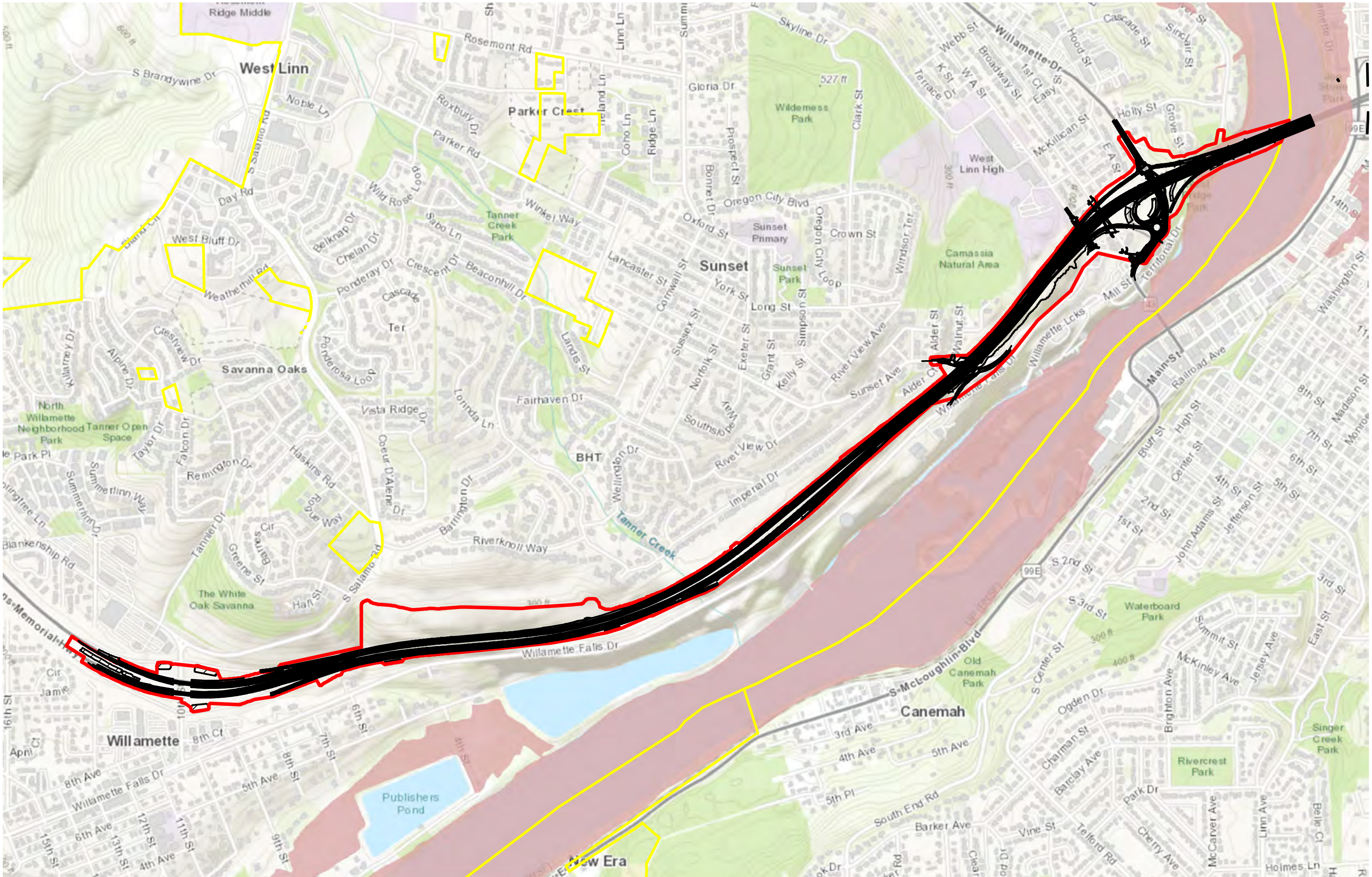
I-205 ABERNETHY

SITE PLAN OVERVIEW - WEST LINN

FIGURE 1 - 9

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN_OVERVIEW.MXD - USER: JBEARD - DATE: 1/26/2021

Attachment D. Ch. 27 Flood Management Area Site Map



Construction Impact Area
Project Design
City Limits
Flood Management Area

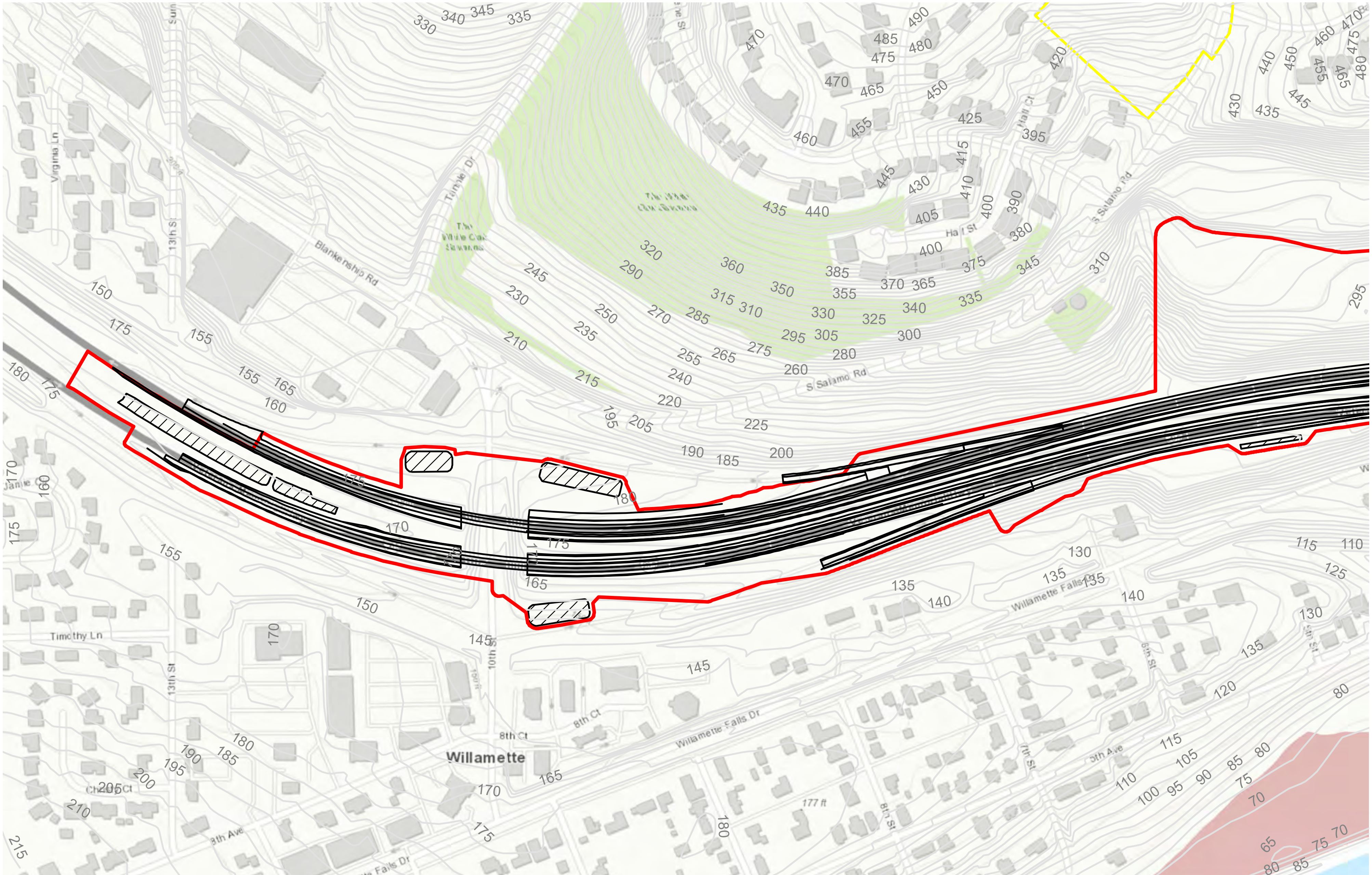
0 Miles 0.3

FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 1

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\FLOOD MGMT AREA.MXD - USER: RBARKSDALE - DATE: 1/27/2021



FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 2

0 Miles 0.08

Construction Impact Area

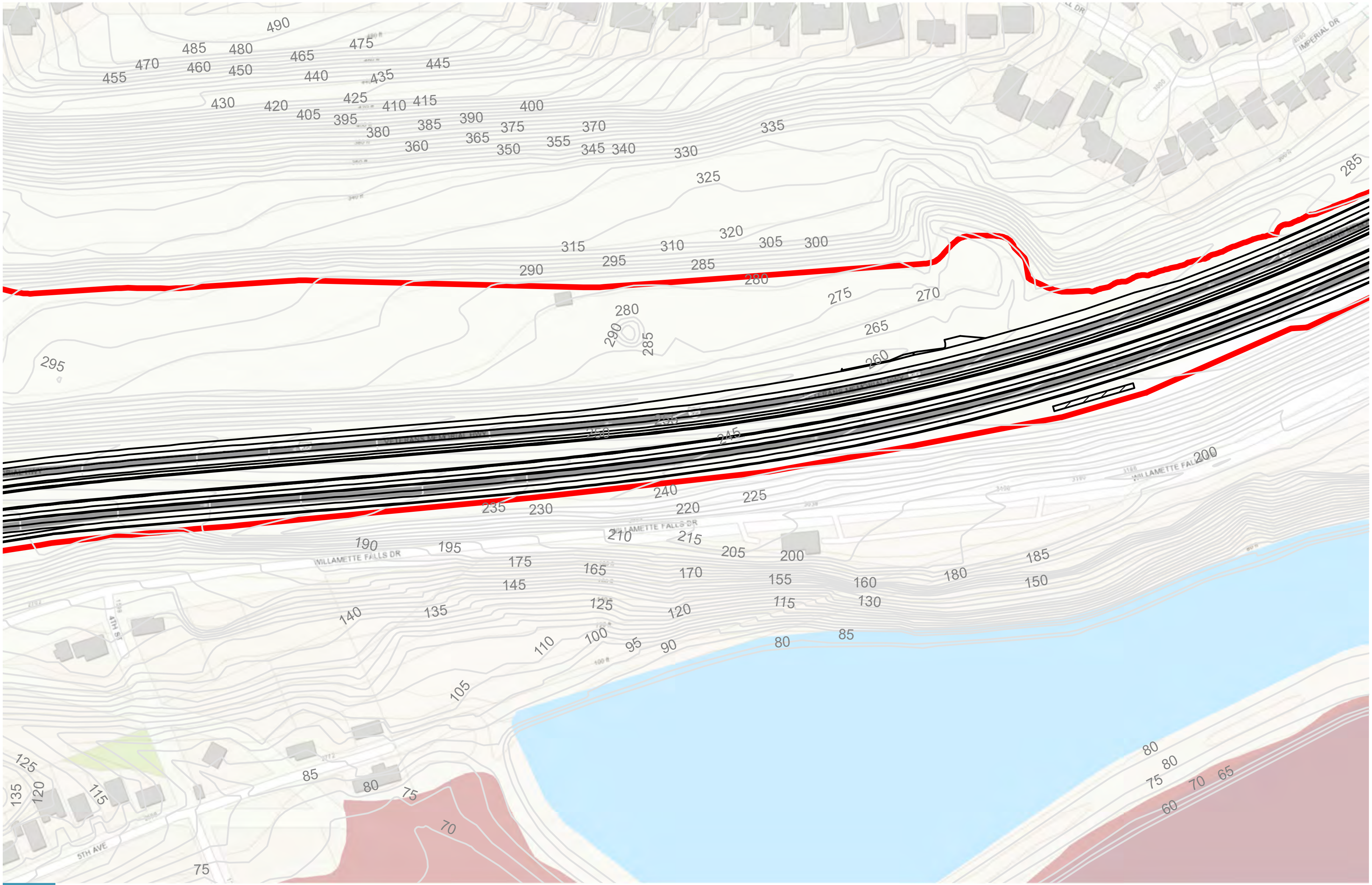
City Limits

5-ft contours

Project Design

Flood Management Area

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\FLOOD MGMT AREA.MXD - USER: RBARKSDALE - DATE: 1/27/2021



FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 3

HDR

0 Miles 0.055

Construction Impact Area

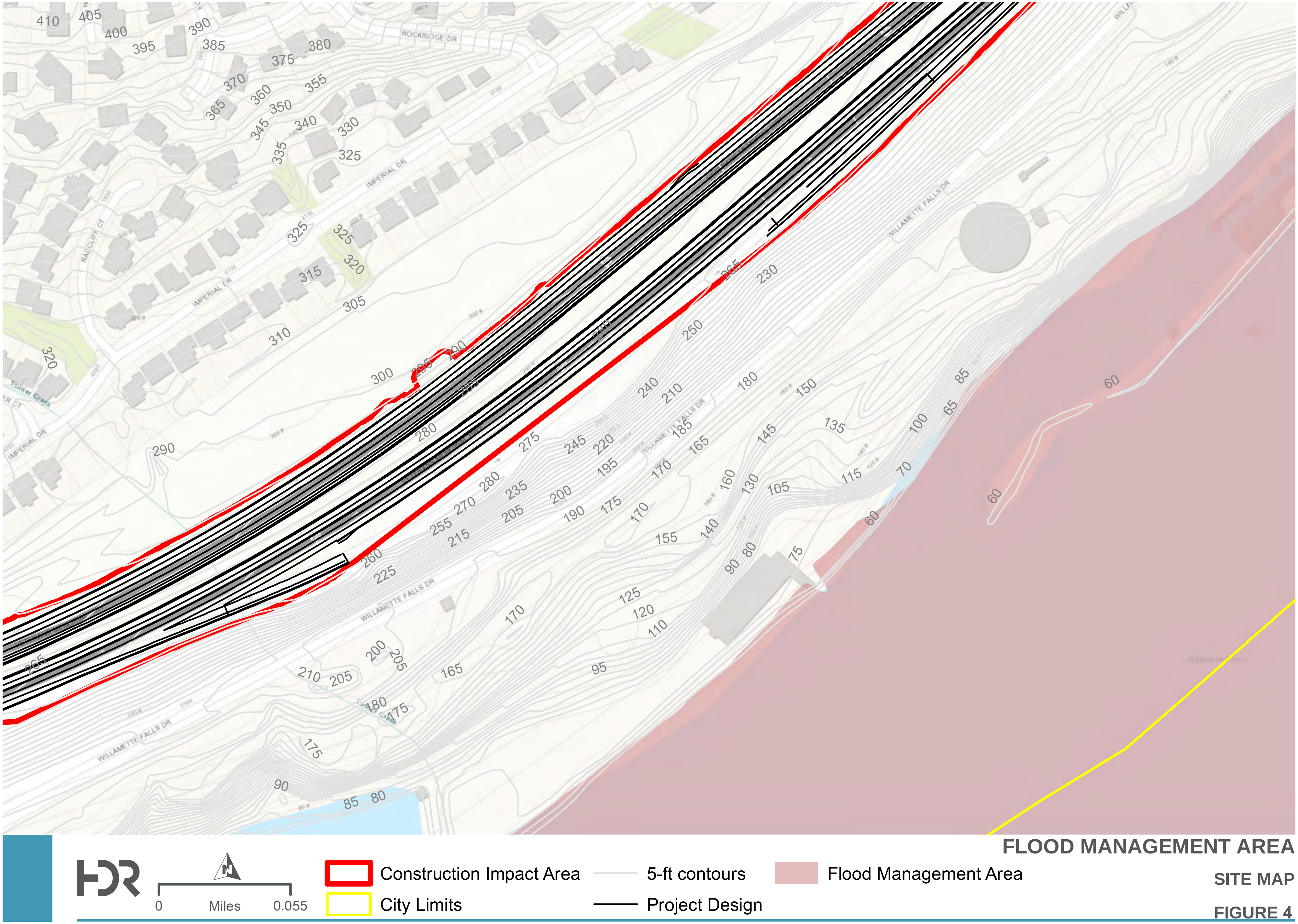
City Limits

5-ft contours

Project Design

Flood Management Area

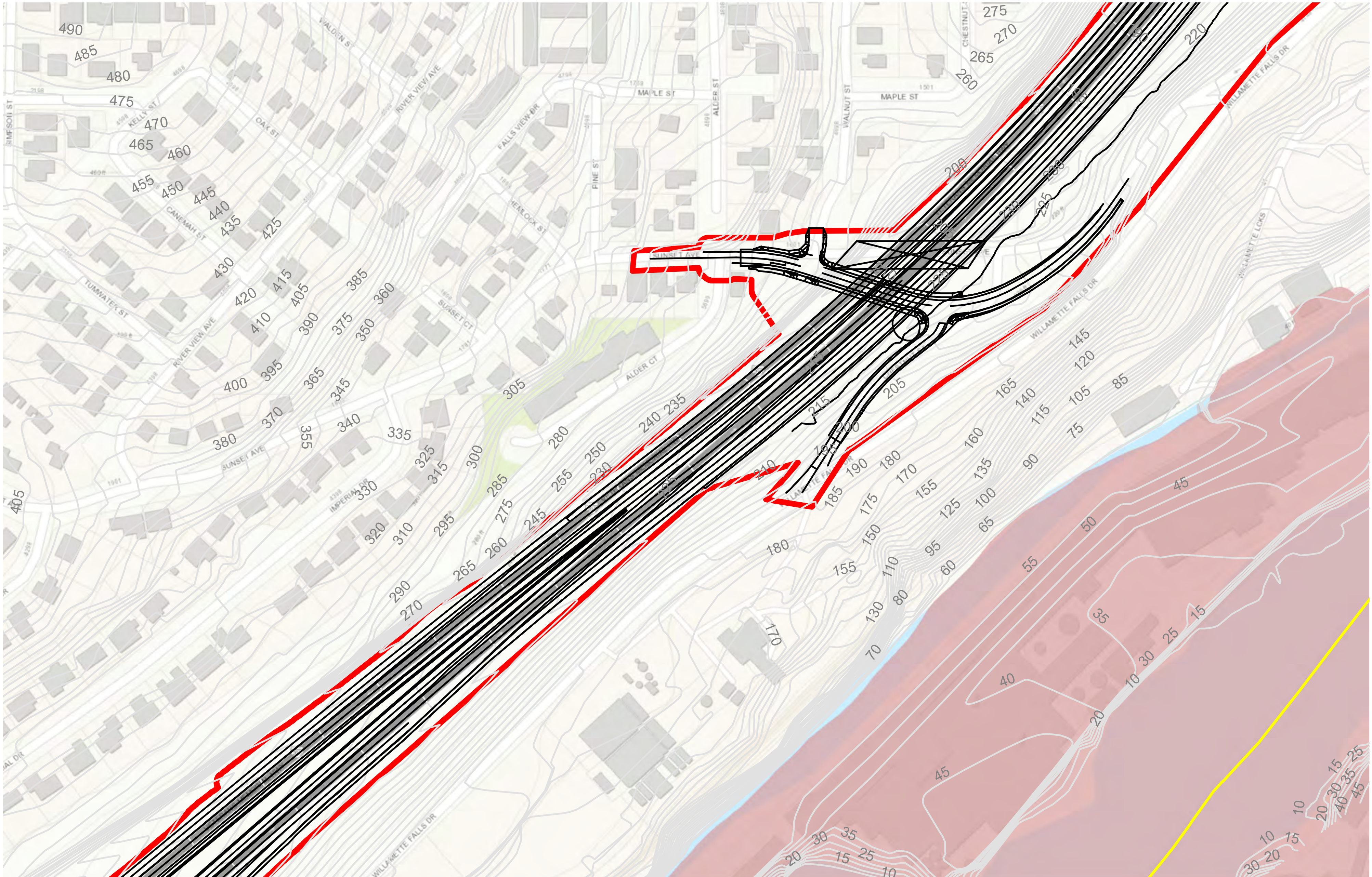
PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\FLOOD MGMT AREA.MXD - USER: RBARKSDALE - DATE: 12/5/2020



FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 4



Construction Impact Area

City Limits

5-ft contours

Project Design

Flood Management Area

0 Miles 0.055

FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 5

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\FLOOD MGMT AREA.MXD - USER: RBARKSDALE - DATE: 12/5/2020

0 Miles 0.055

Construction Impact Area

City Limits

5-ft contours

Project Design

Flood Management Area

FLOOD MANAGEMENT AREA

SITE MAP

FIGURE 6

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\FLOOD MGMT AREA.MXD - USER: RBARKSDALE - DATE: 1/27/2021

Attachment E. Floodplain Cut-Fill Memo

Memorandum

Date:	Thursday, December 03, 2020
Project:	ODOT | K19786 I-205 Improvements: Stafford Road to OR 213
To:	Mike Bertram, HDR PM
From:	Brian Reis, PE - HDR Cory Gieseke, PE - HDR
Subject:	**Willamette River Floodplain Cut and Fill Analysis – West Linn**

The Oregon Department of Transportation's proposed improvements to I-205 extend from Stafford Road in Clackamas County, through the City of West Linn, to OR 213 in Oregon City. This memorandum addresses the City of West Linn's Community Development Code requirements with respect to development in the City's flood management areas. The Community Development Code requires that development, excavation, and fill be performed in a manner to maintain or increase flood storage and conveyance and not increase design flood elevations, 27.060(A). Specifically, with respect to the placement of fill, the Community Development Code requires:

> *No net fill increase in any floodplain is allowed. All fill placed in a floodplain shall be balanced with an equal amount of soil material removal. Excavation areas shall not exceed fill areas by more than 50 percent of the square footage. Any excavation below the ordinary high-water line shall not count toward compensating for fill. 27.060(B)*
>
> *Excavation to balance a fill shall be located on the same lot or parcel as the fill unless it is not reasonable or practicable to do so. In such cases, the excavation shall be located in the same drainage basin and as close as possible to the fill site, so long as the proposed excavation and fill will not increase flood impacts for surrounding properties as determined through hydrologic and hydraulic analysis. 27.060(C)*

The ordinary high water (OHW) elevation near the Abernethy Bridge is 30.0 feet and the 100-year flood elevation of 48.4 feet on Willamette River is taken from the Flood Insurance Study dated June 17, 2008. Elevations are based on the North American Vertical Datum of 1988.

The proposed project includes replacement of four sets of bridge piers within the City's flood management area (Figure 1). Existing piers 5, 6, 7 and 8 (ten columns in total) will be replaced with eight columns. Figure 2 and Figure 3 illustrate the proposed improvements at piers 7 and 8, respectively. The pier designs at 5 and 6 are similar to that of pier 7. The columns at pier 8 will rest on rectangular shaft caps.

Figure 1. Site Layout

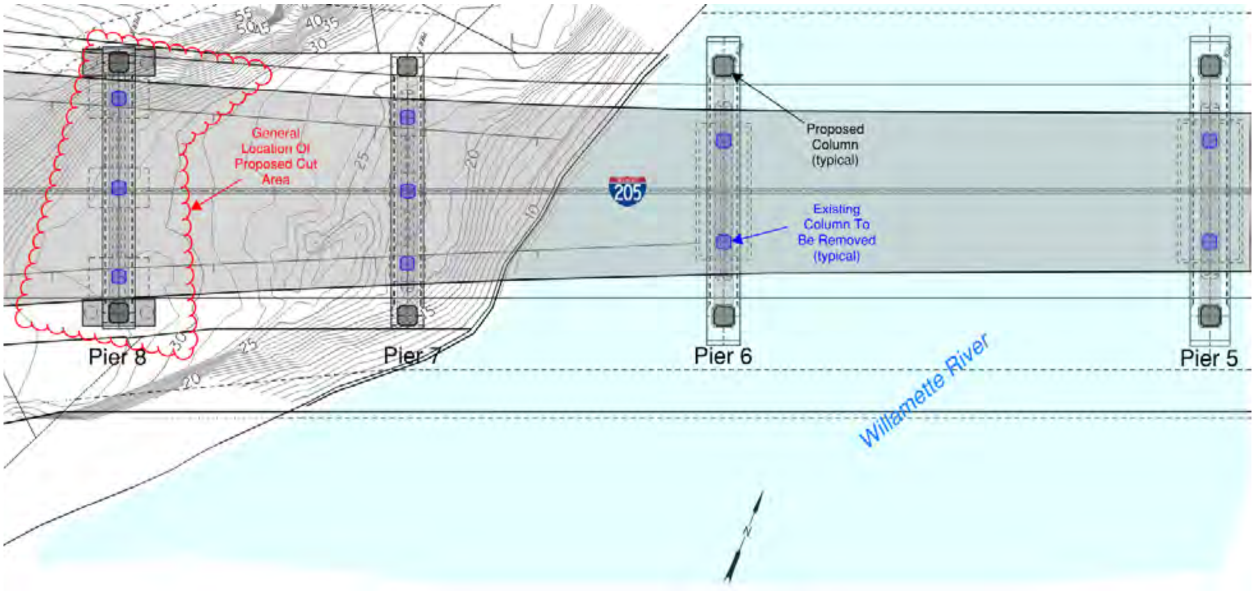


Figure 2. Plan and Elevation View - Pier 7

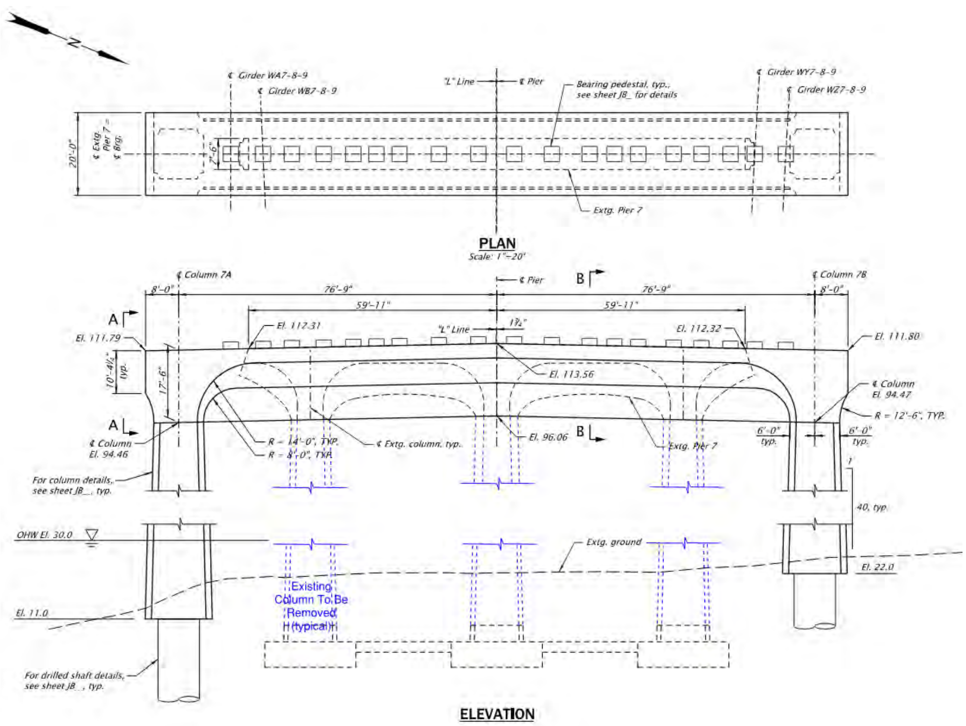


Figure 3. Plan and Elevation View - Pier 8

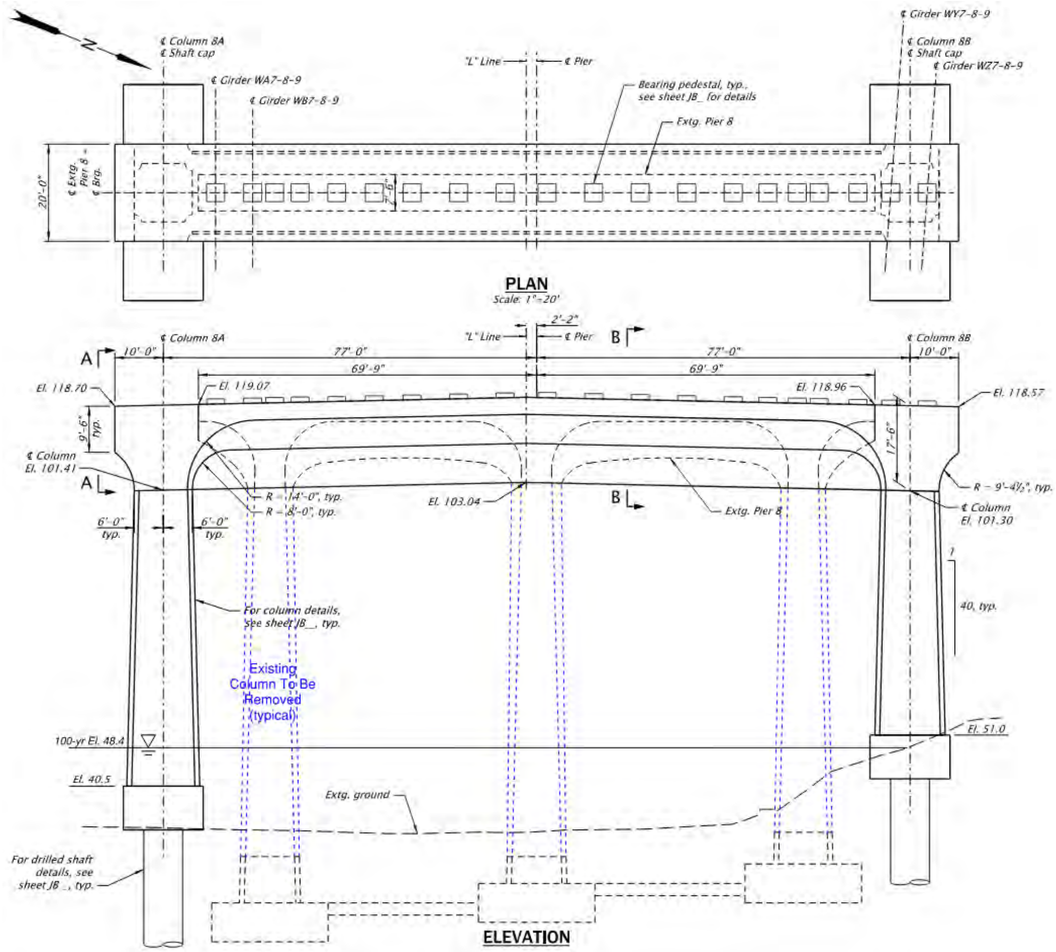


Table 1 includes a summary of existing and proposed volumes between the OHW (30.0 feet) and the 100-year flood elevation (48.4 feet) for piers 5, 6, 7 and 8. The total increase in volume between these elevations is approximately 120 cubic yards. To mitigate the loss of floodplain storage, 120 cubic yards of material will be excavated near pier 8 (Figure 1).

Table 1. Summary of Fill Volumes between Elevations 30.0 Feet and 48.4 Feet

	Volume of Concrete (CY)		
	Existing	**Proposed**	**Difference**
Pier 5	225.3	225.8	--
Pier 6	270.6	225.8	--
Pier 7	254.9	238.7	--
Pier 8	257.3	437.5	--
Total	**1,008.1**	**1,127.8**	**119.7**

Attachment F. No-Rise Memo

Abernethy Bridge No-Rise Memorandum

Date:	Wednesday, September 04, 2019
Project:	ODOT | K19786 I-205 Improvements: Stafford Road to OR 213
To:	Tom Hamstra, ODOT – PM
From:	Mike Bertram, HDR – PM Cory Gieseke, HDR – Hydraulics
Subject:	Task 7.4 Hydraulic Analysis - DRAFT

This memorandum summarizes the approach, analysis, and results associated with the I-205: I-5 to OR 213, Phase 1 project (Project) to satisfy a No-Rise Condition. The Abernethy Bridge crosses the Willamette River between West Linn and Oregon City, Oregon. The Oregon Department of Transportation is currently in the design phase of the Project that includes replacement of piers 3-8, and seismically retrofitting the columns on piers 9 and 10. The proposed construction requires improvements within the Federal Emergency Management Agency (FEMA) 100-year floodway. The Abernethy Bridge has four piers located within the Willamette River channel. Modifications to the structure are limited to one pier located on the west bank of the river.

Because the project features lie within the regulatory floodway as shown on the FEMA Floodway Boundary and Floodway Map (Panel 41005C0276D, dated June 17, 2008 in Attachment A), this project represents an encroachment into the regulatory floodway, requiring it to conform to the requirements of:

Federal Regulation 44 CFR 60.3 (d)(3)

> *(3) Prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.*

Oregon City Regulation: 17.42.190 (A)

> *(A) Encroachments, including fill, new construction, substantial improvements and other development shall be prohibited unless certification by a registered professional engineer or architect is provided demonstrating through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.*

West Linn Regulation: 27.060 (f)

> *(f) Prohibit encroachments, including fill, new construction, substantial improvements, and other development in floodways unless certification by a professional civil engineer licensed to practice in*

the State of Oregon is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

To demonstrate compliance with the requirements of the cited regulations, the existing FEMA effective model was updated following standard procedures to include the additional cross sections and new project survey information necessary to model the proposed pier modifications under the Abernethy Bridge. Existing and proposed conditions results were compared to determine no rise in the 100-year flood elevation and/or the regulatory floodway elevations would occur as the result of the I-205: I-5 to OR 213, Phase 1 project.

The proposed seismic retrofit bridge modifications in the floodway of the Willamette River at the Abernethy Bridge will meet the requirements of 44 CFR 60.3 (d)(3) based on the analyses performed using the FEMA effective model.

Abernethy Bridge

The Project will replace or modify existing piers located within the floodplain with piers at the same roadway stationing, but spaced farther apart than existing columns to support the widened roadway surface. The proposed diameter of the columns within the river channel (piers 3-6) will be slightly increased. Three existing columns for each pier (piers 7 and 8) on the left overbank will be removed and replaced with two columns per pier. Pier 9 will not be modified, pier C3-1 will be replaced with a slightly larger pier, and pier 10 will be fortified by increasing the size of the existing columns. The proposed construction requires improvements within the FEMA floodway.

In relation to the FEMA cross sections shown on the FIRM panels, the Abernethy Bridge is located approximately 3,400 feet upstream of cross section R in the Flood Insurance Study (FIS), measuring along the river centerline. Cross section S is the closest FEMA cross section located approximately 9,500 feet upstream of the Abernethy Bridge. Attachment A provides the effective FIRM panels, floodway and floodplain maps, and model cross sections.

Effective Model

The FEMA Engineering Library provided the effective model, which represents the data published in the latest FIS for Clackamas County dated June 17, 2008. The effective model was completed for a study that concluded in June 1978 using Hydrologic Engineering Center's HEC-2 software. The model was developed using the National Geodetic Vertical Datum of 1929 (NGVD29); however, the FIS provides elevations in the North American Vertical Datum of 1988 (NAVD88). To convert from NGVD29 to NAVD88, FIS added 3.5 feet to NGVD29 values.

FIS elevations and the converted elevations from the effective model are compared in Table 1. The FIS reports water surface elevations to the nearest tenth of a foot. To stay consistent with the values listed in the FIS, the comparative values extracted from the effective model are also provided to the nearest tenth of a foot.

The Abernethy Bridge was not included in the effective model of the Willamette River, but was added to the corrected effective and existing conditions models. Details of the changes made to include the bridge are covered in the Corrected Effective Model and Existing Conditions Model Sections.

Table 1. FEMA FIS Results Compared to the Effective (HEC-2, Nov. 1976 Version) Model Results – Willamette River

Cross Section	River Station	River Mile	Water Surface Elevations NAVD888 (ft)					
			FIS Results without Floodway	Effective Model Results without Floodway	Difference	FIS Results with Floodway	Effective Model Results with Floodway	Difference
M	118034	22.35	44.0	44.0	0.0	44.7	44.7	0.0
N	122034	23.10	46.1	46.1	0.0	46.8	46.8	0.0
O	125434	23.79	46.2	46.2	0.0	46.9	46.9	0.0
P	126834	24.06	46.8	46.8	0.0	47.5	47.5	0.0
Q	129034	24.50	47.2	47.2	0.0	47.9	47.9	0.0
R	131034	24.90	47.7	47.7	0.0	48.4	48.4	0.0

[a] Feet from Columbia River confluence

Duplicate Effective Model

The effective model was imported from a HEC-2 format into HEC-RAS Version 5.0.7 and rerun to create the duplicate effective model. No revisions were made to the imported effective model. There are five cross sections within the effective model not reported in the FIS. These cross sections were added to Table 2 for comparison purposes.

When comparing the models, the duplicate effective model has slightly higher water surface elevations than the effective model. The differences range from 0.0 feet at the downstream end of the model, to 0.3 feet at the upstream end of the reach. These differences can be attributed to the variation (especially near bridges) of the calculation methods and algorithms used by the different programs.

Table 2. Effective (HEC-2, Nov. 1976 Version) model Compared to Duplicate Effective (HEC-RAS Version 5.0.7) Model Results – Willamette River

Cross Section	River Mile	Water Surface Elevations NAVD88 (ft)					
		Effective Model Results without Floodway	Duplicate Effective Model Results without Floodway	Difference	Effective Model Results with Floodway	Duplicate Effective Model Results with Floodway	Difference
M	22.35	44.02	44.02	0.00	44.72	44.72	0.00
N	23.10	46.06	46.10	0.04	46.78	46.81	0.03
O	23.79	46.24	46.30	0.06	46.89	46.91	0.02
P	24.06	46.82	46.89	0.07	47.48	47.52	0.04
Q	24.50	47.20	47.26	0.06	47.91	47.94	0.03
R	24.90	47.69	47.77	0.08	48.38	48.41	0.03
Not included in FIS, but included in the effective model	25.32	48.25	48.39	0.14	48.98	49.01	0.03
	25.73	49.35	49.44	0.09	50.19	50.25	0.06
	25.98	48.79	48.88	0.09	49.64	49.67	0.03
	26.08	49.09	49.20	0.11	49.83	49.92	0.09
	26.42	51.22	51.45	0.23	52.30	52.48	0.18

[a] River miles from Columbia River confluence

Corrected Effective Model

The duplicate effective model was updated to correct known errors and include improved information, creating the corrected effective model. The following updates were made to the duplicate effective model in order to create the corrected effective model:

- Cross sections 22.35 (M), 23.1 (N), 23.79 (O), and 26.42 were removed from the model to condense the number of cross sections to be updated as part of the corrected effective model.
  - This condensed model was rerun and found to match the results of the duplicate effective model.
- Bank stations were adjusted in most cross sections to correct misplaced bank stations (i.e., stations on bottom of river, inconsistent bank station elevations within the same cross sections).
- The Abernethy Bridge was added to the model at Station 25.55.
  - The upstream and downstream cross section geometries, 25.56 and 25.53, respectively, were based on information from the as-built plans for the bridge. The same terrain profile was used for upstream and downstream.

  - Piers were added based on the as-built drawings and existing survey information. A 27-degree skew was assumed. Due to the skew angle, bents were modeled as multiple piers to represent the actual blockages in the direction of flow.
- Cross sections 24.50 and 24.90 (FIS cross sections Q and R) were extended on the right bank to high ground to include the entire flow areas.
- Cross section 26.08 was extended on the left bank to contain the flow. Negative signs at Stations 230 and 370 were removed to correct an assumed error.
- Cross section 25.98 had a station/elevation point removed at Station 250. It was assumed that a negative sign was missed in the original model, there is no evidence that any structure ever protruded out of the water as the cross section represented.
- Cross section 25.73 had a station/elevation point removed at Station 1100. It was assumed that in the original model this feature represented the impact of the floating marinas located in this section of the river, there is no evidence that any structure ever protruded out of the water as the cross section represented. A higher Manning's n value of 0.15 was used for the portion of the cross section where the marina is located.
- At Station 25.53, the downstream face of the Abernethy Bridge had a Manning's n value of 0.15 applied to define a floating marina from an aerial image dated September 13, 1975.
- The encroachment stations for the added bridge cross sections, 25.56 and 25.53, were measured from the published floodway boundaries.

A comparison of the cross sections between the duplicate effective and the corrected effective models are provided in Attachment B. Table 3 compares the modeled water surface elevations between the two models. The most noticeable change in the modeled results is increased water surface elevations in the cross sections directly upstream of the added Abernethy Bridge.

Table 3. Duplicate Effective (HEC-RAS Version 5.0.7) Model Compared to Corrected Effective (HEC-RAS Version 5.0.7) Model Results – Willamette River

Cross Section	River Mile	Water Surface Elevations NAVD88 (ft)					
		Duplicate Effective Model Results without Floodway	Corrected Effective Model Results without Floodway	Difference	Duplicate Effective Model Results with Floodway	Corrected Effective Model Results with Floodway	Difference
P	24.06	46.89	46.89	0.00	47.52	47.52	0.00
Q	24.50	47.26	47.36	0.10	47.94	47.95	0.01
R	24.90	47.77	47.58	-0.19	48.41	48.29	-0.12
*	25.32	48.39	48.17	-0.22	49.01	48.88	-0.13
**	25.53	--	49.51	--	--	50.24	--

Table 3. Duplicate Effective (HEC-RAS Version 5.0.7) Model Compared to Corrected Effective (HEC-RAS Version 5.0.7) Model Results – Willamette River

Cross Section	River Mile	Water Surface Elevations NAVD88 (ft)					
		Duplicate Effective Model Results without Floodway	Corrected Effective Model Results without Floodway	Difference	Duplicate Effective Model Results with Floodway	Corrected Effective Model Results with Floodway	Difference
Abernethy Bridge							
**	25.56	--	49.69	--	--	50.44	--
*	25.73	49.44	49.83	0.39	50.25	50.66	0.41
*	25.98	48.88	49.49	0.61	49.67	50.31	0.64
*	26.08	49.20	49.49	0.29	49.92	49.69	-0.23

[a] River miles from Columbia River confluence
***** Not included in FIS, but included in the effective model
****** Included to model the Abernethy Bridge

Existing Conditions Model

The existing conditions model was created by updating the corrected effective model with new bathymetric survey data collected between cross sections 24.50 and 26.08. Cross sections at the upstream and downstream faces of the bridge were extracted from the recent bathymetric survey to capture effects of riprap removal. In addition to channel survey data, the overbank areas were updated using available light detection and ranging (LiDAR) information for cross sections 24.06, 24.50, 24.90, 25.32, 25.53, and 25.56. The Manning’s n value used to represent a floating marina adjacent to the right bank directly downstream of the Abernethy Bridge was removed, because that feature is not present in existing conditions. The increased Manning’s n value remained upstream of the bridge for the existing marina.

There are significant differences in the left overbank in cross section 25.53 between the corrected effective and existing conditions models. The elevations in the existing conditions model are up to 30 feet higher than in the corrected effective model. This difference is attributable to the terrain information from as-built plans used for the bounding cross sections profile of the bridge in the corrected effective model, which only provided the centerline profile of the bridge. The existing conditions model was updated with current channel bathymetry information combined with LiDAR data for the overbank areas. There is a significant hillside located on the downstream face of the bridge on the left overbank. This hillside is captured in the LiDAR data but not in the as-built information.

The channel cross sections located at the upstream and downstream faces of the bridge, cross sections 25.56 and 25.53, respectively are at a skew of 27 degrees to the river. To account for this in the model, the cross sections a skew factor of 27 degrees was applied. This skew factor corrects the cross section to approximate a model cross section normal to the channel.

This model represents the existing condition for the No-Rise Analysis intended to perform a relative comparison of the difference between existing and proposed conditions water surface elevations, not absolute elevations. Table 4 compares the results of the corrected effective and existing conditions models. The largest differences in water surface elevations were found in the cross sections that were updated the most when comparing the original model geometry to recent surveyed cross sections (Attachment B).

Table 4. Corrected Effective (HEC-RAS Version 5.0.7) Model Compared to Existing Conditions (HEC-RAS Version 5.0.7) Model Results – Willamette River

Cross Section	River Mile	Water Surface Elevations NAVD88 (ft)					
		Corrected Effective Model Results without Floodway	Existing Conditions Model Results without Floodway	Difference	Corrected Effective Model Results with Floodway	Existing Conditions Model Results with Floodway	Difference
P	24.06	46.89	46.89	0.00	47.52	47.52	0.00
Q	24.50	47.36	47.54	0.18	47.95	48.26	0.31
R	24.90	47.58	47.26	-0.32	48.29	47.98	-0.31
*	25.32	48.17	47.59	-0.58	48.88	48.36	-0.52
**	25.53	49.51	48.64	-0.87	50.24	49.38	-0.86
Abernethy Bridge							
**	25.56	49.69	48.76	-0.93	50.44	49.54	-0.90
*	25.73	49.83	48.91	-0.92	50.66	49.76	-0.90
*	25.98	49.49	48.70	-0.79	50.31	49.56	-0.75
*	26.08	49.49	47.87	-1.62	49.69	48.61	-1.08

[a] River miles from Columbia River confluence
* Not included in FIS, but included in the effective model
** Included to model the Abernethy Bridge

Proposed Conditions Model

The proposed conditions model was created by updating the existing bridge pier geometry to the proposed bridge pier geometry dated August 27, 2019 (Attachment C). Changes included replacing the piers in the river with larger diameter columns spaced farther apart on the same bent; increasing the size of some piers on the left bank of the river to represent fortification of the existing piers; and removing the pier for the northbound entrance ramp that will be removed. Table 5 summarizes and compares the modeled water surface elevations from the existing and proposed conditions models. The observed differences range from no change to a 0.03-foot decrease in the cross sections upstream of the bridge in the model with floodway encroachments.

The proposed design widens the bridge deck; however, this does not affect the proposed results because the deck and low chord of the Abernethy Bridge are situated above the floodplain. The internal bridge cross sections were updated to include the proposed riprap excavation around the existing piers and in proposed pier locations.

Table 5. Existing Conditions (HEC-RAS Version 5.0.7) Model Compared to Proposed Conditions (HEC-RAS Version 5.0.7) Model Results – Willamette River

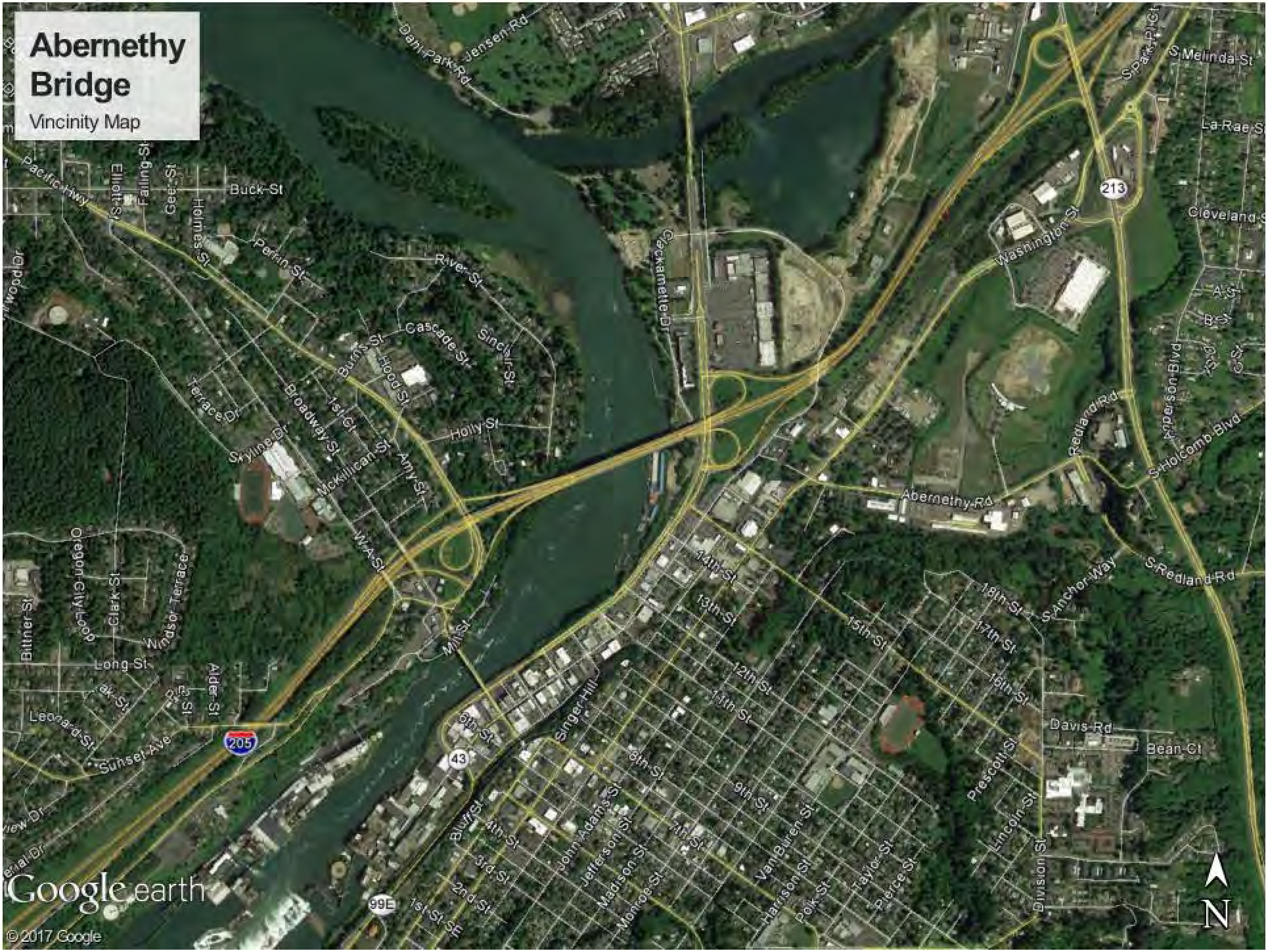
Cross Section	River Mile	Water Surface Elevations NAVD88 (ft)					
		Existing Conditions Model Results without Floodway	Proposed Conditions Model Results without Floodway	Difference	Existing Conditions Model Results with Floodway	Proposed Conditions Model Results with Floodway	Difference
P	24.06	46.89	46.89	0.00	47.52	47.52	0.00
Q	24.50	47.54	47.54	0.00	48.26	48.26	0.00
R	24.90	47.26	47.26	0.00	47.98	47.98	0.00
*	25.32	47.59	47.59	0.00	48.36	48.36	0.00
**	25.53	48.64	48.64	0.00	49.38	49.38	0.00
Abernethy Bridge							
**	25.56	48.76	48.75	-0.01	49.54	49.52	-0.02
*	25.73	48.91	48.90	-0.01	49.76	49.74	-0.02
*	25.98	48.70	48.69	-0.01	49.56	49.53	-0.03
*	26.08	47.87	47.86	-0.01	48.61	48.59	-0.02

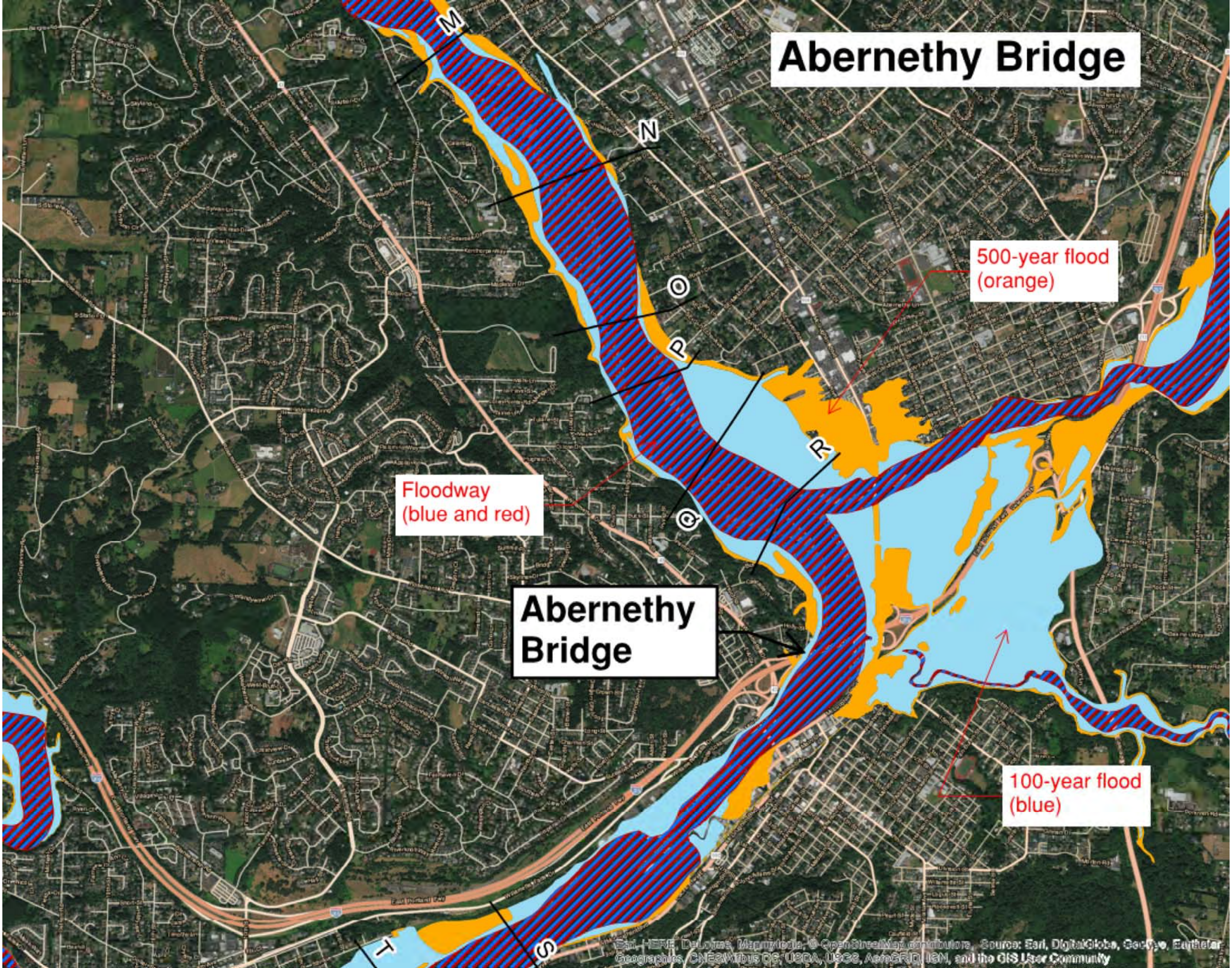
[a] River miles from Columbia River confluence
***** Not included in FIS, but included in the effective model
****** Included to model the Abernethy Bridge

Summary and Conclusions

The No-Rise Analysis was performed to verify the project will be in conformance with federal and local regulatory requirements. Oregon City and West Linn are participating communities in the National Flood Insurance Program and have adopted floodplain management ordinances that comply with the minimum federal requirements defined in 44 CFR Part 60. The proposed bridge improvements will result in no rise in FEMA's effective base flood or floodway elevations.

Attachment A. Bridge Location and FIRM Panel


Abernethy Bridge
Vincinity Map
Buck St
Pacific Hwy
Elliott St
Falling St
Gee St
Holmes St
Perrin St
River St
Cascade St
Burns St
Hood St
Sinclair St
Terrace Dr
Broadway St
1st Ct
Holly St
Skyline Dr
McKillican St
Amy St
W A St
Oregon City Loop
Clark St
Windsor Terrace
Bittner St
Long St
Alder St
Leonard St
Sunset Ave
Mill St
205
43
99E
Clackamette Dr
Dahl Park Rd
Jensen Rd
S Park Pl Ct
S Melinda St
La Rae St
213
Cleveland St
Washington St
Redland Rd
Apperson Blvd
S Holcomb Blvd
Abernethy Rd
S Redland Rd
S Anchor Way
14th St
13th St
12th St
11th St
15th St
18th St
17th St
16th St
Singer Hill
8th St
9th St
7th St
Davis Rd
Bean Ct
Prescott St
Lincoln St
Division St
Bluff St
4th St
3rd St
2nd St
1st St
John Adams St
Jefferson St
Madison St
Monroe St
Van Buren St
Harrison St
Polk St
Taylor St
Pierce St
N
Google earth
© 2017 Google



Abernethy Bridge
500-year flood
(orange)
Floodway
(blue and red)
Abernethy
Bridge
100-year flood
(blue)
M
N
O
P
Q
R
S
T

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from multiple sources. High-resolution color orthophotos produced by Merrick & Co., Pictures, Inc., and Clean Water Services covered portions of the county. USGS Digital Quadrangles at a scale of 1:12000 or less dated 6/20/94 covered the remainder of the county.

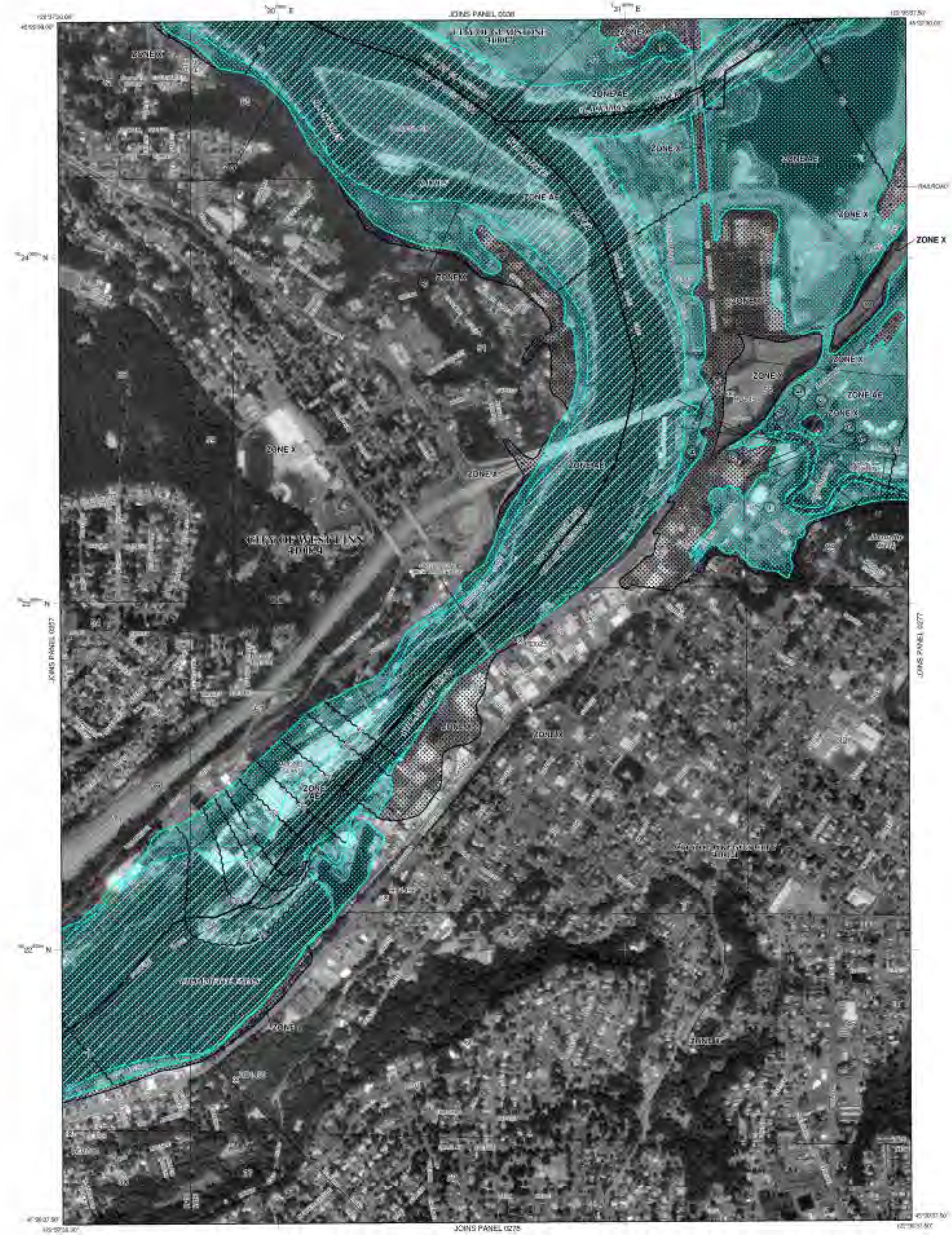
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)——(A)	Cross section line
(23)——(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 10
6000000 M	5000-foot grid ticks: Oregon State Plane coordinate system, north zone (FIPSZONE 3601), Lambert Conformal Conic
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 17, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0276D

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CLACKAMAS COUNTY, OREGON

AND INCORPORATED AREAS

PANEL 276 OF 1175

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GLADSTONE, CITY OF	[illegible]	0276	D
OREGON CITY, CITY OF	[illegible]	0276	D
WEST LINN, CITY OF	[illegible]	0276	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

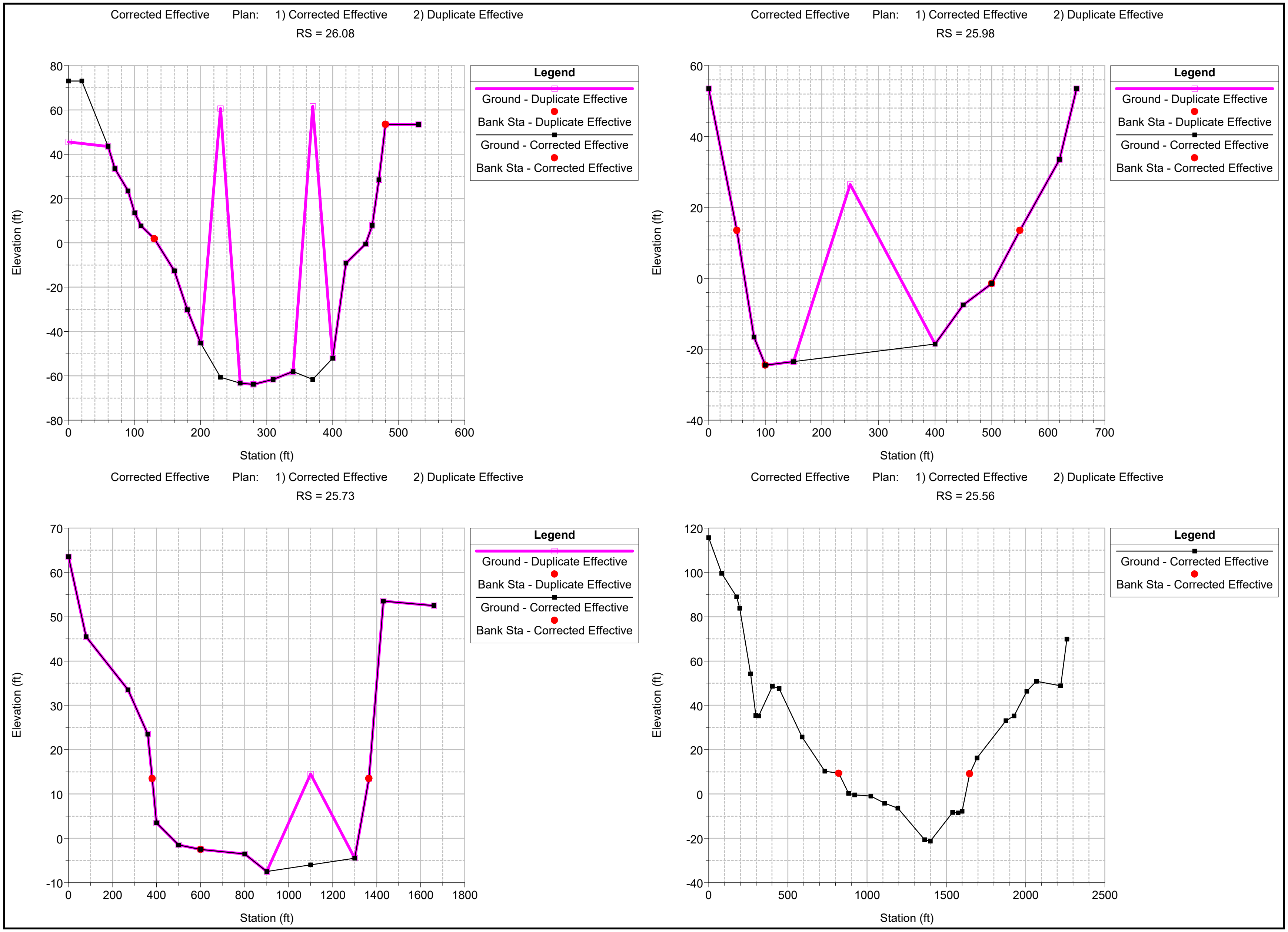
MAP NUMBER
41005C0276D

EFFECTIVE DATE
JUNE 17, 2008

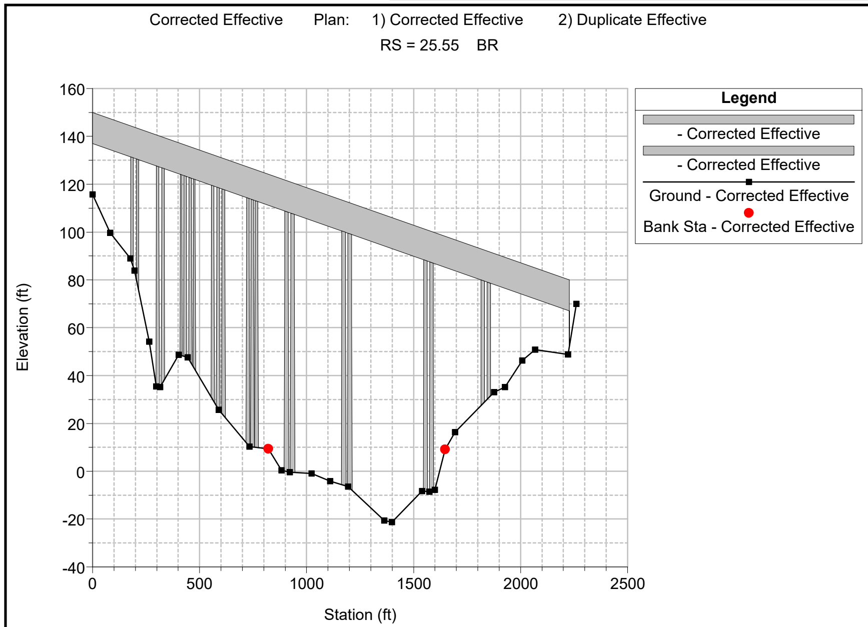
Federal Emergency Management Agency

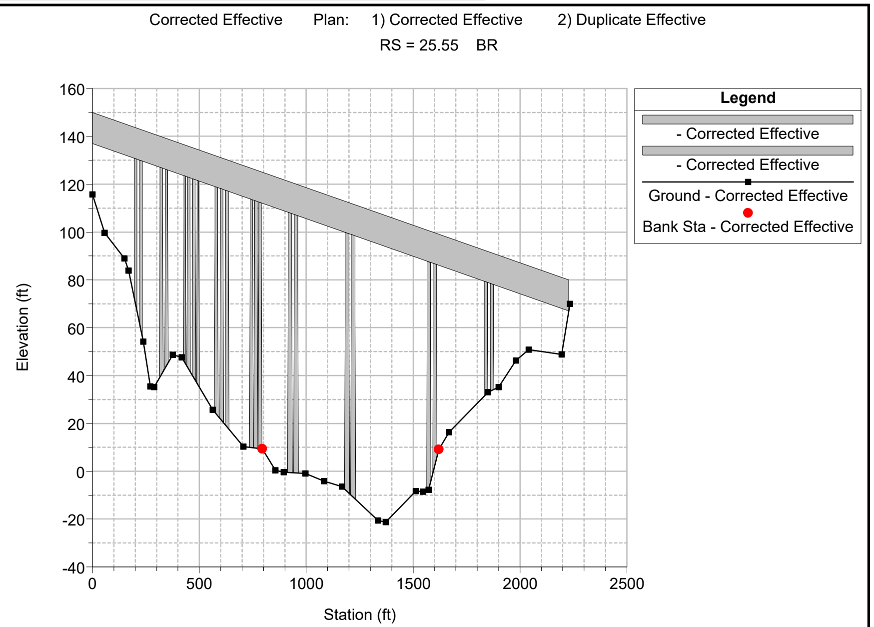
Attachment B. HEC-RAS Cross Sections

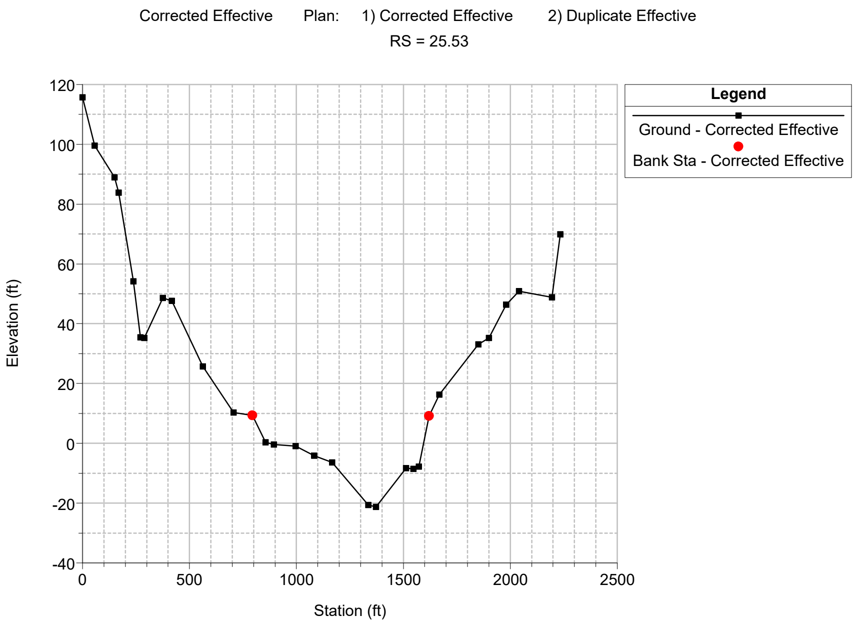
Duplicate Effective Compared to Corrected Effective HEC-RAS Cross Sections

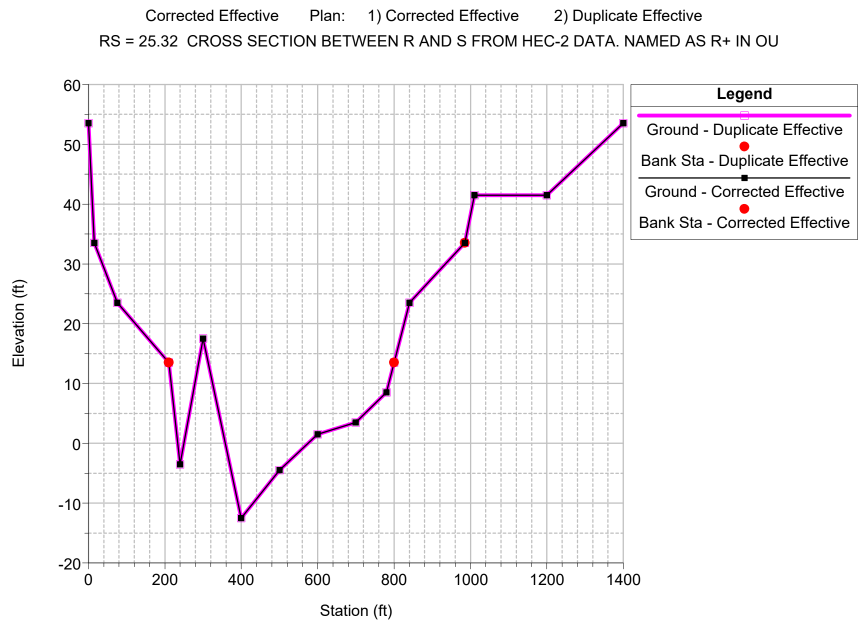


Duplicate Effective Compared to Corrected Effective HEC-RAS Cross Sections

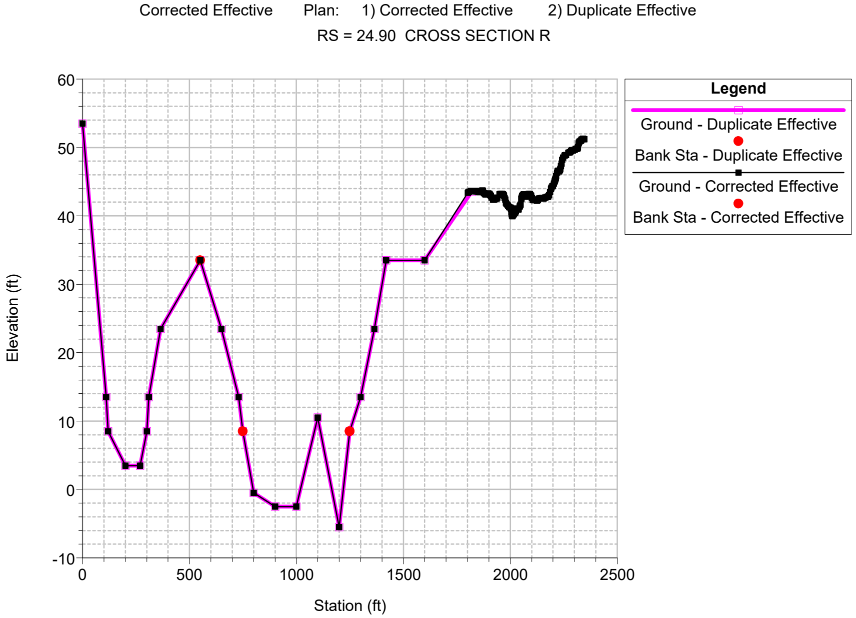


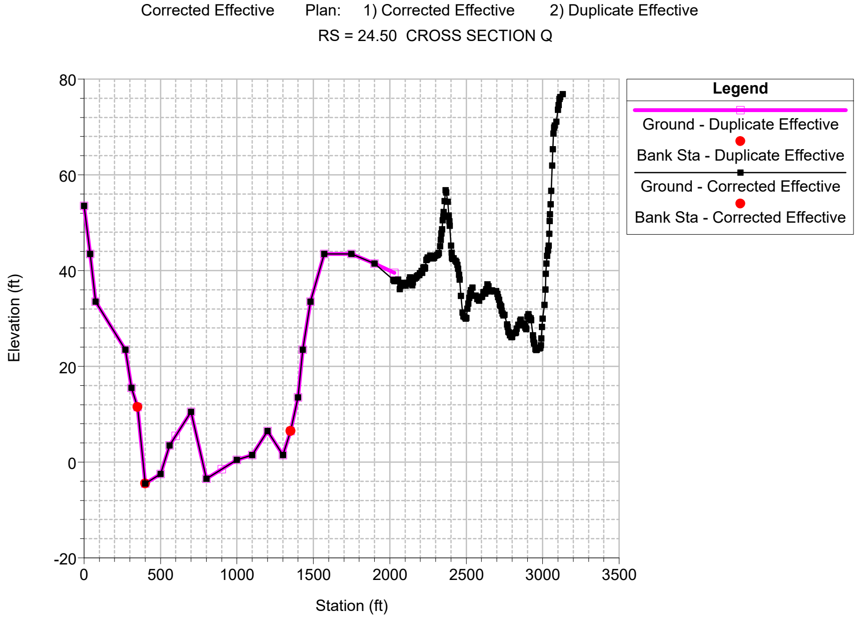


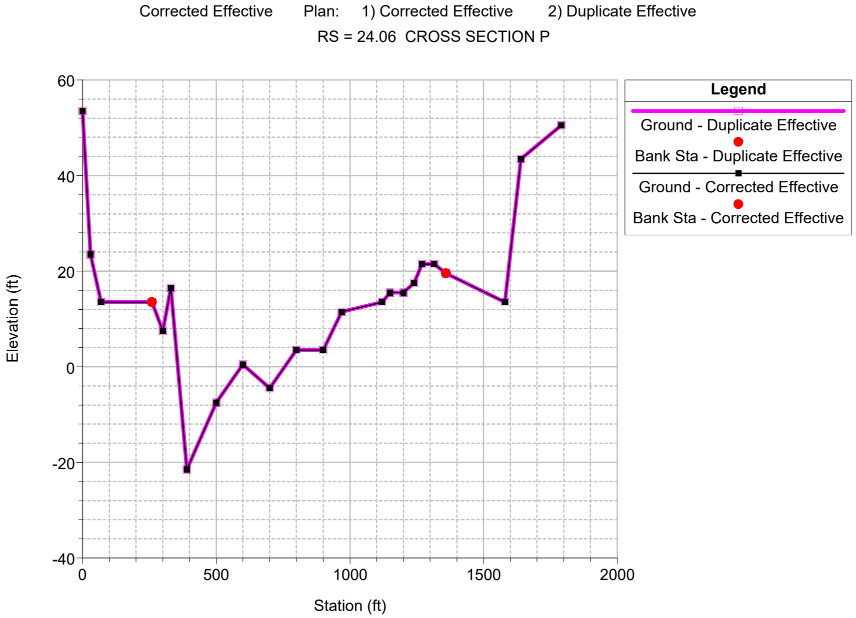




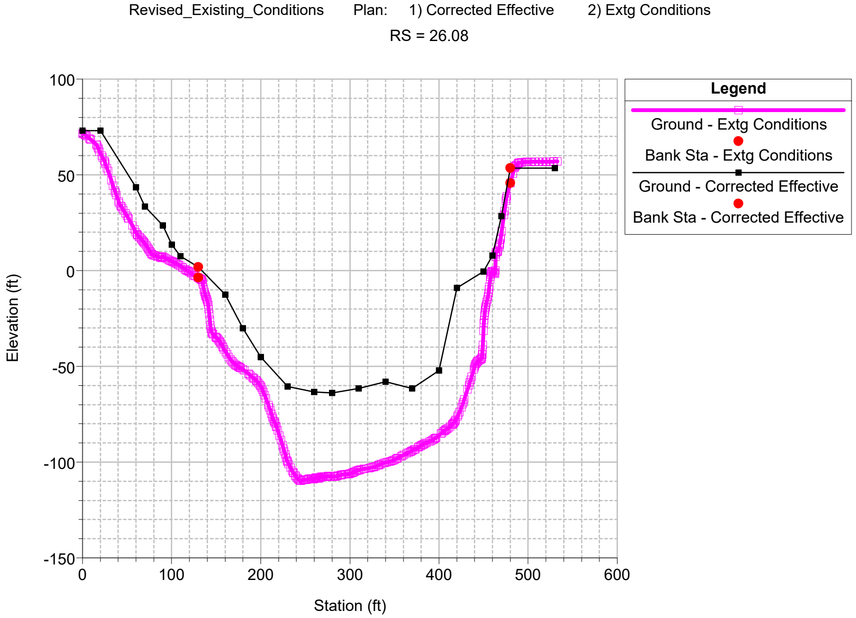
Duplicate Effective Compared to Corrected Effective HEC-RAS Cross Sections

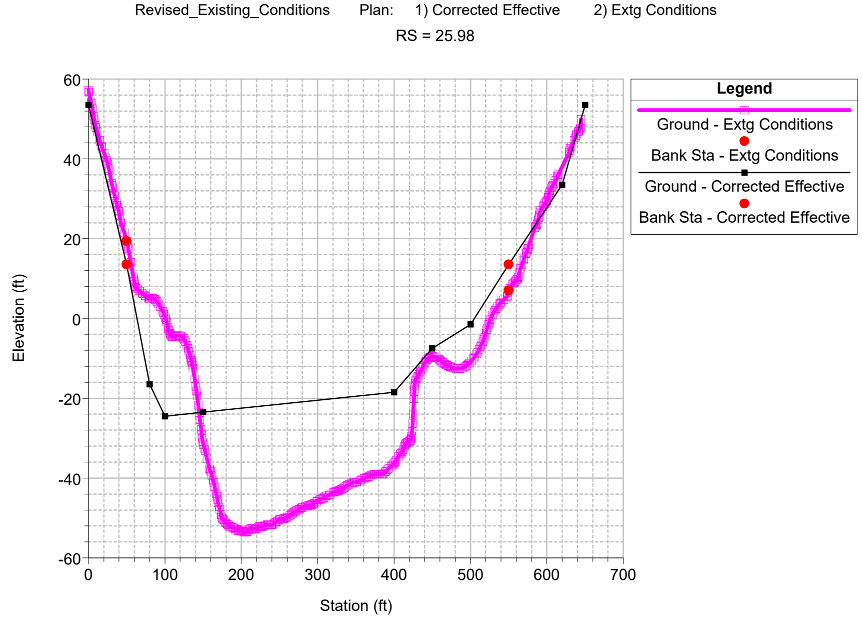


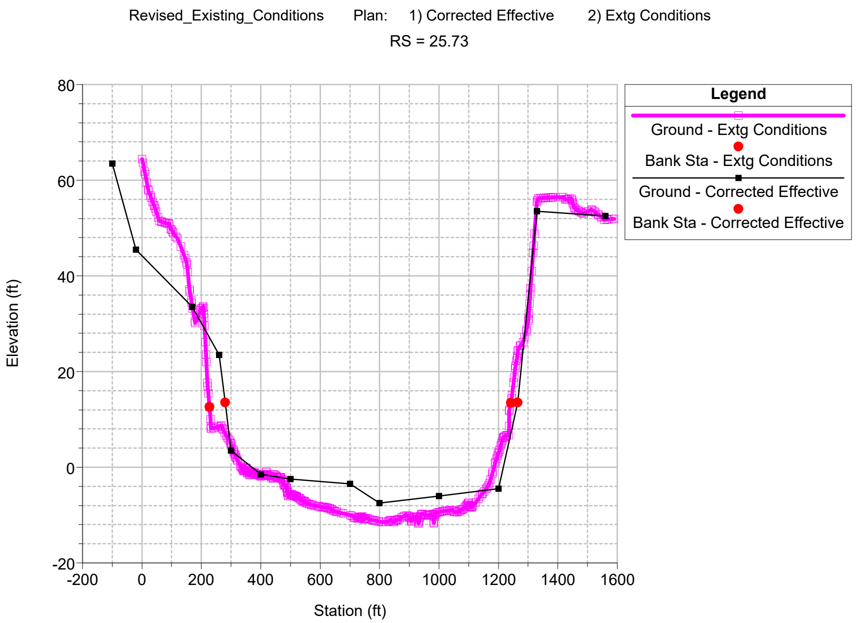


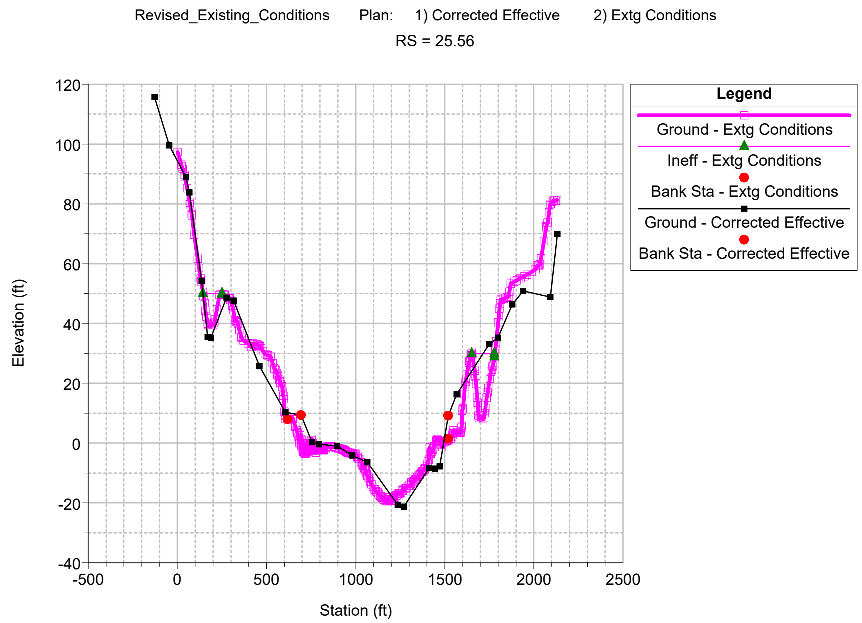


Corrected Effective Compared to Existing Conditions HEC-RAS Cross Sections

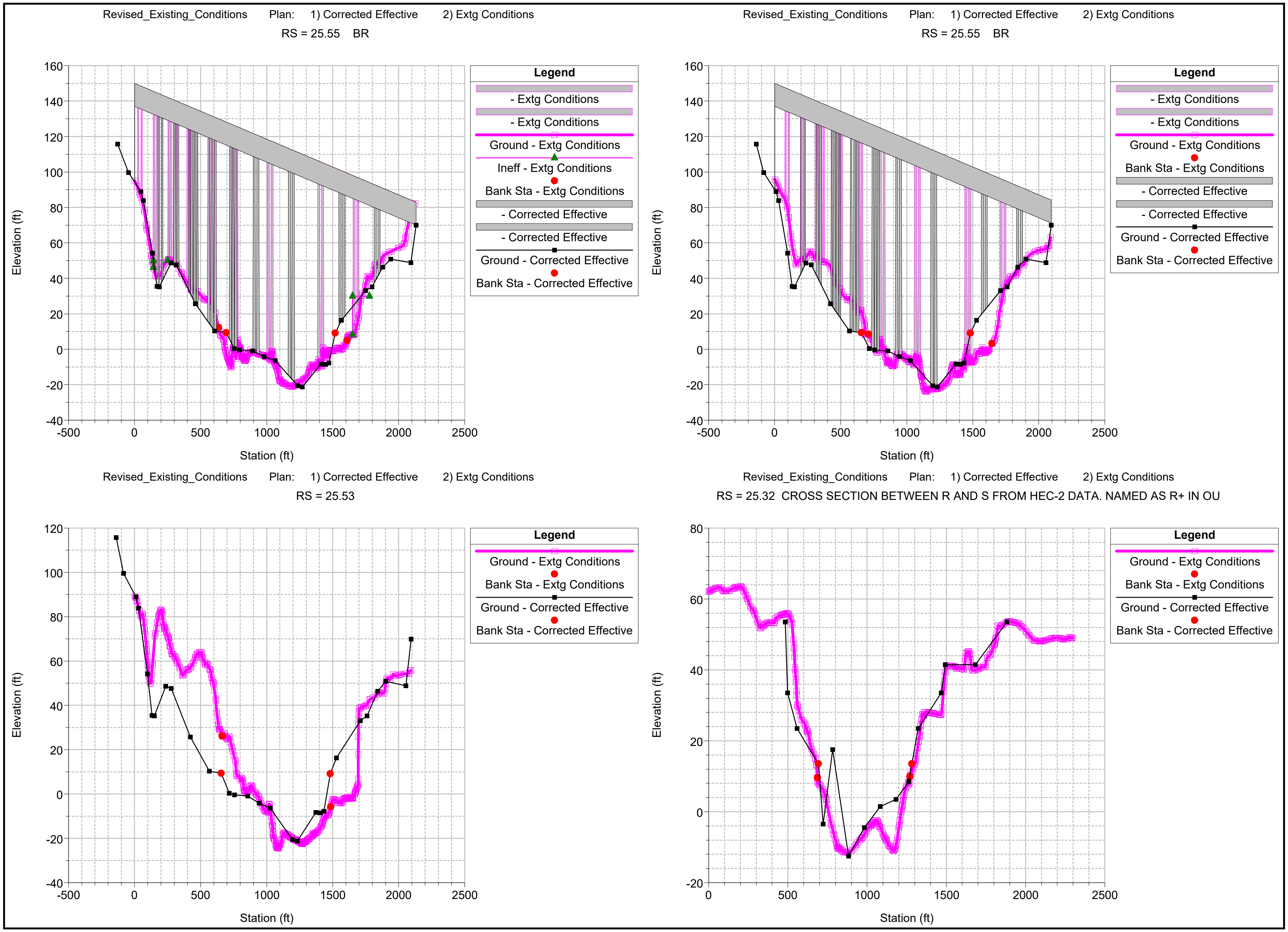




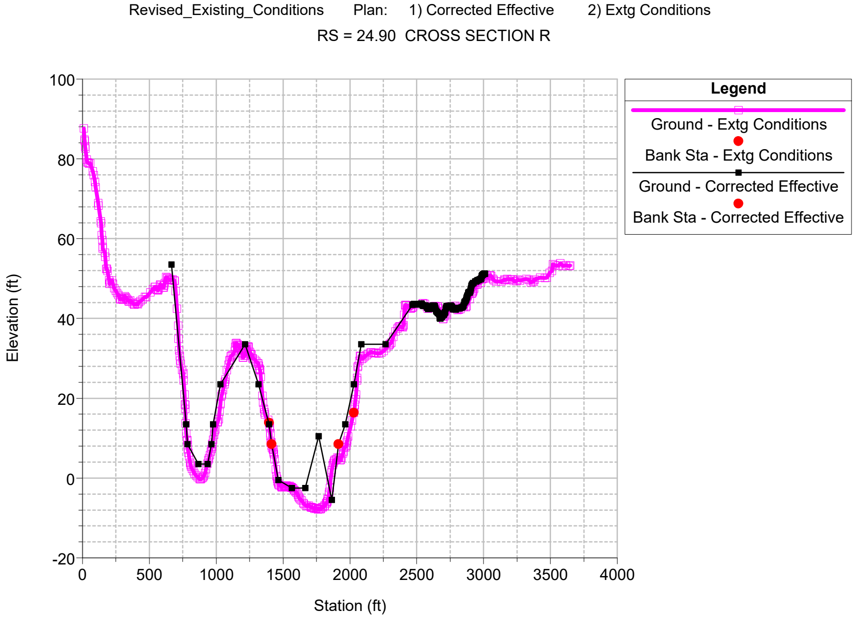


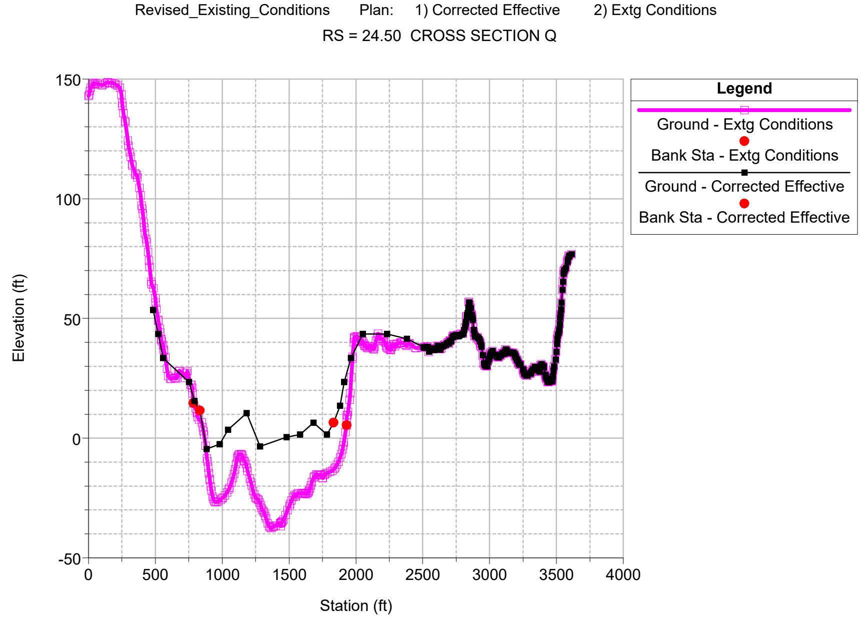


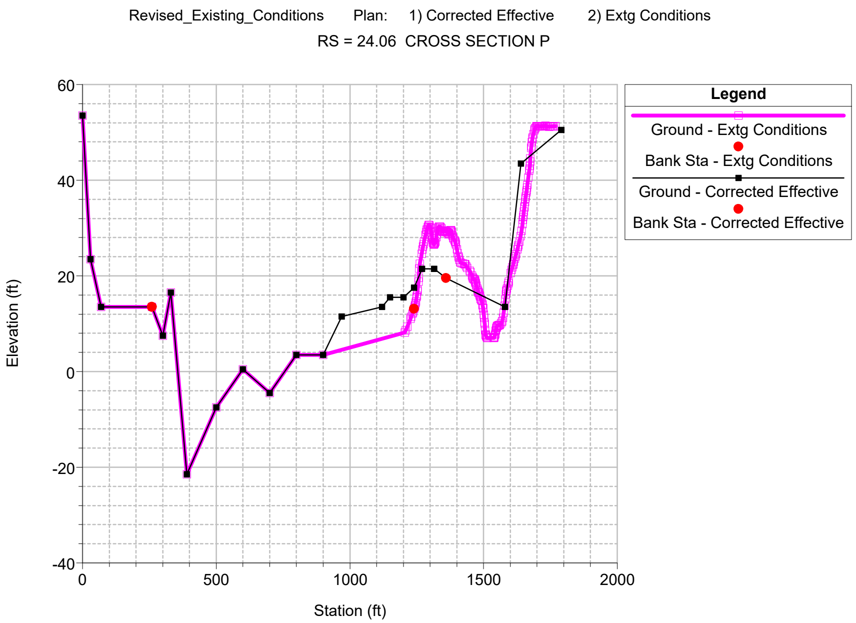
Corrected Effective Compared to Existing Conditions HEC-RAS Cross Sections



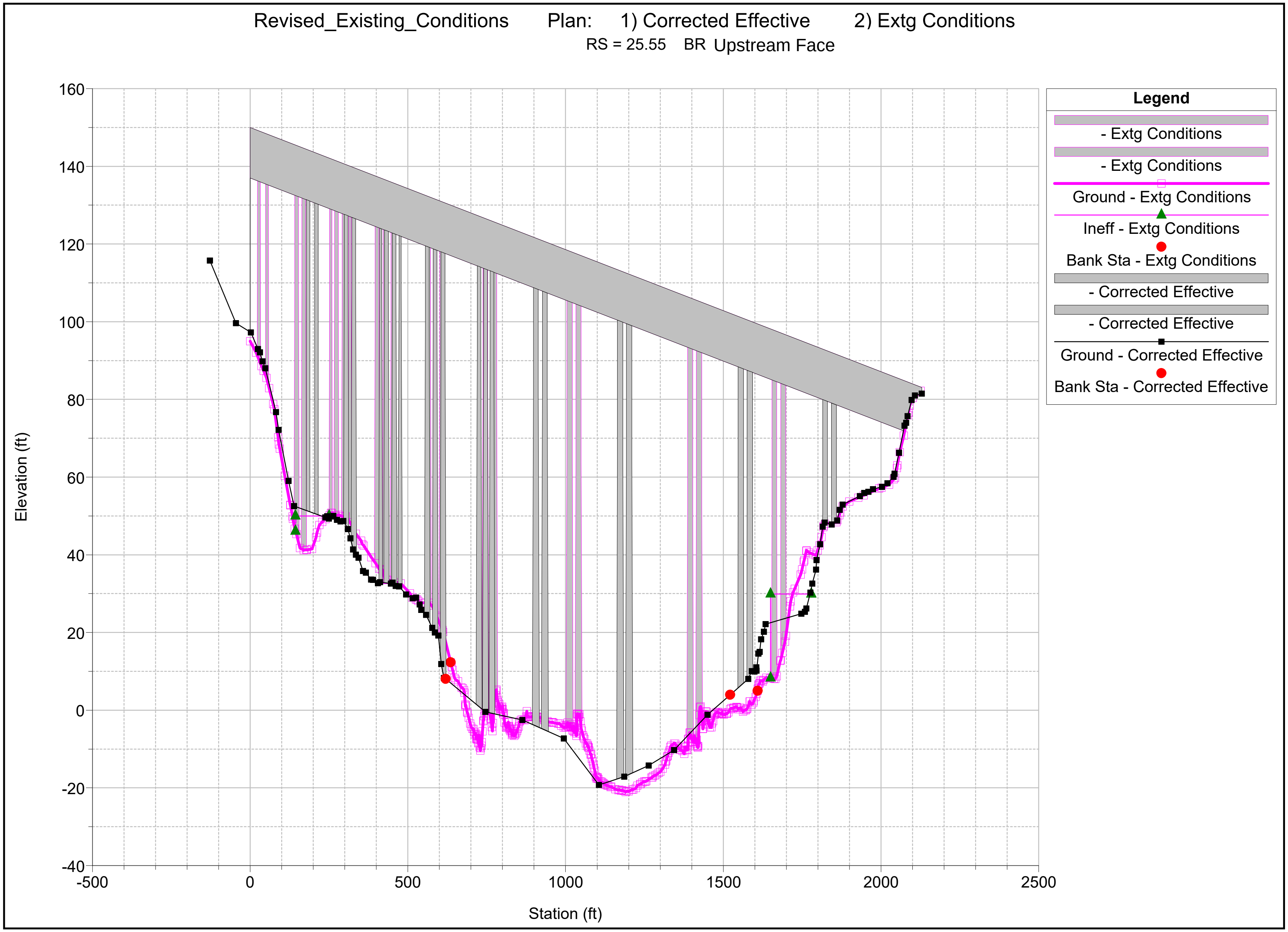
Corrected Effective Compared to Existing Conditions HEC-RAS Cross Sections



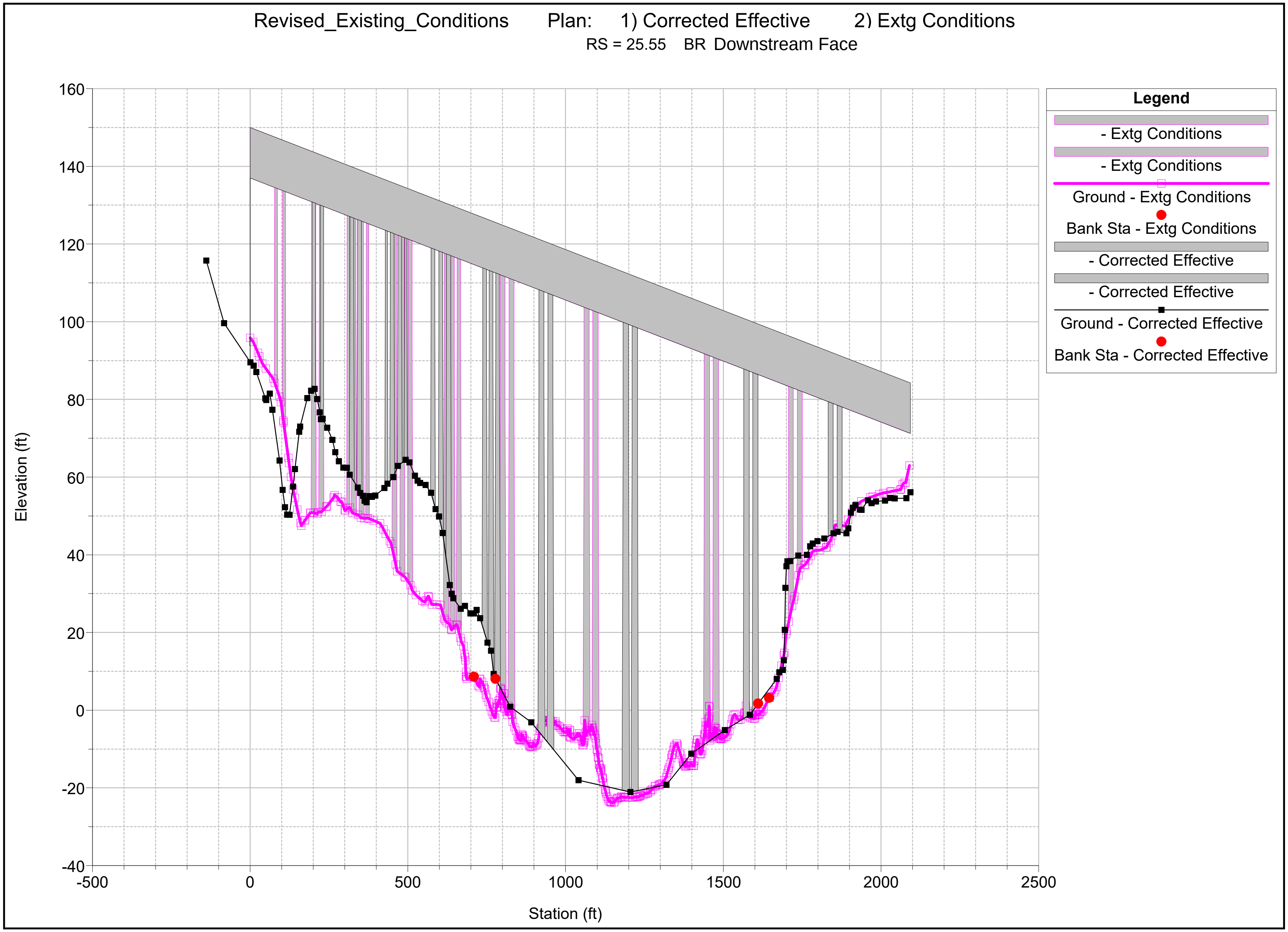




Existing Bridge Compared to Proposed Bridge HEC-RAS Cross Sections

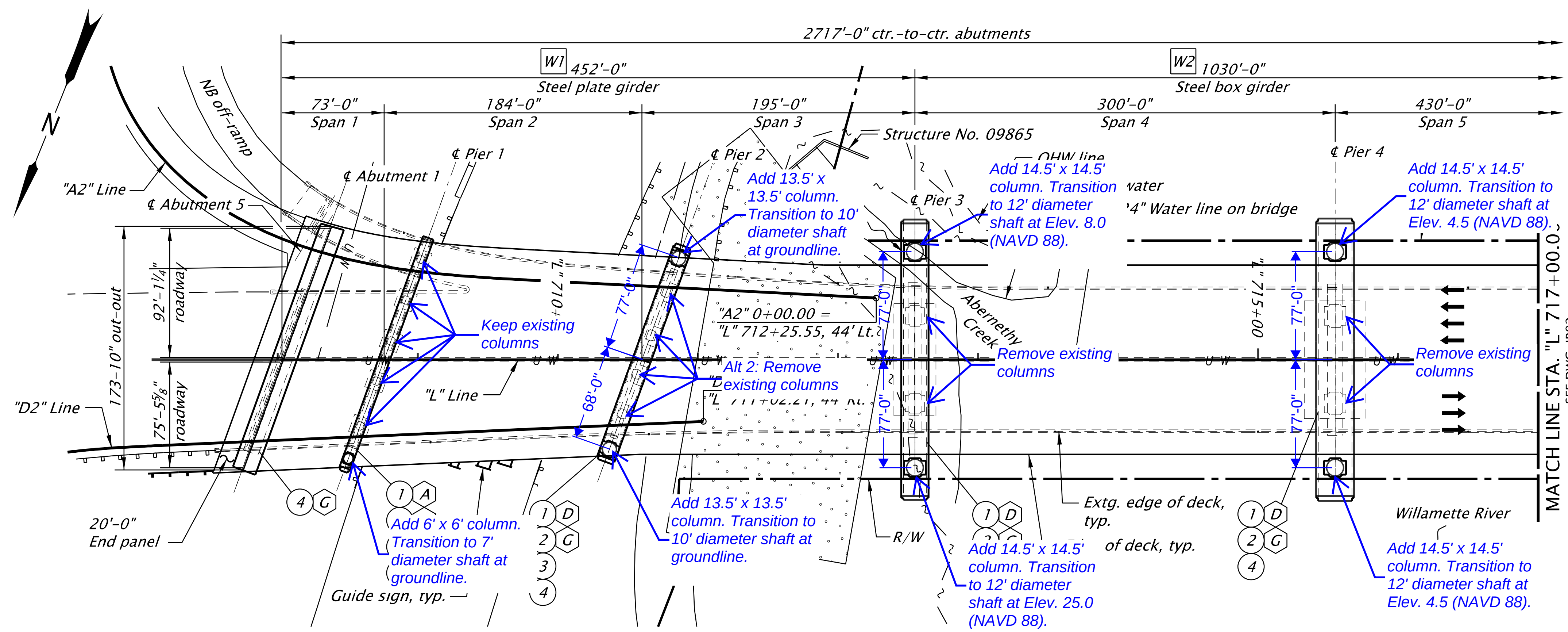


Existing Bridge Compared to Proposed Bridge HEC-RAS Cross Sections



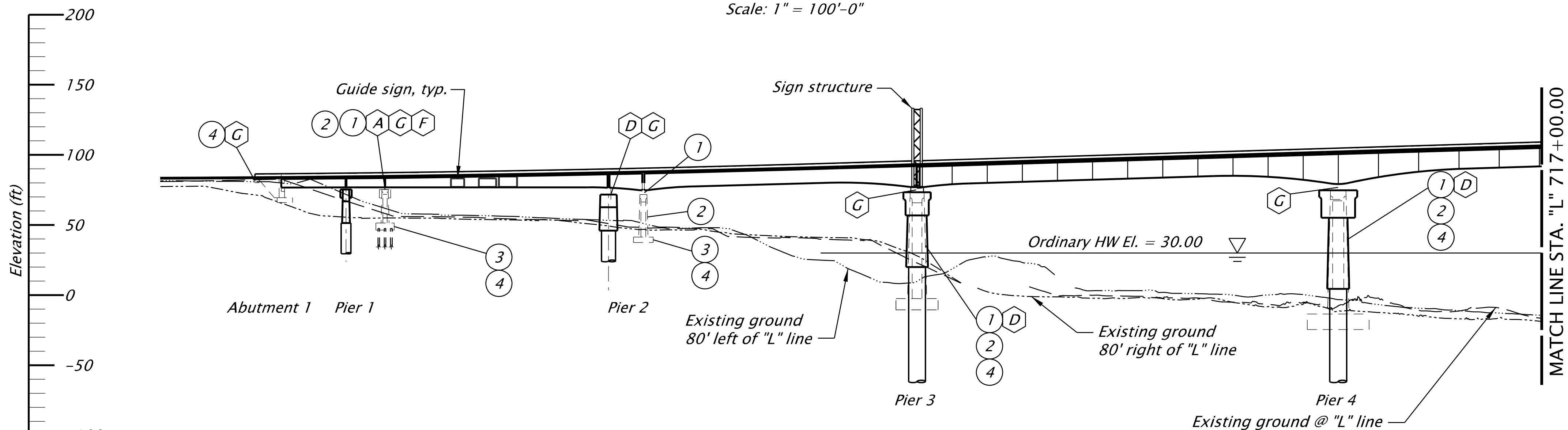
Attachment C. Proposed Bridge Plans

Preliminary - For hydraulic team use - 8/27/2019



PLAN

Scale: 1" = 100'-0"

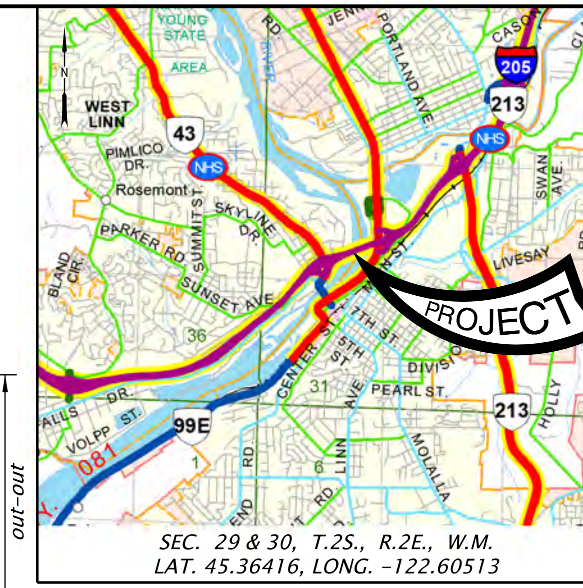


ELEVATION

Scale: 1" = 100'-0"

Existing structure shown approximately at "L" line

Proposed structure shown approximately at right edge of mainline structure



SEC. 29 & 30, T.2S., R.2E., W.M.
LAT. 45.36416, LONG. -122.60513

LOCATION MAP

No Scale

SEISMIC RETROFIT

- A Crossbeam enlargement
- B Column enlargement
- C Pile cap enlargement
- D Substructure replacement
- E Micropiles
- F Strengthen footing and pile connection
- G Isolation bearings

SEISMIC DEFICIENCY

1. Crossbeam flexural/shear strength (LL)
2. Column flexural/shear strength (LL)
3. Lack of top mat pile cap reinforcing (LL)
4. Insufficient pile anchorage (LL)
5. Spread footing overturning/strength (LL)

WIDENING

- W1 Steel girder widening
- W2 Cantilever widening

LEGEND:

Ground improvements

Notes:
1. Elevations shown are based on North American Vertical Datum (1988).

SCALE WARNING
If scale bar doesn't measure one inch then drawing is not to scale

ACCOMPANIED BY DWGS.: See sheets JB01 thru JB4.

STRUCTURE NO.	09403
BDS DWG NO.	00000
CALC. BOOK	0000
HWY: 064 M.P.: 9.03	
COUNTY	Clackamas
DATE	07/2019

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

WILLAMETTE R & HWYS 1E & 3, HWY 64 (GEO ABERNETHY)

I-205: I-5 - OR213, PHASE 1 SEC.

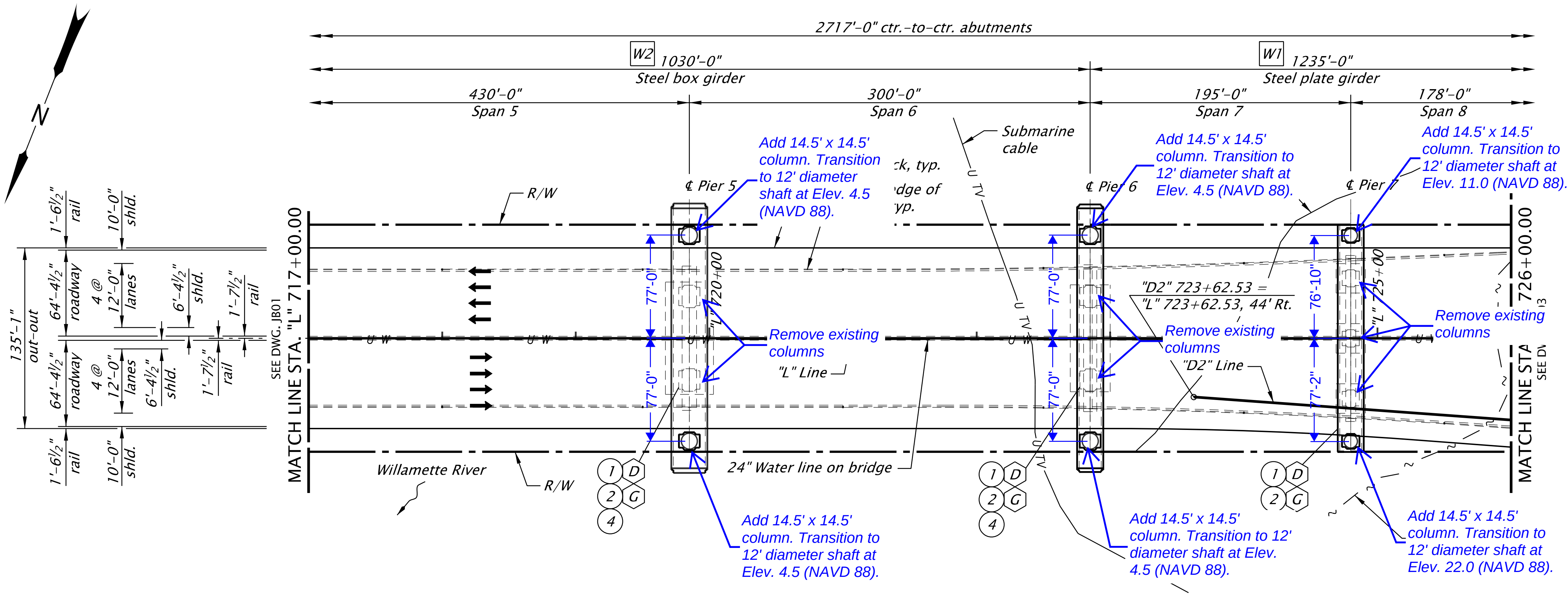
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Mikal Mitchell — Reviewer: Jeff Olson
Drafter: Heather Gonsior — Checker: -

WIDENING AND SEISMIC RETROFIT PLAN AND ELEVATION - 1

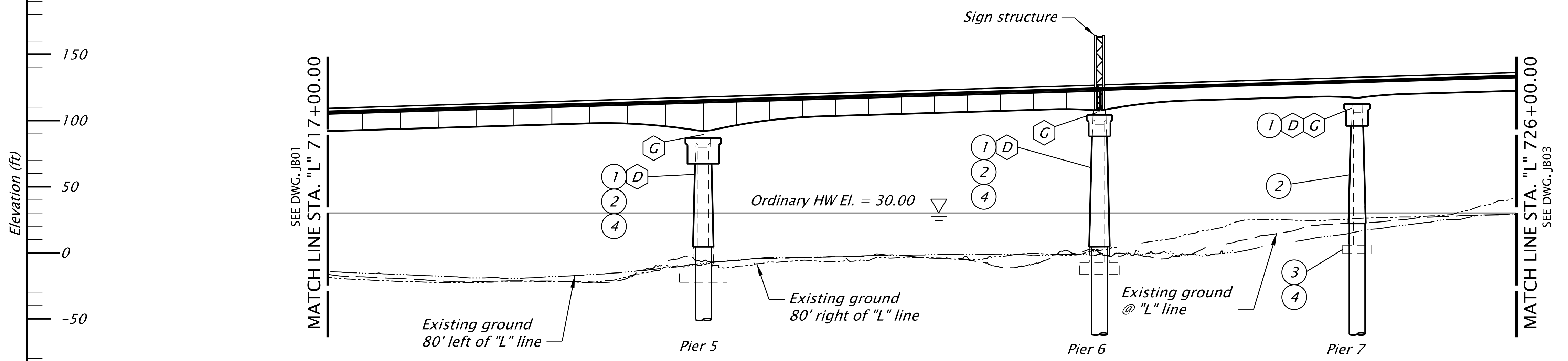
SHEET NO. JB01

Preliminary - For hydraulic team use - 8/27/2019



PLAN

Scale: 1" = 100'-0"



ELEVATION

Scale: 1" = 100'-0"

Existing structure shown approximately at "L" line

Proposed structure shown approximately at right edge of mainline structure

SEISMIC DEFICIENCY

1. Crossbeam flexural/shear strength (LL)
2. Column flexural/shear strength (LL)
3. Lack of top mat pile cap reinforcing (LL)
4. Insufficient pile anchorage (LL)
5. Spread footing overturning/strength (LL)

SEISMIC RETROFIT

- A Crossbeam enlargement
- B Column enlargement
- C Pile cap enlargement
- D Substructure replacement
- E Micropiles
- F Strengthen footing and pile connection
- G Isolation bearings

WIDENING

- W1 Steel girder widening
- W2 Cantilever widening

Notes:

1. Elevations shown are based on North American Vertical Datum (1988).

SCALE WARNING
If scale bar doesn't measure one inch then drawing is not to scale

ACCOMPANIED BY DWGS.:
See sheets JB01 thru JB04.

STRUCTURE NO.	09403
BDS DWG NO.	00000
CALC. BOOK	0000
HWY: 064 M.P.: 9.03	
COUNTY	Clackamas
DATE	07/2019

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

WILLAMETTE R & HWYS 1E & 3, HWY 64 (GEO ABERNETHY)

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

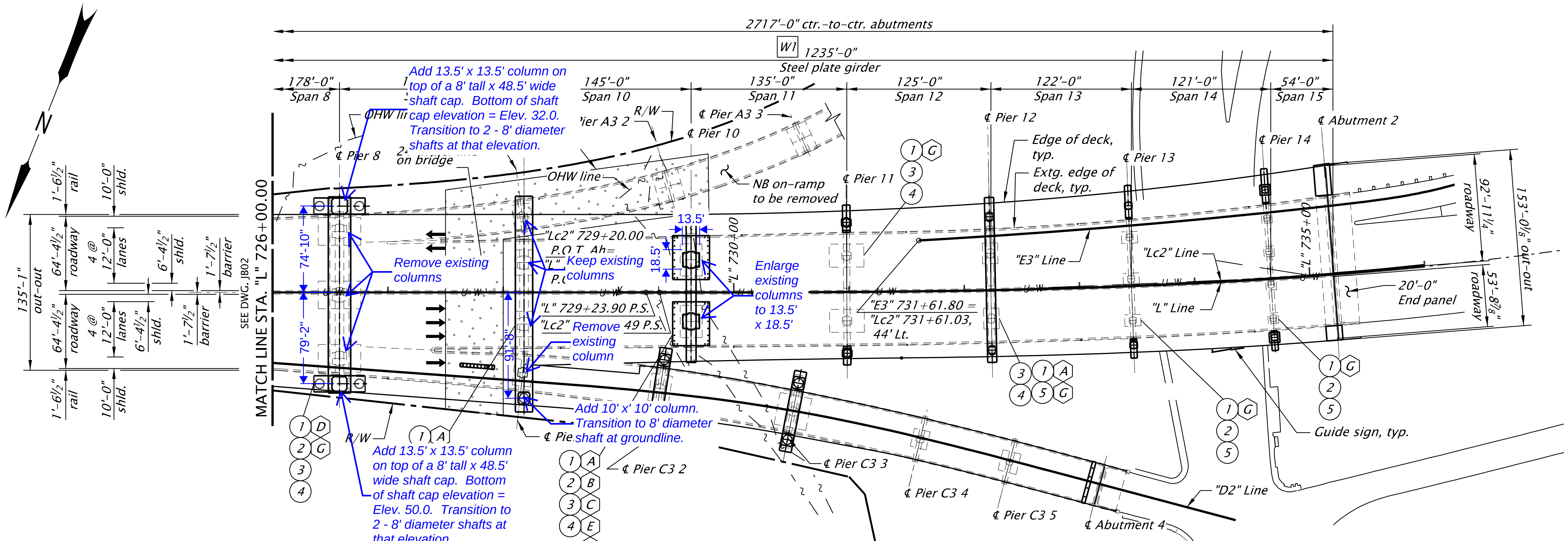
Designer: Mikal Mitchell | Reviewer: Jeff Olson
Drafter: Heather Gonsior | Checker: -

WIDENING AND SEISMIC RETROFIT PLAN AND ELEVATION - 2

SHEET NO. JB02

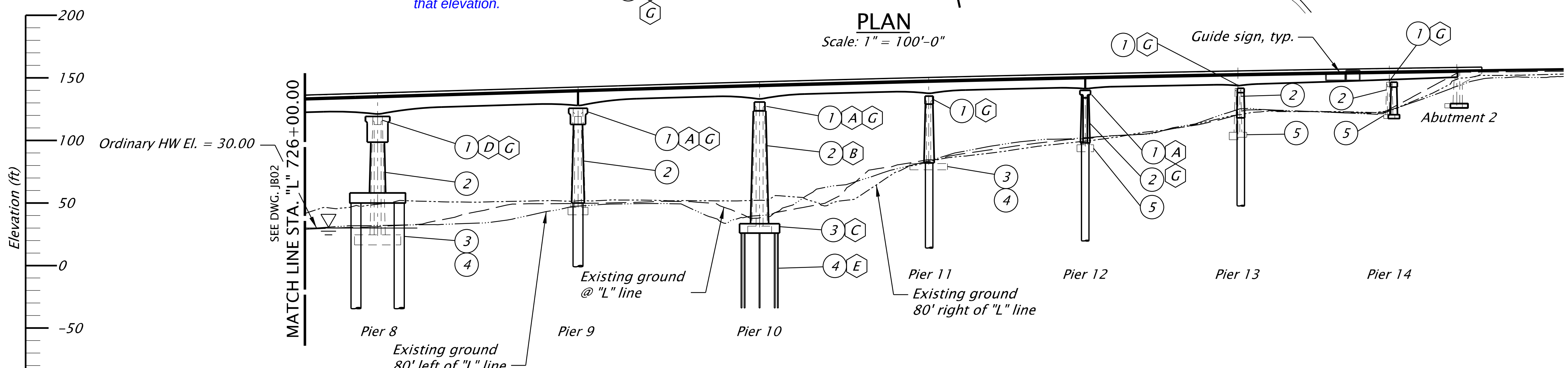
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Preliminary - For hydraulic team use - 8/27/2019



PLAN

Scale: 1" = 100'-0"



ELEVATION

Scale: 1" = 100'-0"

Existing structure shown approximately at "L" line
Proposed structure shown approximately at right edge of mainline structure

Notes:
1. Elevations shown are based on North American Vertical Datum (1988).

SEISMIC DEFICIENCY

1. Crossbeam flexural/shear strength (LL)
2. Column flexural/shear strength (LL)
3. Lack of top mat pile cap reinforcing (LL)
4. Insufficient pile anchorage (LL)
5. Spread footing overturning/strength (LL)

SEISMIC RETROFIT

A. Crossbeam enlargement
B. Column enlargement
C. Pile cap enlargement
D. Substructure replacement
E. Micropiles
F. Strengthen footing and pile connection
G. Isolation bearings

WIDENING

W1 Steel girder widening
W2 Cantilever widening

LEGEND:

Ground improvements

SCALE WARNING
If scale bar doesn't measure one inch then drawing is not to scale

ACCOMPANIED BY DWGS.:
See sheets JB01 thru JB04.

STRUCTURE NO. 09403
BDS DWG NO. 00000
CALC. BOOK 0000
HWY: 064
M.P.: 9.03
COUNTY Clackamas
DATE 07/2019

PRELIMINARY COPY
INFORMATION ONLY

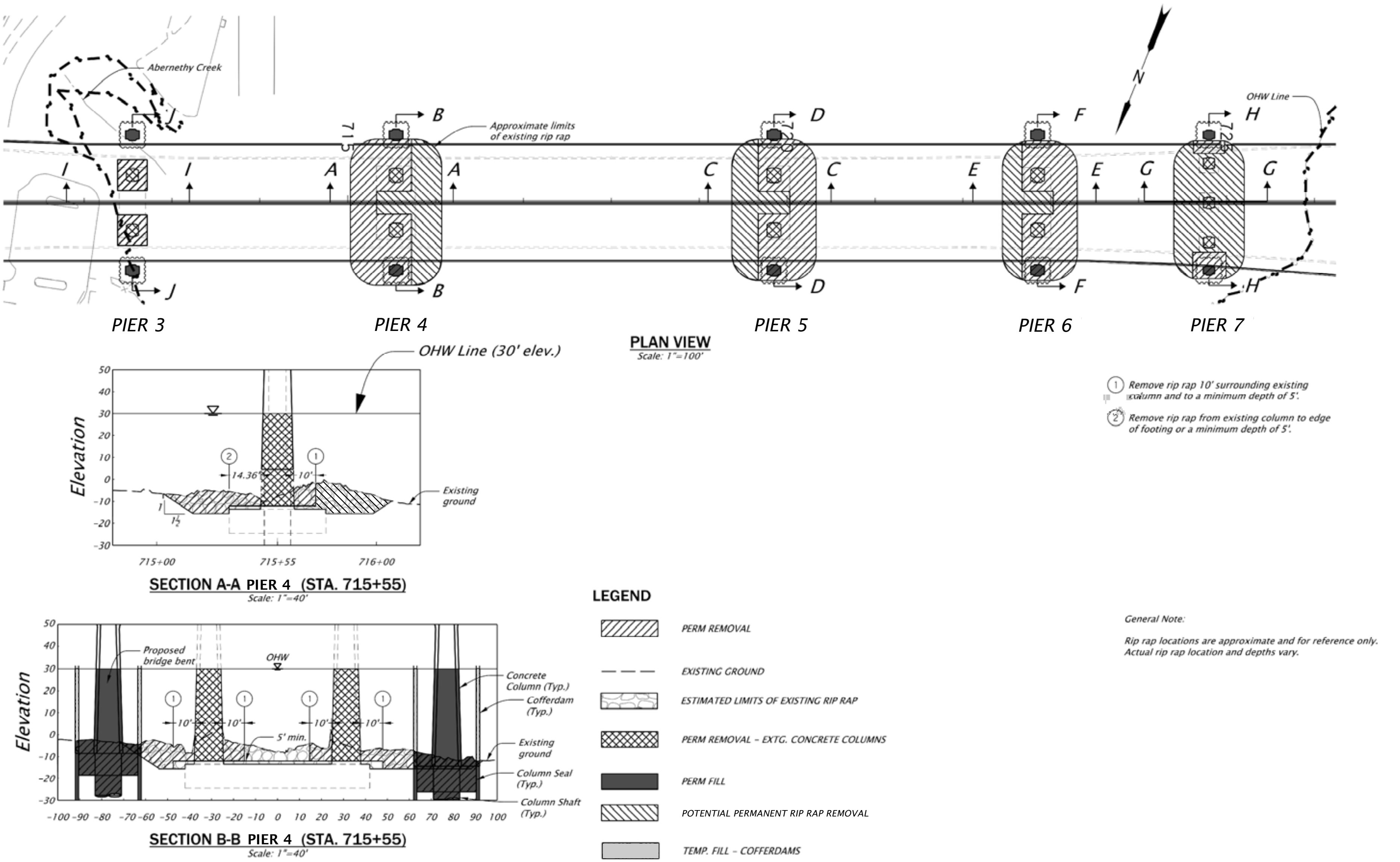
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

WILLAMETTE R & HWYS 1E & 3, HWY 64 (GEO ABERNETHY)
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Mikal Mitchell
Reviewer: Jeff Olson
Drafter: Heather Gonsior
Checker: -

WIDENING AND SEISMIC RETROFIT
PLAN AND ELEVATION - 3

SHEET NO. JB03



HDR

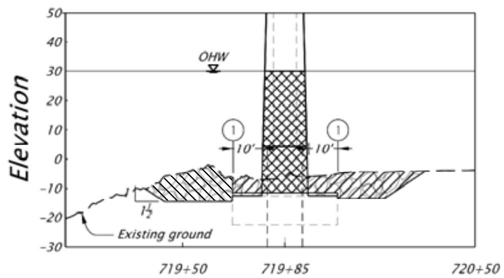
I-205 ABERNETHY

PERMANENT AND TEMPORARY IMPACTS

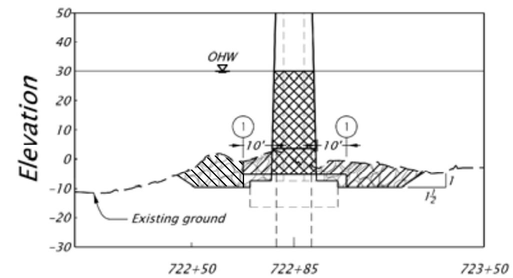
FIGURE 6

DATA SOURCE: HDR 2019

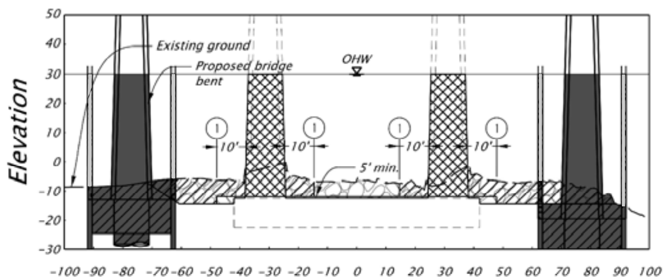
(1) Remove rip rap 10' surrounding existing column and to a minimum depth of 5'



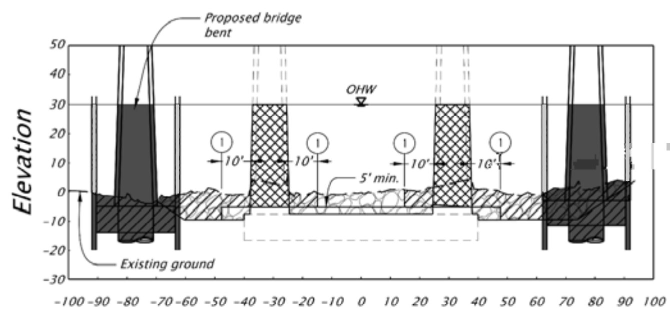
SECTION C-C PIER 5 (STA. 719+85)
Scale: 1"=40'



SECTION E-E PIER 6 (STA. 722+85)
Scale: 1"=40'



SECTION D-D PIER 5 (STA. 719+85)
Scale: 1"=40'



SECTION F-F PIER 6 (STA. 722+85)
Scale: 1"=40'

General Note:

Rip rap locations are approximate and for reference only. Actual rip rap location and depths vary.

LEGEND

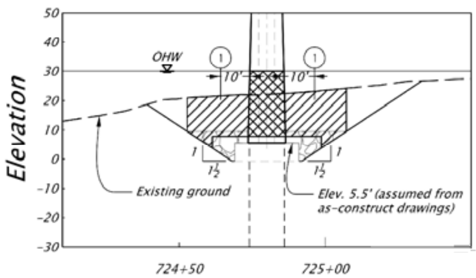
- PERM REMOVAL
- EXISTING GROUND
- ESTIMATED LIMITS OF EXISTING RIP RAP
- PERM REMOVAL
- PERM FILL
- TEMP. FILL - COFFERDAMS
- POTENTIAL PERMANENT RIP RAP REMOVAL

I-205 ABERNETHY
PERMANENT AND TEMPORARY IMPACTS
FIGURE 7

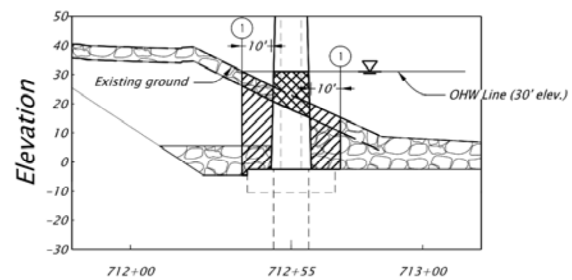
DATA SOURCE: HDR 2019

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET_5_5.MXD - USER: JBEARD - DATE: 4/16/2019

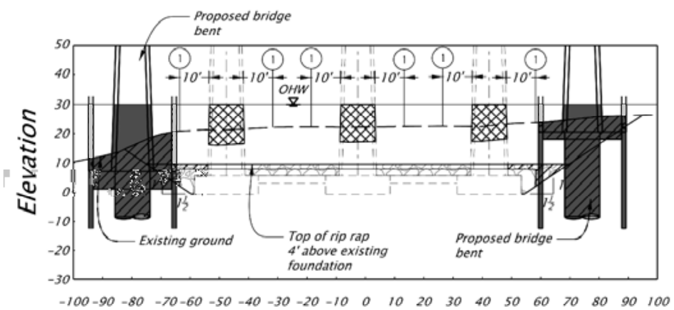
(1) Remove rip rap 10' surrounding existing column and to a minimum depth of 5'



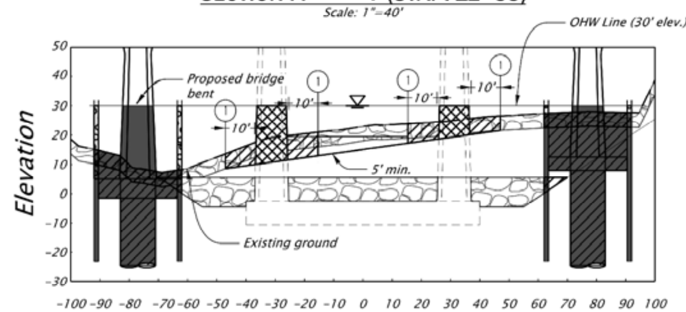
SECTION G-G PIER 7 (STA. 724+80)
Scale: 1"=40'



SECTION I-I PIER 3 (STA. 712+55)
Scale: 1"=40'



SECTION H-H PIER 7 (STA. 724+80)
Scale: 1"=40'



SECTION J-J PIER 3 (STA. 712+55)
Scale: 1"=40'

General Note:

Rip rap locations are approximate and for reference only. Actual rip rap location and depths vary.

LEGEND

- PERM REMOVAL
- EXISTING GROUND
- ESTIMATED LIMITS OF EXISTING RIP RAP
- PERM REMOVAL - EXTG. CONCRETE COLUMNS
- PERM FILL
- TEMP. FILL - COFFERDAMS

HDR

DATA SOURCE: HDR 2019

I-205 ABERNETHY

PERMANENT AND TEMPORARY IMPACTS

FIGURE 8

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET_5_6.MXD - USER: JBEARD - DATE: 4/16/2019

Attachment G. Stormwater Report

Preliminary Stormwater Design Report

ODOT | K19786 I-205: I-5 to OR213, Phase 1 Section

Combined I-205 Freeway Widening and Abernethy Bridge Project

ODOT EA: PE003013
HDR Project # 10063137

August 3, 2020

Plan Prepared by:	Cory Gieseke, PE Morgan Tholl, EIT			
Stormwater Manual Cited:	ODOT's Hydraulics Manual (2014) Oregon City Public Works Stormwater and Grading Design Standards (2019) City of Portland Stormwater Management Manual (2016) City of West Linn Public Works Design Standards (2010)			
Project Location:	Clackamas County			
Project Name:	ODOT K19786 I-205: I-5 to OR 213, Phase 1 Section			
Project Contact Information:	ODOT Project Leader Bret Richards, PE			
Contents	X	Inlets	X	Water Quality
	X	Storm Drains		Small Channels
	X	Detention	X	Energy Dissipaters
		Small culverts		Pipe Rehabilitation
DFI Nos.	To be determined			

Contents

Tables

Appendices

Acronyms and Abbreviations

ADT	Average Daily Traffic
CIA	Contributing Impervious Area
kV	kilovolt
MP	mile post
NAVD88	North American Vertical Datum of 1988
NB	northbound
ODOT	Oregon Department of Transportation
PGE	Portland General Electric
Project	I-205: I-5 to OR-213, Phase 1 Section
ROW	right-of-way
SB	southbound
SBUH	Santa Barbara Urban Hydrograph
STA	Station

This page is intentionally left blank.

1 Overview

1.1 Project Description

The I-205: I-5 to OR-213, Phase 1 Section project (Project) is located on I-205, from milepost (MP) 6.41 to MP 10.11 in Clackamas County, Oregon.

The main components of the Project include:

- Reconstructing the I-205 southbound (SB) auxiliary lane from OR 99E exit ramp to OR 43 entrance ramp (across the Abernethy Bridge)
- Reconstructing and extending the I-205 northbound (NB) auxiliary lane from OR 43 entrance ramp to OR 99E exit ramp (across the Abernethy Bridge)
- Constructing the NB auxiliary lane from OR 99E entrance ramp to OR 213 exit ramp
- Adjusting the OR 99E interchange ramp geometries to conform to the additional freeway lanes
- Modifying the OR 43 interchange by consolidating the entrance and exit ramps and removing the existing OR 43 NB entrance ramp that connects to the Abernethy Bridge
- Removing a portion of the rock slope adjacent to the I-205 NB direction to support the freeway widening
- Widening and seismically retrofitting the following bridges:
    - I-205 over Willamette River (Abernethy Bridge) – MP 9.03
    - I-205 SB Connector #2 to OR 43 (West Linn interchanges) – MP 9.14
    - I-205 NB Connector #1 to OR 99E (Oregon City interchange) – MP 9.30
    - I-205 over Main Street (Oregon City) – MP 9.51
- Eliminating existing seismic vulnerabilities, replacing the following bridges:
    - Sunset Avenue (West Linn) over I-205 – MP 8.28
    - West A Street (West Linn) over I-205 – MP 8.64
- Permanently removing the following conflicting bridges:
    - Broadway Street (West Linn) over I-205 and OR 43 Connector #1 – MP 8.69
    - OR 43 NB Connector to I-205 NB (Abernethy Bridge) – MP 9.00

The purpose of this project is to improve traffic congestion and safety along a 3.7-mile stretch of I-205. Currently, over 100,000 vehicles use this section of I-205 each day. The narrow roadway and volume of traffic cause more than six and a half hours of congestion daily and increase the likelihood of traffic collisions. A third lane will be added in both directions of I-205 to improve mobility and decrease collisions along the corridor.

I-205 has been designated as a lifeline route by ODOT. With this designation, I-205 must be operational if other roadways become unusable after a major earthquake. Abernethy

Bridge, which crosses the Willamette River, would be vulnerable to a large earthquake. Seismic upgrades to the Abernethy Bridge and other bridges along this section of I-205 will increase safety and access in case of a major earthquake.

1.2 Purpose of the Study

This report further evaluates the Preliminary Stormwater Recommendations previously submitted during the Final Design Acceptance Package stage. This report provides facility design information such as the type, size, location, critical dimensions, and other features determined by the project development team after review of the Preliminary Stormwater Recommendations. This report demonstrates that water quality, flow control, and conveyance design meet the requirements for the proposed storm drainage and water quality facilities.

1.3 Key Issues

There are several key issues pertaining to the stormwater design for this Project.

- Existing stormwater management features only consist of conveyance systems; there are no existing water quality facilities within the Project footprint. The existing conveyance systems will be used to the extent feasible; however, incorporating new water quality facilities and providing a conveyance system that meets current design standards will require construction of additional conveyance networks.
- Available space for detention and water quality will be limited in some areas along the Project. In these instances, drainage ditches will be replaced with closed conduit conveyance systems.
- Due to low rates of infiltration observed during testing, infiltration will not be utilized as a treatment and disposal technique. The proposed stormwater facilities are flow-through treatment facilities, where no to little infiltration into the subsurface is anticipated.

1.4 Summary of the Results

The Project area consists of 63.05 acres of Contributing Impervious Area (CIA). Thirteen treatment facilities along the length of the Project are proposed to treat 61.53 acres of the Project CIA. Of the remaining 1.52 acres, 0.93 acres are proposed to remain untreated due to maintenance access concerns and a lack of elevation to convey to proposed facilities. The final 0.59 acres lack suitable right-of-way (ROW) to be treated and non-engineered dispersion is expected to occur before runoff reaches receiving waters. To offset the untreated CIA, 1.80 acres of impervious area outside the Project are proposed to be treated. Table 1shows the analysis of surplus treatment. Facilities have been designed as flow-through treatment facilities due to low infiltration rates observed throughout the Project area.

All water quality and flow control facilities meet the required standards for new construction.

Of the thirteen proposed treatment facilities, seven are biofiltration swales and four are bioretention ponds. The remaining treatment facilities are one bioslope and one stormwater planter. One underground detention system is also proposed.

Table 1. CIA Treatment Summary

	Area w/ADT 0-25k (acre)	Area w/ADT 25k-50k (acre)	Area w/ADT 50k-100k (acre)	Total Area (acre)
Treated CIA	7.489	36.578	17.525	61.592
Non-Treated CIA	1.522	0	0	1.522
Offset Treatment	0.433	0	1.368	1.801
Treatment Total	7.922	36.578	18.893	63.393
Total CIA	9.011	36.578	17.525	63.114
Surplus Treatment	-1.089	0	+1.368	+0.279

ADT= Average Daily Traffic

2 Background

2.1 Watershed Characteristics

The Project is located along the existing I-205 corridor, between the Park Place Interchange and 10th Street. The roadway topography varies between flat and 3 percent slopes and generally slopes downhill in a west to east direction. The embankment side slopes range from flat terrain to vertical retaining walls. The roadway surface is located in both cut and fill sections in relation to the adjacent ground. The northern side of the highway is generally at a higher elevation than the southern side. Elevations along the Project range from 50 to 280 feet. Land within the Project area is primarily used as an Oregon Department of Transportation (ODOT) traffic corridor with some residential and commercial areas along the Project's perimeter.

2.1.1 Pre-Construction

General

The existing Project area consists of approximately 50 acres of CIA including pavement, gravel shoulders, overpasses that drain to the Project, and bridges.

Conveyance systems are the only existing stormwater management feature. These systems will be utilized to the extent feasible; however, new water quality facilities and construction of additional conveyance networks that meet current design standards will be incorporated to the conveyance system.

Wetlands

HDR prepared a Wetlands and Waterbodies Delineation Report describing 2017 and 2018 field investigations of nearby wetlands for the I-205 expansion. Thirteen wetland features totaling 5.12 acres were identified in the Phase 1 section during the field investigations. These features met the definition of a wetland and contained all three wetland parameters (soils, vegetation, and hydrology).

Storm Drain Piping

The existing conveyance system consists of a combination of open ditches and closed conveyance pipes, with diameters generally between 10 and 24 inches.

Inlets

Existing inlets are mostly type G-2 grate inlets.

Culverts

Several culverts drain West Linn neighborhoods across I-205 to the Willamette River. These existing drainage patterns would be maintained wherever possible to keep Project flow separate from offsite flow. Two, 12-foot box culverts cross I-205 between the Park Place Interchange and Main Street Bridge. The culverts connect the Oregon City stormwater system to its outfall to the Clackamas River.

2.1.2 Post-Construction

General

The proposed changes to existing conditions that could affect water quality or hydrology include widening the roadway surface an additional travel lane in both directions and, to a lesser extent, removing and relocating existing bridges and ramps. The additional travel lanes would not change existing roadway drainage patterns, but to meet stormwater design criteria, water quality facilities and detention facilities are proposed along the length of the Project. These facilities would be located in areas with adequate available ROW to construct and safely maintain the facilities following ODOT guidelines. Appendix A provides facility locations and proposed CIA.

Drainage curbs and inlets will be used to the extent practicable to capture roadway surface runoff, but not to capture or convey runoff from non-roadway surfaces to water quality facilities. This would reduce the required amount of ROW for the water quality facilities’ footprints. Appendix B provides an inlet basin map. A set of stormwater construction plans is included in Appendix C.

Storm Drain Piping

In some areas along the Project, drainage ditches will be replaced with closed conduit conveyance systems due to lack of available space. Existing conveyance systems would be left in place where possible.

Inlets

Type G-2 inlets are proposed to collect runoff.

Manholes

Diversion manholes and pollution control manholes are proposed upstream of facilities to provide flow control and pre-treatment.

Planting Plan

The stormwater facilities will be planted in accordance with ODOT standard practices. Vegetation will be established prior to operation. Permanent seeding should be performed March 1 through May 15 and September 1 through October 31. The planting plan, which includes plant species and a schematic showing how facilities will be planted, is provided in the planting plan included in Attachment D “Stream and Wetland Restoration Plan” of the Joint Permit Application. The proposed seeding mix for the vegetated water quality facility bottoms and sides is provided in Table 2.

Table 2 Water Quality Facility Seeding

Common Name	Botanical Name	Pounds per Acre
California Oatgrass	*Danthonia californica*	5
Tufted Hairgrass	*Deschampsia cespitosa*	4
Slender Hairgrass	*Deschampsia elongata*	4
Red Fescue	*Festuca rubra var. rubra*	10
Meadow Barley	*Hordeum brachyantherum*	10
Dense Sedge	*Carex densa*	1
Slough Sedge	*Carex obnupta*	1
Slender Rush	*Juncus patens*	0.5
Spreading Rush	*Juncus tenuis*	0.5
Broadleaf Lupine	*Lupinus latifolius*	0.25
Graceful Cinquefoil	*Potentilla gracilis*	0.25

Stormwater Management Facilities

For basins where treatment is proposed, runoff is conveyed to a water quality facility for treatment. The water quality facilities consist of seven biofiltration swales, one bioslope, and one stormwater planter. In addition, four bioretention ponds are proposed for flow control, two of which are combination biofiltration swales designed to meet water quality treatment standards. One underground detention system is proposed for flow control. Details of the facilities can be found in the stormwater construction plans in Appendix C. Table 3 provides a summary of the facilities.

Table 3. Stormwater Management Facility Summary

Facility	Treated Project Area (acres)	Construction Plan Sheet	Facility Type	Description
1	1.065	HA01	Bioretention pond	Located between Station (STA) "L" 663+50 and STA "L" 665+46. The pond receives runoff from Basin 10 via sheet flow and conveyance in an existing ditch, and outfalls to an Abernethy Creek tributary.
2	3.147	HA02	Bioslope	Located between STA "L" 665+06 and STA "L" 684+64. The bioslope receives runoff from Basins 20A – 20E via sheet flow. The bioslope outfalls to an existing roadside ditch, which is connected to the Clackamas River via an existing stormwater conveyance system.
3	4.413	HA03	Bioretention pond	Bioretention pond located between STA "L" 688+85 and STA "L" 691+53. A pollution control manhole is proposed for pre-treatment. The pond receives runoff from Basin 30 and OS-31 via the proposed pipe network, which uses existing pipes and structures where possible, and outfalls to an existing system leading to Clackamas River.
4	4.553	HA04	Two biofiltration swales	Two biofiltration swales, one located between STA "99E2" 108+95 and STA "99E2" 110+07 and the other between STA "99E2" 110+31 and STA "99E2" 111+42. Runoff from Basins 40, 41, 42, 43, and 44 is collected through proposed pipe network via diversion and pollution control manholes. After treatment, the proposed network connects to an existing system that outfalls to the Willamette River.
5	4.331	HA05	Two biofiltration swales	Two biofiltration swales, one located between STA "99E2" 114+24 and STA "99E2" 115+29 and the other between STA "99E2" 116+46 and STA "99E2" 115+44. Runoff from Basins 50, 51, 52, and 53 is collected and piped under the on- and off-ramps connecting I-205 NB to OR99E through diversion and pollution control manholes before reaching either swale. After treatment, the proposed network connects to an existing system that outfalls to the Willamette River.
6	12.393	HA06, HA07	Biofiltration swale	Biofiltration swale located between STA "OR43" 10+12 and STA "OR43" 8+77. Runoff from Basins 60, 61, 62, 63, 65, 66, and 67 is conveyed to the swale from a pollution control manhole via a pipe network. After treatment, the proposed system outfalls to the Willamette River at a proposed riprap pad underneath the Abernethy Bridge.

Facility	Treated Project Area (acres)	Construction Plan Sheet	Facility Type	Description
7	1.309	HA08	Biofiltration swale	Biofiltration swale located between STA “E3” 740+37 and STA “OR43” 9+53. Runoff from Basin 72 is captured and conveyed via a ditch to the high end of the I-205 NB off-ramp to OR43. The stormwater is conveyed through the proposed pipe network and picks up flow from Basins 70 and 71. A flow splitter manhole diverts the volumetric flow rate generated by the water quality storm event in Basins 70, 71, and 72 to the swale. After treatment, the proposed system outfalls to the Willamette River at a proposed riprap pad underneath the Abernethy Bridge.
8	10.202	HA09	Biofiltration swale	Biofiltration swale located between STA “E3” 737+53 and STA “E3” 738+66. Runoff from Basin 80 is conveyed to the swale in a pipe network. The swale is sized to treat runoff from improvements further upstream, as well as some of the offsite flow from a large residential area. After treatment, the proposed system outfalls to the Willamette River at a proposed riprap pad underneath the Abernethy Bridge.
9	0.433	HA10	Stormwater planter	Stormwater planter located behind curbline of proposed parking lot in Jon Storm Park. Runoff from Basin 90 is conveyed via sheet flow. The stormwater planter is sized to treat runoff from the proposed impervious area’s new parking area. After treatment, the proposed facility connects to an existing stormwater network and discharges into the Willamette River.
10	2.951	HA11	Bioretention swale	Bioretention swale located between STA “Ln” 812+12 and STA “Ln” 813+82. Runoff from basins 100, 101 and 102 is conveyed from the proposed pipe network to a diversion manhole, followed by a pollution control manhole for pre-treatment. After treatment, the proposed system connects to an existing 18-inch culvert that reaches a tributary to the Willamette River.
11	5.836	HA12, HA13	Biofiltration swale and underground detention system	Biofiltration swale located between STA “Ln2” 836+83 and STA “Ln2” 838+60. Runoff from basins 110 and 111 is conveyed to the biofiltration swale via a diversion manhole from the proposed pipe network. A pollution control manhole is proposed for pre-treatment. After treatment, flow moves to the proposed underground system of detention pipes, outfalling into the existing conveyance system and then into a Willamette River tributary.
12	4.925	HA14	Bioretention pond	Bioretention pond located between STA “D2” 856+67 and STA “D2” 859+15. The pond receives runoff from Basins 120, 121, and 122 via sheet flow and an existing ditch. The pond outfalls to an existing ditch via proposed 24-inch pipe.

Facility	Treated Project Area (acres)	Construction Plan Sheet	Facility Type	Description
13	4.408	HA15	Bioretention pond	Bioretention pond located between STA “A2” 859+07 and STA “A2” 860+92. The pond receives runoff from Basins 130, 131, and 132 via the proposed pipe network and an existing ditch. The pond outfalls to an existing ditch via proposed 24-inch pipe.

2.2 Outfalls

Detention is proposed for facilities that outfall to systems with an upstream drainage basin of less than 100 square miles. Therefore, the existing stormwater system outfall is expected to have capacity for the additional flow. Two key outfalls to the Willamette River will be added/replaced:

- Due to proposed ground improvements, the outfall on the east side of the Willamette River underneath Abernethy Bridge will be removed and replaced.
- A new outfall will be installed on the west side of the Willamette River above the Ordinary High Water line and underneath Abernethy Bridge.

The new and replaced outfalls will have slope protection and capacity for the proposed flows.

The proposed receiving waterbody is the Willamette River. Table 4 lists the beneficial uses and water quality impairments for the receiving waterbody.

Table 4. Receiving Waters Beneficial Uses and Water Quality Impairments

Waterbody	Beneficial Uses[1]	Listed Water Quality Impairments[2]
Willamette River	Public/private/industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, hydropower, commercial navigation and transportation	aldrin, chlorophyll a, chlordane, DDE, DDT, dieldrin, dioxin, e coli, hexachlorobenzene, iron, lead, manganese, mercury, PCB, pentachlorophenol, polynuclear aromatic hydrocarbons, temperature

[1] Section 401 Water Quality Certification Post-Construction Stormwater Management Plan Submission Guidelines, Appendix 3 Designated Beneficial Uses(Oregon Department of Environmental Quality [DEQ] 2018)

[2] Water Quality Assessment – Oregon's 2012 Integrated Report Assessment Database and 303(d) List (DEQ 2014)

DDE=Dichloro-2,2-bis(p-chlorophenyl) ethylene

DDT=Dichlorodiphenyltrichloroethane

PCB=Polychlorinated Biphenyls

Pollutants of concern typically expected in highway runoff are sediment, nutrients, oil and grease, polycyclic aromatic hydrocarbons (PAH), and particulate and dissolved metals (such as copper and lead). Because I-205 has high average daily traffic (ADT), high pollutant loads and concentrations are expected.

2.3 Utilities

Utilities located within the existing Project area include gas, power, storm and sanitary sewers, water, and communications. Utilities, owned by various private and public entities, are listed by utility owner and divided into categories that indicate if a utility is to be relocated, a potential utility conflict, unconfirmed conflicts, or if no conflicts are anticipated. The utility information is based on utility locates performed by the Oregon Utility Notification Center and researched within the Project study area. ODOT facilities have not been provided because the facilities are part of the Project and addressed in other reports.

- Gas (NW Natural): Relocation required for 6-5/8-inch steel high pressure main and a 2-inch steel line hanging from the bridge at Broadway Street. Minor adjustments needed for 6-5/8-inch high pressure steel line on northern side of Willamette Falls Drive; 4-1/2-inch steel line on southern side of Willamette Falls Drive; 8-5/8-inch high pressure and 4-1/2-inch steel lines within Willamette Falls Drive roadway at Broadway Street; 4-1/2-inch steel line within OR43. Unconfirmed conflicts include a 2-inch poly line on southern side of 15th Street; 4-1/2-inch steel line on McLoughlin Boulevard crossing through southeastern gore of NB off-ramp to 17th Street; pressure reducing station West A Street to Broadway Street at I-205.
- Power (PGE): Potential conflicts include a 12.5 kilovolt (kV) aerial distribution line north of I-205 along West A Street. Minor adjustment needed for 12.5kV underground distribution line crossing OR43 between SB ramps and I-205. Unconfirmed conflicts include 12.5 kV aerial distribution line crossing I-205 between West A Street and Broadway Street; 12.5 kV and 115 kV aerial distribution lines along Main Street; 12.5kV underground distribution line crossing I-205 west of Main Street; secondary aerial serving street lights along Willamette Falls Drive; 60 count underground fiber crossing I-205 west of Main Street; 60 count aerial fiber along Main Street. No conflicts anticipated for 12.5 kV aerial distribution lines along Broadway Street, Clackamette Drive, McLoughlin Boulevard, and lines adjacent to I-205 SB ramps; secondary overhead power crossing Broadway Street and Willamette Falls Drive; secondary underground north of I-205 along Mcloughlin Boulevard; 144 count aerial fiber crossing OR43 south of Willamette Falls Drive.
- Water:
  - City of Oregon City potential conflicts include 8-inch waterline along Clackamette Drive, 6- and 8-inch abandoned waterlines along Clackamette Drive. No conflicts anticipated for 12-inch waterline along Mcloughlin Boulevard; 12-inch waterline along Main Street from 15th to 18th Street; 10-inch waterline crossing Main Street and Agnes Avenue intersection.
  - City of West Linn, relocation required for 8-inch waterline poured into bridge at West A Street. Minor adjustments needed for 24-inch waterline along northern side of Willamette Drive at Broadway Street and OR43. Potential conflicts include 24-inch waterline touchdown across Abernethy Bridge from Broadway Street to Willamette Drive and 24-inch waterline attached to Abernethy Bridge. No conflicts anticipated for 20-inch and abandoned 8-inch waterlines along Willamette Falls Drive at West A Street; 6-inch waterline along Broadway Street, north and south of I-205; 8-inch abandoned waterline crossing Broadway Street north of I-205; and 24-inch waterline attached to Abernethy Bridge.
- Sanitary: City of Oregon City, potential conflicts include force main crossing Clackamette Drive and 30-inch line along western side of Mcloughlin Boulevard. No conflicts anticipated for 30-inch line south of I-205 along Clackamette Drive. City of West Linn potential conflicts include sewer line crossing Willamette Falls Drive at Broadway Street and 24-inch sewer line crossing I-205 from Willamette Drive to

Abernethy Bridge. No conflicts anticipated for sewer line crossing Broadway Street on northern side of I-205.

- Storm: City of Oregon City, potential conflicts include 12-inch storm line south of I-205 along western side of Main Street. City of West Linn, no conflicts anticipated for storm line on southern side of Willamette Falls Drive at West A Street.
- Communication:
  - CenturyLink, relocation required for major duct bank from Broadway Street within sidewalk of bridge to new West A Street Bridge. Minor adjustments needed for major duct banks along Willamette Falls Drive at West A Street and within Willamette Drive (OR43). Unconfirmed conflicts include buried cable within Clackamette Drive; underground copper serving cell tower near West A Street and Broadway Street; major duct bank along eastern side of McLoughlin Boulevard.
  - Comcast Cable, potential conflict includes aerial along West A Street north of I-205. Unconfirmed conflicts include 48 count aerial fiber along Main Street and underground under I-205; 24 count aerial fiber on PGE poles and underground fiber serving cell tower West A Street to Broadway Street. No conflicts anticipated for 96 count and dark aerial fiber along southern side of Willamette Falls Drive at West A Street.
  - CBX, unconfirmed conflicts include aerial fiber on PGE poles across I-205 between West A Street and Broadway Street; aerial fiber along Main Street becomes underground under I-205. No conflicts anticipated for aerial fiber on PGE poles along West A Street north of I-205.
  - Wave Broadband, unconfirmed conflict includes cell tower adjacent to rock cut on southern side of I-205 between West A Street and Broadway Street.
  - City of Oregon City, potential conflict includes 720 count underground fiber crossing I-205 on eastern side of Main Street.

2.4 Investigations

The location survey, online mapping, past reports, and field reconnaissance were referenced when designing the proposed stormwater system. Available online mapping includes ODOT’s TransGIS, West Linn’s MapOptix, Oregon City’s Web Maps, and as-built drawings. Oregon City’s Drainage Master Plan and West Linn’s Surface Water Management Plan were used to help analyze offsite drainage patterns.

Soils within the Project area generally consist of the Hydrologic Soil Groups C and D, with a few pockets of B. The Natural Resources Conservation Service (NRCS) Soil Survey Report can be found in Appendix D (NRCS 2017).

In-situ infiltration tests were completed in several locations throughout the proposed Project area. Test locations are shown in the Stormwater CIA Exhibit (Appendix A) with the Phase 1 located tests summarized in Table 5. Multiple tests were conducted at each location. The average infiltration rates during the August 2018 geotechnical investigation ranged from 0.24 to 3.36 inches per hour (in/hr).

Table 5. In-Situ Infiltration Test Results

Designation	Approximate Depth (feet)	Infiltration Testing Method	Final Infiltration Rate for each Trial (in/hr)			Average Infiltration Rate (in/hr)
			1	*2*	*3*	
INF19786-08	2.0	Open Pit Falling Head Test	1.44	1.44	1.44	1.44
INF19786-09	2.0		3.60	3.60	2.88	3.36
INF19786-10	2.0		2.88	2.88	2.88	2.88
INF19786-11	2.0		0.72	0.36	0.36	0.48
INF19786-12	2.0		1.44	0.72	1.44	1.20
INF19786-13	3.0		1.44	1.44	1.44	1.44
INF19786-14	3.5		1.44	0.72	1.44	1.20
INF19786-15	2.0		0.36	0.00	0.36	0.24

Groundwater wells were installed in October 2017 and November 2018, and elevations of seasonal groundwater levels have been measured periodically since installation. Piezometers were also installed near the western and eastern ends of the Abernethy Bridge. Table 6 provides measured seasonal high groundwater elevations and Appendix D locations of wells. For locations not near the test wells, the U.S. Geological Survey (2009) groundwater elevation maps are referenced for approximate groundwater elevations. The portion of the Project located within West Linn has groundwater levels between 20 and 100 feet below ground surface. The portion of the Project located in Oregon City has groundwater levels between 12 and 20 feet below ground surface.

Table 6. Measured Seasonal High Groundwater Elevations

Facility Number	Anticipated Seasonal High Groundwater Elevation (feet, NAVD88)
TB19786-01	13.8
TB19786-09	27.4
TB19786-30B	17.5
TB19786-32	17.6
TB19786-40	26.1
TB19786-44	36.5
TB19786-63	82.2

NAVD88= North American Vertical Datum of 1988

3 Design

3.1 Design Criteria

The Project will be designed to meet stormwater management design standards outlined in ODOT's *Hydraulics Manual* (2014), Oregon City Public Works *Stormwater and Grading Design Standards* (2020), and City of Portland *Stormwater Management Manual (2016)*, as amended and adopted by the City of West Linn, and the requirements in the City of West Linn Public Works *Design Standards* (2010). In the event design standards are different for the two agencies in overlapping coverage areas, the most conservative standard will be used.

3.1.1 Water Quality Standards

Stormwater treatment within ODOT's ROW is required to meet water quality control standards (ODOT 2014). The Project water quality goal is met if "…treatment is provided for all of the runoff generated by the Water Quality Design Storm from the contributing impervious area (CIA) using Best Management Practices (BMPs) that utilize infiltration, media filtration, or vegetative filtration." The Project's CIA consists of all impervious surfaces within the Project limits and those owned or operated by ODOT outside the Project limits that drain to the Project via direct flow or discrete conveyance.

Stormwater quality treatment facilities will be designed based on a water quality design flow rate and volume. Per City of West Linn and Oregon City, the water quality design storm is 0.83 and 1.0 inch respectively. However, ODOT's *Hydraulics Manual*'s water quality design storm is one-half of the 2-year, 24-hour storm event, or 1.22 inches. Water quality facilities will be designed using the ODOT water quality design storm of 1.22 inches. Table 7 provides additional Project design rainfall depths.

Table 7. Design Rainfall Depth

Return Interval	Rainfall Depth ODOT (inches)[1]	Rainfall Depth West Linn (inches)[2]	Rainfall Depth Oregon City (inches)[3]
Water Quality	1.22	0.83	1.0
2	2.44	2.4	2.8
10	3.28	3.4	3.5
25	3.82	3.9	4.0
50	4.17	N/A	4.4
100	4.65	4.4	4.5

[1]ODOT Hydraulics Manual Chapter 7 Appendix H, Oregon 24-Hour Precipitation Maps
[2]City of Portland Stormwater Management Manual Appendix A, Table A-1
[3]Oregon City Stormwater and Grading Design Standards Chapter 5, Table 5-2

Water quality facilities are sized based on the volumetric flow rate expected to result from the water quality storm event in the corresponding basins. Flow rate calculations for each basin can be found in Appendix E. Key design considerations for the biofiltration swales included a minimum residence time of 9 minutes and a maximum velocity of 3 feet per second during a 25-year storm event. Swale and bioslope sizing calculations are included in Appendix F. The bioslope and stormwater planter were sized to infiltrate the peak flows anticipated during the water quality storm event.

3.1.2 Detention Standards

ODOT requires detention when one of the following criteria is met (ODOT 2014):

- Required by a local jurisdiction
- Drainage deficiencies, such as flooding, have been documented
- Discharge into an intermittent or perennial water body with an upstream drainage basin less than 100 square miles
- Uncontrolled peak post-construction discharge rate during the design storm increases 0.5 cubic feet per second or more
- Total contributing area after the proposed development is 0.25 acres or more

ODOT detention guidelines are in place to reduce streambed and bank impacts to the receiving streams. The Project should not increase peak flows or duration of flows for a recurrence interval that corresponds to a flow resulting in sediment transport. ODOT defines sediment transport flows from a lower end of 42 percent of the 2-year event to an upper threshold of the 10-year event for incised streams or bank overtopping for minimally incised streams.

ODOT does not require detention if the site discharges into a water body with an upstream drainage basin greater than 100 square miles.

Oregon City uses the same flow control guidelines as ODOT, and exempts systems that discharge directly to the Clackamas River, Willamette River, and Abernethy Creek from flow control if the development lies within the 100-year floodplain or is up to 10 feet above the design flood elevation of 50.7 feet NAVD88, and the entire project is drained through a manmade conveyance system with sufficient hydraulic capacity. If detention is required, facilities should be sized using the BMP Sizing Tool explained in the Oregon City Public Works *Stormwater and Grading Design Standards*.

The City of West Linn requires the post-Project runoff from a 2-year, 24-hour storm event to be less than or equal to one-half the runoff from a 2-year, 24-hour storm for pre-development conditions. The facilities must also control the post-development peak flows from the 5-, 10-, and 25-year, 24-hour storm to the predevelopment 5-, 10-, and 25-year, 24-hour design storm events. Systems that discharge stormwater runoff directly into the Willamette River or through a conveyance system that has adequate capacity to convey the 10-year storm event to the Willamette River are exempt from detention requirements.

The bioretention ponds were sized to provide enough detention to achieve an outflow rate during the 10-year storm equal to the pre-construction outflow rate. Inflow and outflow hydrographs for the proposed detention facilities are provided in Appendix E.

3.1.3 Infiltration Design Standards

The City of West Linn and Oregon City stormwater design guidance materials recommend using infiltration as a stormwater treatment and disposal technique above other methods. Both the City of Portland *Stormwater Management Manual*, as modified by the City of West Linn and the Oregon City Public Works *Stormwater and Grading Design Standards* state that infiltration may not be required if site conditions make infiltration infeasible. Examples include:

- The site has seasonally high groundwater of less than 5 feet below the lowest elevation of the infiltration facility
- The site has low infiltration rates of less than 2.0 inches per hour
- The facility would be located on fill
- The site is located near steep slopes or does not meet slope setbacks

As discussed in Section 2.4, infiltration rates rarely exceeded 2.0 inches per hour. Because of the low onsite infiltration rates, infiltration will not be utilized as a standalone treatment and disposal technique. Instead infiltration will be combined with other stormwater treatment and disposal techniques to the extent site conditions allow.

3.1.4 Inlet Capacity and Spacing

Inlets are designed to capture flow while limiting spread as described in Chapter 13 of ODOT's *Hydraulics Manual* (2014). The design standards relevant to the Project are summarized in Table 8.

Table 8. Inlet Spread Requirements

Location	Recurrence Interval (years)	Maximum Spread	Clogging (percent)
On-grade	10	Shoulder	30
Local sag point	25	Shoulder	50
Main sag point	50	Shoulder	50

The maximum spread increases by 2 feet for the limited number of Project locations where the speed limit is less than 45 miles per hour. The minimum 5-minute time of concentration was assumed for all roadway basins. The maximum inlet spacing is 400 feet.

3.1.5 Storm Drains

Storm drains must convey the 10-year design storm. The minimum diameter for a storm drain pipe is 12 inches. For pipes that cross the highway, the minimum diameter is 18 inches. The minimum full-flow velocity for storm drains is 3 feet per second.

3.2 Analysis Methods

Flows to the water quality facilities and offsite flows were analyzed using the Santa Barbara Urban Hydrograph (SBUH) method. Runoff from small roadway basins to inlets, for the spread and conveyance calculations, was analyzed using the rational method.

1. Hydraulic calculations for the capacity analysis were performed using Manning's equation. Spread calculations were performed using Bentley MicroStation Inroads, which uses the same equations for intercepted flow and spread found in ODOT's *Hydraulics Manual*. Most of the stormwater management facilities were designed using the methodology provided in ODOT's *Hydraulics Manual*. Facilities 1, 3, and 9 were sized, using the BMP Sizing Tool per Oregon City design standards, to filter the water quality storm event through water quality mix and provide enough detention to achieve a 10-year storm outflow rate equal to the preconstruction outflow rate. Inflow and outflow hydrographs for the proposed detention facilities are provided in Appendix F. The bioslope and stormwater planter were sized to filter the peak flows anticipated during the water quality storm event through water quality mix. Assumptions are included in the relevant supporting calculations and described in the narrative below.

3.3 Calculations Discussion

3.3.1 Hydrology

The Project is divided into basins based on topography and the proposed conveyance system. Appendix A provides a map of basin and facility locations. Table 9 provides a summary of proposed drainage basins.

Table 9. Basin Summary

Basin	Treatment Facility	Treated CIA (acres)	Untreated CIA (acres)	Offset Treatment Impervious Area (acres)	Comments
10	1	1.065	0	0	--
20A	2	0.253	0	0	--
20B	2	0.839	0	0	--
20C	2	0.517	0	0	--
20D	2	0.496	0	0	--
20E	2	1.042	0	0	--
30	3	3.045	0	0	--
0S-31	3	0	0	1.368	--
40	4	0.304	0	0	--

Basin	Treatment Facility	Treated CIA (acres)	Untreated CIA (acres)	Offset Treatment Impervious Area (acres)	Comments
41	4	2.673	0	0	--
42	4	0.886	0	0	--
43	4	0.316	0	0	--
44	4	0.374	0	0	--
50	5	0.696	0	0	--
51	5	0.474	0	0	--
52	5	2.591	0	0	--
53	5	0.550	0	0	--
60	6	1.115	0	0	--
61	6	0.474	0	0	--
62	6	2.320	0	0	--
63	6	0.123	0	0	--
64	--	0	0.592	0	Unfeasible to provide engineered treatment due to lack of suitable ROW and proximity to Willamette River. Non-engineered dispersion is expected to occur before runoff reaches receiving water.
65	6	7.606	0	0	--
66	6	0.450	0	0	--
67	6	0.305	0	0	--
X	TBD	2.079	0	0	Facilities under bridge to treat subbasin X are under development and will be included in the next design iteration.
70	7	0.287	0	0	--
71	7	0.432	0	0	--
72	7	0.590	0	0	--
80	8	2.320	0	0	--
81	8	7.675	0	0	--

Basin	Treatment Facility	Treated CIA (acres)	Untreated CIA (acres)	Offset Treatment Impervious Area (acres)	Comments
82	8	0.207	0	0	--
83	--	0	0.293	0	Unfeasible to provide engineered treatment due to roadway being too low to connect to proposed drainage system.
84	--	0	0.386	0	Unfeasible to provide engineered treatment due to roadway being too low to connect to proposed drainage system.
90	9	0.268	0	0	--
91	--	0	0.251	0	--
100	10	1.533	0	0	--
101	10	2.461	0	0	--
102	10	0.490	0	0	--
110	11	3.507	0	0	--
111	11	2.329	0	0	--
120	12	3.287	0	0	--
121	12	1.252	0	0	--
122	12	0.386	0	0	--
130	13	3.528	0	0	--
131	13	0	0	0.433	--
132	13	0.447	0	0	--
Totals		**61.592**	**1.522**	**1.801**	**--**

3.3.2 Facility Design

The water quality design flow was calculated in HydroCAD using the SBUH method. The biofiltration swales were designed to treat the water quality design flow using the parameters described in ODOT's *Hydraulics Manual*. These parameters are noted in the sizing calculations in Appendix F. Swale dimensions and locations can be found in the construction plans (Appendix C).

The bioslope was designed to treat the water quality design flow and capture and convey the peak flow from a 2-year storm event. The design procedures listed in Chapter 14, Appendix C of ODOT's *Hydraulic Manual* were used to size the proposed bioslope. Facility plans and cross sections are provided in the construction plans.

Bioretention ponds and the underground detention system are designed so that the post-construction design peak flow is less than or equal to the pre-construction design peak flow for the 10-year storm event. The 10-year design storm hydrograph was calculated in HydroCAD using the SBUH method. The bioretention ponds are designed to provide detention while using the parameters in ODOT's *Hydraulics Manual*.

For facilities 1, 3, and 9, the BMP Sizing Tool was used for design. Output from the tool is included in Appendix F.

Design values for pond, swale, and bioslope sizing can be found in the sizing calculations in Appendix F. A summary of all facilities, with the CIA they are designed to treat and their locations in the construction plans, can be found in Table 3.

3.3.3 Groundwater Considerations

Stormwater facilities were designed to not infiltrate in areas with high groundwater tables. Table 10 summarizes the anticipated seasonal high groundwater elevations at each water quality facility and whether or not a liner is proposed for each facility. Facilities 2 and 6 have proposed impermeable membranes for structural purposes as both facilities are located on fill. Because the groundwater elevation was obtained from the USGS Depth to Groundwater maps and the anticipated close proximity of the groundwater to the facility invert, an impermeable membrane is proposed for Facility 3 to prevent migration to the groundwater.

Table 10 Water Quality Facility Depth to Groundwater

Facility ID	Facility Invert Elevation	Anticipated High Seasonal Groundwater Elevation	Depth to Groundwater	Impermeable Liner
1	48.5	33.7*	14.8*	No
2	Varies	Varies	Varies	Yes
3	35.0	29.3*	5.7*	Yes
4	43.8	17.5	26.3	No
5	52.9	17.5	35.4	No
6	105.8	36.5	69.3	Yes
7	118.7	66.2*	52.5*	No
8	142.8	74.3*	68.5*	No
9	37.9	17.6	20.3	No
10	252.5	151.9*	100.6*	No

11	201.0	136.6*	64.4*	No
12	159.9	82.2	77.7	No
13	141.2	82.2	59.0	No

* Groundwater elevation from USGS Depth to Groundwater Interactive Maps (USGS)

3.3.4 Inlet Capacity and Spacing

Inlets are designed to accept the design storm while limiting spread per the requirements outlined in Section 3.1.4. The spread analysis was conducted using Bentley MicroStation Inroads (Appendix G).

3.3.5 Pipe Sizing

Storm drains were designed to convey the 10-year storm and meet other requirements outlined in Section 3.1.5. Manning's equation, assuming full flow, was used to analyze the storm drain capacity (Appendix H).

4 Maintenance

4.1.1 Responsible Party

ODOT staff will provide oversight during Project construction to ensure water quality and stormwater management Project elements are properly constructed following Project plans and specifications. Vegetation shall be established prior to use. Planting should take place from March 1 through May 15 or September 1 through October 31. During this post-construction period, ODOT construction inspection staff will conduct inspections to determine if the water quality and stormwater management swales are vegetated according to specifications and treatment needs. After construction, ODOT maintenance staff will review the facilities at intervals sufficient to ensure continued functioning as designed.

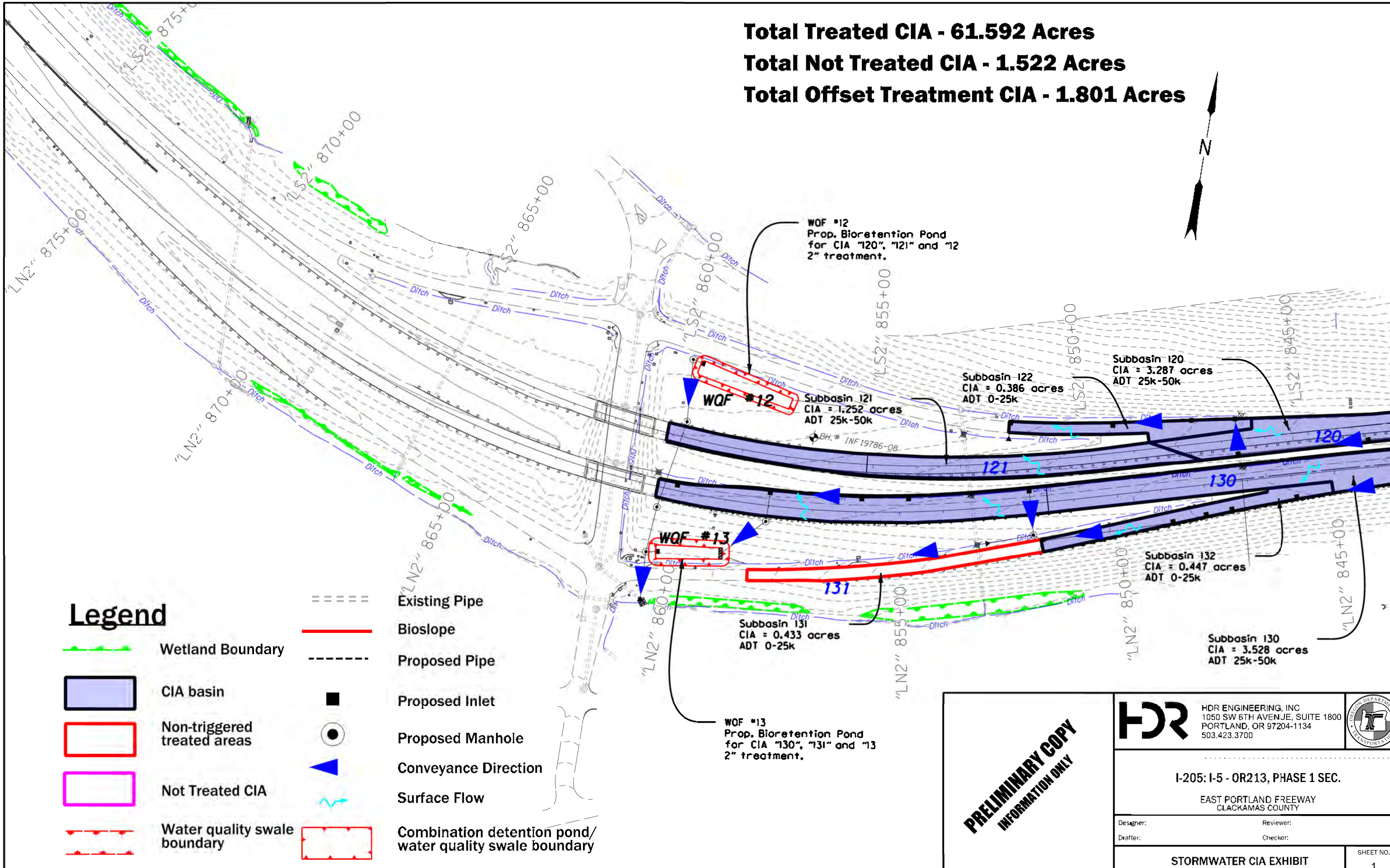
4.1.2 Routine Maintenance Actions

As part of the final plans package, templates for each stormwater facility will be provided. After the facilities are constructed, a comprehensive Operations and Maintenance Manual will be prepared by ODOT staff for each facility using standards described in the ODOT *Hydraulics Manual*. Appendix I provides tables of routine maintenance for the applicable stormwater facilities.

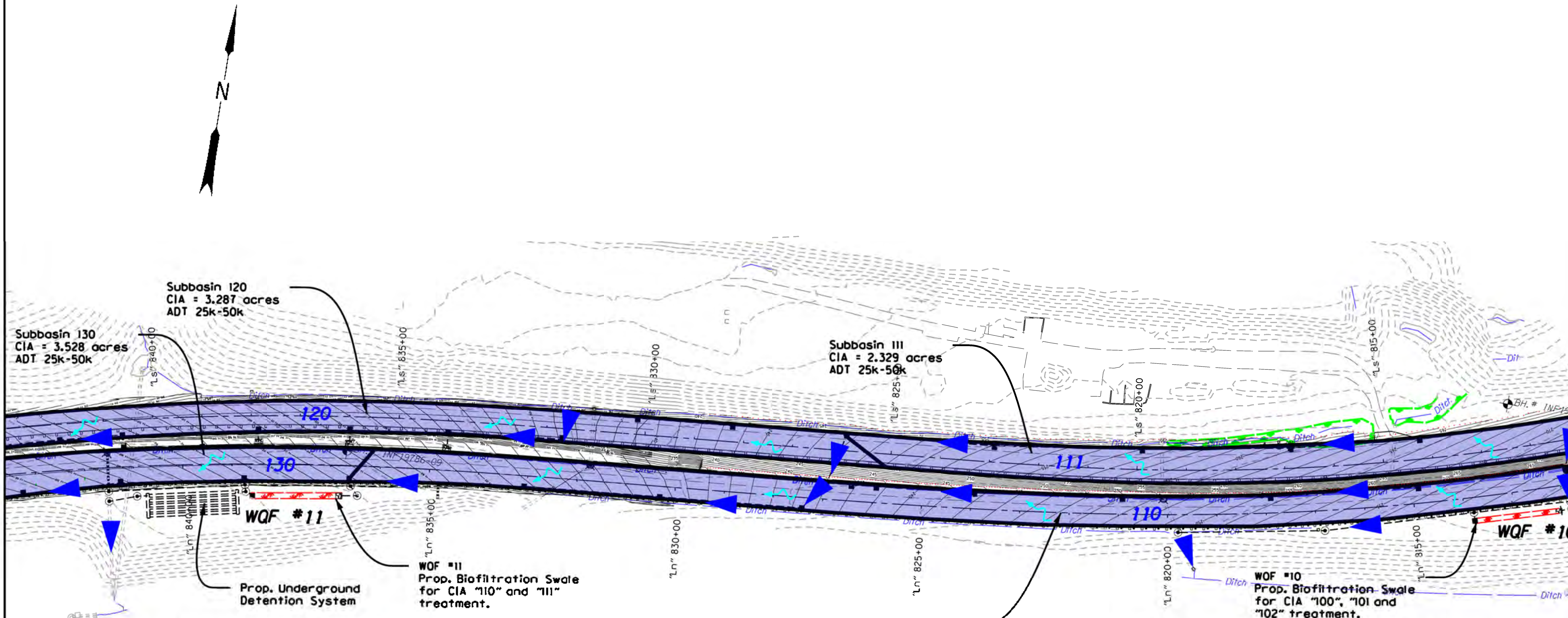
4.1.3 Maintenance Activity Schedule

Maintenance activities will follow the schedule outlined in the tables provided in Appendix I as well as the maintenance schedules determined by ODOT District 2B.

Appendix A. CIA Exhibit



FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST



Legend

- Wetland Boundary
- CIA basin
- Non-triggered treated areas
- Not Treated CIA
- Water quality swale boundary
- Existing Pipe
- Bioslope
- Proposed Pipe
- Proposed Inlet
- Proposed Manhole
- Conveyance Direction
- Surface Flow
- Combination detention pond/ water quality swale boundary

Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

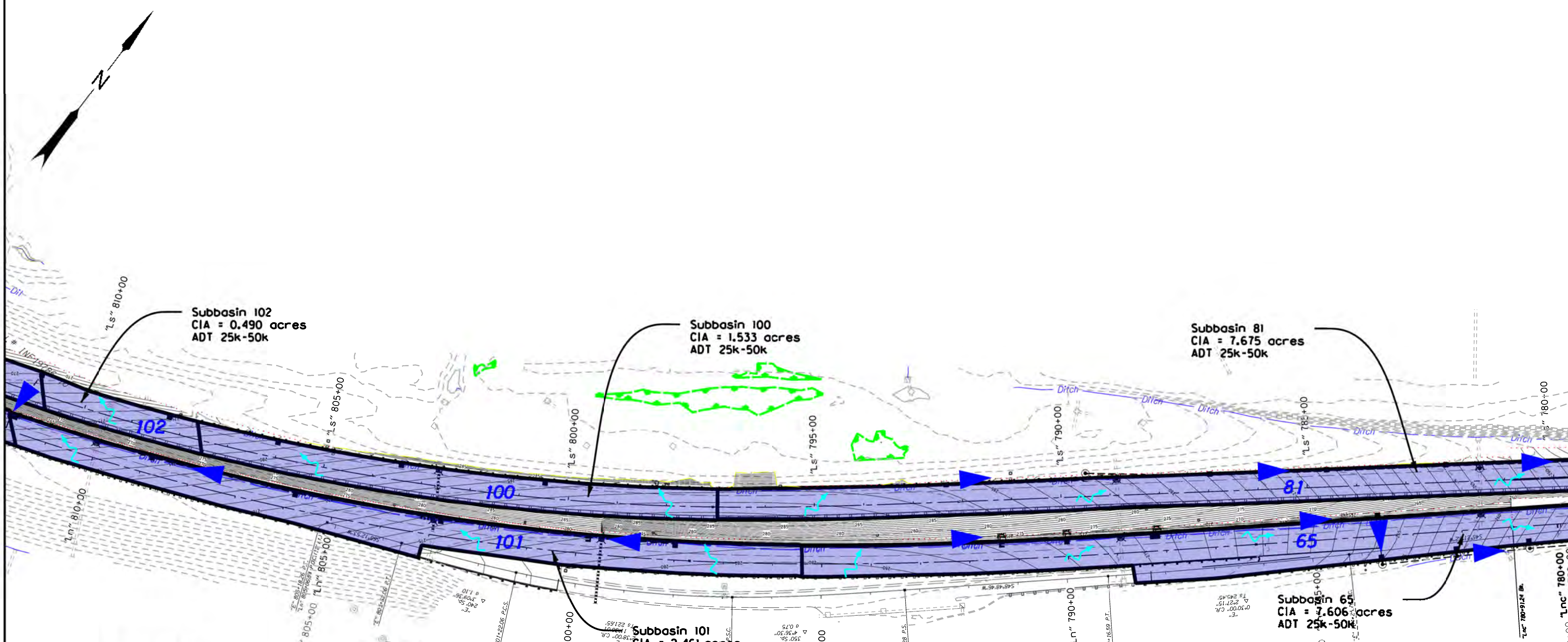
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:	Reviewer:
Drafter:	Checker:

STORMWATER CIA EXHIBIT

SHEET NO. 2

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST



Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

Legend

	Wetland Boundary		Existing Pipe
	CIA basin		Bioslope
	Non-triggered treated areas		Proposed Pipe
	Not Treated CIA		Proposed Inlet
	Water quality swale boundary		Proposed Manhole
			Conveyance Direction
			Surface Flow
			Combination detention pond/ water quality swale boundary

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

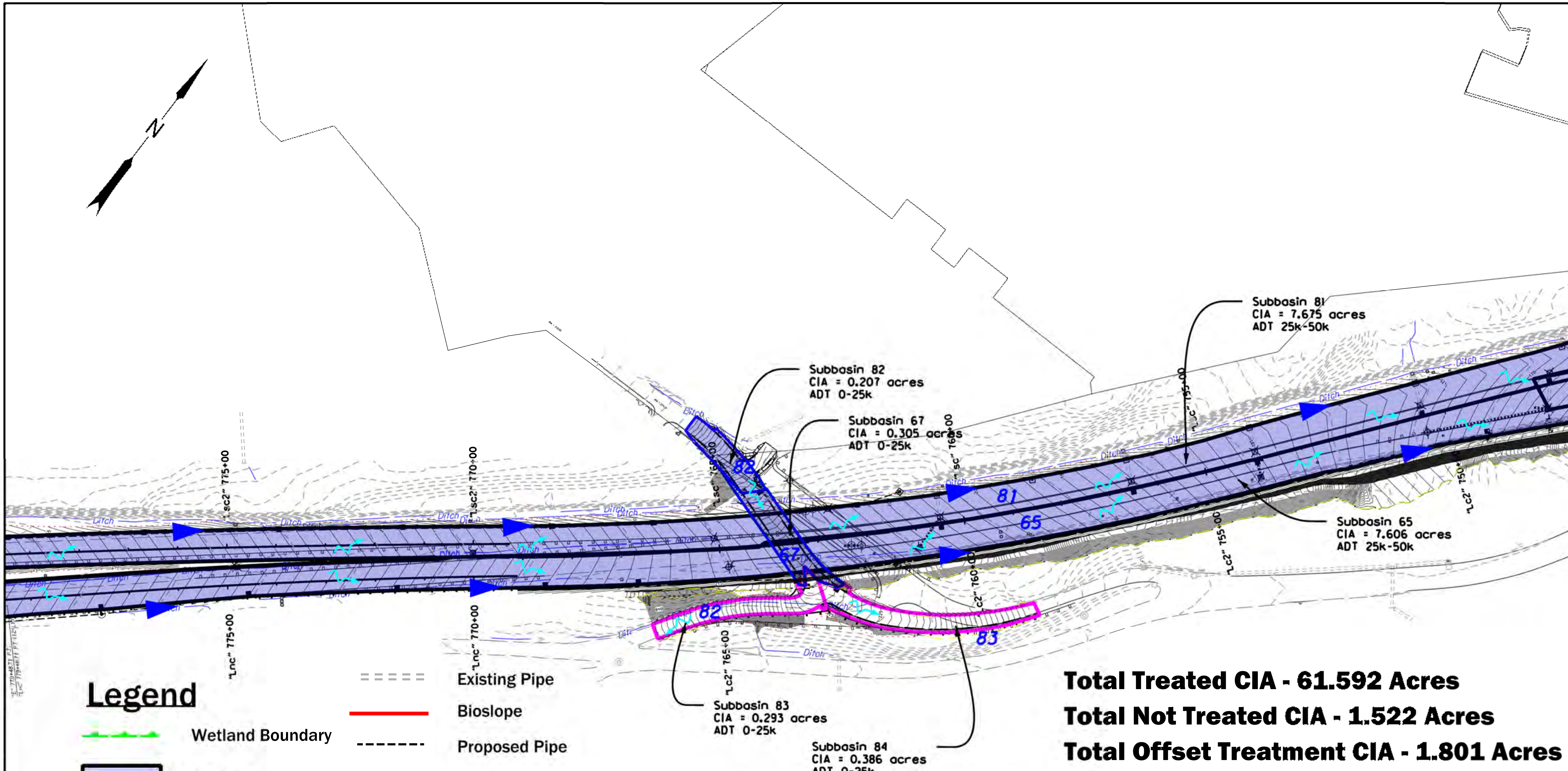
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

STORMWATER CIA EXHIBIT

SHEET NO. 3

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST



Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

Legend

- Wetland Boundary
- CIA basin
- Non-triggered treated areas
- Not Treated CIA
- Water quality swale boundary
- Existing Pipe
- Bioslope
- Proposed Pipe
- Proposed Inlet
- Proposed Manhole
- Conveyance Direction
- Surface Flow
- Combination detention pond/ water quality swale boundary

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

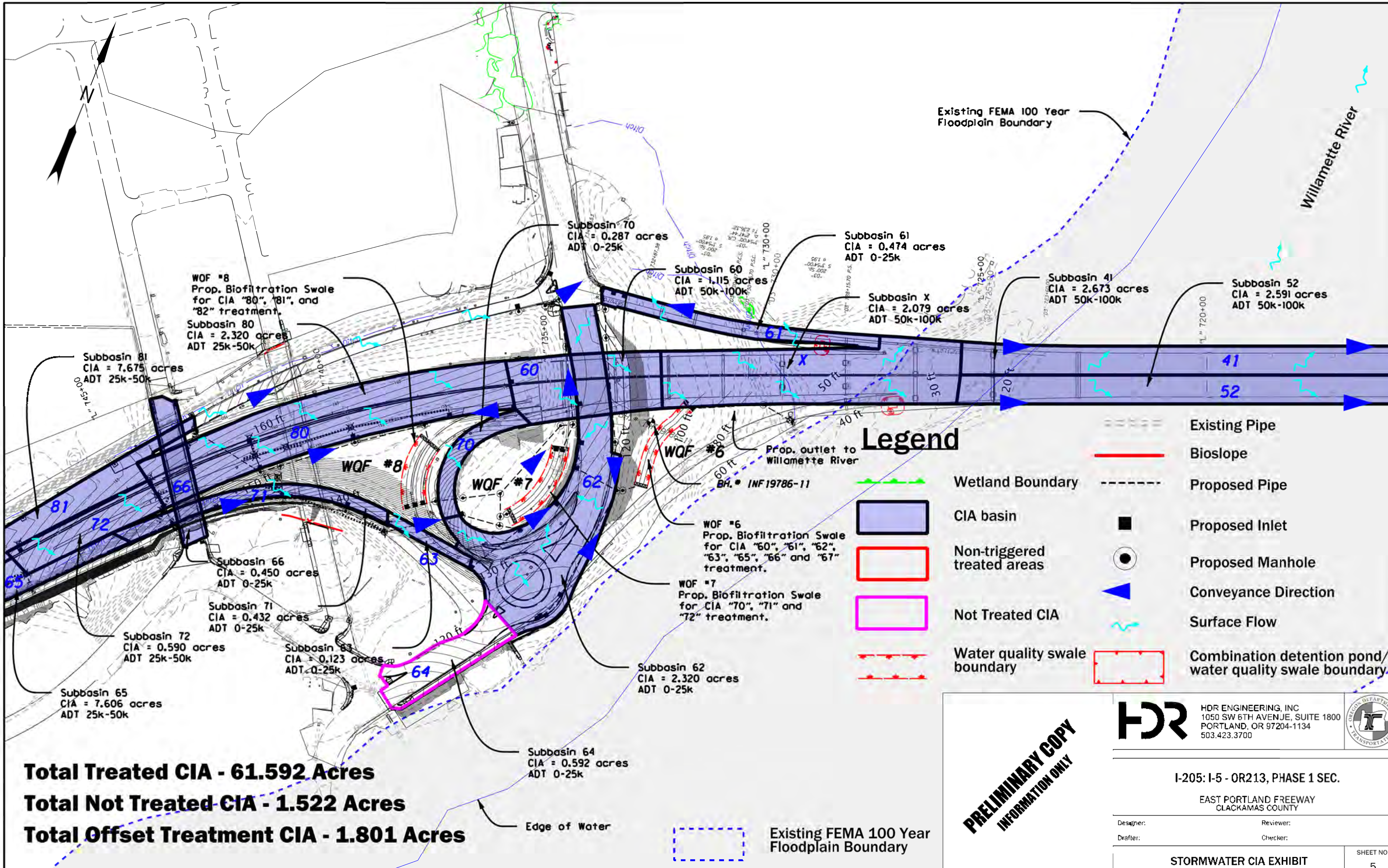
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

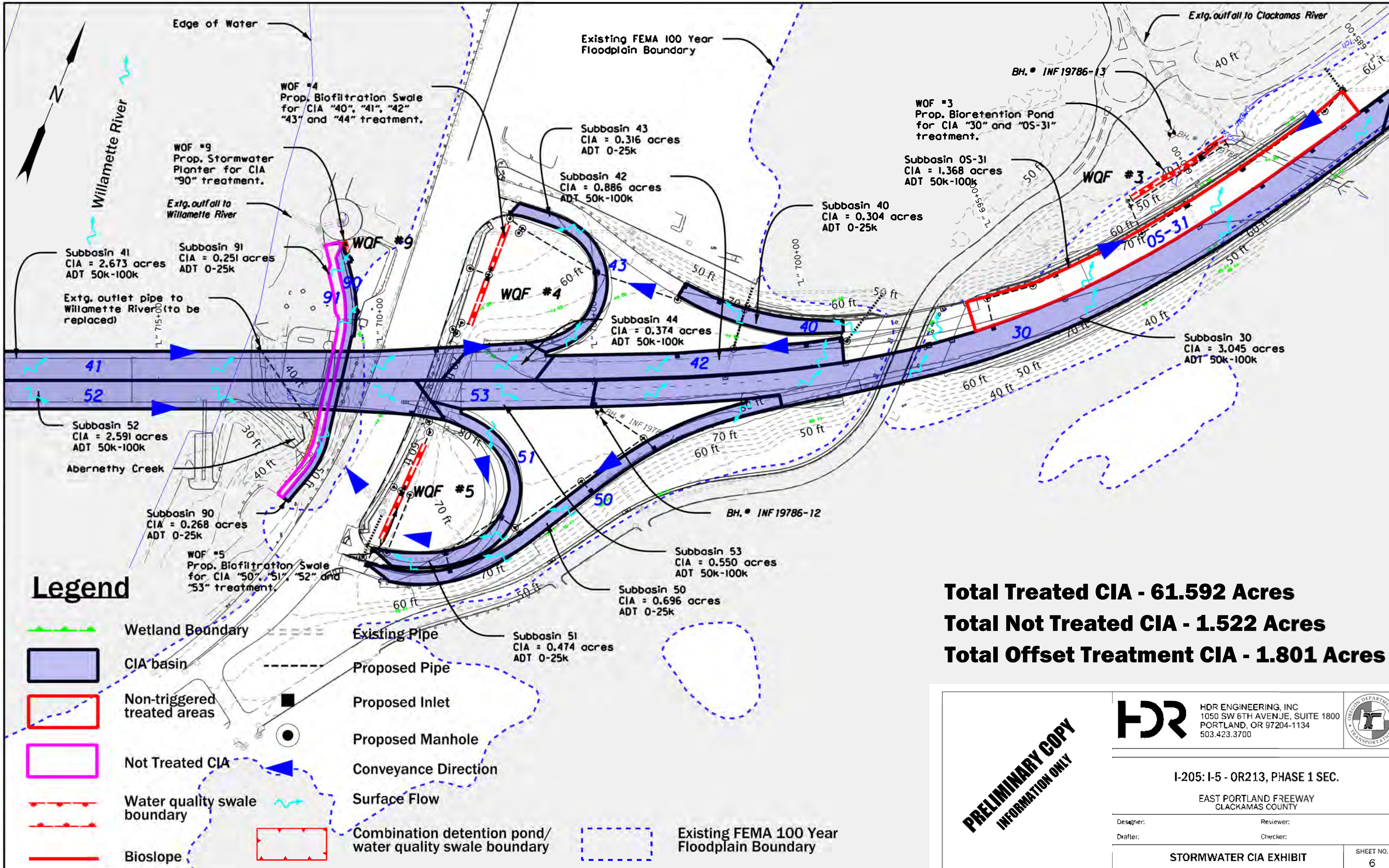
Designer: Reviewer:
Drafter: Checker:

STORMWATER CIA EXHIBIT

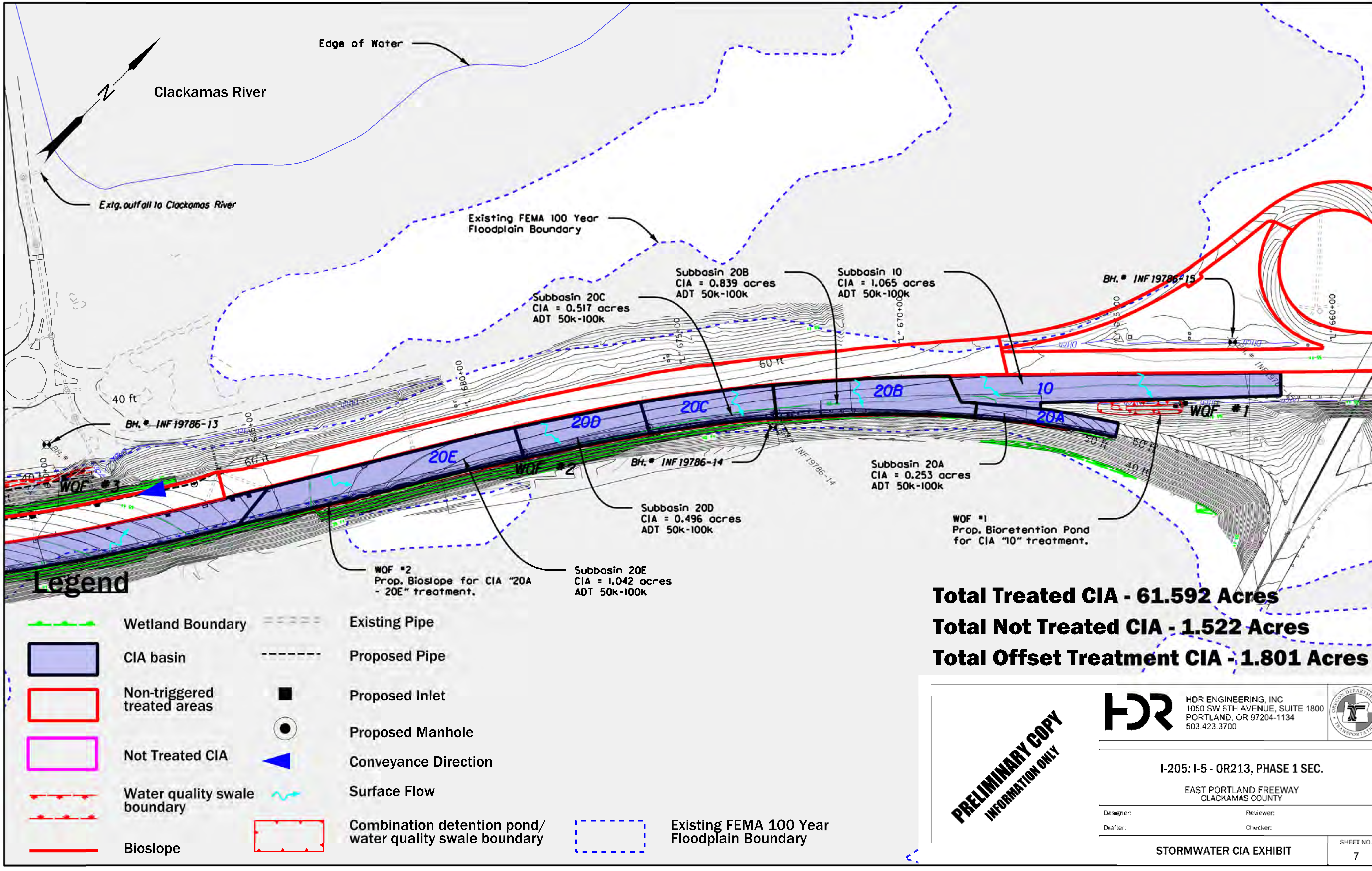
SHEET NO. 4

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST


N
Existing FEMA 100 Year Floodplain Boundary
Willamette River
Subbasin 70
CIA = 0.287 acres
ADT 0-25k
Subbasin 61
CIA = 0.474 acres
ADT 0-25k
Subbasin 60
CIA = 1.115 acres
ADT 50k-100k
Subbasin X
CIA = 2.079 acres
ADT 50k-100k
Subbasin 41
CIA = 2.673 acres
ADT 50k-100k
Subbasin 52
CIA = 2.591 acres
ADT 50k-100k
WQF #8
Prop. Biofiltration Swale for CIA "80", "81", and "82" treatment.
Subbasin 80
CIA = 2.320 acres
ADT 25k-50k
Subbasin 81
CIA = 7.675 acres
ADT 25k-50k
WQF #7
WQF #6
Prop. outlet to Willamette River
BH.# INF 19786-11
WQF #6
Prop. Biofiltration Swale for CIA "60", "61", "62", "63", "65", "66" and "67" treatment.
WQF #7
Prop. Biofiltration Swale for CIA "70", "71" and "72" treatment.
Subbasin 66
CIA = 0.450 acres
ADT 0-25k
Subbasin 71
CIA = 0.432 acres
ADT 0-25k
Subbasin 72
CIA = 0.590 acres
ADT 25k-50k
Subbasin 63
CIA = 0.123 acres
ADT 0-25k
Subbasin 62
CIA = 2.320 acres
ADT 0-25k
Subbasin 65
CIA = 7.606 acres
ADT 25k-50k
Subbasin 64
CIA = 0.592 acres
ADT 0-25k
Edge of Water
Legend
Existing Pipe
Bioslope
Wetland Boundary
Proposed Pipe
CIA basin
Proposed Inlet
Non-triggered treated areas
Proposed Manhole
Conveyance Direction
Not Treated CIA
Surface Flow
Water quality swale boundary
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
PRELIMINARY COPY
INFORMATION ONLY
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
5



Edge of Water
Willamette River
N
Existing FEMA 100 Year Floodplain Boundary
Extg. outfall to Clackamas River
WQF #4 Prop. Biofiltration Swale for CIA "40", "41", "42" "43" and "44" treatment.
WQF #9 Prop. Stormwater Planter for CIA "90" treatment.
Extg. outfall to Willamette River
Subbasin 43 CIA = 0.316 acres ADT 0-25k
Subbasin 42 CIA = 0.886 acres ADT 50k-100k
Subbasin 40 CIA = 0.304 acres ADT 0-25k
WQF #3 Prop. Bioretention Pond for CIA "30" and "OS-31" treatment.
BH. # INF 19786-13
Subbasin OS-31 CIA = 1.368 acres ADT 50k-100k
Subbasin 41 CIA = 2.673 acres ADT 50k-100k
Subbasin 91 CIA = 0.251 acres ADT 0-25k
Extg. outlet pipe to Willamette River (to be replaced)
Subbasin 44 CIA = 0.374 acres ADT 50k-100k
Subbasin 30 CIA = 3.045 acres ADT 50k-100k
Subbasin 52 CIA = 2.591 acres ADT 50k-100k
Abernethy Creek
BH. # INF 19786-12
Subbasin 90 CIA = 0.268 acres ADT 0-25k
WOF #5 Prop. Biofiltration Swale for CIA "50", "51", "52" and "53" treatment.
Subbasin 53 CIA = 0.550 acres ADT 50k-100k
Subbasin 50 CIA = 0.696 acres ADT 0-25k
Subbasin 51 CIA = 0.474 acres ADT 0-25k
WQF #9
WQF #4
WQF #5
WQF #3
41
52
53
42
43
44
40
30
OS-31
50
51
90
91
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
Legend
Wetland Boundary
CIA basin
Non-triggered treated areas
Not Treated CIA
Water quality swale boundary
Bioslope
Existing Pipe
Proposed Pipe
Proposed Inlet
Proposed Manhole
Conveyance Direction
Surface Flow
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
PRELIMINARY COPY INFORMATION ONLY
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
6



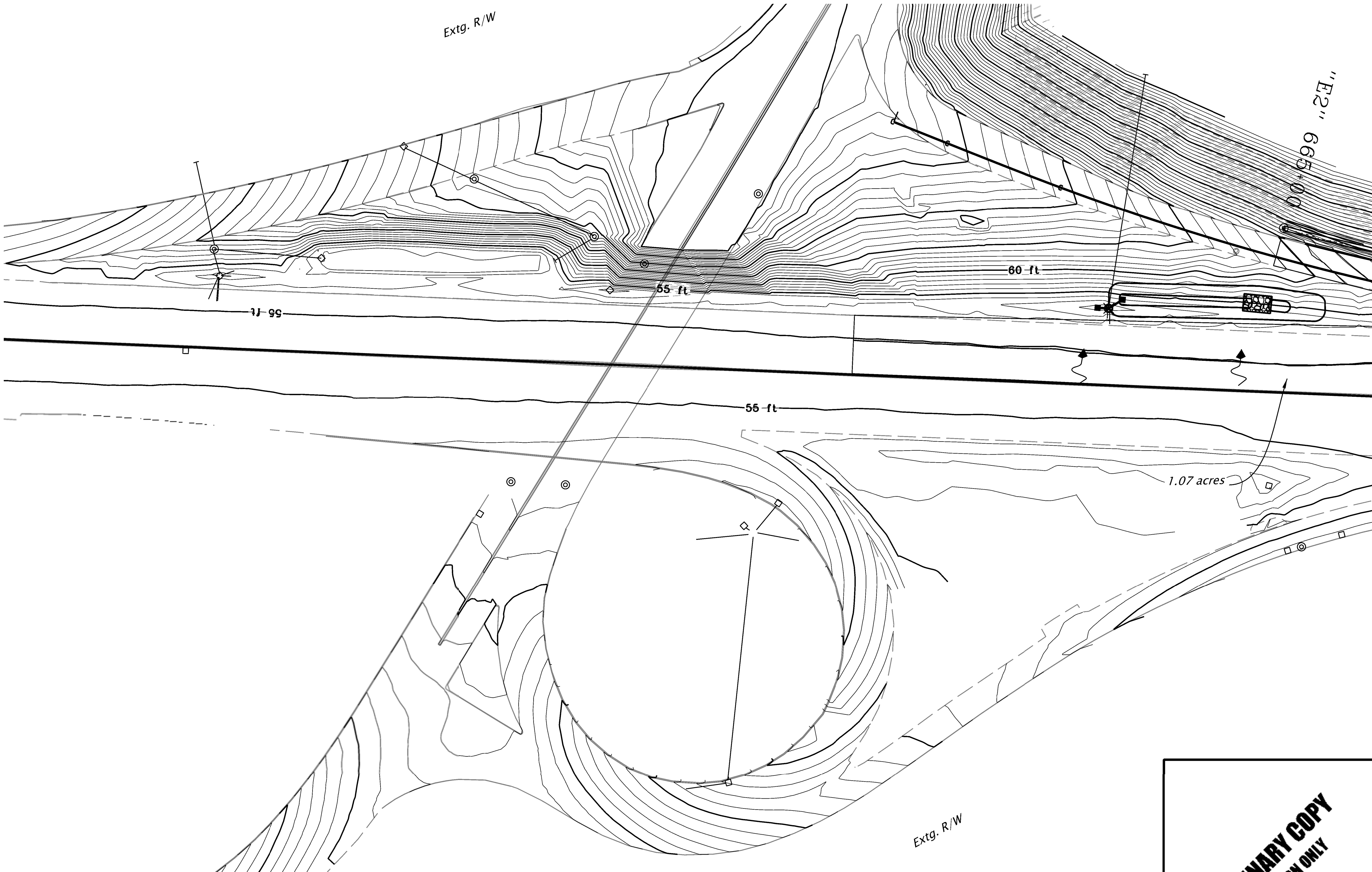
Edge of Water
Clackamas River
N
Extg. outfall to Clackamas River
Existing FEMA 100 Year Floodplain Boundary
Subbasin 20C
CIA = 0.517 acres
ADT 50k-100k
Subbasin 20B
CIA = 0.839 acres
ADT 50k-100k
Subbasin 10
CIA = 1.065 acres
ADT 50k-100k
BH. # INF 19786-15
BH. # INF 19786-13
BH. # INF 19786-14
INF 19786-14
40 ft
60 ft
50 ft
20A
20B
20C
20D
20E
10
WQF #1
WQF #2
WQF #3
Subbasin 20A
CIA = 0.253 acres
ADT 50k-100k
Subbasin 20D
CIA = 0.496 acres
ADT 50k-100k
WQF #1
Prop. Bioretention Pond for CIA "10" treatment.
WQF #2
Prop. Bioslope for CIA "20A - 20E" treatment.
Subbasin 20E
CIA = 1.042 acres
ADT 50k-100k
Legend
Wetland Boundary
CIA basin
Non-triggered treated areas
Not Treated CIA
Water quality swale boundary
Bioslope
Existing Pipe
Proposed Pipe
Proposed Inlet
Proposed Manhole
Conveyance Direction
Surface Flow
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
PRELIMINARY COPY
INFORMATION ONLY
HDR
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
7
Rotation: 44.768°
Scale: 1"=200'

Appendix B. Inlet Basin Map

Sec. 29, T. 2S, R.2E, W.M.

PARK PLACE INTERCHANGE

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke Reviewer: Karen Tatman
Drafter: Morgan Tholl Checker: Christine Higgins

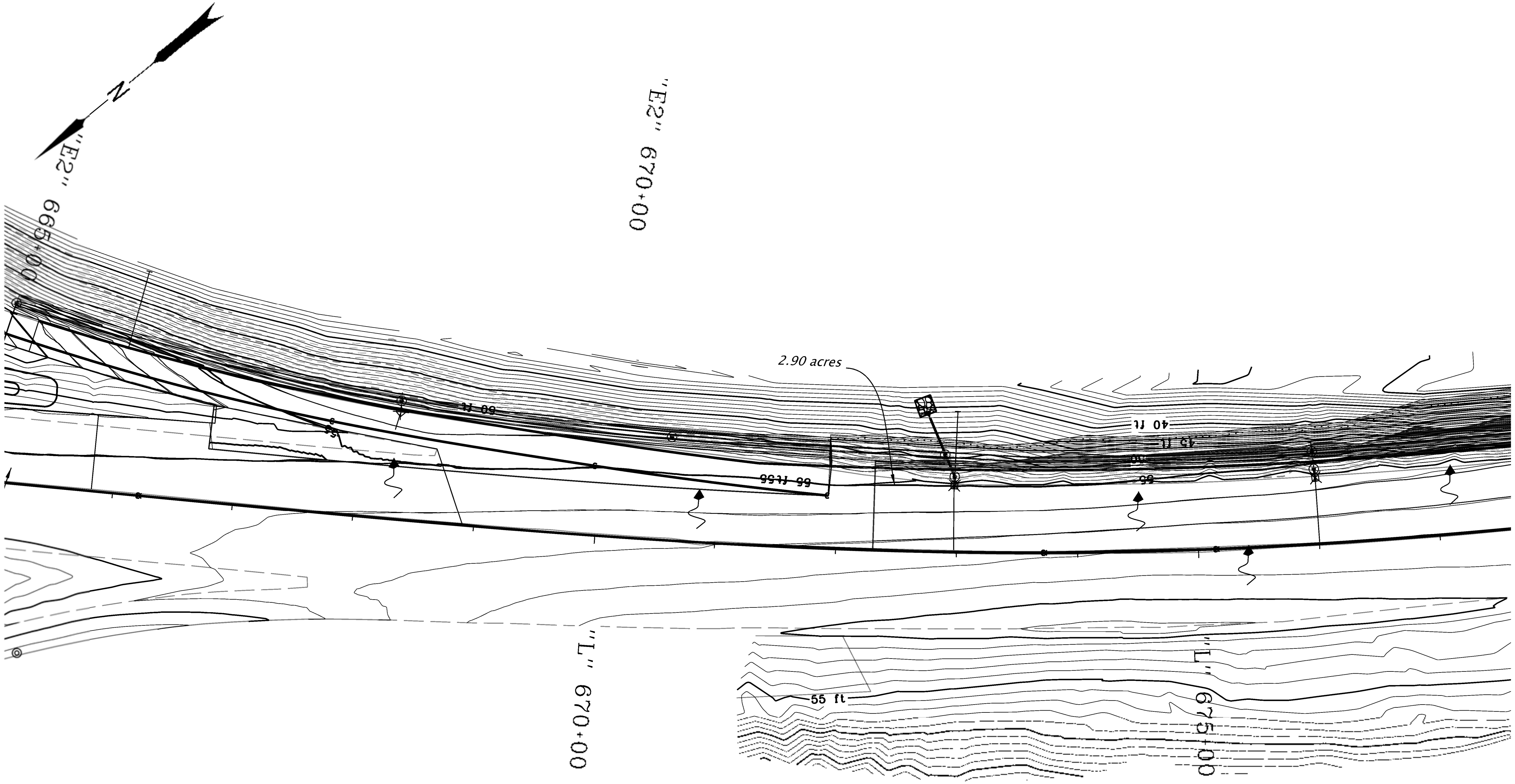
DRAINAGE BASIN MAP

SHEET NO. 01

R_K19786_HDR_dr_basin_map.dgn :: C01B 7/14/2020 2:30:26 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 227.6721° Scale: 1"=100'



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

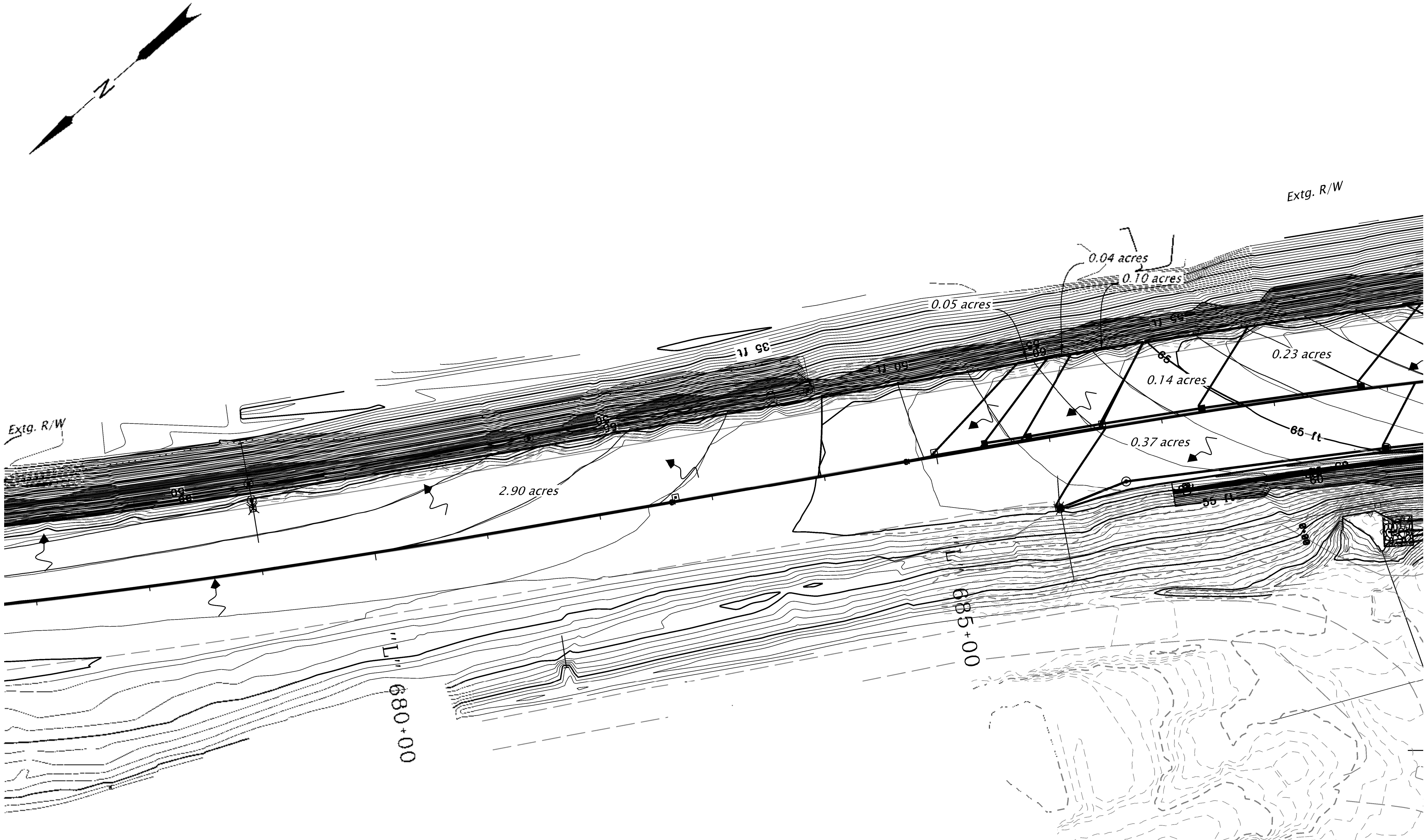
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
02

Sec. 29, T. 2S, R.2E, W.M.

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

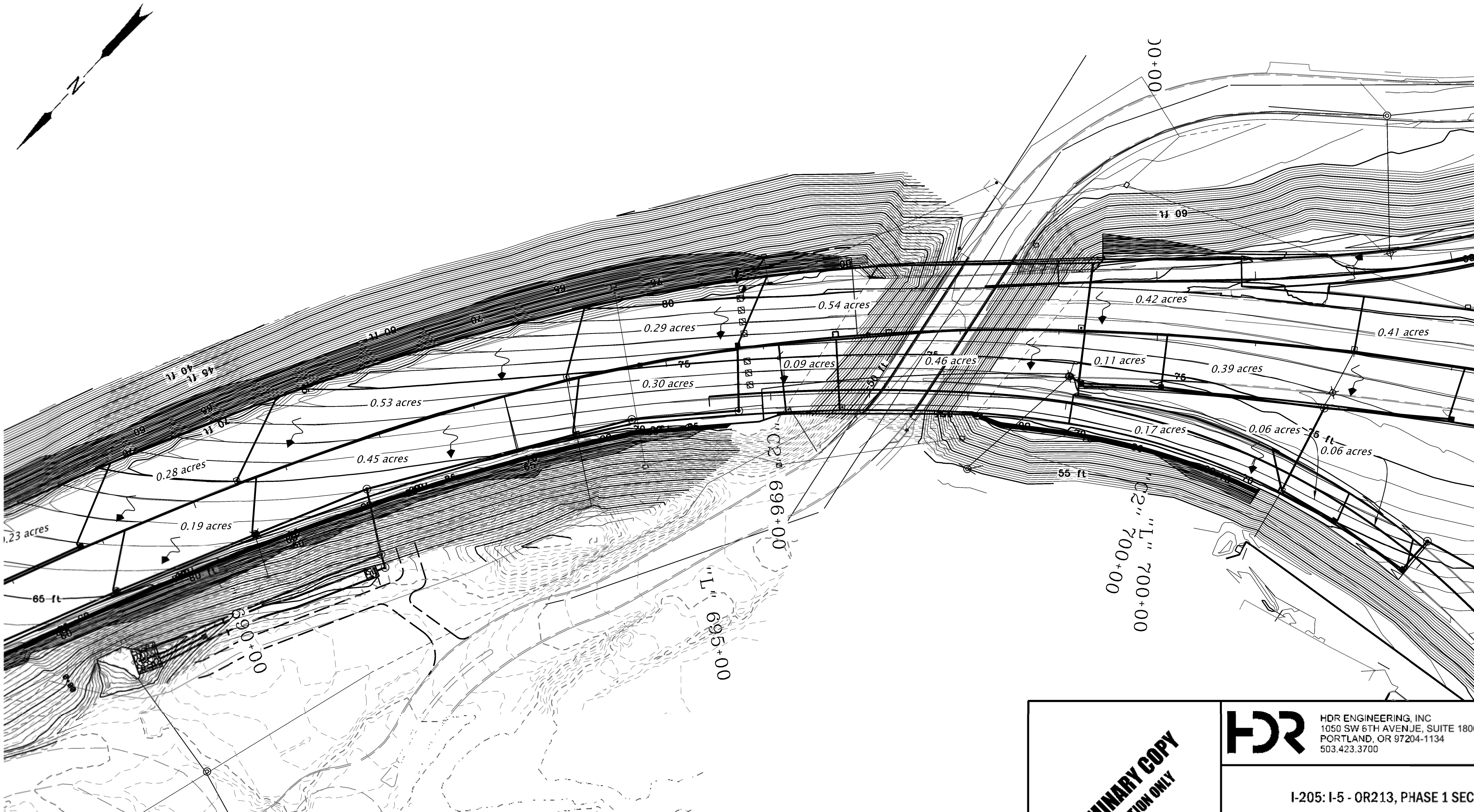
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO. 03

Sec. 29, T. 2S, R.2E, W.M.

OREGON CITY INTERCHANGE



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

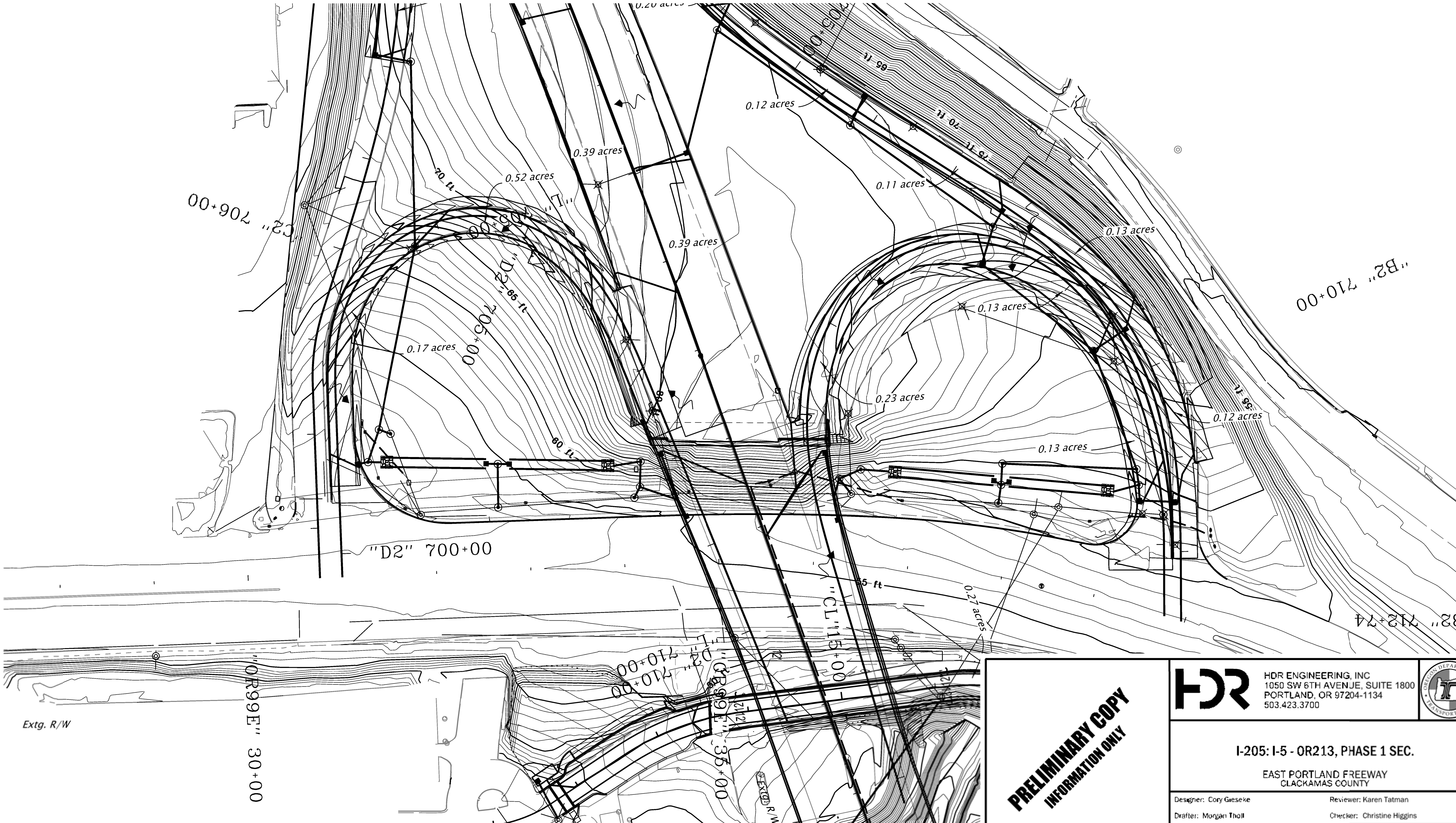
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
04

Sec. 29, T. 2S, R.2E, W.M.

OREGON CITY INTERCHANGE



PRELIMINARY COPY
INFORMATION ONLY

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

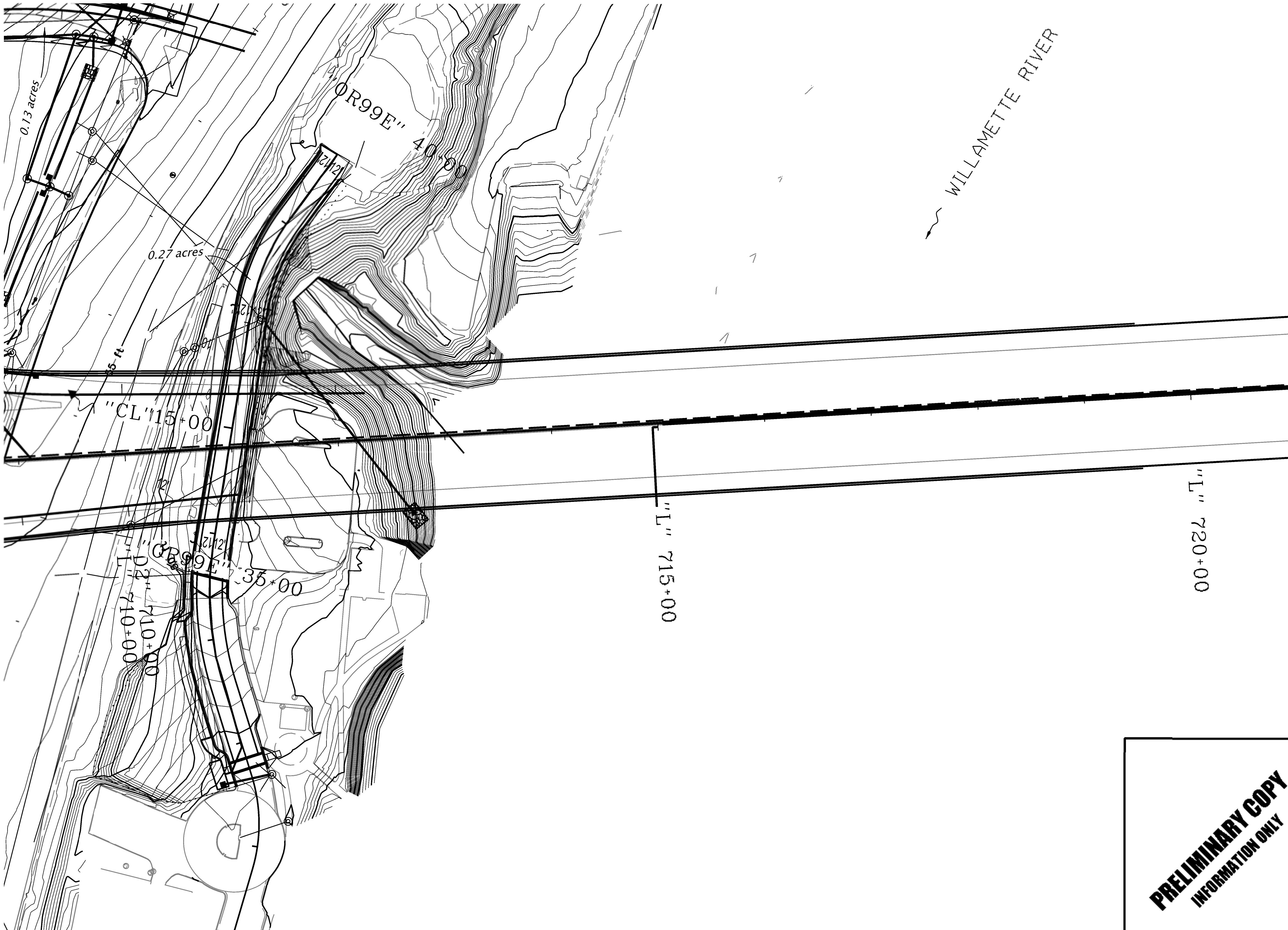
DRAINAGE BASIN MAP

SHEET NO. 05

Sec. 29, T. 2S, R.2E, W.M.

OREGON CITY INTERCHANGE

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

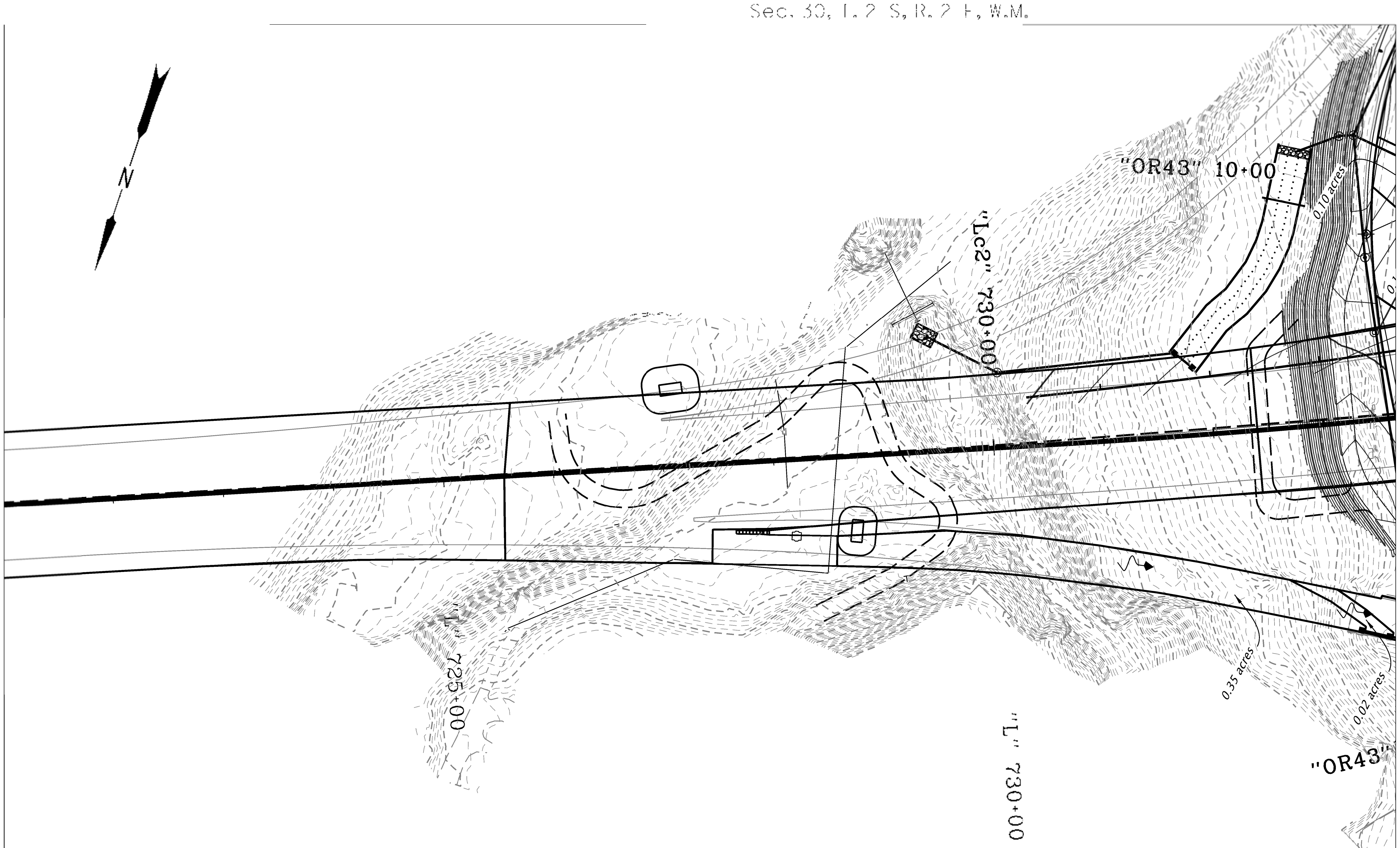
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
06



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

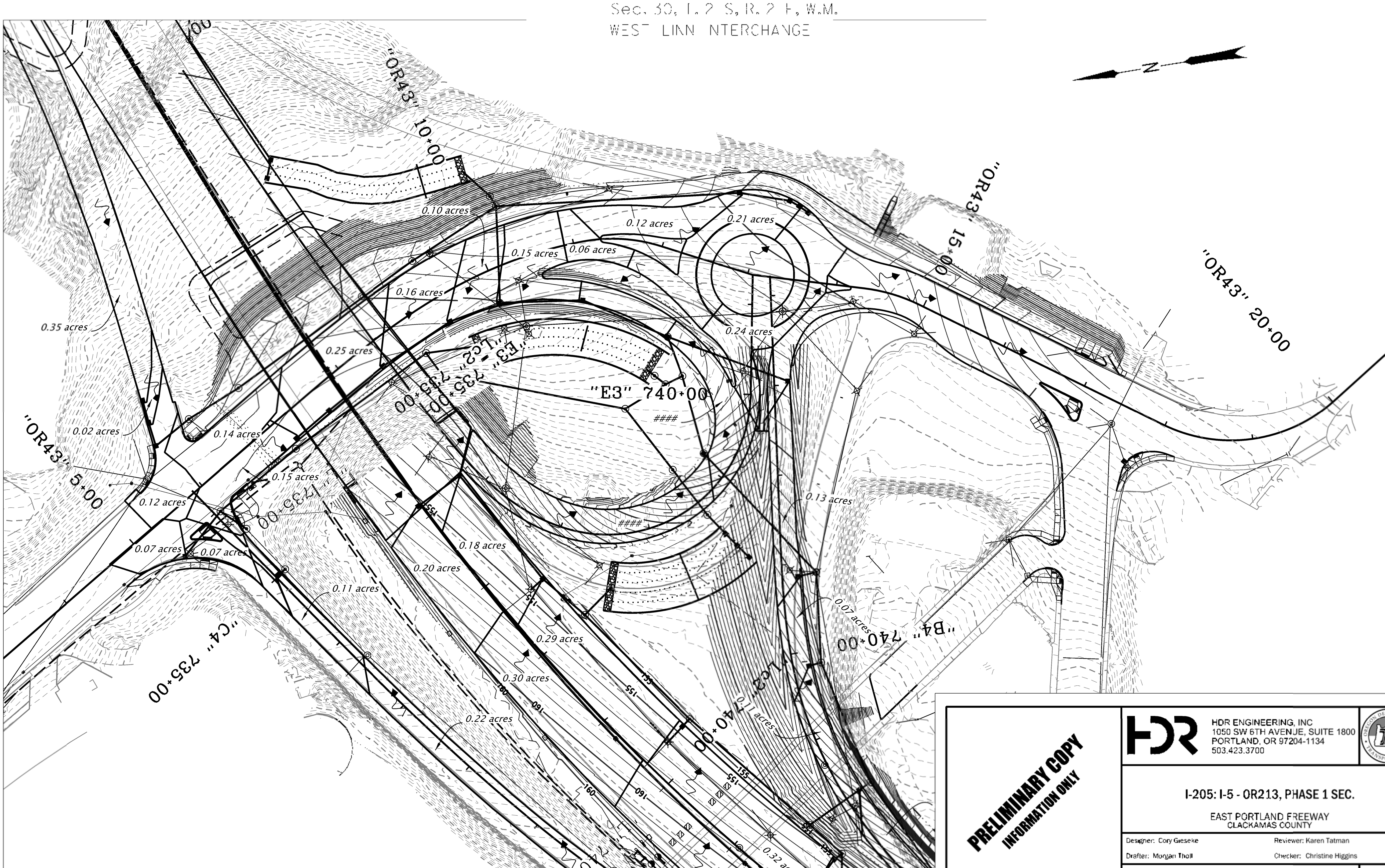
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
07



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
08

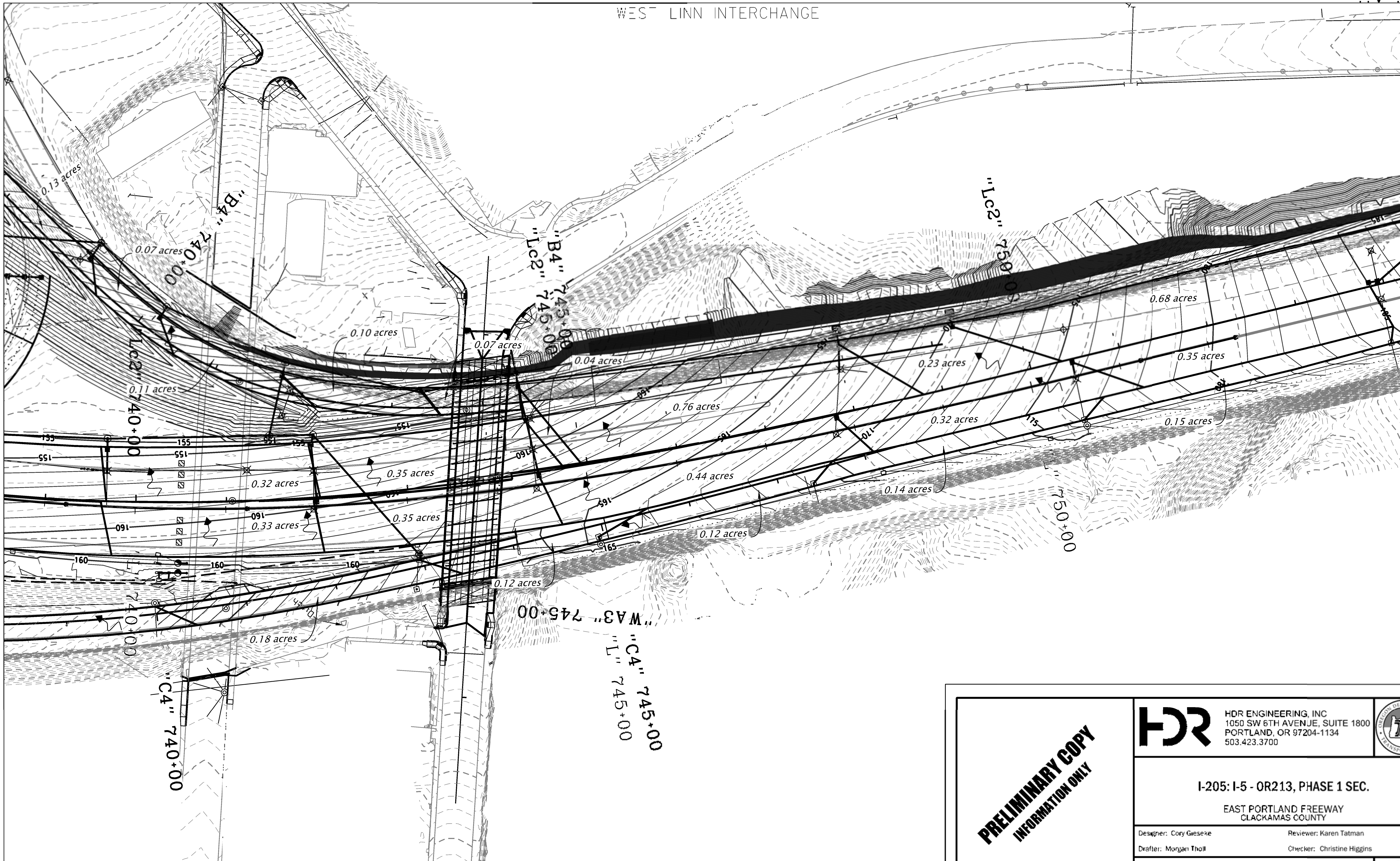
R_K19786_HDR_dr_basin_map.dgn :: C08C 7/14/2020 2:37:45 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 260.6437° Scale: 1"=100'

Sec. 30, T. 2 S, R. 2 E, W.M.
WEST LINN INTERCHANGE

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

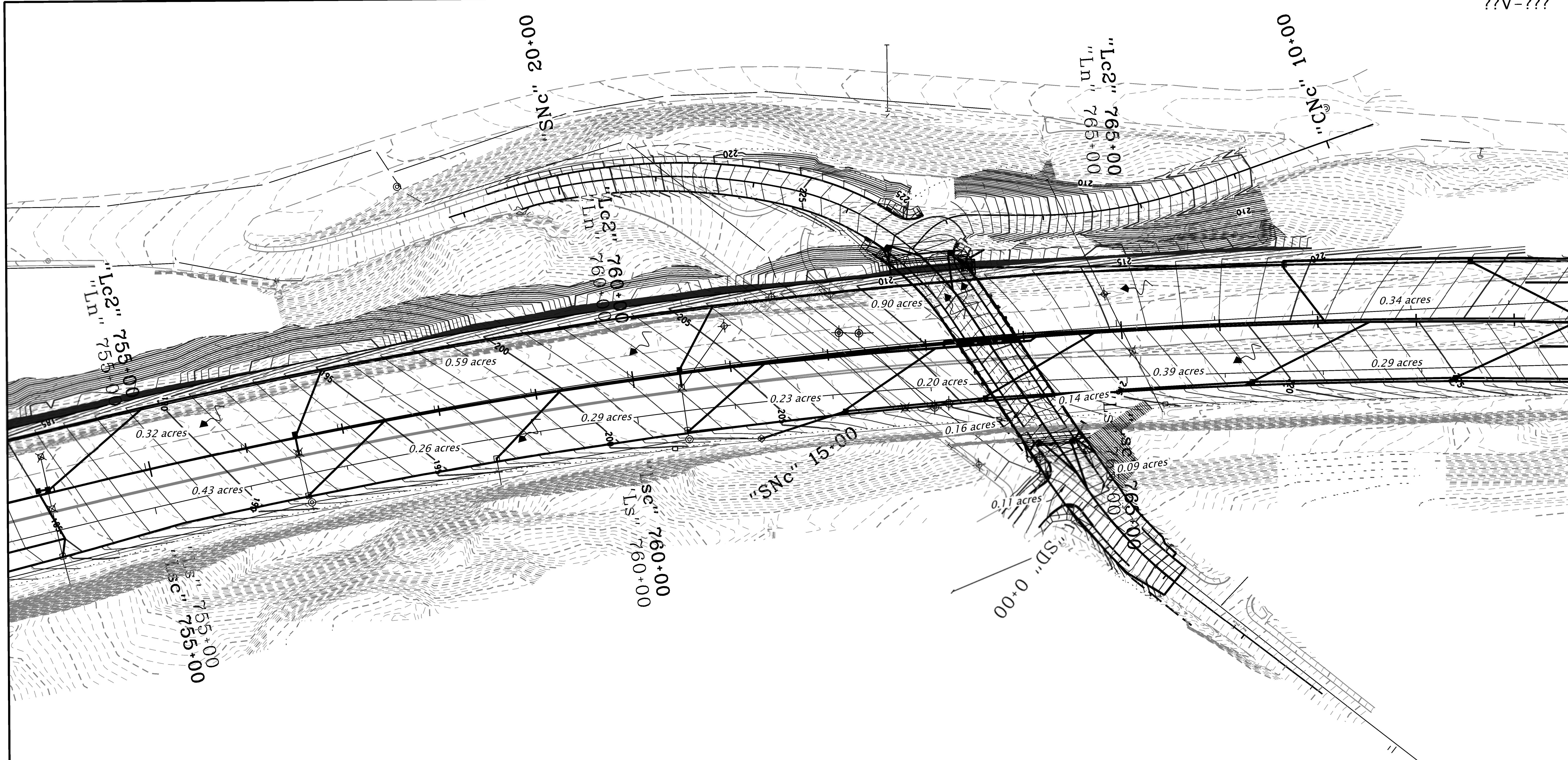
DRAINAGE BASIN MAP

SHEET NO.
09

R_K19786_HDR_dr_basin_map.dgn :: C09C 7/14/2020 2:38:56 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 218.1362° Scale: 1"=100'



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

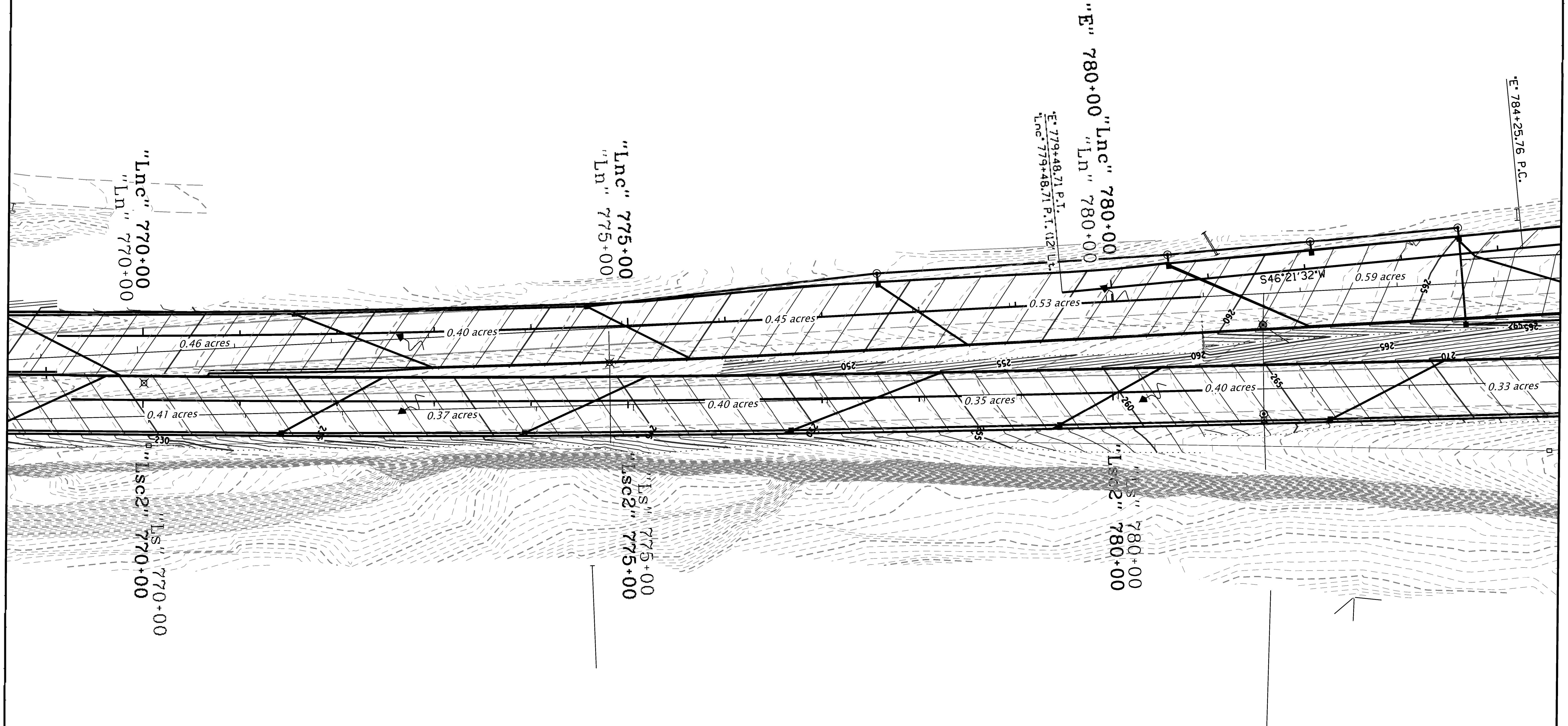
SHEET NO.
10

R_K19786_HDR_dr_basin_map.dgn :: C10C 7/14/2020 2:40:08 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 218.5198° Scale: 1"=100'

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

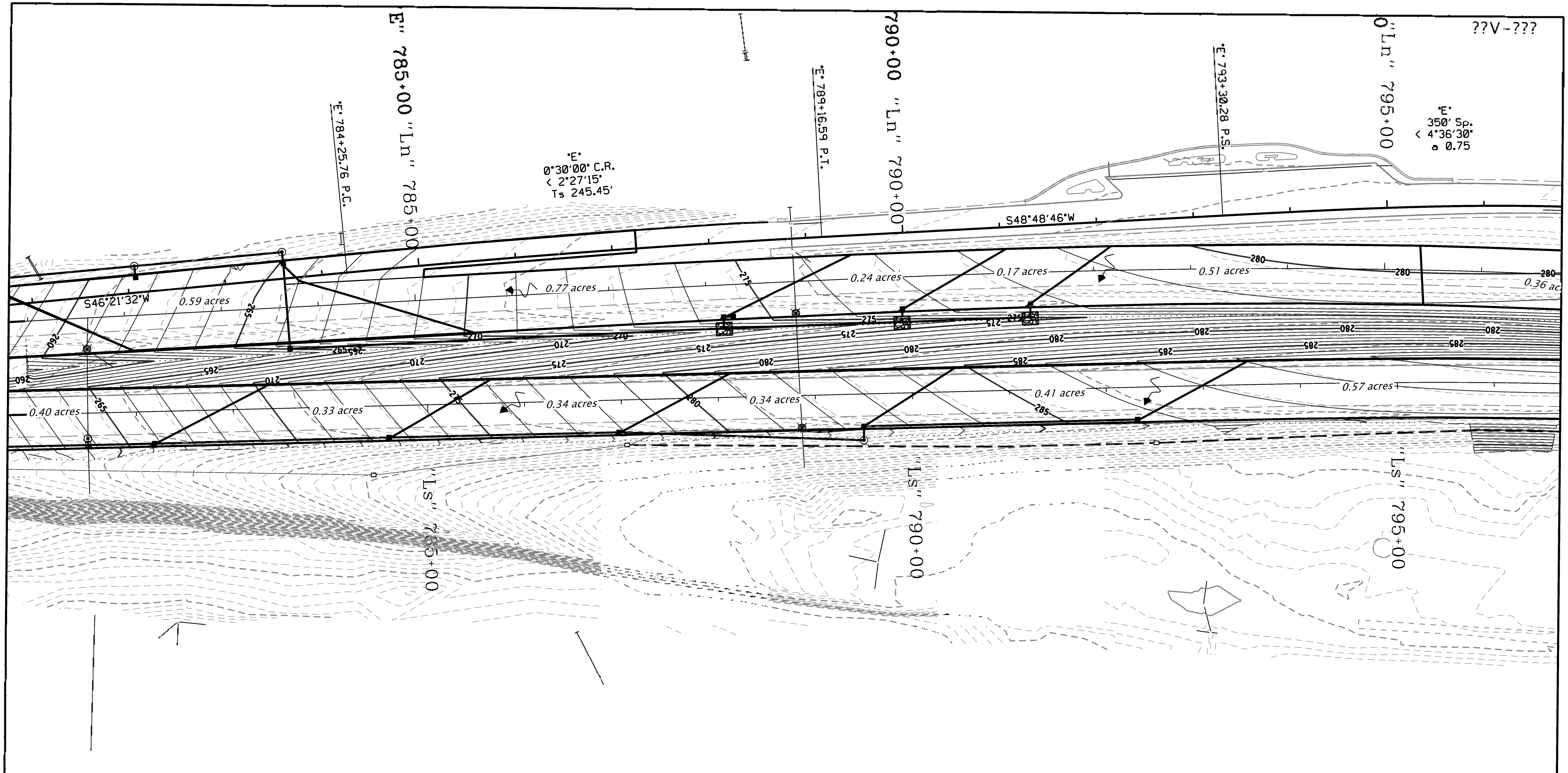
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
11



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE BASIN MAP

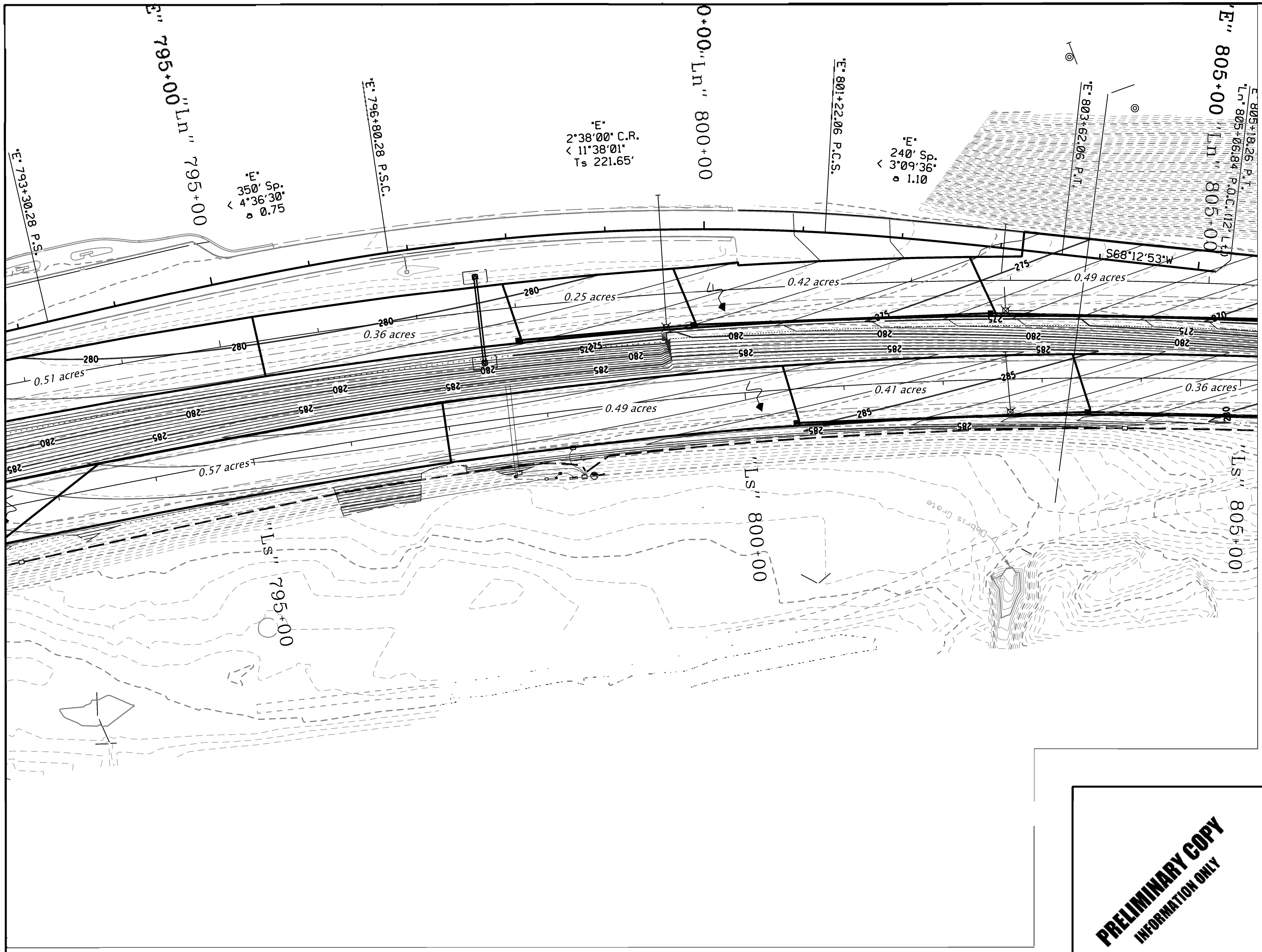
SHEET NO. 12

R_K19786_HDR_dr_basin_map.dgn :: C12C 7/14/2020 2:41:47 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 217.6195° Scale: 1"=100'

??V-???



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

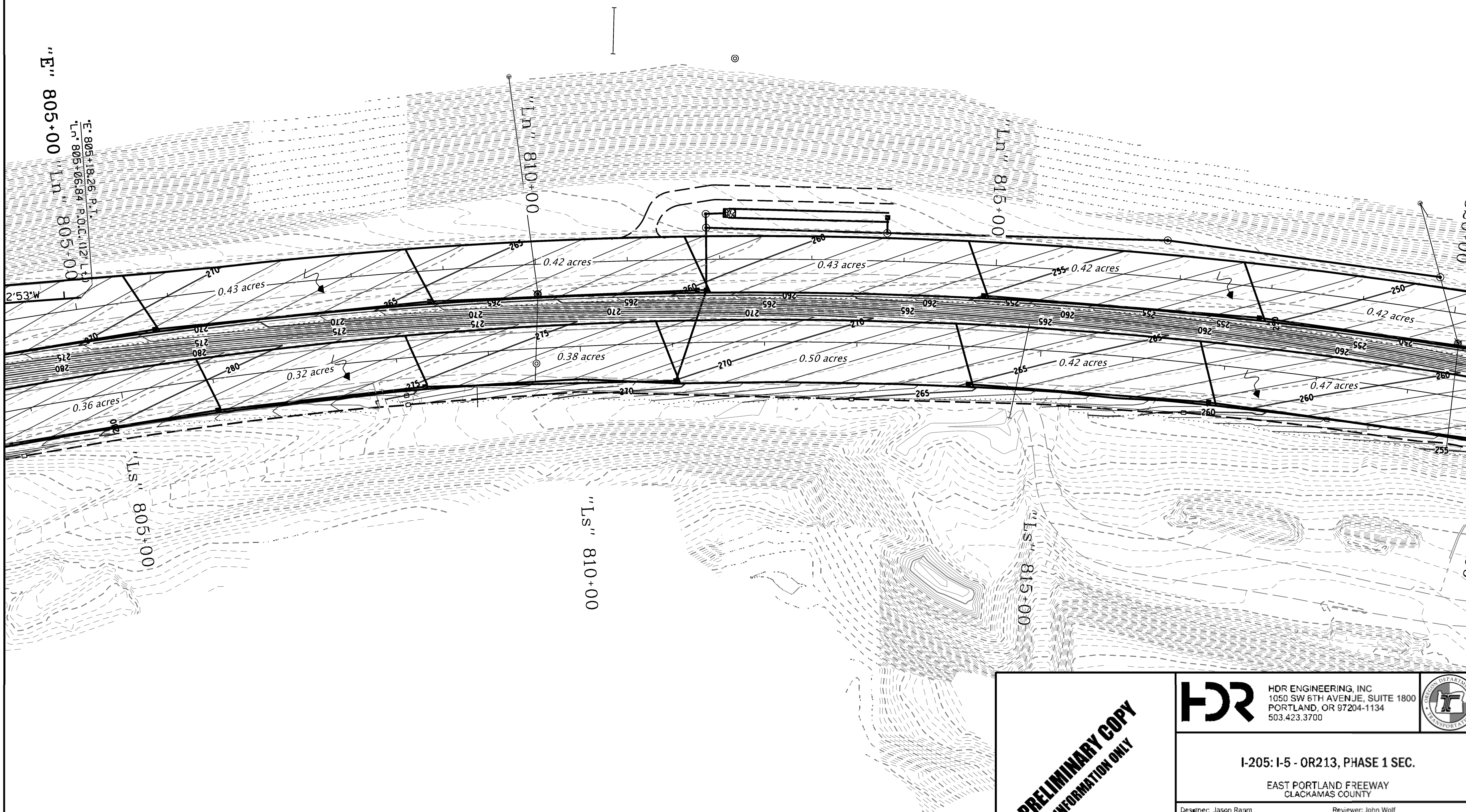
DRAINAGE BASIN MAP

SHEET NO.
13

R_K19786_HDR_dr_basin_map.dgn :: C13C 7/14/2020 2:42:34 PM MTHOLL

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 208.211° Scale: 1"=100'



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

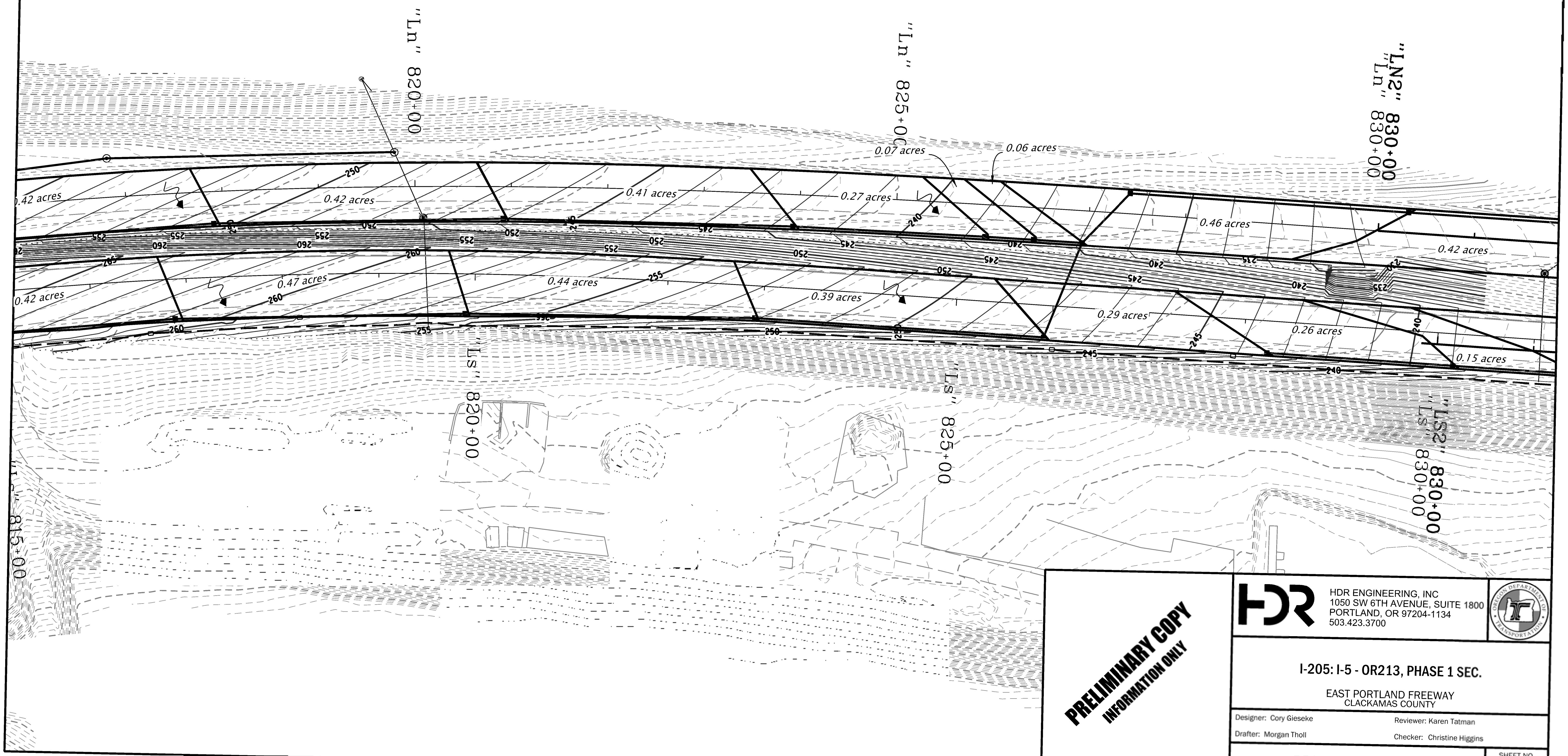
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Jason Rann | Reviewer: John Wolf
Drafter: Connor Donovan | Checker: Brendan LeBlanc

DRAINAGE BASIN MAP

SHEET NO.
14



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

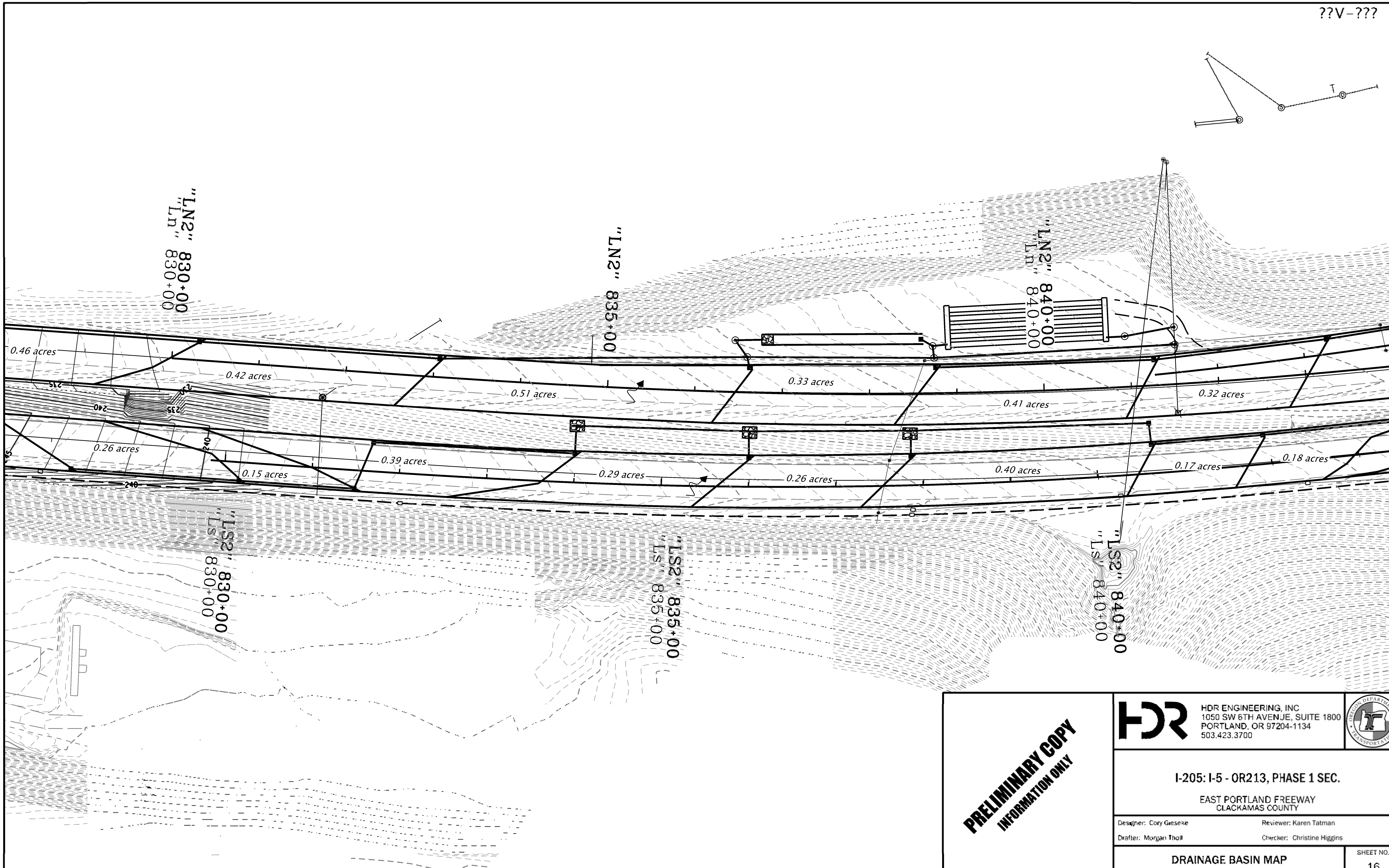
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO. 15

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 187.5797° Scale: 1"=100'



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

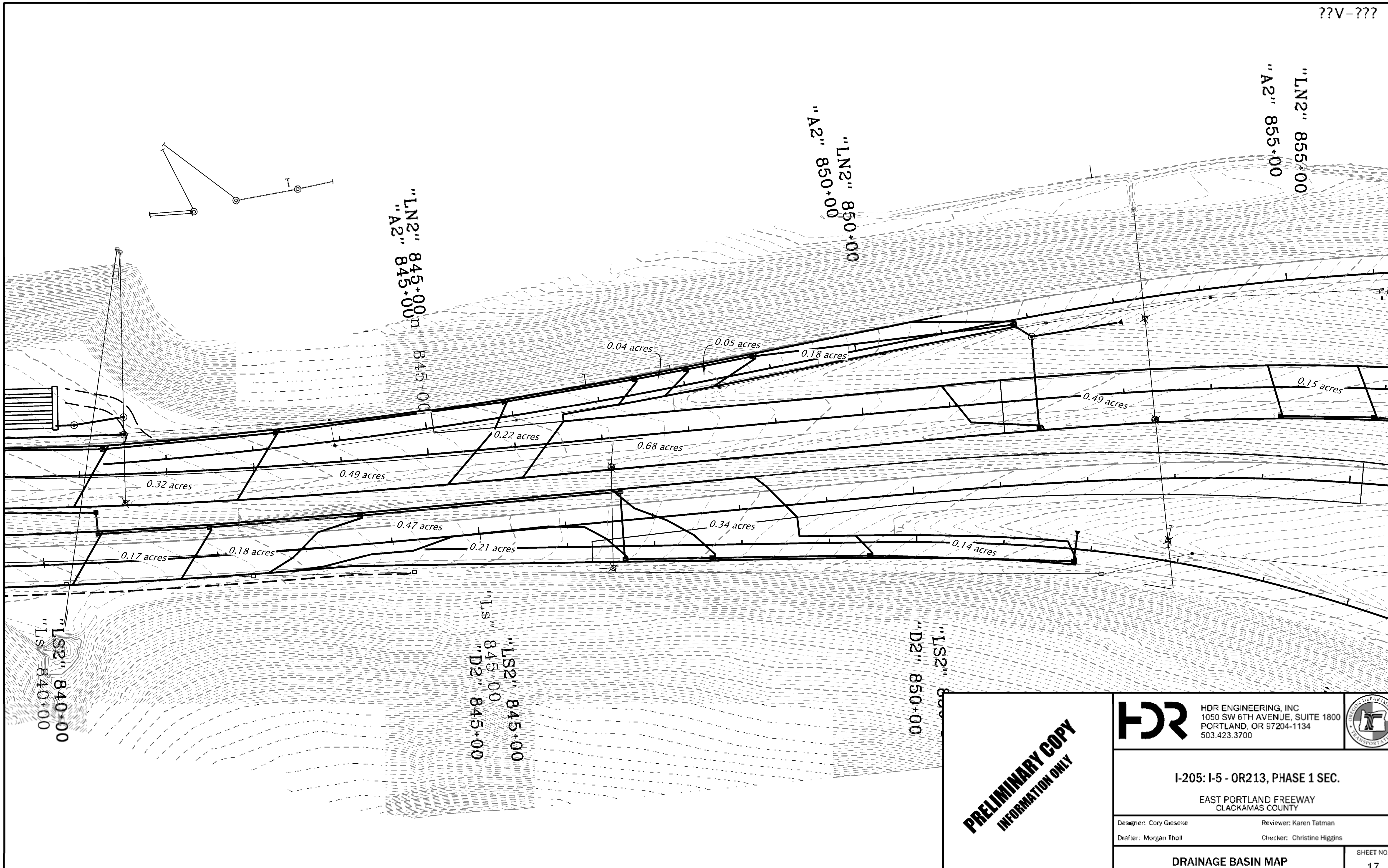
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO.
16



PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

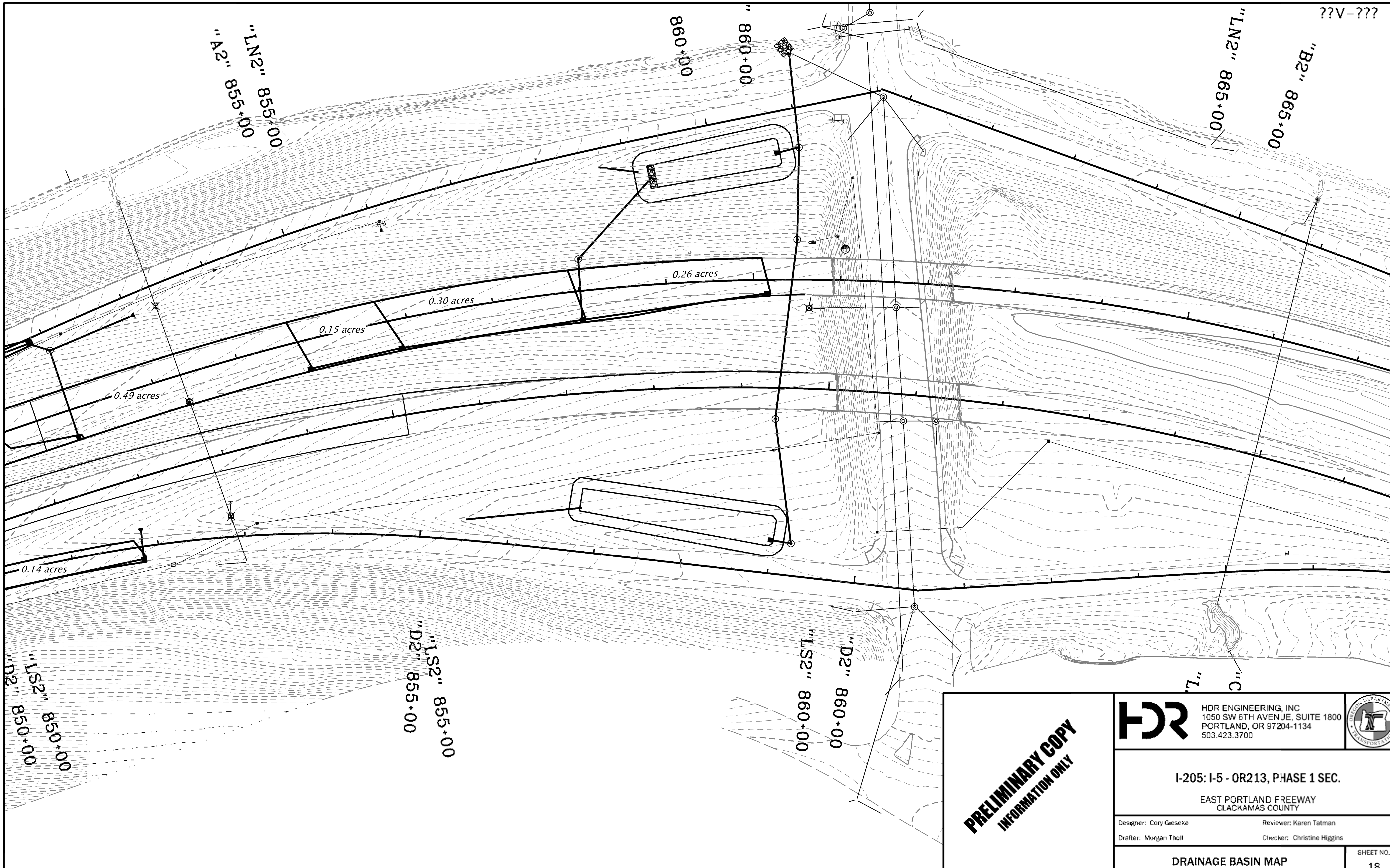
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE BASIN MAP

SHEET NO. 17



PRELIMINARY COPY
INFORMATION ONLY

HDR
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

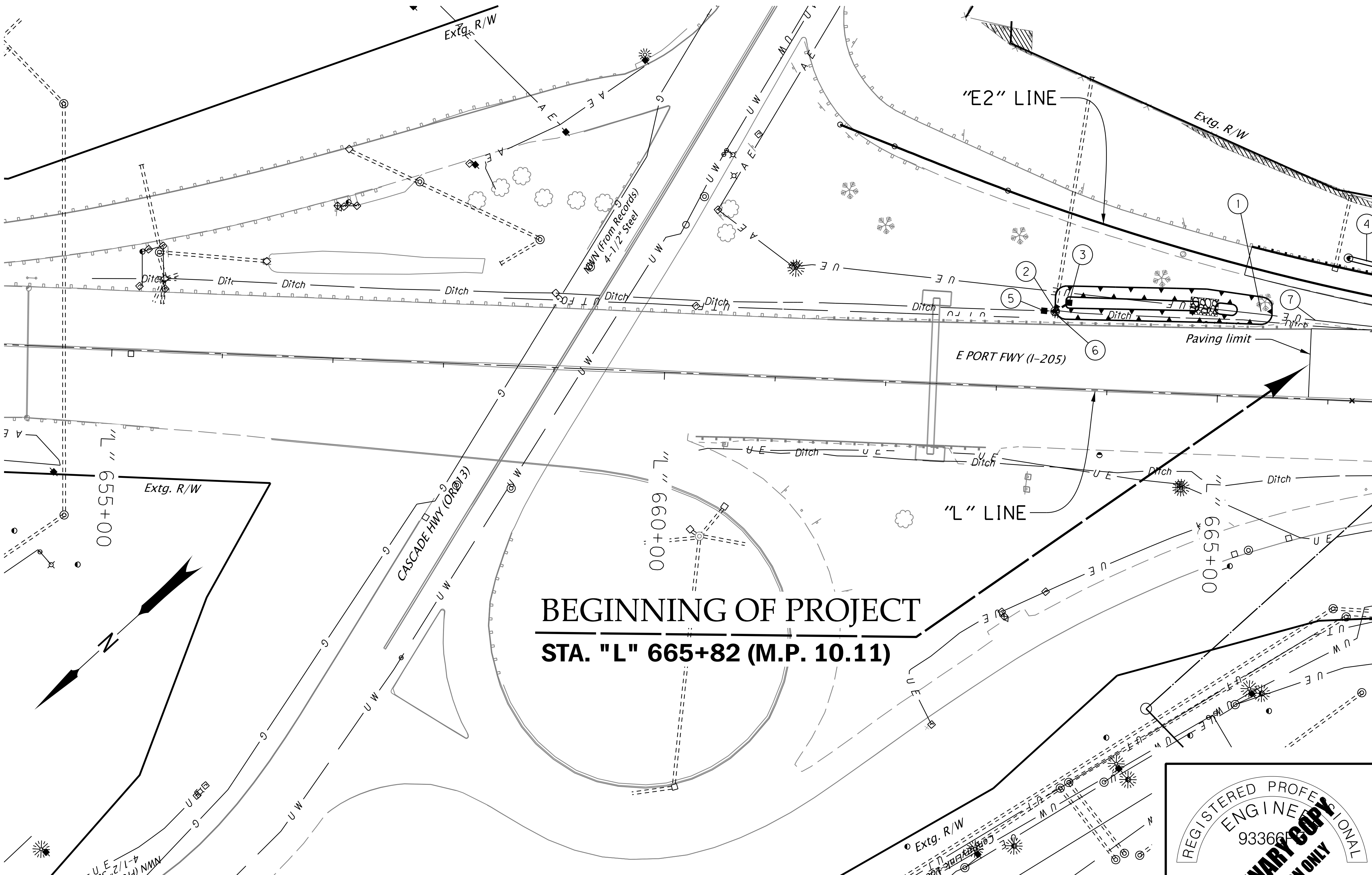
DRAINAGE BASIN MAP

SHEET NO.
18

Appendix C. Stormwater Construction Plans

??V-???

Sec. 29, T. 2 S, R. 2 E, W.M.
PARK PLACE INTERCHANGE



1. Sta. "L" 665+46.16, 77.84' Lt. to Sta. "L" 663+50.02, 77.02' Lt.
   Const. bioretention pond
   (For details, see sht. HA01)
2. See sht. HA01, note 5
3. See sht. HA01, note 4
4. Sta. "L" 666+13.20, 128.57' Lt. to Sta. "L" 684+63.80, 76.93' Lt.
   Const. bioslope - 1851'
   (For details, see sht. HA02)
5. See sht. HA01, note 6
6. Remove inlet
7. Relocate ODOT UG electrial line

LEGEND

Wetland Boundary	
No Work Area	

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

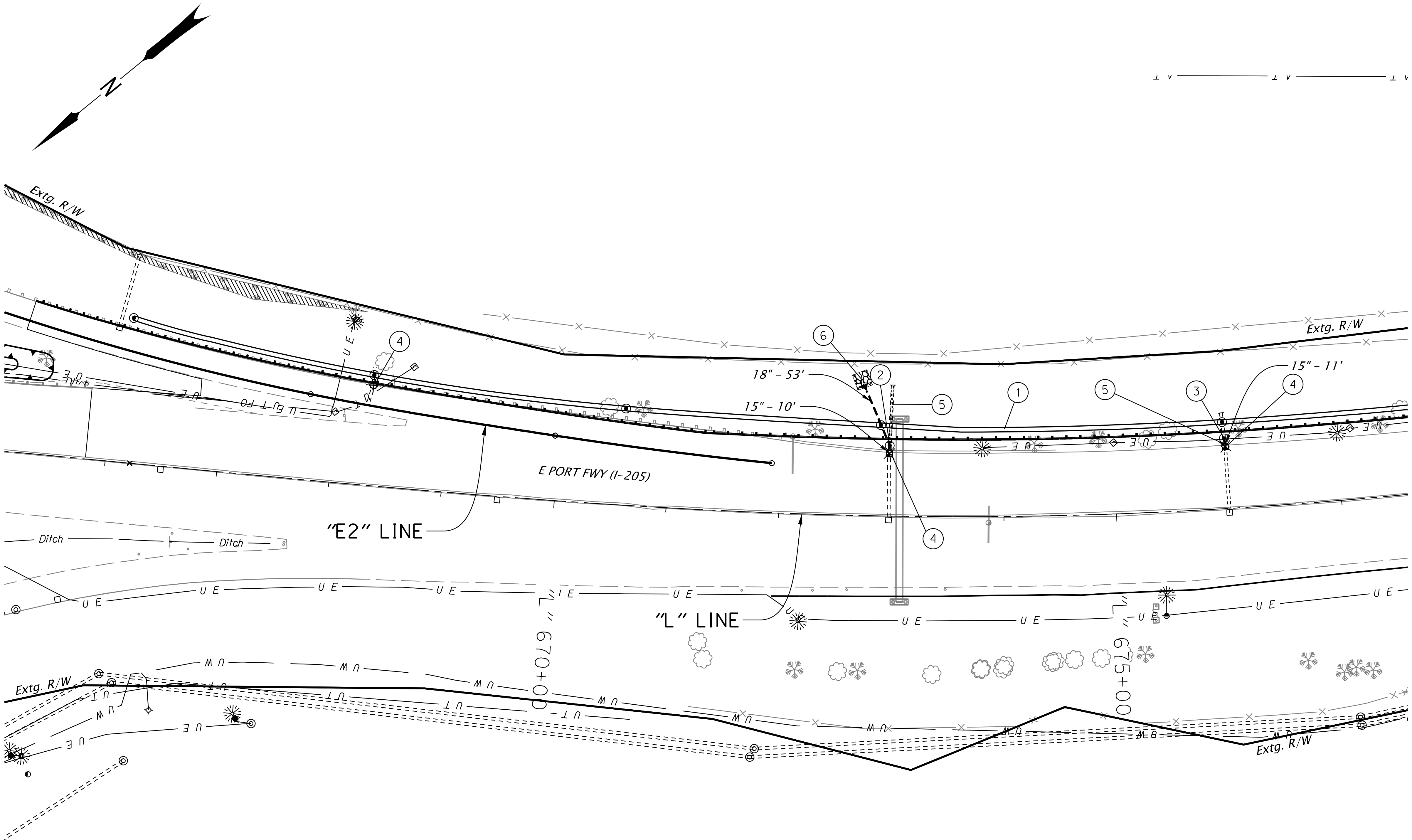
DRAINAGE & UTILITIES

SHEET NO.
C01B

Rotation: 227.6721° Scale: 1"=100'

Sec. 29, T. 2 S, R. 2 E, W.M.

??V-???



1. See sht. C01B, note 4
2. Sta. "L" 672+97.62, 62.54' Lt.
   Const. storm sew. manhole
   Extend 15" storm sew. pipe - 10' Rt.
   5' Depth
   (See drg. nos. RD300, RD335, RD345, RD386, RD390 and RD393)
3. Sta. "L" 675+98.99, 62.29' Lt.
   Const. storm sew. manhole over existing sewer
   Extend 15" storm sew. pipe - 11' Rt.
   5' Depth
4. Remove inlet - 3
5. Remove pipe - 70'
6. Sta. "L" 672+71.92, 120.51' Lt.
   Inst. 18" storm sew. pipe - 53'
   10' Depth
   Const. riprap pad
   Loose riprap (class 50) - 5.0 tons
   (See drg. no. RD317)

LEGEND

Wetland Boundary	
No Work Area	

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

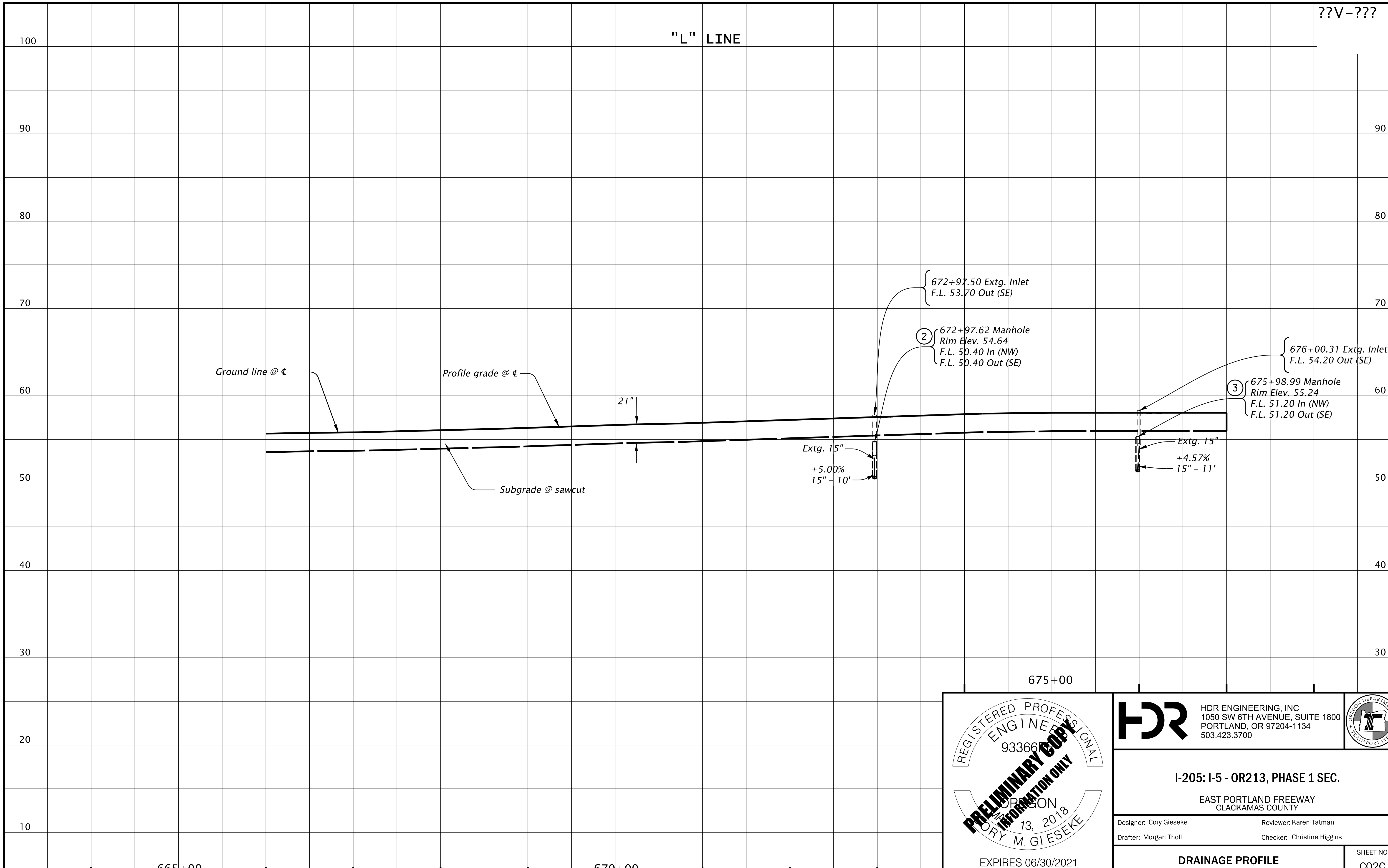
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C02B

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 230.7962°   Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE

PRELIMINARY COPY
INFORMATION ONLY

EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

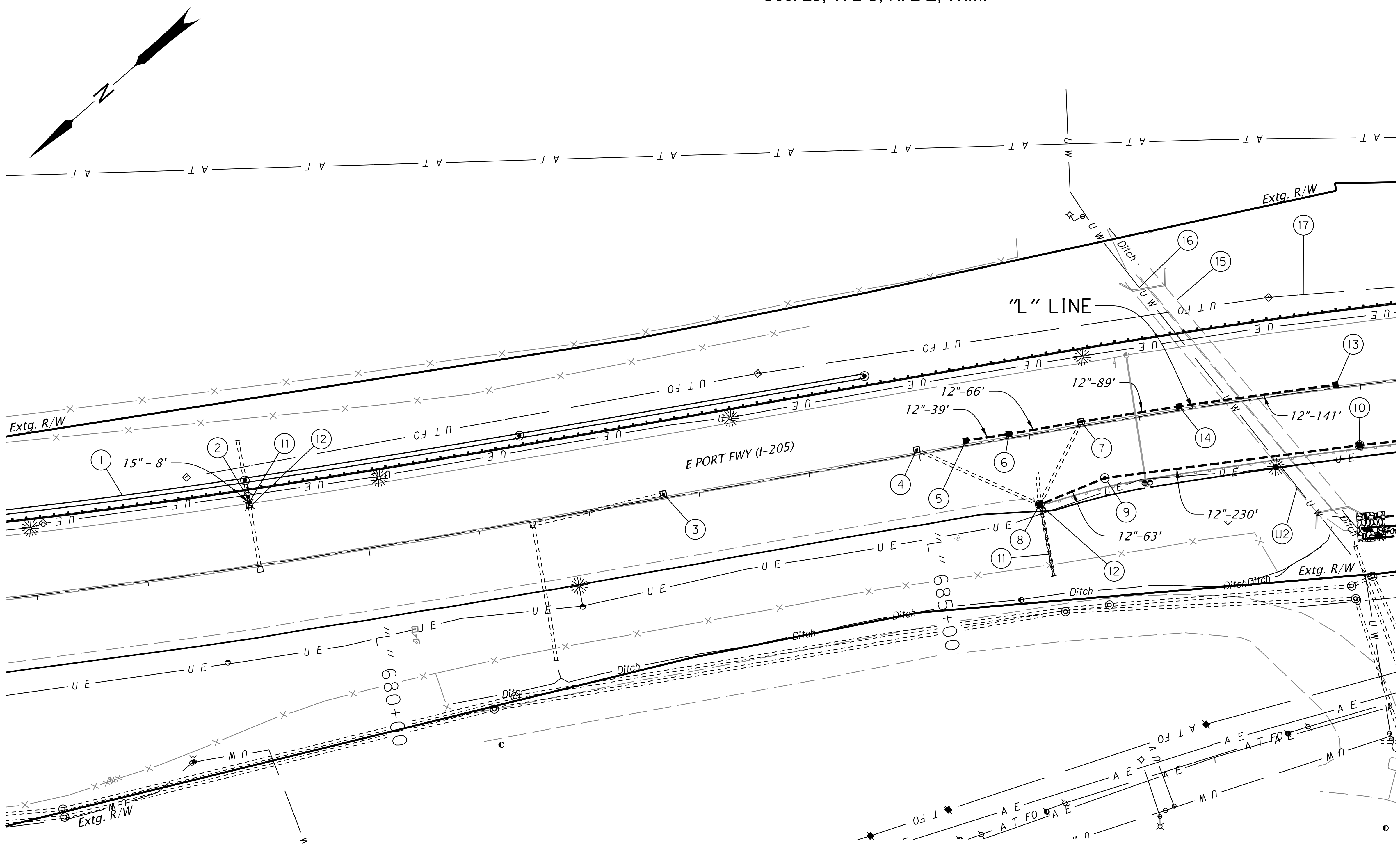
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C02C

Sec. 29, T. 2 S, R. 2 E, W.M.



1. See sht. C01B, note 4
2. Sta. "L" 678+99.77, 62.10 Lt.
   Const. storm sew. manhole
   Extend 15" storm sew. pipe - 8' Rt.,
   5' Depth
3. Sta. "L" 682+68.35, Lt.
   Adjust inlet
4. Sta. "L" 684+98.63, Lt.
   Adjust inlet
5. Sta. "L" 685+43.24, Lt.
   Const. type "G-2" inlet - 18" Sump
   (See drg. no. RD364)
6. Sta. "L" 685+82.29, Lt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 39'
   5' Depth
   Trench resurfacing - 13 sq. yd.
   (See drg. no. RD302)
7. Sta. "L" 686+46.66, Lt.
   Adjust inlet
   Inst. 12" storm sew. pipe - 66'
   10' Depth
   Inst. 12" storm sew. pipe - 89'
   10' Depth
   Trench resurfacing - 22 sq. yd.
   Connect to existing inlet
8. Sta. "L" 685+99.03, Rt.
   Const. storm sew. manhole w/ type "G-2" inlet
   Connect existing pipes
   (See drg. no. RD348)
9. Sta. "L" 686+60.59, 49.38' Rt.
   Const. storm sew. manhole
   Inst. 12" storm sew. pipe - 63'
   10' Depth
   Trench resurfacing - 21 sq. yd.
10. Sta. "L" 688+92.74, Rt.
    Const. storm sew. manhole w/ type "G-2" inlet
    Inst. 12" storm sew. pipe - 230'
    10' Depth
    Trench resurfacing - 77 sq. yd.
11. Remove pipe - 71'
12. Remove inlet - 2
13. Sta. "L" 688+78.02, Lt.
    Const. type "G-2" inlet - 18" Sump
14. Sta. "L" 687+36.94, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 141'
    5' Depth
15. Protect ODOT 12' box culvert
16. Protect Oregon City water line
17. Protect ODOT underground communications line

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

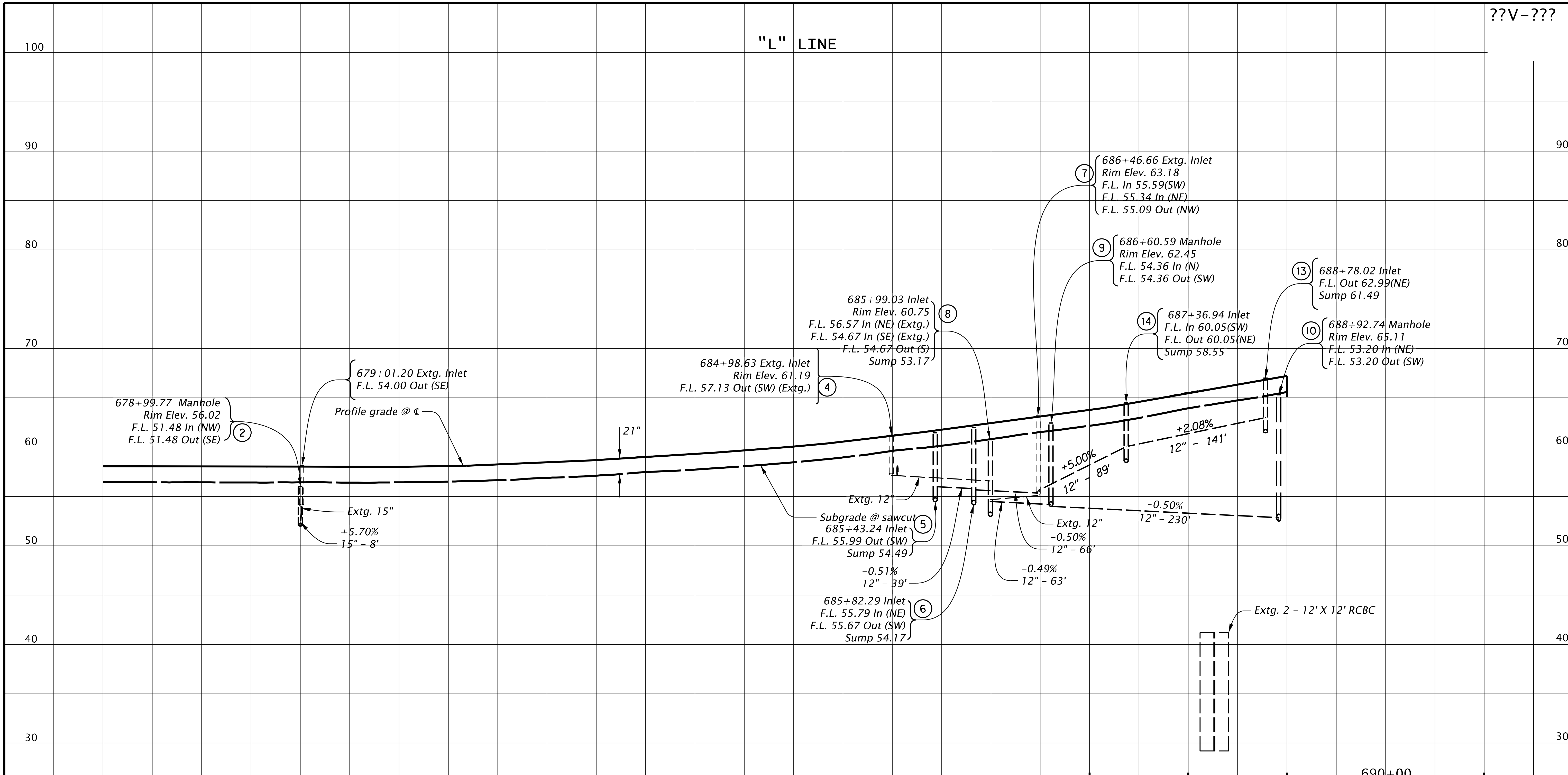
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C03B

Rotation: 228.87° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

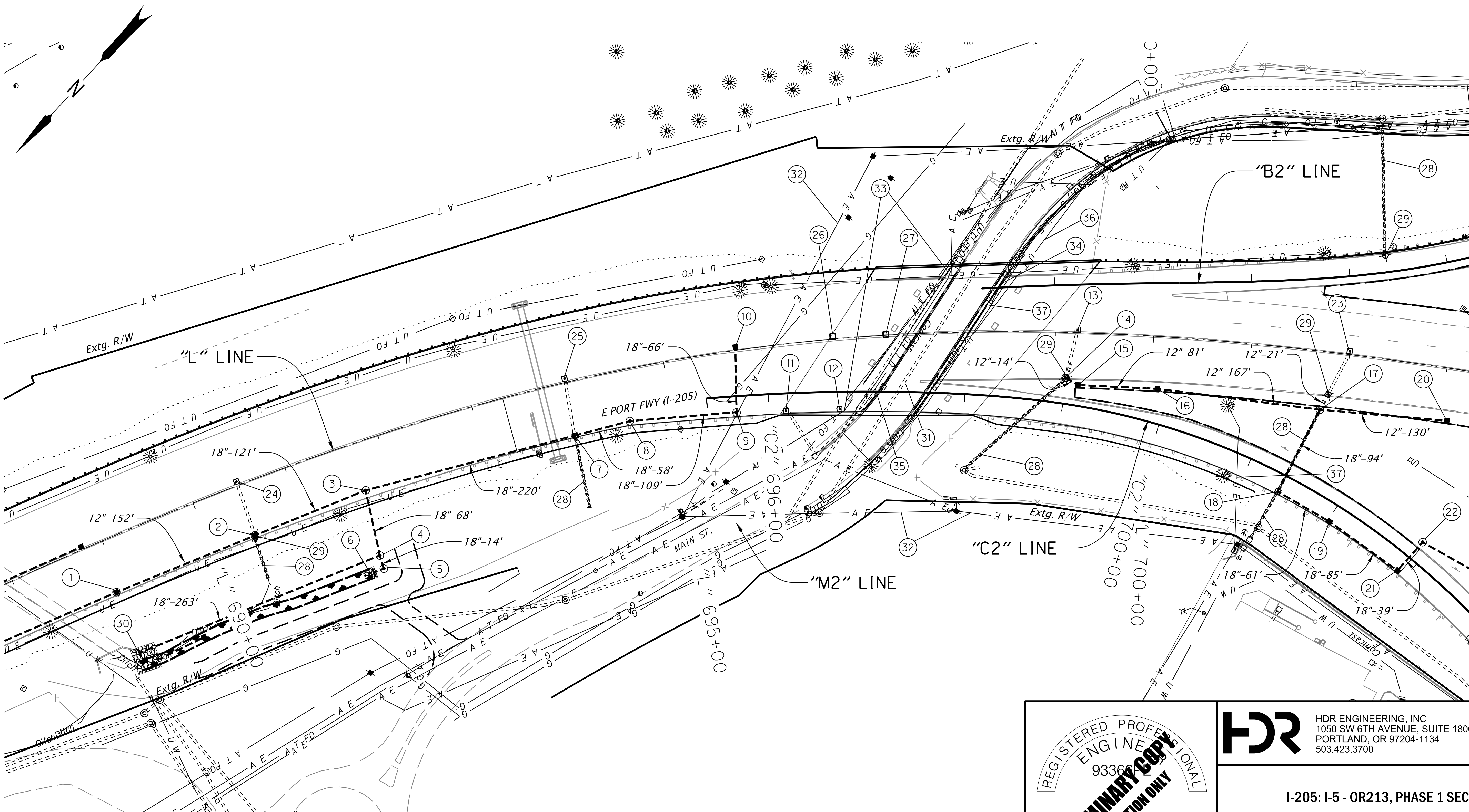
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C03C

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

Sec. 29, T. 2 S, R. 2 E, W.M.
OREGON CITY INTERCHANGE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C04C

Rotation: 212.6746° Scale: 1"=100'

1. See sht. C03B, note 10

2. Sta. "L" 690+47.07, Rt.
Const. storm sew. manhole w/ type "G-2" inlet
Inst. 12" storm sew. pipe - 152'
20' Depth
Trench resurfacing - 51 sq. yd.
Connect existing sewer

3. Sta. "L" 691+70.34, 48.99' Rt.
Const. storm sew. manhole w/ outside drop
Inst. 18" storm sew. pipe - 121'
20' Depth
Inst. 18" storm sew. pipe - 220'
5' Depth
Trench resurfacing - 158 sq. yd.
(See drg. no. RD350)

4. Sta. "L" 691+62.42, 116.45' Rt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 68'
20' Depth
(For details, see sht. HA17)

5. See sht. HA03, note 7

6. Sta. "L" 691+52.67, 130.80' Rt. to Sta. "L" 688+85.28, 133.45' Rt.
Const. bioretention pond
(For details, see sht. HA03)

7. Sta. "L" 693+94.84, Rt.
Adjust inlet
Inst. 18" storm sew. pipe - 58'
10' Depth
Trench resurfacing - 27 sq. yd.
Connect to existing structure

8. Sta. "L" 694+54.39, 52.51' Rt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 109'
5' Depth
Trench resurfacing - 50 sq. yd.

9. Sta. "L" 695+66.12, 62.53' Rt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 66'
5' Depth
Trench resurfacing - 31 sq. yd.

10. Sta. "L" 695+74.21, Lt.
Const. type "G-2" inlet - 18" Sump

11. Sta. "L" 696+18.15, Rt.
Adjust inlet

12. Sta. "L" 696+74.25, Rt.
Adjust inlet

13. Sta. "L" 699+22.67, Lt.
Adjust inlet

14. Sta. "L" 699+11.58, 46.54' Rt.
Const. storm sew. manhole
Connect existing pipe

15. Sta. "L" 699+24.36, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 14'
5' Depth

16. Sta. "L" 700+07.18, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 81'
5' Depth

17. Sta. "L" 701+76.51, 59.40' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 130'
5' Depth
Inst. 12" storm sew. pipe - 167'
10' Depth
Extend 12" storm sew. pipe - 21'
10' Depth

18. Sta. "C2" 701+39.47, Rt.
Adjust inlet
Inst. 18" storm sew. pipe - 94'
10' Depth
Trench resurfacing - 15 sq. yd.

19. Sta. "C2" 702+01.71, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 61'
5' Depth

20. Sta. "L" 703+08.01, Rt.
Const. type "G-2" inlet - 18" sump

21. Sta. "C2" 702+89.10, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 85'
5' Depth
Trench resurfacing - 39 sq. yd.

22. Sta. "C2" 702+90.61, 20.61' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 39'
5' Depth
Trench resurfacing - 18 sq. yd.

23. Sta. "L" 701+99.46, Lt.
Adjust inlet

24. Sta. "L" 690+48.91, Lt.
Adjust inlet

25. Sta. "L" 693+98.26, Lt.
Adjust inlet

26. Sta. "L" 696+73.82, Lt.
Cap inlet

27. Sta. "L" 697+27.63, Lt.
Cap inlet

28. Remove/abandon pipe - 381'

29. Remove inlet - 3

30. Sta. "L" 688+89.76, 119.44' Rt.
Inst. 18" storm sew. pipe - 263'
10' Depth

31. Protect Clackamas County sewer

32. Protect PGE OH power lines

33. Relocate CBX UG communications lines (By others)

34. Relocate NW Natural 2" poly gas line and UG PGE electric (By others)

35. Relocate Comcast UG communications line (By others)

36. Relocate PGE UG Fiber (By others)

37. Relocate PGE UG electric (By others)

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

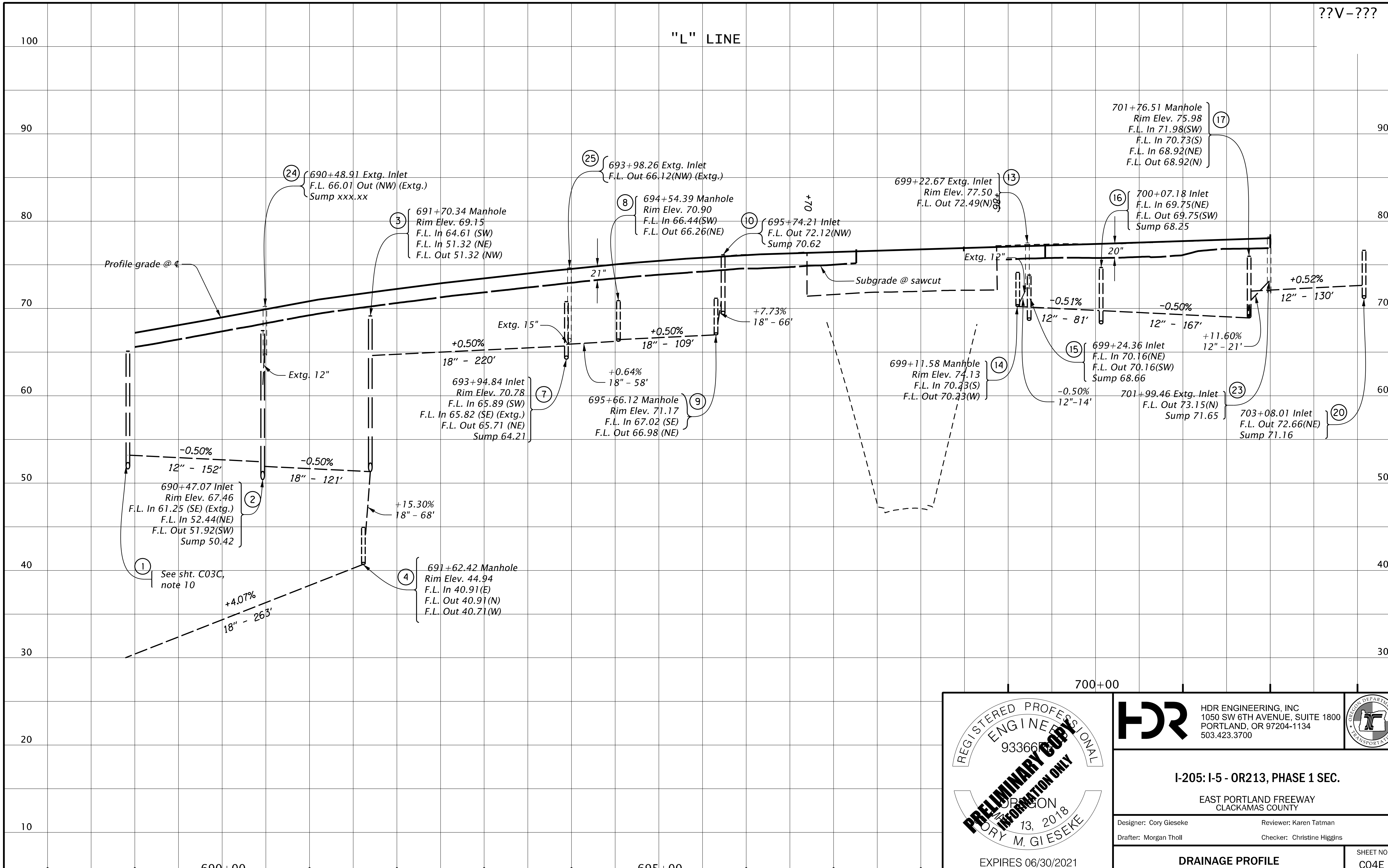
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C04D

Rotation: 0° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

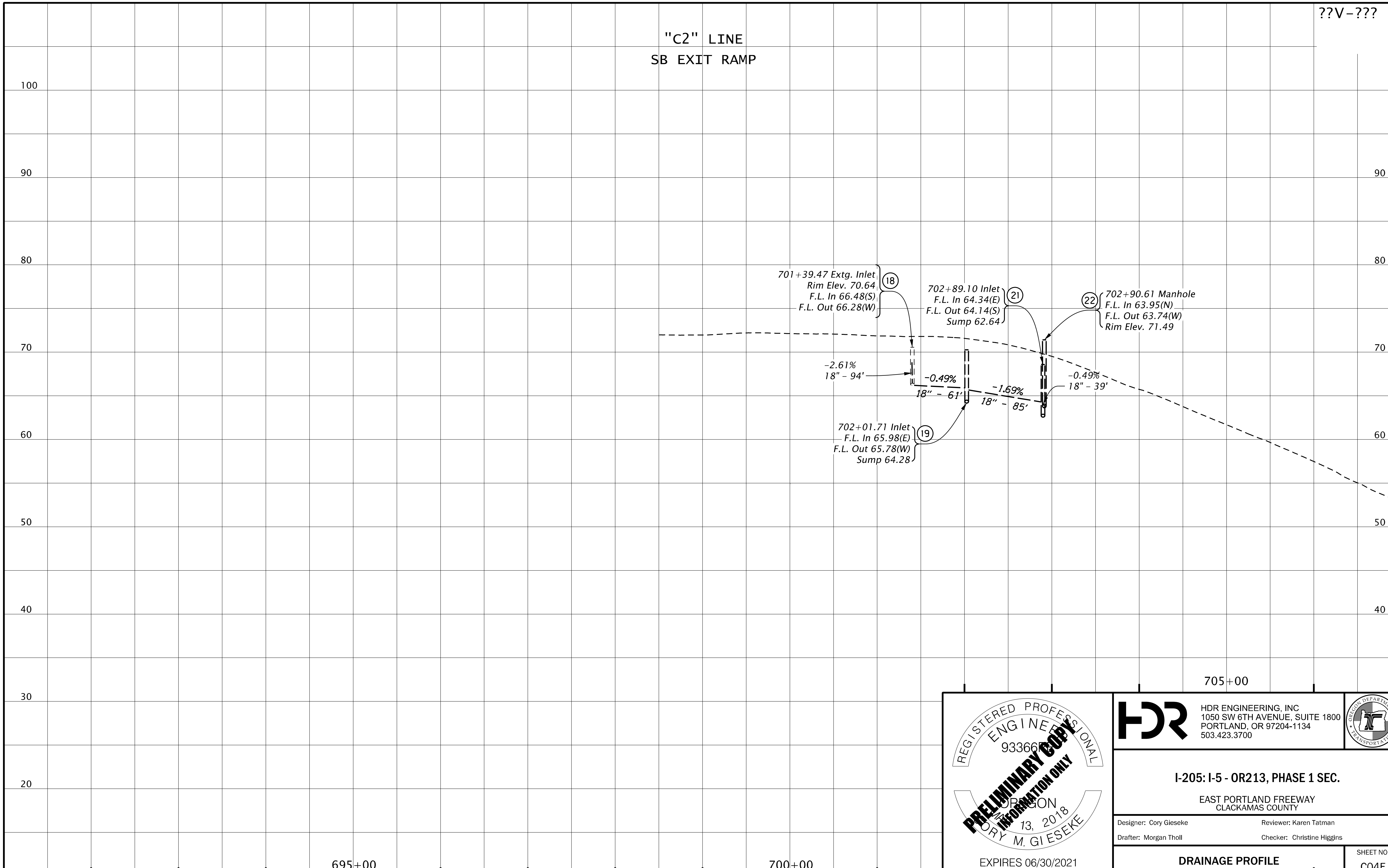
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C04E

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

??V-???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

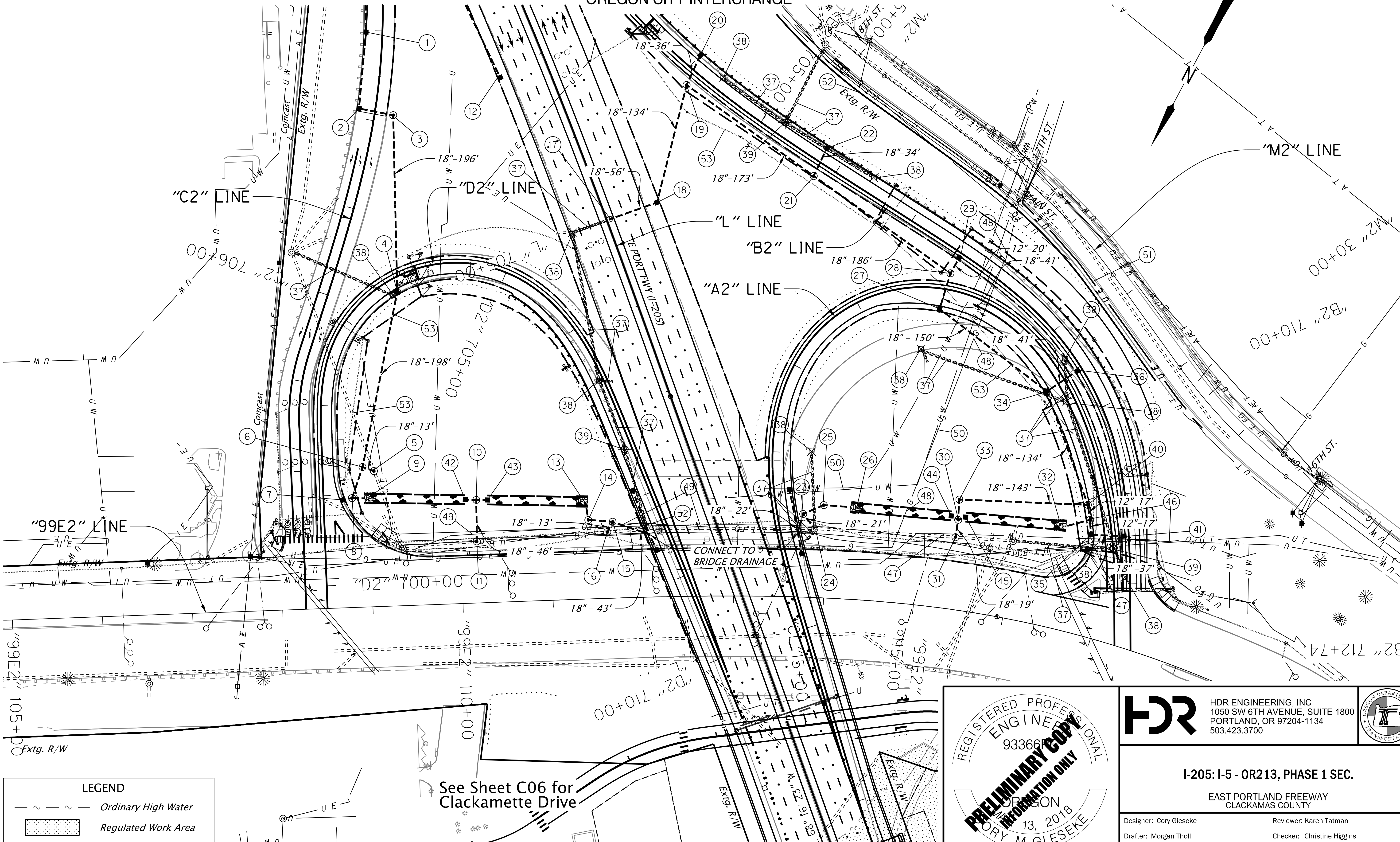
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C04F

Sec. 29, T. 2 S, R. 2 E, W.M.
OREGON CITY INTERCHANGE

??V-???



See Sheet C06 for Clackamette Drive

LEGEND

— ~ — ~ —	Ordinary High Water
(shaded box)	Regulated Work Area

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C05C

Rotation: 272.0412°
Scale: 1"=100'

1 See sht. C04C, note 19

2 See sht. C04C, note 21

3 See sht. C04C, note 22

4 Sta. "D2" 703+67.14, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 196'
10' Depth
Trench resurfacing - 12 sq. yd.

5 Sta. "D2" 701+25.24, 56.96' Rt.
Const. storm sew. manhole over existing sewer
Inst. 18" storm sew. pipe - 13'
5' Depth

6 Sta. "D2" 701+29.99, 44.55' Rt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 198'
5' Depth
(For details, see sht. HA17)

7 Sta. "D2" 700+94.21, Rt.
Const. type "G-2" inlet - 18" Sump

8 See sht. HA04, note 5

9 Sta. "99E2" 108+94.90, 120.45' Lt. to Sta. "99E2" 110+06.66, 114.88' Lt.
Const. biofiltration swale
(For details, see sht. HA04)

10 See sht. HA04, note 7

11 Sta. "99E2" 110+17.87, 68.32' Lt.
Const. storm sew. manhole over existing sewer
Inst. 18" storm sew. pipe - 46'
10' Depth

12 See sht. C04D, note 20

13 Sta. "99E2" 111+42.10, 107.75' Lt. to Sta. "99E2" 110+31.13, 113.76' Lt.
Const. biofiltration swale
(For details, see sht. HA04)

14 See sht. HA04, note 9

15 Sta. "99E2" 111+68.75, 84.58' Lt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 43', S = 1.00%
5' Depth
Connect to bridge drainage
(For details, see sht. HA17)

16 Sta. "99E2" 111+62.31, 73.24' Lt.
Const. storm sew. manhole over existing sewer
Inst. 18" storm sew. pipe - 13'
5' Depth

17 Sta. "L" 704+98.85, Lt.
Adjust inlet

18 Sta. "L" 704+99.63, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 56'
5' Depth
Trench resurfacing - 26 sq. yd.
Connect to extg. structure

19 Sta. "B2" 704+10.45, 17.57' Rt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 134'
5' Depth
Inst. 18" storm sew. pipe - 36'
5' Depth
Trench resurfacing - 17 sq. yd.

20 Sta. "B2" 704+00.42, Lt.
Const. type "G-2" inlet - 18" Sump

21 Sta. "B2" 705+81.57, 16.67' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 34'
5' Depth
Inst. 18" storm sew. pipe - 173'
10' Depth
Trench resurfacing - 16 sq. yd.

22 Sta. "B2" 705+77.05, Rt.
Const. type "G-2" inlet - 18" Sump

23 Sta. "99E2" 113+74.42, 92.04' Lt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 22', S = 1.00%
5' Depth
Connect to bridge drainage
(For details, see sht. HA17)

24 Sta. "99E2" 113+86.99, 76.38' Lt.
Const. storm sew. manhole over existing sewer
Inst. 18" storm sew. pipe - 21'
5' Depth

25 See sht. HA05, note 5

26 Sta. "99E2" 114+24.15, 102.38' Lt. to Sta. "99E2" 115+28.87, 102.40' Lt.
Const. biofiltration swale
(For details, see sht. HA05)

27 Sta. "A2" 705+01.91, Lt.
Const. storm sew. manhole w/ type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 41'
10' Depth

28 Sta. "A2" 704+97.19, 18.05' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 20'
5' Depth
Inst. 18" storm sew. pipe - 186'
10' Depth

29 Sta. "B2" 707+66.43, Rt.
Const. type "G-2" inlet - 18" Sump

30 See sht. HA05, note 7

31 Sta. "99E2" 115+36.07, 79.48' Lt.
Const. storm sew. manhole over existing sewer
Inst. 18" storm sew. pipe - 19'
10' Depth

32 Sta. "99E2" 116+45.63, 114.32' Lt. to Sta. "99E2" 115+43.75, 103.51' Lt.
Const. biofiltration swale
(For details, see sht. HA05)

33 Sta. "99E2" 115+34.87, 121.46' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 143'
10' Depth

34 Sta. "A2" 703+26.53, Lt.
Const. storm sew. manhole w/ type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 41'
5' Depth
Inst. 18" storm sew. pipe - 150'
5' Depth

35 Sta. "A2" 701+49.32, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 37'
5' Depth
Trench resufacing - 17 sq. yd.

36 Sta. "B2" 709+51.44, Rt.
Const. type "G-2" inlet - 18" Sump

37 Remove pipe - 1170'

38 Remove inlet - 11

39 Remove manhole - 3

40 Sta. "A2" 701+84.25, 21.79' Lt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 134'
5' Depth
(For details, see sht. HA17)

41 Sta. "B2" 711+46.87, Rt.
Const. type "G-2" inlet - 18" Sump

42 See sht. HA04, note 6

43 See sht. HA04, note 8

44 See sht. HA05, note 6

45 See sht. HA05, note 8

46 Sta. "A2" 701+66.72, 21.88' Lt.
Const. pollution control manhole
Inst. 12" storm sew. pipe - 17'
5' Depth
Inst. 12" storm sew. pipe - 17'
5' Depth

47 Relocate Oregon City water line (By others)

48 Relocate NW Natural 4 1/2" steel gas line (By others)

49 Relocate CenturyLink fiber optic duct bank (By others)

50 Protect West Linn 24" water line

51 Protect PGE UG electric

52 Relocate PGE UG (By others)

53 Protect ODOT signal conduits

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

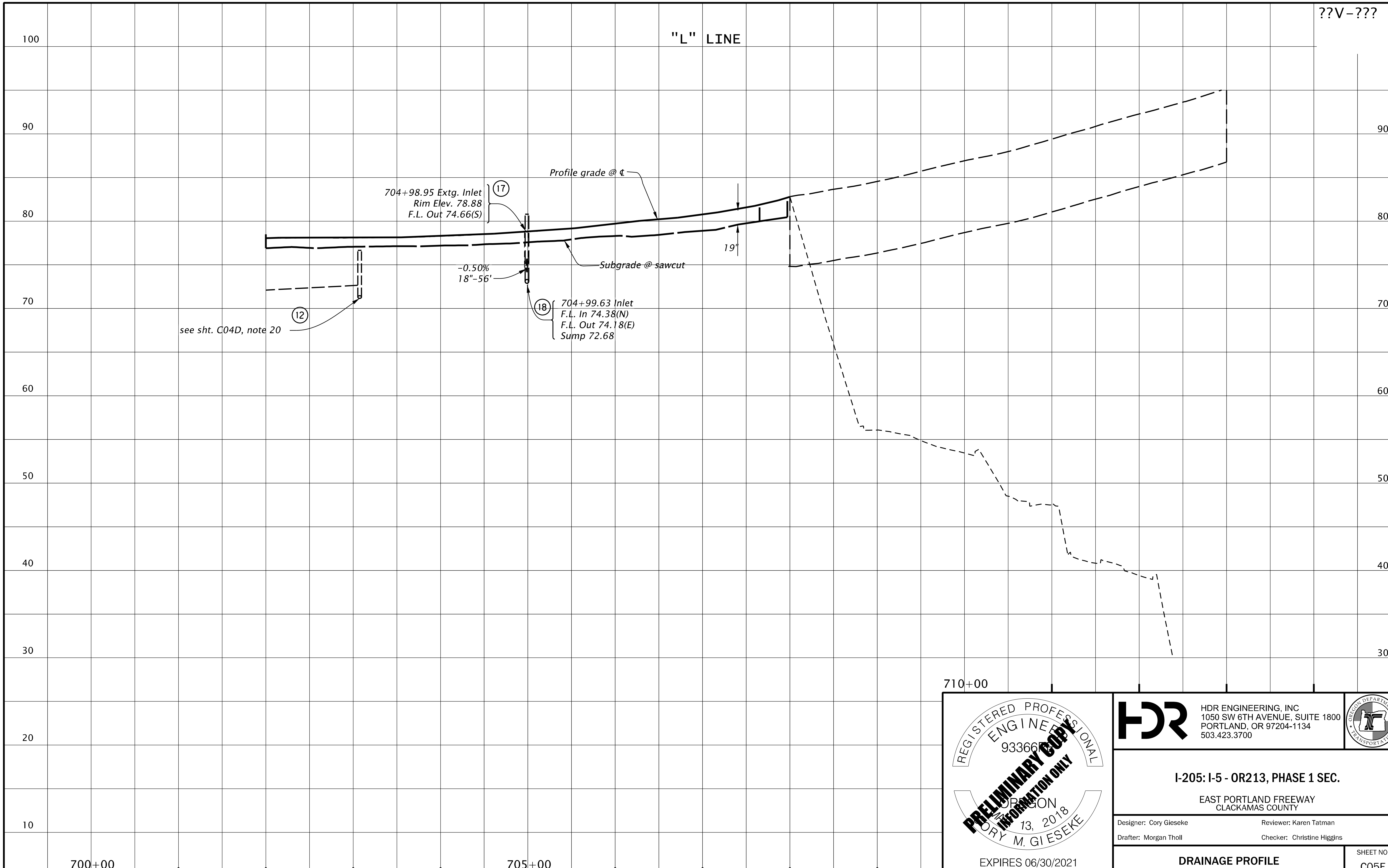
OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES
SHEET NO. C05D

Rotation: 0° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

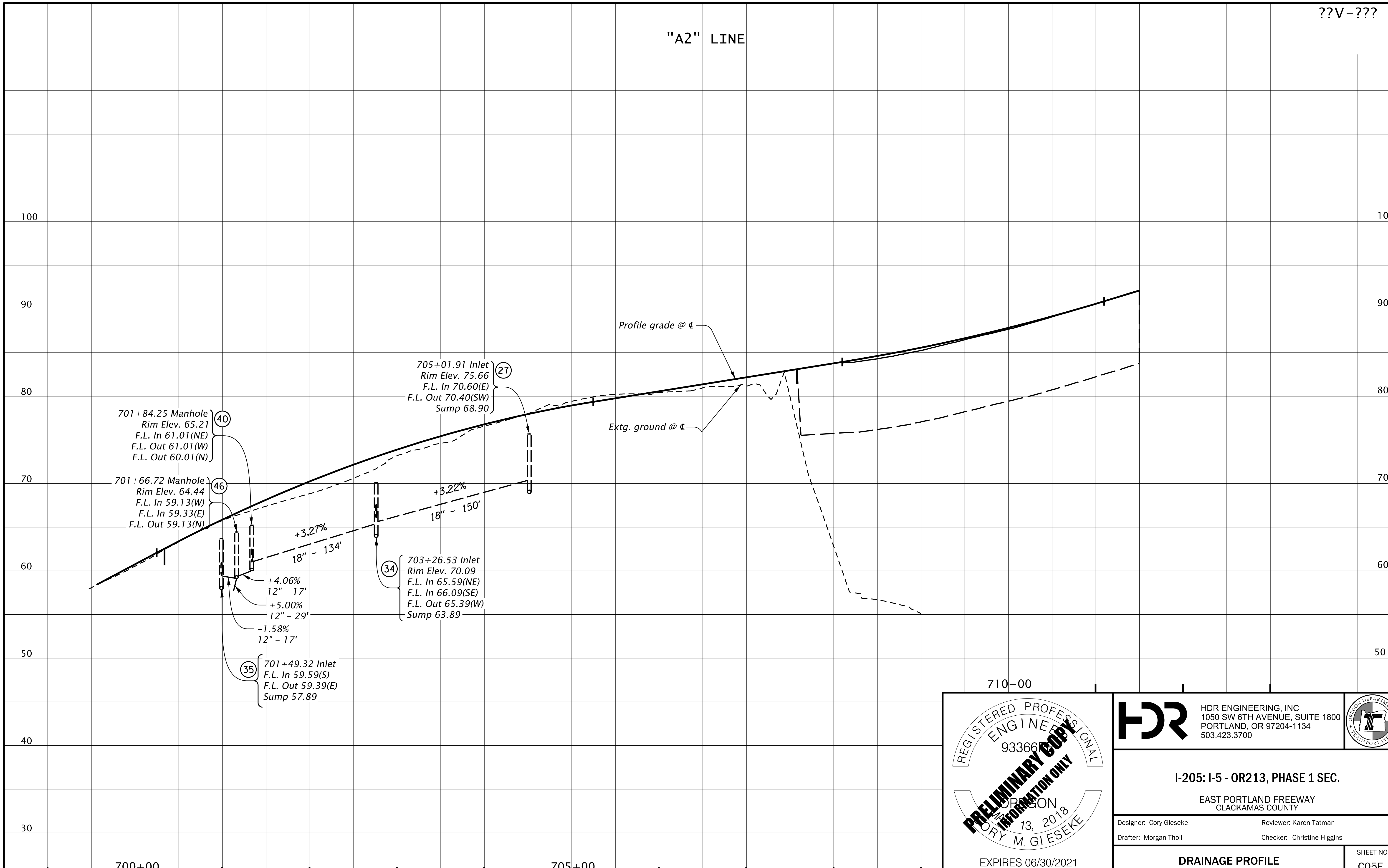
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C05E



REGISTERED PROFESSIONAL ENGINEER
93366PE
PRELIMINARY COPY
INFORMATION ONLY
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

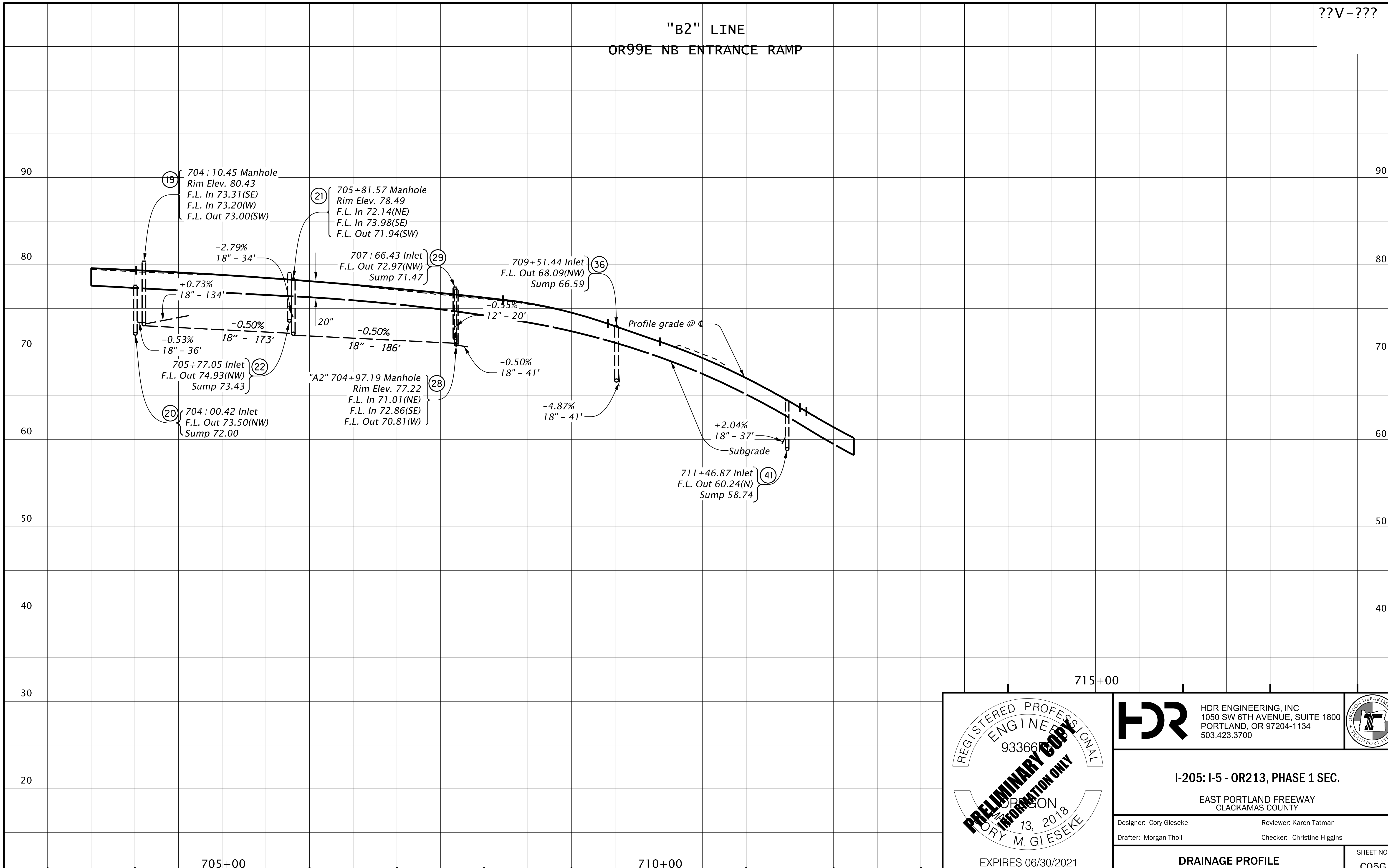
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C05F



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

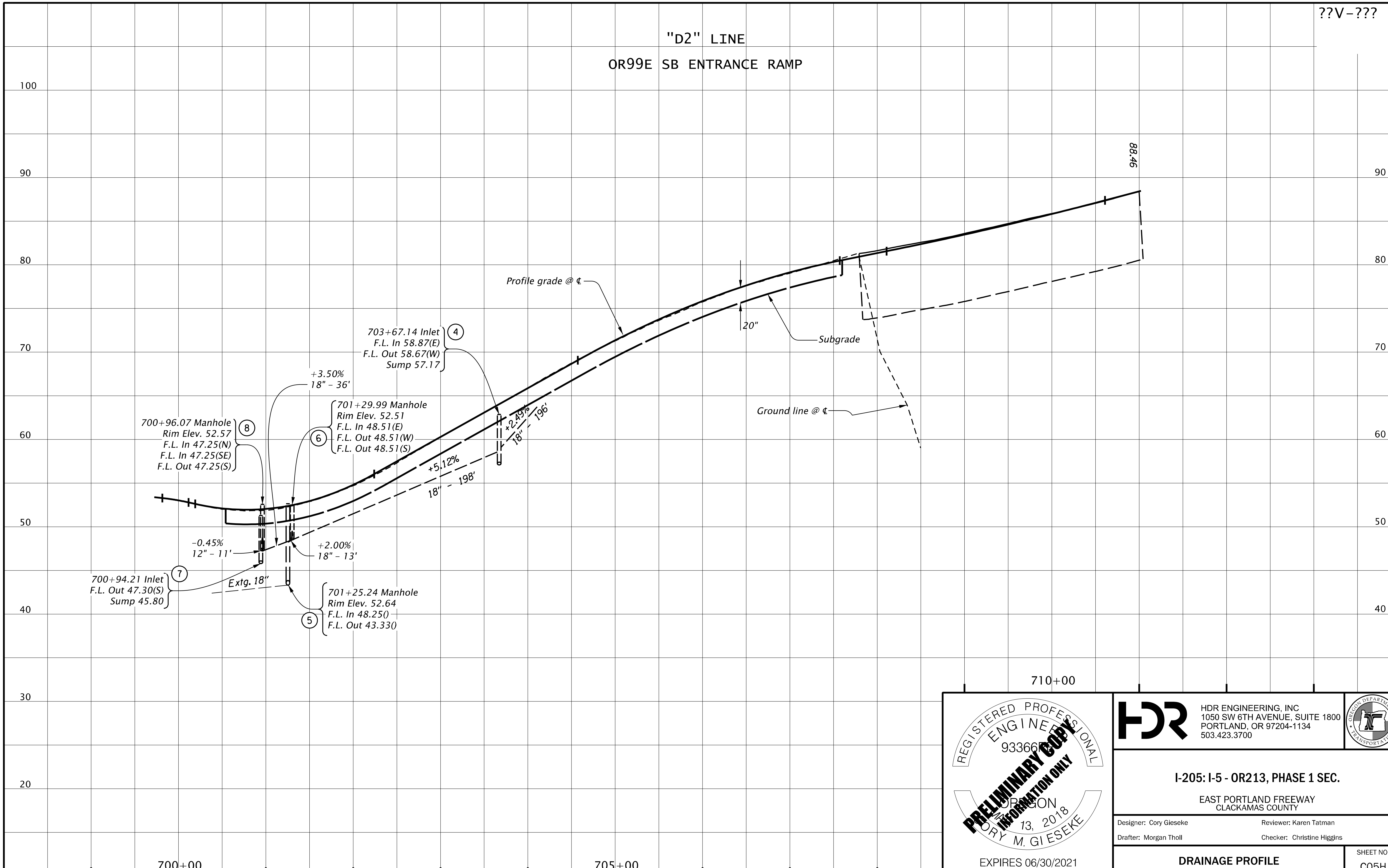
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C05G

??V-???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

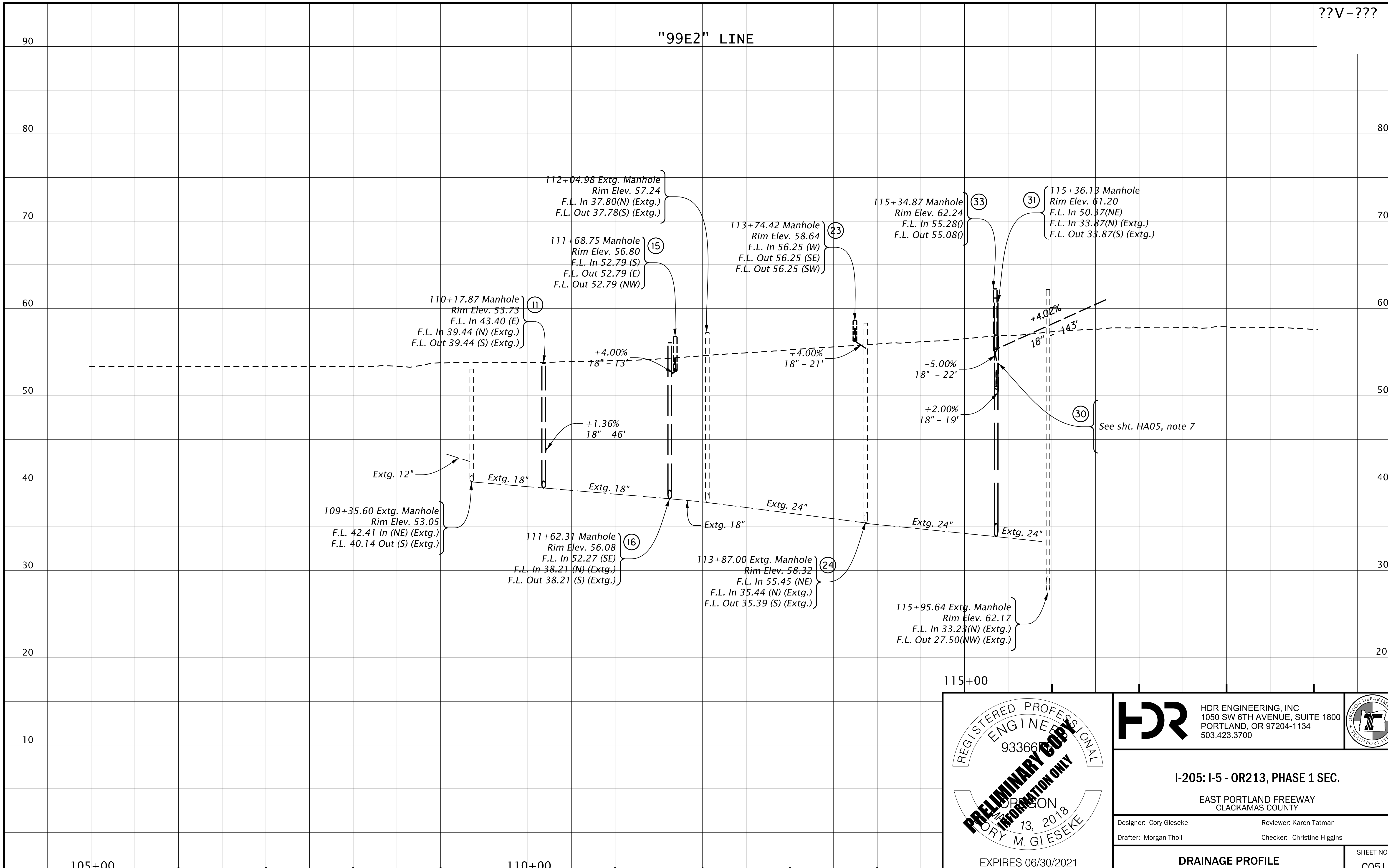
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C05H

??V-???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

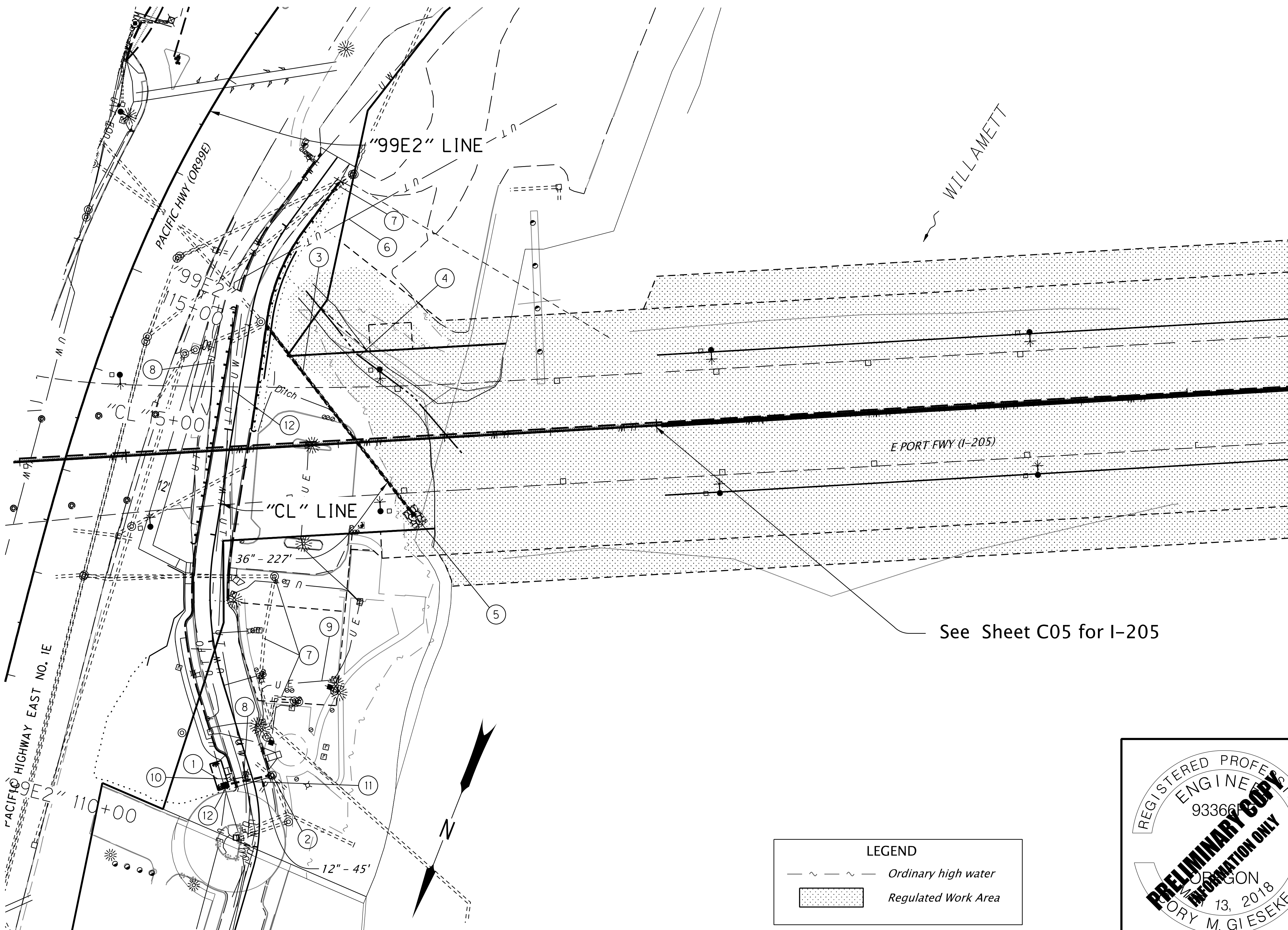
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C05J

Sec. 30, T. 2 S, R. 2 E, W.M.
OREGON CITY INTERCHANGE



1. Sta. "CL" 11+85.69, 27.58' Lt. to Sta. "CL" 11+62.98, 27.28' Lt.
   Const. stormwater planter
   (For details, see sht. HA10)
2. Sta. "CL" 11+63.04, 18.86' Rt.
   Adjust manhole
   Inst. 12" storm sew. pipe - 45'
   10' Depth
   Connect to existing structure
3. Remove pipe - 227'
4. Const. Abernethy Creek
   (For details, see sht. FC01 - FC02)
5. Sta. "CL" 14+47.54, 181.74' Rt.
   Const. riprap basin
   Loose riprap (class 50) - 5.0 tons
   Inst. 36" storm sew. pipe
   w/ sloped end section - 227'
   20' Depth
6. Protect CenturyLink UG communications
7. Protect Oregon City sanitary sewer
8. Relocate CenturyLink fiber optic duct bank (By others)
9. Relocate PGE UG electric
10. Relocate fire hydrant (By others)
11. Relocate Oregon City waterline (By others)
12. Relocate PG UG Electric (By others)

LEGEND

— ~ — ~ —	Ordinary high water
(dotted box)	Regulated Work Area

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke — Reviewer: Karen Tatman
Drafter: Morgan Tholl — Checker: Christine Higgins

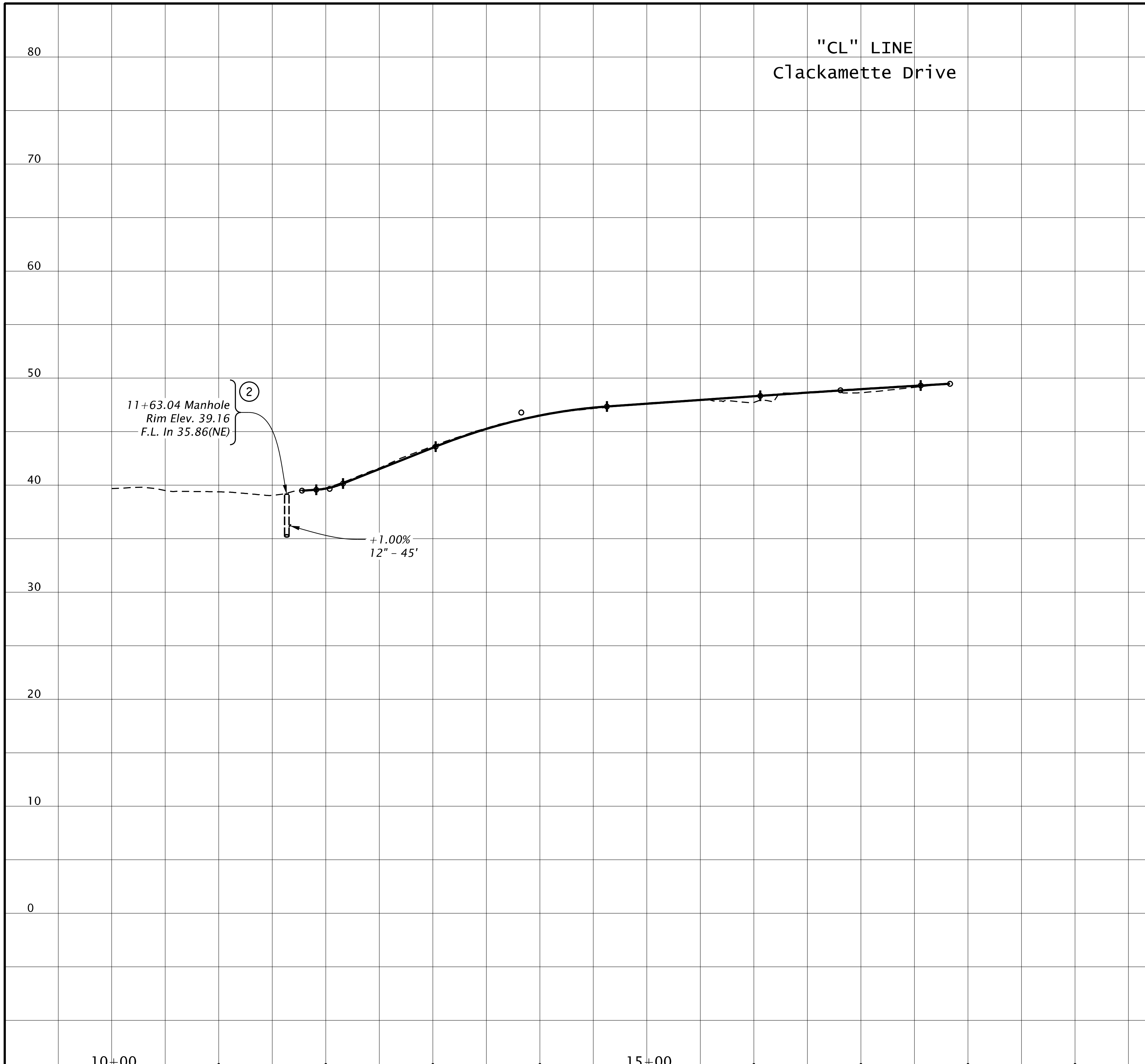
DRAINAGE & UTILITIES

SHEET NO. C06B

Rotation: 198.4431° Scale: 1"=100'

??V-???

"CL" LINE
Clackamette Drive



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

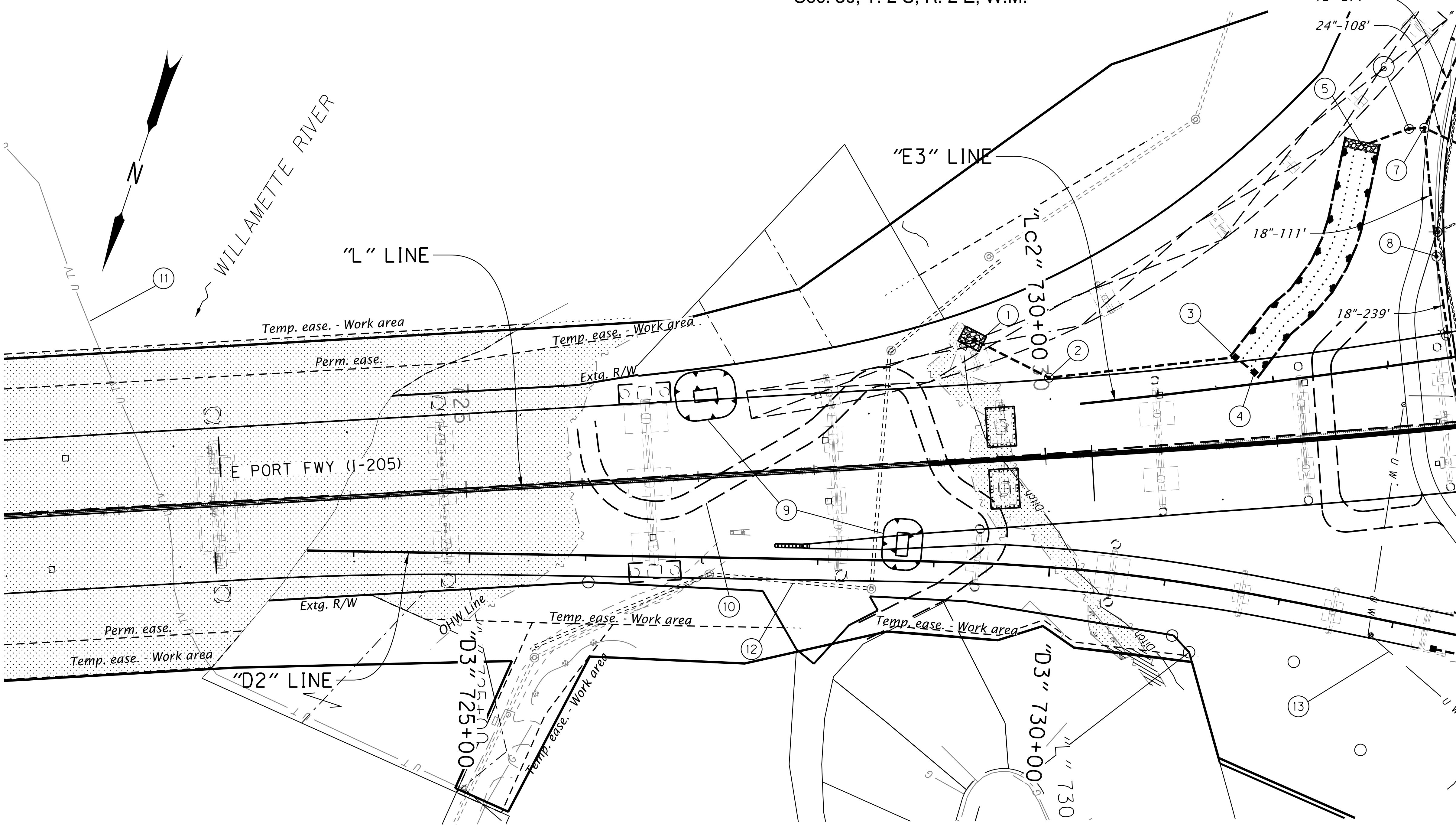
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C06C

Sec. 30, T. 2 S, R. 2 E, W.M.



1. See sht. HA07, note 4
2. See sht. HA07, note 3
3. See sht. HA06, note 5
4. See sht. HA06, note 6
5. Sta. "OR43" 10+12.40, 104.31' Lt. to Sta. "OR43" 8+77.47, 208.62' Lt.
   Const. biofiltration swale
   (For details, see sht. HA06)
6. See sht. HA06, note 8
7. Sta. "OR43" 10+29.84, 53.44' Lt.
   Const. diversion manhole
   Inst. 12" storm sew. pipe - 271'
   10' Depth
   Inst. 18" storm sew. pipe - 111'
   10' Depth
   Inst. 24" storm sew. pipe - 108'
   10' Depth
   (For details, see sht. HA17)
   (For profile, see sht. C08G)
8. Sta. "OR43" 9+31.77, 33.19' Lt.
   Const. storm sew. manhole
   Inst. 18" storm sew. pipe - 239'
   10' Depth
   (For profile, see sht. C08G)
9. Const. water quality facilities for bridge drainage
10. Const. access road
11. Abandon CenturyLink submarine cable (By others)
12. Relocate West Linn sanitary (By others)
13. Relocate West Linn water line (By others)

LEGEND

- Ordinary high water
- Wetlands
- No Work Area
- Regulated Work Area

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

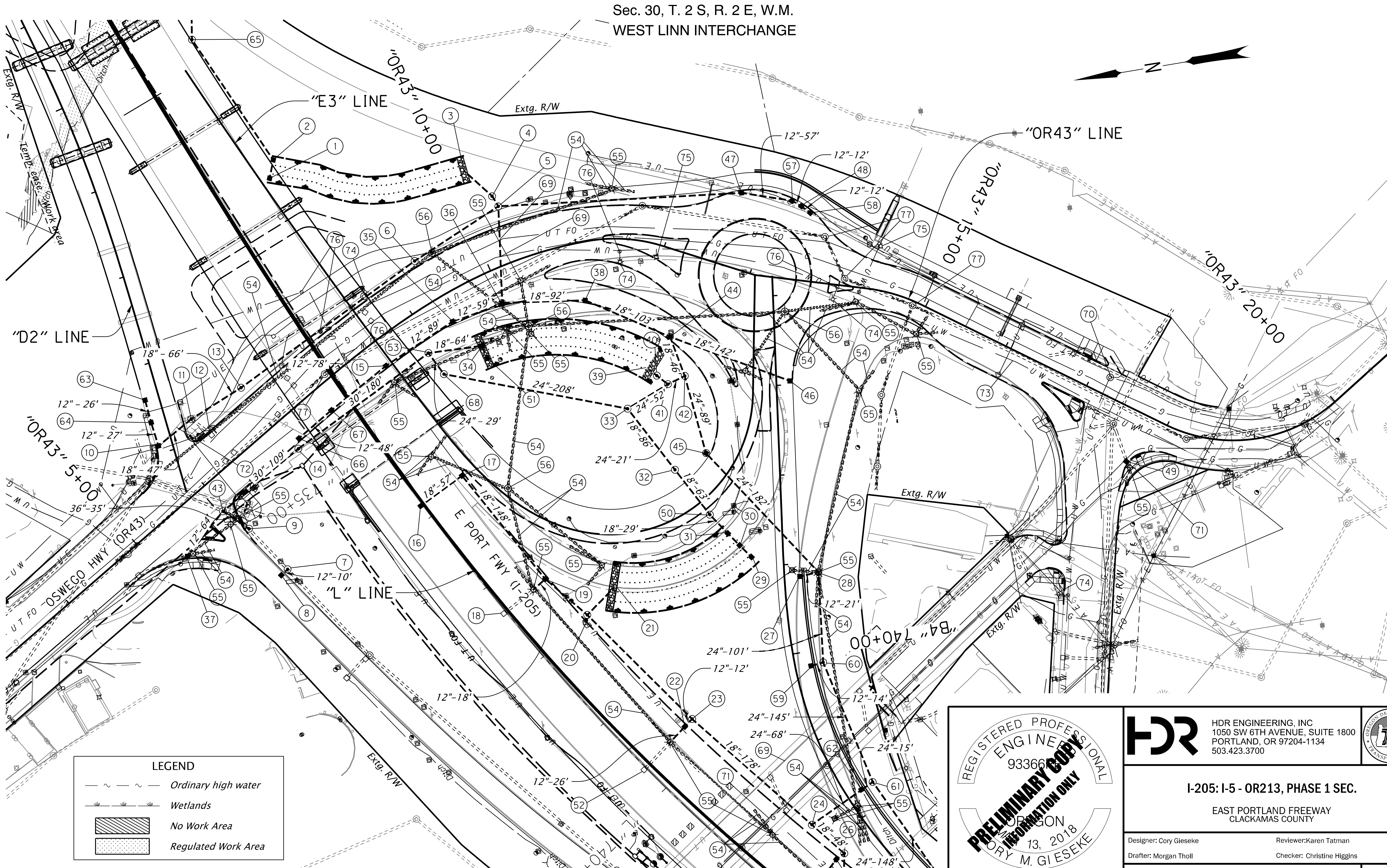
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO. C07B

Rotation: 198.4431° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C08C

Rotation: 260.6437° Scale: 1"=100'

1. See C07B, note 4
2. See C07B, note 3
3. See C07B, note 5
4. See HA06, note 8
5. See C07B, note 7
6. See C07B, note 8
7. Sta. "C4" 734+99.68, 13.15' Lt.
   Const. storm sew. manhole over existing sewer
   Inst. 12" storm sew. pipe - 10'
   5' Depth
8. Sta. "C4" 734+99.49, Lt.
   Const. type "G-2" inlet - 18" Sump
9. Sta. "OR43" 6+05.93, 68.69' Rt.
   Const. storm sew. manhole over existing sewer
10. Sta. "D2" 733+92.05, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 27'
    5' Depth
11. Sta. "D2" 733+73.30, 27.71' Lt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 47'
    5' Depth
    Connect extg. 12" storm sewer pipe
12. Sta. "D2" 733+94.54, 47.16' Lt.
    Adjust inlet
13. Sta. "OR43" 7+02.39, 55.56' Lt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 66'
    5' Depth
14. Sta. "OR43" 7+06.05, 37.39' Rt.
    Const. storm sew. manhole
    Inst. 30" storm sew. pipe - 180'
    5' Depth
15. Sta. "OR43" 8+41.86, 32.03' Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 78'
    5' Depth
16. Sta. "L" 735+83.55, Rt.
    Const. type "G-2" inlet - 18" Sump
17. Sta. "E3" 735+77.22, 14.30' Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 57'
    5' Depth
    Trench resurfacing - 26 sq. yd.
18. Sta. "L" 737+37.54, Rt.
    Adjust inlet
19. Sta. "L" 737+34.33, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 148'
    5' Depth
    Trench resurfacing - 16 sq. yd.
    Extend extg. 12" pipe - 18'
20. See sht. HA09, note 4
21. Sta. "E3" 737+52.57, 56.87' Rt. to Sta. "E3" 738+66.37, 64.42' Rt.
    Const. biofiltration swale
    Const. riprap basin
    (For details, see sht. HA09)
22. Sta. "L" 739+69.26, Lt.
    Const. type "G-2" inlet - 18" Sump
    Extend 12" storm sew. pipe - 26'
23. Sta. "L" 739+65.94, 74.67' Lt.
    Const. storm sew. manhole
    Inst. 12" storm sew. pipe - 12'
    5' Depth
    Inst. 18" storm sew. pipe - 178'
    10' Depth
24. Sta. "L" 741+50.10, 79.65' Lt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 48'
    10' Depth
25. Sta. "L" 741+97.14, Lt.
    Const. type "G-2" inlet
    Inst. 12" storm sew. pipe - 63'
    x' Depth
26. See C09C, note 10
27. Sta. "B4" 739+13.79, Lt.
    Const. type "G-2" inlet - 18" Sump
28. Sta. "B4" 739+10.44, 37.95' Lt.
    Const. storm sew. manhole
    Inst. 12" storm sew. pipe - 21'
    5' Depth
    Inst. 24" storm sew. pipe - 101'
    5' Depth
29. See sht. HA09, note 7
30. See sht. HA09, note 6
31. See sht. HA09, note 5
32. Sta. "E3" 738+63.13, 46.04' Lt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 63'
    10' Depth
33. Sta. "OR43" 12+15.17, 184.58' Rt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 86'
    5' Depth
    Inst. 24" storm sew. pipe - 52'
    5' Depth
34. See sht. HA08, note 7
35. Sta. "OR43" 9+35.10, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 89'
    5' Depth
36. Sta. "OR43" 10+02.36, Rt.
    Const. storm sew. manhole w/ type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 59'
    10' Depth
    Inst. 18" storm sew. pipe - 92'
    10' Depth
37. Sta. "OR43" 5+29.79, 49.13' Rt.
    Const. type "G-2" inlet over extg. sewer - 18" Sump
38. Sta. "OR43" 11+11.99, 65.27' Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 103'
    5' Depth
39. Sta. "E3" 740+37.28, 107.23' Lt. to Sta. "OR43" 9+52.79, 60.58' Rt.
    Const. biofiltration swale
    Const. riprap basin
    Inst. 12" storm sew. pipe - 11'
    x' Depth
    (For details, see sht. HA07)
40. See sht. HA08, note 5
41. Sta. "OR43" 12+49.77, 145.15' Rt.
    Const. diversion manhole
    Inst. 24" storm sew. pipe - 21'
    5' Depth
    (For details, see sht. HA17)
42. Sta. "OR43" 12+64.91, 130.68' Rt.
    Const. diversion manhole
    Inst. 24" storm sew. pipe - 89'
    5' Depth
    (For details, see shts. HA18)
43. Sta. "OR43" 5+96.78, 34.94' Rt.
    Const. storm sew. manhole over existing sewer
    Inst. 12" storm sew. pipe - 64'
    5' Depth
    Inst. 30" storm sew. pipe - 109'
    5' Depth
    Inst. 36" storm sew. pipe - 35'
    5' Depth
44. Sta. "OR43" 12+35.36, 96.80' Rt.
    Const. manhole with type "G-2" inlet
    Inst. 18" storm sew. pipe - 46'
    5' Depth
    Inst. 18" storm sew. pipe - 142'
    10' Depth
45. Sta. "E3" 739+15.44, 32.23' Lt.
    Const. manhole with type "D" inlet
    Inst. 24" storm sew. pipe - 182'
    10' Depth
46. Sta. "B4" 736+95.67, 18.07' Lt.
    Const. type "G-2" inlet - 18" Sump
47. Sta. "OR43" 12+62.73, 85.28' Lt.
    Const. type "G-2" inlet
    Inst. 12" storm sew. pipe - 57'
    5' Depth
48. Sta. "OR43" 13+49.43, 84.54' Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 12'
    5' Depth
49. Sta. "OR43" 17+76.87, 55.36' Rt.
    Const. type "G-2" inlet - 18" Sump
    Connect existing sewer
50. Sta. "E3" 738+61.43, 17.19' Rt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 29'
    5' Depth
51. See sht. HA08, note 6
52. Sta. "L" 739+68.75, Rt.
    Adjust inlet
53. Sta. "OR43" 8+90.34, 45.60' Rt.
    Const. storm sew. manhole
    Inst. 18" storm sew. pipe - 64'
    5' Depth
    Inst. 24" storm sew. pipe - 29'
    5' Depth
54. Remove pipe - 3612'
55. Remove inlet - 21
56. Remove manhole - 4
57. Sta. "OR43" 13+39.72, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 12'
    5' Depth
58. Sta. "OR43" 13+61.62, Lt.
    Const. type "G-2" inlet - 18" Sump
59. Sta. "B4" 740+17.26, 16.85' Lt.
    Const. type "G-2" inlet - 18" Sump
60. Sta. "B4" 740+15.99, 31.35' Lt.
    Const. storm sew. manhole
    Inst. 12" storm sew. pipe - 14'
    5' Depth
    Inst. 24" storm sew. pipe - 145'
    10' Depth
61. Sta. "B4" 741+73.01, 32.09' Lt.
    Const. storm sew. manhole
    Inst. 24" storm sew. pipe - 15'
    5' Depth
    Inst. 24" storm sew. pipe - 148'
    5' Depth
62. Sta. "B4" 741+73.00, 16.92' Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 24" storm sew. pipe - 68'
    10' Depth

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C08D

Rotation: 0° Scale: 1"=100'

63 *Sta. 733+38.11, Rt.*
Const. type "G-2" inlet - 18" Sump

64 *Sta. 733+64.02, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 26'
5' Depth

65 *See C07B, note 2*

66 *Sta. "OR43" 7+11.01, Rt.*
Const. type "G-2" inlet - 18" Sump

67 *Sta. "OR43" 7+59.10, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 48'
5' Depth

68 *Sta. "OR43" 8+83.90, 89.84' Rt.*
Const. storm sew. manhole
Inst. 24" storm sew. pipe - 208'
10' Depth

69 *Relocate CenturyLink-Local (By others)*

70 *Adjust CenturyLink-Local manhole (By others)*

71 *Relocate NW Natural (By others)*

72 *Relocate PGE UG electric (By others)*

73 *Relocate West Linn waterline (By others)*

74 *Relocate West Linn fire hydrant (By others)*

75 *Relocate West Linn water meter (By others)*

76 *Adjust West Linn water valves (By others)*

77 *Adjust West Linn sanitary manhole (By others)*

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

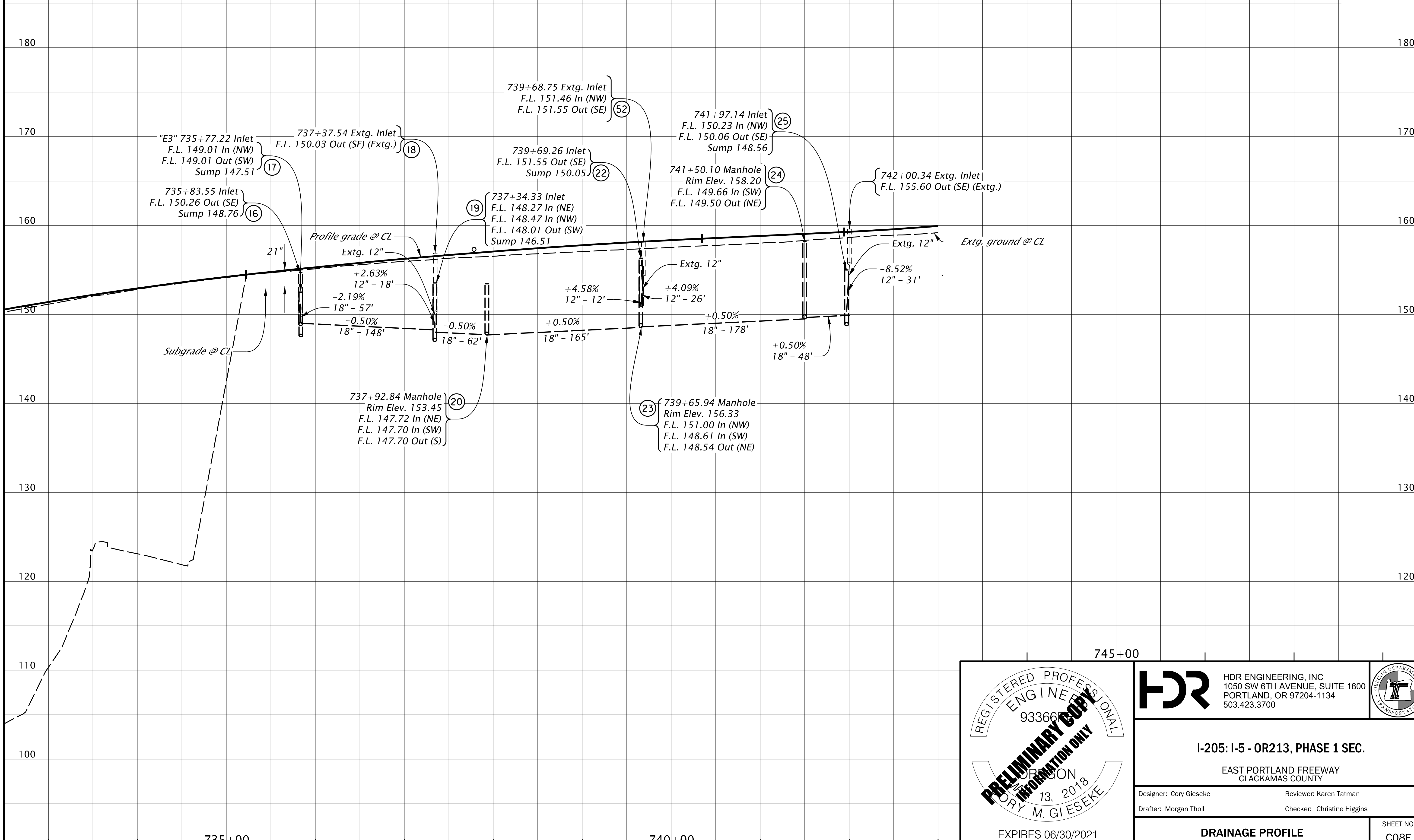
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO.
C08E

Rotation: 0° Scale: 1"=100'

"L" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

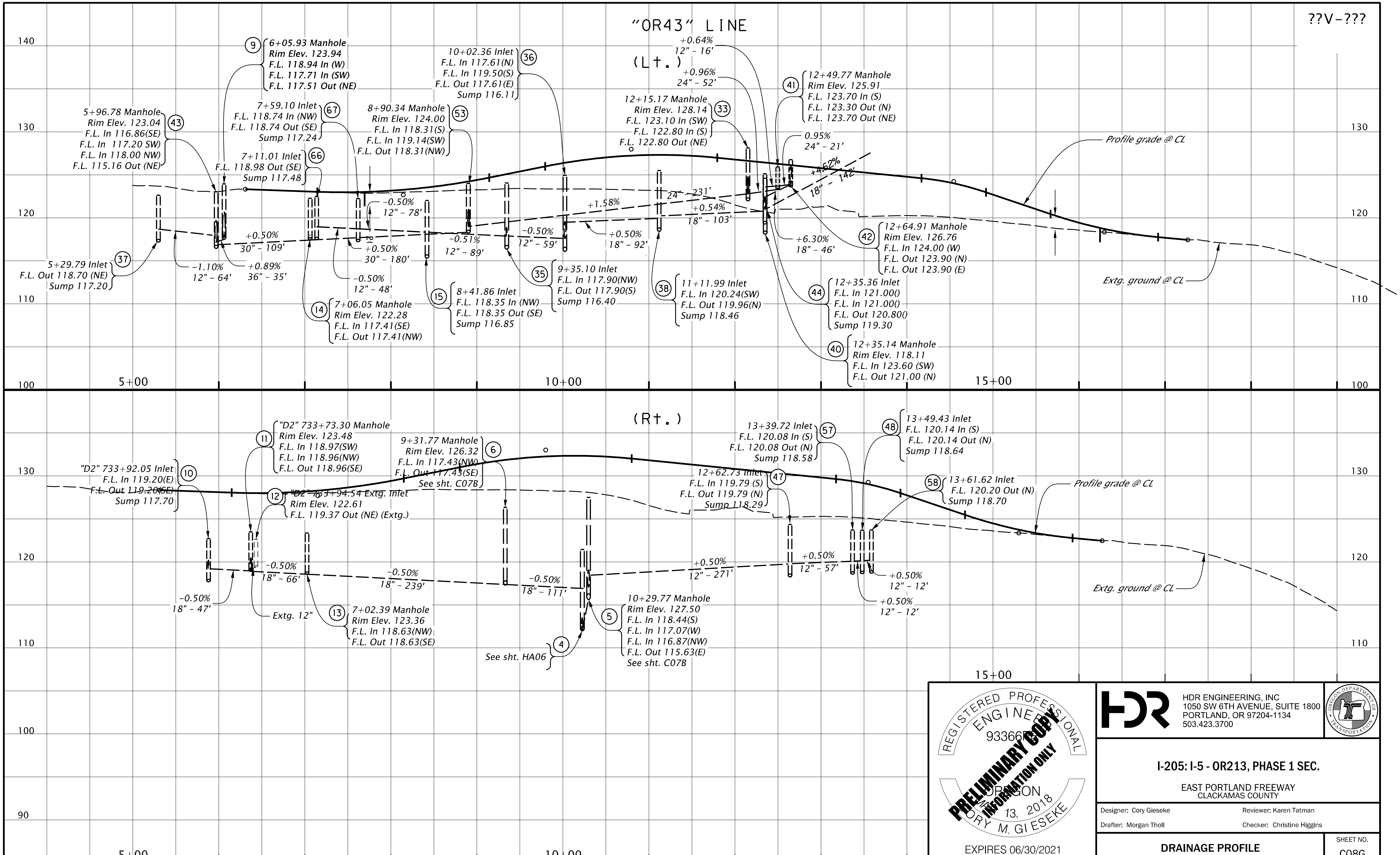
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C08F



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021
PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

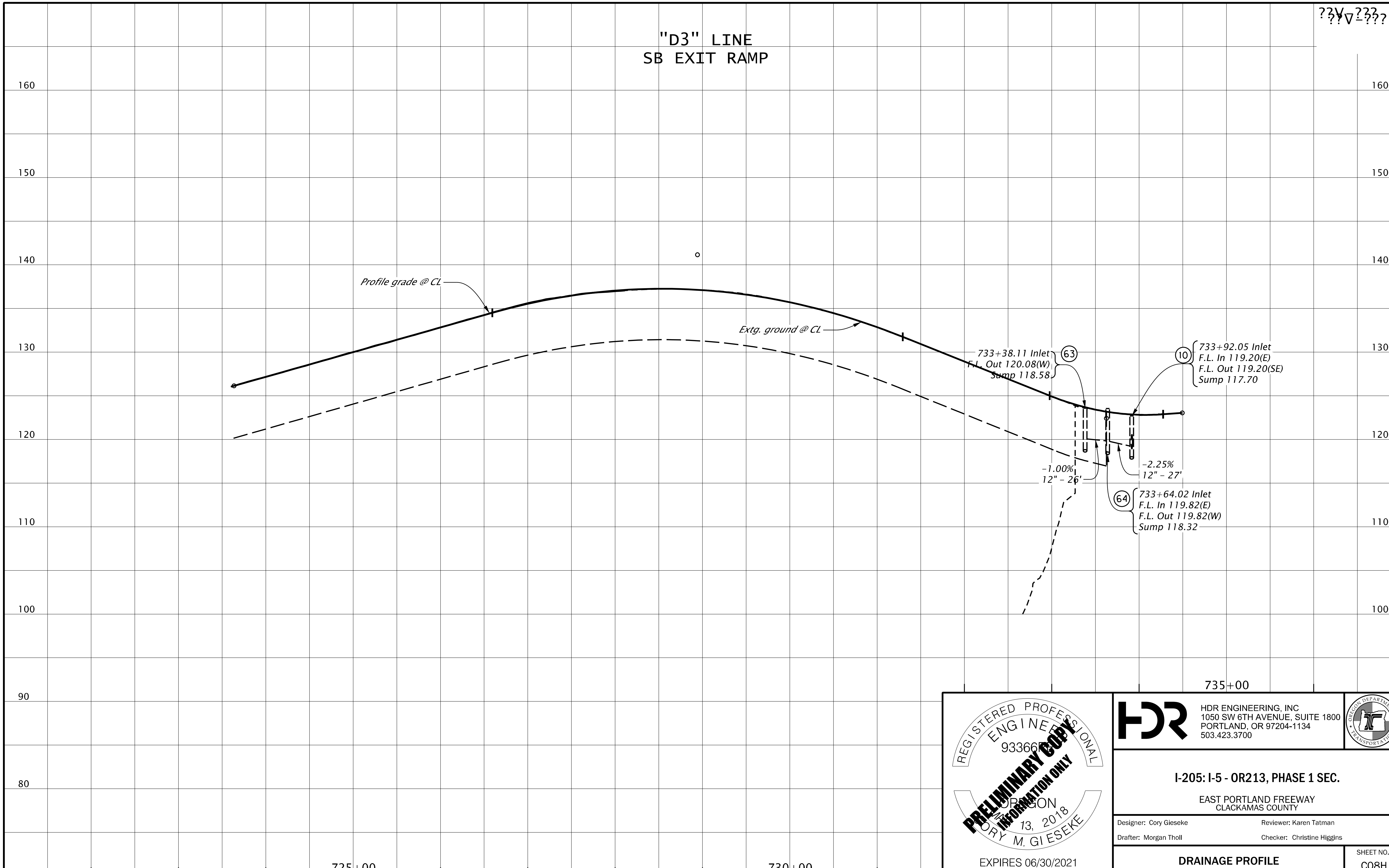
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C08G



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

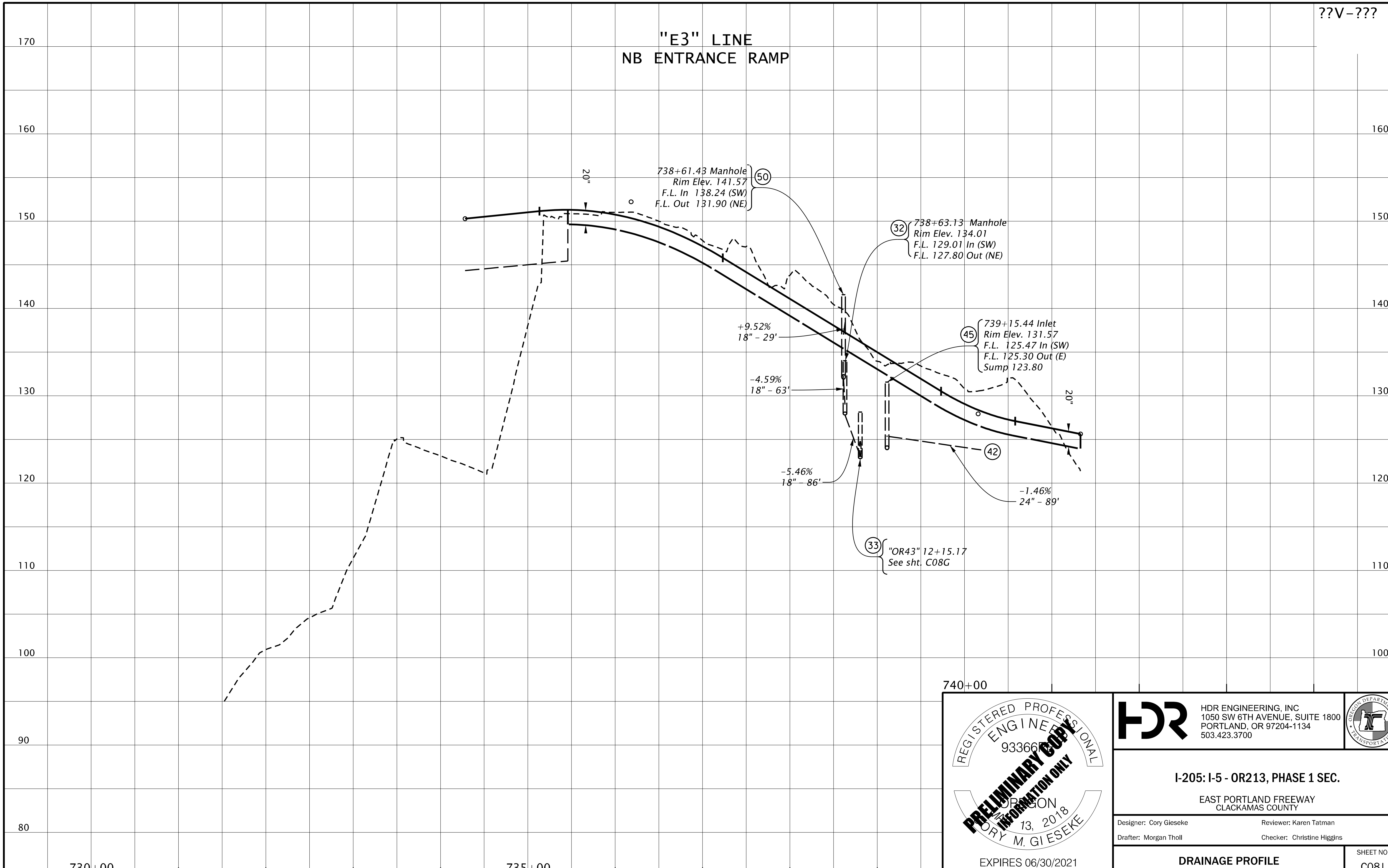
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C08H



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

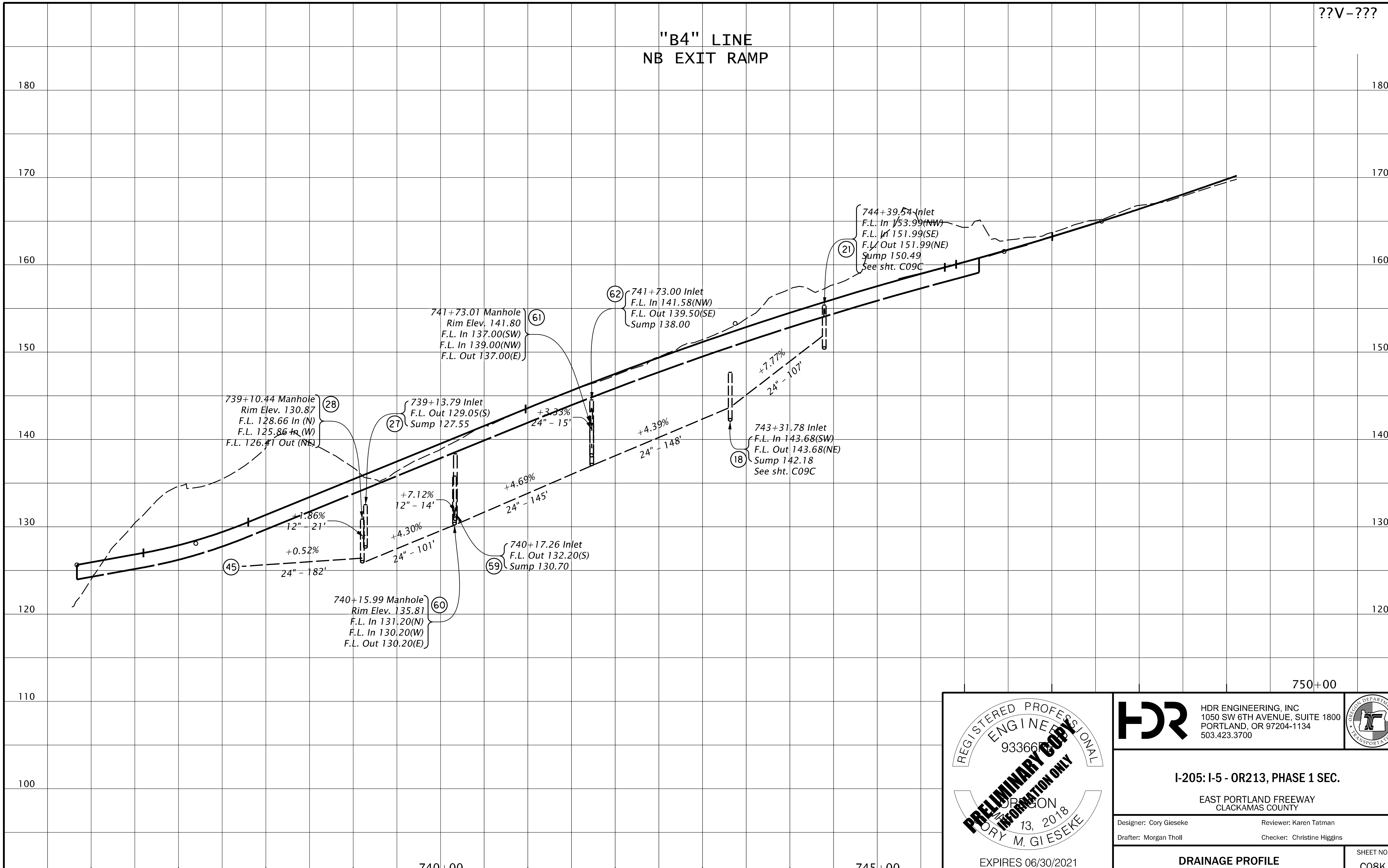
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C08J



HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

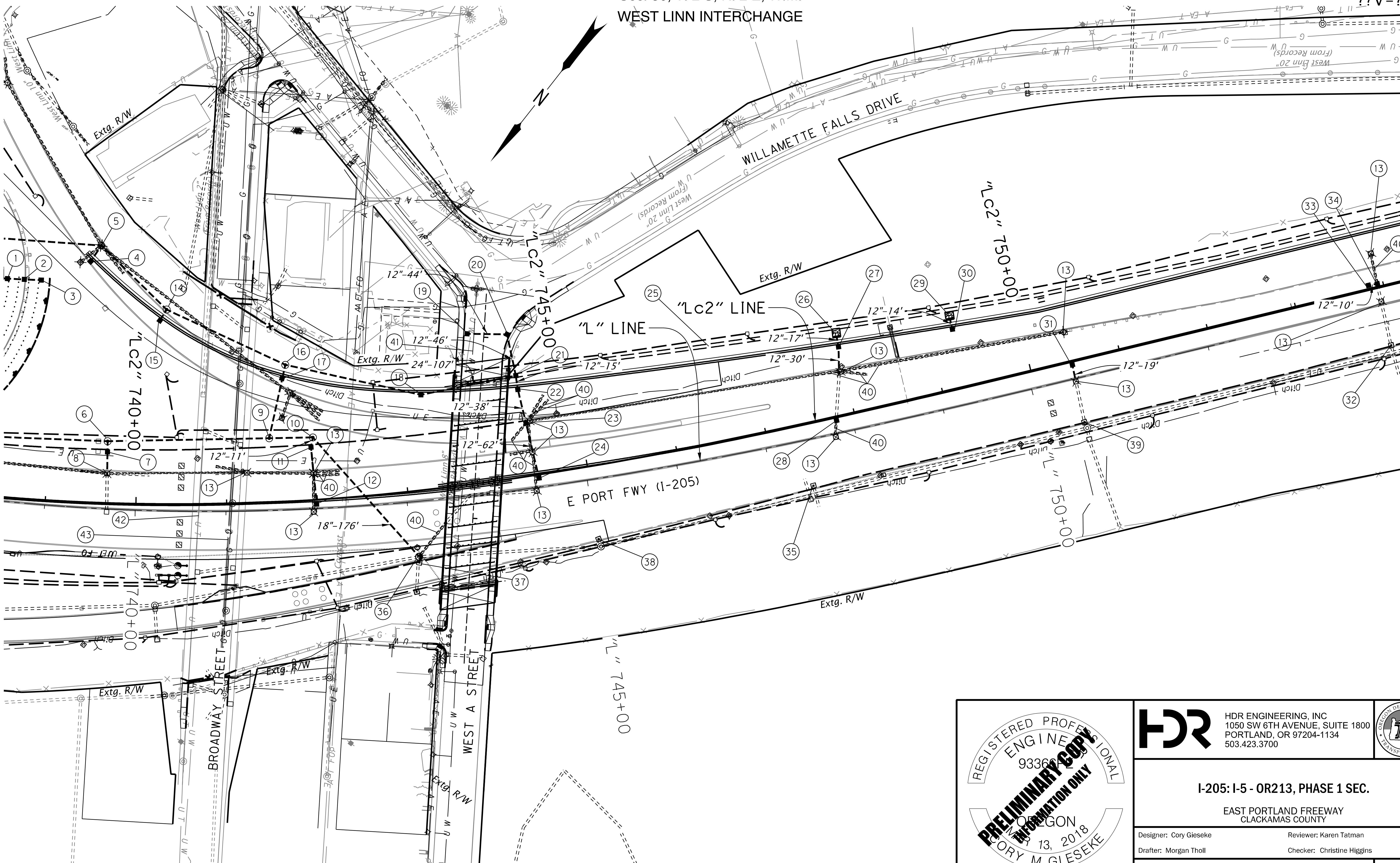
SHEET NO.
C08K

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

Sec. 30, T. 2 S, R. 2 E, W.M.

WEST LINN INTERCHANGE

??V–???



PRELIMINARY COPY INFORMATION ONLY

REGISTERED PROFESSIONAL ENGINEER 93360PE OREGON MAY 13, 2018 CORY M. GIESEKE

EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO. C09C

Rotation: 218.1362° Scale: 1"=100'

(1) See C08C, note 31

(2) See C08C, note 30

(3) See C08C, note 29

(4) See C08C, note 27

(5) See C08C, note 28

(6) See C08C, note 23

(7) See C08C, note 22

(8) See C08C, note 55

(9) See C08C, note 24

(10) Sta. "Lc2" 741+99.97, 68.63' Lt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 11'
5' Depth
Inst. 18" storm sew. pipe - 176'
5' Depth
Trench resurfacing - 81 sq. yd.

(11) See C08C, note 25

(12) Sta. "Lc2" 741+98.86, Rt.
Const. type "G-2" inlet - 18" Sump

(13) Remove inlet - 12

(14) See C08C, note 60

(15) See C08C, note 59

(16) See C08C, note 61

(17) See C08C, note 62

(18) Sta. "B4" 743+31.78, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 24" storm sew. pipe - 107'
5' Depth
For profile, see sht. C08K

(19) Sta. "WA3" 741+97.36, Rt.
Const. type "G-2" inlet - 18" Sump

(20) Sta. "WA3" 741+96.02, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 44'
5' Depth

(21) Sta. "B4" 744+39.54, 32.48' Lt.
Const. type "D" inlet - 18" Sump
Inst. 12" storm sew. pipe - 15'
5' Depth
Inst. 12" storm sew. pipe - 46'
10' Depth
For profile, see sht. C08K

(22) Sta. "B4" 744+40.80, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 38'
5' Depth

(23) Sta. "Lc2" 744+40.37, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 62', S = 5.69%
5' Depth
Trench resurfacing - 21 sq. yd.

(24) Sta. "Lc2" 744+45.59, Rt.
Const. type "G-2" inlet - 18" Sump

(25) Sta. "Lc2" 744+36.93, 111.87' Lt. to Sta.
"Lc2" 763+50.54, 73.54' Lt.
Const. ditch

(26) Sta. "Lc2" 748+00.18, 89.14' Lt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 17', S = 0.94%
5' Depth

(27) Sta. "Lc2" 747+99.34, Lt.
Const. type "G-2" inlet - 18" Sump
Extend 12" storm sew. pipe - 30', S = 2.99%

(28) Sta. "Lc2" 747+79.20, Rt.
Const. type "G-2" inlet - 18" Sump
Connect extg. pipe

(29) Sta. "Lc2" 749+26.79, 79.57' Lt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 14', S = 1.00%
5' Depth

(30) Sta. "Lc2" 749+26.39, Rt.
Const. type "G-2" inlet - 18" Sump

(31) Sta. "Lc2" 750+46.08, Rt.
Const. type "G-2" inlet - 18" Sump
Extend 12" storm sew. pipe - 19'
Trench resurfacing - 6 sq. yd.

(32) Sta. "Lc2" 753+97.90, Rt.
Adjust inlet

(33) Sta. "Lc2" 753+83.29, Lt.
Const. type "G-2" inlet - 18" Sump

(34) Sta. "Lc2" 753+93.62, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 10', S = 0.50%
5' Depth
Connect existing pipe

(35) Sta. "Lc2" 747+39.13, Rt.
Adjust inlet

(36) Sta. "Lc2" 743+04.78, 72.78' Rt.
Adjust manhole

(37) Sta. "C4" 742+95.53, Lt.
Adjust inlet

(38) Sta. "C4" 744+93.97, Rt.
Adjust inlet

(39) Sta. "Lc2" 750+44.15, Rt.
Adjust inlet

(40) Remove pipe - 957'

(41) Relocate West Linn waterline (By others)

(42) Relocate Century Link UG (By others)

(43) Relocate NW Natural Gas (By others)

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

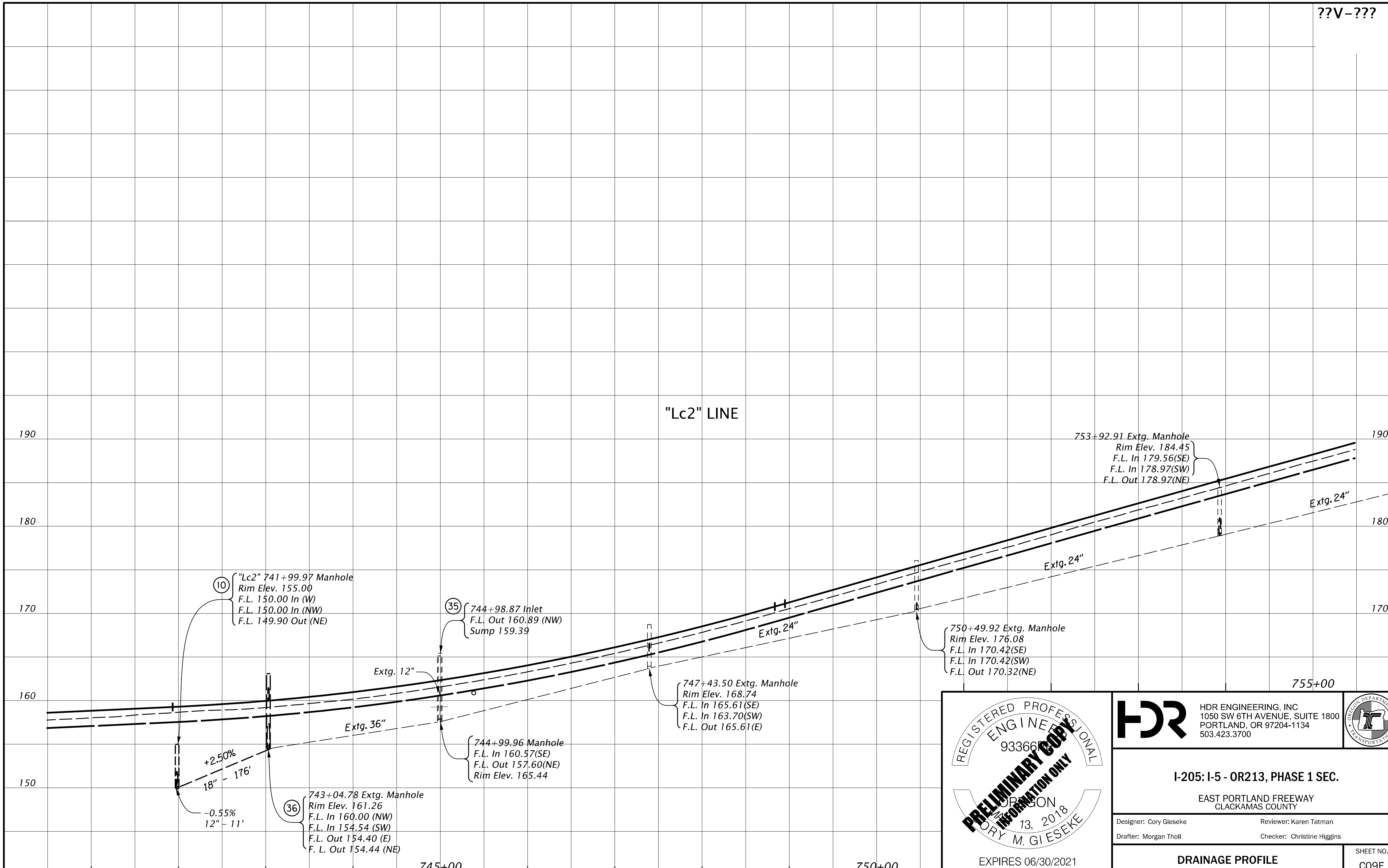
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C09D

Rotation: 218.1362° Scale: 1"=100'

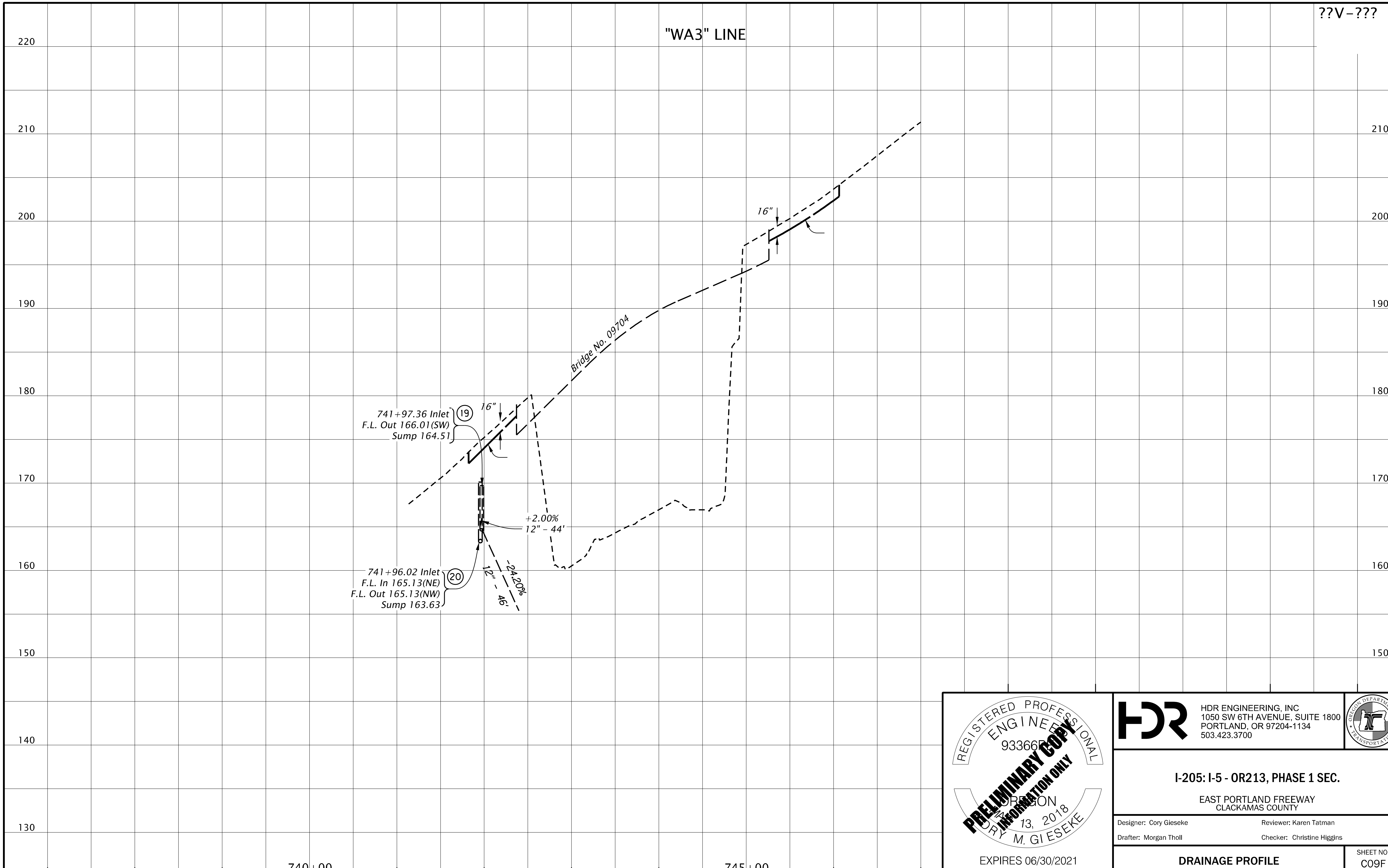


R_K19786_HDR_drpf_01.dgn :: C09E 7/17/2020 1:58:22 PM CGIESEKE

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Rotation: 0° Scale: 1"=100'

??V–???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

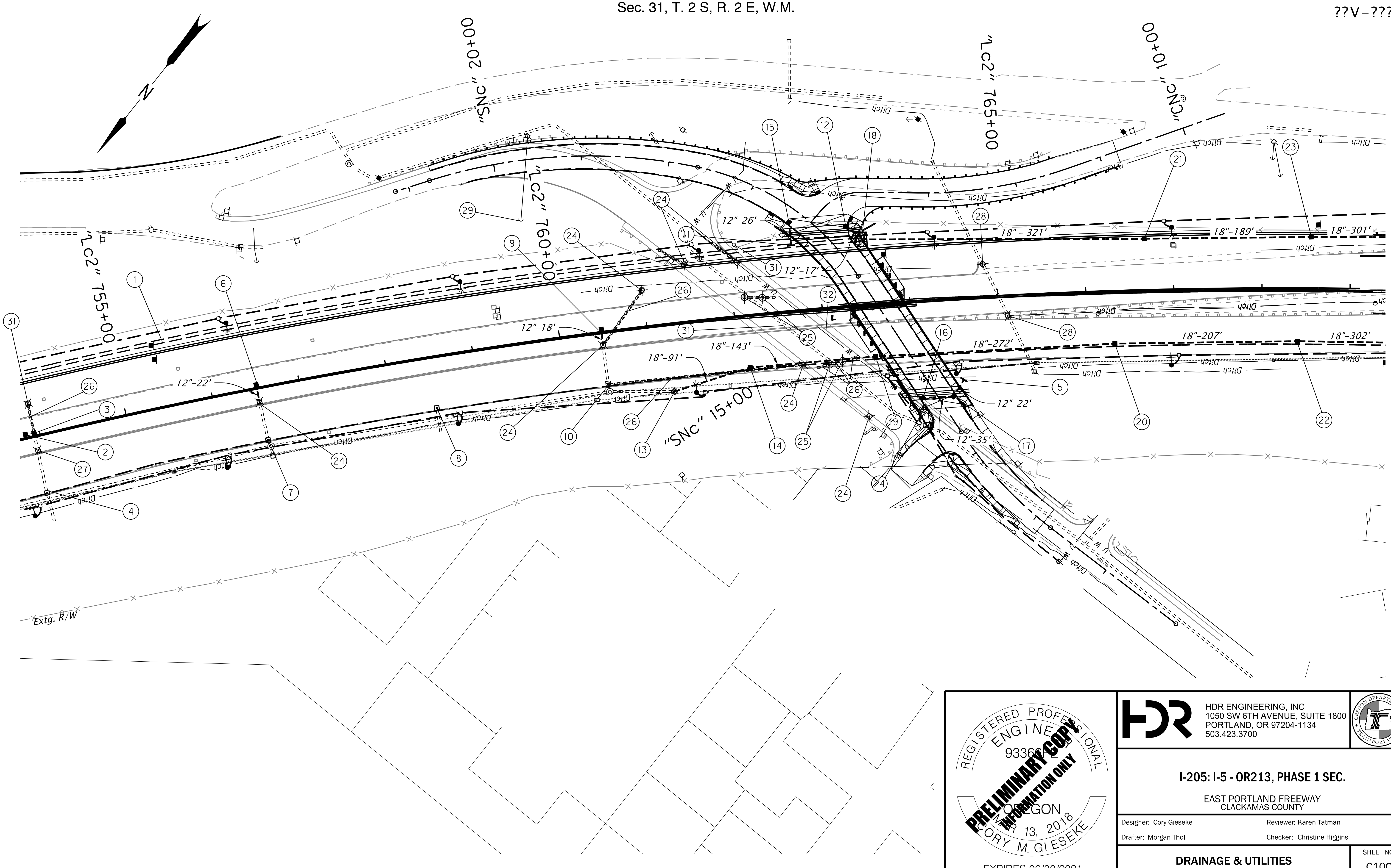
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C09F

Sec. 31, T. 2 S, R. 2 E, W.M.

??V-???



REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C10C

Rotation: 218.5198°
Scale: 1"=100'

1. See C09C, note 25
2. See C09C, note 33
3. See C09C, note 34
4. See C09C, note 32
5. Sta. "SNc" 13+76.51, 34.95' Rt.
   Inst. 12" storm sew. pipe - 22'
   5' Depth
6. Sta. "Lc2" 756+51.40, Lt.
   Const. type "G-2" inlet - 18" Sump
   Extend 12" storm sew. pipe - 22'
   Trench resurfacing - 7 sq. yd.
7. Sta. "Lc2" 756+52.77, Rt.
   Adjust inlet
8. Sta. "Lc2" 758+50.00, Rt.
   Adjust inlet
9. Sta. "Lc2" 760+48.19, Lt.
   Const. type "G-2" inlet - 18" Sump
   Extend 12" storm sew. pipe - 18'
   Trench resurfacing - 6 sq. yd.
10. Sta. "Lc2" 760+48.41, Rt.
    Adjust inlet
11. Sta. "Lc2" 762+71.42, 74.14' Lt.
    Inst. 12" storm sew. pipe - 26', S = 37.85%
    5' Depth
12. Sta. "SNc" 15+91.70, Rt.
    Const. type "G-2" inlet - 18" Sump
13. Sta. "Lc2" 761+22.45, 77.57' Rt.
    Adjust inlet
    Inst. 18" storm sew. pipe - 91'
    5' Depth
14. Sta. "Lc2" 762+11.78, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 143'
    5' Depth
15. Sta. "SNc" 16+42.55, Lt.
    Const. type "G-2" inlet - 18" Sump
16. Sta. "SNc" 13+85.05, Lt.
    Const. type "G-2" inlet - 18" Sump
17. Sta. "SNc" 13+67.01, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 35'
    5' Depth
18. Sta. "Lc2" 763+55.53, 70.83' Lt.
    Const. riprap pad
    Loose riprap (class 50) - 5.0 tons
    Inst. 12" storm sew. pipe - 17', S = 60.29%
    5' Depth
    Inst. 18" storm sew. pipe - 321'
    5' Depth
19. Sta. "Lc2" 763+56.41, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 272'
    5' Depth
20. Sta. "Lc2" 766+31.15, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 207'
    5' Depth
21. Sta. "Lc2" 766+67.81, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 189'
    5' Depth
22. Sta. "Lc2" 768+40.11, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 302'
    5' Depth
23. Sta. "Lc2" 768+55.24, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 301'
    5' Depth
24. Remove inlet - 7
25. Remove manhole - 3
26. Remove pipe - XX'
27. See C08C, note 13
28. Cap inlet - 2
29. Relocate Utility Anchor (By others)
30. Relocate Utility Pole (By others)
31. Relocate West Linn sanitary (By others)
32. Relocate West Linn waterline (By others)

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

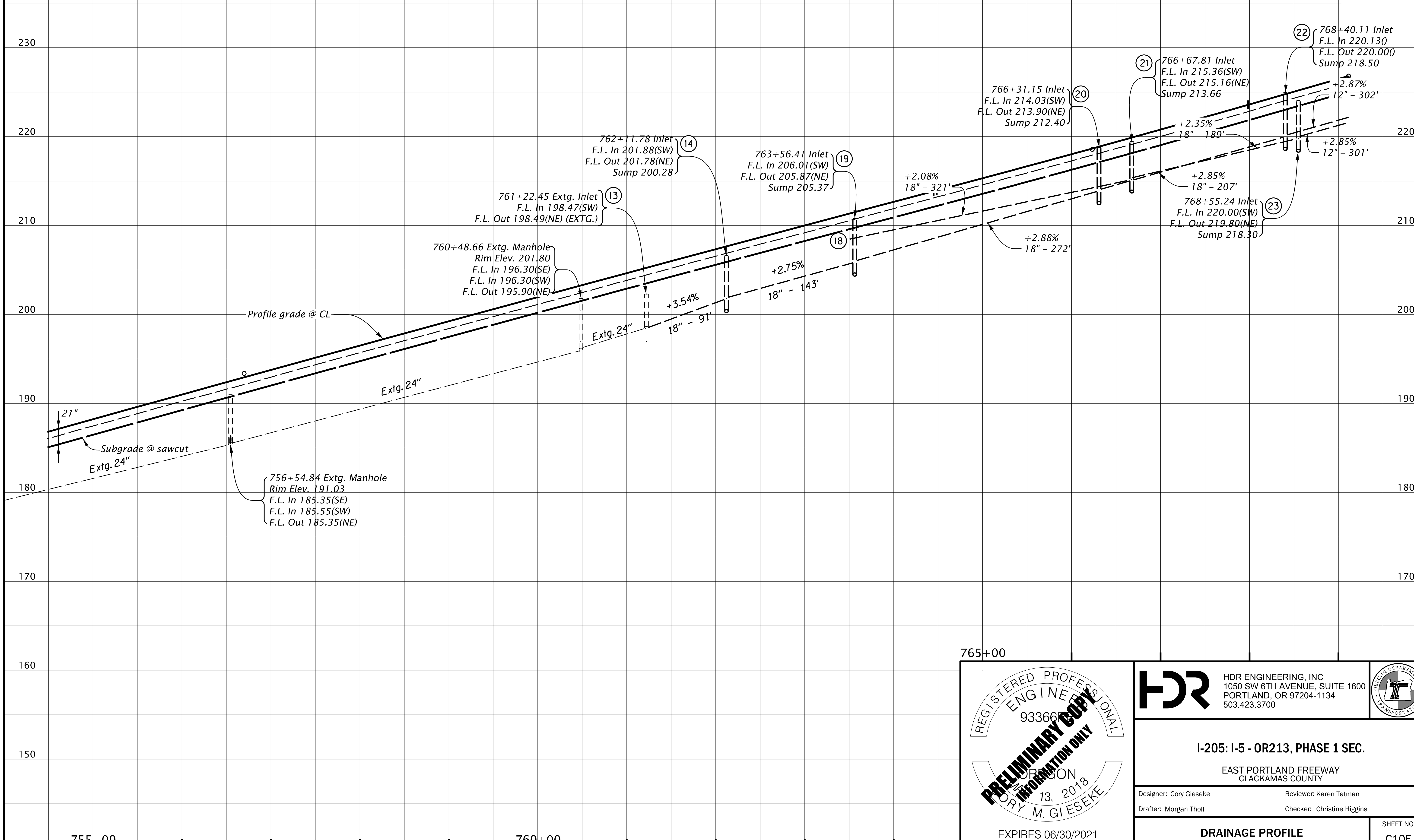
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C10D

"Lc2" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

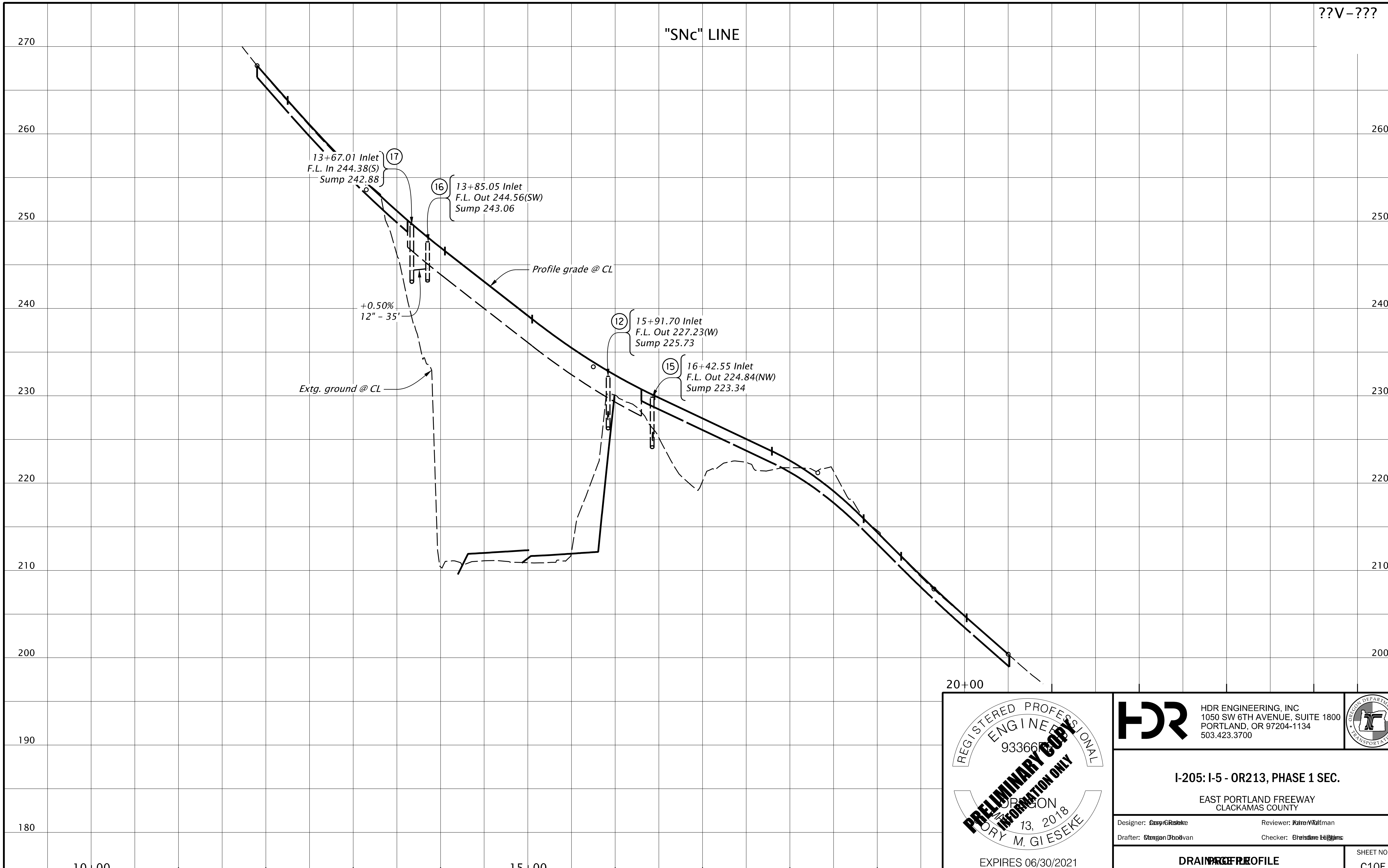
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C10E

??V-???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

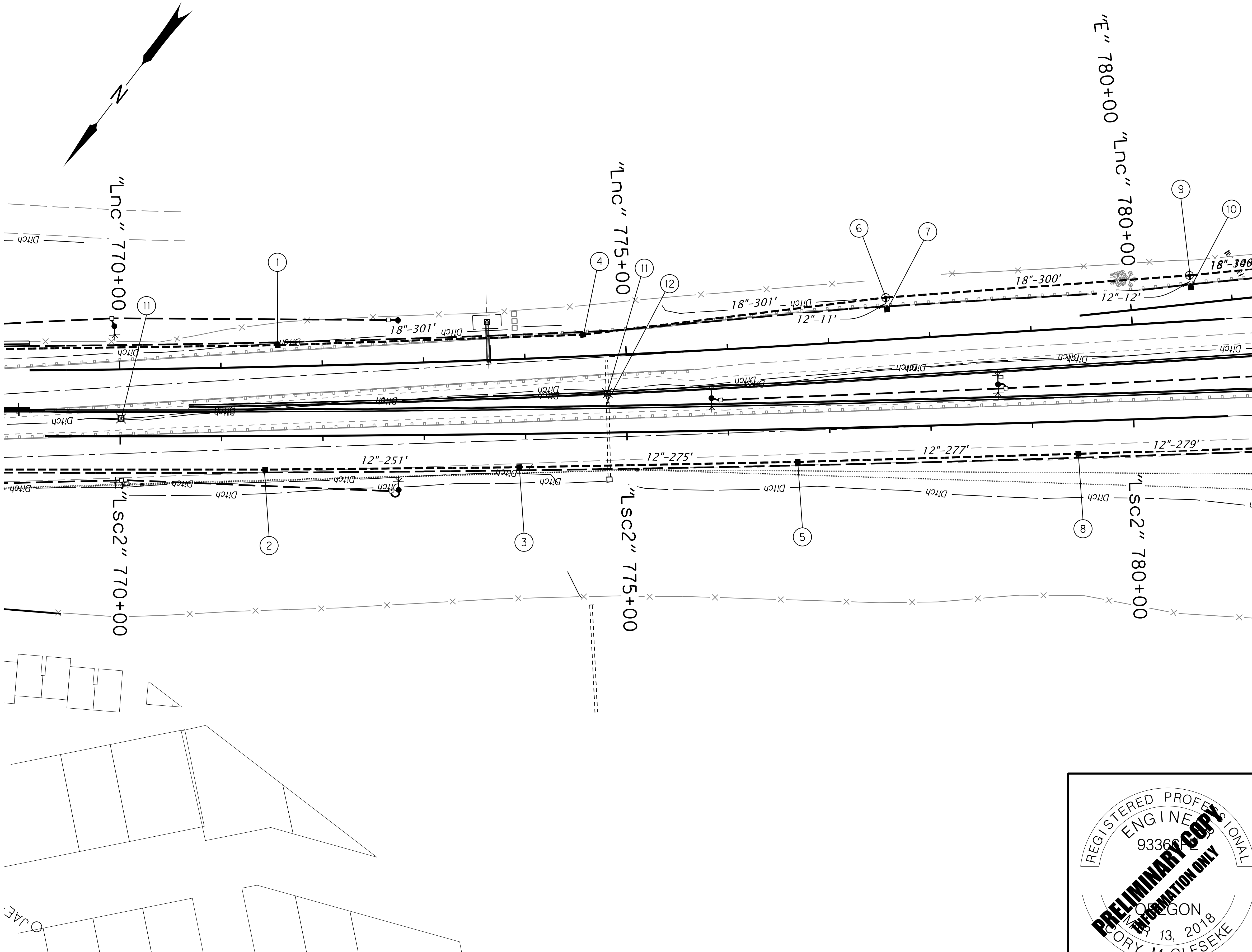
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Wolfman
Drafter: Morgan Donovan
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C10F

Sec. 31, T. 2 S, R 2 E & Sec. 36, T. 2 S, R. 1 E, W.M.



REGISTERED PROFESSIONAL ENGINEER
93369PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:	Reviewer:
Drafter:	Checker:

DRAINAGE & UTILITIES

SHEET NO.
C11B

Rotation: 217.6195° Scale: 1"=100'

(1) *Sta. "Lnc" 771+56.27, Lt.*
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 301'
5' Depth

(2) *Sta. "Lsc2" 771+42.83, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 251'
5' Depth

(3) *Sta. "Lsc2" 773+93.32, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 275'
5' Depth

(4) *Sta. "Lnc" 774+57.81, Lt.*
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 301'
5' Depth

(5) *Sta. "Lsc2" 776+67.90, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 277'
5' Depth

(6) *Sta. "Lnc" 777+58.88, 41.26' Lt.*
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 11'
5' Depth
Inst. 18" storm sew. pipe - 300'
5' Depth

(7) *Sta. "Lnc" 777+59.72, Lt.*
Const. type "G-2" inlet - 18" Sump

(8) *Sta. "Lsc2" 779+44.19, Rt.*
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 279'
5' Depth

(9) *Sta. "Lnc" 780+59.25, 44.93' Lt.*
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 12'
5' Depth
Inst. 18" storm sew. pipe - 148'
5' Depth

(10) *Sta. "Lnc" 780+60.09, Lt.*
Const. type "G-2" inlet - 18" Sump

(11) *Remove inlet - 2*

(12) *Remove pipe - 8'*

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

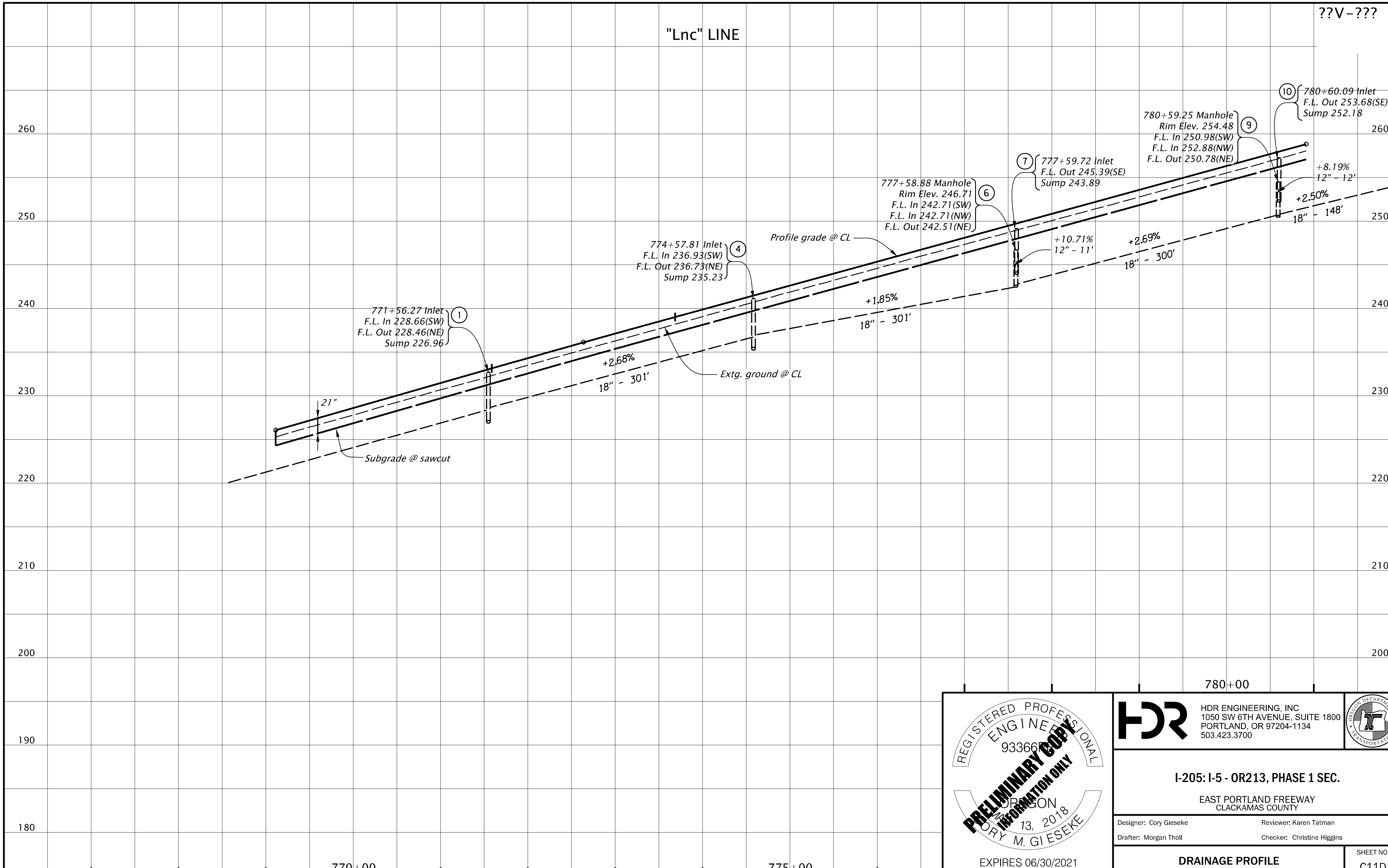
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

DRAINAGE & UTILITIES NOTES

SHEET NO.
C11C

Rotation: 0° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

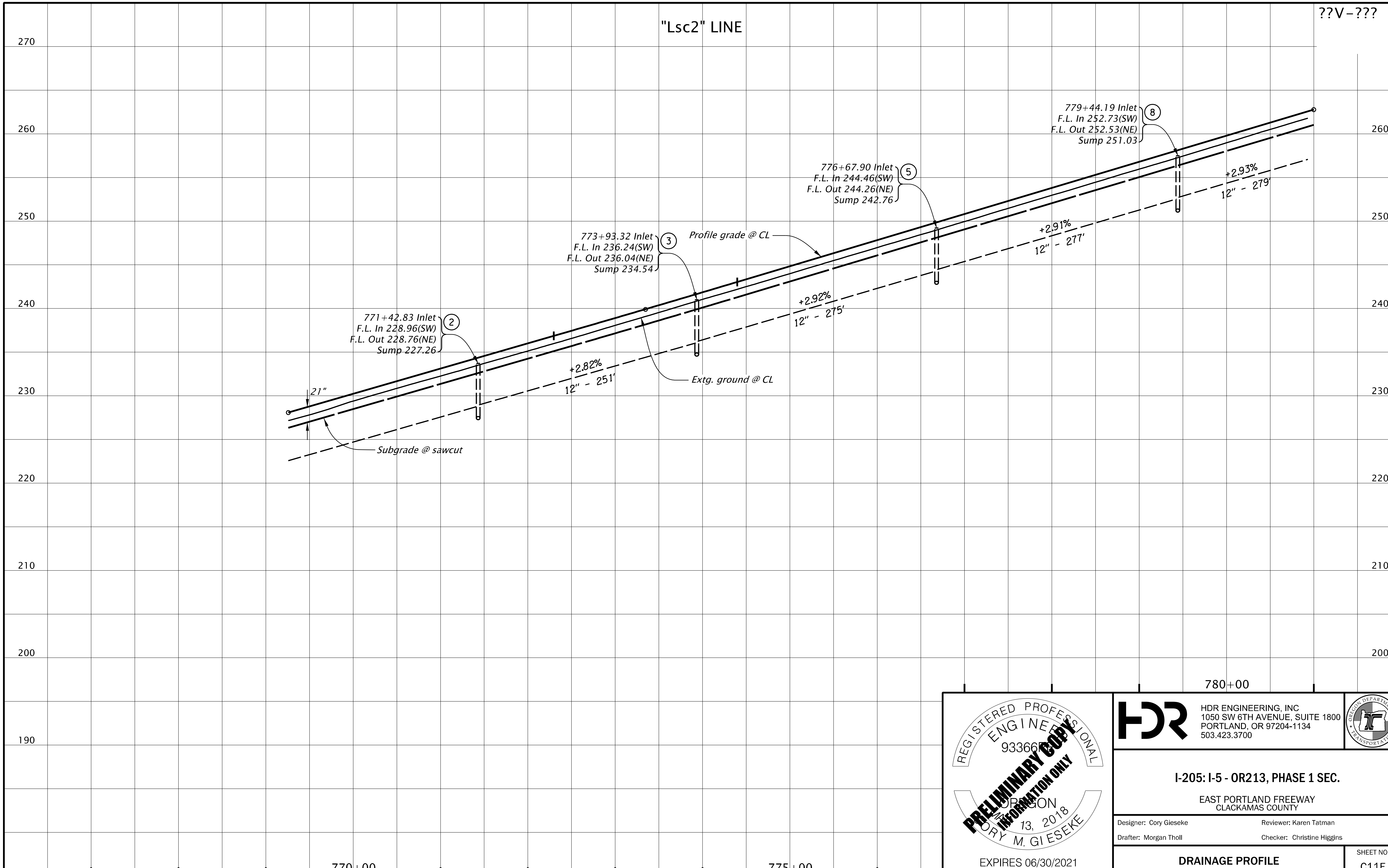
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C11D



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

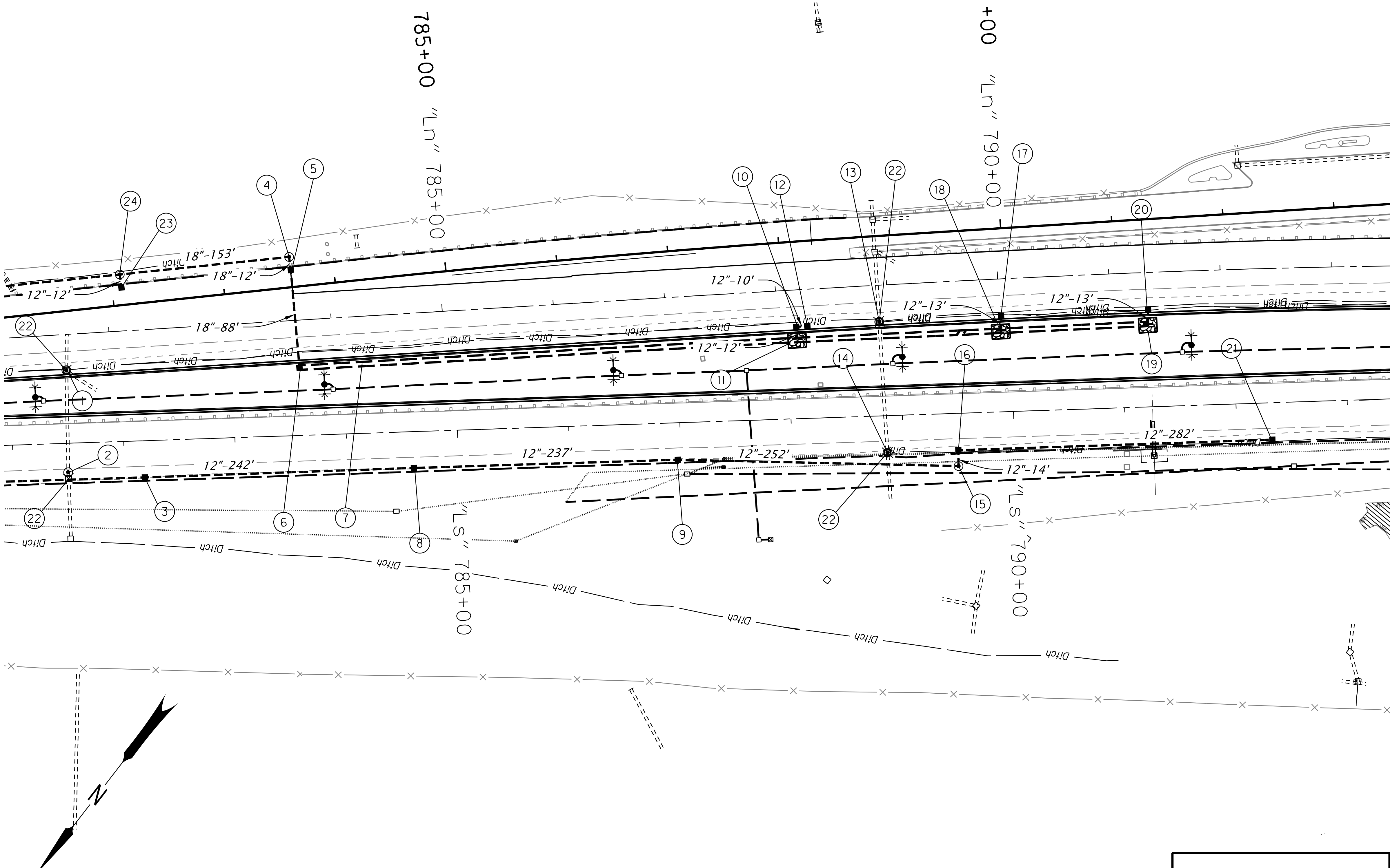
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C11E

Sec. 36, T. 2 S, R. 1 E, W.M.

??V–???



LEGEND

Wetlands

No Work Area

REGISTERED PROFESSIONAL ENGINEER

93366PE

OREGON

MAY 13, 2018

CORY M. GIESEKE

EXPIRES 06/30/2021

PRELIMINARY COPY

INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:	Reviewer:
Drafter:	Checker:

DRAINAGE & UTILITIES

SHEET NO.
C12B

Rotation: 217.6195° Scale: 1"=100'

(1) Sta. "Ln" 781+59.91, 31.89' Rt.
Const. storm sew. manhole
Connect extg. pipes

(2) Sta. "Ls" 781+49.24, 25.74' Rt.
Const. storm sew. manhole over existing sewer

(3) Sta. "Ls" 782+17.89, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 242'
5' Depth

(4) Sta. "Ln" 783+65.66, 57.28' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 12'
5' Depth

(5) Sta. "Ln" 783+66.59, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 88'
5' Depth
Trench resurfacing - 41 sq. yd.

(6) Sta. "Ln" 783+68.80, 39.29' Rt.
Const. type "D" inlet

(7) Sta. "Lnc" 783+69.21, 42.39' Rt. to Sta. "Lnc" 791+33.46, 46.49' Rt.
Const. ditch

(8) Sta. "Ls" 784+59.81, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 237'
5' Depth

(9) Sta. "Ls" 786+96.91, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 252'
5' Depth

(10) Sta. "Ln" 788+16.53, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 10'
5' Depth

(11) Sta. "Ln" 788+16.47, 44.94' Rt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 12'
5' Depth

(12) Sta. "Ln" 788+26.84, Rt.
Const. type "G-2" inlet

(13) Sta. "Ln" 788+91.69, 31.55' Rt.
Const. storm sew. manhole
Connect extg. pipes

(14) Sta. "Ls" 788+85.35, 33.28' Rt.
Const. storm sew. manhole
Connect extg. pipes

(15) Sta. "Ls" 789+49.28, 47.67' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 14'
10' Depth

(16) Sta. "Ls" 789+49.56, Rt.
Const. type "G-2" inlet
Inst. 12" storm sew. pipe - 282'
5' Depth

(17) Sta. "Ln" 790+01.30, Rt.
Const. type "G-2" inlet

(18) Sta. "Ln" 790+01.10, 47.51' Rt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 13'
5' Depth

(19) Sta. "Ln" 791+33.46, 46.49' Rt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 13'
5' Depth

(20) Sta. "Ln" 791+33.97, Rt.
Const. type "G-2" inlet

(21) Sta. "Ls" 792+31.61, Rt.
Const. type "G-2" inlet

(22) Remove inlet - 4

(23) Sta. "Ln" 782+13.41, Rt.
Const. type "G-2" inlet

(24) Sta. "Ln" 782+13.00, 50.75' Rt.
Const. storm sew. manhole
Inst. 12"" storm sew. pipe - 12'
5' Depth
Inst. 18" storm sew. pipe - 153'
5' Depth

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

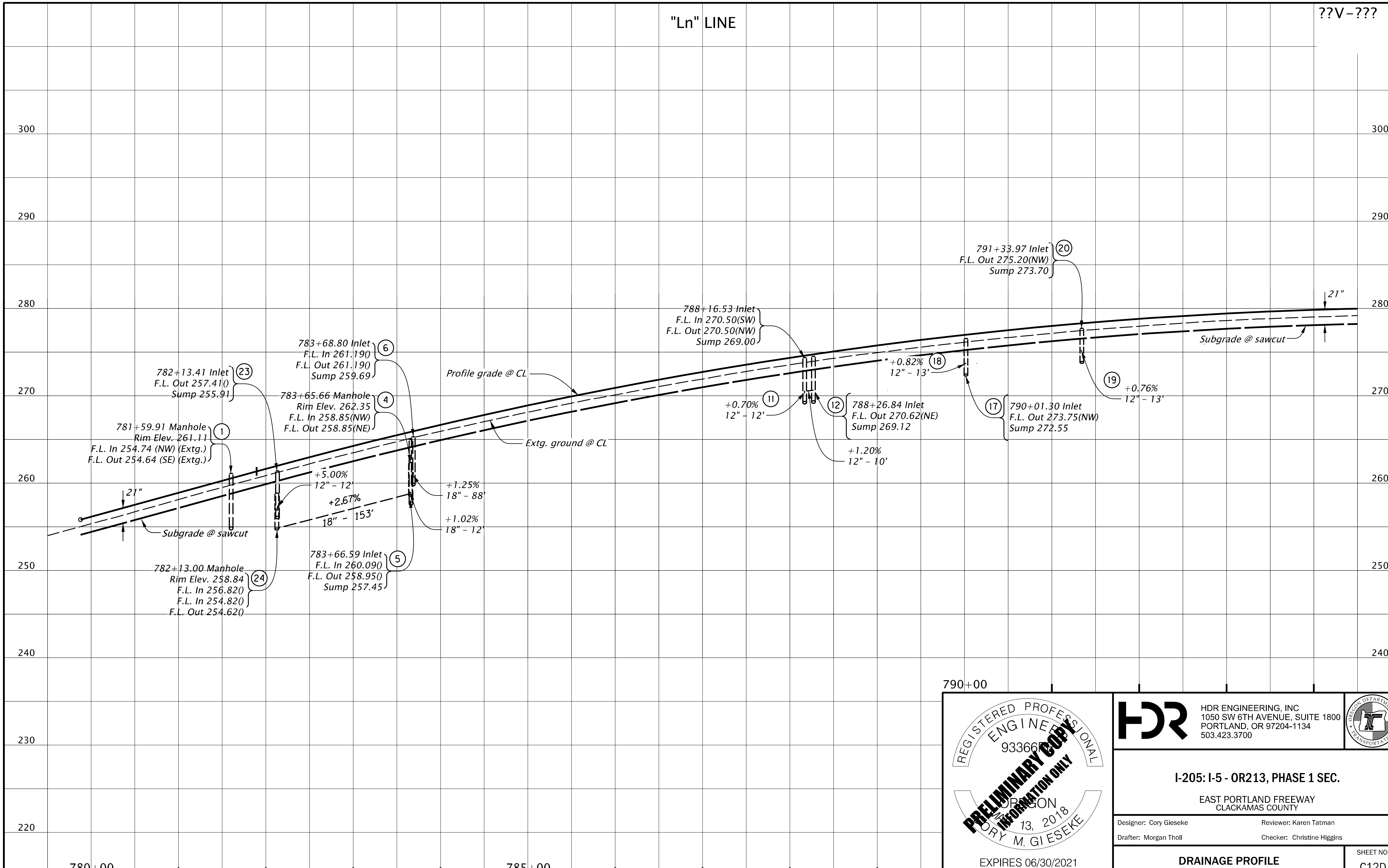
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

DRAINAGE & UTILITIES NOTES

SHEET NO. C12C

Rotation: 0° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

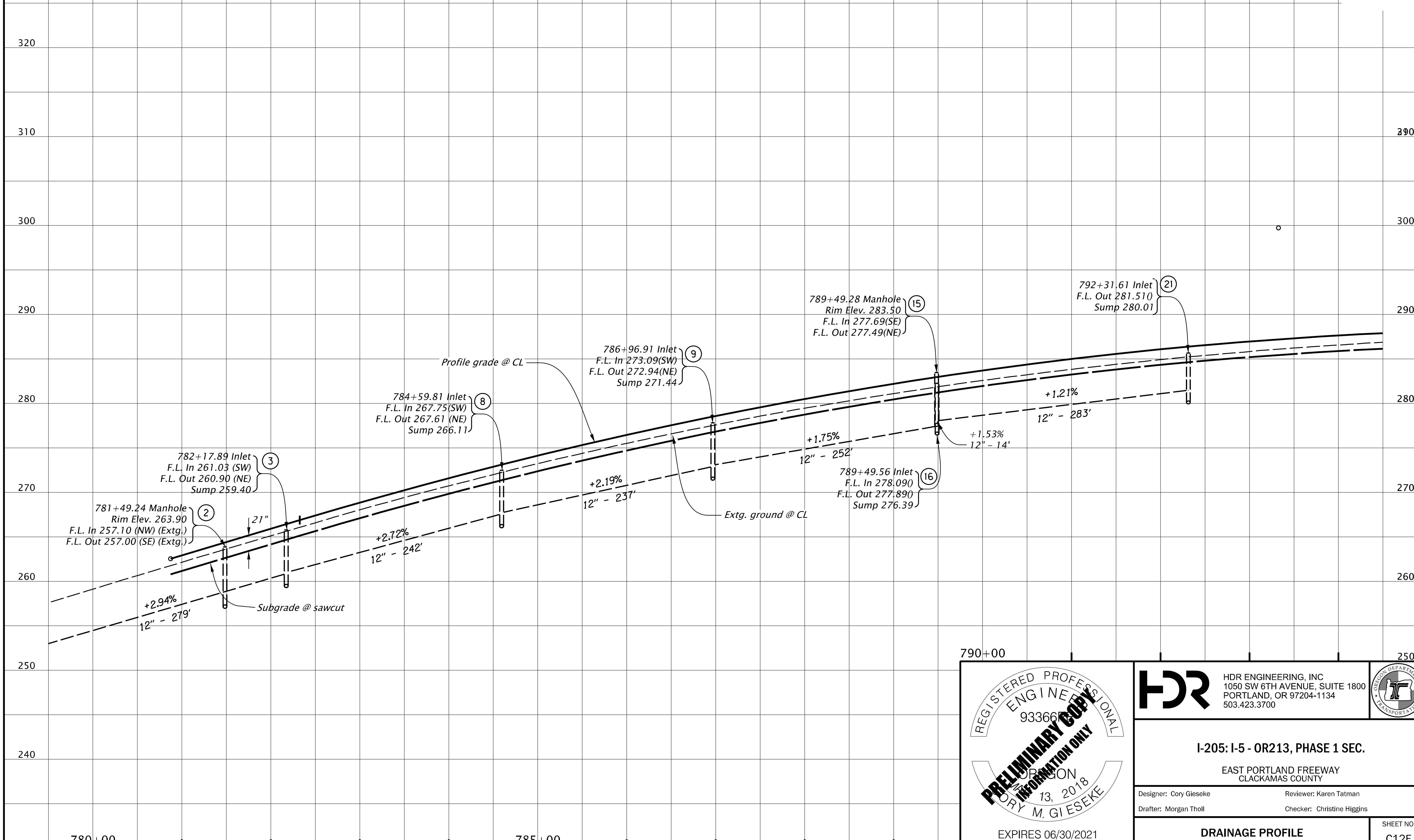
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C12D

??V–???

"Ls" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

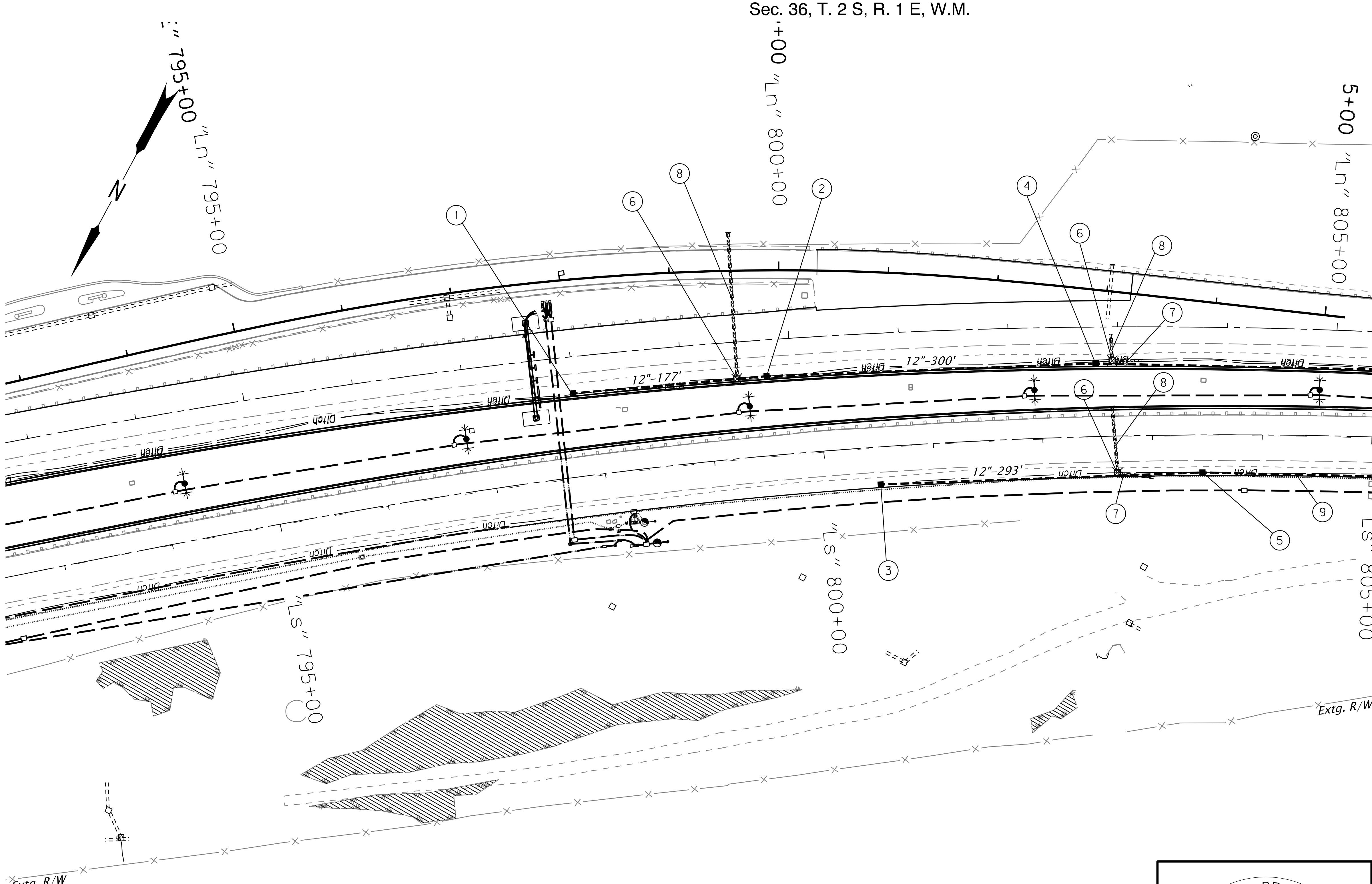
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C12E

Sec. 36, T. 2 S, R. 1 E, W.M.

??V-???



1. Sta. "Ln" 797+99.30, Rt. Const. type "G-2" inlet - 18" Sump
2. Sta. "Ln" 799+77.68, Rt. Const. type "G-2" inlet - 18" Sump Inst. 12" storm sew. pipe - 177' 5' Depth
3. Sta. "Ls" 800+49.62, Rt. Const. type "G-2" inlet - 18" Sump
4. Sta. "Ln" 802+79.53, Rt. Const. type "G-2 inlet" - 18" Sump Inst. 12" storm sew. pipe - 300' 5' Depth
5. Sta. "Ls" 803+45.57, Rt. Const. type "G-2" inlet - 18" Sump Inst. 12" storm sew. pipe - 293' 5' Depth
6. Remove inlet - 3
7. Remove pipe - 57'
8. Abandon pipe
9. Relocate PGE UG (By others)

LEGEND

Wetlands

No Work Area

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

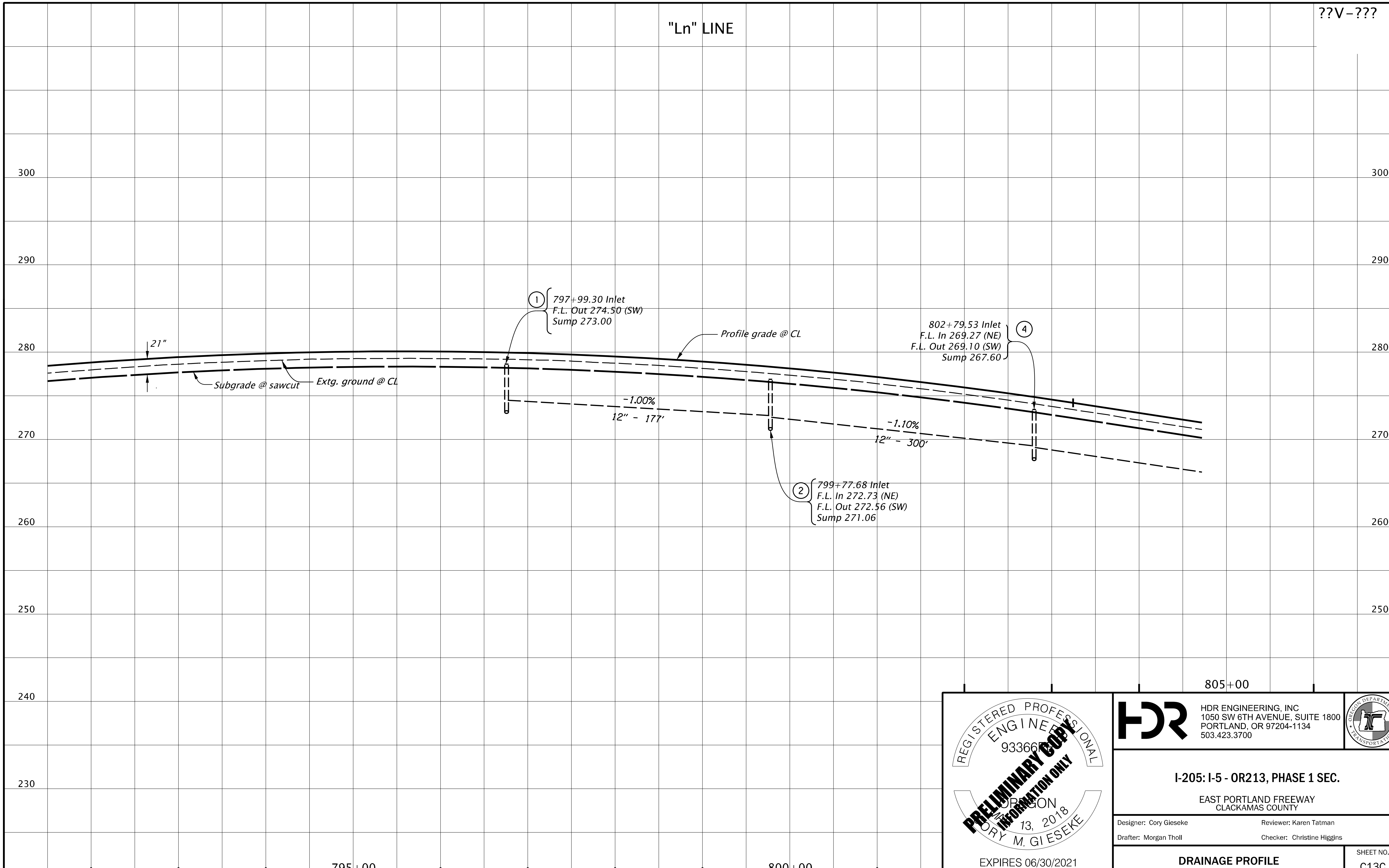
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

DRAINAGE & UTILITIES

SHEET NO. C13B

Rotation: 208.1457° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

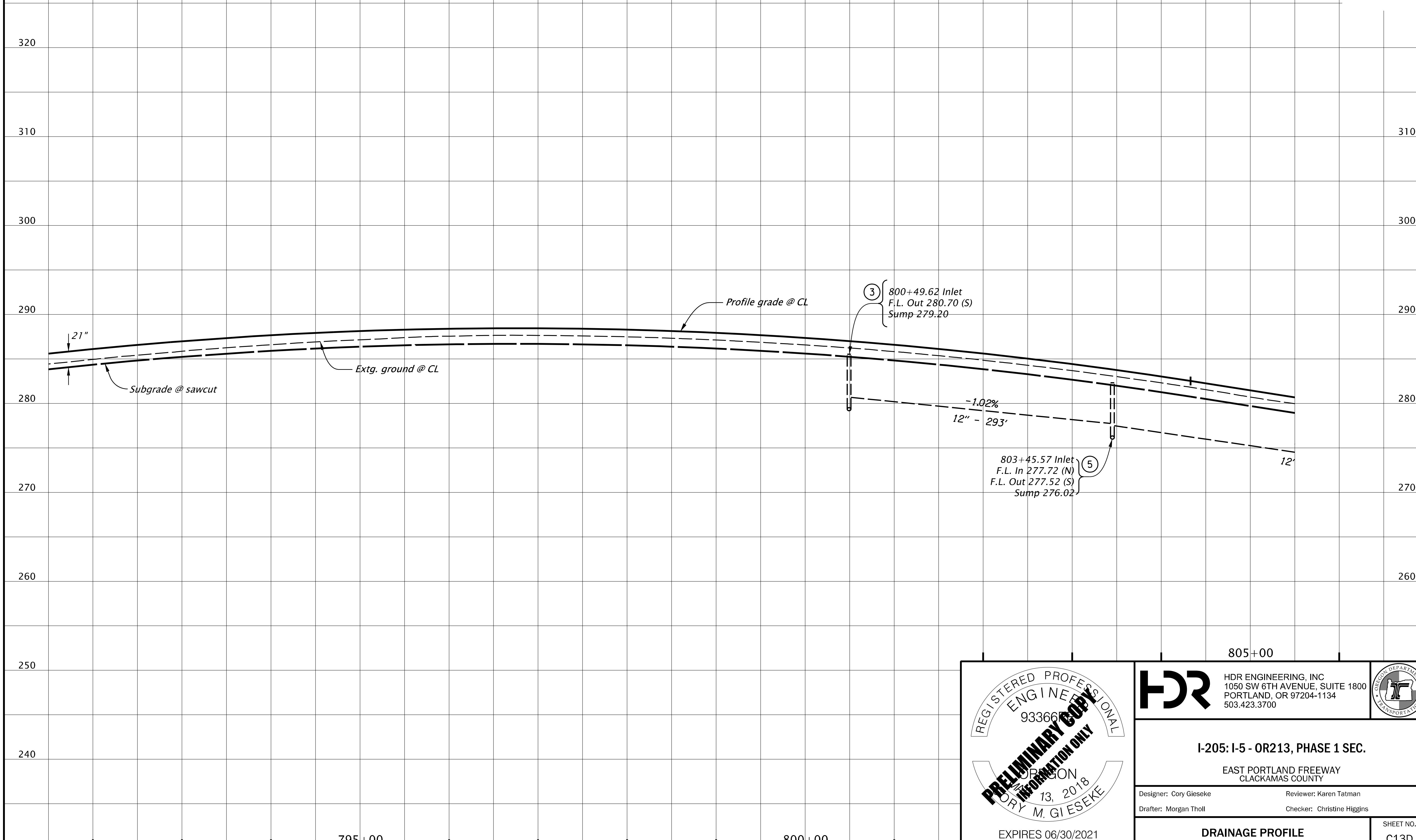
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C13C

"Ls" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
... 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

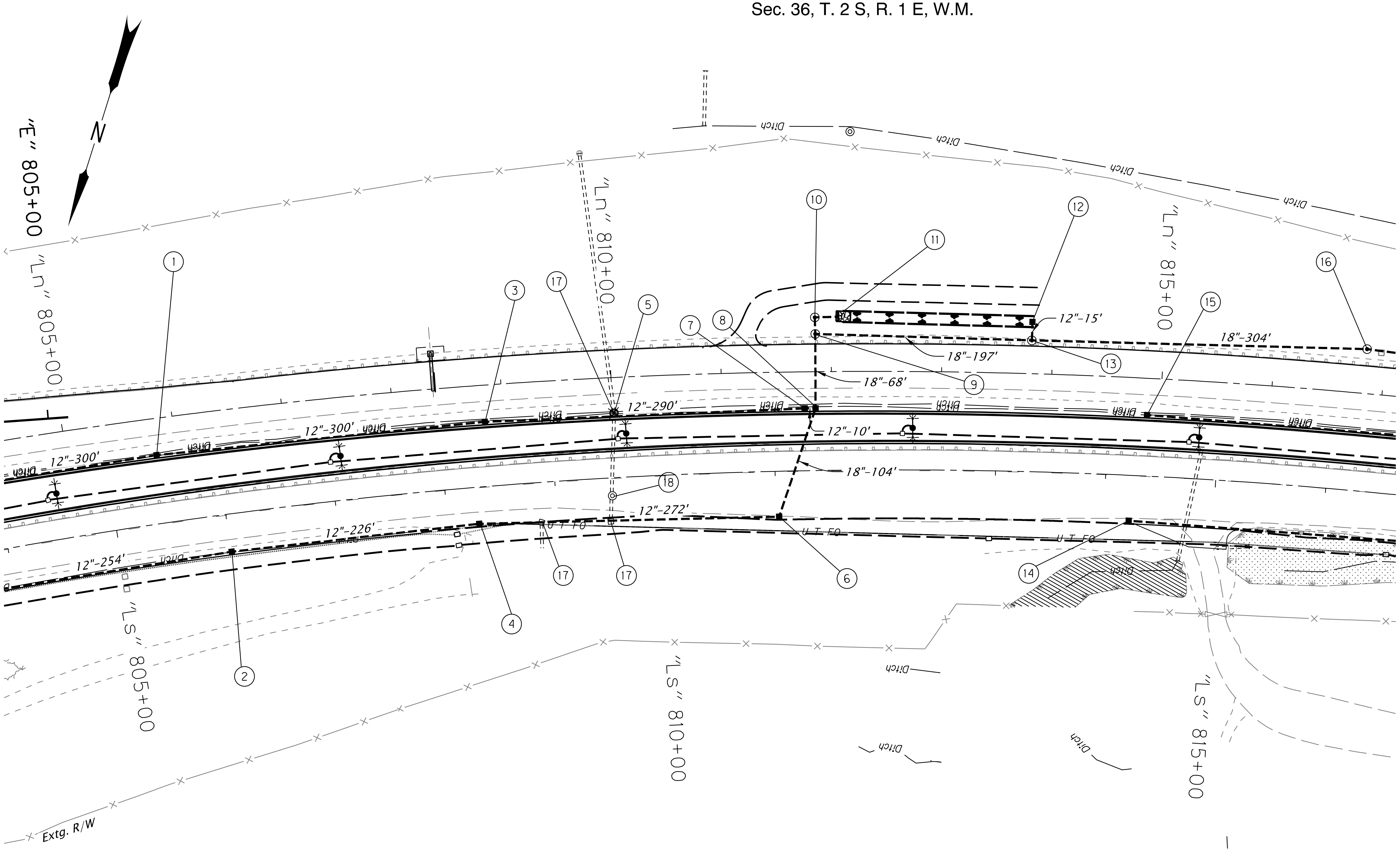
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C13D

Sec. 36, T. 2 S, R. 1 E, W.M.

??V–???



LEGEND

Wetlands	
No Work Area	
Regulated Work Area	

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

DRAINAGE & UTILITIES

SHEET NO.
C14B

Rotation: 197.6361° Scale: 1"=100'

1 Sta. "Ln" 805+81.61, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 300'
5' Depth

2 Sta. "Ls" 806+00.75, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 254'
5' Depth

3 Sta. "Ln" 808+83.32, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 300'
5' Depth

4 Sta. "Ls" 808+28.16, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 226'
5' Depth

5 Sta. "Ln" 810+01.57, 31.78' Rt.
Const. storm sew. manhole
Connect extg. pipes

6 Sta. "Ls" 811+02.95, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 272'
5' Depth

7 Sta. "Ln" 811+75.35, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 290'
5' Depth

8 Sta. "Ln" 811+85.08, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 10'
5' Depth
Inst. 18" storm sew. pipe - 104'
5' Depth
Trench resurfacing - 48 sq. yd.

9 Sta. "Ln" 811+85.97, 34.08' Lt.
Const. diversion manhole
Inst. 18" storm sew. pipe - 68'
5' Depth
Trench resurfacing - 31 sq. yd.
(For details, see sht. HA18)

10 See sht. HA11, note 3

11 Sta. "Ln" 812+11.63, 49.46' Lt. to Sta. "Ln" 813+82.31, 47.34' Lt.
Const. biofiltration swale
(For details, see sht. HA11)

12 See sht. HA11, note 4

13 Sta. "Ln" 813+81.04, 30.37' Lt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 15'
5' Depth
Inst. 18" storm sew. pipe - 197'
5' Depth

14 Sta. "Ls" 814+22.78, Rt.
Const. type "G-2" inlet - 18" Sump

15 Sta. "Ln" 814+87.95, Rt.
Const. type "G-2" inlet - 18" Sump

16 Sta. "Ln" 816+83.11, 40.15' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 304'
5' Depth

17 Remove inlet - 3

18 Sta. "Ls" 809+51.46, 16.38' Rt.
Adjust manhole

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021
PRELIMINARY COPY
INFORMATION ONLY
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

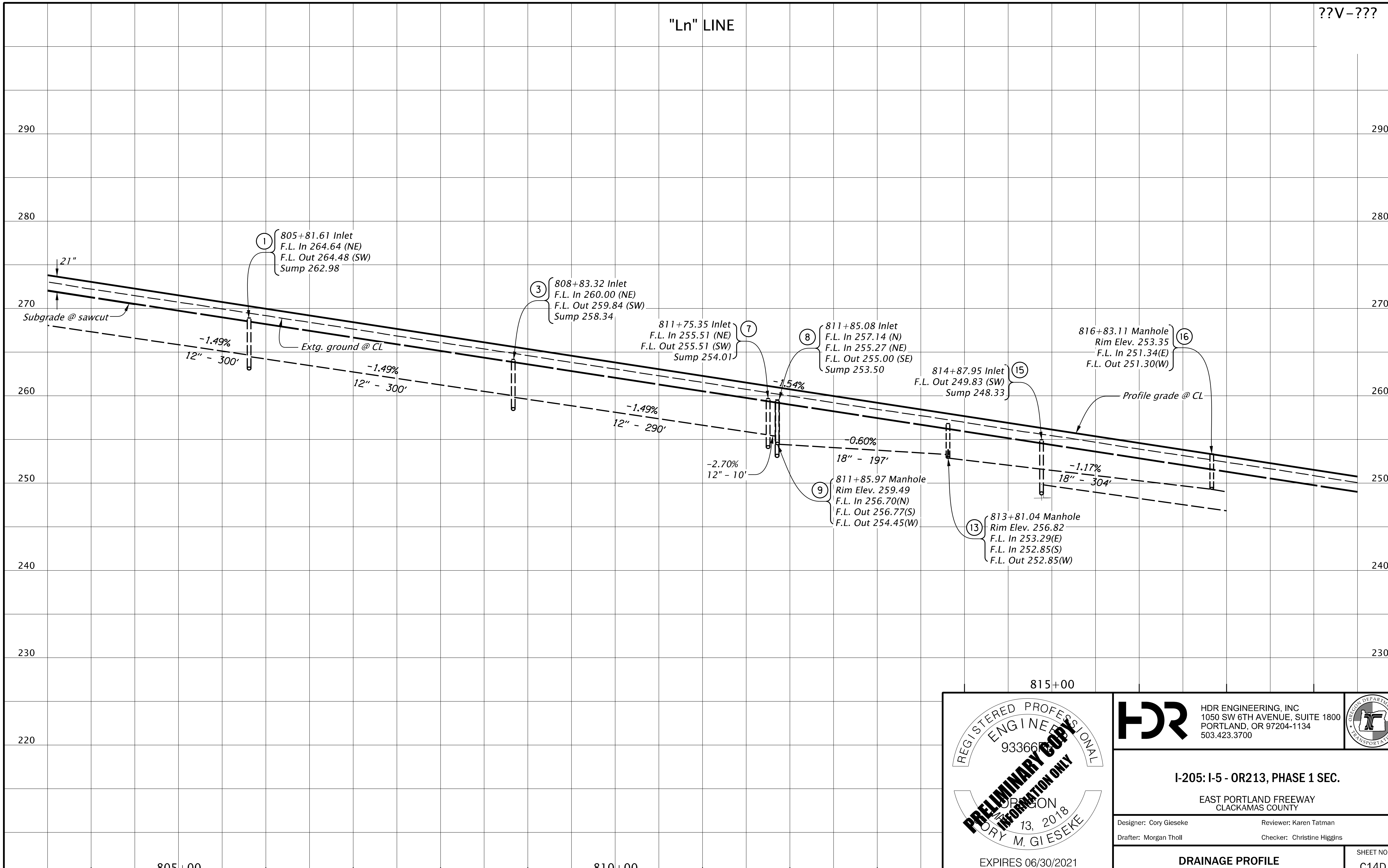
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

DRAINAGE & UTILITIES NOTES

SHEET NO. C14C

Rotation: 0° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

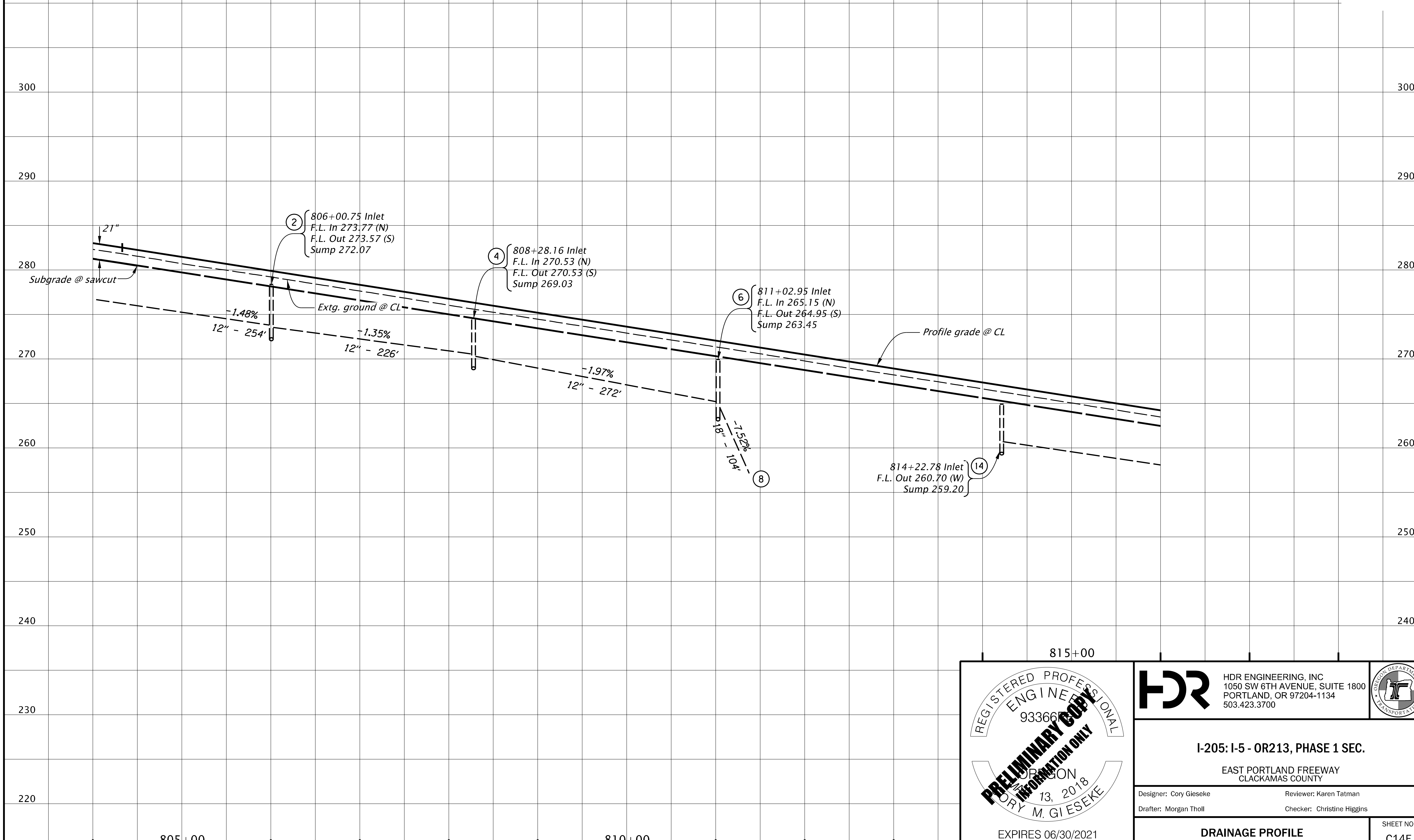
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C14D

"Ls" LINE

??V-???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

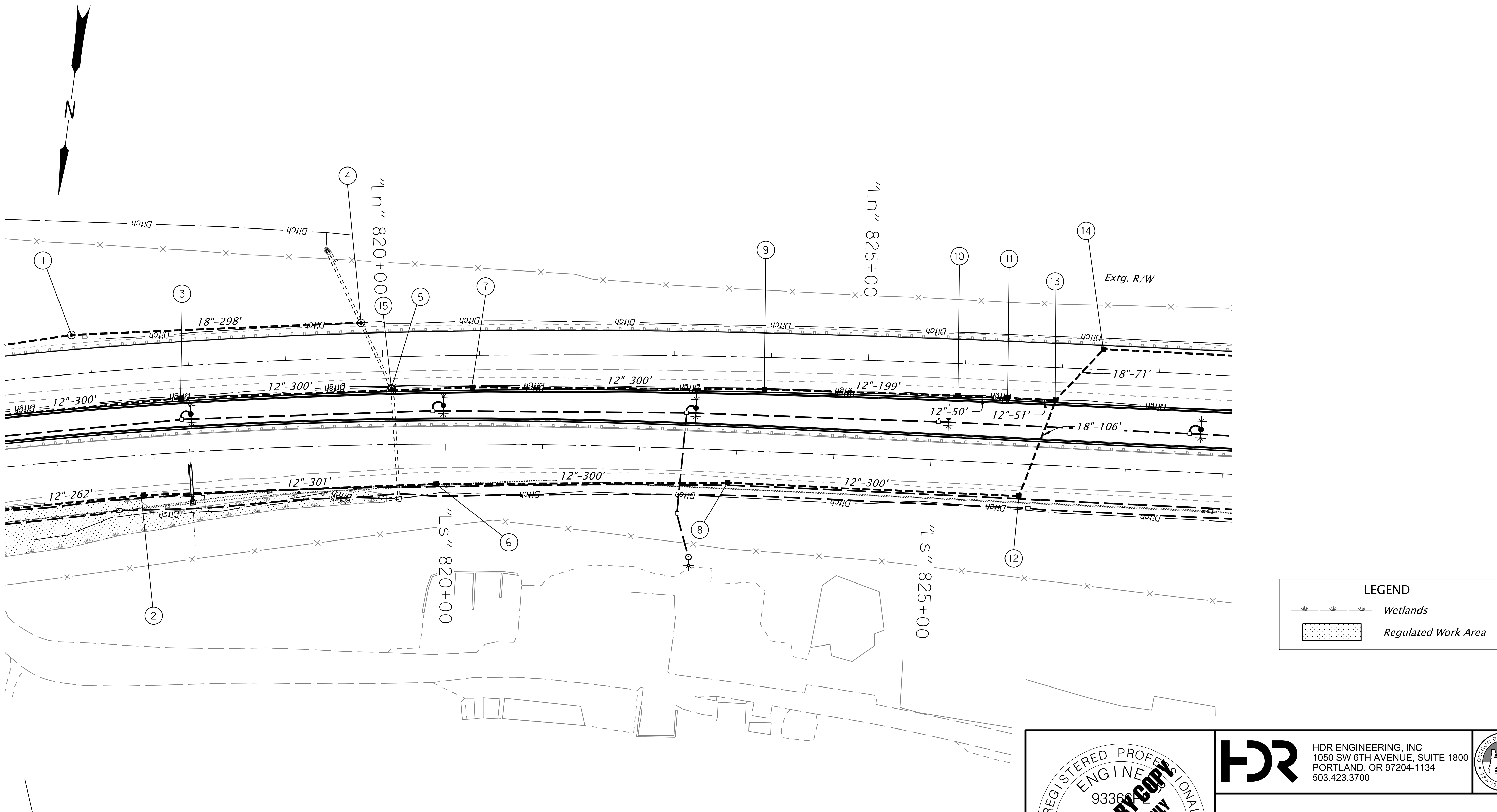
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C14E

Sec. 36, T. 2 S, R. 1 E, W.M.

??V–???



REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:	Reviewer:
Drafter:	Checker:

	SHEET NO.
DRAINAGE & UTILITIES	C15B

Rotation: 187.5797° Scale: 1"=100'

1. See C14C, note 16

2. Sta. "Ls" 816+86.77, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 262'
   5' Depth

3. Sta. "Ln" 817+90.21, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 300'
   5' Depth

4. Sta. "Ln" 819+79.18, 35.70' Lt.
   Const. storm sew. manhole over existing sewer
   Inst. 18" storm sew. pipe - 298'
   5' Depth

5. Sta. "Ln" 820+08.43, 32.26' Rt.
   Const. storm sew. manhole
   Connect extg. pipes

6. Sta. "Ls" 819+90.29, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 301'
   5' Depth

7. Sta. "Ln" 820+92.09, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 300'
   5' Depth

8. Sta. "Ls" 822+92.01, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 300'
   5' Depth

9. Sta. "Ln" 823+93.70, Rt.
   Const. type "G-2" inlet - 18" Sump
   Inst. 12" storm sew. pipe - 300'
   5' Depth

10. Sta. "Ln" 825+93.38, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 199'
    5' Depth

11. Sta. "Ln" 826+43.80, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 50'
    5' Depth

12. Sta. "Ls" 825+92.20, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 300'
    5' Depth

13. Sta. "Ln" 826+94.48, Rt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 12" storm sew. pipe - 51'
    5' Depth
    Inst. 18" storm sew. pipe - 106'
    5' Depth
    Trench resurfacing - 49 sq. yd.

14. Sta. "Ln" 827+40.96, Lt.
    Const. type "G-2" inlet - 18" Sump
    Inst. 18" storm sew. pipe - 71'
    5' Depth
    Trench resurfacing - 33 sq. yd.

15. Remove inlet

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

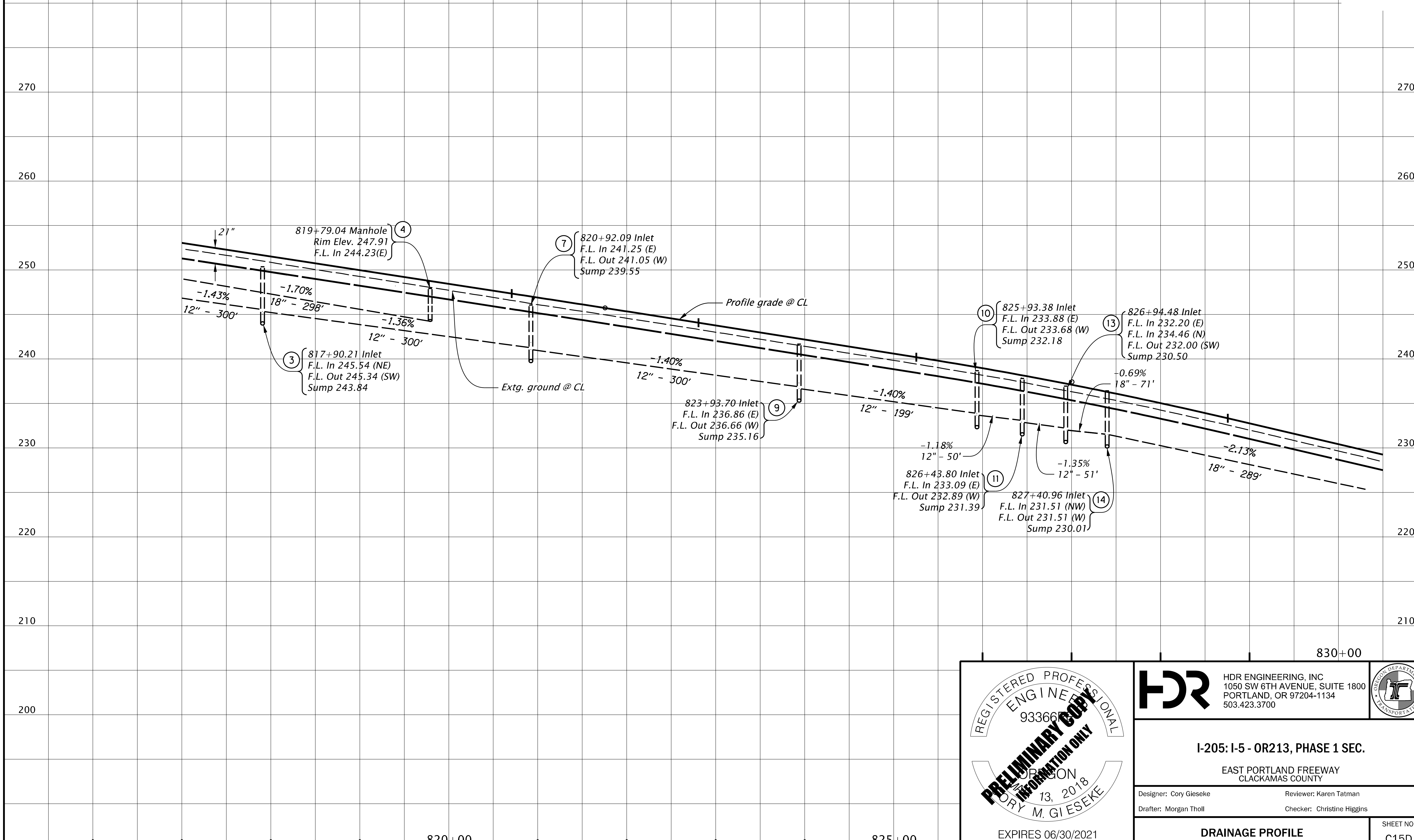
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES
SHEET NO. C15C

Rotation: 0° Scale: 1"=100'

"Ln" LINE

??V–???



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

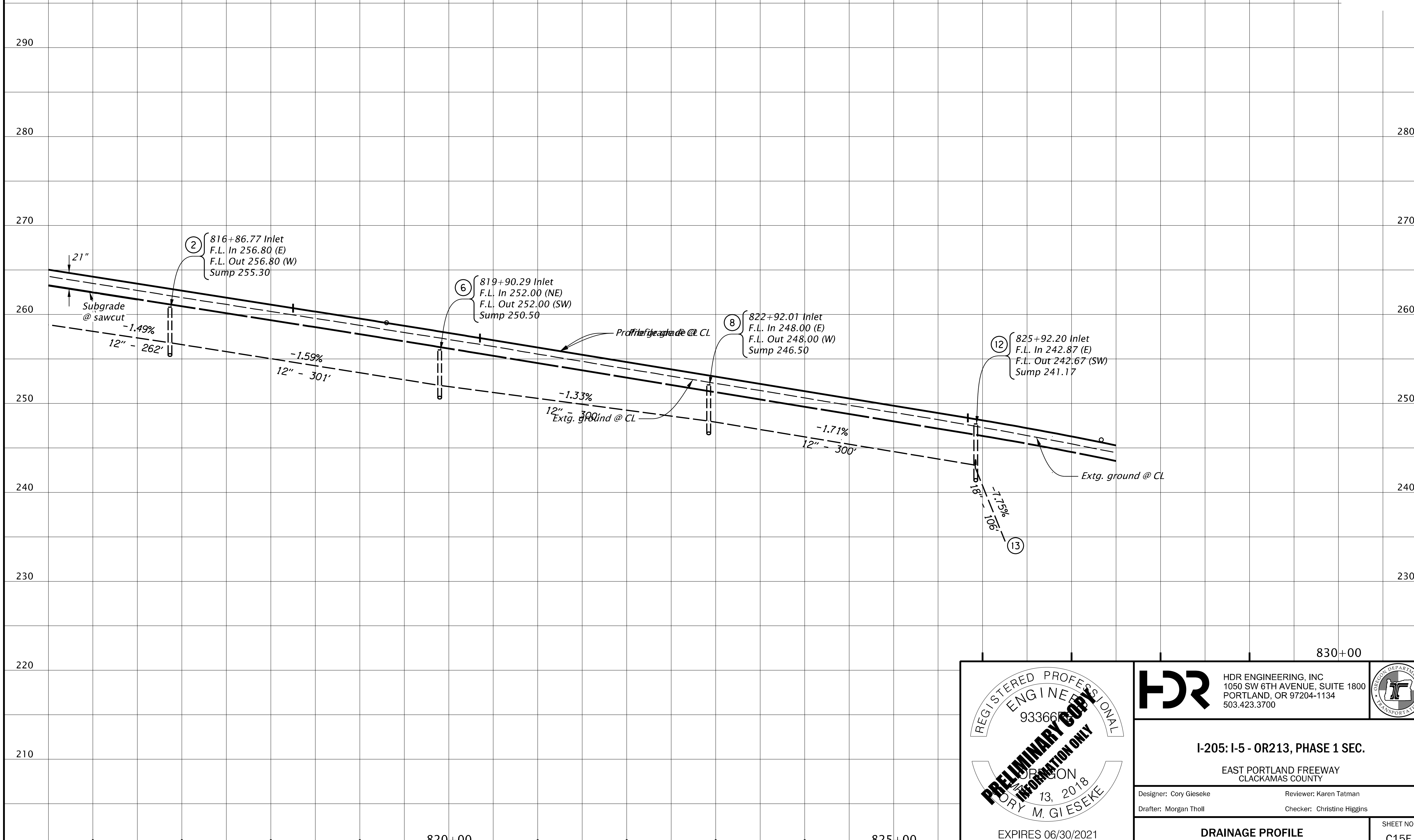
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO. C15D

"Ls" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

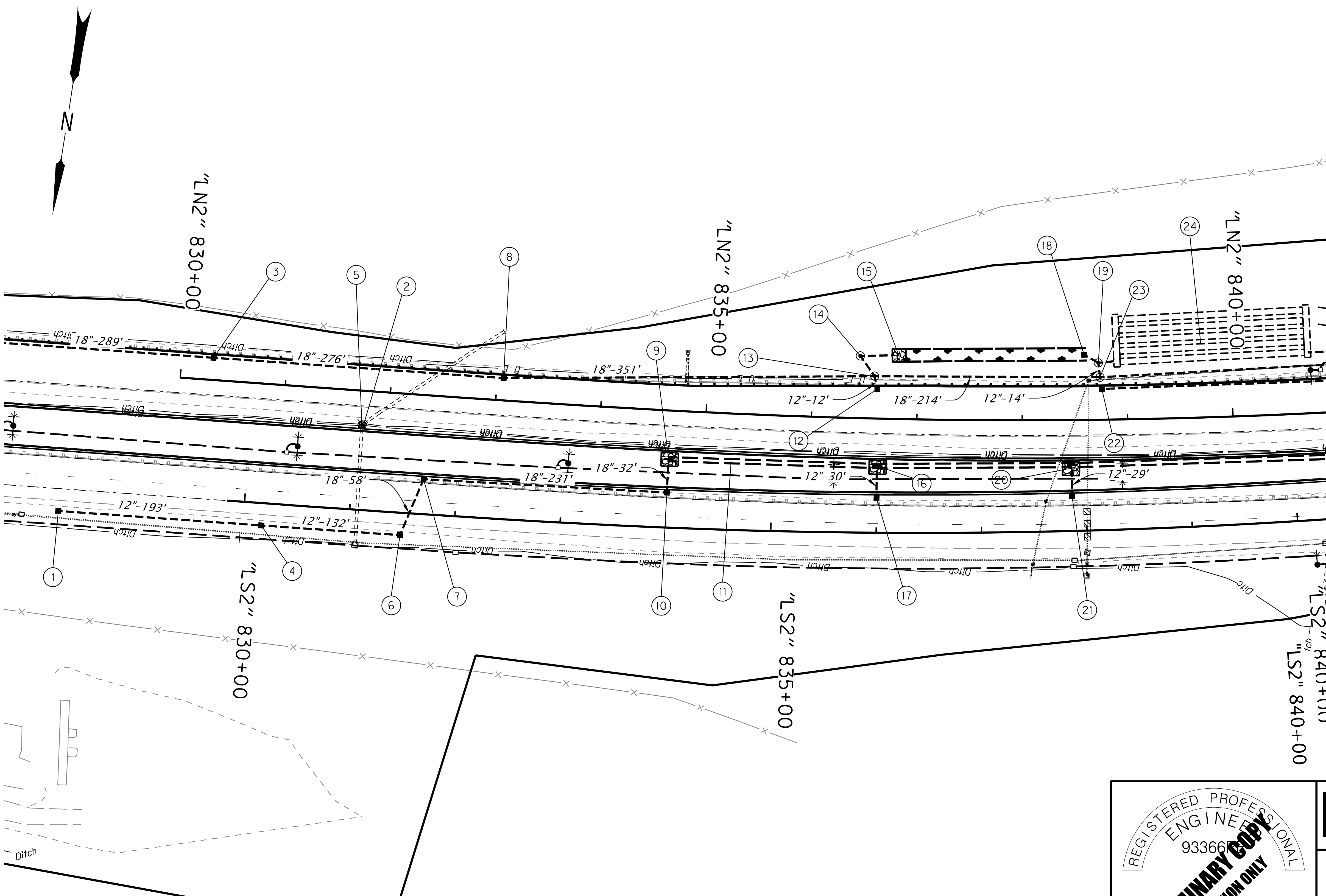
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO. C15E



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C16B

Rotation: 188.8482° Scale: 1"=100'

(1) Sta. "Ls2" 828+24.24, Rt.
Const. type "G-2" inlet - 18" Sump

(2) Remove inlet

(3) Sta. "Ln2" 830+30.43, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 289'
5' Depth

(4) Sta. "Ls2" 830+17.30, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 193'
5' Depth

(5) Sta. "Ln2" 831+75.35, 32.42' Rt.
Const. storm sew. manhole
Connect extg. pipes

(6) Sta. "Ls2" 831+48.88, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 132'
5' Depth

(7) Sta. "Ls2" 831+68.26, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 58'
5' Depth
Trench resurfacing - 27 sq. yd.

(8) Sta. "Ln2" 833+06.36, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 276'
5' Depth

(9) Sta. "Ls2" 834+00.45, 65.16' Lt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 18" storm sew. pipe - 32'
5' Depth

(10) Sta. "Ls2" 833+99.72, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 231'
5' Depth

(11) Sta. "Ln2" 834+00.45, 65.16' Lt. to Sta. "Ls2" 840+63.09, 57.81' Lt.
Const. ditch

(12) Sta. "Ln2" 836+62.06, Lt.
Const. type "G-2" inlet - 18" Sump

(13) Sta. "Ln2" 836+58.92, 40.04' Lt.
Const. diversion manhole
Inst. 12" storm sew. pipe - 12'
5' Depth
Inst. 18" storm sew. pipe - 351'
5' Depth

(14) See sht. HA12, note 2

(15) Sta. "Ln2" 836+82.56, 60.48' Lt. to Sta. "Ln2" 838+59.54, 61.72' Lt.
Const. biofiltration swale
(For details, see sht. HA12)

(16) Sta. "Ls2" 836+01.22, 62.20' Lt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 30'
5' Depth

(17) Sta. "Ls2" 836+00.39, Lt.
Const. type "G-2" inlet - 18" Sump

(18) See sht. HA12, note 4

(19) See sht. HA12, note 5

(20) Sta. "Ls2" 837+86.56, 59.09' Lt.
Const. riprap pad
Loose riprap (class 50) - 5.0 tons
Inst. 12" storm sew. pipe - 29'
5' Depth

(21) Sta. "Ls2" 837+86.82, Lt.
Const. type "G-2" inlet - 18" Sump

(22) Sta. "Ln2" 838+75.93, Lt.
Const. type "G-2" inlet - 18" Sump

(23) Sta. "Ln2" 838+74.55, 40.43' Lt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 14'
5' Depth
Inst. 18" storm sew. pipe - 214'
5' Depth

(24) Sta. "Ln2" 838+90.37 to Sta. "Ln2" 840+73.42
Const. underground detention system
(For details, see sht. HA13)

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

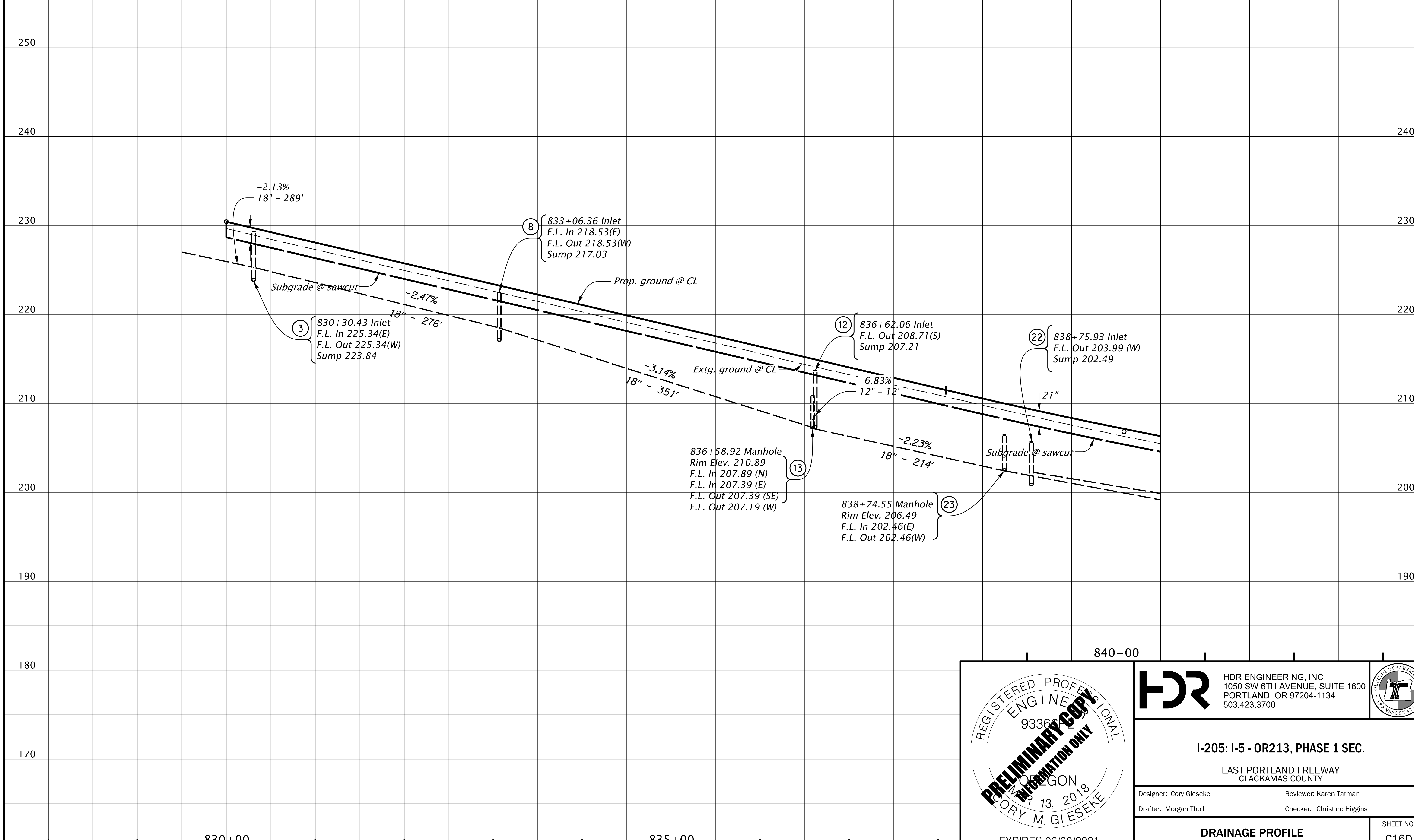
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C16C

Rotation: 0° Scale: 1"=100'

"LN2" LINE



REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

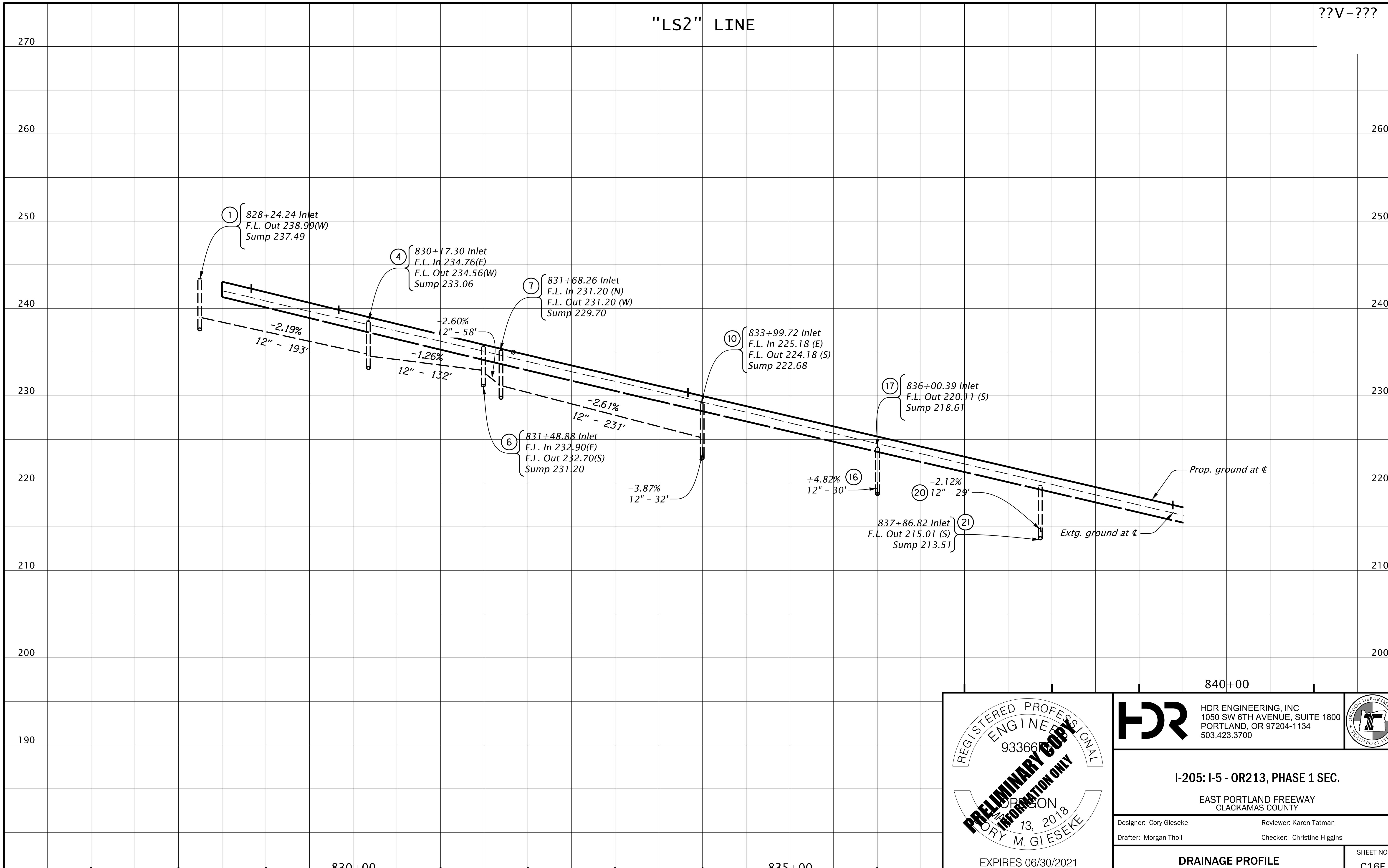
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C16D



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

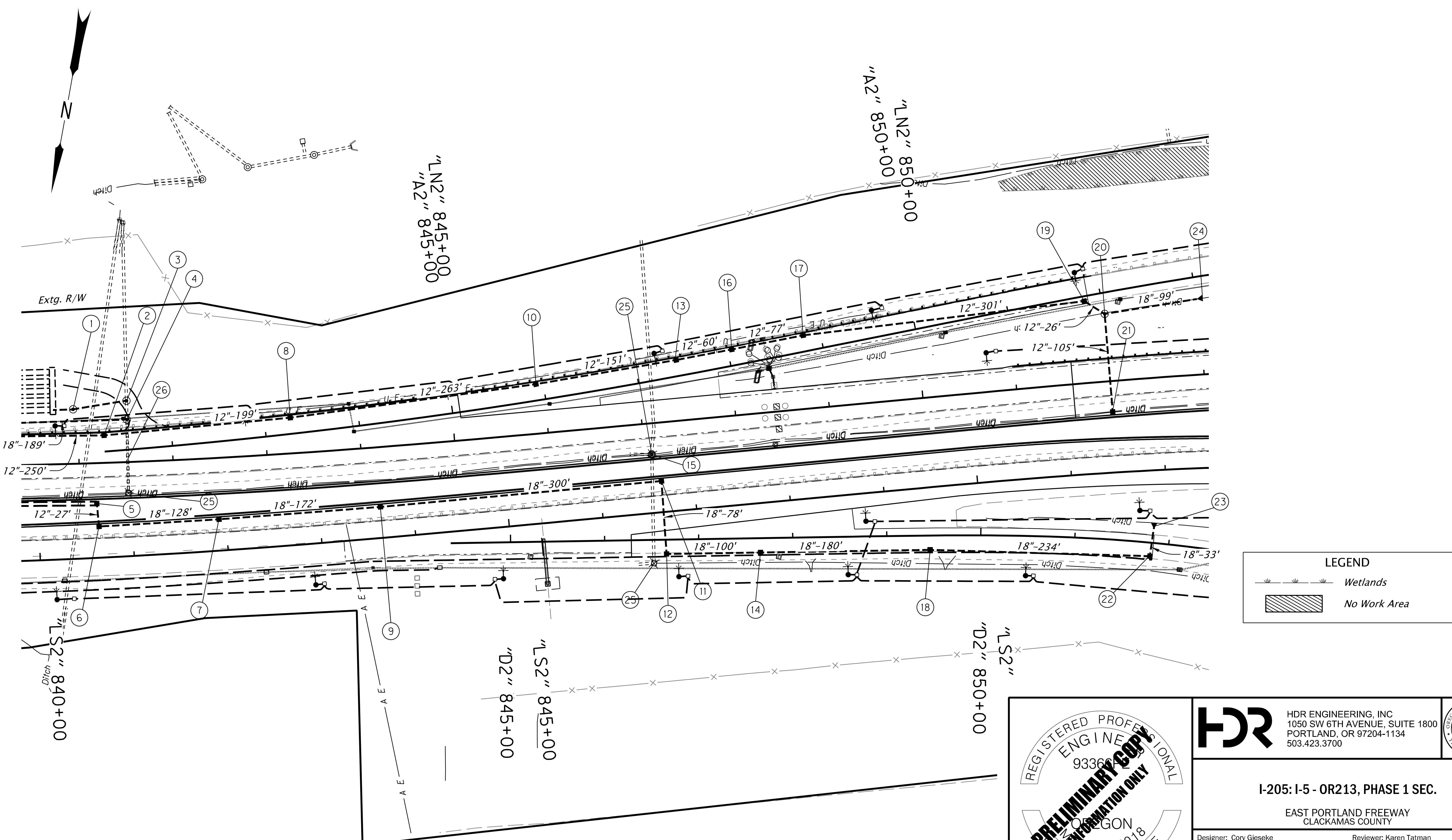
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C16E

Sec. 35, T. 2 S, R. 1 E, W.M.

S. WEST LINN INTERCHANGE



REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO. C17B

Rotation: 190.2392° Scale: 1"=100'

1. See sht. HA13, note 3

2. Sta. "Ln2" 841+27.32, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 250'
5' Depth

3. See sht. HA13, note 4

4. Sta. "Ln2" 841+52.35, 44.93' Lt.
Const. storm sew. manhole over existing pipe
Inst. 18" storm sew. pipe - 189'
5' Depth

5. Sta. "Ls2" 840+63.09, 57.81' Lt.
Const. type "D" inlet

6. Sta. "Ls2" 840+64.22, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 27'
10' Depth

7. Sta. "Ls2" 841+91.78, 32.98' Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 128'
5' Depth

8. Sta. "Ln2" 843+27.33, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 199'
5' Depth

9. Sta. "Ls2" 843+65.22, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 172'
10' Depth

10. Sta. "Ln2" 845+91.45, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 263'
5' Depth

11. Sta. "Ls2" 846+65.26, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 300'
10' Depth

12. Sta. "Ls2" 846+63.83, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 78'
5' Depth

13. Sta. "A2" 847+43.18, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 151'
5' Depth

14. Sta. "Ls2" 847+63.10, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 100'
5' Depth

15. Sta. "Ln2" 847+07.48, 32.96' Rt.
Const. storm sew. manhole
Connect extg. pipes

16. Sta. "A2" 848+03.87, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 60'
5' Depth

17. Sta. "A2" 848+80.88, Lt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 77'
5' Depth

18. Sta. "D2" 849+45.81, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 180'
5' Depth

19. Sta. "A2" 851+81.63, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 301'
5' Depth

20. Sta. "A2" 852+00.51, 22.77' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 26'
5' Depth
Inst. 12" storm sew. pipe - 105'
5' Depth
Trench resurfacing - 16 sq. yd.

21. Sta. "Ln2" 852+00.03, Rt.
Const. type "G-2" inlet - 18" Sump

22. Sta. "D2" 851+81.16, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 18" storm sew. pipe - 234'
5' Depth

23. Sta. "D2" 851+82.27, 18.68' Lt.
Inst. 18" storm sew. pipe - 33'
5' Depth
Trench resurfacing - 11 sq. yd.

24. Sta. "A2" 853+00.36, 23.84' Rt.
Inst. 18" storm sew. pipe - 99'
5' Depth

25. Remove inlet - 3

26. Remove pipe - 78'

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

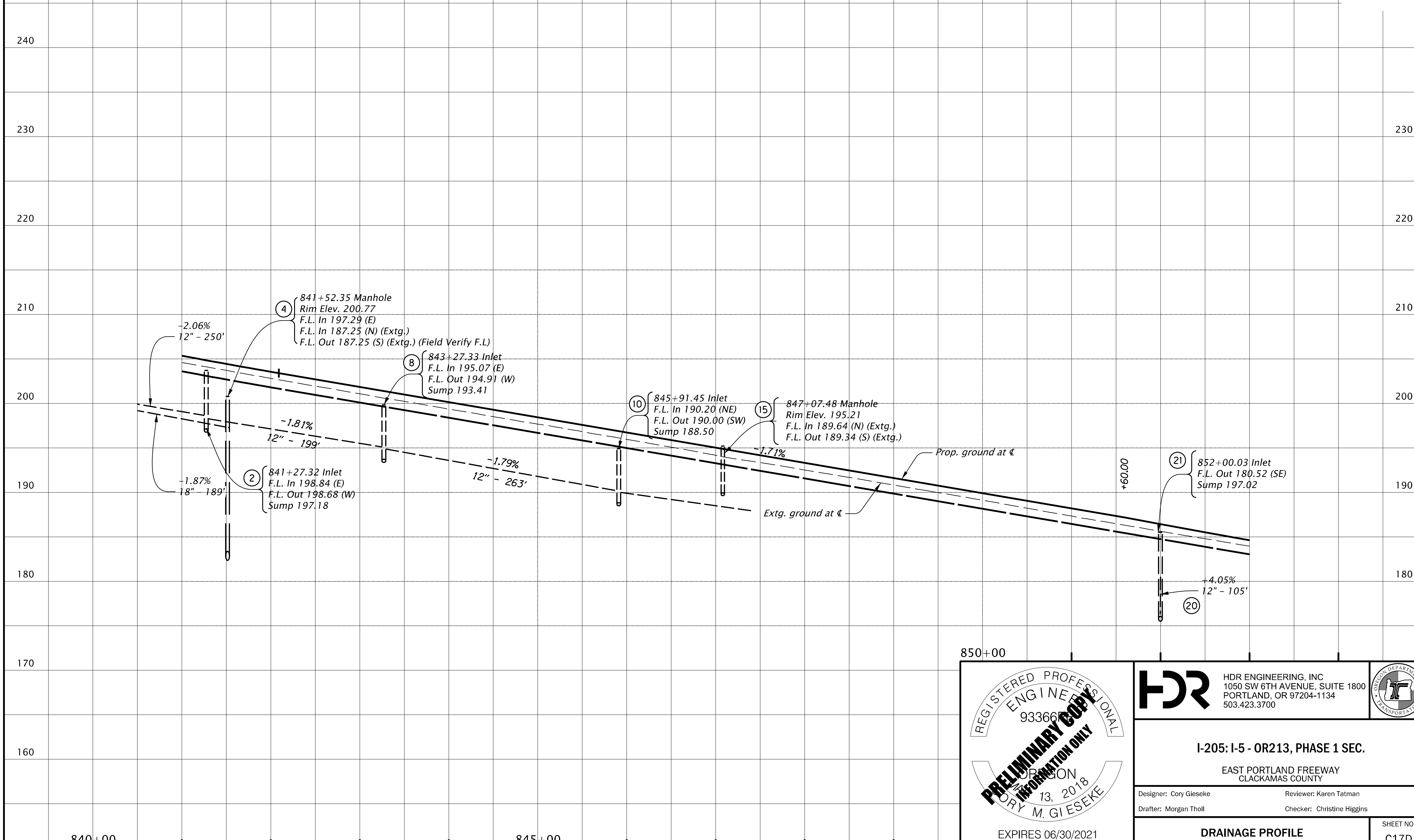
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES

SHEET NO. C17C

Rotation: 0° Scale: 1"=100'

"LN2" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

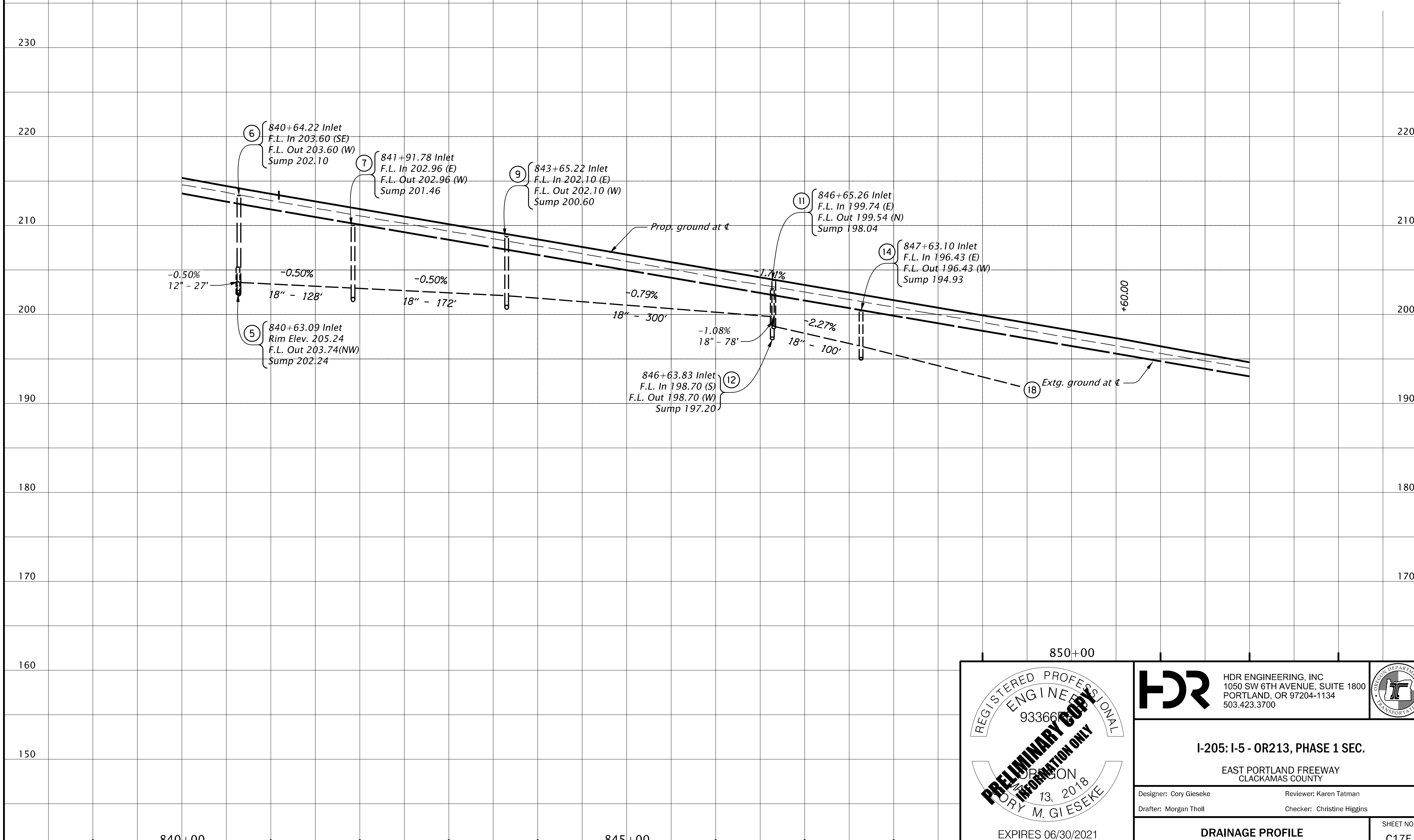
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C17D

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

"LS2" LINE



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

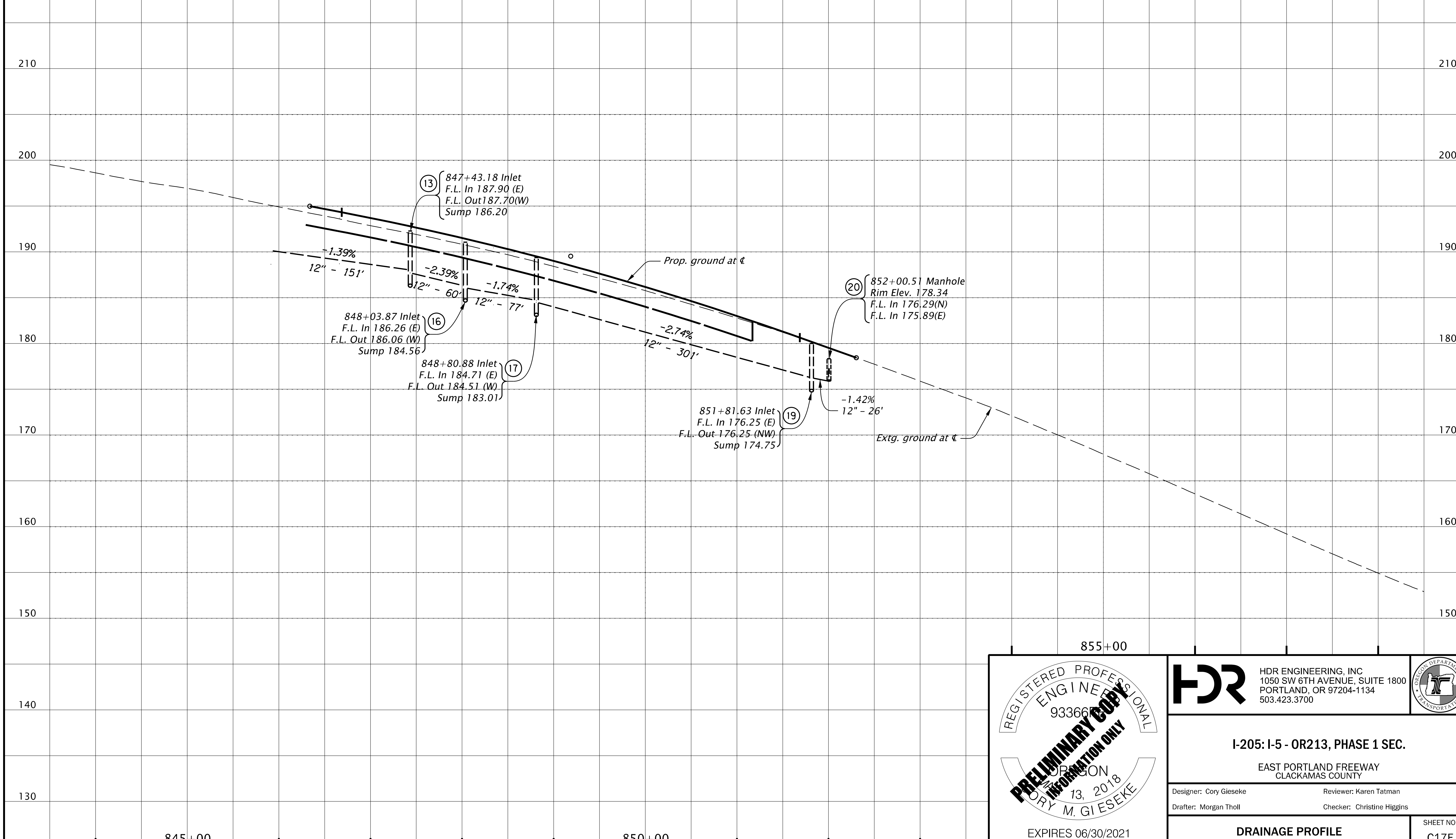
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C17E

"A2" LINE
NB ENTRANCE RAMP



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

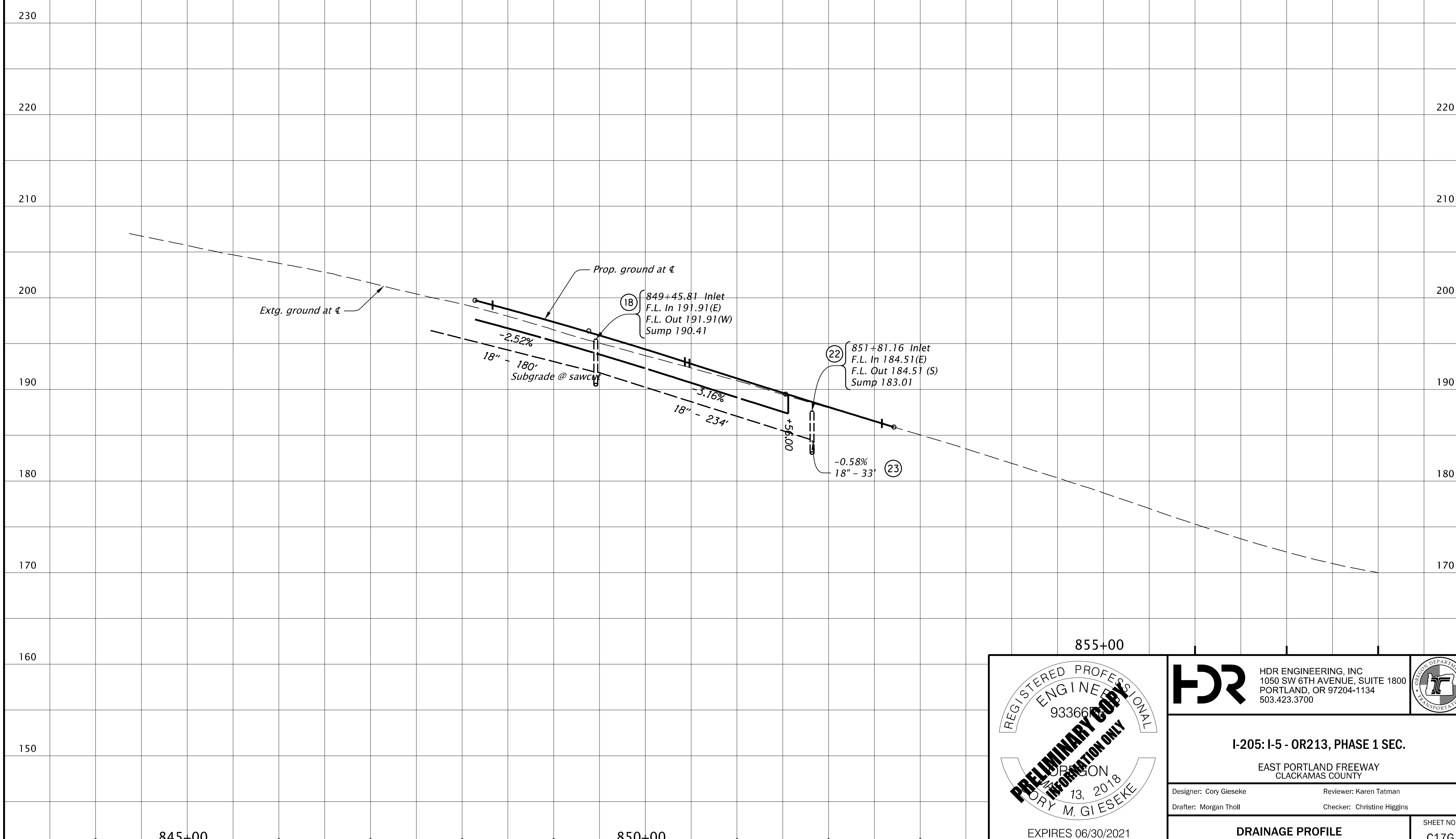
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C17F

"D2" LINE
SB EXIT RAMP



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

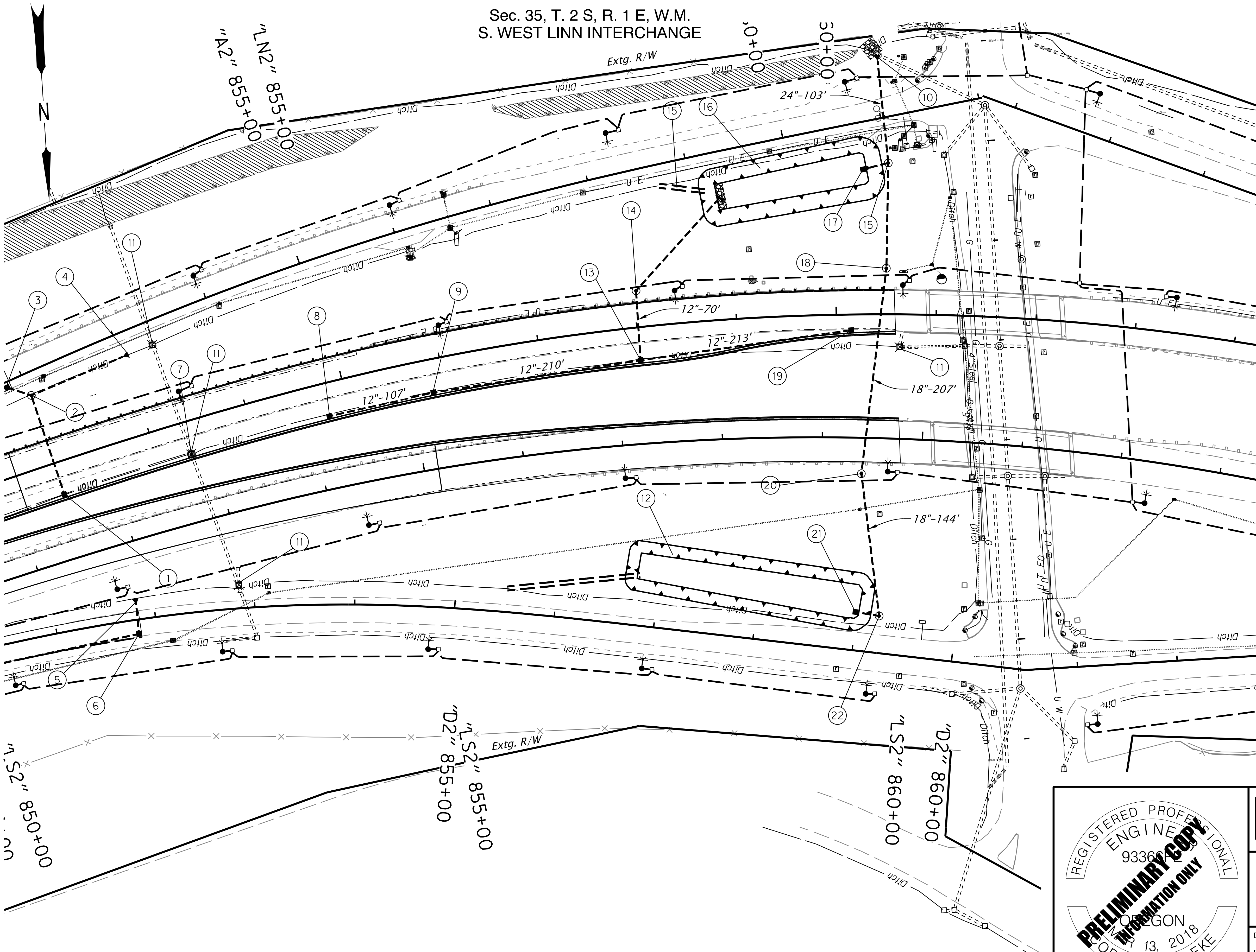
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C17G

??V-???



LEGEND

Wetlands

No Work Area

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY

EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE & UTILITIES

SHEET NO.
C18B

Rotation: 176.5124° Scale: 1"=100'

(1) See C17C, note 21

(2) See C17C, note 20

(3) See C17C, note 19

(4) See C17C, note 24

(5) See C17C, note 23

(6) See C17C, note 22

(7) Sta. "LN2" 853+34.32, 32.75' Rt.
Const. storm sew. manhole
Connect extg. pipes

(8) Sta. "LN2" 854+78.76, Rt.
Const. type "G-2" inlet - 18" Sump

(9) Sta. "LN2" 855+87.23, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 107'
5' Depth

(10) Sta. "A2" 861+07.74, 56.03' Lt.
Inst. 24" storm sew. pipe - 103'
5' Depth
Trench resurfacing - 57 sq. yd.

(11) Removed inlet - 4

(12) Sta. "D2" 856+66.70, 60.41' Lt. to Sta. 859+14.63, 48.14' Lt.
Const. bioretention pond
(For details, see sht. HA14)

(13) Sta. "LN2" 858+00.13, Rt.
Const. type "G-2" inlet - 18" Sump
Inst. 12" storm sew. pipe - 210'
5' Depth
Inst. 12" storm sew. pipe - 213'
5' Depth

(14) Sta. "LN2" 858+03.00, 36.58' Lt.
Const. pollution control manhole
Inst. 12" storm sew. pipe - 70'
5' Depth
Trench resurfacing - 19 sq. yd.

(15) See sht. HA15, note 4

(16) Sta. "A2" 859+06.98, 45.55' Rt. to Sta. "A2" 860+91.75, 46.62' Rt.
Const. bioretention pond
(For details, see sht. HA15)

(17) See sht. HA15, note 3

(18) Sta. "LN2" 860+50.05, 46.11' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 207'
5' Depth
Trench resurfacing - 31 sq. yd.

(19) Sta. "LN2" 860+15.03, Rt.
Const. type "G-2" inlet - 18" Sump

(20) Sta. "LS2" 859+39.59, 36.06' Rt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 144'
5' Depth

(21) See sht. HA14, note 2

(22) See sht. HA14, note 3

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

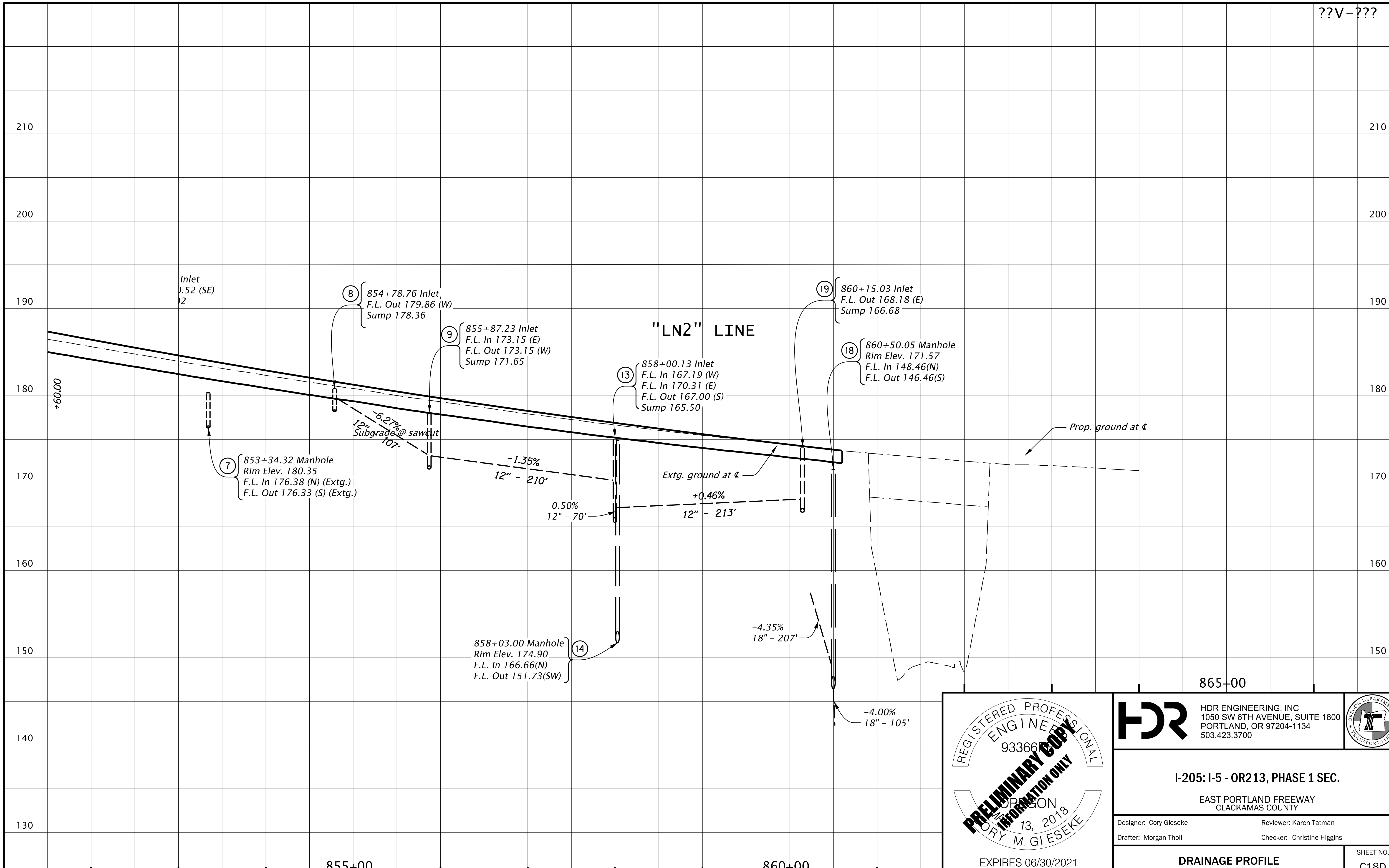
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE & UTILITIES NOTES — SHEET NO. C18C

Rotation: 176.5124° Scale: 1"=100'



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

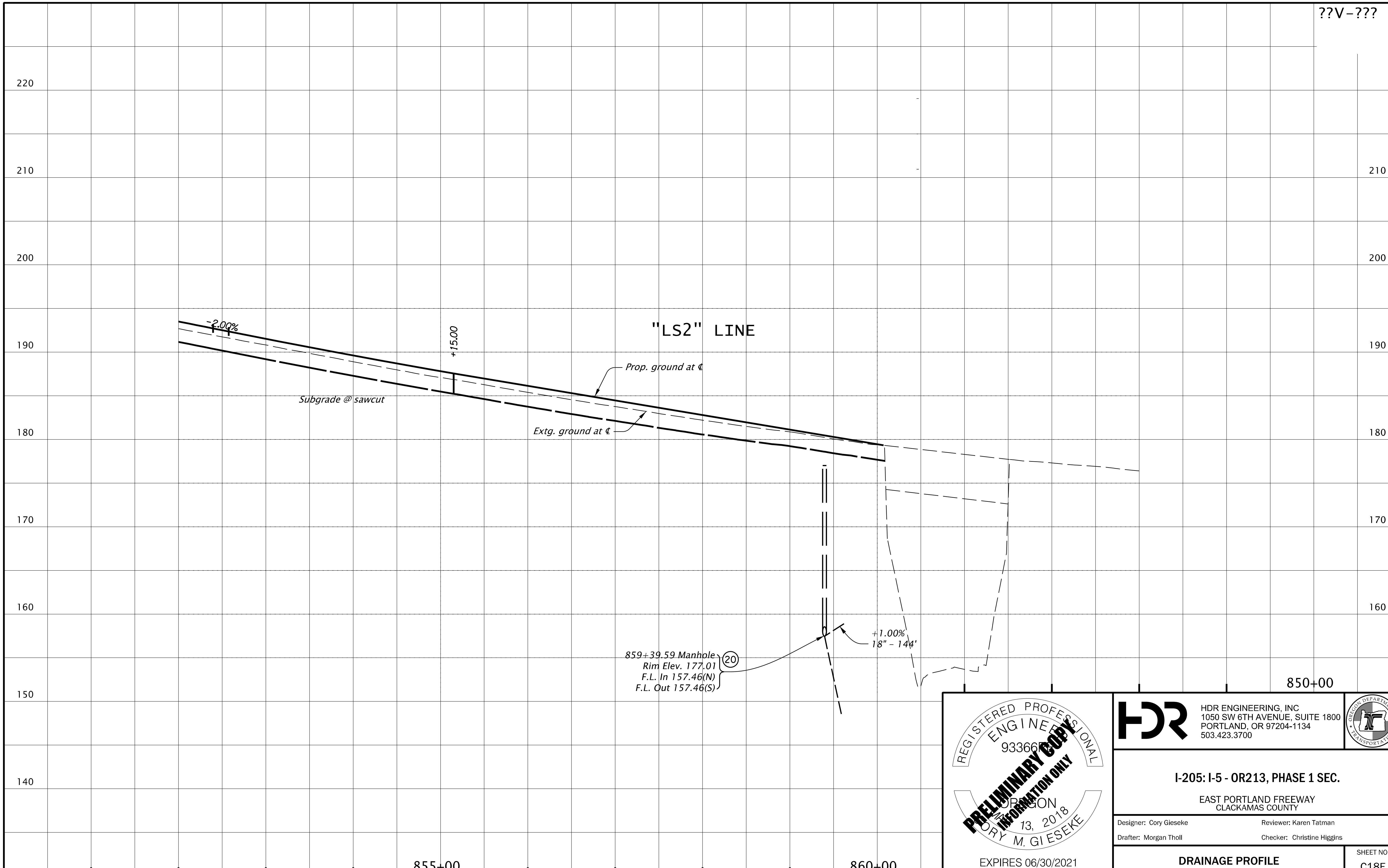
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO.
C18D



REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

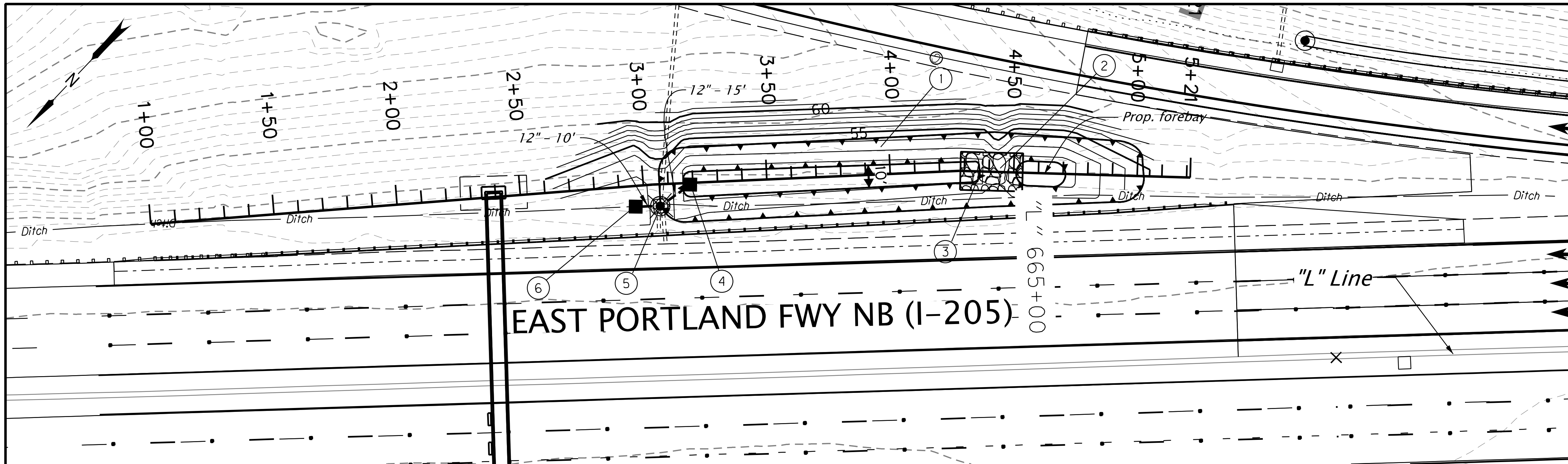
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

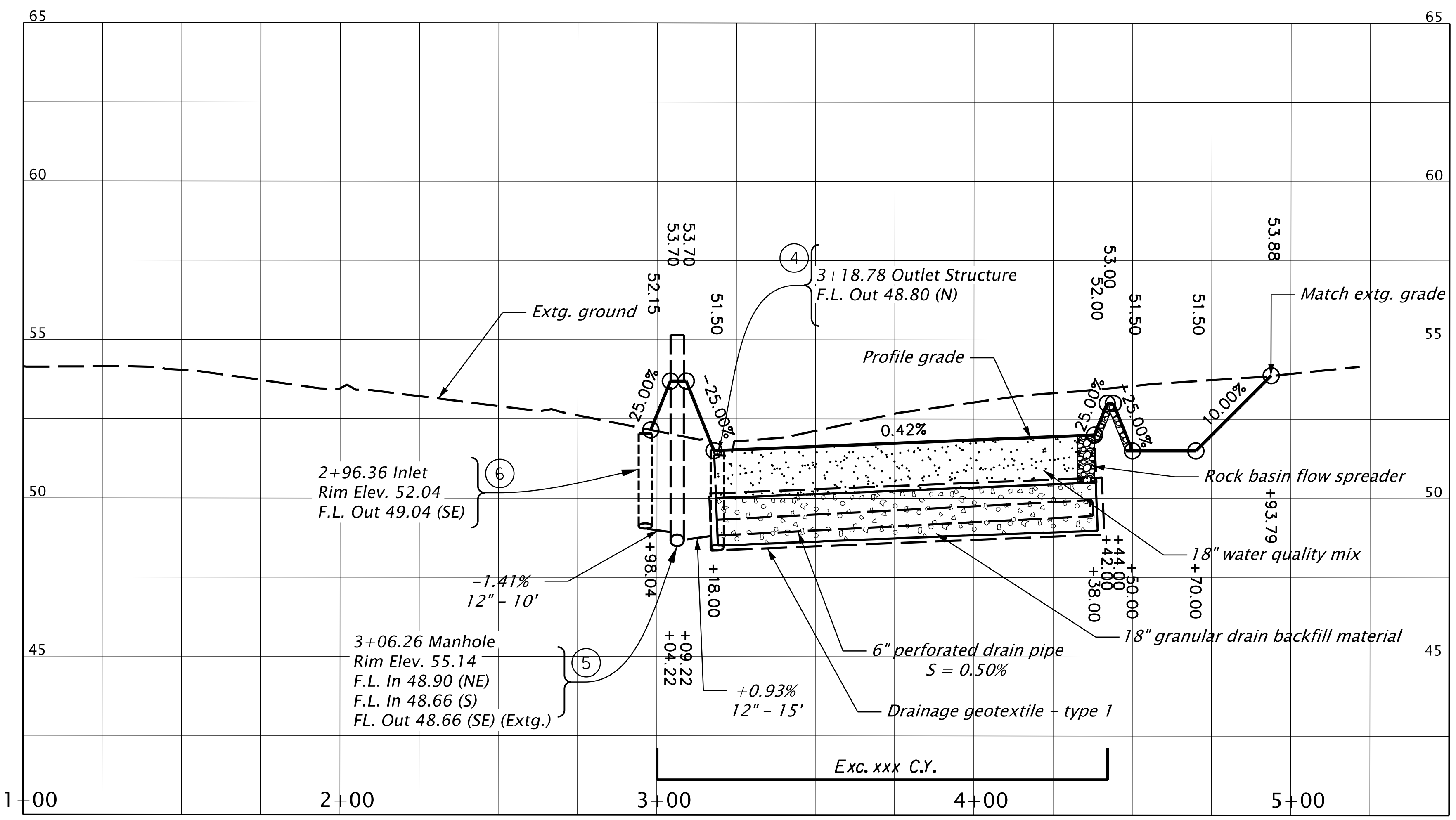
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

DRAINAGE PROFILE

SHEET NO. C18E



1. Sta. 5+02.44 to Sta. 3+06.48 = Sta. "L" 665+46.16, 77.84' Lt. to Sta. "L" 663+50.02, 77.02' Lt.
   Const. bioretention pond
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA17)
2. Sta. 4+50.00
   Const. bioretention pond berm
   (For details, see sht. HA16)
3. Sta. 4+39.51
   Const. rock basin flow spreader
   (For details, see sht. HA16)
4. Sta. 3+18.78, 0.61' Rt.
   Const. water quality facility outlet structure
   (For details, see sht. HA19)
5. Sta. 3+06.26, 8.77' Rt.
   Const. storm sew. manhole over existing sewer
   Inst. 12" storm sew. pipe - 10'
   5' Depth
   Inst. 12" storm sew. pipe - 15'
   5' Depth
6. Sta. 2+96.36, 8.44' Rt.
   Const. type "D" inlet



DFI no. #######

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

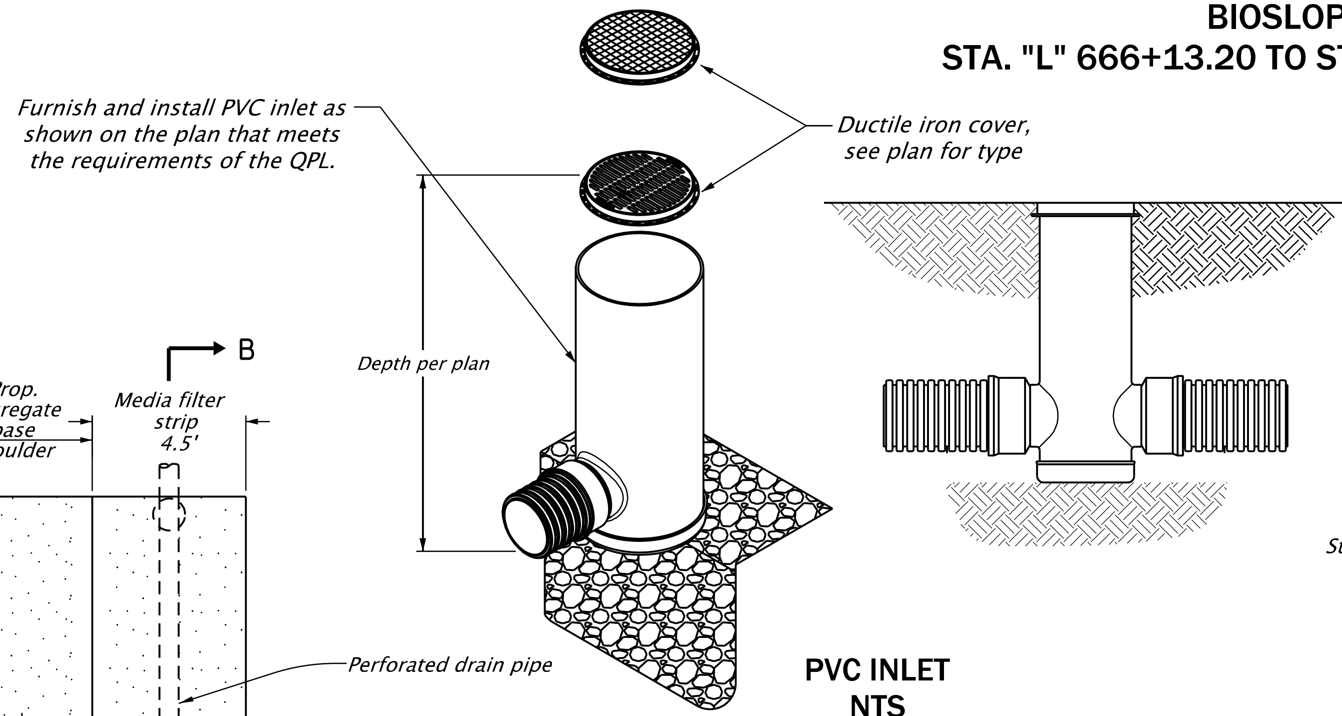
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

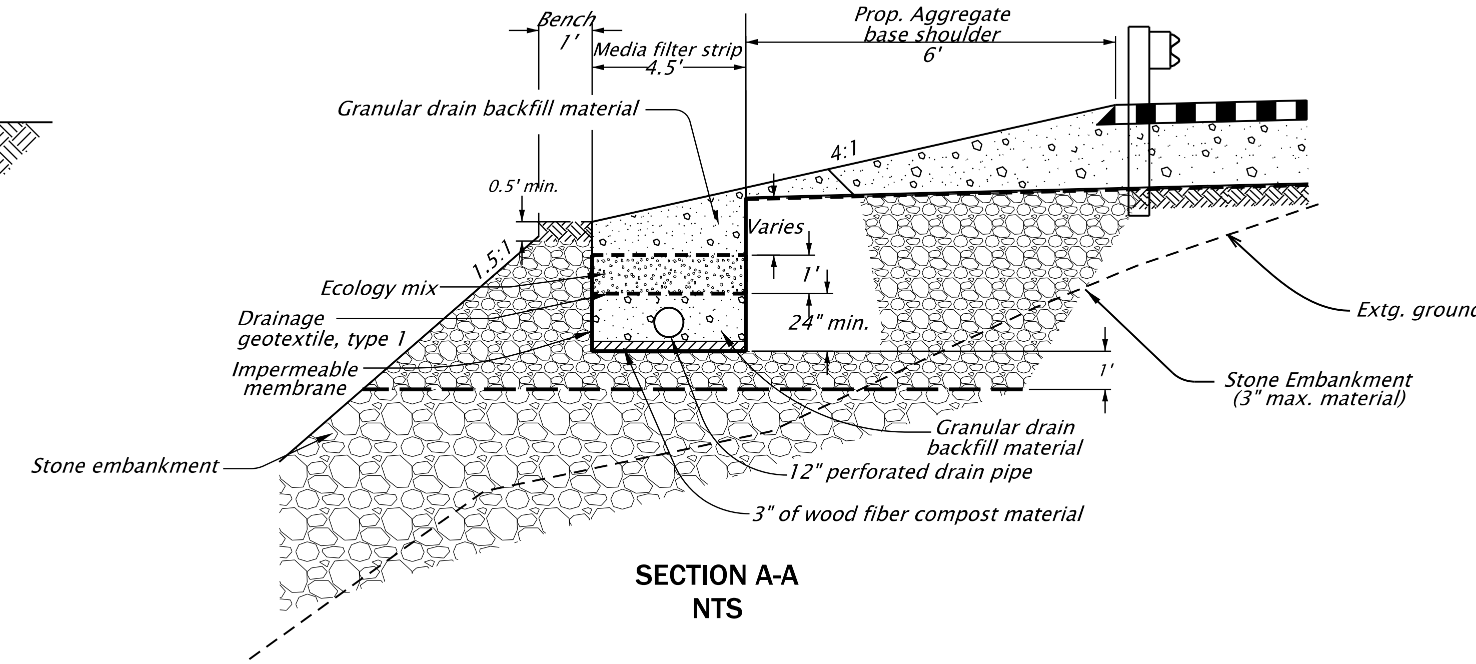
SHEET NO.
HA01

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10

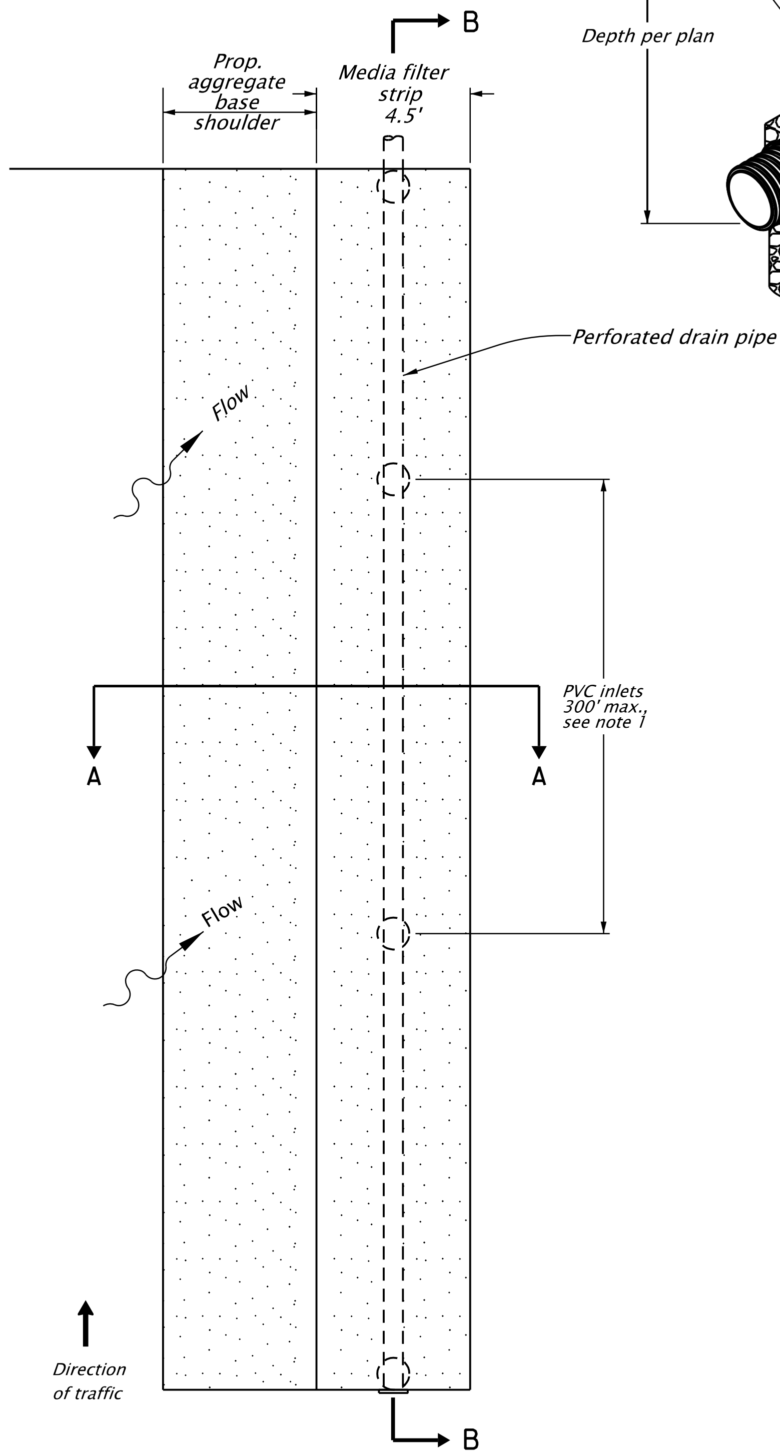
BIOSLOPE
STA. "L" 666+13.20 TO STA. "L" 684+63.80



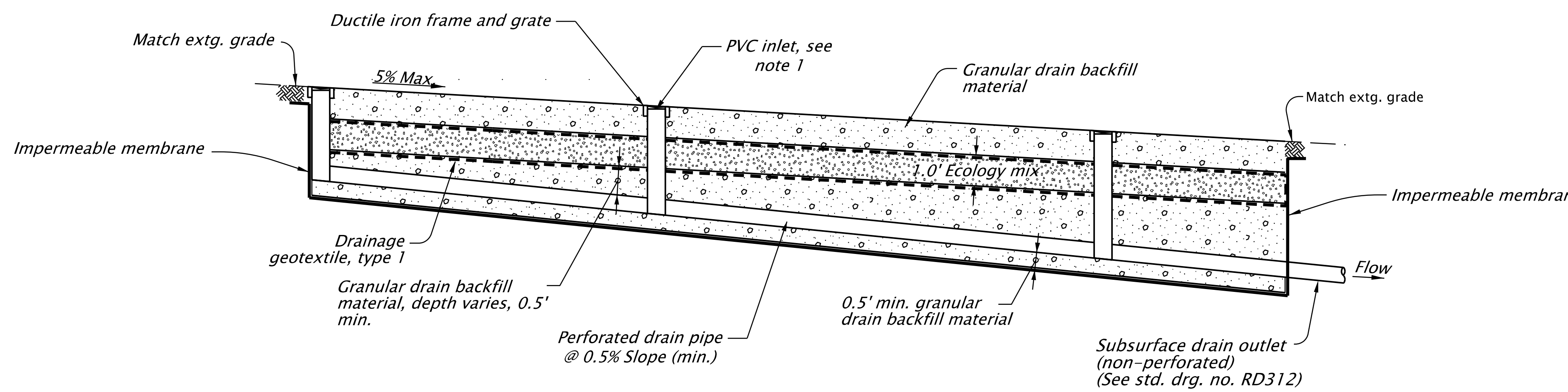
PVC INLET
NTS



SECTION A-A
NTS



PLAN
NTS



SECTION B-B
NTS

Notes:

1. Install PVC inlets as shown along perforated drain pipe. PVC inlet should be flush to ground surface.

Bioslope I.D.	*Basin Area (acres)*	*2-Year Peak Flow (cfs)*	*Length (ft)*	*Assumed Long Term * Infiltration Capacity (cfs)*	*Rdwy Slope*	*Pipe Slope*	*Pipe ** Capacity (cfs)*
Bioslope #1	*0.253*	*0.14*	*333*	*0.35*	*1.9%*	*1.9%*	*2.37*
Bioslope #2	*0.840*	*0.47*	*459*	*0.48*	*0.2%*	*0.5%*	*1.22*
Bioslope #3	*0.517*	*0.29*	*307*	*0.32*	*0.2%*	*0.5%*	*1.22*
Bioslope #4	*0.496*	*0.28*	*301*	*0.31*	*0.3%*	*0.5%*	*1.22*
Bioslope #5	*0.871*	*0.49*	*565*	*0.52*	*0.8%*	*0.8%*	*1.54*

** assumes 4.5 feet wide infilration trench as shown in detail*
*** assumes 12 inch pipe and 0.027 mannings coefficient*

DFI#XXXXXX

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

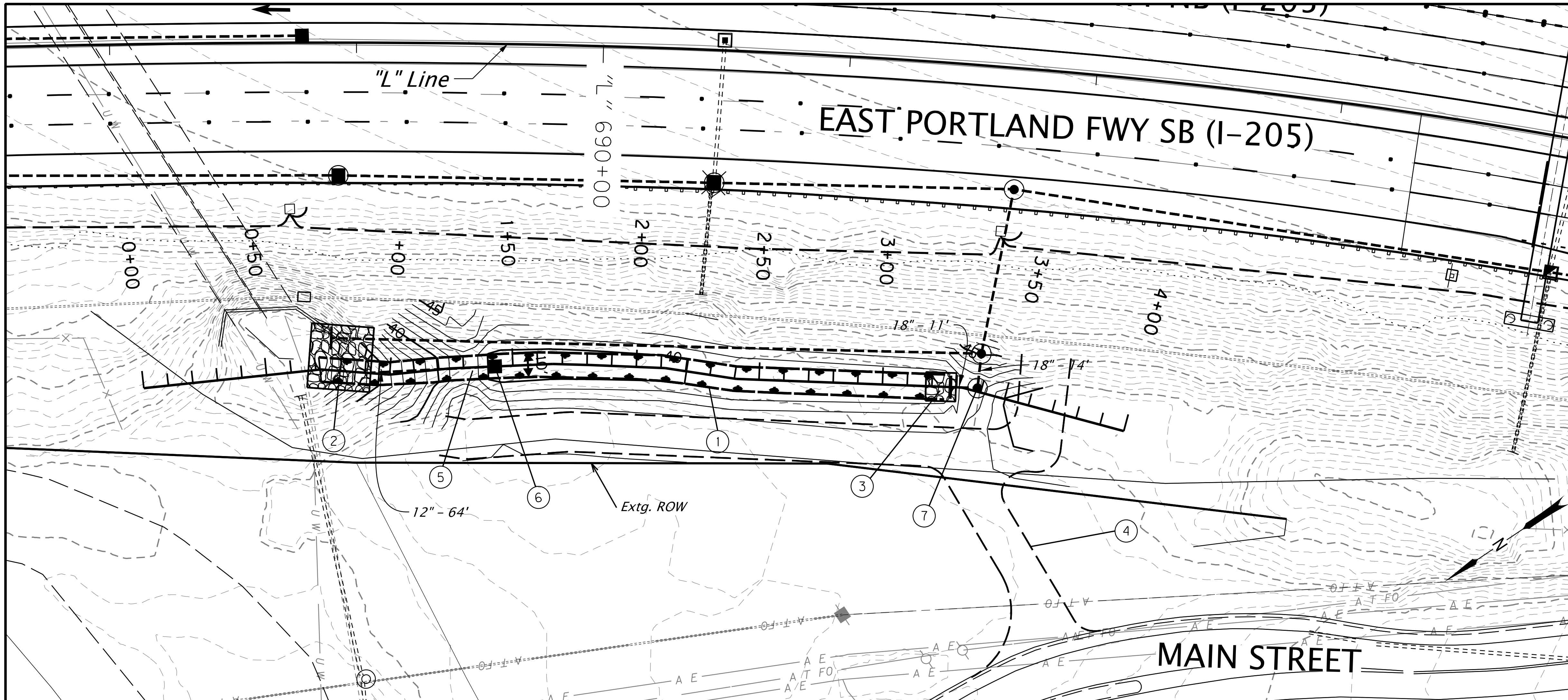
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

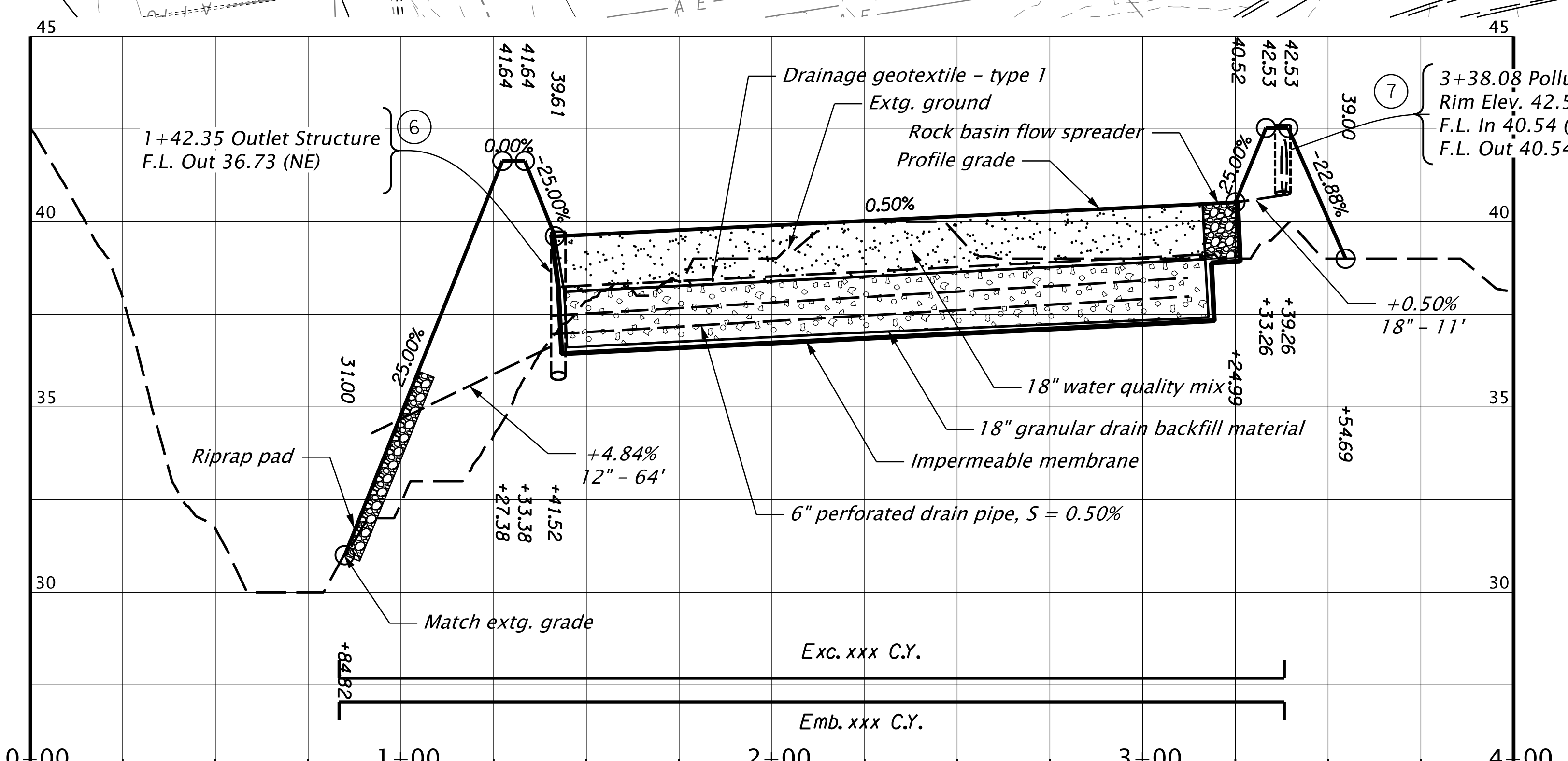
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY DETAILS

SHEET NO.
HA02

Rotation: 0° Scale: 1"=60'





1. Sta. 3+24.89 to Sta. 0+71.34 = Sta. "L" 691+52.67, 130.80' Rt. to Sta. "L" 688+85.28, 133.45' Rt.
   Const. bioretention pond
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA17)

2. Sta. 0+81.52, 9.75' Lt.
   Const. riprap pad
   Loose riprap (class 50) - 5.0 tons
   Inst. 12" storm sew. pipe - 64'
   5' Depth

3. Sta. 3+23.60
   Const. rock basin flow spreader
   (For details, see sht. HA16)
   Inst. 18" storm sew. pipe - 11'
   5' Depth

4. Const. maintenance access road
   Exc. - xx cu. yd.
   Agg. base - xx ton
   Subgrade geotextile - sq. yd.
   (For details, see sht. HA17)

5. Sta. 1+30.37
   Const. bioretention pond berm
   (For details, see sht. HA16)

6. Sta. 1+42.35
   Const. water quality facility outlet structure
   (For details, see sht. HA19)

7. Sta. 3+38.08, 1.50' Rt.
   Const. pollution control manhole
   Inst. 18" storm sew. pipe - 14'
   5' Depth

DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

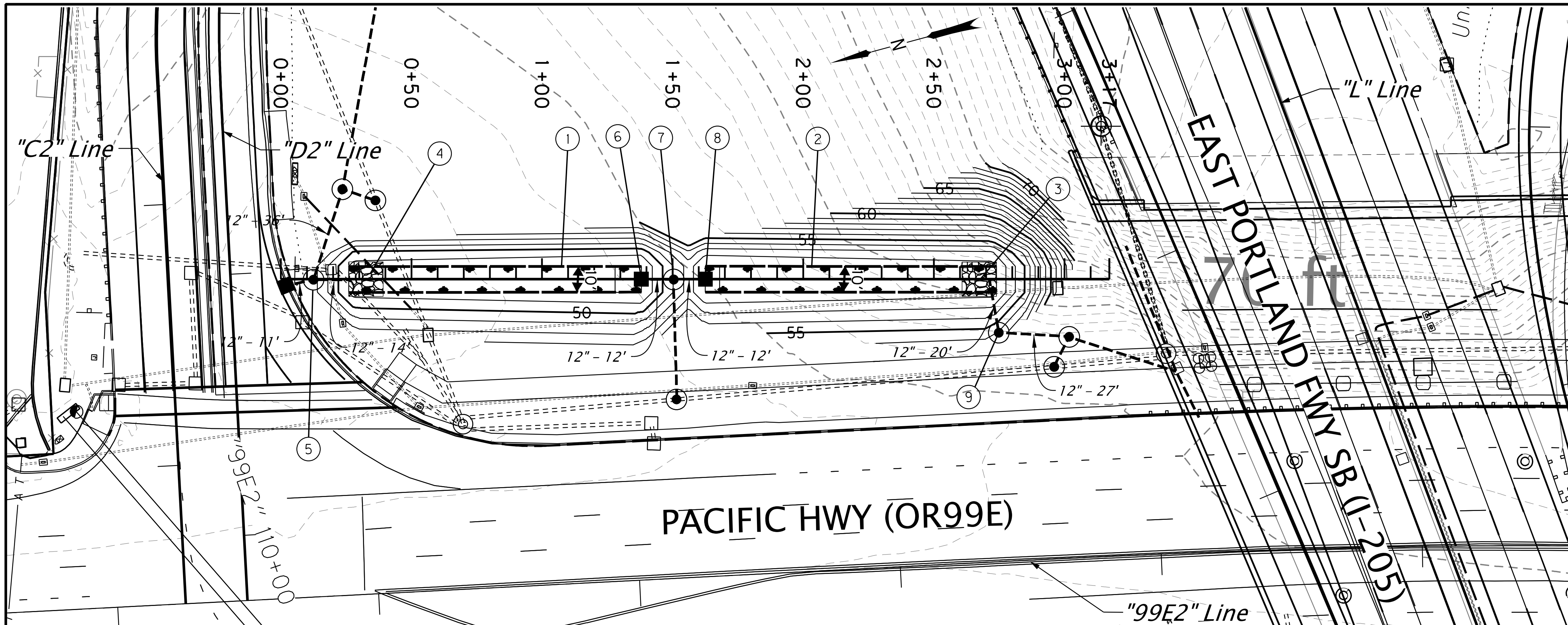
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

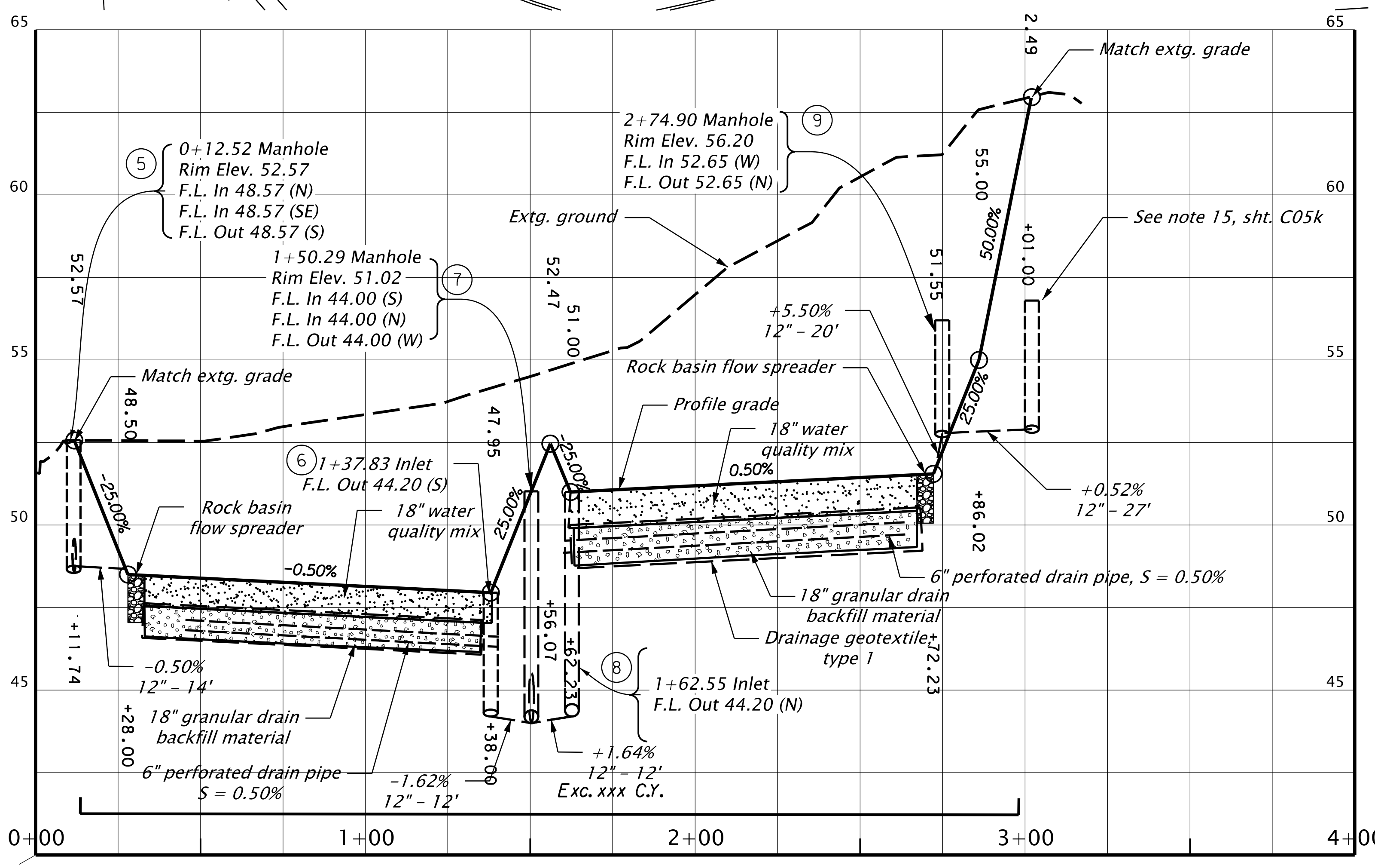
Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO.
HA03

Rotation: 236.1297° Scale: 1"=50'
Vertical Scale: 1:10





① Sta. 0+25.96 to Sta. 1+37.92 = Sta. "99E2" 108+94.90, 120.45' Lt. to Sta. "99E2" 110+06.66, 114.88' Lt.
Const. biofiltration swale
Inst. field facility marker (Type S2) - 2
(For details, see sht. HA16)

② Sta. 2+73.76 to Sta. 1+62.80 = Sta. "99E2" 111+42.10, 107.75' Lt. to Sta. "99E2" 110+31.13, 113.76' Lt.
Const. biofiltration swale
(For details, see sht. HA16)

③ Sta. 2+67.30
Construct rock basin flow spreader
Inst. 12" storm sew. pipe - 20'
5' Depth
(For details, see sht. HA16)

④ Sta. 0+32.40
Construct rock basin flow spreader
Inst. 12" storm sew. pipe - 14'
5' Depth
(For details, see sht. HA16)

⑤ Sta. 0+12.52, 0.00'
Const. pollution control manhole
Inst. 12" storm sew. pipe - 11'
5' Depth
Inst. 12" storm sew. pipe - 36'
5' Depth

⑥ Sta. 1+37.83, 0.00'
Const. type "D" inlet

⑦ Sta. 1+50.29, 0.00'
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 12'
5' Depth
Inst. 12" storm sew. pipe - 12'
5' Depth

⑧ Sta. 1+62.55, 0.00'
Const. type "D" inlet

⑨ Sta. 2+74.90, 20.40' Lt.
Const. pollution control manhole
Inst. 12" storm sew. pipe - 27'
5 Depth

DFI no. ######

REGISTERED PROFESSIONAL ENGINEER 93366PE OREGON MAY 13, 2018 CORY M. GIESEKE
PRELIMINARY COPY INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

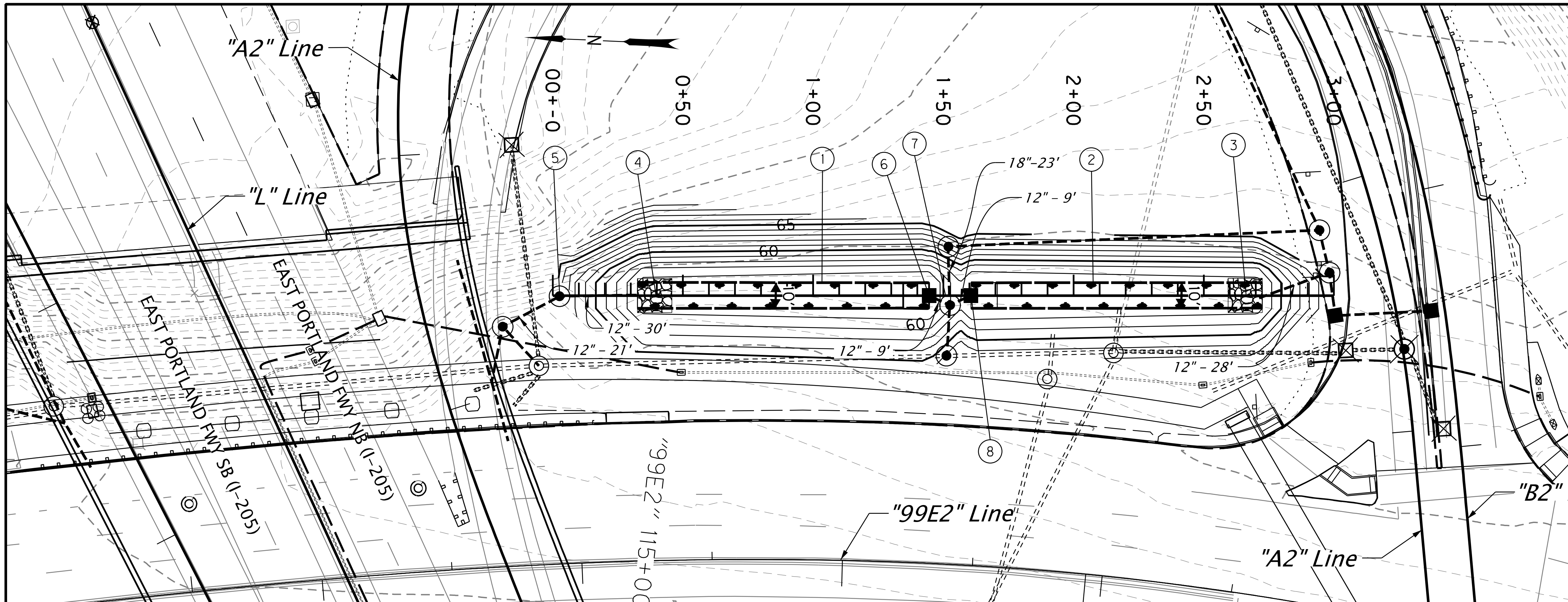
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA04

Rotation: 271.1643° Scale: 1"=50'
Vertical Scale: 1:10



(1) Sta. 0+32.52 to Sta. 1+44.44 = Sta. "99E2" 114+24.15, 102.38' Lt. to Sta. "99E2" 115+28.87, 102.40' Lt.
Construct biofiltration swale
Inst. field facility marker (Type S2) - 2
(For details, see sht. HA16)

(2) Sta. 2+72.49 to Sta. 1+60.81 = Sta. "99E2" 116+45.63, 114.32' Lt. to Sta. "99E2" 115+43.75, 103.51' Lt.
Construct biofiltration swale
(For details, see sht. HA16)

(3) Sta. 2+65.35
Construct rock basin flow spreader
Inst. 12" storm sew. pipe - 30'
10' Depth
(For details, see sht. HA16)

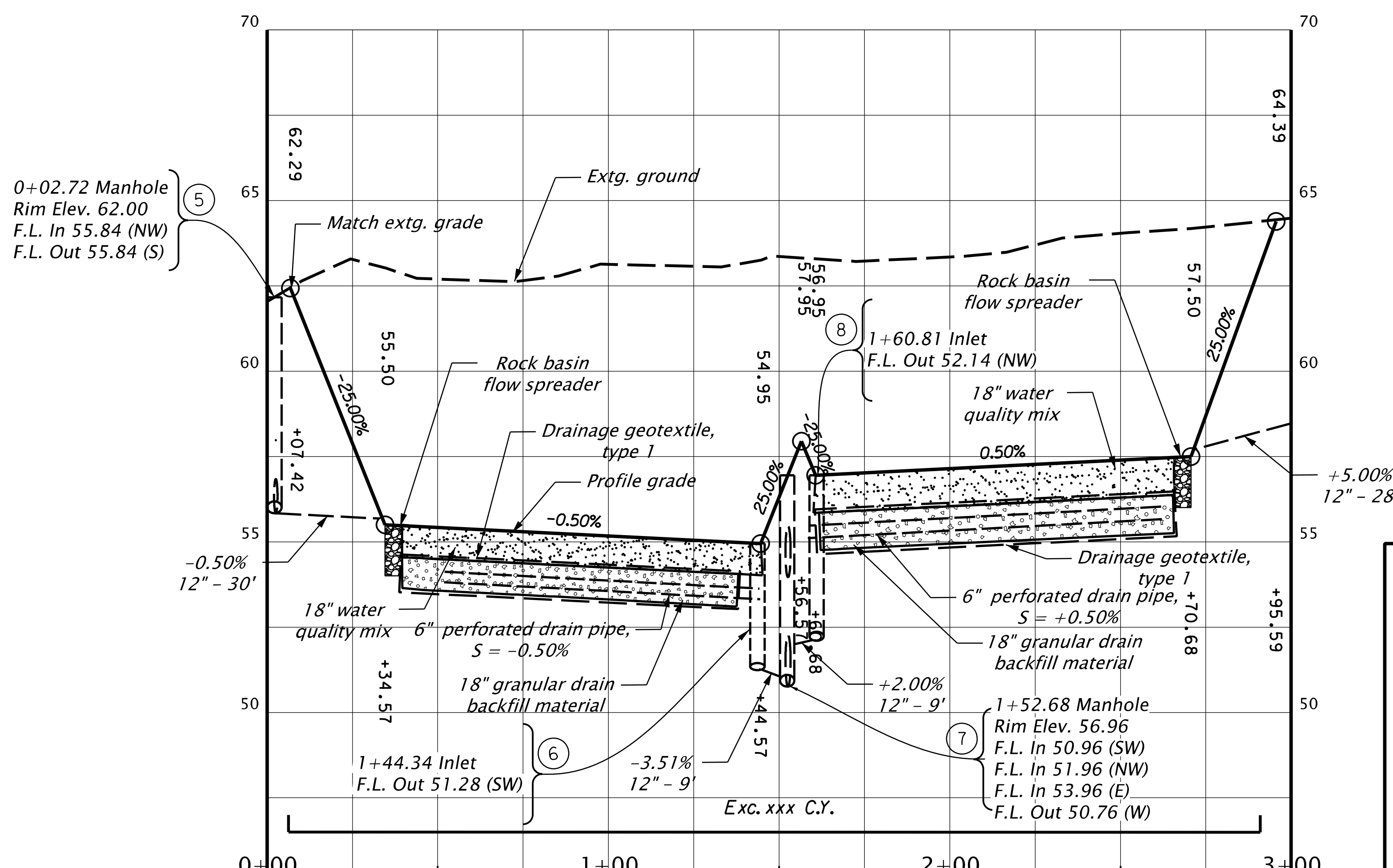
(4) Sta. 0+39.05
Construct rock basin flow spreader
Inst. 12" storm sew. pipe - 35'
10' Depth
(For details, see sht. HA16)

(5) Sta. 0+02.72, 0.30' Rt.
Const. pollution control manhole
Inst. 12" storm sew. pipe - 21'
10' Depth

(6) Sta. 1+44.34
Const. type "D" inlet

(7) Sta. 1+52.68, 3.95' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 9'
5' Depth
Inst. 12" storm sew. pipe - 9'
5' Depth
Inst. 18" storm sew. pipe - 23', S = 5.00%
5' Depth

(8) Sta. 1+60.81
Const. type "D" inlet



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

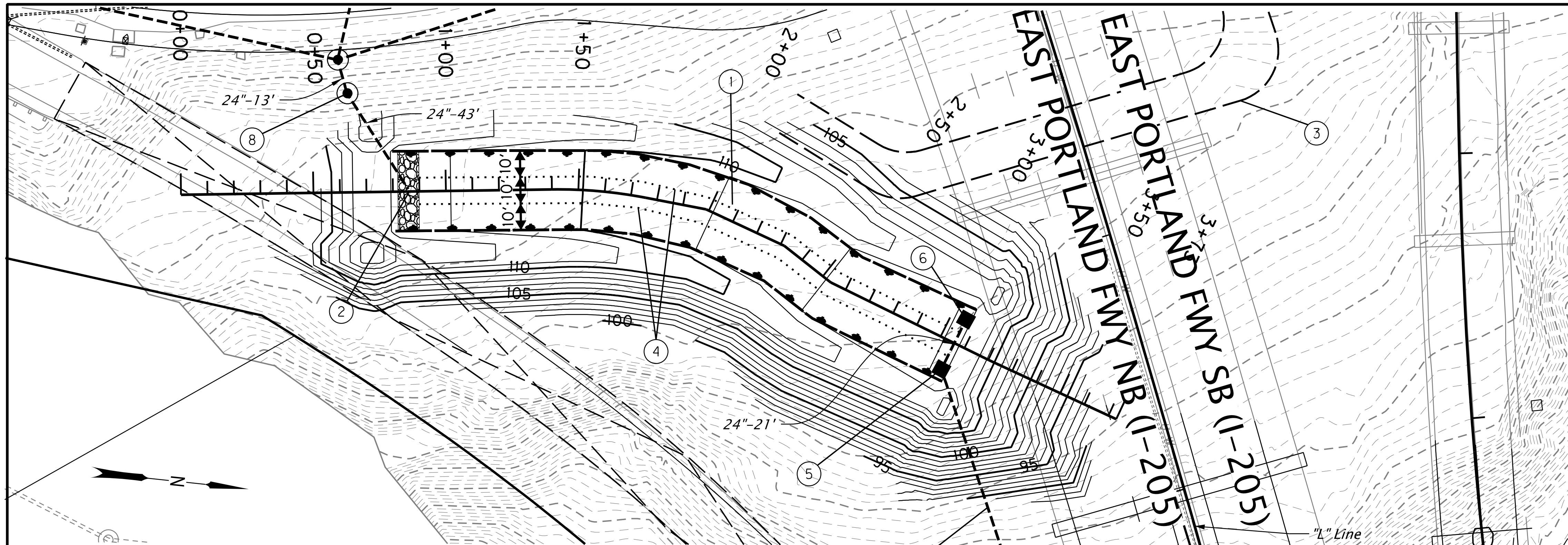
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

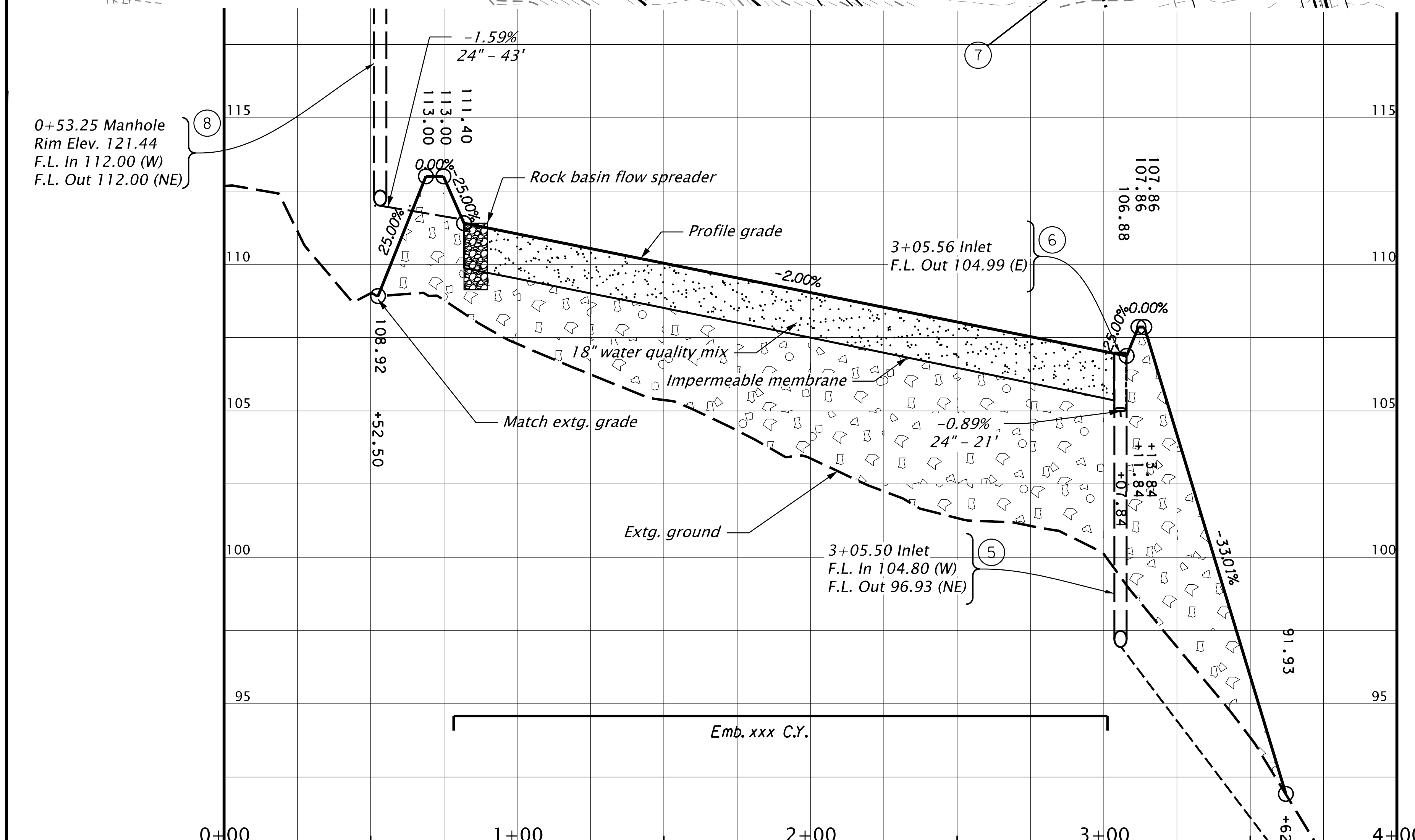
Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO.
HA05

Rotation: 267.1179° Scale: 1"=50'
Vertical Scale: 1:10





1. Sta. 0+80.76 to Sta. 3+07.72 = Sta. "OR43" 10+12.40, 104.31' Lt. to Sta. "OR43" 8+77.47, 208.62' Lt.
   Construct biofiltration swale
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA16)
2. Sta. 0+86.13
   Construct rock basin flow spreader
   Inst. 24" storm sew. pipe - 43'
   5' Depth
   (For details, see sht. HA16)
3. Const. maintenance access road
   Exc. - xx cu. yd.
   Agg. base - xx ton
   Subgrade geotextile - sq. yd.
   (For details, see sht. HA17)
4. Construct biofiltration swale divider
   (For details, see sht. HAxx)
5. Sta. 3+05.56, 10.11' Lt.
   Const. type "D" inlet
   Inst. 24" storm sew. pipe - 21'
   5' Depth
6. Sta. 3+05.50, 10.87' Rt.
   Const. type "D" inlet
7. See sht. HA07 for outfall details
8. Sta. 0+53.25, 37.24' Rt.
   Const. pollution control manhole
   Inst. 24" storm sew. pipe - 13'
   10' Depth

DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

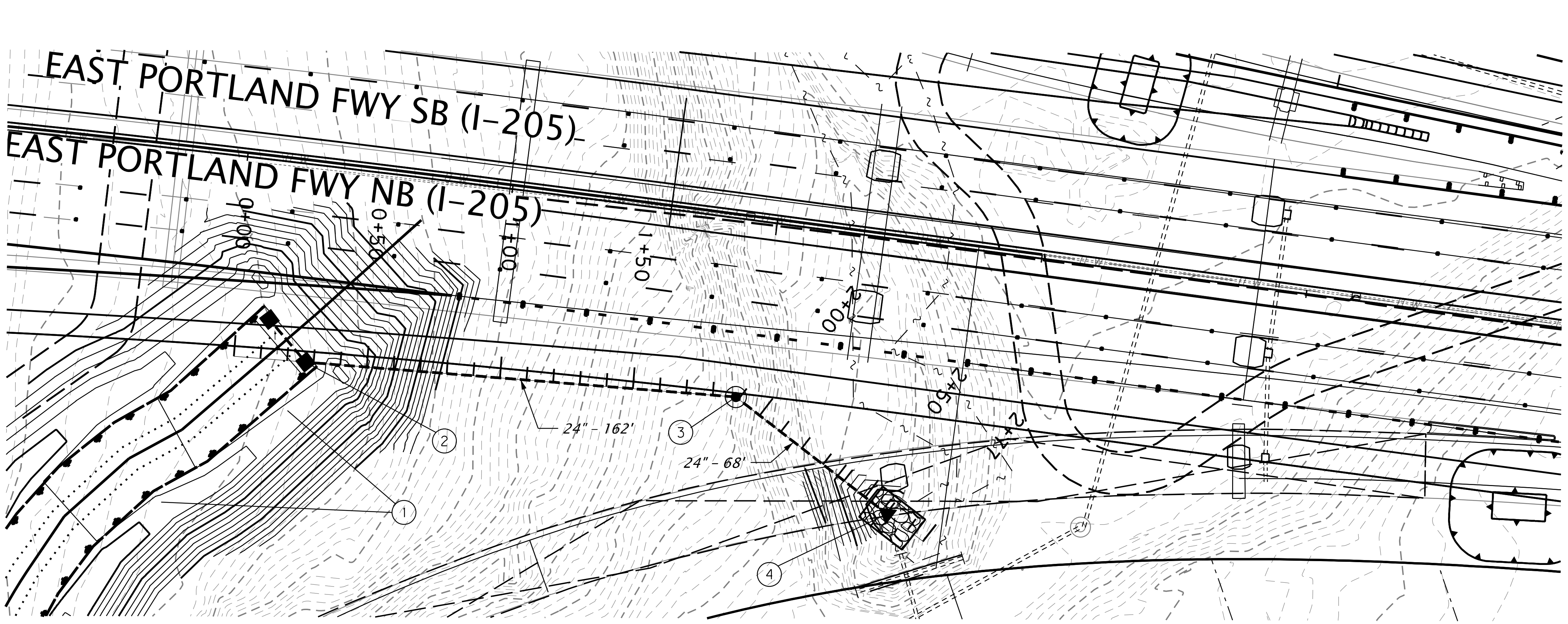
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

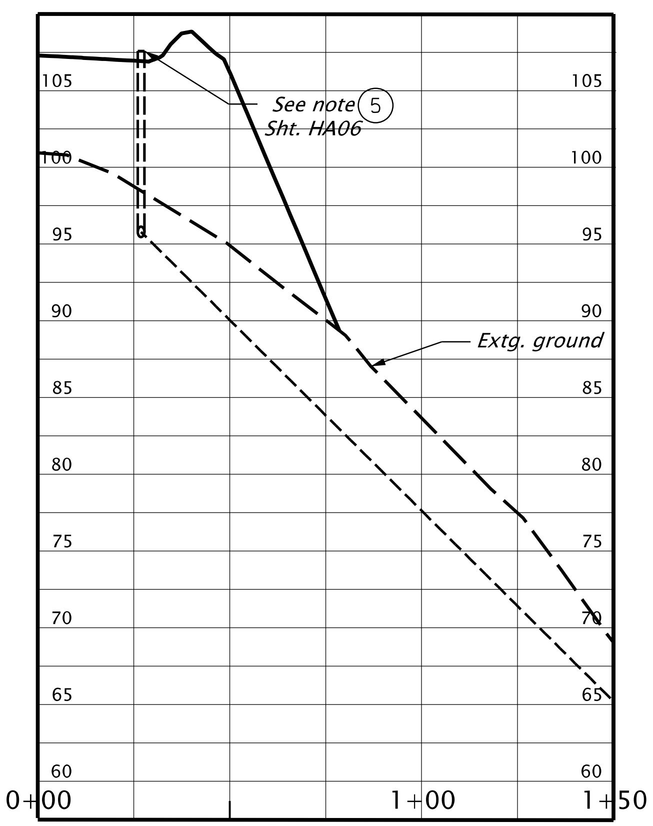
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

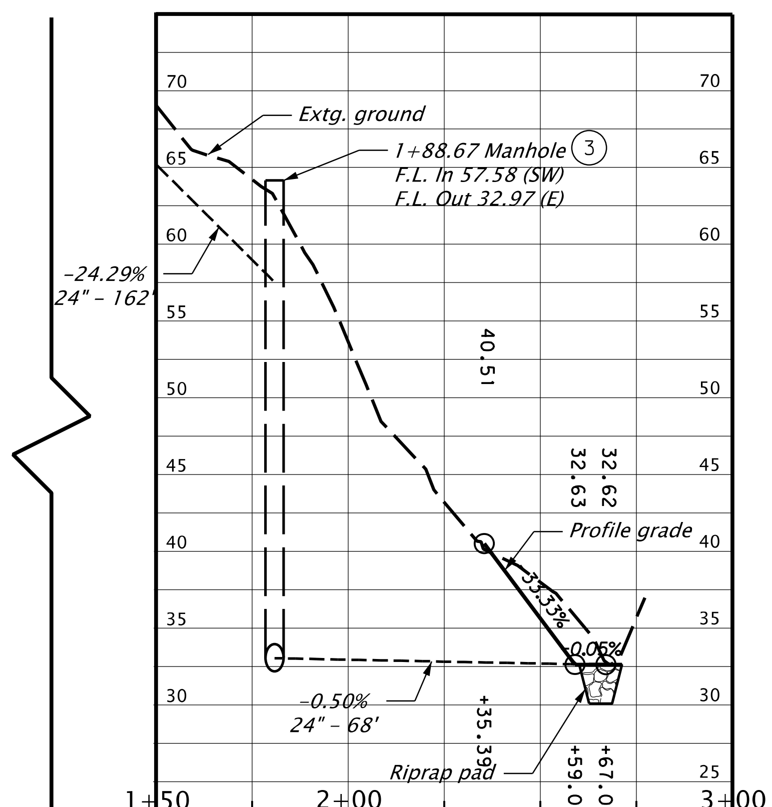
WATER QUALITY PLAN & PROFILE

SHEET NO. HA06

Rotation: 96.0998° Scale: 1"=50'
Vertical Scale: 1:10







1. See sht. HA06, note 1
2. See sht. HA06, note 5
3. Sta. 1+88.67
   Const. outside drop manhole
   Inst. 24" storm sew. pipe - 162'
   20' Depth
4. Sta. 2+50.00
   Construct riprap pad
   Loose riprap (class 50) - 5.0 tons
   Inst. 24" storm sew. pipe w/ sloped end section- 68'
   5' Depth

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
13, 2018
M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

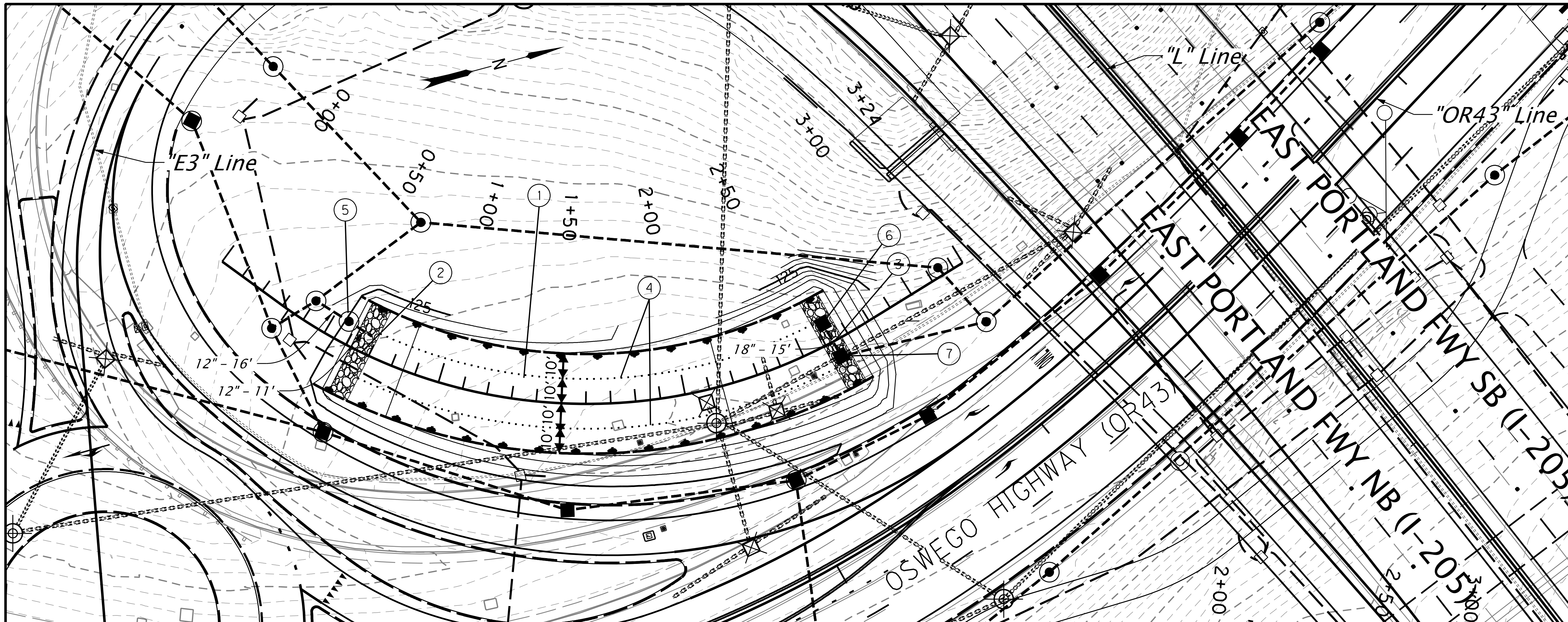
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

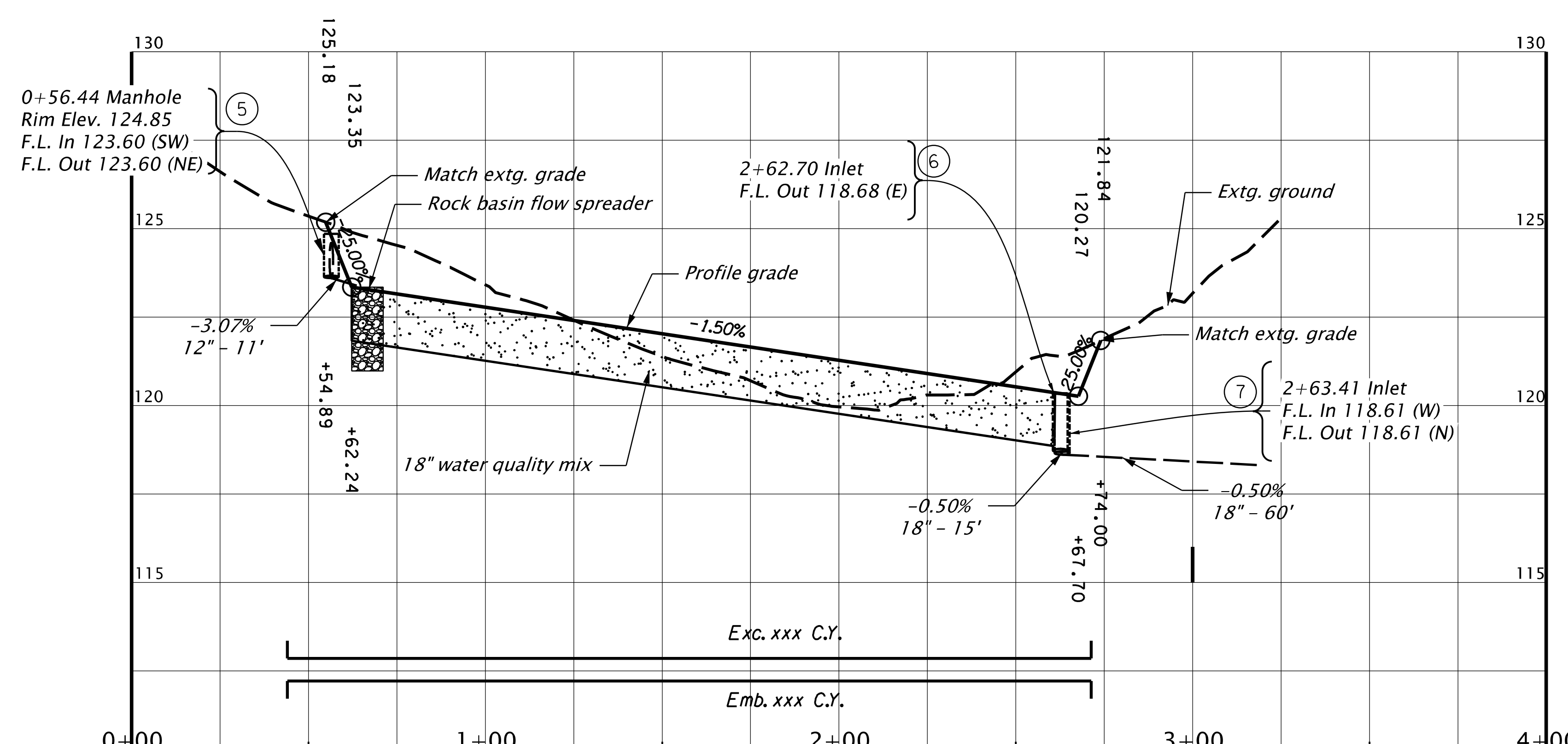
WATER QUALITY PLAN & PROFILE

SHEET NO. HA07

Rotation: 29.332° Scale: 1"=50'
Vertical Scale: 1:4



1. *Sta. 0+59.27 to 2+69.56 = Sta. "E3" 740+37.28, 107.23' Lt. to Sta. "OR43" 9+52.79, 60.58' Rt.*
   Construct biofiltration swale
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA16)
2. *Sta. 0+66.37*
   Construct rock basin flow spreader
   Install 12" storm sew. pipe - 11'
   5' Depth
   (For details, see sht. HA16)
3. *Sta. 2+62.73*
   Construct rock basin flow spreader
   (For details, see sht. HA16)
4. *Construct biofiltration swale divider*
   (For details, see sht. HAxx)
5. *Sta. 0+56.44, 8.79' Lt.*
   Const. pollution control manhole
   Inst. 12" storm sew. pipe - 16'
   5' Depth
6. *Sta. 2+62.70, 8.64' Lt.*
   Const. type "D" inlet
7. *Sta. 2+63.41, 6.55' Rt.*
   Const. type "D" inlet
   Inst. 18" storm sew. pipe - 15'
   5' Depth



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

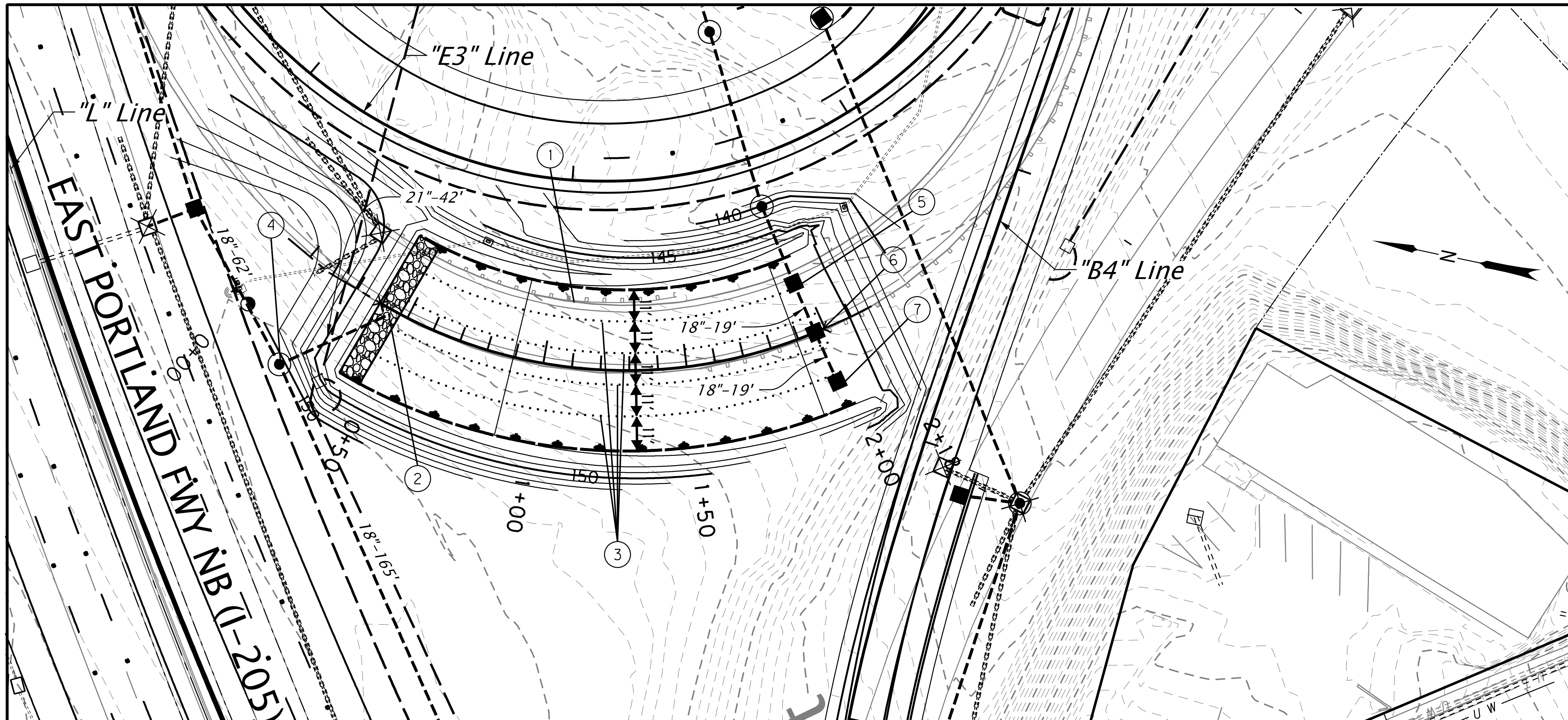
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA08

Rotation: 75.0253° Scale: 1"=50'
Vertical Scale: 1:10



1. Sta. 0+39.24 to Sta. 1+98.79 = Sta. "E3" 737+52.57, 56.87' Rt. to Sta. "E3" 738+66.37, 64.42' Rt.
   Construct biofiltration swale
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA16)

2. Sta. 0+44.18, 0.00'
   Construct rock basin flow spreader
   Inst. 21" storm sew. pipe - 42'
   5' Depth
   (For details, see sht. HA16)

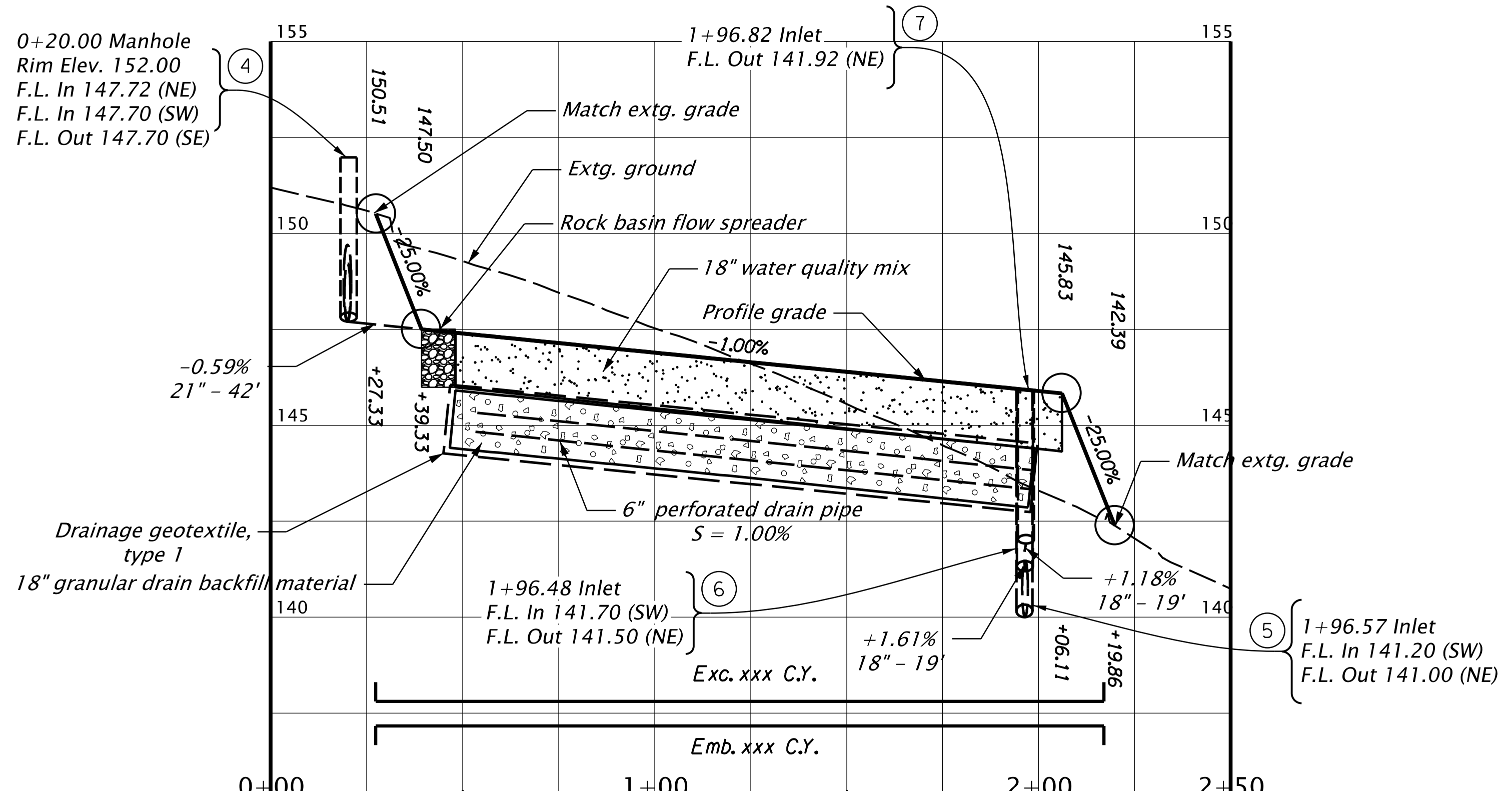
3. Construct biofiltration swale divider
   (For details, see sht. HAxx)

4. Sta. 0+20.00, 36.16' Rt.
   Const. pollution control manhole
   Inst. 18" storm sew. pipe - 62'
   5' Depth
   Inst. 18" storm sew. pipe - 165'
   5' Depth

5. Sta. 1+96.57, 18.41' Lt.
   Const. type "D" inlet
   Inst. 18" storm sew. pipe - 19'
   5' Depth

6. Sta. 1+96.48, 0.21' Rt.
   Const. type "D" inlet
   Inst. 18" storm sew. pipe - 19'
   5' Depth

7. Sta. 1+96.82, 18.86' Rt.
   Const. type "D" inlet



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER 93360PE OREGON MAY 13, 2018 CORY M. GIESEKE
PRELIMINARY COPY INFORMATION ONLY
EXPIRES 06/30/2021

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

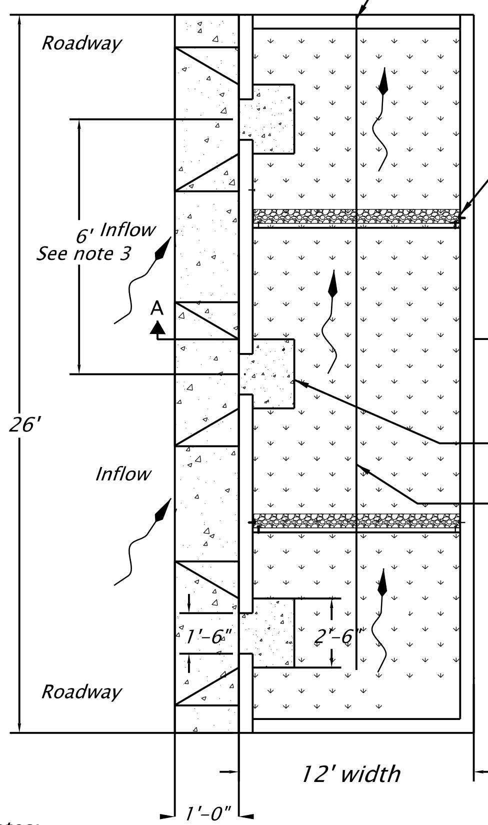
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA09

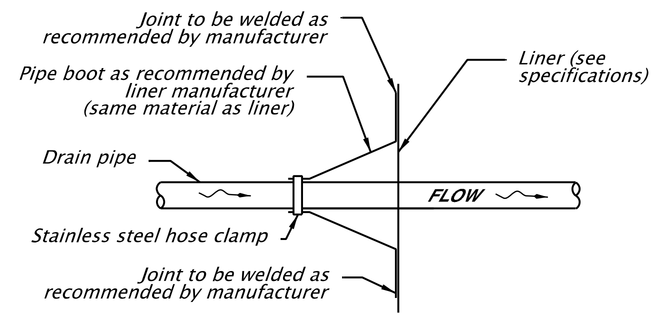
Rotation: 281.7947° Scale: 1"=50'
Vertical Scale: 1"=5'

S T O R M W A T E R   P L A N T E R

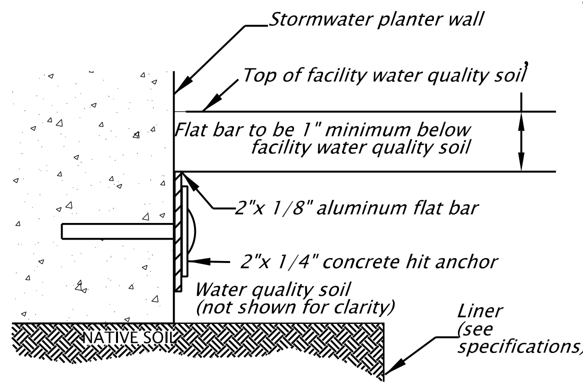


Notes:
1. Match longitudinal slope of planter to slope of the road.
2. If less than 18" is between splash pad and planter end wall, extend pad to wall.
3. Install inlets (6' on center) on all sides of facility that are adjacent to parking lot.

PLAN VIEW

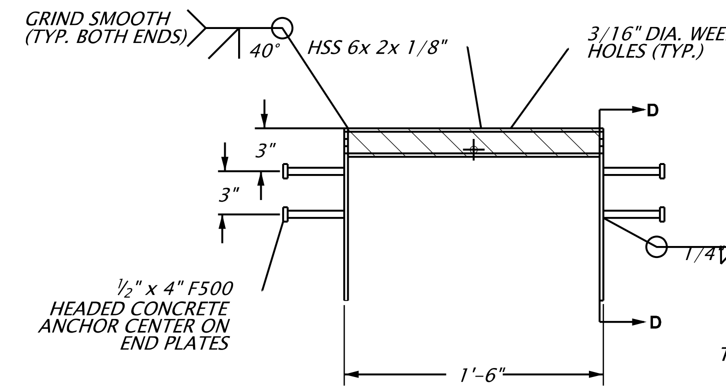


PIPE BOOT
NOT TO SCALE

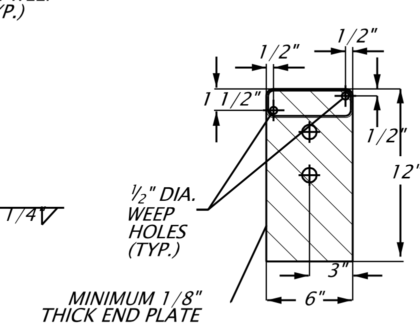


Notes:
1. Adhere liner to concrete with top coat tc moldable sealant, or approved equal.
2. Liner to extend from top of water quality soil to the bottom of excavation.
3. 3" of concrete is required on all sides of attachment. Adjust sidewalk depth as necessary.
4. Secure liner to concrete with 2" aluminum flat bar, placed as directed (around entire facility).
5. Attach flat bar with concrete hit anchors, 24" o.c.
6. Trim excess liner to the top of the flat bar.

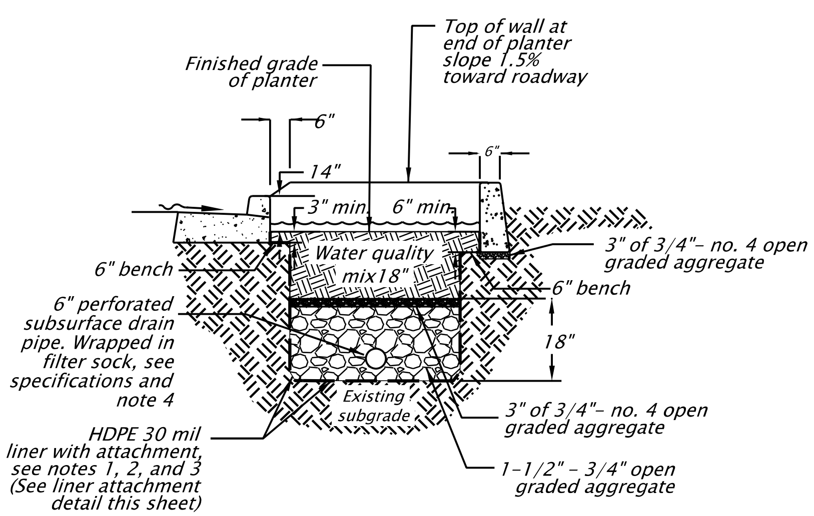
LINER ATTACHMENT DETAIL
NOT TO SCALE



ELEVATION



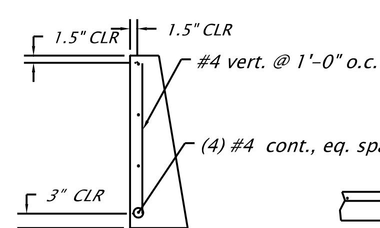
SECTION D-D



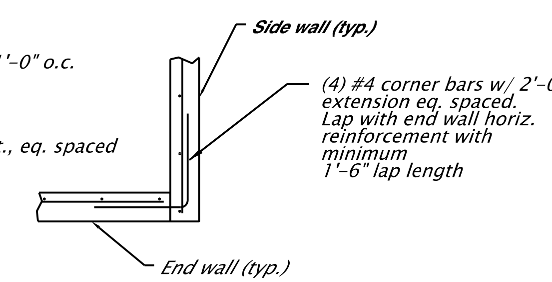
Notes:
1. Partial or full liner required. See stormwater planter table (this sheet) for requirement.
2. Partial liner located along side of planter adjacent to roadway.
3. Full liner located along all sides of planter.
4. Drain pipe only required for fully lined planters.
5. Scarify the native soil 12" following the initial excavation and before installing water quality soil and rock.

SECTION A-A

STORMWATER PLANTER DETAIL
NOT TO SCALE



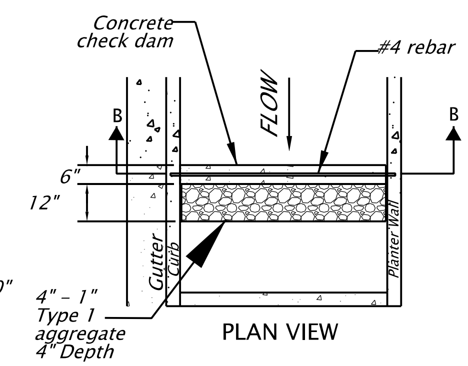
TYPICAL PLANTER WALL SECTION (NOT ADJACENT TO ROADWAY)



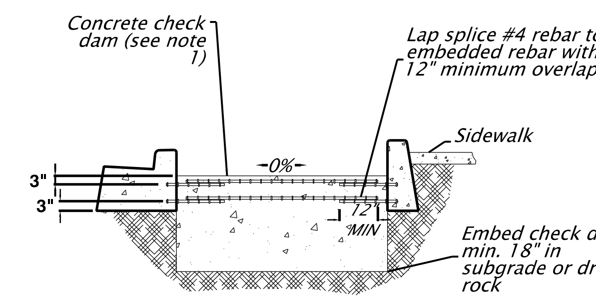
WALL CORNER DETAIL

Notes:
1. Top of planter walls to be 4" higher than adjacent sidewalk.
2. Bottom of planter walls to be 6" below top of water quality soil.

PLANTER WALL
NOT TO SCALE



PLAN VIEW



SECTION B-B

Notes:
1. Top of dam elevation to be 2" lower than upstream curb depression elevation.
2. Concrete to be 3,000 psi.
3. Embed #4 rebar 3" into curb and planter wall.

CONCRETE CHECK DAM
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

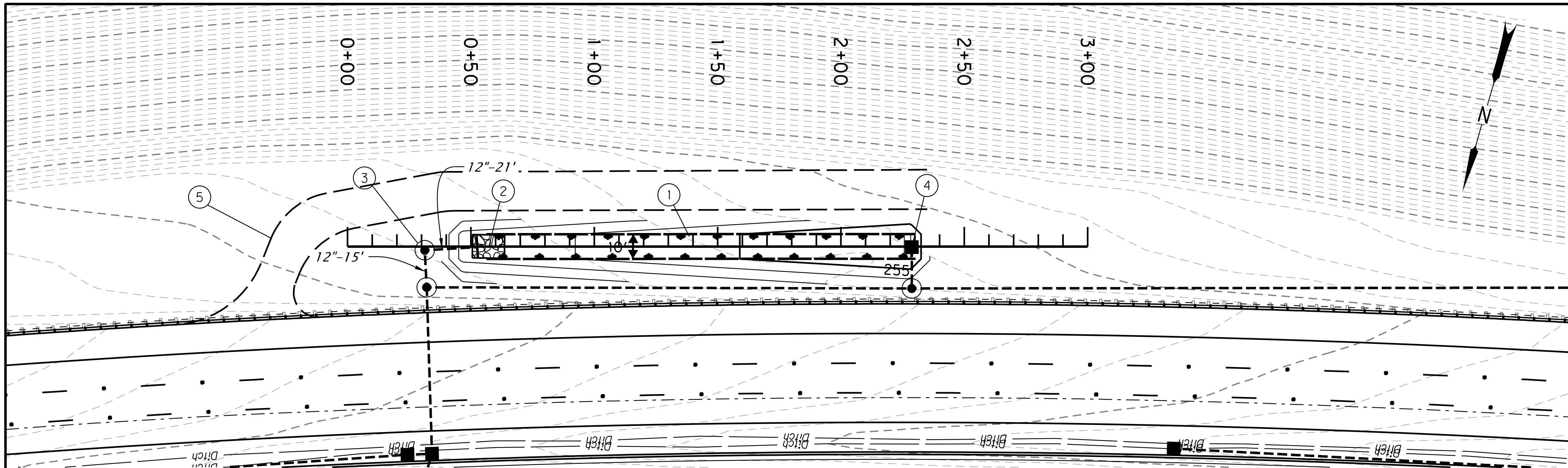
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY DETAILS

SHEET NO. HA10

Rotation: 0°   Scale: 1"=60'



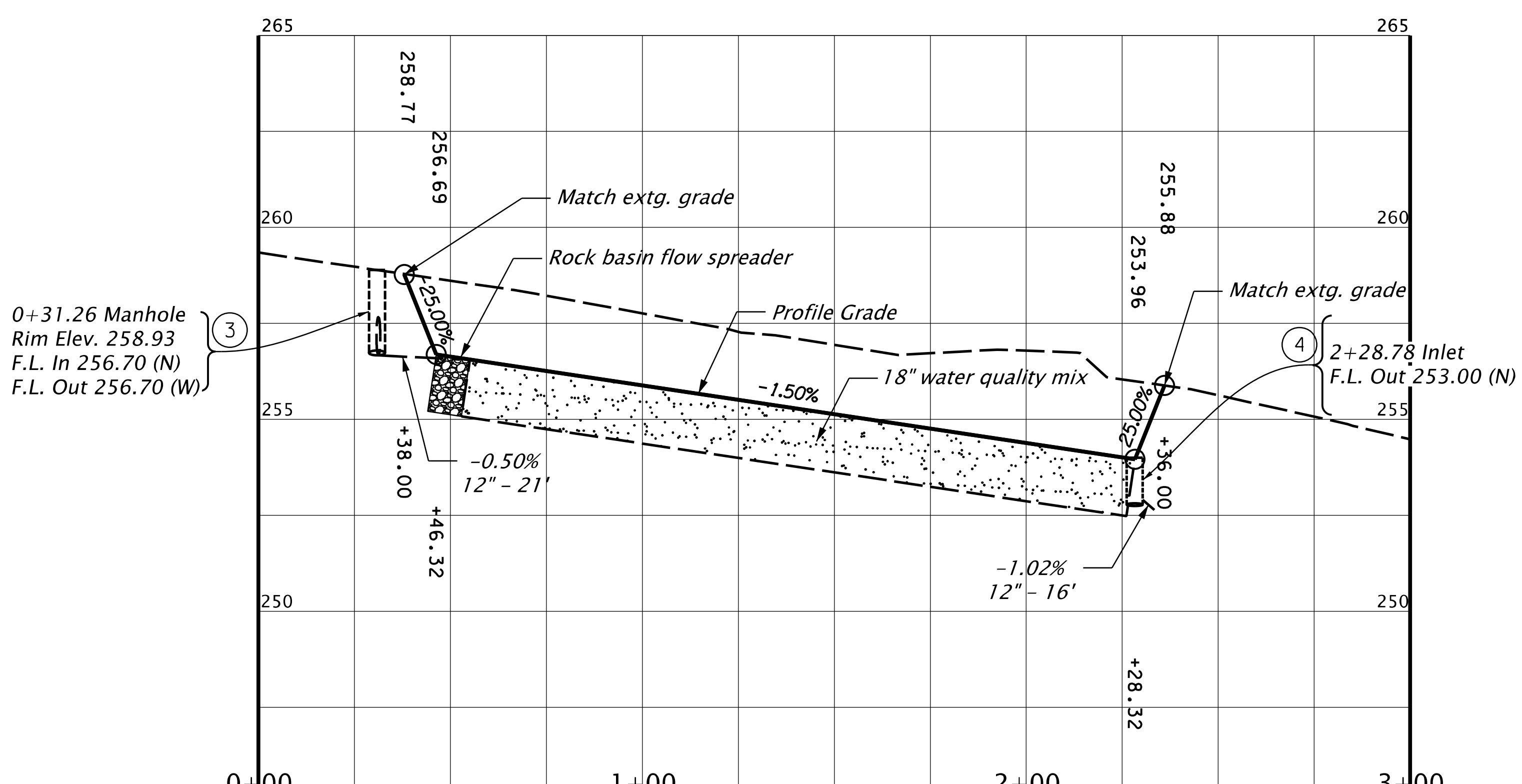
1. Sta. 0+56.01 to Sta. 2+30.32 =
Sta. "Ln" 812+11.63, 49.46' Lt. to
Sta. "Ln" 813+82.31, 47.34' Lt.
Construct bioretention swale
Inst. field facility marker (Type S2) - 2
(For details, see sht. HA16)

2. Sta. 0+57.34
Construct rock basin flow spreader
Inst. 12" storm sew. pipe - 21'
5' Depth
(For details, see sht. HA16)

3. Sta. 0+31.26, 1.40' Rt.
Const. pollution control manhole
Inst. 12" storm sew. pipe - 15'
5' Depth

4. Sta. 2+28.78, 0.00'
Const. type "D" inlet

5. Const. maintenance access road
Exc. - xx cu. yd.
Agg. base - xx ton
Subgrade geotextile - sq. yd.
(For details, see sht. HA17)



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

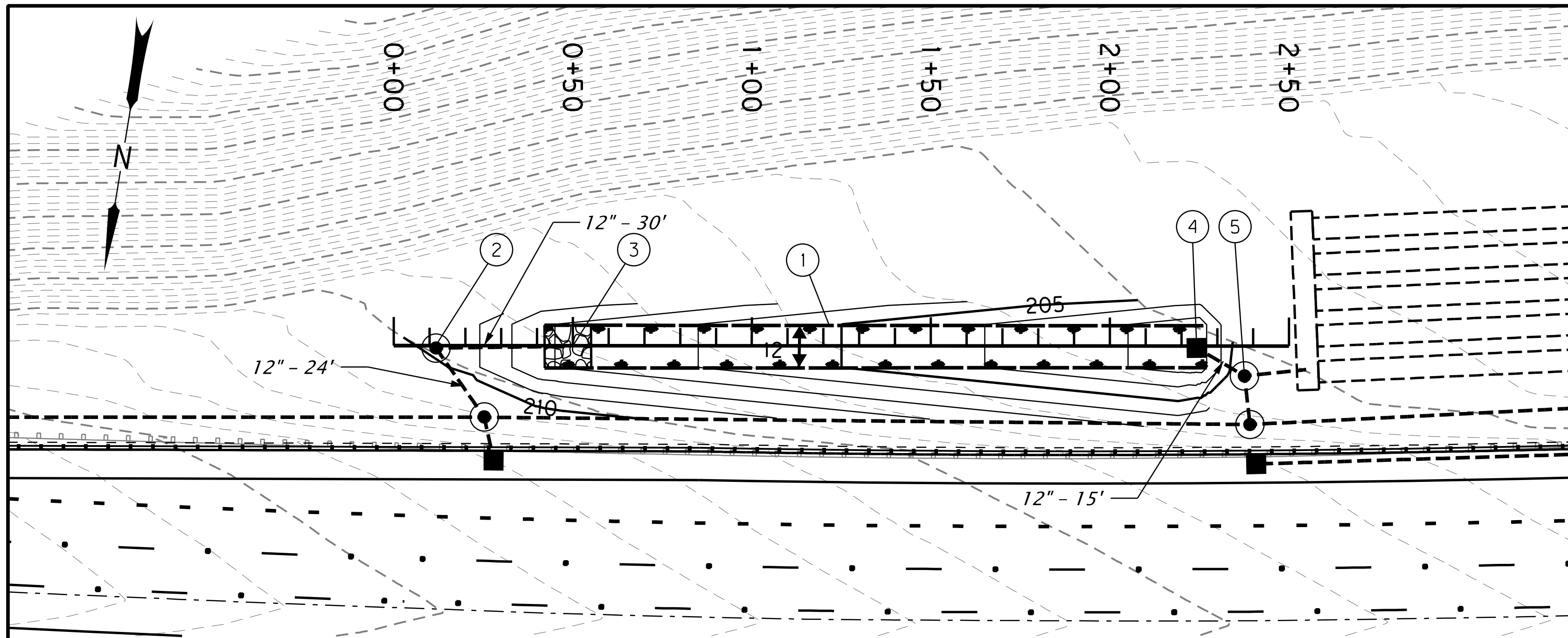
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA11

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10



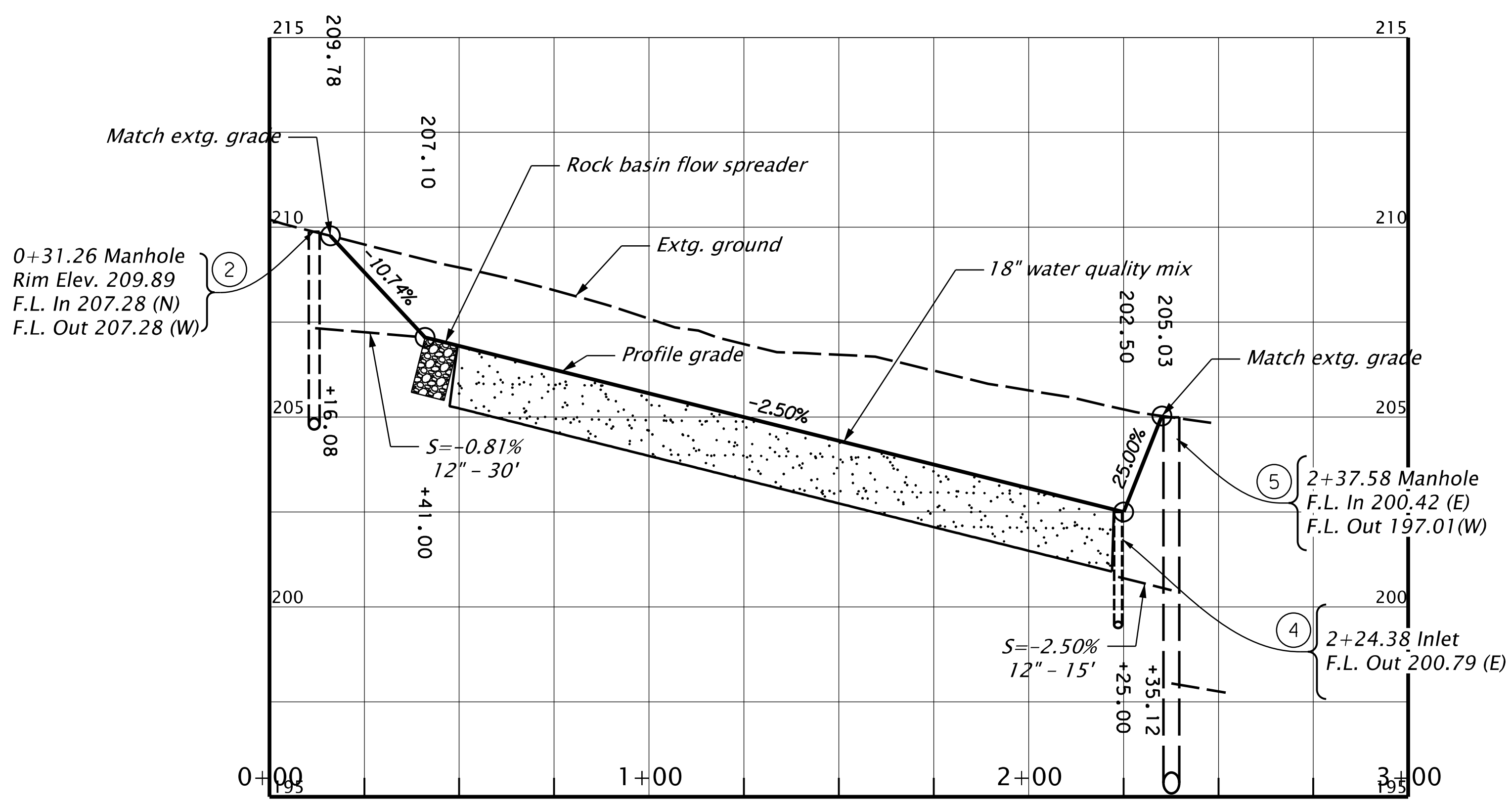
1. Sta. 0+41.77 to Sta 2+24.40 = Sta. "Ln2" 836+82.56, 60.48' Lt. to Sta. "Ln2" 838+59.54, 61. 72' Lt.
   Construct biofiltration swale
   Inst. 12" storm sew. pipe - 30'
   5' Depth
   Inst. field facility marker (Type S2) - 2
   (For details, see sht. HA16)

2. Sta. 0+31.26, 1.40' Rt.
   Const. pollution control manhole
   Inst. 12" storm sew. pipe - 24'
   5' Depth

3. Sta. 0+48.66
   Construct rock basin flow spreader
   (For details, see sht. HA16)

4. Sta. 2+24.38, 0.38' Rt.
   Const. type "D" inlet

5. Sta. 2+37.58, 8.32' Rt.
   Const. diversion manhole
   Inst. 12" storm sew. pipe - 15'
   5' Depth



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

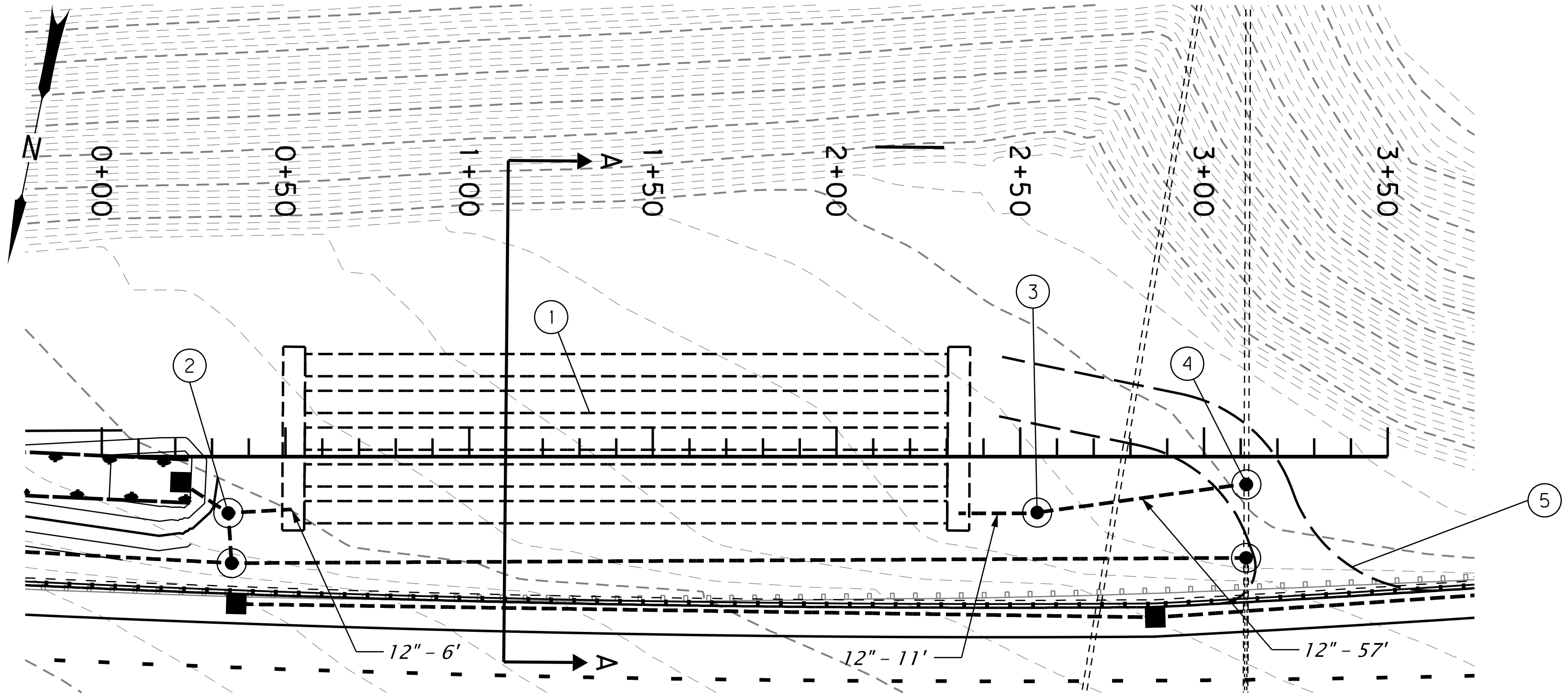
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA12

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10



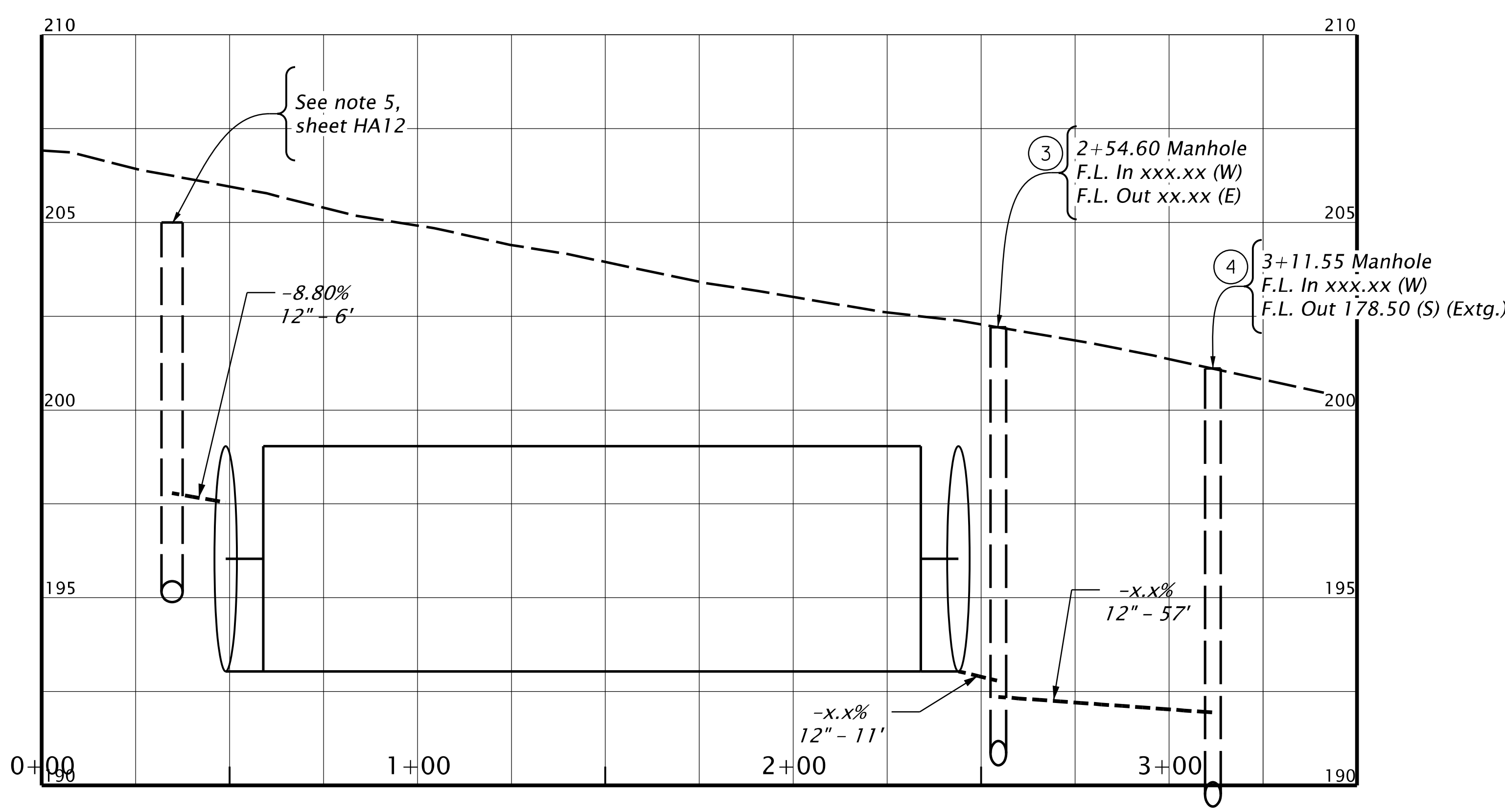
1. Sta. 0+42.14 to Sta. 2+42.32 =
Sta. "Ln2" 838+80.48, 70.62' Lt. to
Sta "Ln2" 840+81.69, 75.39' Lt.
Const. underground detention system
Inst. 72" storm sew. pipe - 875'
20' Depth
Inst. field facility marker (Type S2) - 2

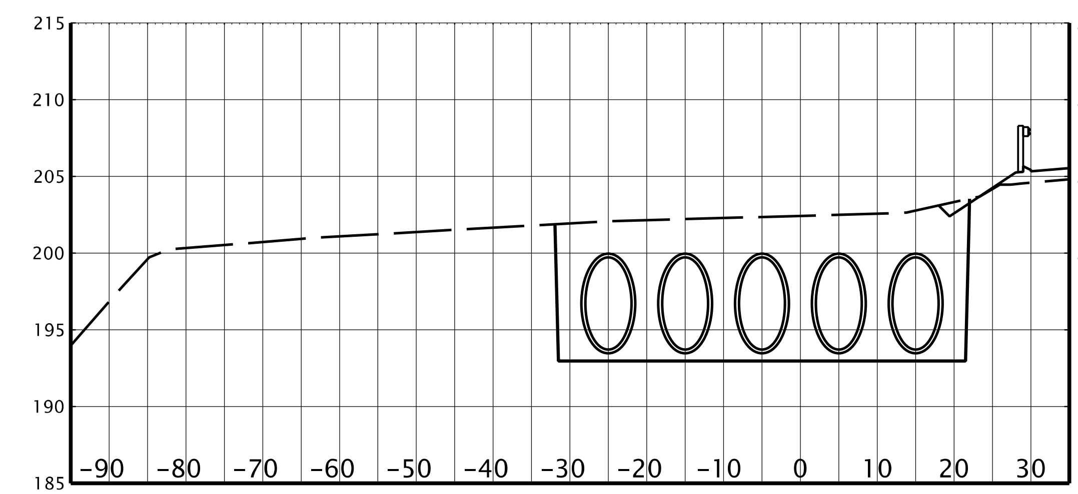
2. See note 5, sht. HA12

3. Sta. 2+54.60, 15.20' Rt.
Const. storm sew. manhole
Inst. 12" storm sew. pipe - 11'
10' Depth

4. Sta. 3+11.55, 7.37' Rt.
Const. storm sew. manhole over existing pipe
Inst. 12" storm sew. pipe - 57'
20' Depth

5. Const. maintenance access road
Exc. - xx cu. yd.
Agg. base - xx ton
Subgrade geotextile - sq. yd.
(For details, see sht. HA17)





SECTION A-A

DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

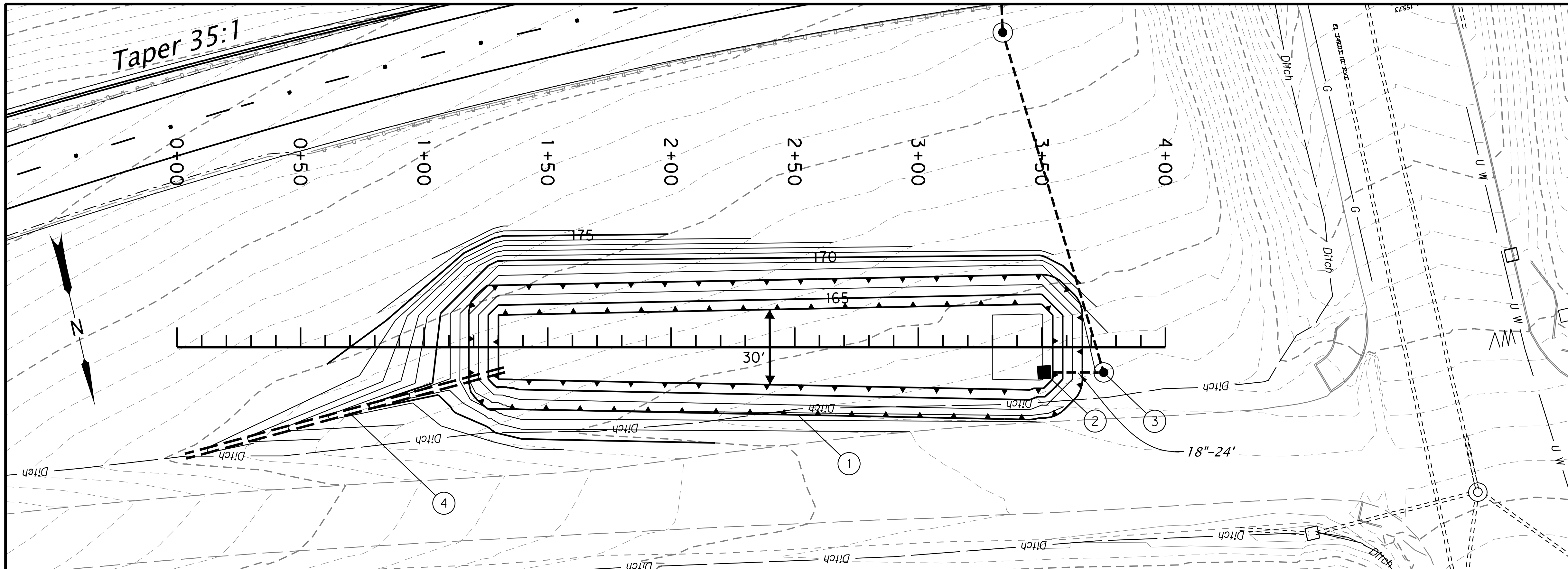
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke
Reviewer: Karen Tatman
Drafter: Morgan Tholl
Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA13

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10

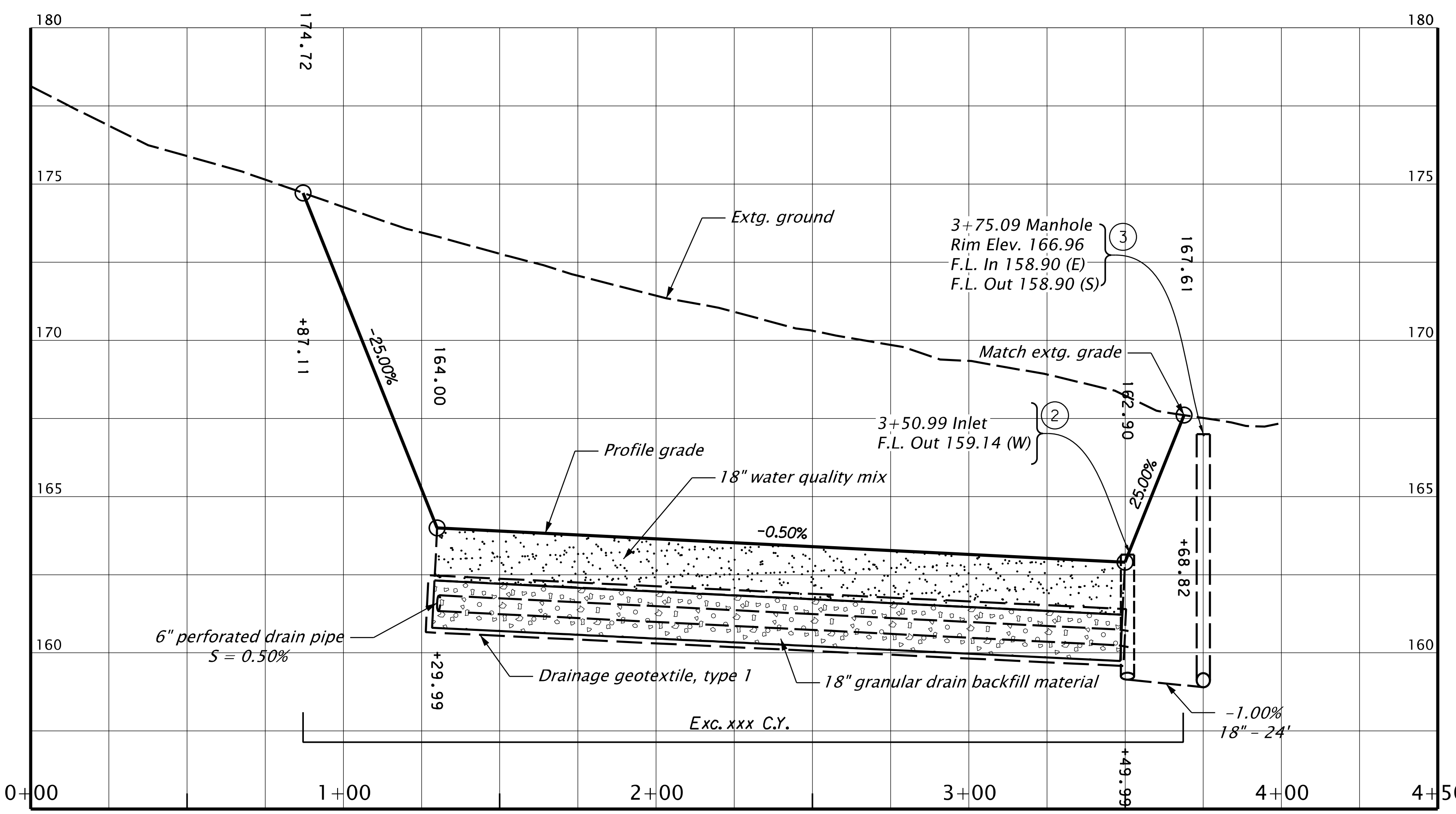


1. Sta. 1+18.08 to Sta. 3+66.37 =
Sta. "D2" 856+66.70, 60.41' Lt. to
Sta. "D2" 859+14.63, 48.14' Lt.
Construct bioretention pond
Inst. filed facility marker (Type S2) - 2
(For details, see sht. HA17)

2. Sta. 3+50.99, 10.15' Rt.
Const. water quality facility outlet structure
(For details, see sht. HA19)

3. Sta. 3+75.09, 9.97' Rt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 24'
10' Depth

Const. ditch



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

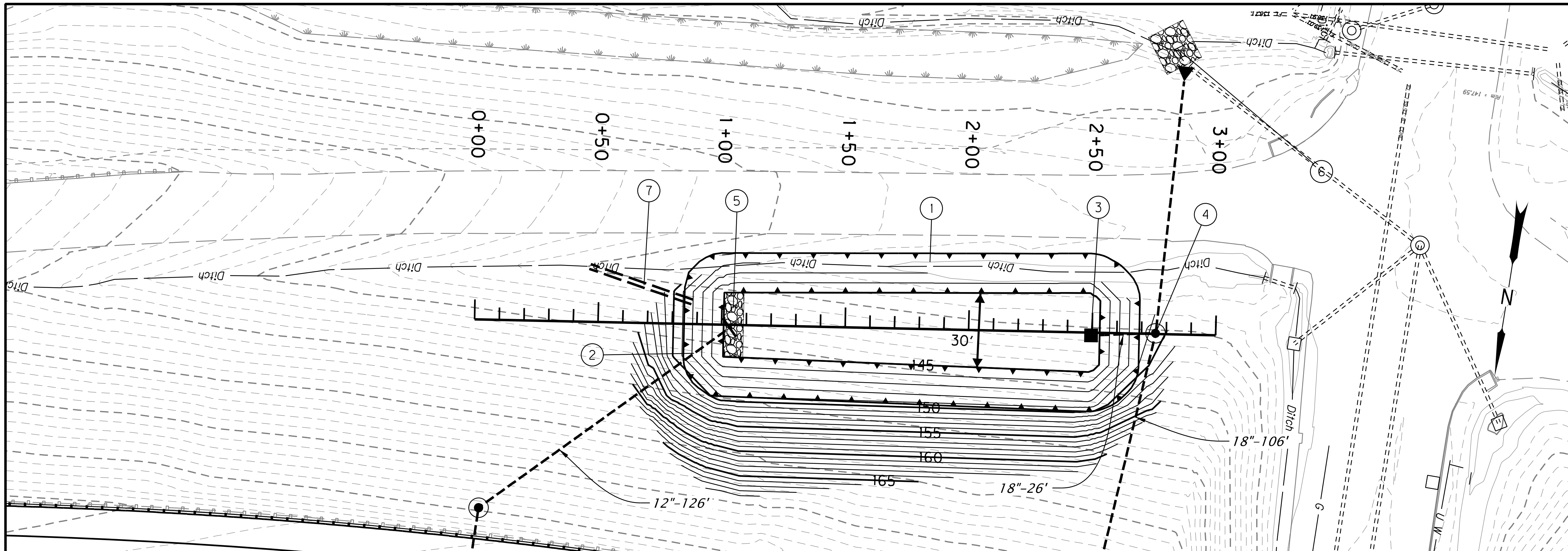
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY PLAN & PROFILE

SHEET NO. HA14

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10



1. Sta. 0+84.80 to Sta. 2+69.05 =
Sta. "A2" 859+06.98, 45.55' Rt. to
Sta. "A2" 860+91.75, 46.62' Rt.
Construct bioretention pond
Inst. field facility marker (Type S2) - 2
(For details, see sht. HA17)

2. Sta. 0+89.08, 11.96' Rt.
Inst. 12" storm sew. pipe - 126'
20' Depth

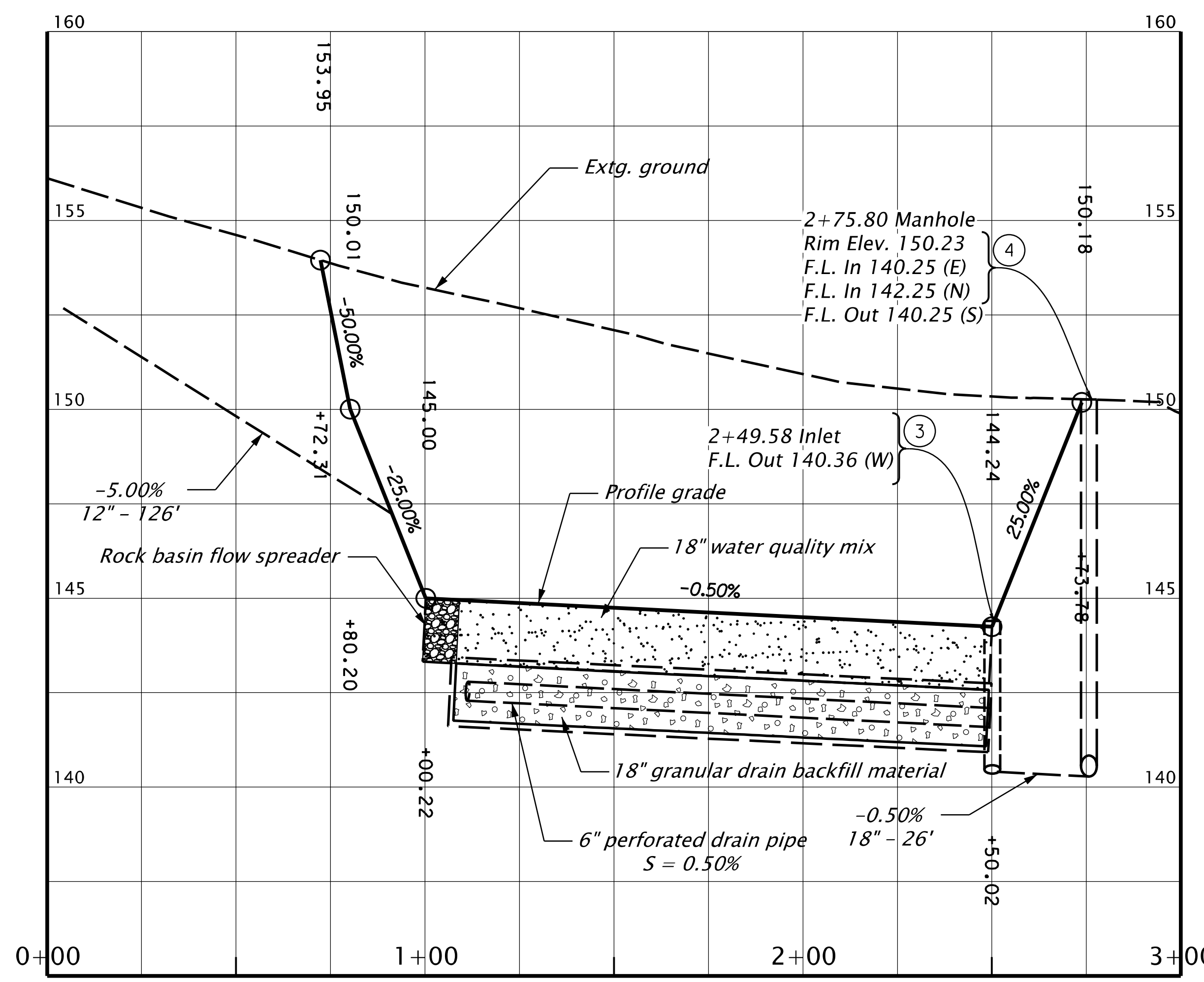
3. Sta. 2+49.58, 1.05' Rt.
Const. water quality facility outlet structure
(For details, see sht. HA19)

4. Sta. 2+75.80, 0.29' Lt.
Const. storm sew. manhole
Inst. 18" storm sew. pipe - 26'
5' Depth
Inst. 18" storm sew. pipe - 106'
10' Depth

5. Sta. 1+02.00
Const. rock basin flow spreader
(For details see sht. HA16)

6. Sta. 2+81.68, 115.50' Lt.
Const. rock basin flow spreader
(For details see sht. HA16)

7. Const. ditch



DFI no. ######

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

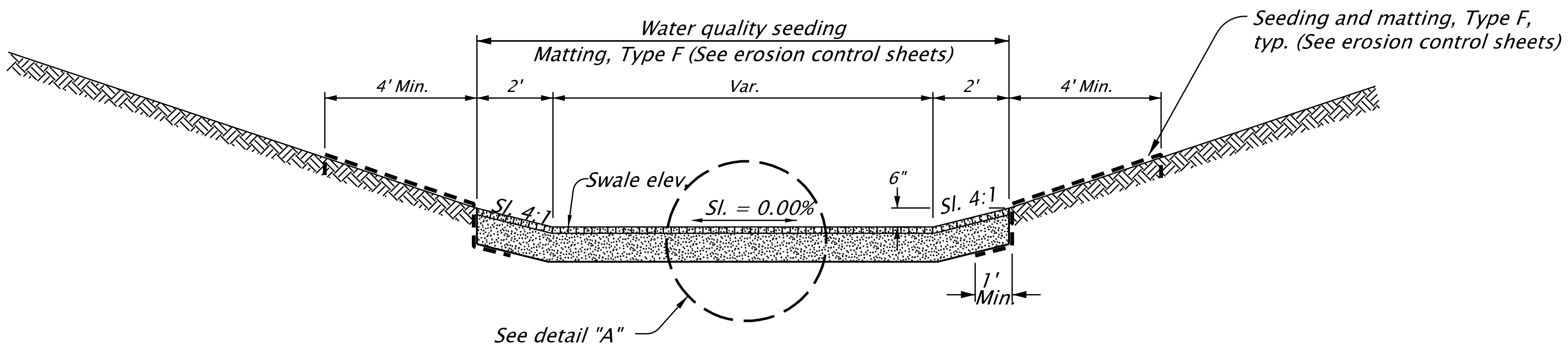
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke	Reviewer: Karen Tatman
Drafter: Morgan Tholl	Checker: Christine Higgins

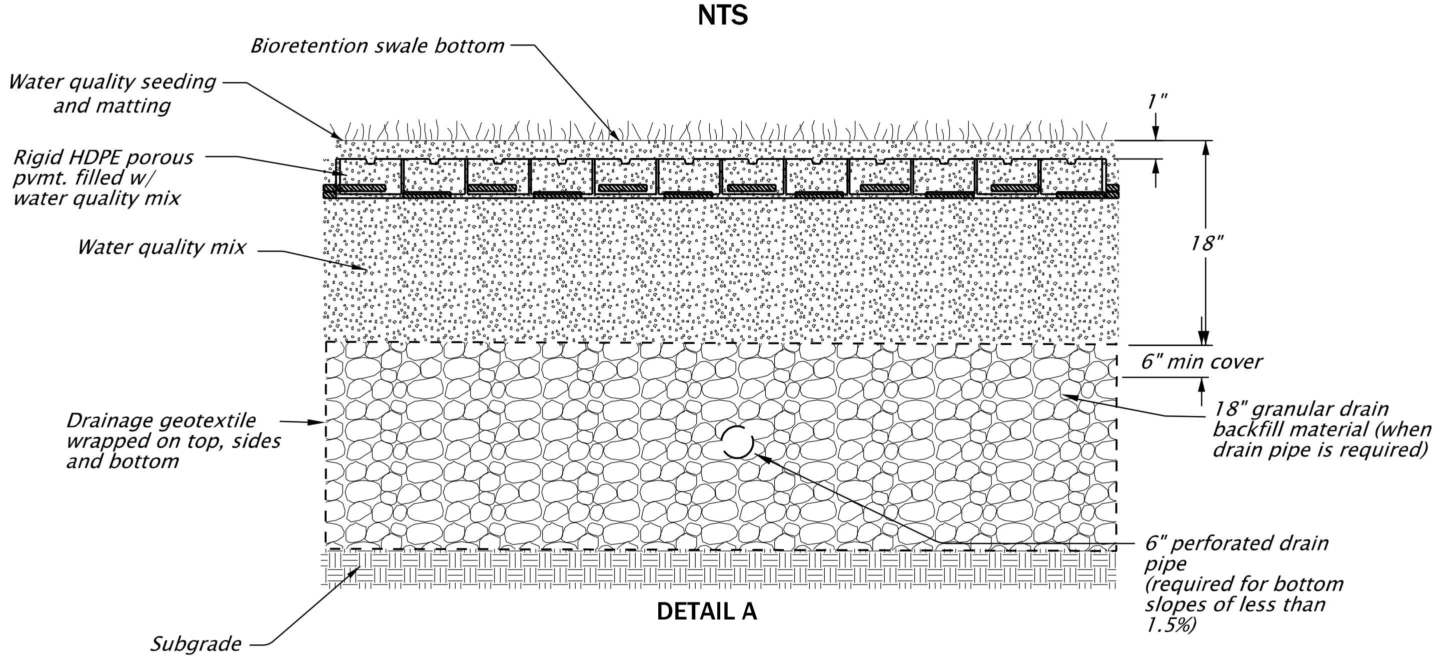
WATER QUALITY PLAN & PROFILE

SHEET NO. HA15

Rotation: 223.5514° Scale: 1"=50'
Vertical Scale: 1:10



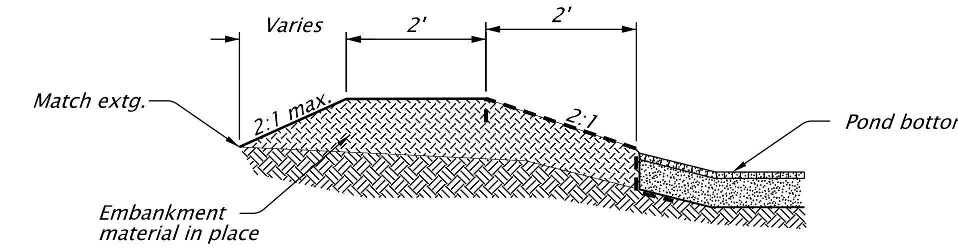
BIOFILTRATION SWALE
NTS



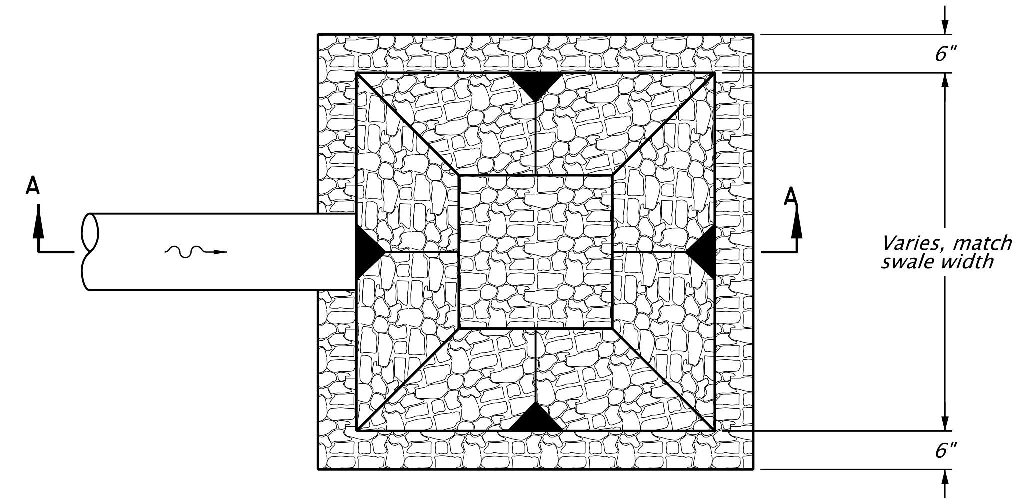
DETAIL A

BIOFILTRATION SWALE TABLE

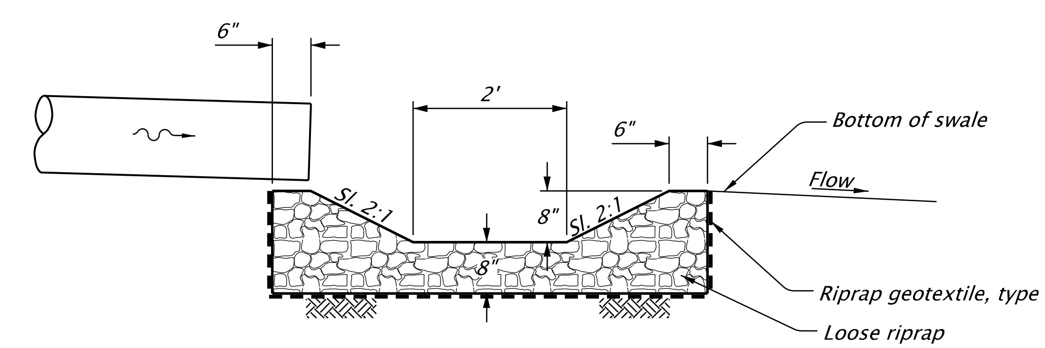
Station	Facility DFI	Biofiltration Swale Bottom Width (feet)	Biofiltration Swale Bottom Length (feet)
"99E2" 108+94.90 to "99E2" 110+06.66	#	10	220
"99E2" 114+24.15 to "99E2" 115+28.87	#	10	220
"OR43" 10+12.40 to "OR43" 8+77.47	#	30	226
"A2" 859+06.98 to "A2" 860+91.75	#	40	205
"L" 691+52.97 to "L" 688+85.28	#	10	183
"D2" 856+66.70 to "D2" 859+14.63	#	30	220
"A2" 859+06.98 to "A2" 860+91.75	#	30	150



BIORETENTION POND BERM
NTS



ROCK BASIN FLOW SPREADER
NTS



SECTION A-A

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

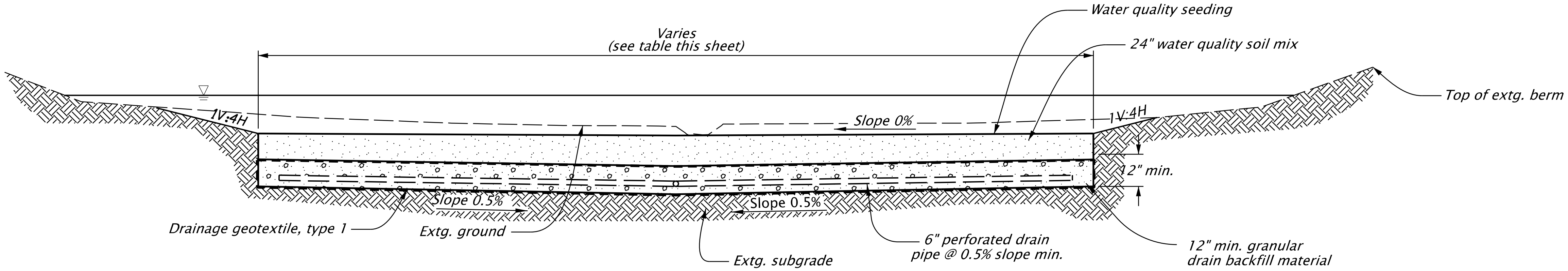
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

WATER QUALITY DETAILS

SHEET NO.
HA16

Rotation: 0° Scale: 1"=60'

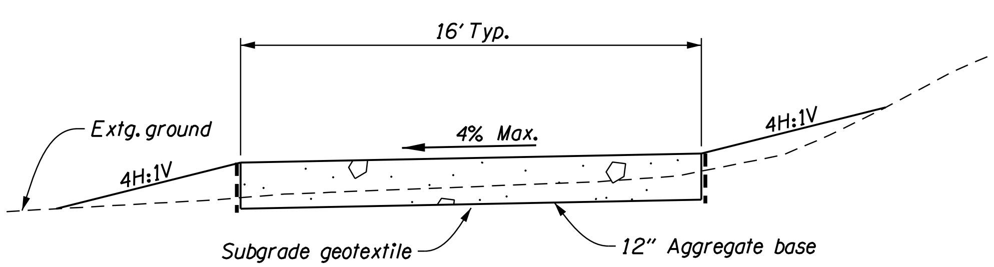


BIORETENTION POND SECTION

Scale: NTS

BIORETENTION POND TABLE

Station	Facility DFI	Bioretention Pond Bottom Width (feet)	Bioretention Pond Length (feet)
"L" 665+46.16 to "L" 663+50.02	#	10	120
"L" 691+52.97 to "L" 688+85.28	#	10	183
"D2" 856+66.70 to "D2" 859+14.63	#	30	220
"A2" 859+06.98 to "A2" 860+91.75	#	30	150



MAINTENANCE ACCESS ROAD SECTION
NTS

REGISTERED PROFESSIONAL ENGINEER
93360PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
EXPIRES 06/30/2021
PRELIMINARY COPY
INFORMATION ONLY
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

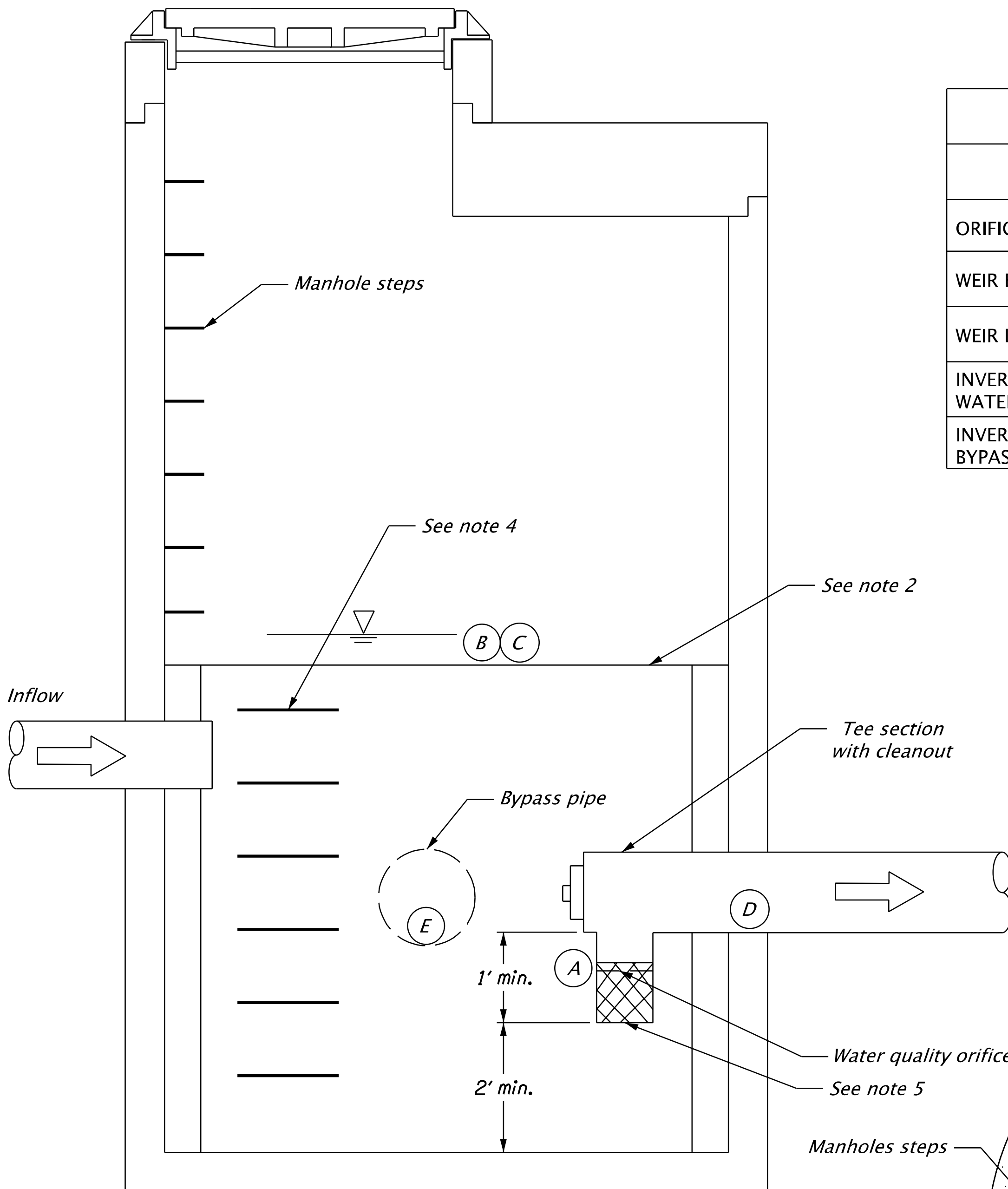
WATER QUALITY DETAILS

SHEET NO. HA17

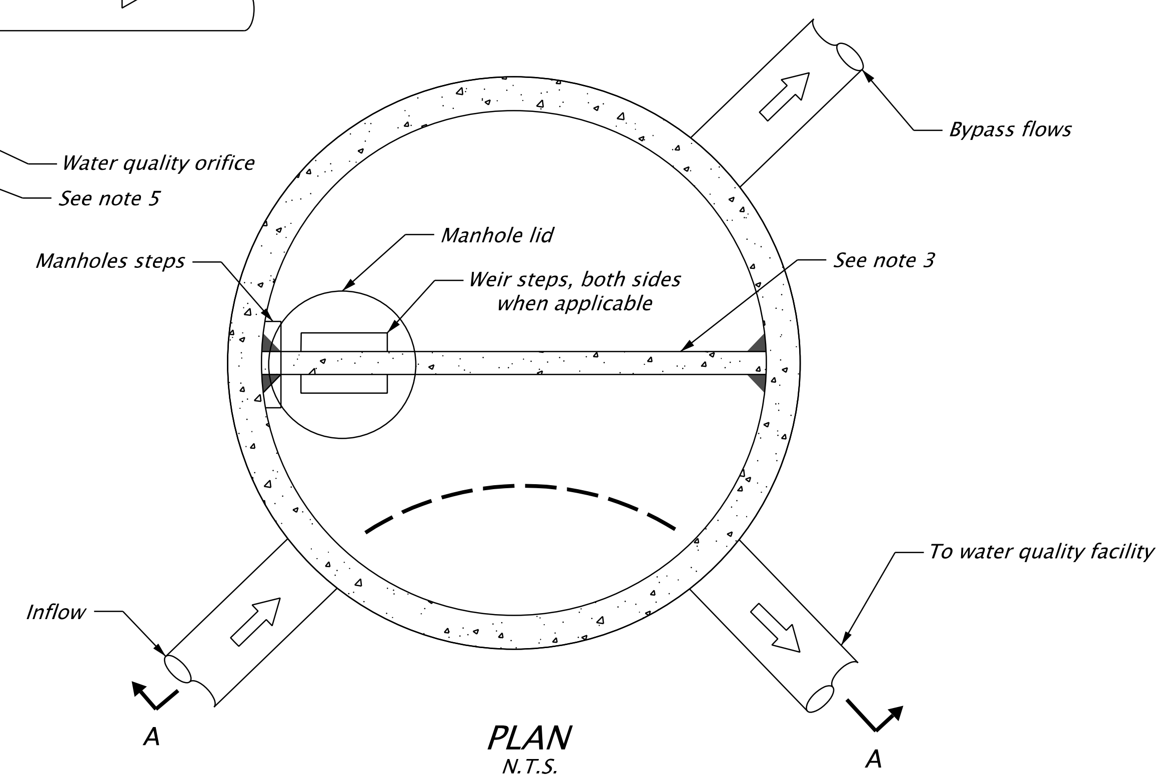
Rotation: 0° Scale: Full Size 1=1

DIVERSION MANHOLE

		WQF#3	WQF#4	WQF#5	WQF#6	WQF#7	WQF#8	WQF#11	WQF#12
DESCRIPTION	LETTER	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE
ORIFICE DIAMETER	A	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed
WEIR ELEVATION	B	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed
WEIR LENGTH	C	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed
INVERT OF OUTLET PIPE TO WATER QUALITY FACILITY	D	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed
INVERT OF HIGH FLOW BYPASS OUTLET PIPE	E	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed	To Be Developed



SECTION A-A
N.T.S.



PLAN
N.T.S.

GENERAL NOTES:

1. *Manhole structure 72 in. min. dia.*
2. *4 in . min. thickness reinforced concrete weir.*
3. *Weir shall be grouted to manhole stucture (both ends)*
4. *Provide weir steps when height of weir is greater than 36 inches, both sides*
5. *Water quality orifice screening. The wire cloth strainer assembly should be secured to pipe with a stainless steel hose clamp. Orifice screening must contain mulitple openings that are equal to or less than the orifice diameter.*
6. *Include tracer wire as shown in Standard Drawing RD336.*

REGISTERED PROFESSIONAL ENGINEER
93366PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

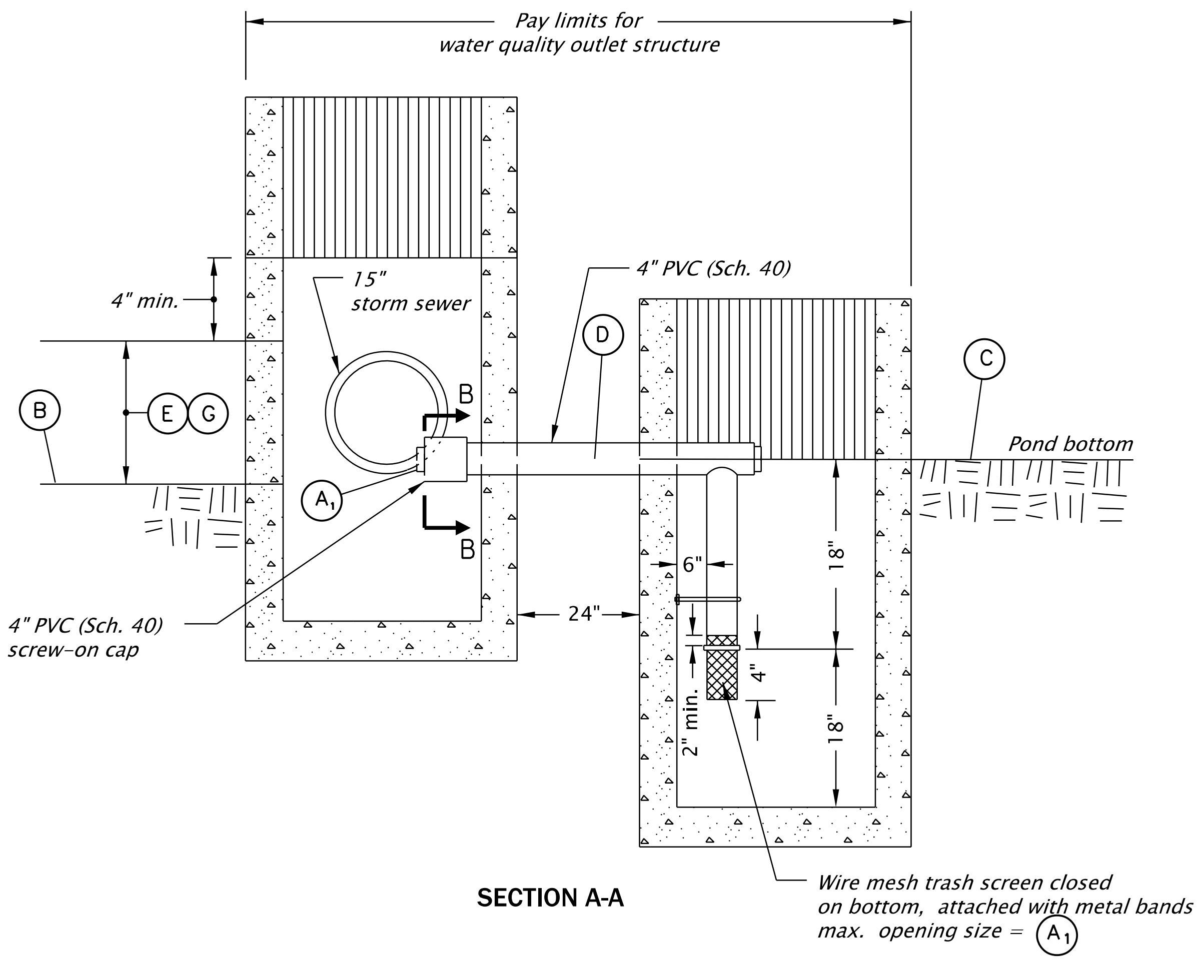
Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY DETAILS

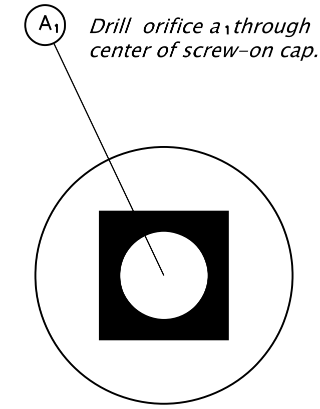
SHEET NO. HA18

Rotation: 0° Scale: Full Size 1=1

WATER QUALITY OUTLET STRUCTURE

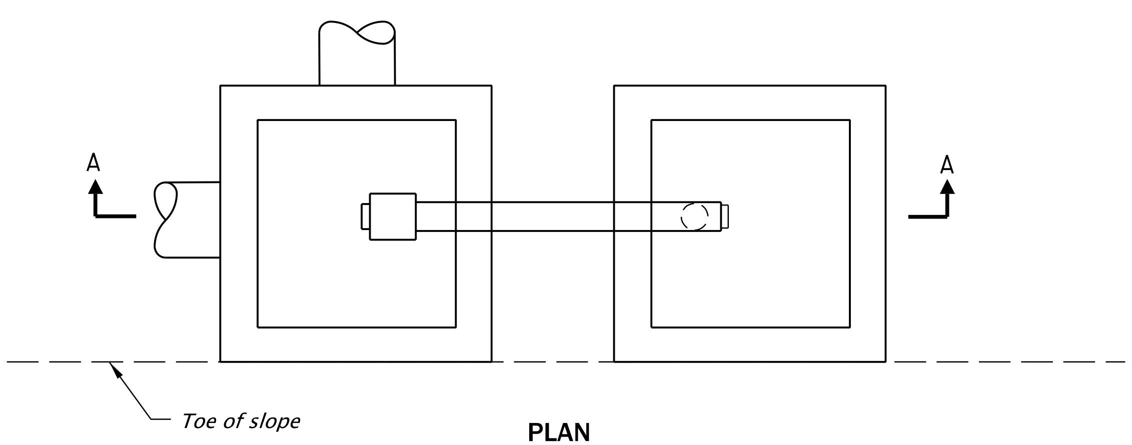


SECTION A-A



SECTION B-B

Letter	Value (inch)	Description
A_1	To Be Developed	Orifice diameter
A_2	To Be Developed	Elev. of center of orifice
B	To Be Developed	Elev. of pond bottom
C	To Be Developed	Elev. of lip of inlet
D	To Be Developed	F.L. elev. of 4" PVC
E	To Be Developed	Pond design depth
F	To Be Developed	F.L. elev. of outfall pipe
G	To Be Developed	Pond design volume
H	To Be Developed	Elev. of lip of inlet



PLAN

POND BOTTOM

REGISTERED PROFESSIONAL ENGINEER
93369PE
OREGON
MAY 13, 2018
CORY M. GIESEKE
PRELIMINARY COPY
INFORMATION ONLY
EXPIRES 06/30/2021
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Cory Gieseke | Reviewer: Karen Tatman
Drafter: Morgan Tholl | Checker: Christine Higgins

WATER QUALITY DETAILS | SHEET NO. HA19

Rotation: 0° Scale: Full Size 1=1

Appendix D. NRCS Soil Survey Report and Draft Infiltration Testing Memo

United States Department of Agriculture

NRCS

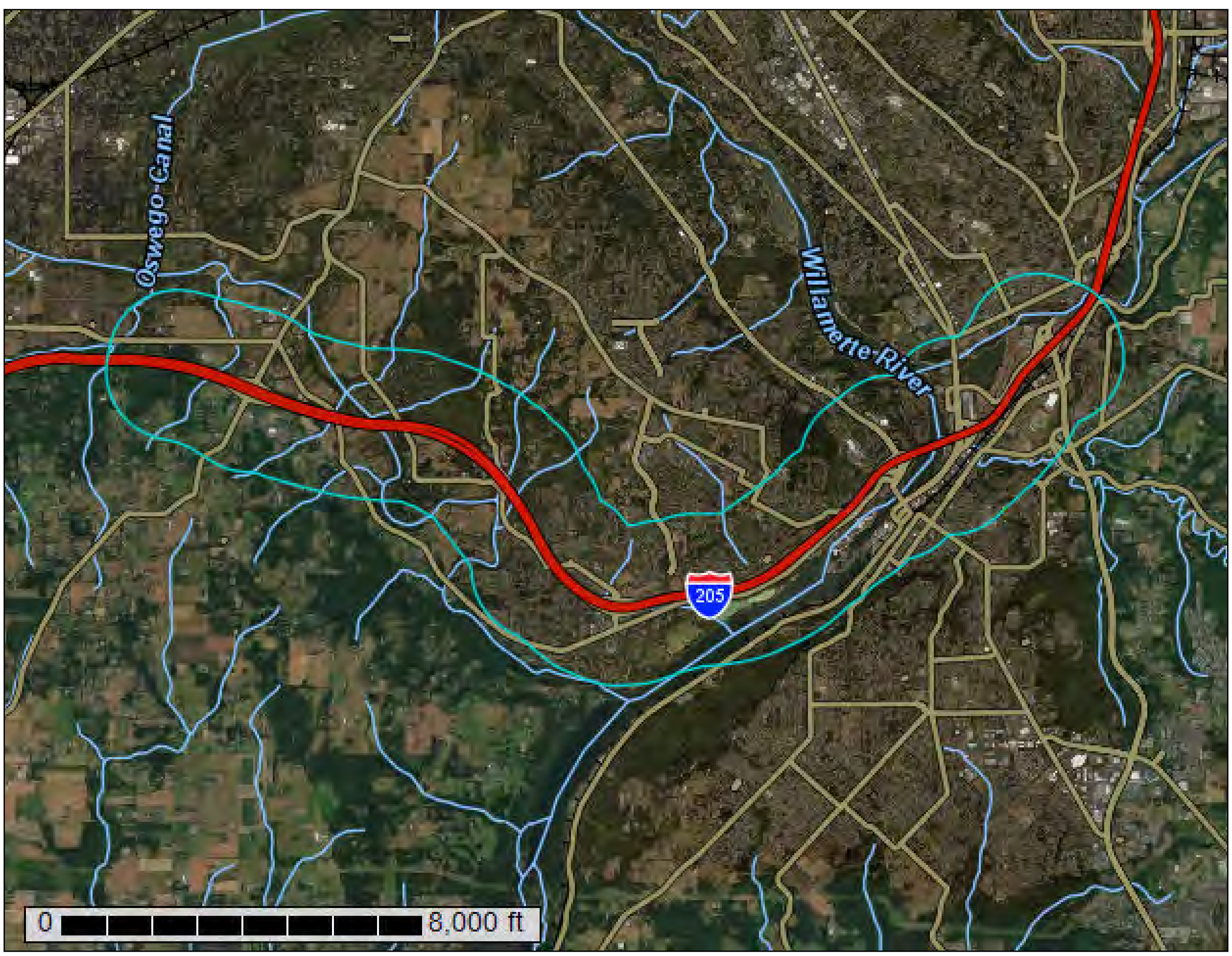
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Clackamas County Area, Oregon

I-205 Abernethy to Stafford Widening



August 8, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

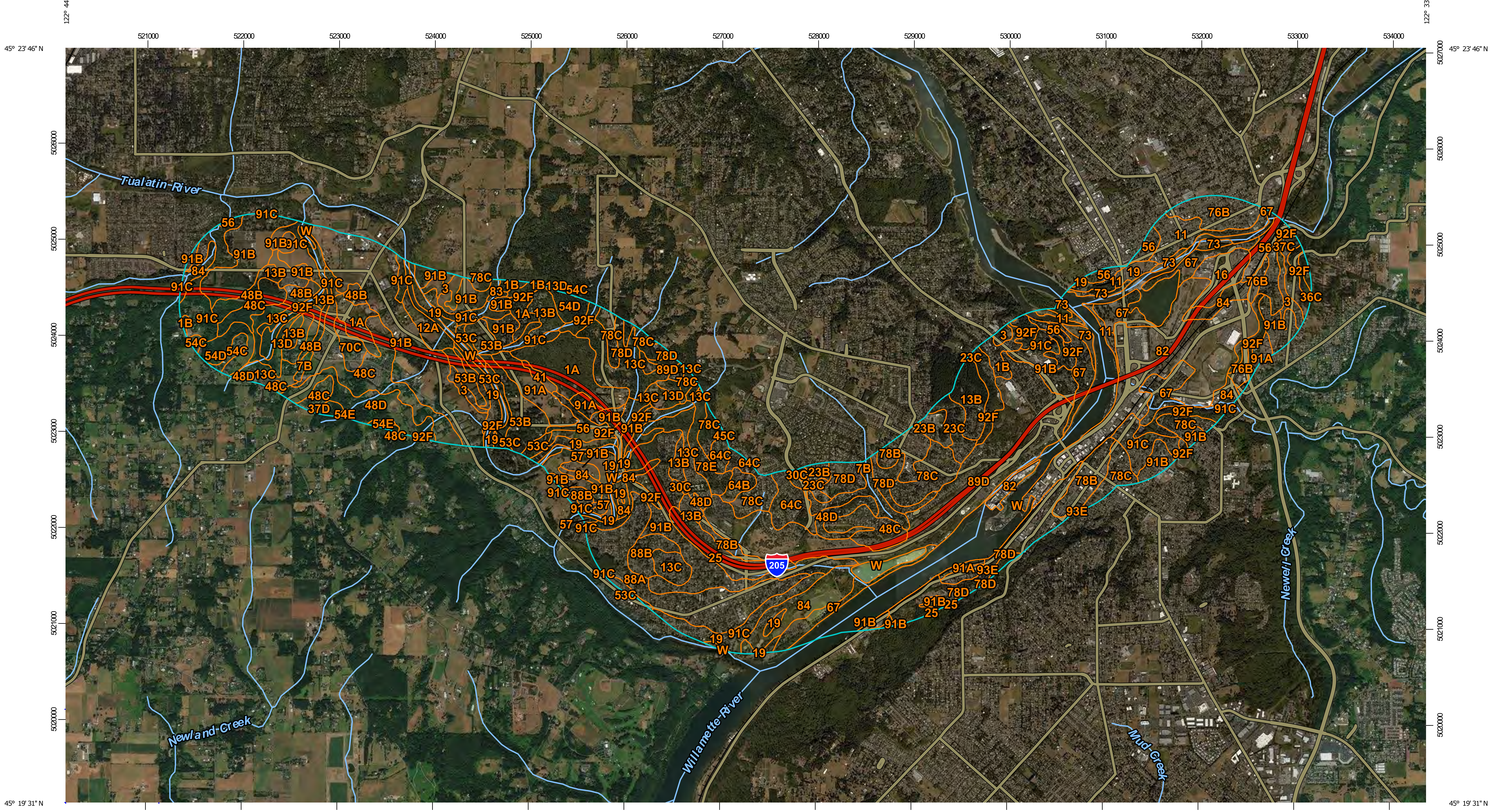
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	34.9	0.6%
3	Amity silt loam	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	47.0	0.8%
11	Camas gravelly sandy loam	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	53.4	0.9%
16	Chehalis silt loam	50.7	0.8%
19	Cloquato silt loam	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	48.2	0.8%
25	Cove silty clay loam	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	7.9	0.1%
41	Huberly silt loam	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	94.8	1.6%

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
53C	Latourell loam, 8 to 15 percent slopes	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	6.5	0.1%
56	McBee silty clay loam	74.6	1.2%
57	McBee variant loam	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	61.0	1.0%
67	Newberg fine sandy loam	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	23.5	0.4%
73	Riverwash	39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	39.9	0.7%
82	Urban land	363.1	6.0%
83	Wapato silt loam	6.5	0.1%
84	Wapato silty clay loam	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	287.0	4.7%
93E	Xerochrepts-Rock outcrop complex, moderately steep	115.8	1.9%

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
W	Water	477.5	7.9%
Totals for Area of Interest		**6,050.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Clackamas County Area, Oregon

1A—Aloha silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 223l
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 51 inches: silt loam
H3 - 51 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 3 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

1B—Aloha silt loam, 3 to 6 percent slopes

Map Unit Setting

National map unit symbol: 223m
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 51 inches: silt loam
H3 - 51 to 80 inches: silt loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 3 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

3—Amity silt loam

Map Unit Setting

National map unit symbol: 2247
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Amity and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amity

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 22 inches: silt loam
H2 - 22 to 62 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Huberly

Percent of map unit: 2 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

7B—Borges silty clay loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2277
Elevation: 250 to 1,400 feet
Mean annual precipitation: 48 to 65 inches
Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 140 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Borges and similar soils: 80 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Borges

Setting

Landform: Depressions on terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 18 inches: silty clay loam
H2 - 18 to 45 inches: silty clay
H3 - 45 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Delena

Percent of map unit: 6 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

11—Camas gravelly sandy loam

Map Unit Setting

National map unit symbol: 2231
Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Camas and similar soils: 80 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Camas

Setting

Landform: Flood plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 10 inches: gravelly sandy loam
H2 - 10 to 17 inches: gravelly sandy loam
H3 - 17 to 60 inches: stratified extremely gravelly coarse sand to very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 9 to 17 inches to strongly contrasting textural stratification
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

12A—Canderly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2232
Elevation: 120 to 250 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Canderly and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canderly

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 46 inches: sandy loam
H3 - 46 to 60 inches: stratified gravelly sand to coarse sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

13B—Cascade silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2234
Elevation: 250 to 1,400 feet
Mean annual precipitation: 50 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Cascade and similar soils: 80 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cascade

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 21 inches: silt loam
H3 - 21 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)

Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 3 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

13C—Cascade silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2235
Elevation: 250 to 1,400 feet
Mean annual precipitation: 50 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cascade and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cascade

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 21 inches: silt loam
H3 - 21 to 60 inches: silty clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

13D—Cascade silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2236
Elevation: 250 to 1,400 feet
Mean annual precipitation: 50 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cascade and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cascade

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 21 inches: silt loam
H3 - 21 to 60 inches: silty clay loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

16—Chehalis silt loam

Map Unit Setting

National map unit symbol: 223g
Elevation: 50 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 44 inches: silty clay loam
H3 - 44 to 60 inches: stratified fine sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

19—Cloquato silt loam

Map Unit Setting

National map unit symbol: 223k
Elevation: 50 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Cloquato and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cloquato

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 42 inches: silt loam
H3 - 42 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

23B—Cornelius silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 223r
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Cornelius and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cornelius

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material

Typical profile

H1 - 0 to 16 inches: silt loam

H2 - 16 to 34 inches: silty clay loam
H3 - 34 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 3 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

23C—Cornelius silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 223s
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cornelius and similar soils: 80 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cornelius

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 34 inches: silty clay loam
H3 - 34 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 4 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

25—Cove silty clay loam

Map Unit Setting

National map unit symbol: 223y

Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cove and similar soils: 85 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cove

Setting

Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Wapato

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Conser

Percent of map unit: 4 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Concord

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Dayton

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

30C—Delena silt loam, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2248
Elevation: 250 to 1,400 feet
Mean annual precipitation: 48 to 65 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Delena and similar soils: 80 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Delena

Setting

Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 25 inches: silty clay loam
H3 - 25 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Borges

Percent of map unit: 8 percent
Landform: Depressions on terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

36C—Hardscrabble silt loam, 7 to 20 percent slopes

Map Unit Setting

National map unit symbol: 224k
Elevation: 150 to 600 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hardscrabble and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hardscrabble

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile
H1 - 0 to 8 inches: silt loam
H2 - 8 to 14 inches: silty clay loam
H3 - 14 to 60 inches: clay

Properties and qualities
Slope: 7 to 20 percent
Depth to restrictive feature: 12 to 24 inches to abrupt textural change
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

37C—Helvetia silt loam, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 224m
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Helvetia and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helvetia

Setting
Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed old alluvium

Typical profile
H1 - 0 to 14 inches: silt loam

H2 - 14 to 21 inches: silty clay loam
H3 - 21 to 40 inches: silty clay
H4 - 40 to 60 inches: silty clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 2 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

37D—Helvetia silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 224n
Elevation: 250 to 500 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Helvetia and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helvetia

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed old alluvium

Typical profile

H1 - 0 to 14 inches: silt loam
H2 - 14 to 21 inches: silty clay loam
H3 - 21 to 40 inches: silty clay
H4 - 40 to 60 inches: silty clay loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)
Hydric soil rating: No

41—Huberly silt loam

Map Unit Setting

National map unit symbol: 224s
Elevation: 150 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Huberly and similar soils: 85 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huberly

Setting

Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 24 inches: silt loam
H3 - 24 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Dayton

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Delena

Percent of map unit: 2 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

45C—Jory silty clay loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 224y
Elevation: 250 to 1,200 feet
Mean annual precipitation: 50 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Jory and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Jory

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium

Typical profile

H1 - 0 to 13 inches: silty clay loam
H2 - 13 to 60 inches: silty clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

48B—Kinton silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2256
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kinton and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kinton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 35 inches: silt loam
H3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 3 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

48C—Kinton silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2257
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kinton and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kinton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 35 inches: silt loam
H3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena
Percent of map unit: 3 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

48D—Kinton silt loam, 15 to 30 percent slopes

Map Unit Setting
National map unit symbol: 2258
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Kinton and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kinton

Setting
Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile
H1 - 0 to 15 inches: silt loam
H2 - 15 to 35 inches: silt loam

H3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 2 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

53B—Latourell loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 225k
Elevation: 50 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Latourell and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Latourell

Setting

Landform: Terraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 48 inches: loam
H3 - 48 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

53C—Latourell loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 225l
Elevation: 50 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Latourell and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Latourell

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 48 inches: loam

H3 - 48 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

54C—Laurelwood silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 225p
Elevation: 200 to 1,500 feet
Mean annual precipitation: 45 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Laurelwood and similar soils: 85 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laurelwood

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material over older clayey material

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 46 inches: silty clay loam
H4 - 46 to 60 inches: silty clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Aqualfs

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

54D—Laurelwood silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 225q
Elevation: 200 to 1,500 feet
Mean annual precipitation: 45 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Laurelwood and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laurelwood

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material over older clayey material

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 46 inches: silty clay loam
H4 - 46 to 60 inches: silty clay

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

54E—Laurelwood silt loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 225r
Elevation: 200 to 1,500 feet
Mean annual precipitation: 45 to 60 inches
Mean annual air temperature: 51 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Laurelwood and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laurelwood

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Silty material over older clayey material

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 18 inches: silty clay loam
H3 - 18 to 46 inches: silty clay loam
H4 - 46 to 60 inches: silty clay

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

56—McBee silty clay loam

Map Unit Setting

National map unit symbol: 225t
Elevation: 50 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Mcbee and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcbee

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 15 inches: silty clay loam
H2 - 15 to 48 inches: silty clay loam
H3 - 48 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

57—McBee variant loam

Map Unit Setting

National map unit symbol: 225v
Elevation: 50 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Mcbee, variant, and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcbee, Variant

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 28 inches: loam

H2 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

64B—Nekia silty clay loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2268
Elevation: 250 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Nekia and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nekia

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, crest, interfluve

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from basalt

Typical profile

H1 - 0 to 19 inches: silty clay loam
H2 - 19 to 39 inches: clay
H3 - 39 to 43 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

64C—Nekia silty clay loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2269
Elevation: 250 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nekia and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nekia

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, crest, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from basalt

Typical profile

H1 - 0 to 19 inches: silty clay loam

H2 - 19 to 39 inches: clay
H3 - 39 to 43 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

67—Newberg fine sandy loam

Map Unit Setting

National map unit symbol: 226g
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Newberg and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newberg

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 14 inches: fine sandy loam
H2 - 14 to 23 inches: fine sandy loam
H3 - 23 to 42 inches: fine sand
H4 - 42 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

70C—Powell silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 226m
Elevation: 250 to 1,400 feet
Mean annual precipitation: 50 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Powell and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Powell

Setting

Landform: Terraces
Landform position (three-dimensional): Riser

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material over old silty alluvium

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 15 inches: silt loam
H3 - 15 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 15 to 23 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 15 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 3 percent
Landform: Terraces, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, riser
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

73—Riverwash

Map Unit Composition

Riverwash: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riverwash

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear

Typical profile

H1 - 0 to 60 inches: stratified sand to gravel

Properties and qualities

Slope: 0 to 3 percent
Natural drainage class: Well drained
Depth to water table: About 0 to 24 inches
Frequency of flooding: Frequent

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

76B—Salem silt loam, 0 to 7 percent slopes

Map Unit Setting

National map unit symbol: 226y
Elevation: 200 to 650 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Salem and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salem

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 24 inches: gravelly clay loam
H3 - 24 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

78B—Saum silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2271
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

78C—Saum silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2272
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

78D—Saum silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2273
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

78E—Saum silt loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2274
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

82—Urban land

Map Unit Setting

National map unit symbol: 227g
Elevation: 50 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

83—Wapato silt loam

Map Unit Setting

National map unit symbol: 227h
Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wapato and similar soils: 90 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wapato

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 41 inches: silty clay loam
H3 - 41 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Cove

Percent of map unit: 6 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

84—Wapato silty clay loam

Map Unit Setting

National map unit symbol: 227j
Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wapato and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wapato

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 18 inches: silty clay loam
H2 - 18 to 45 inches: silty clay loam
H3 - 45 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Cove

Percent of map unit: 6 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Humaquepts

Percent of map unit: 4 percent
Landform: Flood plains
Hydric soil rating: Yes

88A—Willamette silt loam, wet, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 227q

Elevation: 150 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Willamette, wet, and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Willamette, Wet

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 14 inches: silt loam
H2 - 14 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

88B—Willamette silt loam, wet, 3 to 7 percent slopes

Map Unit Setting

National map unit symbol: 227r
Elevation: 150 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Willamette, wet, and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Willamette, Wet

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 14 inches: silt loam
H2 - 14 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

89D—Witzel very stony silt loam, 3 to 40 percent slopes

Map Unit Setting

National map unit symbol: 227s
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Witzel and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Witzel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, nose slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from basalt

Typical profile

H1 - 0 to 4 inches: very stony silt loam
H2 - 4 to 16 inches: very stony silty clay loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 40 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

91A—Woodburn silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 227y
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodburn and similar soils: 85 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 3 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

91B—Woodburn silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 227z
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodburn and similar soils: 90 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 2 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

Dayton

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

91C—Woodburn silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2280
Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

92F—Xerochrepts and Haploxerolls, very steep

Map Unit Setting

National map unit symbol: 2281
Elevation: 50 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Xerochrepts and similar soils: 50 percent
Haploxerolls and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Xerochrepts

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from igneous rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 48 inches: gravelly clay loam
H3 - 48 to 60 inches: very cobbly clay loam

Properties and qualities

Slope: 20 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Haploxerolls

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium derived from igneous rock

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 60 inches: very gravelly loam

Properties and qualities

Slope: 20 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 36 to 48 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

93E—Xerochrepts-Rock outcrop complex, moderately steep

Map Unit Setting
National map unit symbol: 2282
Elevation: 100 to 500 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Xerochrepts and similar soils: 60 percent
Rock outcrop: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Xerochrepts

Setting
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from andesite and/or basalt

Typical profile
H1 - 0 to 26 inches: gravelly loam
H2 - 26 to 30 inches: unweathered bedrock

Properties and qualities
Slope: 0 to 30 percent
Depth to restrictive feature: 10 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C
Hydric soil rating: No

Description of Rock Outcrop

Typical profile
R - 0 to 60 inches: unweathered bedrock

Properties and qualities
Slope: 0 to 30 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

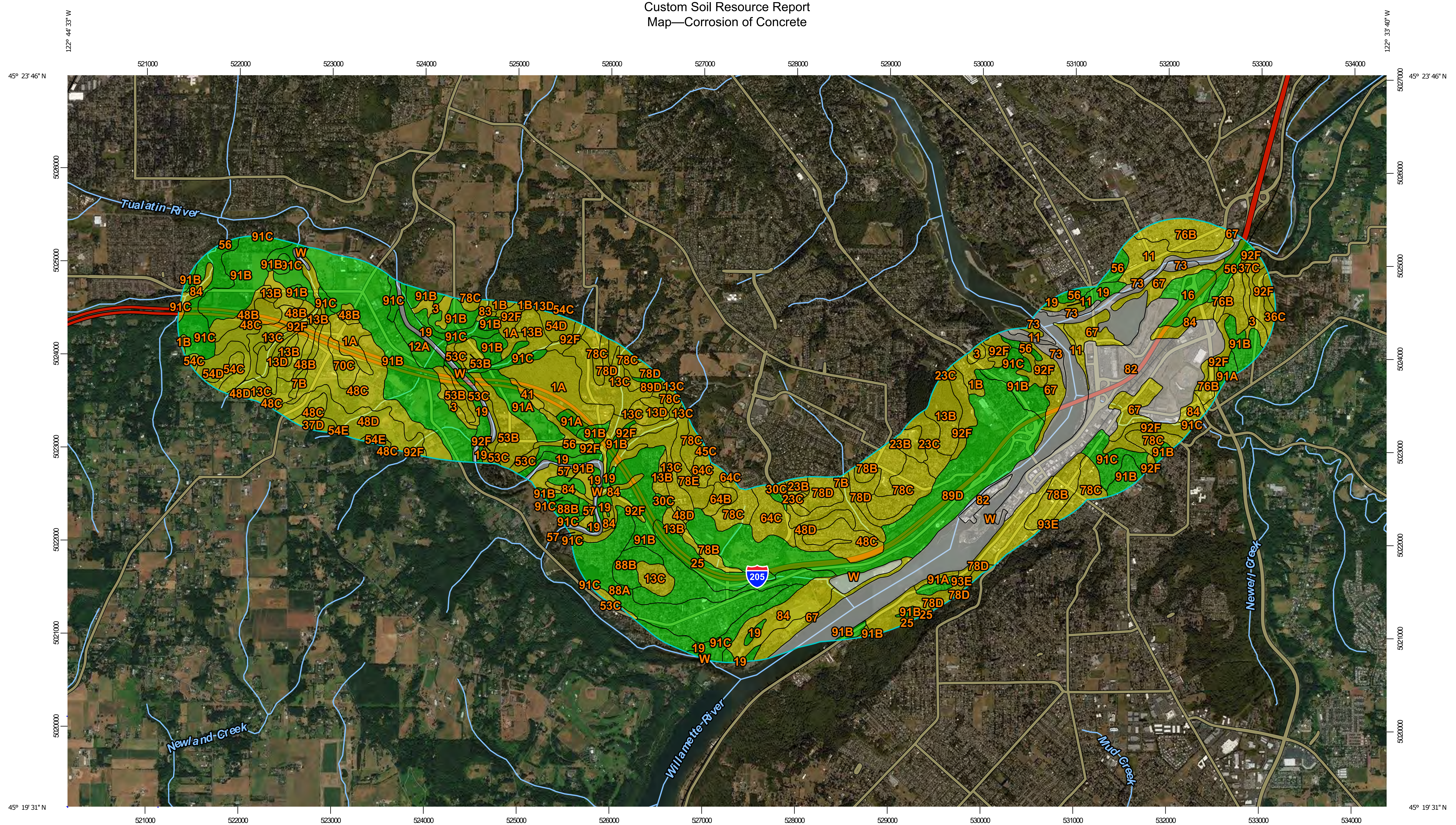
Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Corrosion of Concrete

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens concrete. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the concrete in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Map—Corrosion of Concrete



Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Lines

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Points

- High
- Moderate
- Low
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Concrete

Corrosion of Concrete— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	Moderate	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	Moderate	34.9	0.6%
3	Amity silt loam	Moderate	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	Moderate	47.0	0.8%
11	Camas gravelly sandy loam	Moderate	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	Low	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	Moderate	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	Moderate	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	Moderate	53.4	0.9%
16	Chehalis silt loam	Low	50.7	0.8%
19	Cloquato silt loam	Low	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	Moderate	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	Moderate	48.2	0.8%
25	Cove silty clay loam	Low	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	Low	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	High	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	Moderate	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	Moderate	7.9	0.1%
41	Huberly silt loam	Moderate	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	Moderate	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	Moderate	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	Moderate	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	Moderate	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	Moderate	94.8	1.6%

Corrosion of Concrete— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53C	Latourell loam, 8 to 15 percent slopes	Moderate	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	Moderate	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	Moderate	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	Moderate	6.5	0.1%
56	McBee silty clay loam	Low	74.6	1.2%
57	McBee variant loam	Moderate	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	Moderate	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	Moderate	61.0	1.0%
67	Newberg fine sandy loam	Moderate	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	Moderate	23.5	0.4%
73	Riverwash		39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	Moderate	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	Moderate	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	Moderate	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	Moderate	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	Moderate	39.9	0.7%
82	Urban land		363.1	6.0%
83	Wapato silt loam	Moderate	6.5	0.1%
84	Wapato silty clay loam	Moderate	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	Low	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	Low	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	Low	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	Low	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	Low	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	Low	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	Moderate	287.0	4.7%

Corrosion of Concrete— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
93E	Xerochrepts-Rock outcrop complex, moderately steep	Moderate	115.8	1.9%
W	Water		477.5	7.9%
Totals for Area of Interest			**6,050.5**	**100.0%**

Rating Options—Corrosion of Concrete

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

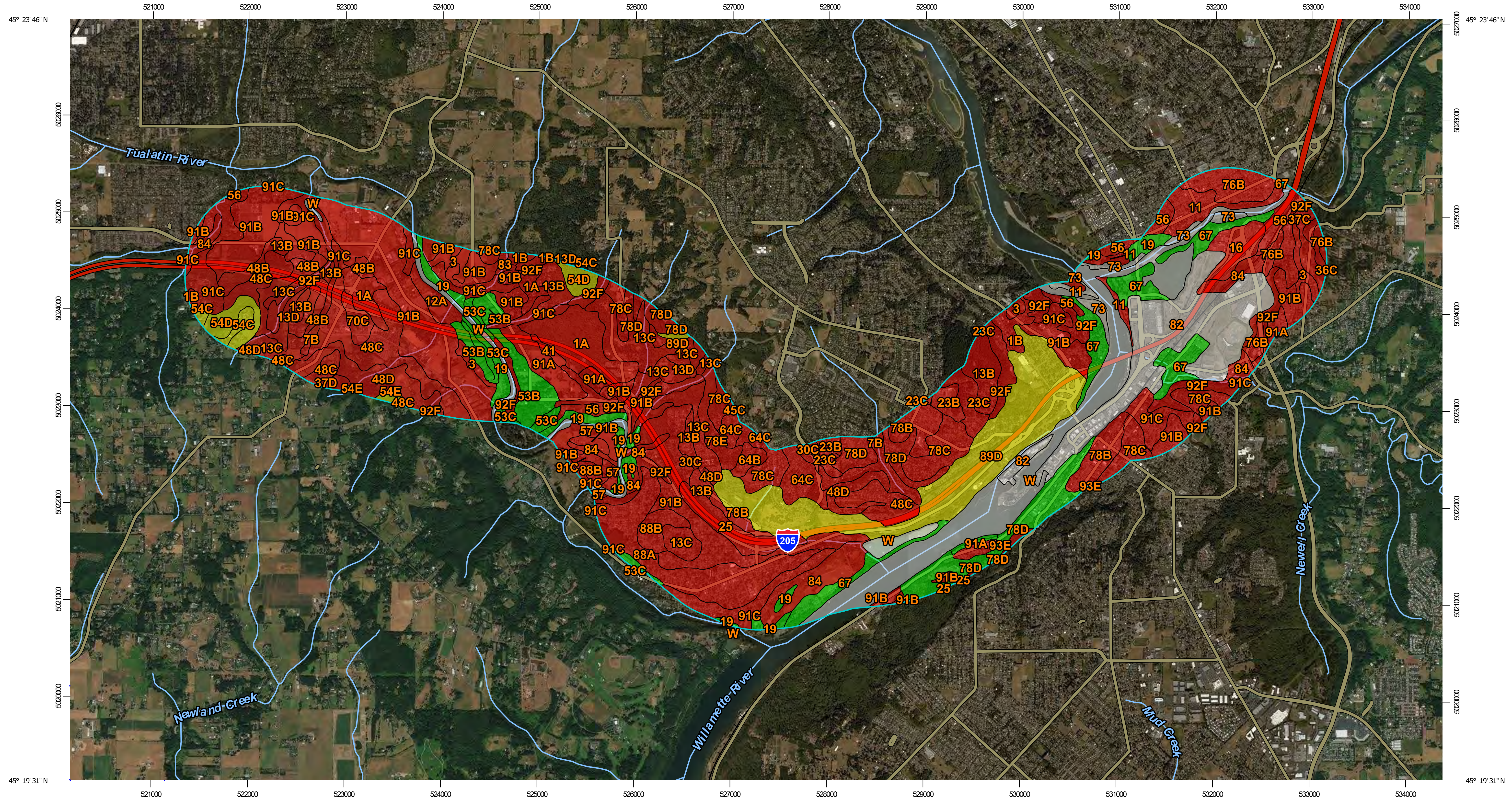
Tie-break Rule: Higher

Corrosion of Steel

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Map—Corrosion of Steel



Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

High

Moderate

Low

Not rated or not available

Soil Rating Lines

High

Moderate

Low

Not rated or not available

Soil Rating Points

High

Moderate

Low

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Steel

Corrosion of Steel— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	High	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	High	34.9	0.6%
3	Amity silt loam	High	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	High	47.0	0.8%
11	Camas gravelly sandy loam	High	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	High	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	High	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	High	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	High	53.4	0.9%
16	Chehalis silt loam	High	50.7	0.8%
19	Cloquato silt loam	Low	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	High	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	High	48.2	0.8%
25	Cove silty clay loam	High	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	High	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	High	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	High	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	High	7.9	0.1%
41	Huberly silt loam	High	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	High	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	High	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	High	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	High	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	Low	94.8	1.6%

Corrosion of Steel— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
53C	Latourell loam, 8 to 15 percent slopes	Low	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	Moderate	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	Moderate	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	Moderate	6.5	0.1%
56	McBee silty clay loam	High	74.6	1.2%
57	McBee variant loam	High	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	High	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	High	61.0	1.0%
67	Newberg fine sandy loam	Low	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	High	23.5	0.4%
73	Riverwash		39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	High	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	High	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	High	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	High	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	High	39.9	0.7%
82	Urban land		363.1	6.0%
83	Wapato silt loam	High	6.5	0.1%
84	Wapato silty clay loam	High	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	High	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	High	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	Moderate	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	High	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	High	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	High	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	High	287.0	4.7%

Corrosion of Steel— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
93E	Xerochrepts-Rock outcrop complex, moderately steep	Low	115.8	1.9%
W	Water		477.5	7.9%
Totals for Area of Interest			**6,050.5**	**100.0%**

Rating Options—Corrosion of Steel

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Management

Water Management interpretations are tools for evaluating the potential of the soil in the application of various water management practices. Example interpretations include pond reservoir area, embankments, dikes, levees, and excavated ponds.

Subsurface Water Management, Outflow Quality

The ratings for Subsurface Water Management, Outflow Quality are based on the soil properties that affect the capacity of the soil to convey surface and subsurface water and on the properties that affect water quality. The properties that affect the conveyance and water quality include salinity, sodicity, soil reaction, soil taxonomic great group placement, gypsum content, shrink-swell potential, soil saturation, and surface erosion.

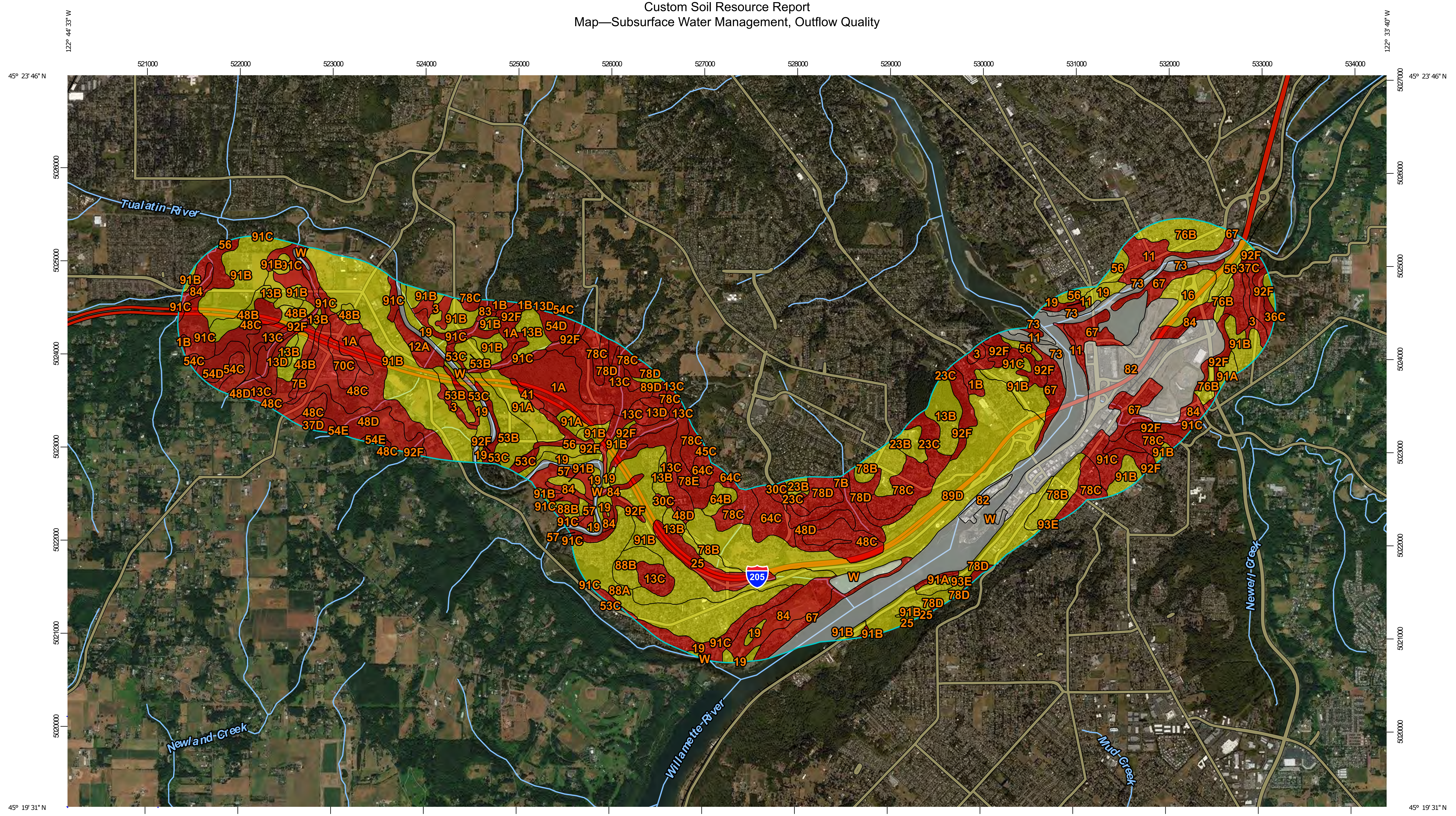
The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor water quality can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as that listed for the map unit. The percent composition of each component in a particular map unit is given so that the user will realize the percentage of each map unit that has the specified rating.

A map unit may have other components with different ratings. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Subsurface Water Management, Outflow Quality



Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

Meters: 0 500 1000 2000 3000

Feet: 0 1500 3000 6000 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Lines

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Points

Very limited

Somewhat limited

Not limited

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables—Subsurface Water Management, Outflow Quality

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
1A	Aloha silt loam, 0 to 3 percent slopes	Very limited	Aloha (85%)	Pesticide and nutrient movement (1.00)	161.9	2.7%
			Huberly (3%)	Pesticide and nutrient movement (1.00)		
			Dayton (2%)	Pesticide and nutrient movement (1.00)		
1B	Aloha silt loam, 3 to 6 percent slopes	Very limited	Aloha (85%)	Pesticide and nutrient movement (1.00)	34.9	0.6%
				Water Erosion (0.46)		
			Huberly (3%)	Pesticide and nutrient movement (1.00)		
			Dayton (2%)	Pesticide and nutrient movement (1.00)		
3	Amity silt loam	Very limited	Amity (85%)	Pesticide and nutrient movement (1.00)	51.2	0.8%
			Dayton (3%)	Pesticide and nutrient movement (1.00)		
			Huberly (2%)	Pesticide and nutrient movement (1.00)		
7B	Borges silty clay loam, 0 to 8 percent slopes	Very limited	Borges (80%)	Pesticide and nutrient movement (1.00)	47.0	0.8%
				Water Erosion (0.12)		
			Delena (6%)	Pesticide and nutrient movement (1.00)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
				Water Erosion (1.00)		
11	Camas gravelly sandy loam	Very limited	Camas (80%)	Pesticide and nutrient movement (1.00)	78.0	1.3%
			Wapato (2%)	Pesticide and nutrient movement (1.00)		
12A	Canderly sandy loam, 0 to 3 percent slopes	Very limited	Canderly (90%)	Pesticide and nutrient movement (1.00)	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	Somewhat limited	Cascade (80%)	Pesticide and nutrient movement (0.99)	130.4	2.2%
				Water Erosion (0.12)		
13C	Cascade silt loam, 8 to 15 percent slopes	Very limited	Cascade (80%)	Water Erosion (1.00)	134.6	2.2%
				Pesticide and nutrient movement (0.99)		
13D	Cascade silt loam, 15 to 30 percent slopes	Very limited	Cascade (80%)	Water Erosion (1.00)	53.4	0.9%
				Pesticide and nutrient movement (0.99)		
16	Chehalis silt loam	Somewhat limited	Chehalis (85%)	Pesticide and nutrient movement (0.22)	50.7	0.8%
19	Cloquato silt loam	Somewhat limited	Cloquato (85%)	Pesticide and nutrient movement (0.22)	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	Somewhat limited	Cornelius (85%)	Pesticide and nutrient movement (0.71)	30.8	0.5%
				Water Erosion (0.12)		
23C	Cornelius silt loam, 8 to 15 percent slopes	Very limited	Cornelius (80%)	Water Erosion (1.00)	48.2	0.8%
				Pesticide and nutrient movement (0.71)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Delena (4%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
25	Cove silty clay loam	Very limited	Cove (85%)	Pesticide and nutrient movement (1.00)	63.3	1.0%
			Wapato (5%)	Pesticide and nutrient movement (1.00)		
			Conser (4%)	Pesticide and nutrient movement (1.00)		
			Concord (2%)	Pesticide and nutrient movement (1.00)		
			Dayton (1%)	Pesticide and nutrient movement (1.00)		
30C	Delena silt loam, 3 to 12 percent slopes	Very limited	Delena (80%)	Pesticide and nutrient movement (1.00)	9.9	0.2%
				Water Erosion (0.90)		
			Borges (8%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (0.04)		
36C	Hardscrabble silt loam, 7 to 20 percent slopes	Very limited	Hardscrabble (85%)	Pesticide and nutrient movement (1.00)	0.0	0.0%
				Water Erosion (1.00)		
				Too acid (0.04)		
37C	Helvetia silt loam, 8 to 15 percent slopes	Very limited	Helvetia (85%)	Water Erosion (1.00)	51.0	0.8%
				Pesticide and nutrient movement (0.14)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Delena (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
37D	Helvetia silt loam, 15 to 30 percent slopes	Very limited	Helvetia (85%)	Water Erosion (1.00)	7.9	0.1%
				Pesticide and nutrient movement (0.14)		
41	Huberly silt loam	Very limited	Huberly (85%)	Pesticide and nutrient movement (1.00)	8.3	0.1%
			Dayton (5%)	Pesticide and nutrient movement (1.00)		
			Delena (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
45C	Jory silty clay loam, 8 to 15 percent slopes	Very limited	Jory (90%)	Water Erosion (1.00)	0.7	0.0%
				Pesticide and nutrient movement (0.00)		
48B	Kinton silt loam, 3 to 8 percent slopes	Somewhat limited	Kinton (85%)	Pesticide and nutrient movement (0.71)	67.3	1.1%
				Water Erosion (0.42)		
48C	Kinton silt loam, 8 to 15 percent slopes	Very limited	Kinton (85%)	Water Erosion (1.00)	247.5	4.1%
				Pesticide and nutrient movement (0.71)		
			Delena (3%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
48D	Kinton silt loam, 15 to 30 percent slopes	Very limited	Kinton (85%)	Water Erosion (1.00)	125.4	2.1%
				Pesticide and nutrient movement (0.71)		
			Delena (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
53B	Latourell loam, 3 to 8 percent slopes	Somewhat limited	Latourell (90%)	Water Erosion (0.42)	94.8	1.6%
				Pesticide and nutrient movement (0.22)		
53C	Latourell loam, 8 to 15 percent slopes	Very limited	Latourell (85%)	Water Erosion (1.00)	37.2	0.6%
				Pesticide and nutrient movement (0.22)		
54C	Laurelwood silt loam, 8 to 15 percent slopes	Very limited	Laurelwood (85%)	Water Erosion (1.00)	16.3	0.3%
				Pesticide and nutrient movement (0.00)		
54D	Laurelwood silt loam, 15 to 30 percent slopes	Very limited	Laurelwood (80%)	Water Erosion (1.00)	62.1	1.0%
				Pesticide and nutrient movement (0.00)		
54E	Laurelwood silt loam, 30 to 60 percent slopes	Very limited	Laurelwood (80%)	Water Erosion (1.00)	6.5	0.1%
				Pesticide and nutrient movement (0.00)		
56	McBee silty clay loam	Somewhat limited	McBee (85%)	Pesticide and nutrient movement (0.82)	74.6	1.2%
57	McBee variant loam	Very limited	McBee, Variant (90%)	Pesticide and nutrient movement (1.00)	35.5	0.6%

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Wapato (3%)	Pesticide and nutrient movement (1.00)		
64B	Nekia silty clay loam, 2 to 8 percent slopes	Somewhat limited	Nekia (80%)	Water Erosion (0.08)	17.7	0.3%
				Pesticide and nutrient movement (0.00)		
64C	Nekia silty clay loam, 8 to 15 percent slopes	Very limited	Nekia (80%)	Water Erosion (1.00)	61.0	1.0%
				Pesticide and nutrient movement (0.00)		
67	Newberg fine sandy loam	Very limited	Newberg (85%)	Pesticide and nutrient movement (1.00)	189.0	3.1%
			Wapato (2%)	Pesticide and nutrient movement (1.00)		
70C	Powell silt loam, 8 to 15 percent slopes	Very limited	Powell (85%)	Pesticide and nutrient movement (1.00)	23.5	0.4%
				Water Erosion (1.00)		
			Delena (3%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
73	Riverwash	Not rated	Riverwash (100%)		39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	Somewhat limited	Salem (85%)	Pesticide and nutrient movement (0.22)	89.8	1.5%
				Water Erosion (0.12)		
78B	Saum silt loam, 3 to 8 percent slopes	Somewhat limited	Saum (80%)	Water Erosion (0.42)	110.0	1.8%
				Pesticide and nutrient movement (0.22)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
78C	Saum silt loam, 8 to 15 percent slopes	Very limited	Saum (80%)	Water Erosion (1.00)	229.2	3.8%
				Pesticide and nutrient movement (0.22)		
78D	Saum silt loam, 15 to 30 percent slopes	Very limited	Saum (80%)	Water Erosion (1.00)	157.1	2.6%
				Pesticide and nutrient movement (0.22)		
78E	Saum silt loam, 30 to 60 percent slopes	Very limited	Saum (80%)	Water Erosion (1.00)	39.9	0.7%
				Pesticide and nutrient movement (0.22)		
82	Urban land	Not rated	Urban land (100%)		363.1	6.0%
83	Wapato silt loam	Very limited	Wapato (90%)	Pesticide and nutrient movement (1.00)	6.5	0.1%
			Cove (6%)	Pesticide and nutrient movement (1.00)		
84	Wapato silty clay loam	Very limited	Wapato (85%)	Pesticide and nutrient movement (1.00)	146.1	2.4%
			Cove (6%)	Pesticide and nutrient movement (1.00)		
			Humaquepts (4%)	Pesticide and nutrient movement (1.00)		
88A	Willamette silt loam, wet, 0 to 3 percent slopes	Somewhat limited	Willamette, wet (85%)	Pesticide and nutrient movement (0.64)	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	Somewhat limited	Willamette, wet (85%)	Pesticide and nutrient movement (0.64)	42.8	0.7%
				Water Erosion (0.36)		
89D	Witzel very stony silt loam, 3 to	Somewhat limited	Witzel (80%)	Water Erosion (0.68)	439.2	7.3%

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
	40 percent slopes			Pesticide and nutrient movement (0.22)		
91A	Woodburn silt loam, 0 to 3 percent slopes	Somewhat limited	Woodburn (85%)	Pesticide and nutrient movement (0.96)	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	Somewhat limited	Woodburn (90%)	Pesticide and nutrient movement (0.96)	779.4	12.9%
				Water Erosion (0.12)		
91C	Woodburn silt loam, 8 to 15 percent slopes	Very limited	Woodburn (90%)	Water Erosion (1.00)	283.3	4.7%
				Pesticide and nutrient movement (0.96)		
			Dayton (2%)	Pesticide and nutrient movement (1.00)		
92F	Xerochrepts and Haploxerolls, very steep	Very limited	Xerochrepts (50%)	Water Erosion (1.00)	287.0	4.7%
				Pesticide and nutrient movement (0.14)		
			Haploxerolls (35%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.48)		
93E	Xerochrepts-Rock outcrop complex, moderately steep	Somewhat limited	Xerochrepts (60%)	Water Erosion (0.72)	115.8	1.9%
				Pesticide and nutrient movement (0.00)		
W	Water	Not rated	Water (100%)		477.5	7.9%
Totals for Area of Interest					**6,050.5**	**100.0%**

Subsurface Water Management, Outflow Quality— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Very limited	2,732.4	45.2%
Somewhat limited	2,437.8	40.3%

Subsurface Water Management, Outflow Quality— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Null or Not Rated	880.4	14.5%
Totals for Area of Interest	**6,050.5**	**100.0%**

Rating Options—Subsurface Water Management, Outflow Quality

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

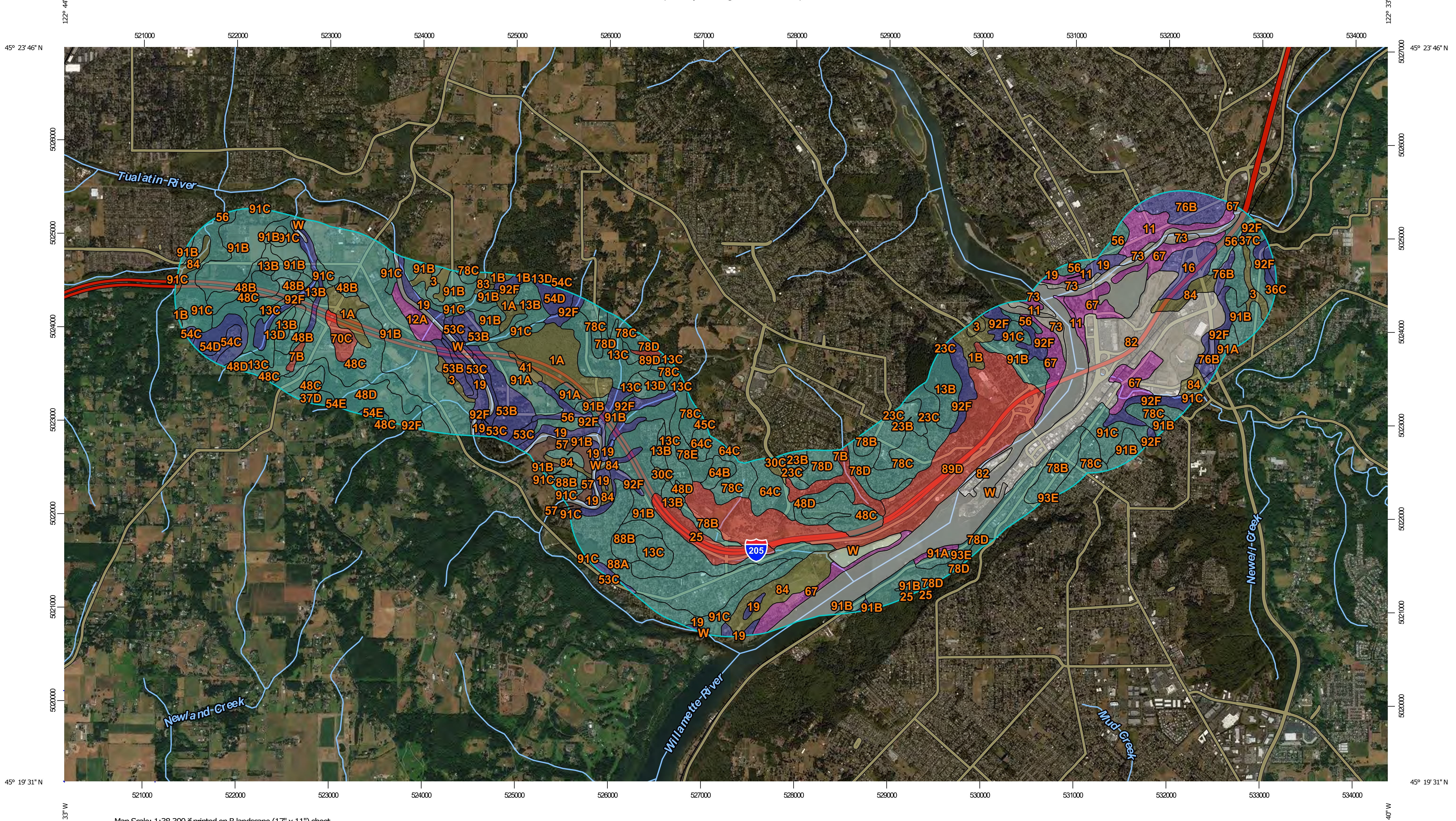
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1A	Aloha silt loam, 0 to 3 percent slopes	C/D	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	C/D	34.9	0.6%
3	Amity silt loam	C/D	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	D	47.0	0.8%
11	Camas gravelly sandy loam	A	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	A	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	C	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	C	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	C	53.4	0.9%
16	Chehalis silt loam	B	50.7	0.8%
19	Cloquato silt loam	B	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	C	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	C	48.2	0.8%
25	Cove silty clay loam	D	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	C/D	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	D	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	C	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	C	7.9	0.1%
41	Huberly silt loam	C/D	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	C	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	C	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	C	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	C	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	B	94.8	1.6%

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53C	Latourell loam, 8 to 15 percent slopes	B	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	B	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	B	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	B	6.5	0.1%
56	McBee silty clay loam	C	74.6	1.2%
57	McBee variant loam	B/D	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	C	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	C	61.0	1.0%
67	Newberg fine sandy loam	A	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	D	23.5	0.4%
73	Riverwash		39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	B	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	C	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	C	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	C	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	C	39.9	0.7%
82	Urban land		363.1	6.0%
83	Wapato silt loam	C/D	6.5	0.1%
84	Wapato silty clay loam	C/D	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	C	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	C	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	D	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	C	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	C	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	C	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	B	287.0	4.7%

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
93E	Xerochrepts-Rock outcrop complex, moderately steep	C	115.8	1.9%
W	Water		477.5	7.9%
Totals for Area of Interest			**6,050.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map—Hydrologic Soil Group

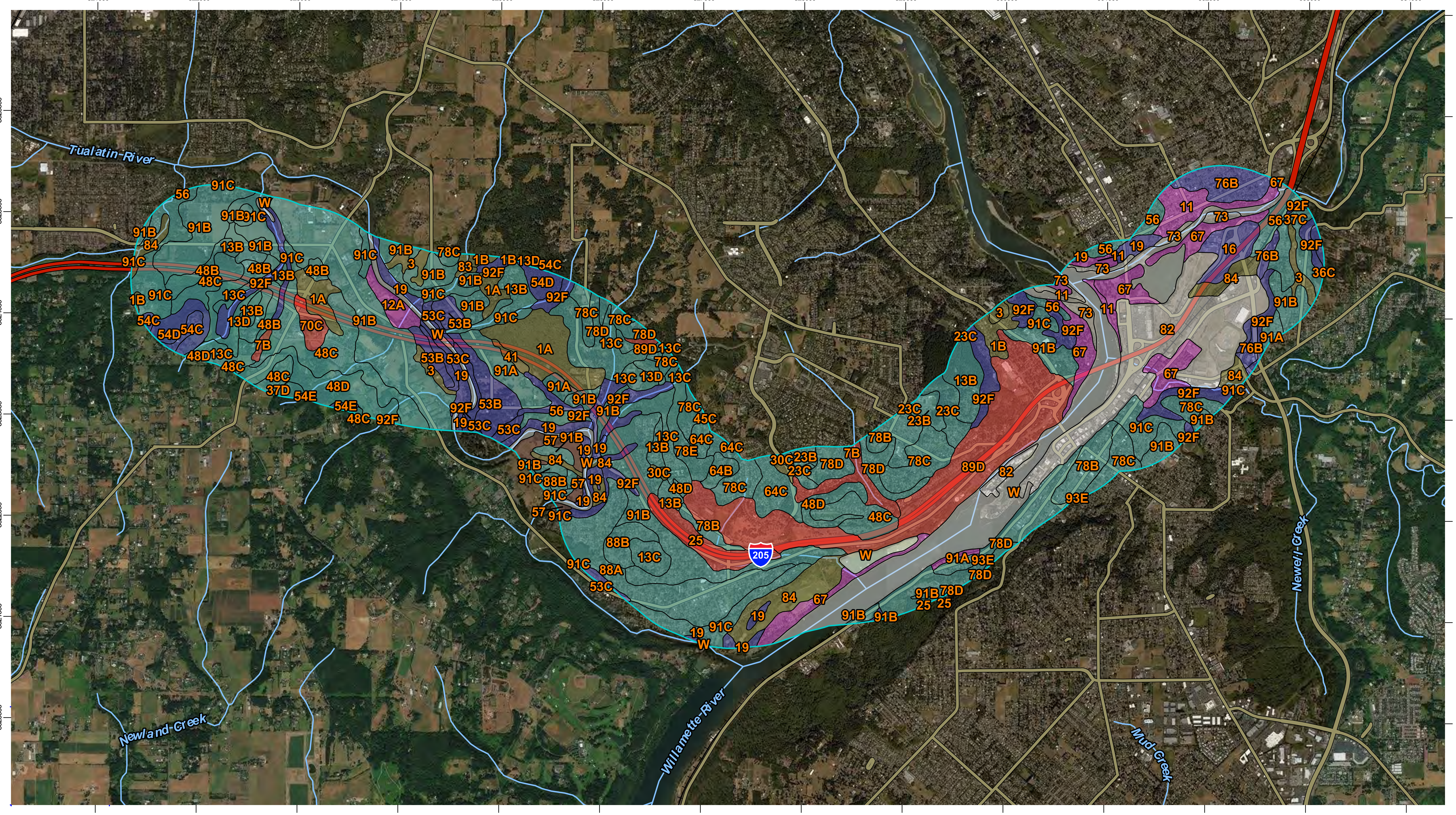
122° 44' 33" W

122° 33' 40" W

45° 23' 46" N

521000 522000 523000 524000 525000 526000 527000 528000 529000 530000 531000 532000 533000 534000

5027000 5026000 5025000 5024000 5023000 5022000 5021000 5020000



45° 19' 31" N

521000 522000 523000 524000 525000 526000 527000 528000 529000 530000 531000 532000 533000 534000

122° 44' 33" W

122° 33' 40" W

Map Scale: 1:38,300 if printed on B landscape (17" x 11") sheet.

Meters: 0 500 1000 2000 3000

Feet: 0 1500 3000 6000 9000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1A	Aloha silt loam, 0 to 3 percent slopes	C/D	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	C/D	34.9	0.6%
3	Amity silt loam	C/D	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	D	47.0	0.8%
11	Camas gravelly sandy loam	A	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	A	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	C	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	C	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	C	53.4	0.9%
16	Chehalis silt loam	B	50.7	0.8%
19	Cloquato silt loam	B	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	C	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	C	48.2	0.8%
25	Cove silty clay loam	D	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	C/D	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	D	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	C	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	C	7.9	0.1%
41	Huberly silt loam	C/D	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	C	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	C	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	C	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	C	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	B	94.8	1.6%

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53C	Latourell loam, 8 to 15 percent slopes	B	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	B	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	B	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	B	6.5	0.1%
56	McBee silty clay loam	C	74.6	1.2%
57	McBee variant loam	B/D	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	C	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	C	61.0	1.0%
67	Newberg fine sandy loam	A	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	D	23.5	0.4%
73	Riverwash		39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	B	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	C	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	C	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	C	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	C	39.9	0.7%
82	Urban land		363.1	6.0%
83	Wapato silt loam	C/D	6.5	0.1%
84	Wapato silty clay loam	C/D	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	C	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	C	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	D	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	C	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	C	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	C	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	B	287.0	4.7%

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
93E	Xerochrepts-Rock outcrop complex, moderately steep	C	115.8	1.9%
W	Water		477.5	7.9%
Totals for Area of Interest			**6,050.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

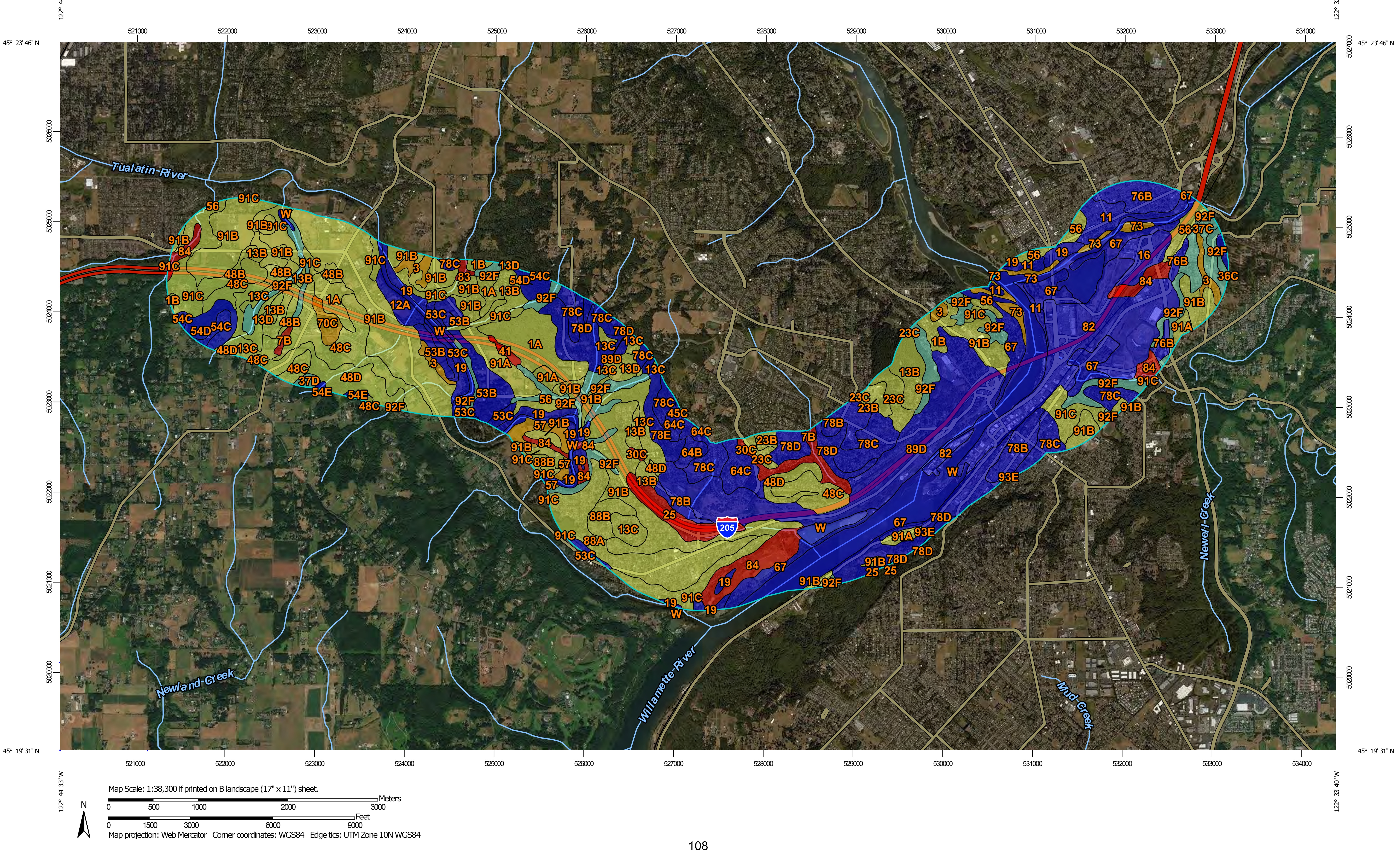
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Water Table



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Lines

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Points

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Depth to Water Table

Depth to Water Table— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	54	161.9	2.7%
1B	Aloha silt loam, 3 to 6 percent slopes	54	34.9	0.6%
3	Amity silt loam	31	51.2	0.8%
7B	Borges silty clay loam, 0 to 8 percent slopes	8	47.0	0.8%
11	Camas gravelly sandy loam	>200	78.0	1.3%
12A	Canderly sandy loam, 0 to 3 percent slopes	>200	29.1	0.5%
13B	Cascade silt loam, 3 to 8 percent slopes	61	130.4	2.2%
13C	Cascade silt loam, 8 to 15 percent slopes	61	134.6	2.2%
13D	Cascade silt loam, 15 to 30 percent slopes	61	53.4	0.9%
16	Chehalis silt loam	>200	50.7	0.8%
19	Cloquato silt loam	>200	113.2	1.9%
23B	Cornelius silt loam, 3 to 8 percent slopes	86	30.8	0.5%
23C	Cornelius silt loam, 8 to 15 percent slopes	86	48.2	0.8%
25	Cove silty clay loam	15	63.3	1.0%
30C	Delena silt loam, 3 to 12 percent slopes	23	9.9	0.2%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	31	0.0	0.0%
37C	Helvetia silt loam, 8 to 15 percent slopes	137	51.0	0.8%
37D	Helvetia silt loam, 15 to 30 percent slopes	137	7.9	0.1%
41	Huberly silt loam	23	8.3	0.1%
45C	Jory silty clay loam, 8 to 15 percent slopes	>200	0.7	0.0%
48B	Kinton silt loam, 3 to 8 percent slopes	86	67.3	1.1%
48C	Kinton silt loam, 8 to 15 percent slopes	86	247.5	4.1%
48D	Kinton silt loam, 15 to 30 percent slopes	86	125.4	2.1%
53B	Latourell loam, 3 to 8 percent slopes	>200	94.8	1.6%

Depth to Water Table— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
53C	Latourell loam, 8 to 15 percent slopes	>200	37.2	0.6%
54C	Laurelwood silt loam, 8 to 15 percent slopes	>200	16.3	0.3%
54D	Laurelwood silt loam, 15 to 30 percent slopes	>200	62.1	1.0%
54E	Laurelwood silt loam, 30 to 60 percent slopes	>200	6.5	0.1%
56	McBee silty clay loam	76	74.6	1.2%
57	McBee variant loam	31	35.5	0.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	>200	17.7	0.3%
64C	Nekia silty clay loam, 8 to 15 percent slopes	>200	61.0	1.0%
67	Newberg fine sandy loam	>200	189.0	3.1%
70C	Powell silt loam, 8 to 15 percent slopes	38	23.5	0.4%
73	Riverwash	31	39.8	0.7%
76B	Salem silt loam, 0 to 7 percent slopes	>200	89.8	1.5%
78B	Saum silt loam, 3 to 8 percent slopes	>200	110.0	1.8%
78C	Saum silt loam, 8 to 15 percent slopes	>200	229.2	3.8%
78D	Saum silt loam, 15 to 30 percent slopes	>200	157.1	2.6%
78E	Saum silt loam, 30 to 60 percent slopes	>200	39.9	0.7%
82	Urban land	>200	363.1	6.0%
83	Wapato silt loam	0	6.5	0.1%
84	Wapato silty clay loam	8	146.1	2.4%
88A	Willamette silt loam, wet, 0 to 3 percent slopes	92	192.6	3.2%
88B	Willamette silt loam, wet, 3 to 7 percent slopes	92	42.8	0.7%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	>200	439.2	7.3%
91A	Woodburn silt loam, 0 to 3 percent slopes	64	88.6	1.5%
91B	Woodburn silt loam, 3 to 8 percent slopes	64	779.4	12.9%
91C	Woodburn silt loam, 8 to 15 percent slopes	64	283.3	4.7%
92F	Xerochrepts and Haploxerolls, very steep	137	287.0	4.7%

Depth to Water Table— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
93E	Xerochrepts-Rock outcrop complex, moderately steep	>200	115.8	1.9%
W	Water	>200	477.5	7.9%
Totals for Area of Interest			**6,050.5**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

August 22, 2018

Mr. Steve Drahota
HDR, Inc.
1001 SW 5th Avenue, Suite 1800
Portland, Oregon 97204

RE: DRAFT PRELIMINARY INFILTRATION TESTING RESULTS MEMORANDUM CLACKAMAS COUNTY, OREGON

Dear Mr. Drahota:

This letter report summarizes results of infiltration testing performed by Shannon & Wilson, Inc. (Shannon & Wilson), to support design of stormwater management facilities for the I-205: Stafford Road to OR99E Corridor Widening Project. The project area is shown on the Vicinity Map, Figure 1. We understand the Oregon Department of Transportation (ODOT) is planning to widen the Interstate-205 (I-205) corridor from Stafford Road to OR99E. This project will widen I-205 to three lanes northbound and three lanes southbound from Stafford Road to OR213. We also understand the project will include proposed facilities such as detention ponds and swales which will be deeper than 3 feet.

To assist HDR, Inc. (HDR), for the design of the proposed stormwater management facilities, Shannon & Wilson is providing geotechnical field explorations and infiltration testing services. Our services were performed in accordance with the scope of services defined in the HDR Subconsultant Task Order No.10063137-001, dated June 14, 2018.

INFILTRATION TESTING

Shannon & Wilson is currently performing a subsurface investigation for Amendment 3 at the project site. As part of the ongoing subsurface investigation, we completed 15 infiltration tests. Approximate locations of the infiltration test sites are shown on the Site and Exploration Plan, Figure 2. A Shannon & Wilson representative was on site to perform each infiltration test.

Infiltration Testing

Infiltration tests were conducted in accordance with the procedures described in the Infiltration Testing Guide, of the *Stormwater Standards, Clackamas County Stormwater Service District No.*

1(E.2.2). Infiltration tests must be performed at the base of the proposed facilities, which is anticipated to be approximately six feet. As shown in Table 1 below, nine of the holes were excavated to less than 3.5 feet. At these locations, we encountered refusal conditions after several attempts due to gravels, cobbles, and boulders, at or near the surface.

The test hole was advanced using a gasoline-powered auger and hand tools. A 6-inch-diameter PVC casing was embedded into the underlying soil to perform the Encased Falling Head Test method. This method is not appropriate in gravelly soils or conditions in which a good seal with the casing cannot be established. In these cases, the Open Pit Falling Head Test method was followed.

The excavated hole was then filled with clean water a minimum of 12 inches deep, and this depth was maintained for at least 4 hours to presoak the native material. After the presaturation period, the holes were refilled with water to 6 inches (12 inches for Open Pit Falling Head Test Method) and the drawdown time was measured. Measurements were made every 10 minutes for one hour in faster draining soils, or 20 minutes for two hours in slower draining soils.

The process of refilling the hole and taking measurements (a trial) is repeated until the change in measured infiltration rate between two successive trials is no more than five percent. At least three trials were conducted for each test.

The infiltration test results of all infiltration tests are presented on Figures 3 through 17.

RESULTS

According to the *Stormwater Standards, Clackamas County Stormwater Service District No. 1(E.2.2),* the final infiltration rates were calculated using the following standard calculation. The calculation is performed for each water level drop and is outlined below:

= (Drop in water level/Time interval) x conversion

= 0.055ft/20min x (12in/ft) x (60min/hr)

= 1.98 inches per hour

Field-measured infiltration rates in the final test of each trial for each test location are provided in Table 1 below.

SHANNON & WILSON, INC.

TABLE 1
INFILTRATION TESTING SUMMARY

Designation	Approximate Depth (feet)	Infiltration Testing Method	Final Infiltration Rate (inches/hour) for each Trial		
			1	2	3
INF19786-01	5.0	Encased Falling Head Test	0.06	0.00	0.00
INF19786-02	5.5	Encased Falling Head Test	0.72	0.36	0.72
INF19786-03	5.5	Encased Falling Head Test	0.09	0.18	0.0
INF19786-04	6	Encased Falling Head Test	1.44	1.44	0.72
INF19786-05	5.25	Encased Falling Head Test	0.00	0.00	0.00
INF19786-06	2.5	Open Pit Falling Head Test	0.36	0.17	0.36
INF19786-07	5.5	Encased Falling Head Test	0.72	0.72	0.72
INF19786-08	2.0	Open Pit Falling Head Test	1.44	1.44	1.44
INF19786-09	2.0	Open Pit Falling Head Test	3.60	3.60	2.88
INF19786-10	2.0	Open Pit Falling Head Test	2.88	2.88	2.88
INF19786-11	2.0	Open Pit Falling Head Test	0.72	0.36	0.36
INF19786-12	2.0	Open Pit Falling Head Test	1.44	0.72	1.44
INF19786-13	3.0	Open Pit Falling Head Test	1.44	1.44	1.44
INF19786-14	3.5	Open Pit Falling Head Test	1.44	0.72	1.44
INF19786-15	2.0	Open Pit Falling Head Test	0.36	0.00	0.36

LIMITATIONS

Shannon & Wilson has prepared this report in a professional manner, using a level of skill and care normally exercised for similar projects under similar conditions by reputable and competent geotechnical consultants currently practicing in the area, and in accordance with the terms and conditions set forth in our proposal. The facts and conditions referenced in this report may change over time, and the conclusions set forth herein are applicable to the facts and conditions as described only at the time of this report. Conclusions were made within the operative constraints of the scope, budget, and schedule for this project. We believe that the conditions stated here are factual, but no guarantee is made or implied. This report is for the exclusive use of HDR, Inc. We have prepared an enclosure, "Important Information About Your Geotechnical/Environmental Report," to help you and others understand the use and limitations of our reports.

Sincerely,

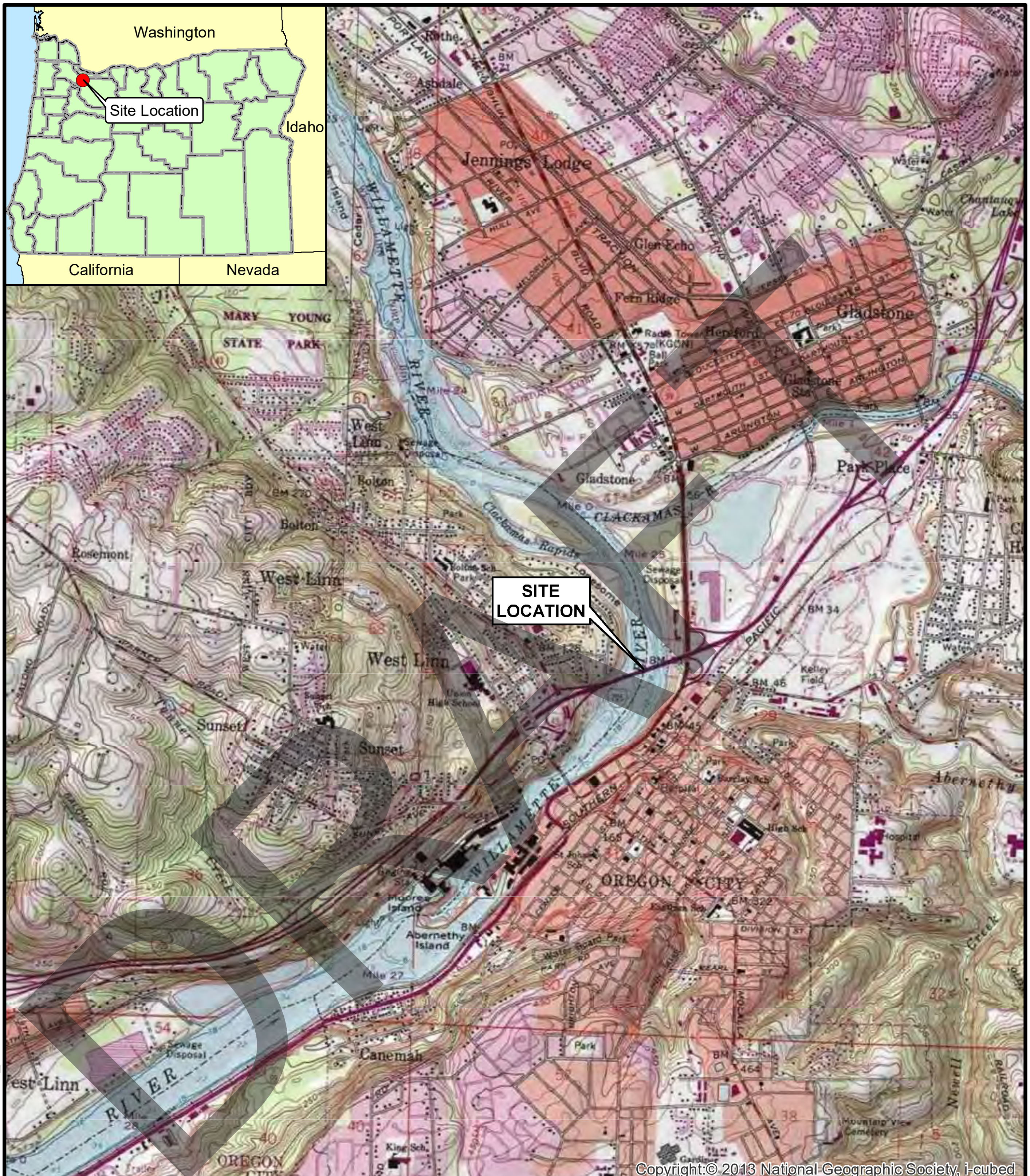
SHANNON & WILSON, INC.

Cody Sorensen, CEG
Senior Engineering Geologist

Christina Villeneuve, GIT
Staff Geologist

CLV:NMV/mmm

Enc: Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Figures 3 through 17: Infiltration Test Results
Important Information About Your Geotechnical/Environmental Report



0 0.25 0.5 1

Scale in Miles

N

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

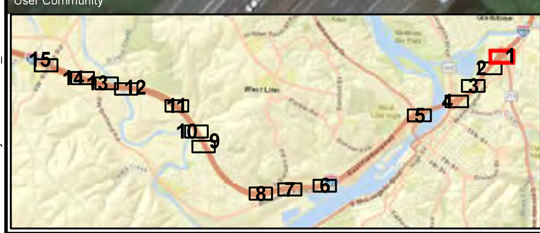
VICINITY MAP

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\VicinityMap.mxd Date: 11/15/2017 Login: ath



LEGEND

INF19786-15A (Final Depth) — Approximate Infiltration Location

0 50 100 200

Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

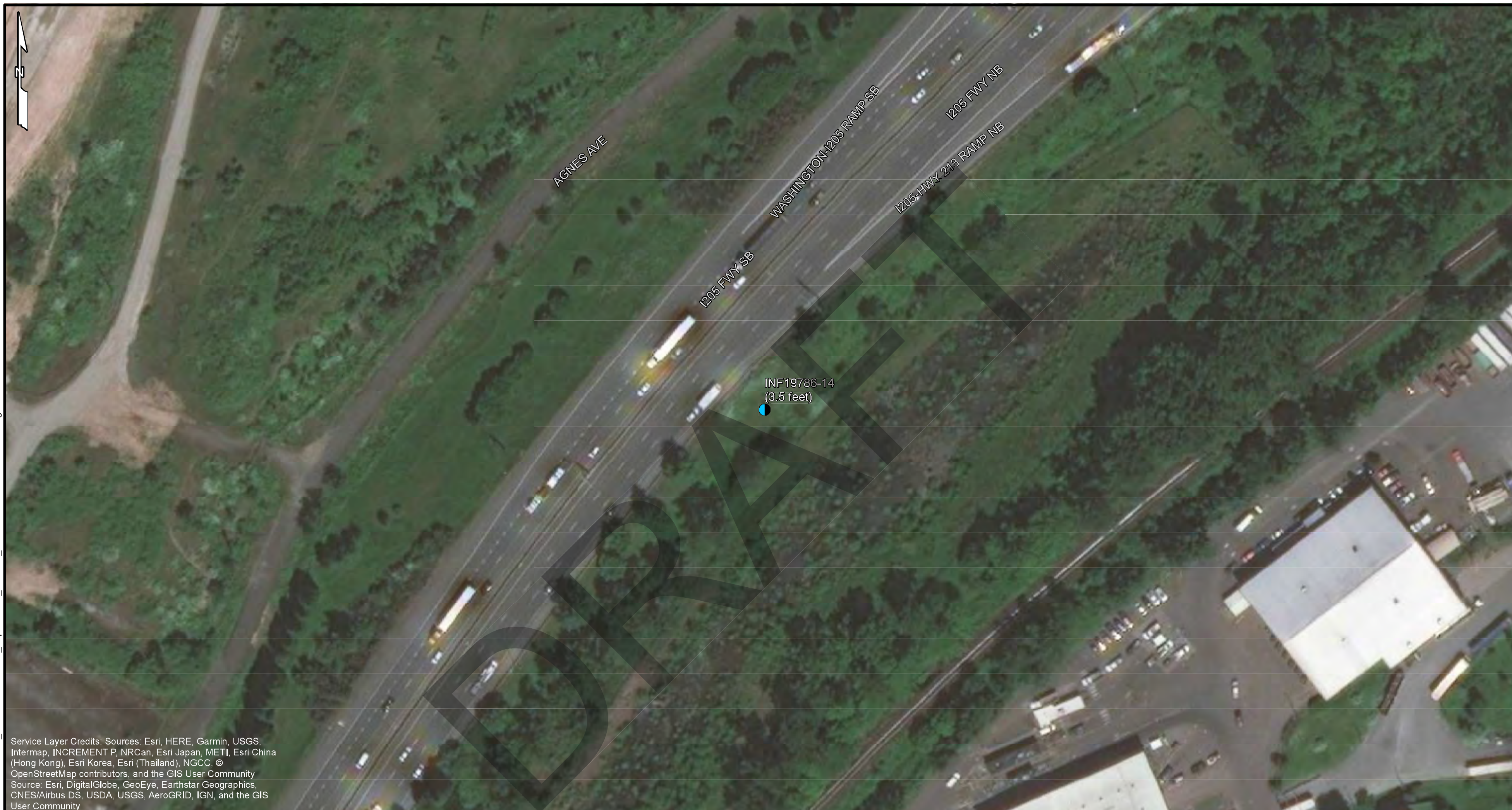
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 1 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

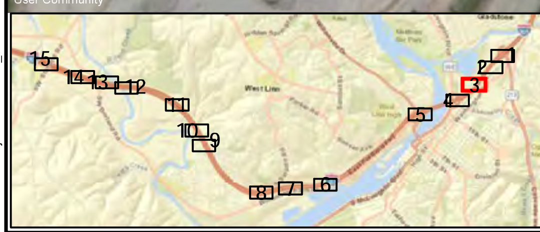
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 2 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A (Final Depth) — Approximate Infiltration Location

0 50 100 200

Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 3 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 4 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

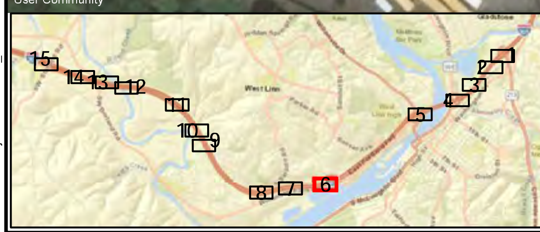
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 5 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A (Final Depth) — Approximate Infiltration Location

0 50 100 200
Scale in Feet

N

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 6 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

LEGEND

INF19786-15A (Final Depth) — Approximate Infiltration Location

0 50 100 200

Scale in Feet

N

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 7 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

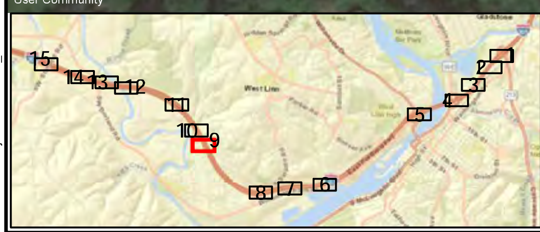
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 8 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A (Final Depth)

Approximate Infiltration Location

0 50 100 200

Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

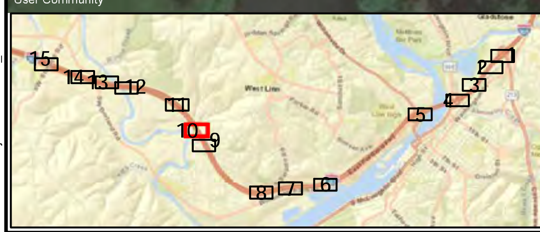
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 9 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200

Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 10 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

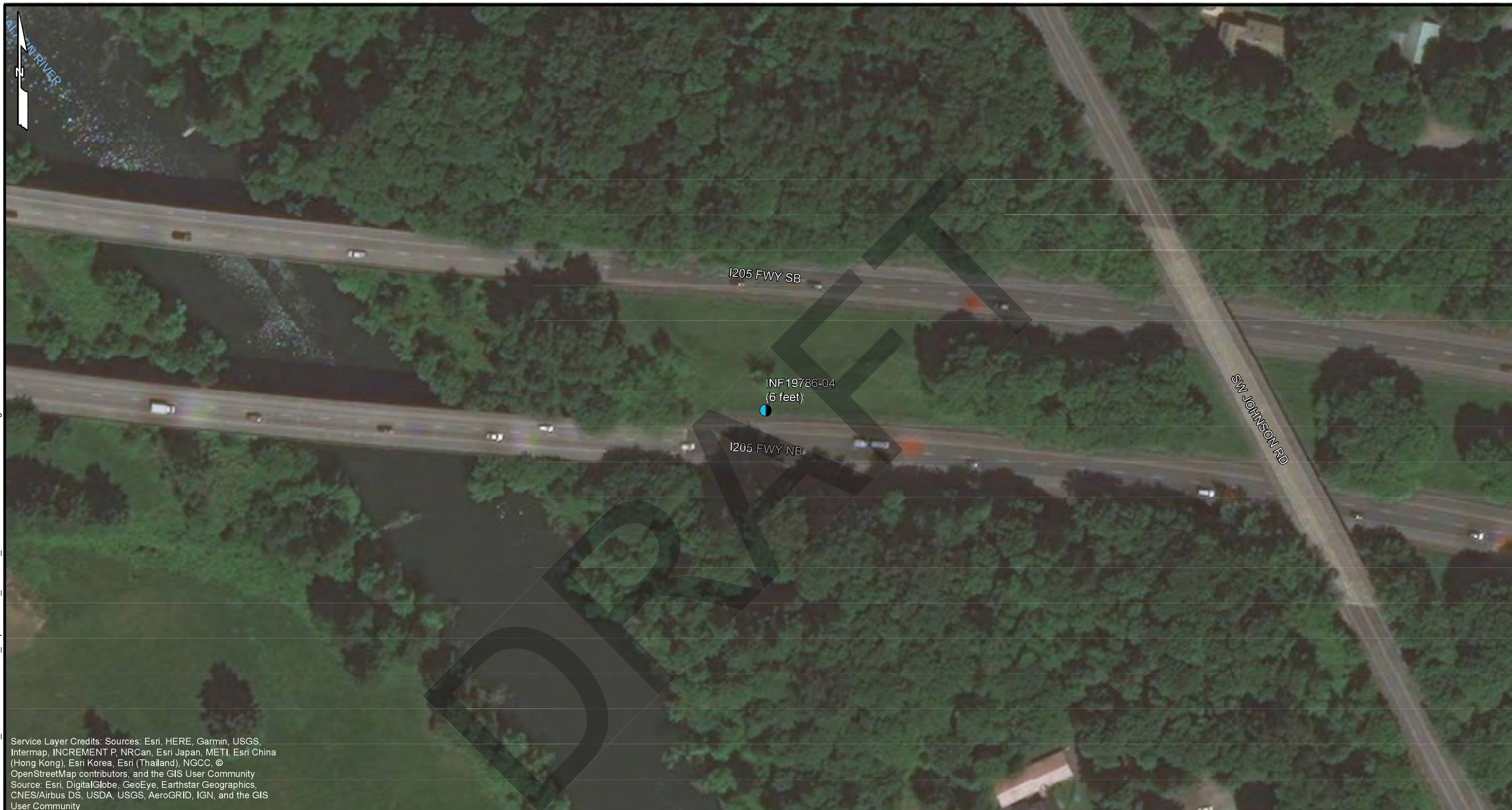
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 11 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

N

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 12 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

LEGEND

INF19786-15A
(Final Depth)

Approximate Infiltration Location

0 50 100 200
Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 13 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

LEGEND

INF19786-15A (Final Depth)

Approximate Infiltration Location

0 50 100 200

Scale in Feet

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

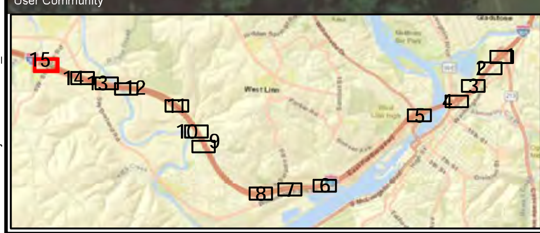
EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 14 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath



LEGEND

INF19786-15A (Final Depth) — Approximate Infiltration Location

0 50 100 200
Scale in Feet

N

I-205: Stafford Road to OR99E
Corridor Widening
Clackamas County, Oregon

EXPLORATION PLAN
INFILTRATION TESTING

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 15 of 15

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\2018_Amendment 3\2018_Explorations_Amend3_inf.mxd Date: 8/10/2018 Login: ath

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/6/2018

Location: I-205 northbound median mile marker 3.0

Test Hole Number: INF19786-01

Depth to bottom of hole: 5.0 feet

Diameter of hole: 6 inches

Test method: Encased Falling Head Test

Depth (feet):	Soil Texture:
0 - 2.0	Sandy SILT; ML; Light brown; Moist
2.0 - 5.0	Silty SAND; SM; Brown; Nonplastic fines; Moist; Fine to medium sand

Presaturation Start Time: 8:00 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
12:00	0	5.40	-	-	-	Trial #1
12:20	20	5.40	0.00	0.01	0.06	
12:40	20	5.40	0.00			
13:00	20	5.40	0.00			
13:20	20	5.40	0.00			
13:40	20	5.40	0.00			
14:00	20	5.41	0.01			
14:00	0	5.40		-	-	Trial #2
14:20	20	5.40	0.00	0.00	0.00	
14:40	20	5.40	0.00			
15:00	20	5.40	0.00			
15:20	20	5.40	0.00			
15:40	20	5.40	0.00			
16:00	20	5.40	0.00			
16:00	0	5.40		-	-	Trial #3
16:20	20	5.40	0.00	0.00	0.00	
16:40	20	5.40	0.00			
17:00	20	5.40	0.00			
17:20	20	5.40	0.00			
17:40	20	5.40	0.00			
18:00	20	5.40	0.00			

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-01

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/9/2018

Location: I-205 southbound median mile marker 3.5		**Test Hole Number:** INF19786-02
Depth to bottom of hole: 5.5 feet	**Diameter of hole:** 6 inches	**Test method:** Encased Falling Head Test
Depth (feet):	**Soil Texture:**	
0 -5.5	SILT with trace sand; ML; Brown; Nonplastic fines; Moist	
Presaturation Start Time:	8:15 AM	

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
12:02	0	5.45	-	-	-	Trial #1
12:12	10	5.46	0.01	0.01	0.72	
12:22	10	5.47	0.01	0.01	0.72	
12:32	10	5.48	0.01	0.01	0.72	
12:42	10	5.48	0.00	0.01	0.36	
12:52	10	5.49	0.01			
13:02	10	5.50	0.01	0.01	0.72	
13:06	0	5.45	-	-	-	Trial #2
13:26	20	5.47	0.02		0.72	
13:46	20	5.48	0.01		0.36	
14:06	20	5.50	0.02		0.72	
14:26	20	5.52	0.02		0.72	
14:46	20	5.54	0.02		0.72	
15:06	20	5.55	0.01		0.36	
15:10	0	5.45	-	-	-	Trial #3
15:30	20	5.47	0.02		0.72	
15:50	20	5.49	0.02		0.72	
16:10	20	5.50	0.01		0.36	
16:30	20	5.52	0.02		0.72	
16:50	20	5.54	0.02		0.72	
17:10	20	5.56	0.02		0.72	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-02

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/10/2018

Location: I-205 southbound shoulder mile marker 4.0

Test Hole Number: INF19786-03

Depth to bottom of hole: 5.5 feet

Diameter of hole: 6 inches

Test method: Encased Falling Head Test

Depth (feet):	Soil Texture:
0 - 2.0	SILT; ML; Light brown; Moist
2.0 - 5.5	Sandy SILT; ML; Brown; Nonplastic fines; Moist; Fine to medium sand

Presaturation Start Time: 8:09 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
12:00	0	5.97	-	-	-	Trial #1
12:20	20	5.97	0.00	0.01	0.36	
12:40	20	5.98	0.01	0.01	0.36	
13:00	20	5.99	0.01	0.01	0.36	
13:20	20	5.99	0.00			
13:40	20	5.99	0.00	0.01	0.09	
14:00	20	6.00	0.01			
14:00	0	5.97	-	-	-	Trial #2
14:20	20	5.97	0.00			
14:40	20	5.97	0.00	0.01	0.09	
15:00	20	5.98	0.01			
15:40	20	5.99	0.00	0.01	0.18	
16:00	20	6.00	0.01			
16:00	0	5.97	-	-	-	Trial #3
16:20	20	5.97	0.00			
16:40	20	5.97	0.00	0.01	0.09	
17:00	20	5.98	0.01			
17:40	20	5.99	0.01	0.01	0.18	
18:00	20	5.99	0.00	0.00	0.00	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-03

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 5

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/11/2018

Location: I-205 northbound median mile marker 4.1		**Test Hole Number:** INF19786-04
Depth to bottom of hole: 6.0 feet	**Diameter of hole:** 6 inches	**Test method:** Encased Falling Head Test

Depth (feet):	**Soil Texture:**
0 - 1.5	Sandy SILT; ML; Light brown; Moist
1.5 - 6.0	Silty SAND; ML; Light brown; Moist; Fine to medium sand

Presaturation Start Time: 8:07 AM

Time:	**Time Interval (minutes):**	**Measurement (feet):**	**Drop in water level (feet):**	**Infiltration rate (inches per hour):**	**Remarks:**
12:02	0	6.14	-	-	Trial #1
12:12	10	6.15	0.01	0.72	
12:22	10	6.17	0.02	1.44	
12:32	10	6.19	0.02	1.44	
12:42	10	6.20	0.01	0.72	
12:52	10	6.22	0.02	1.44	
13:02	10	6.24	0.02	1.44	
13:03	0	6.14	-	-	Trial #2
13:13	10	6.15	0.01	0.72	
13:23	10	6.16	0.01	0.72	
13:33	10	6.18	0.02	1.44	
13:43	10	6.19	0.01	0.72	
13:53	10	6.21	0.02	1.44	
14:03	10	6.23	0.02	1.44	
14:05	0	6.14	-	-	Trial #3
14:15	10	6.16	0.02	1.44	
14:25	10	6.17	0.01	0.72	
14:35	10	6.19	0.02	1.44	
14:45	10	6.20	0.01	0.72	
14:55	10	6.22	0.02	1.44	
15:05	10	6.23	0.01	0.72	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-04

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 6

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/12/2018

Location: I-205 southbound median mile marker 4.7

Test Hole Number: INF19786-05

Depth to bottom of hole: 5.25 feet

Diameter of hole: 6 inches

Test method: Encased Falling Head Test

Depth (feet):	**Soil Texture:**
0 - 0.5	SILT; ML; Light brown; Moist
0.5 - 5.25	SILT with some sand; ML; Light brown; Moist

Presaturation Start Time: 8:17 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
12:00	0	6.04	-	-	-	Trial #1
12:20	20	6.04	0.00	0.00	0.00	
12:40	20	6.04	0.00			
13:00	20	6.04	0.00			
13:20	20	6.04	0.00			
13:40	20	6.04	0.00			
14:00	20	6.04	0.00			
14:00	0	6.04	-	-	-	Trial #2
14:20	20	6.04	0.00	0.01	0.09	
14:40	20	6.04	0.00			
15:00	20	6.04	0.00			
15:20	20	6.05	0.01			
15:40	20	6.05	0.00	0.00	0.00	
16:00	20	6.05	0.00			
16:00	0	6.04	-	-	-	Trial #3
16:20	20	6.04	0.00	0.00	0.00	
16:40	20	6.04	0.00			
17:00	20	6.04	0.00			
17:20	20	6.04	0.00			
17:40	20	6.04	0.00			
18:00	20	6.04	0.00			

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-05

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 7

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/16/2018

Location: I-205 northbound median mile marker 5.4

Test Hole Number: INF19786-06

Depth to bottom of hole: 2.5 feet

Diameter of hole: 8 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0 - 1.0	SILT; ML; Light brown; Moist
0.5 - 2.5	SILT with trace sand and gravel, with cobbles; ML; Light brown; Moist
2.5	Silty GRAVEL with Cobbles; GM; Refusal

Presaturation Start Time: 8:20 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
11:24	0	4.01	-	-	-	Trial #1
11:44	20	4.01	0.00	0.02	0.24	
12:04	20	4.01	0.00			
12:24	20	4.03	0.02			
12:44	20	4.03	0.00	0.02	0.36	
13:04	20	4.05	0.02			
13:24	20	4.06	0.01	0.01	0.36	
13:25	0	4.01	-	-	-	Trial #2
13:45	20	4.01	0.00	0.01	0.17	
14:05	20	4.02	0.01			
14:25	20	4.03	0.01	0.01	0.36	
14:45	20	4.04	0.01	0.01	0.36	
15:05	20	4.04	0.00	0.01	0.17	
15:25	20	4.05	0.01			
15:26	0	4.01	-	-	-	Trial #3
15:46	20	4.02	0.01	0.01	0.36	
16:06	20	4.02	0.00	0.01	0.17	
16:26	20	4.03	0.01			
16:46	20	4.03	0.00	0.01	0.17	
17:06	20	4.04	0.01			
17:26	20	4.05	0.01	0.01	0.36	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-06

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 8

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/13/2018

Location: I-205 northbound shoulder mile marker 5.5

Test Hole Number: INF19786-07

Depth to bottom of hole: 5.5 feet

Diameter of hole: 6 inches

Test method: Encased Falling Head Test

Depth (feet):	Soil Texture:
0 - 5.5	Sandy SILT; ML; Light brown; Moist

Presaturation Start Time: 8:40 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
12:00	0	5.91	-	-	-	Trial #1
12:10	10	5.93	0.02	0.02	1.44	
12:20	10	5.93	0.00	0.01	0.36	
12:30	10	5.94	0.01			
12:40	10	5.96	0.02	0.02	1.44	
12:50	10	5.97	0.01	0.01	0.72	
13:00	10	5.98	0.01	0.01	0.72	
13:01	0	5.91	-	-	-	Trial #2
13:11	10	5.92	0.01	0.01	0.72	
13:21	10	5.93	0.01	0.01	0.72	
13:31	10	5.94	0.01	0.01	0.72	
13:41	10	5.95	0.01	0.03	2.15	
13:51	10	5.97	0.02	0.02	0.72	
14:01	10	5.97	0.00			
14:02	0	5.91	-	-	-	Trial #3
14:12	10	5.92	0.01	0.01	0.72	
14:22	10	5.93	0.01	0.01	0.72	
14:32	10	5.94	0.01	0.01	0.72	
14:42	10	5.96	0.02	0.02	1.44	
14:52	10	5.97	0.01	0.01	0.72	
15:02	10	5.98	0.01	0.01	0.72	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-07

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 9

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/19/2018

Location: I-205 southbound median mile marker 6.5

Test Hole Number: INF19786-08

Depth to bottom of hole: 2.0 feet

Diameter of hole: 10 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0.0 - 0.5	SILT; ML; Light brown; Moist
0.5-2.0	SILT with trace sand and gravel, with cobbles; ML; Light brown; Moist
2.0	Silty GRAVEL with Cobbles; ML; Refusal

Presaturation Start Time: 8:25 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
12:01	0	3.81	-	-	Trial #1
12:11	10	3.83	0.02	1.44	
12:21	10	3.87	0.04	2.88	
12:31	10	3.90	0.03	2.16	
12:41	10	3.92	0.02	1.44	
12:51	10	3.94	0.02	1.44	
13:01	10	3.96	0.02	1.44	
13:02	0	3.83	-	-	Trial #2
13:12	10	3.86	0.03	2.16	
13:22	10	3.89	0.03	2.16	
13:32	10	3.91	0.02	1.44	
13:42	10	3.93	0.02	1.44	
13:52	10	3.95	0.02	1.44	
14:02	10	3.97	0.02	1.44	
14:04	0	3.83	-	-	Trial #3
14:14	10	3.85	0.02	1.44	
14:24	10	3.87	0.02	1.44	
14:34	10	3.89	0.02	1.44	
14:44	10	3.92	0.03	2.16	
14:54	10	3.93	0.01	0.72	
15:04	10	3.95	0.02	1.44	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-08

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 10

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS	Job #:	24-1-04165-006
	Field Rep.:	PJS
	Date	7/17/2018

Location: I-205 northbound median mile marker 7.0

Test Hole Number: INF19786-09

Depth to bottom of hole: 2.0 feet

Diameter of hole: 12 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0.0 - 0.5	SILT; ML; Light brown; Moist
0.5-2.0	Gravelly SILT with some sand, with cobbles; ML; Light brown; Moist
2.0	Silty GRAVEL with Cobbles; GM; Refusal

Presaturation Start Time: 9:00 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
13:00	0	3.43	-	-	Trial #1
13:10	10	3.64	0.21	15.12	
13:20	10	3.75	0.11	7.92	
13:30	10	3.83	0.08	5.76	
13:40	10	3.91	0.08	5.76	
13:50	10	3.97	0.06	4.32	
14:00	10	4.02	0.05	3.60	
14:34	0	3.44	-	-	Trial #2
14:44	10	3.59	0.15	10.80	
14:54	10	3.69	0.10	7.20	
15:04	10	3.77	0.08	5.76	
15:14	10	3.84	0.07	5.04	
15:24	10	3.90	0.06	4.32	
15:34	10	3.95	0.05	3.60	
15:37	0	3.42	-	-	Trial #3
15:47	10	3.57	0.15	10.80	
15:57	10	3.67	0.10	7.20	
16:07	10	3.74	0.07	5.04	
16:17	10	3.81	0.07	5.04	
16:27	10	3.87	0.06	4.32	
16:37	10	3.91	0.04	2.88	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-09

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 11

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/20/2018

Location: I-205 southbound shoulder mile marker 7.2

Test Hole Number: INF19786-10

Depth to bottom of hole: 2.0 feet

Diameter of hole: 14 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0.0 - 2.0	GRAVEL with some silt and sand, with Cobbles; GP-GM; Light brown, Moist
2.0	GRAVEL with Cobbles; Refusal

Presaturation Start Time: 9:20 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
13:01	0	3.88	-	-	Trial #1
13:11	10	3.99	0.11	7.92	
13:21	10	4.06	0.07	5.04	
13:31	10	4.12	0.06	4.32	
13:41	10	4.18	0.06	4.32	
13:51	10	4.22	0.04	2.88	
14:01	10	4.26	0.04	2.88	
14:03	0	3.88	-	-	Trial #2
14:13	10	3.98	0.10	7.20	
14:23	10	4.04	0.06	4.32	
14:33	10	4.10	0.06	4.32	
14:43	10	4.14	0.04	2.88	
14:53	10	4.19	0.05	3.60	
15:03	10	4.23	0.04	2.88	
15:05	0	3.82	-	-	Trial #3
15:15	10	3.93	0.11	7.92	
15:25	10	4.01	0.08	5.76	
15:35	10	4.07	0.06	4.32	
15:45	10	4.11	0.04	2.88	
15:55	10	4.16	0.05	3.60	
16:05	10	4.20	0.04	2.88	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-10

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 12

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/23/2018

Location: I-205 northbound beneath east Abernethy Bridge abutment mile marker 8.9		**Test Hole Number:** INF19786-11
Depth to bottom of hole: 2.0 feet	**Diameter of hole:** 14 inches	**Test method:** Open Pit Falling Head Test

Depth (feet):	**Soil Texture:**
0.0 - 1.5	GRAVEL with some silt and sand, with Cobbles; GP-GM; Light brown, Moist
1.5-3.0	SILT with some sand and gravel, with Cobbles; ML, Light brown, Moist
3.0	GRAVEL and Cobbles; Refusal

Presaturation Start Time: 9:05 AM

Time:	**Time Interval (minutes):**	**Measurement (feet):**	**Drop in water level (feet):**	**Drop in water level - Corrected (feet):**	**Infiltration rate (inches per hour):**	**Remarks:**
13:00	0	4.44	-	-	-	Trial #1
13:10	10	4.45	0.01	0.01	0.72	
13:20	10	4.45	0.00	0.01	0.36	
13:30	10	4.46	0.01			
13:40	10	4.46	0.00	0.02	0.72	
13:50	10	4.48	0.02			
14:00	10	4.49	0.01	0.01	0.72	
14:02	0	4.43	-		-	Trial #2
14:22	20	4.45	0.02		0.72	
14:42	20	4.47	0.02		0.72	
15:02	20	4.48	0.01		0.36	
15:22	20	4.49	0.01		0.36	
15:42	20	4.51	0.02		0.72	
16:02	20	4.52	0.01		0.36	
16:04	0	4.44	-		-	Trial #3
16:24	20	4.46	0.02		0.72	
16:44	20	4.47	0.01		0.36	
17:04	20	4.49	0.02		0.72	
17:24	20	4.50	0.01		0.36	
17:44	20	4.51	0.01		0.36	
18:04	20	4.52	0.01		0.36	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-11

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 13

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/24/2018

Location: I-205 northbound shoulder mile marker 9.4

Test Hole Number: INF19786-12

Depth to bottom of hole: 2.0 feet

Diameter of hole: 10 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0.0 - 2.0	SILT; ML; Light brown, Moist
2.0	BASALT fragments and GRAVEL; GP; Refusal

Presaturation Start Time: 8:05 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
11:31	0	4.01	-	-	Trial #1
11:41	10	4.03	0.02	1.44	
11:51	10	4.06	0.03	2.16	
12:01	10	4.08	0.02	1.44	
12:11	10	4.11	0.03	2.16	
12:21	10	4.14	0.03	2.16	
12:31	10	4.16	0.02	1.44	
12:32	0	4.01	-	-	Trial #2
12:42	10	4.03	0.02	1.44	
12:52	10	4.05	0.02	1.44	
13:02	10	4.08	0.03	2.16	
13:12	10	4.10	0.02	1.44	
13:22	10	4.13	0.03	2.16	
13:32	10	4.14	0.01	0.72	
13:33	0	4.01	-	-	Trial #3
13:33	10	4.03	0.02	1.44	
13:33	10	4.06	0.03	2.16	
14:03	10	4.08	0.02	1.44	
14:13	10	4.10	0.02	1.44	
14:23	10	4.12	0.02	1.44	
14:33	10	4.15	0.02	1.44	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-12

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 14

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/25/2018

Location: I-205 southbound south of Agnes Avenue mile marker 9.7		**Test Hole Number:** INF19786-13
Depth to bottom of hole: 3.0 feet	**Diameter of hole:** 10 inches	**Test method:** Open Pit Falling Head Test

Depth (feet):	**Soil Texture:**
0.0 - 3.0	SILT with some sand and gravel; ML; Light brown, Moist
3.0	GRAVEL and Cobbles; Refusal

Presaturation Start Time: 7:55 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
11:30	0	3.86	-	-	Trial #1
11:40	10	3.89	0.03	2.16	
11:50	10	3.92	0.03	2.16	
12:00	10	3.95	0.03	2.16	
12:10	10	3.97	0.02	1.44	
12:20	10	3.99	0.02	1.44	
12:30	10	4.01	0.02	1.44	
12:31	0	3.85	-	-	Trial #2
12:41	10	3.88	0.03	2.16	
12:51	10	3.91	0.03	2.16	
13:01	10	3.94	0.03	2.16	
13:11	10	3.96	0.02	1.44	
13:21	10	3.98	0.02	1.44	
13:31	10	4.00	0.02	1.44	
13:32	0	3.86	-	-	Trial #3
13:32	10	3.89	0.03	2.16	
13:32	10	3.92	0.03	2.16	
14:02	10	3.94	0.02	1.44	
14:12	10	3.97	0.03	2.16	
14:22	10	3.99	0.02	1.44	
14:32	10	4.01	0.02	1.44	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-13

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 15

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/26/2018

Location: I-205 northbound shoulder mile marker 10.0		**Test Hole Number:** INF19786-14
Depth to bottom of hole: 3.5 feet	**Diameter of hole:** 8 inches	**Test method:** Open Pit Falling Head Test

Depth (feet):	**Soil Texture:**
0.0 - 2.0	SILT with some gravel, ML, Brown, Moist
2.0-3.5	SILT with some gravel, with Cobbles; trace organics, ML, **Dark brown,** Moist
3.5	GRAVEL with Cobbles; Refusal

Presaturation Start Time: 9:12 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Infiltration rate (inches per hour):	Remarks:
13:00	0	3.78	-	-	Trial #1
13:10	10	3.82	0.04	2.88	
13:20	10	3.86	0.04	2.88	
13:30	10	3.89	0.03	2.16	
13:40	10	3.91	0.02	1.44	
13:50	10	3.93	0.02	1.44	
14:00	10	3.95	0.02	1.44	
14:01	0	3.82	-	-	Trial #2
14:11	10	3.84	0.02	1.44	
14:21	10	3.87	0.03	2.16	
14:31	10	3.88	0.01	0.72	
14:41	10	3.90	0.02	1.44	
14:51	10	3.92	0.02	1.44	
15:01	10	3.93	0.01	0.72	
15:02	0	3.81	-	-	Trial #3
15:12	10	3.82	0.01	0.72	
15:22	10	3.84	0.02	1.44	
15:32	10	3.87	0.03	2.16	
15:42	10	3.89	0.02	1.44	
15:52	10	3.90	0.01	0.72	
16:02	10	3.92	0.02	1.44	

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-14

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 16

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Job #:	24-1-04165-006
Field Rep.:	PJS
Date	7/16/2018

Location: I-205 southbound shoulder mile marker 10.1

Test Hole Number: INF19786-15A

Depth to bottom of hole: 2.0 feet

Diameter of hole: 10 inches

Test method: Open Pit Falling Head Test

Depth (feet):	Soil Texture:
0 - 2.0	SILT with some sand and gravel, with Cobbles; ML; Light brown; Moist
2.0	GRAVEL with Cobbles; Refusal

Presaturation Start Time: 8:30 AM

Time:	Time Interval (minutes):	Measurement (feet):	Drop in water level (feet):	Drop in water level - Corrected (feet):	Infiltration rate (inches per hour):	Remarks:
11:30	0	3.98	-		-	Trial #1
11:50	20	3.99	0.01		0.36	
12:10	20	4.00	0.01		0.36	
12:30	20	4.01	0.01		0.36	
12:50	20	4.03	0.02		0.72	
13:10	20	4.04	0.01		0.36	
13:30	20	4.05	0.01		0.36	
13:31	0	3.98	-	-	-	Trial #2
13:51	20	3.99	0.01	0.01	0.36	
14:11	20	4.01	0.02	0.02	0.72	
14:31	20	4.02	0.01	0.01	0.36	
14:51	20	4.03	0.01	0.02	0.36	
15:11	20	4.04	0.01			
15:31	20	4.04	0.00	0.00	0.00	
15:32	0	3.98	-		-	Trial #3
15:52	20	3.99	0.01		0.36	
16:12	20	4.00	0.01		0.36	
16:32	20	4.01	0.01		0.36	
16:52	20	4.02	0.01		0.36	
17:12	20	4.03	0.01		0.36	
17:32	20	4.04	0.01		0.36	

DRAFT

I-205: Stafford Road to OR99E Corridor Widening
Clackamas County, Oregon

INFILTRATION TEST RESULTS
INF19786-15

August 2018 24-1-04165-006

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 17

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

LEGEND

- Boring (Shannon & Wilson, 2017-2019)
- CPT (Shannon & Wilson, 2017)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Proposed Retaining Wall
- Proposed Sound Wall
- Proposed Traffic Sign

0 50 100 200

Scale in Feet

NOTES

1. Locations of proposed features from files downloaded from ProjectWise: TN_K19786_OBEC_snd_bas_01.dgn, TN_K21400_OBEC_snd_bas_01.dgn, TN_K21401_OBEC_snd_bas_01.dgn, R_K19786_rtw_bas_01.dgn, and R_K21401_rtw_bas_01.dgn, on December 10, 2018, file R_K19786_QEI_bas_03.dgn, on December 26, 2018, and file R_K21401_OBEC_bas_01.dgn, on December 31, 2018.

I-205: Stafford Road to OR99E Widening
Clackamas County, Oregon

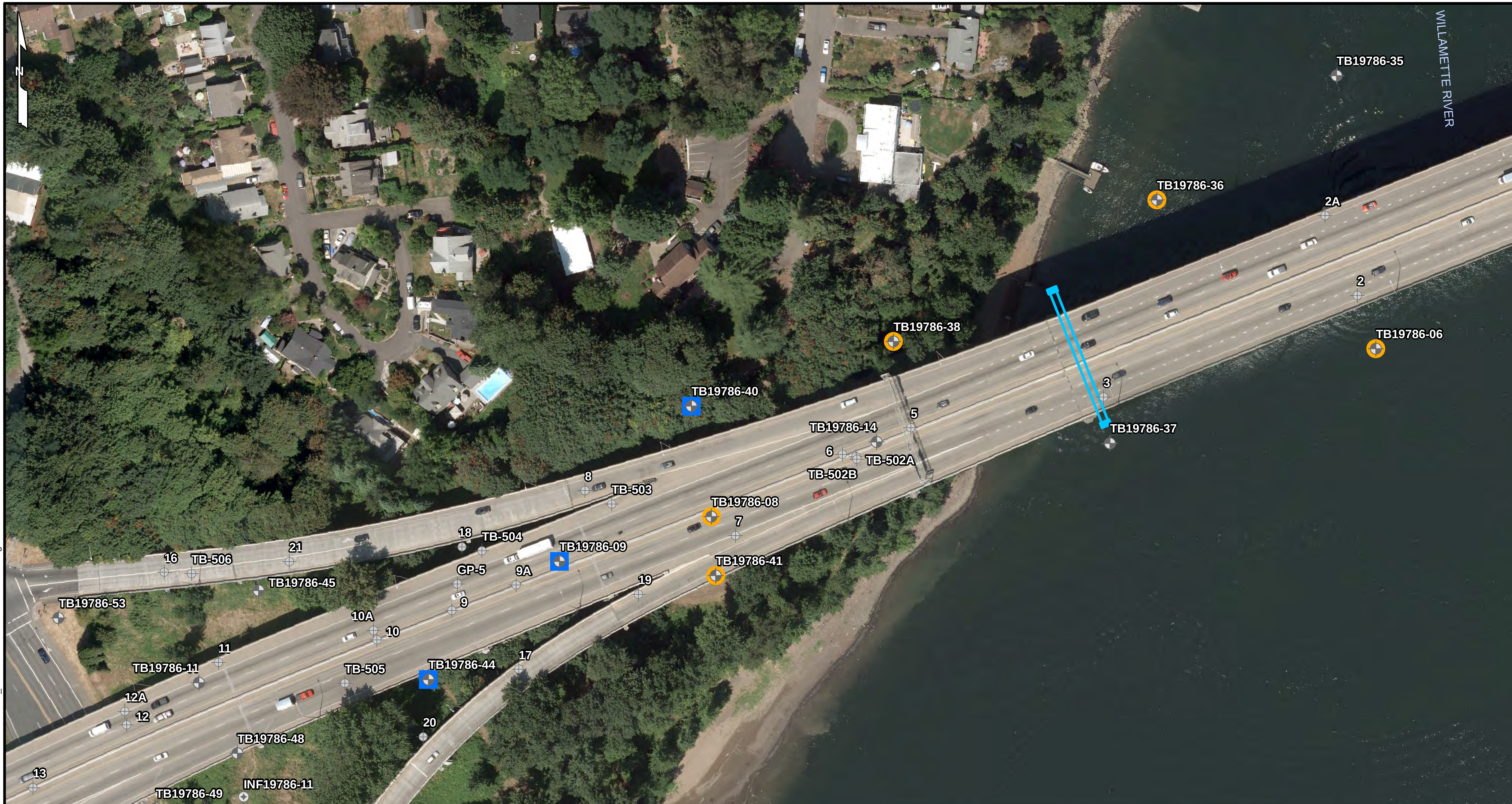
SITE AND EXPLORATION PLAN

March 2019 | 24-1-04165

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1
Sheet 1 of 4

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\SitePlan-VWPs_10.3.mxd Date: 3/4/2019 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2019)
- CPT (Shannon & Wilson, 2017)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Proposed Retaining Wall
- Proposed Sound Wall
- Proposed Traffic Sign

0 50 100 200

Scale in Feet

NOTES

1. Locations of proposed features from files downloaded from ProjectWise: TN_K19786_OBEC_snd_bas_01.dgn, TN_K21400_OBEC_snd_bas_01.dgn, TN_K21401_OBEC_snd_bas_01.dgn, R_K19786_rtw_bas_01.dgn, and R_K21401_rtw_bas_01.dgn, on December 10, 2018, file R_K19786_QEI_bas_03.dgn, on December 26, 2018, and file R_K21401_OBEC_bas_01.dgn, on December 31, 2018.

I-205: Stafford Road to OR99E Widening
Clackamas County, Oregon

SITE AND EXPLORATION PLAN

March 2019 | 24-1-04165

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1
Sheet 2 of 4

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\SitePlan-VWPs_10.3.mxd Date: 3/4/2019 Login: AEH

LEGEND

- Boring (Shannon & Wilson or FEI, 2017-2019)
- CPT (Shannon & Wilson, 2017)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Shear Wave Velocity Profile
- Vibrating Wire Piezometer
- Proposed Retaining Wall
- Approximate Culvert Location at Wall A1
- Approximate Limits of Proposed Embankment Fill
- A1 A1' Location and Designation of Interpretive Subsurface Profile

0 50 100 200
Scale in Feet

NOTES

1. Existing contours from file S_K19786_e_bas.dgn, downloaded from ProjectWise on November 19, 2018.
2. Culvert location based on file GT_K19786_OBEC_rtwpe_01.dgn, downloaded from ProjectWise on July 11, 2019.
3. Locations of proposed retaining walls from files GT_K19786_OBEC_rtwpe_A1.dgn and GT_K19786_OBEC_rtwpe_A3.dgn, provided by OBEC Consulting Engineers on June 18, 2019.
4. Embankment fill limits based on file R_K19786_QEI_cn_bas_03.dgn, downloaded from ProjectWise on July 1, 2019.

I-205: Stafford Road to OR99E Widening
(Key #19786 & 21401)
Clackamas County, Oregon

SITE AND EXPLORATION PLAN

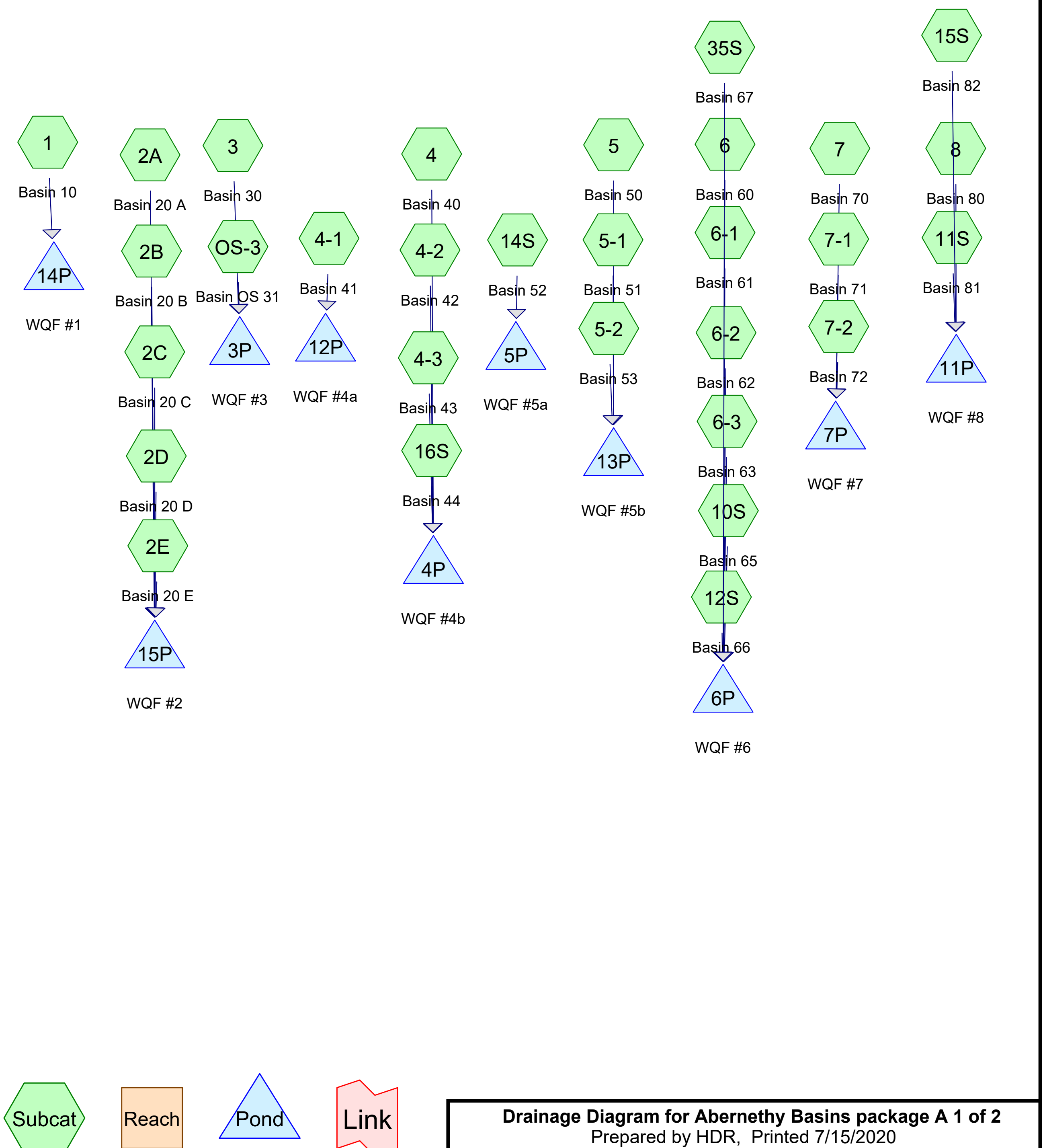
July 2019 24-1-04165-007

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

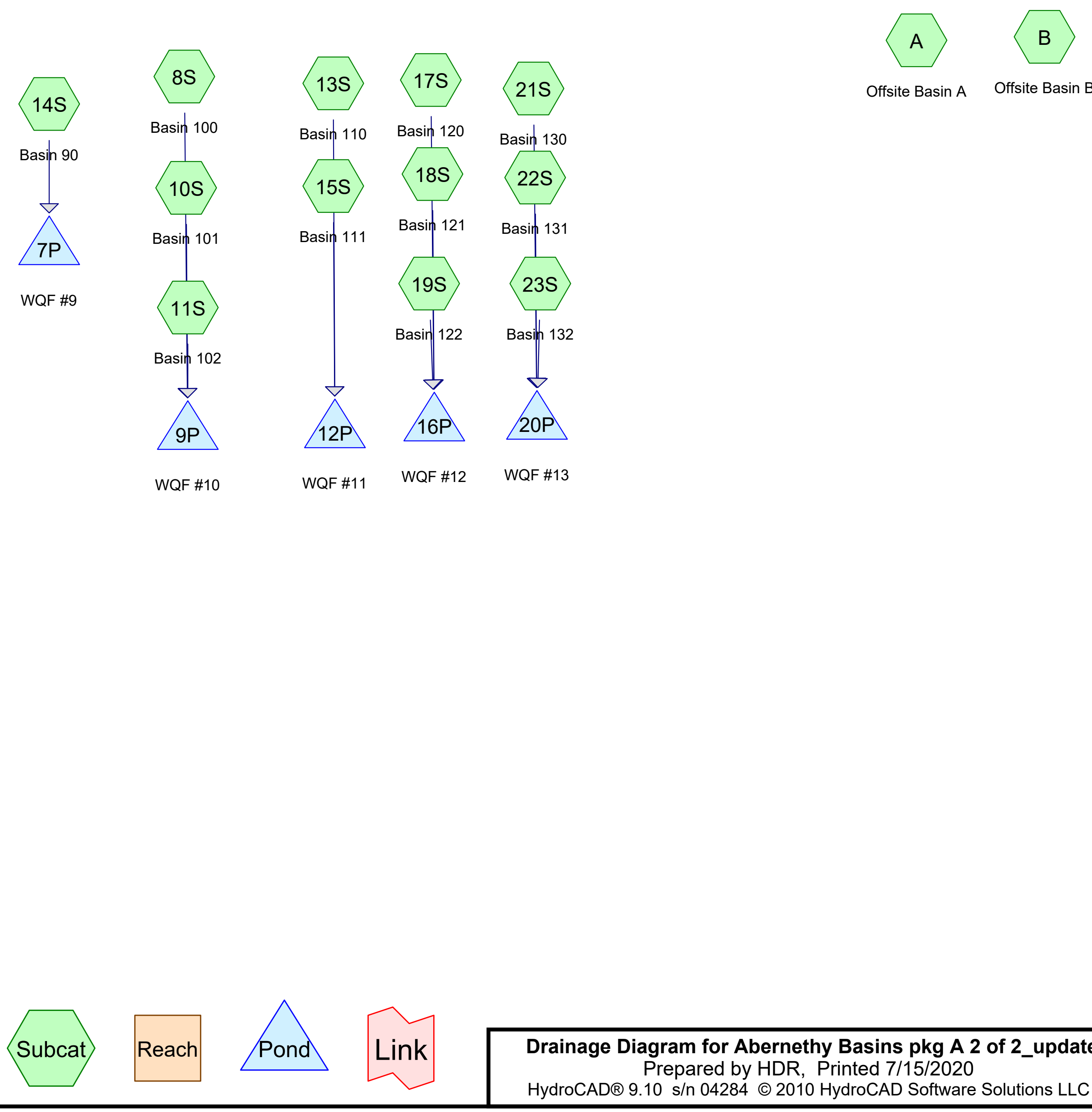
FIG. 2
Sheet 9 of 11

Filename: T:\Projects\24-1\04165_I-205 Stafford\Avmxd\SitePlan-WallsEmbank_10.6.mxd Date: 7/12/2019 Login: AEH

Appendix E. Hydrology Calculations (HydroCAD Analysis)



Drainage Diagram for Abernethy Basins package A 1 of 2
Prepared by HDR, Printed 7/15/2020
HydroCAD® 9.10 s/n 04284 © 2010 HydroCAD Software Solutions LLC



Drainage Diagram for Abernethy Basins pkg A 2 of 2_updated
Prepared by HDR, Printed 7/15/2020
HydroCAD® 9.10 s/n 04284 © 2010 HydroCAD Software Solutions LLC

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Basin 10 Runoff Area=1.065 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.28 cfs 0.089 af

Subcatchment 2A: Basin 20 A Runoff Area=0.253 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.07 cfs 0.021 af

Subcatchment 2B: Basin 20 B Runoff Area=0.840 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.22 cfs 0.070 af

Subcatchment 2C: Basin 20 C Runoff Area=0.517 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.13 cfs 0.043 af

Subcatchment 2D: Basin 20 D Runoff Area=0.496 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.13 cfs 0.042 af

Subcatchment 2E: Basin 20 E Runoff Area=1.042 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.27 cfs 0.087 af

Subcatchment 3: Basin 30 Runoff Area=3.045 ac 100.00% Impervious Runoff Depth=1.01"
Tc=8.0 min CN=0/98 Runoff=0.77 cfs 0.255 af

Subcatchment 4: Basin 40 Runoff Area=0.304 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.08 cfs 0.025 af

Subcatchment 4-1: Basin 41 Runoff Area=2.673 ac 100.00% Impervious Runoff Depth=1.01"
Tc=10.0 min CN=0/98 Runoff=0.66 cfs 0.224 af

Subcatchment 4-2: Basin 42 Runoff Area=0.886 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.23 cfs 0.074 af

Subcatchment 4-3: Basin 43 Runoff Area=0.316 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.08 cfs 0.026 af

Subcatchment 5: Basin 50 Runoff Area=0.696 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.18 cfs 0.058 af

Subcatchment 5-1: Basin 51 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.12 cfs 0.040 af

Subcatchment 5-2: Basin 53 Runoff Area=0.550 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.14 cfs 0.046 af

Subcatchment 6: Basin 60 Runoff Area=1.115 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.29 cfs 0.093 af

Subcatchment 6-1: Basin 61 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.12 cfs 0.040 af

Subcatchment 6-2: Basin 62 Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.60 cfs 0.194 af

Subcatchment 6-3: Basin 63 Runoff Area=0.123 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.03 cfs 0.010 af

Subcatchment 7: Basin 70 Runoff Area=0.287 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.07 cfs 0.024 af

Subcatchment 7-1: Basin 71 Runoff Area=0.432 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.11 cfs 0.036 af

Subcatchment 7-2: Basin 72 Runoff Area=0.590 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.15 cfs 0.049 af

Subcatchment 8: Basin 80 Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=1.01"
Tc=12.0 min CN=0/98 Runoff=0.56 cfs 0.194 af

Subcatchment 10S: Basin 65 Runoff Area=7.606 ac 100.00% Impervious Runoff Depth=1.01"
Tc=17.0 min CN=0/98 Runoff=1.71 cfs 0.637 af

Subcatchment 11S: Basin 81 Runoff Area=7.675 ac 100.00% Impervious Runoff Depth=1.01"
Tc=16.0 min CN=0/98 Runoff=1.75 cfs 0.643 af

Subcatchment 12S: Basin 66 Runoff Area=0.450 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.12 cfs 0.038 af

Subcatchment 14S: Basin 52 Runoff Area=2.591 ac 100.00% Impervious Runoff Depth=1.01"
Tc=10.0 min CN=0/98 Runoff=0.64 cfs 0.217 af

Subcatchment 15S: Basin 82 Runoff Area=0.207 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.05 cfs 0.017 af

Subcatchment 16S: Basin 44 Runoff Area=0.374 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.10 cfs 0.031 af

Subcatchment 35S: Basin 67 Runoff Area=0.305 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.08 cfs 0.026 af

Subcatchment OS-3: Basin OS 31 Runoff Area=1.368 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.36 cfs 0.115 af

Total Runoff Area = 41.394 ac Runoff Volume = 3.467 af Average Runoff Depth = 1.01"
0.00% Pervious = 0.000 ac 100.00% Impervious = 41.394 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 8S: Basin 100 Runoff Area=1.533 ac 100.00% Impervious Runoff Depth=1.01"
Tc=10.0 min CN=0/98 Runoff=0.38 cfs 0.128 af

Subcatchment 10S: Basin 101 Runoff Area=2.461 ac 100.00% Impervious Runoff Depth=1.01"
Tc=9.0 min CN=0/98 Runoff=0.61 cfs 0.206 af

Subcatchment 11S: Basin 102 Runoff Area=0.490 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.13 cfs 0.041 af

Subcatchment 13S: Basin 110 Runoff Area=3.507 ac 100.00% Impervious Runoff Depth=1.01"
Tc=11.0 min CN=0/98 Runoff=0.86 cfs 0.294 af

Subcatchment 14S: Basin 90 Runoff Area=0.268 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.07 cfs 0.022 af

Subcatchment 15S: Basin 111 Runoff Area=2.329 ac 100.00% Impervious Runoff Depth=1.01"
Tc=11.0 min CN=0/98 Runoff=0.57 cfs 0.195 af

Subcatchment 17S: Basin 120 Runoff Area=3.287 ac 100.00% Impervious Runoff Depth=1.01"
Tc=9.0 min CN=0/98 Runoff=0.82 cfs 0.275 af

Subcatchment 18S: Basin 121 Runoff Area=1.252 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.33 cfs 0.105 af

Subcatchment 19S: Basin 122 Runoff Area=0.386 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.10 cfs 0.032 af

Subcatchment 21S: Basin 130 Runoff Area=3.528 ac 100.00% Impervious Runoff Depth=1.01"
Tc=10.0 min CN=0/98 Runoff=0.87 cfs 0.296 af

Subcatchment 22S: Basin 131 Runoff Area=0.433 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.11 cfs 0.036 af

Subcatchment 23S: Basin 132 Runoff Area=0.447 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.12 cfs 0.037 af

Subcatchment A: Offsite Basin A Runoff Area=19.530 ac 38.00% Impervious Runoff Depth=0.42"
Tc=20.0 min CN=74/98 Runoff=1.60 cfs 0.689 af

Subcatchment B: Offsite Basin B Runoff Area=97.740 ac 38.00% Impervious Runoff Depth=0.42"
Tc=60.0 min CN=74/98 Runoff=5.27 cfs 3.446 af

Total Runoff Area = 137.191 ac Runoff Volume = 5.804 af Average Runoff Depth = 0.51"
53.00% Pervious = 72.707 ac 47.00% Impervious = 64.484 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 3P: WQF #3	Inflow=1.12 cfs 0.370 af Primary=1.12 cfs 0.370 af
Pond 4P: WQF #4b	Inflow=0.49 cfs 0.157 af Primary=0.49 cfs 0.157 af
Pond 5P: WQF #5a	Inflow=0.64 cfs 0.217 af Primary=0.64 cfs 0.217 af
Pond 6P: WQF #6	Inflow=2.92 cfs 1.038 af Primary=2.92 cfs 1.038 af
Pond 7P: WQF #7	Inflow=0.34 cfs 0.110 af Primary=0.34 cfs 0.110 af
Pond 11P: WQF #8	Inflow=2.36 cfs 0.855 af Primary=2.36 cfs 0.855 af
Pond 12P: WQF #4a	Inflow=0.66 cfs 0.224 af Primary=0.66 cfs 0.224 af
Pond 13P: WQF #5b	Inflow=0.45 cfs 0.144 af Primary=0.45 cfs 0.144 af
Pond 14P: WQF #1	Inflow=0.28 cfs 0.089 af Primary=0.28 cfs 0.089 af
Pond 15P: WQF #2	Inflow=0.82 cfs 0.264 af Primary=0.82 cfs 0.264 af

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 7P: WQF #9	Inflow=0.07 cfs 0.022 af Primary=0.07 cfs 0.022 af
Pond 9P: WQF #10	Inflow=1.12 cfs 0.376 af Primary=1.12 cfs 0.376 af
Pond 12P: WQF #11	Inflow=1.42 cfs 0.489 af Primary=1.42 cfs 0.489 af
Pond 16P: WQF #12	Inflow=1.24 cfs 0.413 af Primary=1.24 cfs 0.413 af
Pond 20P: WQF #13	Inflow=1.10 cfs 0.369 af Primary=1.10 cfs 0.369 af

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Basin 10 Runoff Area=1.065 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.82 cfs 0.270 af

Subcatchment 2A: Basin 20 A Runoff Area=0.253 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.19 cfs 0.064 af

Subcatchment 2B: Basin 20 B Runoff Area=0.840 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.64 cfs 0.213 af

Subcatchment 2C: Basin 20 C Runoff Area=0.517 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.40 cfs 0.131 af

Subcatchment 2D: Basin 20 D Runoff Area=0.496 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.38 cfs 0.126 af

Subcatchment 2E: Basin 20 E Runoff Area=1.042 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.80 cfs 0.265 af

Subcatchment 3: Basin 30 Runoff Area=3.045 ac 100.00% Impervious Runoff Depth=3.05"
Tc=8.0 min CN=0/98 Runoff=2.26 cfs 0.773 af

Subcatchment 4: Basin 40 Runoff Area=0.304 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.23 cfs 0.077 af

Subcatchment 4-1: Basin 41 Runoff Area=2.673 ac 100.00% Impervious Runoff Depth=3.05"
Tc=10.0 min CN=0/98 Runoff=1.94 cfs 0.679 af

Subcatchment 4-2: Basin 42 Runoff Area=0.886 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.68 cfs 0.225 af

Subcatchment 4-3: Basin 43 Runoff Area=0.316 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.24 cfs 0.080 af

Subcatchment 5: Basin 50 Runoff Area=0.696 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.53 cfs 0.177 af

Subcatchment 5-1: Basin 51 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.36 cfs 0.120 af

Subcatchment 5-2: Basin 53 Runoff Area=0.550 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.42 cfs 0.140 af

Subcatchment 6: Basin 60 Runoff Area=1.115 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.85 cfs 0.283 af

Subcatchment 6-1: Basin 61 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.36 cfs 0.120 af

Subcatchment 6-2: Basin 62	Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=1.78 cfs 0.589 af	
Subcatchment 6-3: Basin 63	Runoff Area=0.123 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.09 cfs 0.031 af	
Subcatchment 7: Basin 70	Runoff Area=0.287 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.22 cfs 0.073 af	
Subcatchment 7-1: Basin 71	Runoff Area=0.432 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.33 cfs 0.110 af	
Subcatchment 7-2: Basin 72	Runoff Area=0.590 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.45 cfs 0.150 af	
Subcatchment 8: Basin 80	Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=3.05" Tc=12.0 min CN=0/98 Runoff=1.64 cfs 0.589 af	
Subcatchment 10S: Basin 65	Runoff Area=7.606 ac 100.00% Impervious Runoff Depth=3.05" Tc=17.0 min CN=0/98 Runoff=5.06 cfs 1.931 af	
Subcatchment 11S: Basin 81	Runoff Area=7.675 ac 100.00% Impervious Runoff Depth=3.05" Tc=16.0 min CN=0/98 Runoff=5.17 cfs 1.949 af	
Subcatchment 12S: Basin 66	Runoff Area=0.450 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.34 cfs 0.114 af	
Subcatchment 14S: Basin 52	Runoff Area=2.591 ac 100.00% Impervious Runoff Depth=3.05" Tc=10.0 min CN=0/98 Runoff=1.88 cfs 0.658 af	
Subcatchment 15S: Basin 82	Runoff Area=0.207 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.16 cfs 0.053 af	
Subcatchment 16S: Basin 44	Runoff Area=0.374 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.29 cfs 0.095 af	
Subcatchment 35S: Basin 67	Runoff Area=0.305 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=0.23 cfs 0.077 af	
Subcatchment OS-3: Basin OS 31	Runoff Area=1.368 ac 100.00% Impervious Runoff Depth=3.05" Tc=5.0 min CN=0/98 Runoff=1.05 cfs 0.347 af	

Total Runoff Area = 41.394 ac Runoff Volume = 10.511 af Average Runoff Depth = 3.05"
0.00% Pervious = 0.000 ac 100.00% Impervious = 41.394 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 8S: Basin 100 Runoff Area=1.533 ac 100.00% Impervious Runoff Depth=3.05"
Tc=10.0 min CN=0/98 Runoff=1.11 cfs 0.389 af

Subcatchment 10S: Basin 101 Runoff Area=2.461 ac 100.00% Impervious Runoff Depth=3.05"
Tc=9.0 min CN=0/98 Runoff=1.81 cfs 0.625 af

Subcatchment 11S: Basin 102 Runoff Area=0.490 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.38 cfs 0.124 af

Subcatchment 13S: Basin 110 Runoff Area=3.507 ac 100.00% Impervious Runoff Depth=3.05"
Tc=11.0 min CN=0/98 Runoff=2.52 cfs 0.891 af

Subcatchment 14S: Basin 90 Runoff Area=0.268 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.21 cfs 0.068 af

Subcatchment 15S: Basin 111 Runoff Area=2.329 ac 100.00% Impervious Runoff Depth=3.05"
Tc=11.0 min CN=0/98 Runoff=1.67 cfs 0.591 af

Subcatchment 17S: Basin 120 Runoff Area=3.287 ac 100.00% Impervious Runoff Depth=3.05"
Tc=9.0 min CN=0/98 Runoff=2.42 cfs 0.835 af

Subcatchment 18S: Basin 121 Runoff Area=1.252 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.96 cfs 0.318 af

Subcatchment 19S: Basin 122 Runoff Area=0.386 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.30 cfs 0.098 af

Subcatchment 21S: Basin 130 Runoff Area=3.528 ac 100.00% Impervious Runoff Depth=3.05"
Tc=10.0 min CN=0/98 Runoff=2.56 cfs 0.896 af

Subcatchment 22S: Basin 131 Runoff Area=0.433 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.33 cfs 0.110 af

Subcatchment 23S: Basin 132 Runoff Area=0.447 ac 100.00% Impervious Runoff Depth=3.05"
Tc=5.0 min CN=0/98 Runoff=0.34 cfs 0.114 af

Subcatchment A: Offsite Basin A Runoff Area=19.530 ac 38.00% Impervious Runoff Depth=1.83"
Tc=20.0 min CN=74/98 Runoff=6.61 cfs 2.985 af

Subcatchment B: Offsite Basin B Runoff Area=97.740 ac 38.00% Impervious Runoff Depth=1.83"
Tc=60.0 min CN=74/98 Runoff=21.39 cfs 14.939 af

Total Runoff Area = 137.191 ac Runoff Volume = 22.982 af Average Runoff Depth = 2.01"
53.00% Pervious = 72.707 ac 47.00% Impervious = 64.484 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 3P: WQF #3 Inflow=3.31 cfs 1.121 af
Primary=3.31 cfs 1.121 af

Pond 4P: WQF #4b Inflow=1.44 cfs 0.477 af
Primary=1.44 cfs 0.477 af

Pond 5P: WQF #5a Inflow=1.88 cfs 0.658 af
Primary=1.88 cfs 0.658 af

Pond 6P: WQF #6 Inflow=8.61 cfs 3.147 af
Primary=8.61 cfs 3.147 af

Pond 7P: WQF #7 Inflow=1.00 cfs 0.332 af
Primary=1.00 cfs 0.332 af

Pond 11P: WQF #8 Inflow=6.97 cfs 2.591 af
Primary=6.97 cfs 2.591 af

Pond 12P: WQF #4a Inflow=1.94 cfs 0.679 af
Primary=1.94 cfs 0.679 af

Pond 13P: WQF #5b Inflow=1.32 cfs 0.437 af
Primary=1.32 cfs 0.437 af

Pond 14P: WQF #1 Inflow=0.82 cfs 0.270 af
Primary=0.82 cfs 0.270 af

Pond 15P: WQF #2 Inflow=2.41 cfs 0.799 af
Primary=2.41 cfs 0.799 af

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 7P: WQF #9	Inflow=0.21 cfs 0.068 af Primary=0.21 cfs 0.068 af
Pond 9P: WQF #10	Inflow=3.29 cfs 1.139 af Primary=3.29 cfs 1.139 af
Pond 12P: WQF #11	Inflow=4.19 cfs 1.482 af Primary=4.19 cfs 1.482 af
Pond 16P: WQF #12	Inflow=3.66 cfs 1.251 af Primary=3.66 cfs 1.251 af
Pond 20P: WQF #13	Inflow=3.23 cfs 1.119 af Primary=3.23 cfs 1.119 af

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Basin 10 Runoff Area=1.065 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.96 cfs 0.318 af

Subcatchment 2A: Basin 20 A Runoff Area=0.253 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.23 cfs 0.076 af

Subcatchment 2B: Basin 20 B Runoff Area=0.840 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.75 cfs 0.251 af

Subcatchment 2C: Basin 20 C Runoff Area=0.517 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.46 cfs 0.154 af

Subcatchment 2D: Basin 20 D Runoff Area=0.496 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.44 cfs 0.148 af

Subcatchment 2E: Basin 20 E Runoff Area=1.042 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.93 cfs 0.311 af

Subcatchment 3: Basin 30 Runoff Area=3.045 ac 100.00% Impervious Runoff Depth=3.59"
Tc=8.0 min CN=0/98 Runoff=2.65 cfs 0.910 af

Subcatchment 4: Basin 40 Runoff Area=0.304 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.27 cfs 0.091 af

Subcatchment 4-1: Basin 41 Runoff Area=2.673 ac 100.00% Impervious Runoff Depth=3.59"
Tc=10.0 min CN=0/98 Runoff=2.27 cfs 0.799 af

Subcatchment 4-2: Basin 42 Runoff Area=0.886 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.79 cfs 0.265 af

Subcatchment 4-3: Basin 43 Runoff Area=0.316 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.28 cfs 0.094 af

Subcatchment 5: Basin 50 Runoff Area=0.696 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.62 cfs 0.208 af

Subcatchment 5-1: Basin 51 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.43 cfs 0.142 af

Subcatchment 5-2: Basin 53 Runoff Area=0.550 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.49 cfs 0.164 af

Subcatchment 6: Basin 60 Runoff Area=1.115 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=1.00 cfs 0.333 af

Subcatchment 6-1: Basin 61 Runoff Area=0.474 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.43 cfs 0.142 af

Subcatchment 6-2: Basin 62	Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=2.08 cfs 0.693 af
Subcatchment 6-3: Basin 63	Runoff Area=0.123 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.11 cfs 0.037 af
Subcatchment 7: Basin 70	Runoff Area=0.287 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.26 cfs 0.086 af
Subcatchment 7-1: Basin 71	Runoff Area=0.432 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.39 cfs 0.129 af
Subcatchment 7-2: Basin 72	Runoff Area=0.590 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.53 cfs 0.176 af
Subcatchment 8: Basin 80	Runoff Area=2.320 ac 100.00% Impervious Runoff Depth=3.59" Tc=12.0 min CN=0/98 Runoff=1.93 cfs 0.693 af
Subcatchment 10S: Basin 65	Runoff Area=7.606 ac 100.00% Impervious Runoff Depth=3.59" Tc=17.0 min CN=0/98 Runoff=5.92 cfs 2.273 af
Subcatchment 11S: Basin 81	Runoff Area=7.675 ac 100.00% Impervious Runoff Depth=3.59" Tc=16.0 min CN=0/98 Runoff=6.05 cfs 2.293 af
Subcatchment 12S: Basin 66	Runoff Area=0.450 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.40 cfs 0.134 af
Subcatchment 14S: Basin 52	Runoff Area=2.591 ac 100.00% Impervious Runoff Depth=3.59" Tc=10.0 min CN=0/98 Runoff=2.20 cfs 0.774 af
Subcatchment 15S: Basin 82	Runoff Area=0.207 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.19 cfs 0.062 af
Subcatchment 16S: Basin 44	Runoff Area=0.374 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.34 cfs 0.112 af
Subcatchment 35S: Basin 67	Runoff Area=0.305 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=0.27 cfs 0.091 af
Subcatchment OS-3: Basin OS 31	Runoff Area=1.368 ac 100.00% Impervious Runoff Depth=3.59" Tc=5.0 min CN=0/98 Runoff=1.23 cfs 0.409 af

Total Runoff Area = 41.394 ac Runoff Volume = 12.368 af Average Runoff Depth = 3.59"
0.00% Pervious = 0.000 ac 100.00% Impervious = 41.394 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 8S: Basin 100 Runoff Area=1.533 ac 100.00% Impervious Runoff Depth=3.59"
Tc=10.0 min CN=0/98 Runoff=1.30 cfs 0.458 af

Subcatchment 10S: Basin 101 Runoff Area=2.461 ac 100.00% Impervious Runoff Depth=3.59"
Tc=9.0 min CN=0/98 Runoff=2.12 cfs 0.735 af

Subcatchment 11S: Basin 102 Runoff Area=0.490 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.44 cfs 0.146 af

Subcatchment 13S: Basin 110 Runoff Area=3.507 ac 100.00% Impervious Runoff Depth=3.59"
Tc=11.0 min CN=0/98 Runoff=2.95 cfs 1.048 af

Subcatchment 14S: Basin 90 Runoff Area=0.268 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.24 cfs 0.080 af

Subcatchment 15S: Basin 111 Runoff Area=2.329 ac 100.00% Impervious Runoff Depth=3.59"
Tc=11.0 min CN=0/98 Runoff=1.96 cfs 0.696 af

Subcatchment 17S: Basin 120 Runoff Area=3.287 ac 100.00% Impervious Runoff Depth=3.59"
Tc=9.0 min CN=0/98 Runoff=2.83 cfs 0.982 af

Subcatchment 18S: Basin 121 Runoff Area=1.252 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=1.12 cfs 0.374 af

Subcatchment 19S: Basin 122 Runoff Area=0.386 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.35 cfs 0.115 af

Subcatchment 21S: Basin 130 Runoff Area=3.528 ac 100.00% Impervious Runoff Depth=3.59"
Tc=10.0 min CN=0/98 Runoff=3.00 cfs 1.054 af

Subcatchment 22S: Basin 131 Runoff Area=0.433 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.39 cfs 0.129 af

Subcatchment 23S: Basin 132 Runoff Area=0.447 ac 100.00% Impervious Runoff Depth=3.59"
Tc=5.0 min CN=0/98 Runoff=0.40 cfs 0.134 af

Subcatchment A: Offsite Basin A Runoff Area=19.530 ac 38.00% Impervious Runoff Depth=2.27"
Tc=20.0 min CN=74/98 Runoff=8.38 cfs 3.696 af

Subcatchment B: Offsite Basin B Runoff Area=97.740 ac 38.00% Impervious Runoff Depth=2.27"
Tc=60.0 min CN=74/98 Runoff=27.10 cfs 18.498 af

Total Runoff Area = 137.191 ac Runoff Volume = 28.147 af Average Runoff Depth = 2.46"
53.00% Pervious = 72.707 ac 47.00% Impervious = 64.484 ac

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 3P: WQF #3	Inflow=3.87 cfs 1.319 af Primary=3.87 cfs 1.319 af
Pond 4P: WQF #4b	Inflow=1.69 cfs 0.562 af Primary=1.69 cfs 0.562 af
Pond 5P: WQF #5a	Inflow=2.20 cfs 0.774 af Primary=2.20 cfs 0.774 af
Pond 6P: WQF #6	Inflow=10.08 cfs 3.703 af Primary=10.08 cfs 3.703 af
Pond 7P: WQF #7	Inflow=1.17 cfs 0.391 af Primary=1.17 cfs 0.391 af
Pond 11P: WQF #8	Inflow=8.16 cfs 3.048 af Primary=8.16 cfs 3.048 af
Pond 12P: WQF #4a	Inflow=2.27 cfs 0.799 af Primary=2.27 cfs 0.799 af
Pond 13P: WQF #5b	Inflow=1.54 cfs 0.514 af Primary=1.54 cfs 0.514 af
Pond 14P: WQF #1	Inflow=0.96 cfs 0.318 af Primary=0.96 cfs 0.318 af
Pond 15P: WQF #2	Inflow=2.82 cfs 0.941 af Primary=2.82 cfs 0.941 af

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 7P: WQF #9 Inflow=0.24 cfs 0.080 af
Primary=0.24 cfs 0.080 af

Pond 9P: WQF #10 Inflow=3.85 cfs 1.340 af
Primary=3.85 cfs 1.340 af

Pond 12P: WQF #11 Inflow=4.90 cfs 1.744 af
Primary=4.90 cfs 1.744 af

Pond 16P: WQF #12 Inflow=4.29 cfs 1.472 af
Primary=4.29 cfs 1.472 af

Pond 20P: WQF #13 Inflow=3.78 cfs 1.317 af
Primary=3.78 cfs 1.317 af

Appendix F. Stormwater Management Facility Design Calculations

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #1 (detention pond)

Water Quality

Manning's n	0.24	
Bottom width, ft	**10.0**	Minimum 10 ft (detention)
Side slope	4	Maximum 4
Bottom slope, ft/ft	0.0150	Minimum 1.5%, maximum 6%
Water depth, ft (WQ)	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Top width	12.7	
Area, ft^2	3.78	
Velocity, fps	0.074	
Design flow, cfs	0.28	
Bottom length, ft	**119.8**	Minimum 100 ft
Top length, ft	**130.5**	
Depth w/FB, ft	1.33	
Top width w/ FB, ft	**20.7**	
Hydraulic radius	0.35	
Max shear stress, lb/sf	0.312	
Residence time, min	26.5	Minimum 9 minutes
25-year v, fps	0.25	Max 3 ft/s
Water volume (detention), ft^3	399	

Detention

Manning's n	0.24
Bottom width, ft	10.0
Side slope	4
Bottom slope, ft/ft	0.015
Water depth, ft	1.7
Top width	23.6
XS Area, ft^2	28.56
Velocity, fps	0.029
Design flow, cfs	0.82
Bottom length, ft	**119.8**
Top length, ft	**141.4**
Depth w/FB, ft	2.70
Top width w/ FB, ft	**31.6**
Max shear stress	1.5912
Residence time, min	69.6
Storage volume	4620

T_c (pre-extg.)

Assume SCF in forest

$V=2.516*S^{0.5}$	
S, ft/ft	0.03
V, ft/s	0.436
L, ft	540
T_{SCF}, min	21

$V_s=V_i-Q_0*t$

t, hr	24.00
V_i, ft^3	14244.12
Q_0, cfs	0.12
V_s, ft^3	3876.12

WQF#1

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	New Project
Project Type	RoadProject
Location	
Stormwater Management Area	2135
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Extg Pavement	40,119	Impervious	ConventionalConcrete	B	BMP(1)
Grass	27,951	Grass	Grass	B	BMP(1)
Proposed Pavement	5,881	Forested	ConventionalConcrete	B	BMP(1)

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
BMP(1)	FCWQT	D1	5.00	2,135.0	4	4,104.3	3,419.6	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

WQF#1

Simple Pond Geometry Configuration

Pond ID: BMP(1)
Design: FlowControlAndTreatment

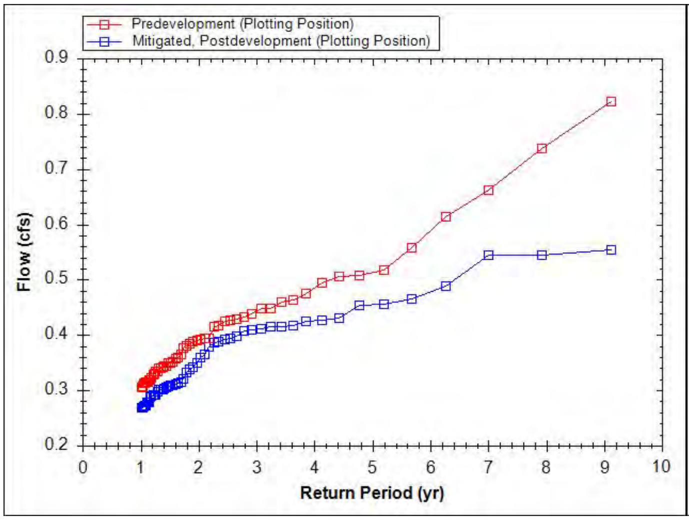
Shape Curve

Depth (ft)	Area (sq ft)
5.0	2,135.0

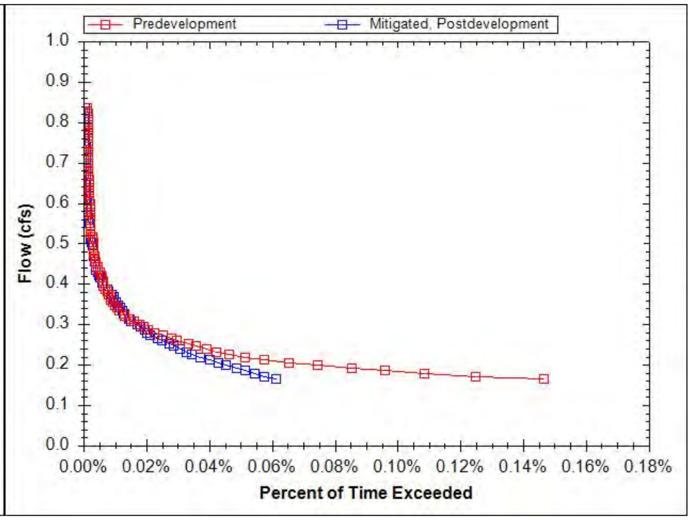
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	1.7
Upper Orifice Invert(ft)	3.4
Upper Orifice Dia (in)	4.5
Overflow Weir Invert(ft)	4.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



ODOT I-205 CW/Abernethy Post-Construction SWMP
Stormwater Facility Design Calculations - WQF #2 (bioslope)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix C

Long term infiltration rate of ecology mix (inches/hour)	10
Length of Bioslope (feet)	1900
Width of bioslope (feet)	4.5
Converstion Factor	43200
Safety Factor	1
$Q_{infiltration}=(LTIR_{EM})(L_{BIO})(W_{BIO})/(C)(SF)$	
Assumed long Term infiltration Capacity $Q_{infiltration}$, cfs	1.98
Required Water Quality Design Flow, cfs	0.82

	Subbasin	SQFT	Acres	2-yr Peak Flow	Length of Bioslope	$Q_{infiltration}$	Start Sta	End Sta
33.144	2A	11037	0.253	0.14	333	0.35	66498.68	66832.09
79.684	2B	36575	0.840	0.47	459	0.48	66832.09	67291.52
73.329	2C	22512	0.517	0.29	307	0.32	67291.52	67598.29
71.757	2D	21599	0.496	0.28	301	0.31	67598.29	67898.86
67.115	2E	37920	0.871	0.49	565	0.59	67898.86	68463.8

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #3 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n	0.24	
Bottom width, ft	**8.4**	$B=nQ/(1.49*y^{1.67}*s^{0.5})$, Minimum 4 ft
Side slope	4	Maximum 4
Bottom slope, ft/ft	0.018	Minimum 1.5%, maximum 6%
Water depth, ft	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Top width	11.1	
XS Area, ft^2	3.26	
Velocity, fps	0.344	v=Q/A
Design flow, cfs	1.12	From HydroCAD output, WQ storm event
Bottom length, ft	**187.5**	L=v*t, Minimum 100 ft
Top length, ft	**198.2**	
Depth w/FB, ft	1.33	
Top width w/ FB, ft	**19.1**	
Max shear stress, lb/sf	0.372	
Residence time, min	9	Minimum t= 9 minutes
25-year v, fps	1.19	$v=Q_{25\text{-}yr}/A_{XS}$, Max 3 ft/s

WQF#3

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	WQF#3
Project Type	RoadProject
Location	
Stormwater Management Area	4639
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Existing Pavement Basin 3	71,961	Impervious	ConventionalConcrete	B	BMP(1)
New Pavement Basin 3	19,297	Forested	ConventionalConcrete	B	BMP(1)
OS-3 Basin	75,707	Impervious	ConventionalConcrete	B	BMP(1)

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
BMP(1)	FCWQT	D1	5.36	4,639.0	4	12,497.8	9,915.6	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only
2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).
3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.
4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

WQF#3

Simple Pond Geometry Configuration

Pond ID: BMP(1)
Design: FlowControlAndTreatment

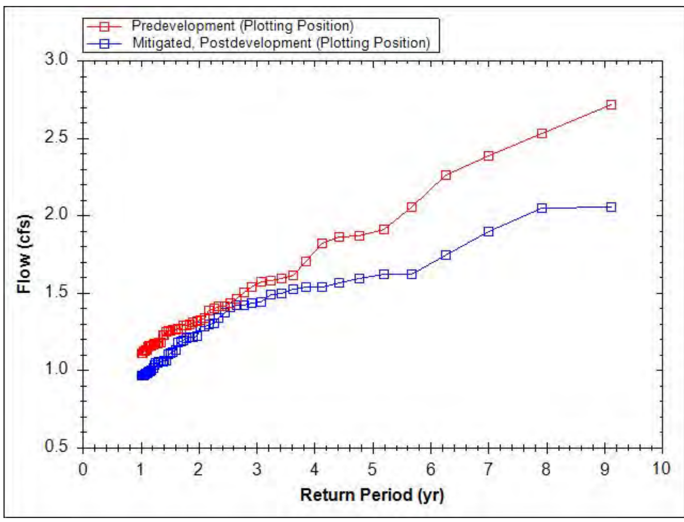
Shape Curve

Depth (ft)	Area (sq ft)
5.4	4,639.0

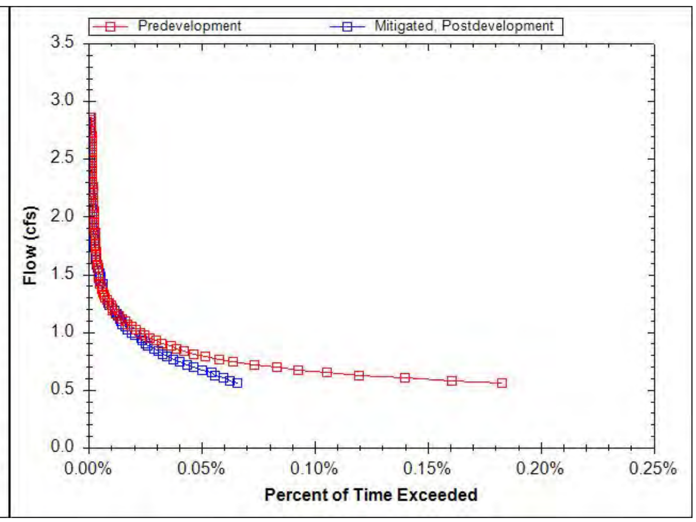
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	3.0
Upper Orifice Invert(ft)	3.6
Upper Orifice Dia (in)	8.2
Overflow Weir Invert(ft)	4.4
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #4 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24		
Bottom Width:	10	(ft)	
Side Slope:	4	(H)	
Bottom Slope:	0.5	(%)	
Depth of Water	0.33	Max Depth 4-6% is 3", 4" for less than 4%	
Area	3.74	sqft	
Wetted Perimeter	12.72	ft	
Hydraulic Radius	0.29	ft	
Velocity	0.19	fps	Max 3 fps
Flow, Q:	0.67	cfs	
Calculated Flow	0.72		
Designed Length	104.45	ft	Minimum = 100 feet + energy dissipator length
Actual Length	110	ft	
Max Shear Stress	0.10296	psf	
Permissible Shear Stress			
Residence time	9.5	minutes	
RT Check	OK		

Manning's n:	0.24	
Bottom Width:	10	(ft)
Side Slope:	4	(H)
Bottom Slope:	0.5	(%)
Depth of Water	0.33	
Area	3.74	sqft
Wetted Perimeter	12.72	ft
Hydraulic Radius	0.29	ft
Velocity	0.19	fps
Flow, Q:	0.71	cfs
Calculated Flow	0.72	
Designed Length	104.45	ft
Actual Length	110	ft
Max Shear Stress	0.10296	psf
Permissible Shear Stress		
Residence time	9.5	minutes
RT Check	OK	
Flow Check	OK	

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF#5 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24	
Bottom Width:	10	(ft)
Side Slope:	4	(H)
Bottom Slope:	0.5	(%)
Depth of Water	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Area	3.74	sqft
Wetted Perimeter	12.72	ft
Hydraulic Radius	0.29	ft
Velocity	0.19	fps
Flow, Q:	0.65	cfs
Calculated Flow	0.72	
Designed Length	104.45	ft
Actual Length	115	ft
Max Shear Stress	0.10296	psf
Permissible Shear Stress		
Residence time	9.9	minutes
RT Check	OK	
Flow Check	OK	

Manning's n:	0.24	
Bottom Width:	8	(ft)
Side Slope:	4	(H)
Bottom Slope:	0.5	(%)
Depth of Water	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Area	3.08	sqft
Wetted Perimeter	10.72	ft
Hydraulic Radius	0.29	ft
Velocity	0.19	fps
Flow, Q:	0.46	cfs
Calculated Flow	0.59	
Designed Length	102.84	ft
Actual Length	115	ft
Max Shear Stress	0.10296	psf
Permissible Shear Stress		
Residence time	10.1	minutes
RT Check	OK	
Flow Check	OK	

Stormwater Facility Design Calculations - WQF#6 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n	0.24	
Bottom width, ft	**30.0**	$B=nQ/(1.49*y^{1.67}*s^{0.5})$, Minimum 4 ft
Side slope	4	Maximum 4
Bottom slope, ft/ft	0.02	Minimum 1.5%, maximum 6%
Water depth, ft	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Top width	32.7	
XS Area, ft^2	10.46	
Velocity, fps	0.403	v=Q/A
Current design flow, cfs	4.21	
Full build out additional flow, cfs	1.29	
Total design flow, cfs	4.21	From HydroCAD output, WQ storm event
Bottom length, ft	**219.4**	L=v*t, Minimum 100 ft
Top length, ft	**230.1**	
Depth w/FB, ft	1.33	
Top width w/ FB, ft	**40.7**	
Max shear stress, lb/sf	0.416	
Residence time, min	9	Minimum t= 9 minutes
25-year v, fps	1.60	$v=Q_{25-yr}/A_{XS}$, Max 3 ft/s

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF#7 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24	
Bottom Width:	40	(ft)
Side Slope:	4	(H)
Bottom Slope:	1.5	(%)
Depth of Water	0.255	Max Depth 4-6% is 3", 4" for less than 4%
Area	10.4601	
Wetted Perimeter	42.10278	sqft
Hydraulic Radius	0.248442	ft
Velocity	0.299688	fps
Flow, Q:	3.11	cfs
Calculated Flow	3.1	
Designed Length	161.8317	ft
Actual Length	190	ft
Max Shear Stress	0.23868	psf
Permissible Shear Stress		
Residence time	10.6	minutes
RT Check	OK	
Flow Check	OK	

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #8 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24	
Bottom Width:	55	(ft)
Side Slope:	4	(H)
Bottom Slope:	1	(%)
Depth of Water	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Area	18.586	sqft
Wetted Perimeter	57.721	ft
Hydraulic Radius	0.322	ft
Velocity	0.291	fps
Flow, Q:	5.1	cfs
Calculated Flow	5.41	
Designed Length	157.0707	ft
Actual Length	160	ft
Max Shear Stress	0.20592	psf
Permissible Shear Stress		
Residence time	9.2	minutes
RT Check	OK	
Flow Check	OK	

WQF#9

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Jon Storm Parking Lot
Project Type	RoadProject
Location	
Stormwater Management Area	240
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Parking Lot	10,200	Grass	ConventionalConcrete	D	BMP

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
BMP	WaterQuality	Stormwater Planter - Infiltration	A1	153.0	240.0	0.0

Pond Sizing Details

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only
2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).
3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.
4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #10 (bioretention swale)

Water quality

Manning's n	0.24	
Bottom width, ft	**10.0**	Minimum 10 ft (detention)
Side slope	4	Maximum 4
Bottom slope, ft/ft	0.015	Minimum 1.5%, maximum 6%
Water depth, ft	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Top width	12.7	
XS Area, ft^2	3.78	
Velocity, fps	0.296	25-year v, fps 1.12 Max 3 ft/s
Design flow, cfs	1.12	
Bottom length, ft	**162.1**	Minimum 100 ft
Top length, ft	**172.8**	
Depth w/FB, ft	1.33	
Top width w/ FB, ft	**20.7**	
Max shear stress	0.312	lb/sf
Residence time, min	9	Minimum 9 minutes

Detention

Manning's n	0.24
Bottom width, ft	10.0
Side slope	4
Bottom slope, ft/ft	0.015
Water depth, ft	6.8
Top width	64.4
XS Area, ft^2	252.96
Velocity, fps	0.004
Design flow, cfs	1.12
Bottom length, ft	**162.1**
Top length, ft	**224.5**
Depth w/FB, ft	7.80
Top width w/ FB, ft	**72.4**
Max shear stress	6.3648
Residence time, min	610.2
Storage volume	54153

T_c (pre-extg.)

Assume SCF in forest, ~3% slope

$V=2.516*S^{0.5}$

S	0.03	ft/ft
V	0.436	ft/s
L	2500	ft
T_{SCF}	96	min

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #11 (biofiltration swale)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n	0.24	
Bottom width, ft	**11.9**	$B=nQ/(1.49*y^{1.67}*s^{0.5})$, Minimum 4 ft
Side slope	4	Maximum 4
Bottom slope, ft/ft	0.015	Minimum 1.5%, maximum 6%
Water depth, ft	0.33	Max Depth 4-6% is 3", 4" for less than 4%
Top width	14.5	
XS Area, ft^2	4.36	
Velocity, fps	0.326	v=Q/A
Design flow, cfs	1.42	From HydroCAD output, WQ storm event
Bottom length, ft	**177.8**	L=v*t, Minimum 100 ft
Top length, ft	**188.5**	
Depth w/FB, ft	1.33	
Top width w/ FB, ft	**22.5**	
Max shear stress, lb/sf	0.309	
Residence time, min	9	Minimum t= 9 minutes
25-year v, fps	1.12	$v=Q_{25\text{-}yr}/A_{XS}$, Max 3 ft/s

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #12 (bioretention pond)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24		
Bottom Width:	30	(ft)	
Side Slope:	4	(H)	
Bottom Slope:	1.5	(%)	
Depth of Water	0.33	Max Depth 4-6% is 3", 4" for less than 4%	
Area	10.44	sqft	
Wetted Perimeter	32.75	ft	
Hydraulic Radius	0.32	ft	
Velocity	0.35	fps	Max Velocity is 3 fps
Flow, Q:	1.24	cfs	
Calculated Flow	3.70		
Designed Length	191.1	ft	
Actual Length	220	ft	Minimum Length is 100 feet plus energy dissipator length
Max Shear Stress	0.312	psf	
Permissible Shear Stress			
Residence time	10.36	minutes	
RT Check	OK		
Flow Check	OK		

ODOT I-205 CW/Abernethy Post-Construction SWMP

Stormwater Facility Design Calculations - WQF #13 (bioretention pond)

Theory: ODOT Hydraulics Manual - Chapter 14, Appendix B

Manning's n:	0.24		
Bottom Width:	30	(ft)	
Side Slope:	4	(H)	
Bottom Slope:	1.5	(%)	
Depth of Water	0.21	Max Depth 4-6% is 3", 4" for less than 4%	
Area	6.42	sqft	
Wetted Perimeter	31.72	ft	
Hydraulic Radius	0.20	ft	
Velocity	0.26	fps	Max Velocity is 3 fps
Flow, Q:	1.10	cfs	
Calculated Flow	1.68		
Designed Length	141.2	ft	
Actual Length	150	ft	Minimum Length is 100 feet plus energy dissipator length
Max Shear Stress	0.195	psf	
Permissible Shear Stress			
Residence time	9.56	minutes	
RT Check	OK		
Flow Check	OK		

Time span=0.00-40.00 hrs, dt=0.01 hrs, 4001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 51S: Historic Basin 12 Runoff Area=4.925 ac 0.00% Impervious Runoff Depth=1.27"
Tc=60.0 min CN=77/0 Runoff=0.62 cfs 0.521 af

Subcatchment 52S: Historic Basin 13 Runoff Area=4.408 ac 0.00% Impervious Runoff Depth=1.27"
Tc=60.0 min CN=77/0 Runoff=0.56 cfs 0.466 af

Pond 36P: WQF #13 Peak Elev=152.49' Storage=0.367 af Inflow=3.23 cfs 1.119 af
Outflow=0.64 cfs 1.115 af

Pond 37P: WQF#12 Peak Elev=166.28' Storage=0.471 af Inflow=3.66 cfs 1.251 af
Outflow=0.61 cfs 1.235 af

Total Runoff Area = 9.333 ac Runoff Volume = 0.987 af Average Runoff Depth = 1.27"
100.00% Pervious = 9.333 ac 0.00% Impervious = 0.000 ac

Appendix G. Spread Analysis

I-205CW: Phase 1 - NE Leg

InRoads Report - Spread Calculations

Station	Structure Type	Previous Bypass	Bypass To	Drainage Area	Runoff Coef	Location	Storm Freq	ToC	Intensity	Runoff	Clogging	Longitudinal Slope	Transverse Slope	Gutter Flow	Roughness Coeff	Intercepted Flow	Bypass Flow	Spread	Allowable Spread	Depth
		(cfs)		(ac)				(min)	(in/h)	(cfs)	(%)	(%)	(%)	(cfs)		(cfs)	(cfs)	(ft)	(ft)	(ft)
"B2" 704+00.42	G-2	0.00	"B2" 705+77.05	0.20	0.90	On grade	10-year	5	2.25	0.40	30	0.65	10.43	0.40	0.016	0.40	0.00	1.97	8	0.21
"B2" 705+77.05	G-2	0.00	"B2" 707+66.43	0.12	0.90	On grade	10-year	5	2.25	0.25	30	0.35	2.57	0.25	0.016	0.22	0.03	4.49	8	0.12
"B2" 707+66.43	G-2	0.03	"B2" 709+51.44	0.11	0.90	On grade	10-year	5	2.25	0.22	30	1.18	5.29	0.25	0.016	0.25	0.00	2.26	4	0.12
"B2" 709+51.44	G-2	0.00	"B2" 711+46.87	0.13	0.90	On grade	10-year	5	2.25	0.26	30	2.75	11.88	0.27	0.016	0.27	0.00	1.19	4	0.14
"B2" 711+46.87	G-2	0.00	-	0.12	0.90	On grade	10-year	5	2.25	0.24	30	5.66	2.65	0.24	0.016	0.23	0.02	2.57	4	0.07
"A2" 705+01.91	G-2	0.00	"A2" 703+26.53	0.23	0.90	On grade	10-year	5	2.25	0.46	30	2.88	12.06	0.46	0.016	0.46	0.00	1.43	6	0.17
"A2" 703+26.53	G-2	0.00	"A2" 701+49.32	0.13	0.90	On grade	10-year	5	2.25	0.26	30	3.15	8.65	0.26	0.016	0.26	0.00	1.40	6	0.12
"A2" 701+49.32	G-2	0.00	-	0.13	0.90	On grade	10-year	5	2.25	0.26	30	4.92	2.78	0.26	0.016	0.24	0.02	2.62	6	0.07
"D2" 703+67.14	G-2	0.00	"D2" 700+94.21	0.52	0.90	On grade	10-year	5	2.25	1.05	30	5.68	12.07	1.05	0.016	0.97	0.08	1.72	6	0.21
"D2" 700+94.21	G-2	0.08	-	0.17	0.90	On grade	10-year	5	2.25	0.35	30	0.47	2.01	0.43	0.016	0.33	0.10	5.60	6	0.11
"C2" 701+39.47	G-2	0.00	"C2" 702+01.71	0.17	0.90	On grade	10-year	5	2.25	0.34	30	0.35	8.18	0.34	0.016	0.33	0.00	2.25	4	0.18
"C2" 702+01.71	G-2	0.00	"C2" 702+89.10	0.06	0.90	On grade	10-year	5	2.25	0.12	30	1.25	8.41	0.13	0.016	0.13	0.00	1.20	4	0.1
"C2" 702+89.10	G-2	0.00	-	0.06	0.90	On grade	10-year	5	2.25	0.13	30	2.85	8.22	0.13	0.016	0.13	0.00	1.14	4	0.09
"L" 704+98.85	G-2	0.00	"L" 701+99.46	0.56	0.90	On grade	10-year	5	2.25	1.12	30	0.63	2.89	1.12	0.016	0.79	0.33	6.53	7	0.19
"L" 701+99.46	G-2	0.33	"L" 699+22.67	0.41	0.90	On grade	10-year	5	2.25	0.83	30	0.18	4.63	1.16	0.016	0.97	0.19	6.21	7	0.29
"L" 699+22.67	G-2	0.19	"L" 695+74.21	0.47	0.90	On grade	10-year	5	2.25	0.95	30	0.34	6.14	1.14	0.016	0.98	0.15	4.60	9	0.28
"L" 695+74.21	G-2	0.15	"L" 693+98.26	0.56	0.90	On grade	10-year	5	2.25	1.12	30	0.50	7.88	1.28	0.016	1.14	0.14	3.82	7	0.3
"L" 693+98.26	G-2	0.14	"L" 690+48.91	0.29	0.90	On grade	10-year	5	2.25	0.58	30	1.37	7.44	0.72	0.016	0.68	0.04	2.64	7	0.2
"L" 690+48.91	G-2	0.04	"L" 688+78.02	0.53	0.90	On grade	10-year	5	2.25	1.07	30	2.04	4.47	1.11	0.016	0.90	0.21	3.96	7	0.18
"L" 688+78.02	G-2	0.21	"L" 687+36.94	0.28	0.90	On grade	10-year	5	2.25	0.56	30	2.95	1.82	0.77	0.016	0.59	0.18	4.56	7	
"L" 687+36.94	G-2	0.18	"L" 686+48.66	0.23	0.90	On grade	10-year	5	2.25	0.46	30	1.81	2.30	0.64	0.016	0.47	0.17	5.01	7	
"L" 686+46.66	G-2	0.17	"L" 685+82.29	0.14	0.90	On grade	10-year	5	2.25	0.28	30	1.45	1.36	0.45	0.016	0.29	0.16	6.36	7	0.14
"L" 685+82.29	G-2	0.16	"L" 685+43.24	0.10	0.90	On grade	10-year	5	2.25	0.21	30	1.47	0.79	0.37	0.016	0.21	0.16	8.09	7	0.09
"L" 685+43.24	G-2	0.16	"L" 684+98.63	0.04	0.90	On grade	10-year	5	2.25	0.09	30	1.37	0.65	0.25	0.016	0.14	0.11	8.23	7	0.05
"L" 684+98.63	G-2	0.11	-	0.05	0.90	On grade	10-year	5	2.25	0.11	30	1.28	0.35	0.22	0.016	0.10	0.12	11.56	7	0.04
"L" 703+08.01	G-2	0.00	"L" 700+07.18	0.39	0.90	On grade	10-year	5	2.25	0.80	30	0.25	3.31	0.80	0.016	0.63	0.16	5.80	12	0.19
"L" 700+07.18	G-2	0.16	"L" 699+24.36	0.39	0.90	On grade	10-year	5	2.25	0.8	30	0.40	5.36	0.96	0.016	0.82	0.14	4.20	12	0.23
"L" 699+24.36	G-2	0.10	"L" 696+74.25	0.11	0.90	On grade	10-year	5	2.25	0.22	30	0.21	5.89	0.32	0.016	0.30	0.01	3.20	12	0.19
"L" 696+74.25	G-2	0.01	"L" 696+18.15	0.46	0.90	On grade	10-year	5	2.25	0.93	30	0.36	8.31	0.94	0.016	0.87	0.07	3.51	6	0.29
"L" 696+18.15	G-2	0.07	"L" 693+94.84	0.09	0.90	On grade	10-year	5	2.25	0.18	30	0.30	8.03	0.25	0.016	0.25	0.00	2.26	6	0.18
"L" 693+94.84	G-2	0.00	"L" 690+47.07	0.30	0.90	On grade	10-year	5	2.25	0.61	30	0.73	6.77	0.61	0.016	0.58	0.04	2.97	10	0.20
"L" 690+47.07	G-2	0.12	"L" 688+92.74	0.45	0.90	On grade	10-year	5	2.25	0.91	30	1.88	4.45	1.03	0.016	0.84	0.19	3.93	12	0.17
"L" 688+92.74	G-2	0.17	"L" 685+99.03	0.19	0.90	On grade	10-year	5	2.25	0.39	30	1.35	3.90	0.56	0.016	0.48	0.08	3.61	12	0.14
"L" 685+99.03	G-2	0.04	-	0.37	0.90	On grade	10-year	5	2.25	0.75	30	1.36	4.63	0.78	0.016	0.67	0.11	3.68	12	0.17

G-2 structure dimensions are based on ODOT std. drg. RD364. Grate size is 2.67' by 2.25'.

I-205CW: Phase 1 - Hilltop to OR43
InRoads Report - Spread Calculations

Station	Structure Type	Previous Bypass	Bypass To	Drainage Area	Runoff Coef	Location	Storm Freq	ToC	Intensity	Runoff	Clogging	Longitudinal Slope	Transverse Slope	Gutter Flow	Roughness Coeff	Intercepted Flow	Bypass Flow	Spread	Allowable Spread	Depth
		(cfs)		(ac)				(min)	(in/h)	(cfs)	(%)	(%)	(%)	(cfs)		(cfs)	(cfs)	(ft)	(ft)	(ft)
"Ln" 791+33.97	G-2	0.00	"Ln" 790+01.30	0.51	0.90	On grade	10-year	5	2.25	1.03	30	0.79	1.78	1.03	0.016	0.62	0.41	8.21	12.00	0.15
"Ln" 790+01.30	G-2	0.41	"Ln" 788+26.84	0.17	0.90	On grade	10-year	5	2.25	0.34	30	1.04	1.34	0.75	0.016	0.43	0.32	8.23	12.00	0.11
"Ln" 788+26.84	G-2	0.32	"Ln" 788+16.53	0.24	0.90	On grade	10-year	5	2.25	0.49	30	1.37	0.74	0.80	0.016	0.35	0.45	11.63	12.00	0.09
"Ln" 788+16.53	G-2	0.45	"Ln" 783+66.59	0.00	0.00	On grade	10-year	5	2.25	0	30	1.39	0.70	0.45	0.016	0.23	0.23	9.72	12.00	0.07
"Ln" 783+66.59	G-2	0.23	"Ln" 782+13.41	0.77	0.90	On grade	10-year	5	2.25	1.56	30	2.44	3.38	1.78	0.016	1.19	0.59	5.46	6.00	0.18
"Ln" 782+13.41	G-2	0.59	"Lnc" 780+60.09	0.32	0.90	On grade	10-year	5	2.25	0.65	30	2.74	1.74	1.24	0.016	0.70	0.54	7.05	7.00	0.12
"Lnc" 780+60.09	G-2	0.54	"Lnc" 777+59.72	0.26	0.90	On grade	10-year	5	2.25	0.53	30	2.74	2.00	1.07	0.016	0.67	0.41	6.13	7.00	0.12
"Lnc" 777+59.72	G-2	0.41	"Lnc" 774+57.81	0.53	0.90	On grade	10-year	5	2.25	1.07	30	2.74	2.00	1.48	0.016	0.84	0.64	6.92	9.00	0.14
"Lnc" 774+57.81	G-2	0.64	"Lnc" 771+56.27	0.45	0.90	On grade	10-year	5	2.25	0.92	30	2.75	1.94	1.56	0.016	0.86	0.69	7.16	9.00	0.14
"Lnc" 771+56.27	G-2	0.69	"Lc2" 768+55.24	0.40	0.90	On grade	10-year	5	2.25	0.81	30	2.86	2.00	1.50	0.016	0.85	0.65	6.89	11.00	0.14
"Lc2" 768+55.24	G-2	0.65	"Lc2" 766+67.81	0.46	0.90	On grade	10-year	5	2.25	0.94	30	2.87	2.15	1.59	0.016	0.92	0.67	6.71	12.00	0.14
"Lc2" 766+67.81	G-2	0.67	"Lc2" 760+48.19	0.34	0.90	On grade	10-year	5	2.25	0.68	30	2.38	1.10	1.35	0.016	0.60	0.75	9.97	12.00	0.11
"Lc2" 760+48.19	G-2	0.75	"Lc2" 756+51.40	0.90	0.90	On grade	10-year	5	2.25	1.82	30	2.57	2.63	2.60	0.016	1.42	1.15	7.18	13.00	0.19
"Lc2" 756+51.40	G-2	1.17	"Lc2" 753+93.62	0.59	0.90	On grade	10-year	5	2.25	1.19	30	2.81	2.10	2.36	0.016	1.21	1.15	7.94	12.00	0.17
"Lc2" 753+93.62	G-2	1.15	"Lc2" 753+83.29	0.32	0.90	On grade	10-year	5	2.25	0.66	30	2.89	1.15	1.81	0.016	0.76	1.05	10.40	12.00	0.12
"Lc2" 753+83.29	G-2	1.05	"Lc2" 749+26.39	0.00	0.00	On grade	10-year	5	2.25	0	30	2.90	1.06	1.05	0.016	0.50	0.56	8.96	12.00	0.09
"Lc2" 749+26.39	G-2	0.56	"Lc2" 747+99.34	0.68	0.90	On grade	10-year	5	2.25	1.38	30	3.49	2.61	1.94	0.016	1.16	0.77	6.18	8.00	0.16
"Lc2" 747+99.34	G-2	0.77	"B4" 744+40.80	0.23	0.90	On grade	10-year	5	2.25	0.47	30	3.42	3.55	1.24	0.016	0.93	0.31	4.34	8.00	0.15
"Lc2" 744+40.37	G-2	0.00	"B4" 744+40.80	0.04	0.90	On grade	10-year	5	2.25	0.07	30	1.88	6.00	0.07	0.016	0.07	0	1.21	12	0.07
"B4" 744+40.80	G-2	0.28	"B4" 743+31.78	0.76	0.90	On grade	10-year	5	2.25	1.54	30	2.66	6.17	1.82	0.016	1.49	0.32	3.71	8	0.23
"B4" 743+31.78	G-2	0.32	"B4" 741+73.00	0.07	0.90	On grade	10-year	5	2.25	0.14	30	2.96	9.02	0.46	0.016	0.46	0	1.72	12	0.16
"B4" 741+73.00	G-2	0.00	"B4" 740+17.26	0.10	0.90	On grade	10-year	5	2.25	0.21	30	6.17	7.10	0.21	0.016	0.21	0	1.29	10	0.09
"B4" 740+17.26	G-2	0.00	"B4" 739+13.79	0.11	0.90	On grade	10-year	5	2.25	0.22	30	10.25	4.93	0.22	0.016	0.22	0	1.50	9	0.07
"B4" 739+13.79	G-2	0.00	"B4" 736+95.67	0.07	0.90	On grade	10-year	5	2.25	0.14	30	5.91	8.34	0.14	0.016	0.14	0	1.02	8	0.08
"B4" 736+95.67	G-2	0.00	"OR43" 13+49.43	0.13	0.90	On grade	10-year	5	2.25	0.27	30	7.83	6.03	0.27	0.016	0.27	0	1.51	8	0.09
"OR43" 13+39.72	G-2	0.07	"OR43" 13+49.43	0.21	0.90	On grade	10-year	5	2.25	0.43	30	0.95	2.24	0.5	0.016	0.38	0.12	5.21	6	0.11
"OR43" 13+61.62	G-2	0.00	"OR43" 13+49.43	0.24	0.90	On grade	10-year	5	2.25	0.49	30	0.39	2.22	0.49	0.016	0.38	0.11	6.17	6	0.14
"OR43" 12+62.73	G-2	0.00	"OR43" 13+49.43	0.12	0.90	On grade	10-year	5	2.25	0.24	30	1.85	1.20	0.24	0.016	0.18	0.07	5.19	6	0.06
"OR43" 13+49.43	G-2	0.23	N/A	0.00	0.00	Sump	25-year	5	2.64	0.00	50	0.00	2.23	0.23	0.016	0.23	0	2.76	6	0.07
"SNc" 13+67.01	G-2	0	"SNc" 15+91.70	0.09	0.9	On grade	10-year	5	2.25	0.19	30	8.56	1.90	0.19	0.016	0.17	0.01	2.66	8	0.05
"SNc" 15+91.70	G-2	0.01	-	0.14	0.9	On grade	10-year	5	2.25	0.28	30	6.24	1.59	0.30	0.016	0.24	0.06	3.75	8	0.06
"SNc" 13+85.05	G-2	0	"SNc" 16+42.55	0.11	0.9	On grade	10-year	5	2.25	0.22	30	8.17	1.96	0.22	0.016	0.20	0.02	2.79	8	0.05
"SNc" 16+42.55	G-2	0.02	-	0.16	0.9	On grade	10-year	5	2.25	0.31	30	4.97	2.21	0.33	0.016	0.28	0.05	3.33	8	0.07
"Ls" 792+31.61	G-2	0.00	"Ls" 789+49.56	0.57	0.90	On grade	10-year	5	2.25	1.16	30	0.78	2.13	1.16	0.016	0.73	0.43	7.68	12.00	0.16
"Ls" 789+49.56	G-2	0.43	"Ls" 786+96.91	0.41	0.90	On grade	10-year	5	2.25	0.83	30	1.54	2.05	1.26	0.016	0.75	0.51	7.15	12.00	0.15
"Ls" 786+96.91	G-2	0.51	"Ls" 784+59.81	0.34	0.90	On grade	10-year	5	2.25	0.68	30	2.01	2.03	1.20	0.016	0.72	0.48	6.71	12.00	0.14
"Ls" 784+59.81	G-2	0.48	"Ls" 782+17.89	0.34	0.90	On grade	10-year	5	2.25	0.69	30	2.48	1.72	1.16	0.016	0.66	0.50	7.08	12.00	0.12
"Ls" 782+17.89	G-2	0.50	"Lsc2" 779+44.19	0.33	0.90	On grade	10-year	5	2.25	0.67	30	2.89	2.20	1.17	0.016	0.74	0.43	5.91	12.00	0.13
"Lsc2" 779+44.19	G-2	0.43	"Lsc2" 776+67.90	0.40	0.90	On grade	10-year	5	2.25	0.81	30	2.99	2.00	1.25	0.016	0.75	0.50	6.36	12.00	0.13
"Lsc2" 776+67.90	G-2	0.50	"Lsc2" 773+93.32	0.35	0.90	On grade	10-year	5	2.25	0.72	30	2.92	1.94	1.21	0.016	0.72	0.49	6.46	12.00	0.13
"Lsc2" 773+93.32	G-2	0.49	"Lsc2" 771+42.83	0.40	0.90	On grade	10-year	5	2.25	0.82	30	2.86	2.11	1.31	0.016	0.79	0.52	6.33	12.00	0.13
"Lsc2" 771+42.83	G-2	0.52	"Lc2" 768+40.11	0.37	0.90	On grade	10-year	5	2.25	0.74	30	2.94	1.91	1.26	0.016	0.74	0.52	6.60	12.00	0.13
"Lc2" 768+40.11	G-2	0.52	"Lc2" 766+31.15	0.41	0.90	On grade	10-year	5	2.25	0.83	30	2.93	1.95	1.36	0.016	0.78	0.57	6.71	12.00	0.13
"Lc2" 766+31.15	G-2	0.57	"Lc2" 763+56.41	0.29	0.90	On grade	10-year	5	2.25	0.59	30	2.87	2.12	1.16	0.016	0.72	0.44	6.02	12.00	0.13
"Lc2" 763+56.41	G-2	0.44	"Lc2" 762+11.78	0.39	0.90	On grade	10-year	5	2.25	0.79	30	2.69	2.28	1.23	0.016	0.77	0.45	5.95	12.00	0.14
"Lc2" 762+11.78	G-2	0.45	"Lc2" 760+48.41	0.20	0.90	On grade	10-year	5	2.25	0.41	30	2.77	2.72	0.86	0.016	0.63	0.23	4.65	12.00	0.13
"Lc2" 760+48.41	G-2	0.23	"Lc2" 758+50.00	0.23	0.90	On grade	10-year	5	2.25	0.46	30	2.80	2.41	0.69	0.016	0.51	0.18	4.61	12.00	0.11
"Lc2" 758+50.00	G-2	0.28	"Lc2" 756+52.77	0.29	0.90	On grade	10-year	5	2.25	0.58	30	2.65	2.43	0.86	0.016	0.61	0.25	5.03	12.00	0.12
"Lc2" 756+52.77	G-2	0.25	"Lc2" 753+97.90	0.26	0.90	On grade	10-year	5	2.25	0.53	30	2.63	1.97	0.78	0.016	0.52	0.26	5.54	12.00	0.11
"Lc2" 753+97.90	G-2	0.26	"L" 750+46.08	0.43	0.90	On grade	10-year	5	2.25	0.88	30	2.51	1.23	1.14	0.016	0.56	0.58	8.62	8.00	0.11
"L" 750+46.08	G-2	0.58	"L" 747+42.91	0.15	0.90	On grade	10-year	5	2.25	0.31	30	2.41	1.96	0.88	0.016	0.57	0.31	5.90	8.00	0.12
"L" 747+39.13	G-2	0.31	"C4" 744+93.97	0.14	0.90	On grade	10-year	5	2.25	0.29	30	2.01	1.76	0.60	0.016	0.41	0.20	5.67	6.00	0.10
"C4" 744+93.97	G-2	0.20	"L" 742+95.52	0.12	0.90	On grade	10-year	5	2.25	0.24	30	1.66	0.65	0.44	0.016	0.22	0.23	9.69	12	0.06
"L" 742+95.52	G-2	0.23	"C4" 739+98.82	0.12	0.90	On grade	10-year	5	2.25	0.25	30	2.42	2.50	0.48	0.016	0.38	0.09	4.02	12	0.10
"C4" 739+98.82	G-2	0.09	"C4" 736+32.28	0.18	0.90	On grade	10-year	5	2.25	0.36	30	5.19	8.14	0.45	0.016	0.45	0	1.63	6	0.13
"C4" 736+32.28	G-2	0.00	"C4" 734+99.49	0.22	0.90	On grade	10-year	5	2.25	0.45	30	5.67	4.17	0.45	0.016	0.43	0.02	2.45	6	0.10
"C4" 734+99.49	G-2	0.02	"OR43" 7+11.01	0.08	0.90	On grade	10-year	5	2.25	0.16	30	2.88	1.04	0.18	0.016	0.13	0.05	4.65	6	0.05
"OR43" 7+11.01	G-2	0.05	"OR43" 7+59.10	0.15	0.90	On grade	10-year	5	2.25	0.30	30	0.56	2.15	0.35	0.016	0.28	0.07	5.14	8	0.11
"OR43" 10+02.36	G-2	0.00	"OR43" 9+35.10	0.21	0.90	On grade	10-year	5	2.25	0.43	30	1.71	3.21	0.43	0.016	0.37	0.06	3.52	8	0.11
"OR43" 9+35.10	G-2	0.06	"OR43" 8+41.86	0.10	0.90	On grade	10-year	5	2.25	0.20	30	1.88	3.09	0.26	0.016	0.24	0.02	2.96	8	0.09
"OR43" 8+41.86	G-2	0.01	"OR43" 7+59.10	0.16	0.90	On grade	10-year	5	2.25	0.33	30	1.26	2.84	0.34	0.016	0.29	0.05	3.69	8	0.10
"OR43" 7+59.10	G-2	0.11	N/A	0.25	0.90	Sump	25-year	5	2.64	0.59	50	0.00	2.28	0.70	0.016	0.70	0	5.76	8	0.13

Station		Previous Bypass	Bypass To	Drainage Area	Runoff Coef	Location	Storm Freq	ToC	Intensity	Runoff	Clogging	Longitudinal Slope	Transverse Slope	Gutter Flow	Roughness Coeff	Intercepted Flow	Bypass Flow	Spread	Allowable Spread	Depth
		(cfs)		(ac)				(min)	(in/h)	(cfs)	(%)	(%)	(%)	(cfs)		(cfs)	(cfs)	(ft)	(ft)	(ft)
"OR43" 5+29.79	G-2	0.00	N/A	0.14	0.90	Sump	25-year	5	2.64	0.33	50	0.00	2.68	0.33	0.016	0.33	0	2.94	8	0.08
"Lc2" 750+46.08	G-2	0.00	"Lc2" 747+79.20	0.35	0.90	On grade	10-year	5	2.25	0.71	30	3.06	1.84	0.71	0.016	0.48	0.24	5.42	12.00	0.10
"Lc2" 747+79.20	G-2	0.24	"Lc2" 744+45.59	0.32	0.90	On grade	10-year	5	2.25	0.65	30	2.12	4.73	0.89	0.016	0.76	0.13	3.50	12.00	0.17
"Lc2" 744+45.59	G-2	0.13	"Lc2" 741+98.86	0.44	0.90	On grade	10-year	5	2.25	0.89	30	1.29	5.87	1.02	0.016	0.89	0.13	3.53	14	0.21
"Lc2" 741+98.86	G-2	0.13	"L" 739+68.75_EXTG	0.35	0.90	On grade	10-year	5	2.25	0.71	30	0.47	6.05	0.84	0.016	0.75	0.09	3.89	11	0.24
"L" 739+68.75_EXTG	G-2	0.09	"L" 737+37.54_EXTG	0.33	0.90	On grade	10-year	5	2.25	0.66	30	0.64	6.01	0.75	0.016	0.68	0.07	3.54	9	0.21
"L" 737+37.54_EXTG	G-2	0.07	"L" 735+83.55	0.30	0.90	On grade	10-year	5	2.25	0.61	30	1.15	5.71	0.69	0.016	0.63	0.06	3.17	6	0.18
"L" 735+83.55	G-2	0.06	-	0.20	0.90	On grade	10-year	5	2.25	0.40	30	1.55	4.35	0.46	0.016	0.42	0.04	3.05	7	0.13
"OR43" 12+35.36	G-2	0.00	N/A	0.14	0.90	Sump	25-year	5	2.64	0.34	50	0.00	4.03	0.34	0.016	0.34	0	2.00	8	0.08
"OR43" 11+11.99	G-2	0.00	N/A	0.06	0.90	Sump	25-year	5	2.64	0.14	50	0.00	3.72	0.14	0.016	0.14	0	1.19	8	0.04
"E3" 739+15.44	G-2	0.00	-	0.28	0.90	On grade	10-year	5	2.25	0.56	30	6.58	10.61	0.56	0.016	0.55	0.01	1.43	9	0.15
"WA3" 741+97.36	G-2	0.00	-	0.16	0.90	On grade	10-year	5	2.25	0.32	30	9.74	1.61	0.32	0.016	0.26	0.06	3.52	6	0.06
"WA3" 741+96.02	G-2	0.00	-	0.21	0.90	On grade	10-year	5	2.25	0.42	30	9.78	1.41	0.42	0.016	0.31	0.11	4.23	6	0.06
"L" 741+97.14	G-2	0.00	"L" 739+69.26	0.37	0.90	On grade	10-year	5	2.25	0.74	30	0.53	7.06	0.74	0.016	0.69	0.06	3.30	12	0.23
"L" 739+69.26	G-2	0.06	"L" 737+34.33	0.32	0.90	On grade	10-year	5	2.25	0.65	30	0.27	6.48	0.71	0.016	0.65	0.06	3.88	12	0.25
"L" 737+34.33	G-2	0.06	"L" 735+77.22	0.29	0.90	On grade	10-year	5	2.25	0.59	30	0.97	5.47	0.64	0.016	0.58	0.06	3.28	12	0.18
"L" 735+77.22	G-2	0.06	-	0.31	0.90	On grade	10-year	5	2.25	0.62	30	1.06	5.01	0.68	0.016	0.60	0.08	3.48	12	0.17
"D2" 733+38.11	G-2	0.00	"D2" 733+64.02	0.35	0.90	On grade	10-year	5	2.25	0.72	30	2.64	2.71	0.72	0.016	0.55	0.17	4.39	6	0.12
"D2" 733+64.02	G-2	0.17	"D2" 733+92.05	0.02	0.90	On grade	10-year	5	2.25	0.05	30	1.34	24.38	0.22	0.016	0.22	0	0.81	6	0.2
"D2" 733+92.05	G-2	0.00	"D2" 733+94.54	0.11	0.90	On grade	10-year	5	2.25	0.22	30	0.88	0.87	0.22	0.016	0.15	0.07	6.99	8	0.06
"D2" 733+94.54	G-2	0.31	N/A	0.14	0.90	Sump	25-year	5	2.64	0.34	50	0.00	2.09	0.65	0.016	0.65	0	5.97	8	0.13

G-2 structure dimensions are based on ODOT std. drg. RD364. Grate size is 2.67' by 2.25'.

I-205CW: Phase 1 - SW Leg
InRoads Report - Spread Calculations

Station	Structure Type	Previous Bypass	Bypass To	Drainage Area	Runoff Coef	Location	Storm Freq	ToC	Intensity	Runoff	Clogging	Longitudinal Slope	Transverse Slope	Gutter Flow	Roughness Coeff	Intercepted Flow	Bypass Flow	Spread	Allowable Spread	Depth
		(cfs)		(ac)				(min)	(in/h)	(cfs)	(%)	(%)	(%)	(cfs)		(cfs)	(cfs)	(ft)	(ft)	(ft)
"Ln" 797+99.30	G-2	0.00	"Ln" 799+77.68	0.36	0.90	On grade	10-year	5	2.25	0.73	30	0.36	4.01	0.73	0.016	0.62	0.12	5.04	12	0.20
"Ln" 799+77.68	G-2	0.12	"Ln" 802+79.53	0.25	0.90	On grade	10-year	5	2.25	0.5	30	0.89	4.02	0.61	0.016	0.52	0.09	3.96	12	0.16
"Ln" 802+79.53	G-2	0.09	"Ln" 805+81.61	0.42	0.90	On grade	10-year	5	2.25	0.84	30	1.31	3.93	0.93	0.016	0.74	0.19	4.38	12	0.17
"Ln" 805+81.61	G-2	0.19	"Ln" 808+83.32	0.49	0.90	On grade	10-year	5	2.25	0.99	30	1.69	3.96	1.18	0.016	0.91	0.28	4.54	12	0.18
"Ln" 808+83.32	G-2	0.28	"Ln" 811+75.35	0.43	0.90	On grade	10-year	5	2.25	0.87	30	1.54	3.89	1.14	0.016	0.88	0.27	4.61	12	0.18
"Ln" 811+75.35	G-2	0.27	"Ln" 811+85.08	0.42	0.90	On grade	10-year	5	2.25	0.85	30	1.53	3.96	1.12	0.016	0.87	0.26	4.53	12	0.18
"Ln" 811+85.08	G-2	0.26	"Ln" 814+87.95	0.00	0.00	On grade	10-year	5	0	0	30	1.53	3.93	0.26	0.016	0.24	0.01	2.62	12	0.10
"Ln" 814+87.95	G-2	0.01	"Ln" 817+90.21	0.43	0.90	On grade	10-year	5	2.25	0.87	30	1.74	3.90	0.88	0.016	0.71	0.17	4.08	12	0.16
"Ln" 817+90.21	G-2	0.17	"Ln" 820+92.09	0.42	0.90	On grade	10-year	5	2.25	0.85	30	1.37	3.64	1.02	0.016	0.78	0.24	4.71	12	0.17
"Ln" 820+92.09	G-2	0.24	"Ln" 823+93.70	0.42	0.90	On grade	10-year	5	2.25	0.85	30	1.61	2.63	1.09	0.016	0.74	0.35	5.73	12	0.19
"Ln" 823+93.70	G-2	0.35	"Ln" 825+93.38	0.41	0.90	On grade	10-year	5	2.25	0.83	30	1.56	1.82	1.18	0.016	0.68	0.50	7.48	12	0.15
"Ln" 825+93.38	G-2	0.50	"Ln" 826+43.80	0.27	0.90	On grade	10-year	5	2.25	0.54	30	1.59	1.28	1.04	0.016	0.53	0.51	8.85	12	0.12
"Ln" 826+43.80	G-2	0.51	"Ln" 826+94.48	0.07	0.90	On grade	10-year	5	2.25	0.13	30	1.74	1.07	0.64	0.016	0.35	0.29	8.12	12	0.09
"Ln" 826+94.48	G-2	0.29	"Ln2" 830+30.43	0.06	0.90	On grade	10-year	5	2.25	0.12	30	1.91	0.61	0.41	0.016	0.20	0.21	9.60	12	0.06
"Ln2" 830+30.43	G-2	0.21	"Ln2" 833+06.36	0.46	0.90	On grade	10-year	5	2.25	0.94	30	2.54	1.77	1.15	0.016	0.66	0.49	6.89	13	0.12
"Ln2" 833+06.36	G-2	0.49	"Ln2" 836+62.06	0.42	0.90	On grade	10-year	5	2.25	0.86	30	2.40	3.29	1.35	0.016	0.95	0.39	5.00	12	0.17
"Ln2" 836+62.06	G-2	0.39	"Ln2" 838+75.93	0.51	0.90	On grade	10-year	5	2.25	1.04	30	2.37	4.43	1.43	0.016	1.11	0.32	4.27	8	0.19
"Ln2" 838+75.93	G-2	0.33	"Ln2" 841+27.32	0.33	0.90	On grade	10-year	5	2.25	0.67	30	2.22	3.87	1.01	0.016	0.80	0.21	4.11	9	0.16
"Ln2" 841+27.32	G-2	0.21	"Ln2" 843+27.33	0.41	0.90	On grade	10-year	5	2.25	0.83	30	1.90	3.09	1.04	0.016	0.75	0.28	4.94	9	0.15
"Ln2" 843+27.33	G-2	0.28	"Ln2" 845+91.45	0.32	0.90	On grade	10-year	5	2.25	0.65	30	1.74	4.27	0.93	0.016	0.76	0.17	3.94	9	0.17
"Ln2" 845+91.45	G-2	0.17	"A2" 847+43.18	0.49	0.90	On grade	10-year	5	2.25	0.99	30	1.65	4.39	1.16	0.016	0.92	0.24	4.24	8	0.19
"A2" 847+43.18	G-2	0.24	"A2" 848+03.87	0.22	0.90	On grade	10-year	5	2.25	0.44	30	2.11	3.08	0.68	0.016	0.54	0.14	4.14	8	0.13
"A2" 848+03.87	G-2	0.14	"A2" 848+80.88	0.04	0.90	On grade	10-year	5	2.25	0.07	30	2.49	1.98	0.21	0.016	0.19	0.03	3.43	8	0.07
"A2" 848+80.88	G-2	0.03	"A2" 851+81.63	0.05	0.90	On grade	10-year	5	2.25	0.09	30	2.43	0.75	0.12	0.016	0.09	0.03	5.10	8	0.04
"A2" 851+81.63	G-2	0.03	-	0.18	0.90	On grade	10-year	5	2.25	0.36	30	3.52	1.82	0.39	0.016	0.30	0.09	4.25	4	0.08
"Ln2" 852+00.03	G-2	0.00	"Ln2" 854+78.76	0.68	0.90	On grade	10-year	5	2.25	1.38	30	2.14	1.40	1.38	0.016	0.68	0.70	8.80	12	0.12
"Ln2" 854+78.76	G-2	0.70	"Ln2" 855+87.23	0.49	0.90	On grade	10-year	5	2.25	0.99	30	1.83	5.69	1.69	0.016	1.35	0.33	4.07	12	0.23
"Ln2" 855+87.23	G-2	0.33	"Ln2" 858+00.13	0.15	0.90	On grade	10-year	5	2.25	0.3	30	1.56	6.62	0.63	0.016	0.60	0.03	2.65	6	0.18
"Ln2" 858+00.13	G-2	0.03	"Ln2" 860+15.03	0.30	0.90	On grade	10-year	5	2.25	0.62	30	1.09	6.75	0.65	0.016	0.61	0.04	2.82	6	0.19
"Ln2" 860+15.03	G-2	0.04	-	0.26	0.90	On grade	10-year	5	2.25	0.54	30	0.97	6.76	0.57	0.016	0.54	0.03	2.75	6	0.19
"Ls" 800+49.62	G-2	0.00	"Ls" 803+45.57	0.49	0.90	On grade	10-year	5	2.25	0.99	30	0.62	5.04	0.99	0.016	0.83	0.16	4.41	12	0.22
"Ls" 803+45.57	G-2	0.16	"Ls" 806+00.75	0.41	0.90	On grade	10-year	5	2.25	0.83	30	1.33	5.05	0.99	0.016	0.84	0.16	3.82	12	0.19
"Ls" 806+00.75	G-2	0.16	"Ls" 808+28.16	0.36	0.90	On grade	10-year	5	2.25	0.72	30	1.63	5.07	0.88	0.016	0.76	0.12	3.50	12	0.18
"Ls" 808+28.16	G-2	0.12	"Ls" 811+02.95	0.32	0.90	On grade	10-year	5	2.25	0.64	30	1.47	5.06	0.76	0.016	0.67	0.09	3.38	12	0.17
"Ls" 811+02.95	G-2	0.09	"Ls" 814+22.78	0.38	0.90	On grade	10-year	5	2.25	0.78	30	2.01	4.75	0.87	0.016	0.74	0.12	3.49	20	0.17
"Ls" 814+22.78	G-2	0.12	"Ls" 816+86.77	0.50	0.90	On grade	10-year	5	2.25	1.02	30	1.98	4.83	1.14	0.016	0.94	0.20	3.84	20	0.19
"Ls" 816+86.77	G-2	0.20	"Ls" 819+90.29	0.42	0.90	On grade	10-year	5	2.25	0.84	30	2.00	4.70	1.04	0.016	0.87	0.18	3.77	20	0.18
"Ls" 819+90.29	G-2	0.18	"Ls" 822+92.01	0.47	0.90	On grade	10-year	5	2.25	0.95	30	2.09	4.46	1.13	0.016	0.91	0.22	3.98	20	0.18
"Ls" 822+92.01	G-2	0.22	"Ls" 825+92.20	0.44	0.90	On grade	10-year	5	2.25	0.89	30	1.91	2.94	1.11	0.016	0.78	0.33	5.22	12	0.15
"Ls" 825+92.20	G-2	0.33	"Ls2" 828+24.24	0.39	0.90	On grade	10-year	5	2.25	0.8	30	1.56	1.58	1.13	0.016	0.62	0.51	8.03	12	0.13
"Ls2" 828+24.24	G-2	0.51	"Ls2" 830+17.30	0.29	0.90	On grade	10-year	5	2.25	0.58	30	2.09	0.88	1.09	0.016	0.46	0.63	10.85	12	0.10
"Ls2" 830+17.30	G-2	0.63	"Ls2" 831+48.88	0.26	0.90	On grade	10-year	5	2.25	0.52	30	2.16	1.86	1.15	0.016	0.67	0.47	6.88	12	0.13
"Ls2" 831+48.88	G-2	0.47	"Ls2" 833+99.72	0.15	0.90	On grade	10-year	5	2.25	0.30	30	2.15	0.93	0.77	0.016	0.37	0.40	9.18	12	0.08
"Ls2" 833+99.72	G-2	0.40	"Ls2" 836+00.39	0.39	0.90	On grade	10-year	5	2.25	0.78	30	2.57	2.75	1.18	0.016	0.81	0.37	5.27	12	0.14
"Ls2" 836+00.39	G-2	0.37	"Ls2" 837+86.82	0.29	0.90	On grade	10-year	5	2.25	0.60	30	2.46	3.69	0.97	0.016	0.77	0.20	4.10	12	0.15
"Ls2" 837+86.82	G-2	0.2	"Ls2" 840+64.22	0.26	0.90	On grade	10-year	5	2.25	0.53	30	2.28	3.71	0.73	0.016	0.61	0.13	3.74	12	0.14
"Ls2" 840+64.22	G-2	0.13	"Ls2" 841+91.78	0.40	0.90	On grade	10-year	5	2.25	0.81	30	1.91	3.54	0.94	0.016	0.73	0.21	4.36	12	0.15
"Ls2" 841+91.78	G-2	0.21	"Ls2" 843+65.22	0.17	0.90	On grade	10-year	5	2.25	0.35	30	1.79	2.56	0.56	0.016	0.43	0.13	4.46	12	0.11
"Ls2" 843+65.22	G-2	0.13	"Ls2" 847+63.10	0.18	0.90	On grade	10-year	5	2.25	0.37	30	1.59	0.81	0.49	0.016	0.26	0.24	8.89	12	0.07
"Ls2" 846+63.83	G-2	0.00	"Ls2" 847+63.10	0.21	0.90	On grade	10-year	5	2.25	0.43	30	2.17	1.92	0.43	0.016	0.32	0.11	4.66	6	0.09
"Ls2" 847+63.10	G-2	0.34	"D2" 849+45.81	0.47	0.90	On grade	10-year	5	2.25	0.94	30	2.14	2.45	1.29	0.016	0.82	0.47	6.04	6	0.15
"D2" 849+45.81	G-2	0.47	"D2" 851+81.16	0.34	0.90	On grade	10-year	5	2.25	0.68	30	3.86	3.51	1.15	0.016	0.88	0.27	4.15	6	0.15
"D2" 851+81.16	G-2	0.27	-	0.14	0.90	On grade	10-year	5	2.25	0.29	30	3.22	7.32	0.55	0.016	0.55	0.01	2.06	6	0.15

G-2 structure dimensions are based on ODOT std. drg. RD364. Grate size is 2.67' by 2.25'.

Appendix H. Pipe Capacity Analysis

I-205 CW - Phase 1: NE Leg
Preliminary Design Conveyance Calculations

Station From	Station To	Hydrology												Pipe Design									Comments	
		Area (acres)	C	CA	F (for diversion MH)	sum CA	Tc to from STA (min)	Tc in pipe (min)	sum Tc (min)	I (in/hr)	Q (cfs)	Addt'l Inflow* (cfs)	Total Q (cfs)	Diameter (inch)	Slope	Manning's n	Capacity (cfs)	Velocity (fps)	Q/Qf	Length (feet)	Invert Elevation US	Invert Elevation DS		
"L" 704+98.85	"L" 704+99.63	0.56	0.90	0.50		0.50	5.00	0.22	5.22	2.23	1.13		1.13	18	0.50%	0.013	7.44	4.21	0.15	56	74.66	74.38	ok	
"L" 704+99.63	"B2" 704+10.45	0.00	0.90	0.00		0.50	5.22	0.44	5.66	2.18	1.10		1.10	18	0.73%	0.013	9.00	5.09	0.12	134	74.18	73.20	ok	
"B2" 704+00.42	"B2" 704+10.45	0.20	0.90	0.18		0.18	5.00	0.14	5.14	2.25	0.40		0.40	18	0.53%	0.013	7.65	4.32	0.05	36	73.50	73.31	ok	
"B2" 704+10.45	"B2" 705+81.57	0.00	0.90	0.00		0.68	5.66	0.69	6.35	2.09	1.43		1.43	18	0.50%	0.013	7.42	4.19	0.19	173	73.00	72.14	ok	
"B2" 705+77.05	"B2" 705+81.57	0.12	0.90	0.11		0.11	5.00	0.06	5.06	2.26	0.24		0.24	18	2.79%	0.013	17.59	9.94	0.01	34	74.93	73.98	ok	
"B2" 705+81.57	"A2" 704+97.19	0.00	0.00	0.00		0.79	6.35	0.74	7.09	2.01	1.59		1.59	18	0.50%	0.013	7.44	4.21	0.21	186	71.94	71.01	ok	
"B2" 707+66.43	"A2" 704+97.19	0.11	0.90	0.10		0.10	5.00	0.10	5.10	2.26	0.22		0.22	12	0.55%	0.013	2.65	3.37	0.08	20	72.97	72.86	ok	
"A2" 704+97.19	"A2" 705+01.91	0.00	0.90	0.00		0.89	7.09	0.16	7.25	1.99	1.78		1.78	18	0.51%	0.013	7.53	4.26	0.24	41	70.81	70.60	ok	
"A2" 705+01.91	"A2" 703+26.53	0.23	0.90	0.21		1.10	7.25	0.23	7.48	1.98	2.17		2.17	18	3.21%	0.013	18.85	10.65	0.12	150	70.40	65.59	ok	
"B2" 709+51.44	"A2" 703+26.53	0.13	0.90	0.12		0.12	5.00	0.05	5.05	2.26	0.26		0.26	18	4.88%	0.013	23.25	13.14	0.01	41	68.09	66.09	ok	
"A2" 703+26.53	"A2" 701+84.25	0.13	0.90	0.12		1.33	7.48	0.21	7.69	1.96	2.61		2.61	18	3.27%	0.013	19.03	10.75	0.14	134	65.39	61.01	ok	
"A2" 701+84.25	"A2" 701+49.32	0.00	0.90	0.00	0.50	0.67	7.69	0.05	7.73	1.95	1.30		1.30	18	4.00%	0.013	21.05	11.90	0.06	33	60.81	59.49	ok	Diversion fraction TBD
"B2" 711+46.87	"A2" 701+49.32	0.12	0.90	0.11		0.11	5.00	0.07	5.07	2.26	0.24		0.24	18	2.03%	0.013	14.98	8.47	0.02	37	60.24	59.49	ok	
"A2" 701+49.32	Swale	0.13	0.90	0.12		0.89	7.73	0.05	7.79	1.95	1.74		1.74	18	2.63%	0.013	17.08	9.65	0.10	30	58.49	57.70	ok	
"A2" 701+84.25	"99E2" 115+34.87	0.00		0.00	0.50	0.67	7.69	0.20	7.89	1.95	1.30		1.30	18	4.01%	0.013	21.07	11.91	0.06	143	61.01	55.28	ok	Diversion fraction TBD
"99E2" 115+34.87	"99E2" 115+36.57	0.00		0.00		0.67	7.89	0.03	7.92	1.94	1.29		1.29	18	4.87%	0.013	23.22	13.13	0.06	23	55.08	53.96	ok	
"99E2" 113+74.42	"99E2" 113+86.99	2.59	0.90	2.33	0.50	1.17	10.00	0.03	10.03	1.77	2.06		2.06	18	4.10%	0.013	21.31	12.04	0.10	20	56.25	55.43	ok	Flow from bridge drop pipe, diversion TBD
"99E2" 113+74.42	"99E2" 113+91.64			0.00	0.50	1.17	10.03	0.06	10.09	1.77	2.06		2.06	18	1.00%	0.013	10.52	5.95	0.20	21	56.25	56.04	ok	Diversion fraction TBD
"99E2" 113+91.64	Swale			0.00		1.17	10.09	0.10	10.18	1.76	2.06		2.06	18	1.00%	0.013	10.52	5.95	0.20	35	55.84	55.49	ok	
"L" 699+22.67	"L" 699+11.58	0.47	0.90	0.42		0.42	5.00	0.09	5.09	2.26	0.96		0.96	12	4.52%	0.013	7.59	9.65	0.13	50	72.49	70.23	ok	Existing
"L" 699+11.58	"L" 699+24.36	0.00	0.90	0.00		0.42	5.09	0.07	5.16	2.25	0.95		0.95	12	0.50%	0.013	2.52	3.21	0.38	14	70.23	70.16	ok	
"L" 699+24.36	"L" 700+07.18	0.11	0.90	0.10		0.52	5.16	0.42	5.58	2.20	1.15		1.15	12	0.51%	0.013	2.54	3.23	0.45	81	70.16	69.75	ok	
"L" 700+07.18	"C2" 701+76.51	0.39	0.90	0.35		0.87	5.58	0.87	6.45	2.08	1.82		1.82	12	0.50%	0.013	2.52	3.20	0.72	167	69.75	68.92	ok	
"L" 701+99.46	"C2" 701+76.51	0.41	0.90	0.37		0.37	5.00	0.13	5.13	2.25	0.83		0.83	12	3.67%	0.013	6.83	8.69	0.12	66	73.15	70.73	ok	Existing
"L" 703+08.01	"C2" 701+76.51	0.39	0.90	0.35		0.35	5.00	0.66	5.66	2.18	0.77		0.77	12	0.52%	0.013	2.58	3.28	0.30	130	72.66	71.98	ok	
"C2" 701+76.51	"C2" 701+39.47	0.00	0.90	0.00		1.59	6.45	0.16	6.61	2.06	3.28		3.28	18	2.60%	0.013	16.96	9.58	0.19	94	68.92	66.48	ok	
"C2" 701+39.47	"C2" 702+01.71	0.17	0.90	0.15		1.75	6.61	0.24	6.85	2.03	3.55		3.55	18	0.49%	0.013	7.38	4.17	0.48	61	66.28	65.98	ok	
"C2" 702+01.71	"C2" 702+89.10	0.06	0.90	0.05		1.80	6.85	0.18	7.04	2.01	3.62		3.62	18	1.69%	0.013	13.70	7.74	0.26	85	65.78	64.34	ok	
"C2" 702+89.10	"C2" 702+90.61	0.06	0.90	0.05		1.85	7.04	0.16	7.19	2.00	3.71		3.71	18	0.49%	0.013	7.35	4.15	0.51	39	64.14	63.95	ok	
"C2" 702+90.61	"D2" 703+67.14	0.00	0.90	0.00		1.85	7.19	0.35	7.54	1.97	3.65		3.65	18	2.48%	0.013	16.59	9.38	0.22	196	63.74	58.87	ok	
"D2" 703+67.14	"D2" 701+29.99	0.52	0.90	0.47		2.32	7.54	0.24	7.79	1.95	4.54		4.54	18	5.13%	0.013	23.84	13.47	0.19	198	58.67	48.51	ok	
"D2" 701+29.99	"D2" 701+25.24	0.00	0.90	0.00	0.50	1.16	7.79	0.03	7.81	1.95	2.26		2.26	18	2.00%	0.013	14.88	8.41	0.15	13	48.51	48.25	ok	Diversion fraction TBD
"D2" 701+29.99	"D2" 700+96.07	0.00	0.90	0.00	0.50	1.16	7.79	0.05	7.84	1.95	2.26		2.26	18	3.50%	0.013	19.69	11.13	0.11	36	48.51	47.25	ok	Diversion fraction TBD
"D2" 700+94.21	"D2" 700+96.07	0.17	0.90	0.15		0.15	5.00	0.06	5.06	2.26	0.35		0.35	12	0.45%	0.013	2.41	3.06	0.14	11	47.30	47.25	ok	
"D2" 700+96.07	Swale	0.00	0.90	0.00		1.31	7.84	0.05	7.89	1.95	2.56		2.56	18	0.57%	0.013	7.96	4.50	0.32	14	47.25	47.17	ok	
"D2" 701+25.24	"99E2" 109+35.60		0.90	0.00		1.16	7.81	0.34	8.15	1.92	2.23		2.23	12	1.00%	0.013	3.57	4.54	0.62	92	43.33	42.41	ok	Existing
"99E2" 109+35.60	"99E2" 110+17.87	0.55	0.90	0.50		1.16	8.15	0.25	8.40	1.89	2.20		2.20	18	0.84%	0.013	9.67	5.46	0.23	83	40.14	39.44	ok	Estimated flow from existing inlets
"99E2" 111+68.75	"99E2" 111+70.20	2.67	0.90	2.41	0.50	1.20	10.00	0.11	10.11	1.76	2.12		2.12	18	0.48%	0.013	7.30	4.13	0.29	27	52.79	52.66	ok	Flow from bridge drop pipe, diversion TBD
"99E2" 111+70.20	Swale		0.90	0.00		1.20	10.11	0.05	10.16	1.76	2.12		2.12	18	3.30%	0.013	19.12	10.80	0.11	30	52.66	51.67	ok	
"99E2" 111+68.75	"99E2" 111+62.31		0.90	0.00	0.50	1.20	10.00	0.02	10.02	1.77	2.13		2.13	18	3.92%	0.013	20.85	11.78	0.10	13	52.79	52.28	ok	
"99E2" 110+18.98	"99E2" 110+17.87		0.90	0.00		2.52	10.02	0.06	10.08	1.77	4.45		4.45	18	3.96%	0.013	20.93	11.83	0.21	46	47.02	45.20	ok	
"99E2" 110+17.87	"99E2" 111+62.31		0.90	0.00		3.68	10.08	0.44	10.52	1.74	6.38		6.38	18	0.85%	0.013	9.69	5.48	0.66	145	39.44	38.21	ok	Existing
"99E2" 111+62.31	"99E2" 112+04.98		0.90	0.00		4.88	10.52	0.12	10.65	1.73	8.43		8.43	18	0.95%	0.013	10.28	5.81	0.82	43	38.21	37.80	ok	Existing
"99E2" 112+04.98	"99E2" 113+86.99		0.90	0.00		4.88	10.65	0.39	11.03	1.70	8.30		8.30	24	1.25%	0.013	25.36	8.06	0.33	187	37.78	35.44	ok	Existing
"99E2" 113+86.99	"99E2" 115+36.07		0.90	0.00		6.05	11.03	0.37	11.40	1.68	10.16		10.16	24	0.97%	0.013	22.30	7.09	0.46	157	35.39	33.87	ok	Existing
"99E2" 115+36.57	"99E2" 115+36.07		0.90	0.00		2.72	10.18	0.04	10.22	1.76	4.78		4.78	18	2.05%	0.013	15.08	8.52	0.32	19	53.76	53.37	ok	
"99E2" 115+36.07	"99E2" 115+95.64		0.90	0.00		8.77	11.40	0.15	11.55	1.68	14.69		14.69	24	1.00%	0.013	22.67	7.21	0.65	64	33.87	33.23	ok	Existing
"L" 695+74.21	"L" 695+66.12	0.56	0.90	0.50		0.50	5.00	0.07	5.07	2.26	1.14		1.14	18	7.73%	0.013	29.26	16.53	0.04	66	72.12	67.02	ok	
"L" 695+66.12	"L" 694+54.42	0.00	0.90	0.00		0.50	5.07	0.43	5.50	2.20	1.11		1.11	18	0.50%	0.013	7.41	4.19	0.15	109	66.98	66.44	ok	
"L" 694+54.42	"L" 693+94.84	0.00	0.90	0.00		0.50	5.50	0.20	5.70	2.17	1.09		1.09	18	0.64%	0.013	8.41	4.75	0.13	58	66.26	65.89	ok	
"L" 693+98.26	"L" 693+94.84	0.29	0.90	0.26		0.26	5.00	0.26	5.26	2.23	0.58		0.58	15	0.51%	0.013	4.61	3.76	0.13	59	66.12	65.82	ok	Existing
"L" 693+94.84	"L" 691+70.34	0.30	0.90	0.27		1.04	5.70	0.87	6.58	2.07	2.14		2.14	18	0.50%	0.013	7.44	4.21	0.29	220	65.71	64.61	ok	
"L" 684+98.63	"L" 685+99.03	0.05	0.90	0.05		0.05	5.00	0.65	5.65	2.18	0.10		0.10	12	0.46%	0.013	2.43	3.09	0.04	121	57.13	56.57	ok	Existing
"L" 685+43.24	"L" 685+82.29	0.04	0.90	0.04		0.04	5.00	0.20	5.20	2.25	0.08		0.08	12	0.51%	0.013	2.56	3.25	0.03	39	55.99	55.79	ok	
"L" 685+82.29	"L" 686+46.66	0.10	0.90	0.09		0.13	5.20	0.34	5.54	2.20	0.28		0.28	12	0.51%	0.013	2.54	3.23	0.11	65	55.67	55.34	ok	
"L" 688+78.02	"L" 687+36.94	0.28	0.90	0.25		0.25	5.00	0.36	5.36	2.22	0.56		0.56	12	2.09%	0.013	5.15	6.55	0.11	141	62.99	60.05	ok	
"L" 687+36.94	"L" 686+46.66	0.23	0.90	0.21		0.46	5.36	0.15	5.50	2.20	1.01		1.01	12	5.01%	0.013	7.99	10.16	0.13	89	60.05	55.59	ok	
"L" 686+46.66	"L" 685+99.03	0.14	0.90	0.13		0.71	5.54	0.43	5.96	2.14	1.52		1.52	12	0.51%	0.013	2.54	3.23	0.60	83	55.09	54.67	ok	Existing
"L" 685+99.03	"L" 686+60.59	0.37	0.90	0.33		1.09	5.96	0.33	6.29	2.11	2.29		2.29	12	0.49%	0.013	2.50	3.18	0.92	63	54.67	54.36	ok	
"L" 686+60.59	"L" 688+92.74	0.00	0.90	0.00		1.09	6.29	1.19	7.48	1.98	2.15		2.15	12	0.50%	0.013	2.53	3.22	0.85	230	54.36	53.20	ok	
"L" 688+92.74	"L" 690+47.07	0.19	0.90	0.17		1.26	7.48	0.79	8.27	1.91	2.41		2.41	12	0.50%	0.013	2.52	3.21	0.95	152	53.20	52.44	ok	
"L" 690+48.91	"L" 690+47.07	0.53	0.90	0.48		0.48	5.00	0.07	5.07	2.26	1.08		1.08	12	8.21%	0.013	10.23	13.00	0.11	58	66.01	61.25	ok	Existing
"L" 690+47.07	"L" 691+70.34	0.45	0.90	0.41		2.14	8.27	0.48	8.75	1.87	4.00		4.00	18	0.50%	0.013	7.41	4.19	0.54	121	51.92	51.32	ok	
"L" 691+70.34	"L" 691+62.42	0.00	0.90	0.00		3.18	8.75	0.05	8.80	1.86	5.90		5.90	18	15.31%	0.013	41.18	23.27	0.14	68	51.32	40.91	ok	
"L" 691+62.42	Outfall		0.90	0.00	0.50	1.59	8.80	0.32	9.12	1.83	2.91		2.91	18	5.29%	0.013	24.21	13.68	0.12	263	43.91	29.99	ok	Diversion fraction TBD
"L" 691+62.42	"L" 691+61.83		0.90	0.00	0.50	1.59	8.80	0.06	8.86	1.86	2.95		2.95	18	0.50%	0.013	7.44	4.21	0.40	14	40.71	40.64	ok	Diversion fraction TBD
"L" 691+61.83	Swale		0.90	0.00		1.59	8.86	0.03	8.88	1.86	2.95		2.95	18	1.36%	0.013	12.29	6.95	0.24	11	40.64	40.49	ok	

I-205 CW: Phase 1 - Hilltop to OR43
Preliminary Design Conveyance Calculations

Station From	Station To	Hydrology												Pipe Design							Invert Elevation		Comments	
		Area (acres)	C	CA	F (for diversion MH)	sum CA	Tc to from STA (min)	Tc in pipe (min)	sum Tc (min)	I (in/hr)	Q (cfs)	Addt'l Inflow* (cfs)	Total Q (cfs)	Diameter (inch)	Slope	Manning's n	Capacity (cfs)	Velocity (fps)	Q/Qf	Length (feet)	US	DS		
"Ls" 792+31.61	"Ls" 789+49.56	0.57	0.90	0.51		0.51	5.00	0.95	5.95	2.14	1.10		1.10	12	1.21%	0.013	3.92	4.99	0.28	283	281.51	278.09	ok	
"Ls" 789+49.56	"Ls" 789+49.28	0.41	0.90	0.37		0.88	5.95	0.04	5.99	2.14	1.89		1.89	12	1.43%	0.013	4.27	5.42	0.44	14	277.89	277.69	ok	
"Ls" 789+49.28	"Ls" 786+96.91	0.00	0.90	0.00		0.88	5.99	0.70	6.69	2.06	1.82		1.82	12	1.75%	0.013	4.72	6.00	0.38	252	277.49	273.09	ok	
"Ls" 786+96.91	"Ls" 784+59.81	0.34	0.90	0.31		1.19	6.69	0.59	7.28	1.99	2.37		2.37	12	2.19%	0.013	5.28	6.72	0.45	237	272.94	267.75	ok	
"Ls" 784+59.81	"Ls" 782+17.89	0.34	0.90	0.31		1.49	7.28	0.54	7.82	1.95	2.91		2.91	12	2.72%	0.013	5.89	7.48	0.49	242	267.61	261.03	ok	
"Ls" 782+17.89	Lsc2_779+44.19	0.33	0.90	0.30		1.79	7.82	0.60	8.41	1.89	3.39		3.39	12	2.94%	0.013	6.12	7.78	0.55	279	260.90	252.70	ok	
Lsc2_779+44.19	Lsc2_776+67.90	0.40	0.90	0.36		2.15	8.41	0.59	9.01	1.84	3.96		3.96	12	2.94%	0.013	6.12	7.78	0.65	277	252.57	244.43	ok	
Lsc2_776+67.90	Lsc2_773+93.32	0.35	0.90	0.32		2.47	9.01	0.59	9.60	1.81	4.45		4.45	12	2.94%	0.013	6.12	7.78	0.73	275	244.30	236.21	ok	
Lsc2_773+93.32	Lsc2_771+42.83	0.40	0.90	0.36		2.83	9.60	0.55	10.14	1.76	4.98		4.98	12	2.85%	0.013	6.02	7.66	0.83	251	236.08	228.93	ok	
Lsc2_771+42.83	"Lc2" 768+40.11	0.37	0.90	0.33		3.16	10.14	0.65	10.80	1.72	5.44		5.44	12	2.87%	0.013	6.05	7.69	0.90	302	228.80	220.13	ok	
"Lc2" 768+40.11	"Lc2" 766+31.15	0.41	0.90	0.37		3.53	10.80	0.34	11.14	1.70	5.98		5.98	18	2.88%	0.013	17.87	10.10	0.33	207	220.00	214.03	ok	
"Lc2" 766+31.15	"Lc2" 763+56.41	0.29	0.90	0.26		3.79	11.14	0.45	11.59	1.68	6.35		6.35	18	2.90%	0.013	17.93	10.13	0.35	272	213.90	206.01	ok	
"Lc2" 763+56.41	"Lc2" 762+11.78	0.39	0.90	0.35		4.14	11.59	0.24	11.83	1.66	6.87		6.87	18	2.79%	0.013	17.58	9.94	0.39	143	205.87	201.88	ok	
"Lc2" 762+11.78	"Lc2" 761+22.45	0.20	0.90	0.18		4.32	11.83	0.13	11.96	1.66	7.15		7.15	18	3.66%	0.013	20.13	11.38	0.36	91	201.78	198.45	ok	
"Lc2" 761+22.45	"Lc2" 760+48.66			0.00		4.32	60.00	0.09	60.09	0.58	2.51	27.1	29.61	24	3.08%	0.013	39.81	12.66	0.74	71	198.49	196.30	ok	Offsite Basin B
"Lc2" 760+48.19	"Lc2" 760+48.41	0.90	0.90	0.81		0.81	5.00	0.09	5.09	2.26	1.83		1.83	12	5.79%	0.013	8.59	10.92	0.21	61	200.42	196.89	ok	Verify upstream IE
"Lc2" 760+48.41	"Lc2" 760+48.66	0.23	0.90	0.21		1.02	5.09	0.01	5.10	2.26	2.30		2.30	12	14.14%	0.013	13.42	17.07	0.17	7	196.89	195.90	ok	
"Lc2" 760+48.66	"Lc2" 756+54.84	0.00	0.90	0.00		52.06	60.09	0.55	60.65	0.58	30.20		30.20	24	2.66%	0.013	36.98	11.75	0.82	389	195.90	185.55	ok	Existing; converted SBUH flow to rational
"Lc2" 758+50.00	Ditch	0.29	0.90	0.26		0.26	5.00	0.07	5.07	2.26	0.59		0.59	8	2.68%	0.013	1.98	5.67	0.30	25	192.17	191.50	ok	
"Lc2" 756+51.40	"Lc2" 756+52.77	0.56	0.90	0.50		0.50	5.00	0.16	5.16	2.25	1.13		1.13	12	2.27%	0.013	5.37	6.83	0.21	64	187.00	185.55	ok	Verify existing IE
"Lc2" 756+52.77	"Lc2" 756+54.84	0.26	0.90	0.23		0.74	5.16	0.01	5.16	2.25	1.66		1.66	12	5.00%	0.013	7.98	10.15	0.21	4	185.55	185.35	ok	Verify existing IE
"Lc2" 756+54.84	"Lc2" 753+92.91	0.00	0.90	0.00		52.80	60.65	0.38	61.03	0.58	30.62		30.62	24	2.46%	0.013	35.58	11.31	0.86	259	185.35	178.97	ok	
"Lc2" 753+83.29	"Lc2" 753+93.62	0.32	0.90	0.29		0.29	5.00	0.05	5.05	2.26	0.65		0.65	12	0.50%	0.013	2.52	3.21	0.26	10	182.03	181.98	ok	
"Lc2" 753+93.62	"Lc2" 753+97.90	0.00	0.90	0.00		0.29	5.05	0.11	5.17	2.25	0.65		0.65	12	4.90%	0.013	7.90	10.04	0.08	69	182.96	179.58	ok	Verify existing IE
"Lc2" 753+97.90	"Lc2" 753+92.91	0.43	0.90	0.39		0.68	5.17	0.06	5.23	2.23	1.51		1.51	12	0.25%	0.013	1.78	2.27	0.84	8	179.58	179.56	ok	Verify existing IE
"Lc2" 753+92.91	"Lc2" 750+45.82	0.00	0.90	0.00		53.47	61.03	0.51	61.54	0.58	31.02		31.02	24	2.46%	0.013	35.58	11.31	0.87	347	178.97	170.42	ok	
"Lc2" 750+46.08	"Lc2" 750+44.15	0.35	0.90	0.32		0.32	5.00	0.31	5.31	2.22	0.70		0.70	12	0.47%	0.013	2.46	3.13	0.28	59	171.49	171.21	ok	Verify existing IE
"Lc2" 750+44.15	"Lc2" 750+45.82	0.15	0.90	0.14		0.45	5.31	0.01	5.32	2.22	1.00		1.00	12	11.29%	0.013	11.99	15.25	0.08	7	171.21	170.42	ok	Verify existing IE
"Lc2" 750+45.82	"Lc2" 747+39.45	0.00	0.90	0.00		53.92	61.54	0.37	61.91	0.58	31.28		31.28	36	2.15%	0.013	98.00	13.85	0.32	308	170.32	163.70	ok	
"Lc2" 747+39.13	"Lc2" 747+39.45	0.14	0.90	0.13		0.13	5.00	0.01	5.01	2.26	0.28		0.28	8	27.29%	0.013	6.32	18.09	0.05	7	165.61	163.70	ok	Verify existing IE
"Lc2" 747+39.45	"L" 744+94.33_EXTG	0.00	0.90	0.00		54.05	61.91	0.30	62.21	0.58	31.35		31.35	36	2.10%	0.013	96.92	13.69	0.32	244	163.7	158.57	ok	
"C4" 744+91.18	"L" 744+94.33_EXTG	0.12	0.90	0.11		0.11	5.00	0.02	5.02	2.26	0.24		0.24	12	2.63%	0.013	5.78	7.35	0.04	8	163.71	163.5	ok	
"L" 742+95.62_EXTG	"L" 742+96.87_EXTG	0.12	0.90	0.11		0.11	20.00	0.01	20.01	1.29	0.14	8.38	8.52	18	8.29%	0.013	30.30	17.12	0.28	7	160.58	160.00	ok	Offsite Basin A
"L" 744+94.33_EXTG	"L" 742+96.87_EXTG		0.90	0.00		54.16	62.21	0.29	62.49	0.58	31.41		31.41	36	1.52%	0.013	82.47	11.65	0.38	201	157.60	154.54	ok	
"L" 742+96.87_EXTG	"L" 741+99.97		0.90	0.00	0.35	21.27	62.49	0.31	62.81	0.58	12.33		12.33	18	2.50%	0.013	16.64	9.40	0.74	176	154.40	150.00	ok	Converted SBUH flow to rational
"L" 742+96.87_EXTG	"C4" 739+98.82_EXTG		0.90	0.00	0.65	39.50	62.49	0.27	62.76	0.58	22.91		22.91	36	3.77%	0.013	129.80	18.34	0.18	297	154.44	143.24	ok	Converted SBUH flow to rational
"C4" 739+98.82_EXTG	"C4" 736+32.28_EXTG	0.18	0.90	0.16		39.66	62.76	0.28	63.04	0.58	23.00		23.00	36	5.20%	0.013	152.39	21.53	0.15	364	143.14	124.22	ok	
"C4" 736+32.28_EXTG	"OR43" 6+05.93	0.22	0.90	0.20		39.86	63.04	0.19	63.23	0.58	23.12		23.12	36	3.30%	0.013	121.38	17.15	0.19	195	124.14	117.71	ok	
"OR43" 6+00.95	"OR43" 6+05.93	0.11	0.90	0.10		0.10	5.00	0.07	5.07	2.26	0.22		0.22	12	0.54%	0.013	2.62	3.33	0.09	13	119.01	118.94	ok	
"OR43" 6+05.93	"OR43" 5+96.78		0.90	0.00		39.95	63.23	0.07	63.30	0.58	23.17		23.17	36	0.89%	0.013	62.91	8.89	0.37	35	117.51	117.20	ok	
"OR43" 5+30.45	"OR43" 5+40.27	0.07	0.90	0.06		0.06	5.00	0.02	5.02	2.26	0.14		0.14	12	3.09%	0.013	6.28	7.98	0.02	11	119.04	118.70	ok	
"OR43" 5+40.27	"OR43" 5+96.78	0.07	0.90	0.06		0.13	5.02	0.21	5.23	2.23	0.28		0.28	12	1.15%	0.013	3.82	4.86	0.07	61	118.70	118.00	ok	
"L" 742+00.34	"L" 741+97.14	0.35	0.90	0.32		0.32	5.00	0.09	5.09	2.26	0.71		0.71	12	7.56%	0.013	9.82	12.48	0.07	71	155.60	150.23	ok	
"L" 741+97.14	"L" 741+99.97	0.37	0.90	0.33		0.65	5.09	0.06	5.15	2.25	1.46		1.46	12	0.45%	0.013	2.41	3.06	0.61	11	150.05	150.00	ok	
"L" 741+99.97	"L" 741+50.10		0.90	0.00		21.91	62.81	0.16	62.96	0.58	12.71		12.71	24	0.50%	0.013	16.03	5.10	0.79	48	149.90	149.66	ok	
"L" 741+50.10	"B4" 741+73.00		0.90	0.00	0.92	20.23	62.96	0.05	63.01	0.58	11.73		11.73	24	11.59%	0.013	77.17	24.53	0.15	68	149.46	141.58	ok	
"L" 741+50.10	"L" 739+65.94		0.90	0.00	0.08	1.69	62.96	0.58	63.54	0.58	0.98		0.98	24	0.50%	0.013	16.03	5.10	0.06	178	149.50	148.61	ok	
"Lc2" 744+45.59	"Lc2" 744+40.37	0.44	0.90	0.40		0.40	5.00	0.10	5.10	2.26	0.89		0.89	12	5.69%	0.013	8.52	10.83	0.11	62	157.47	153.94	ok	
"Lc2" 744+40.37	"B4" 744+40.80	0.04	0.90	0.04		0.43	5.10	0.07	5.16	2.25	0.97		0.97	12	4.37%	0.013	7.46	9.49	0.13	38	153.94	152.28	ok	
"B4" 744+40.80	"B4" 744+39.54	0.76	0.90	0.68		1.12	5.16	0.05	5.21	2.23	2.49		2.49	12	1.20%	0.013	3.91	4.97	0.64	15	154.17	153.99	ok	
"WA3" 741+97.36	"WA3" 741+95.19	0.16	0.90	0.14		0.14	5.00	0.11	5.11	2.25	0.32		0.32	12	2.00%	0.013	5.05	6.42	0.06	44	166.01	165.13	ok	
"WA3" 741+95.19	"B4" 744+39.54	0.21	0.90	0.19		0.33	5.11	0.04	5.15	2.25	0.75		0.75	12	21.20%	0.013	16.43	20.89	0.05	46	165.13	155.38	ok	
"Ln" 791+33.97	Ditch	0.51	0.90	0.46		0.46	5.00	0.05	5.05	2.26	1.04		1.04	12	0.77%	0.013	3.13	3.98	0.33	13	275.20	275.10	ok	
"Ln" 790+01.30	Ditch	0.17	0.90	0.15		0.15	5.00	0.02	5.02	2.26	0.35		0.35	12	3.85%	0.013	7.00	8.90	0.05	13	273.60	273.10	ok	
"Ln" 788+26.84	"Ln" 788+16.53	0.24	0.90	0.22		0.22	5.00	0.03	5.03	2.26	0.49		0.49	12	1.20%	0.013	3.91	4.97	0.12	10	270.62	270.50	ok	
"Ln" 788+16.53	Ditch	0.00	0.90	0.00		0.22	5.03	0.05	5.08	2.26	0.49		0.49	12	0.92%	0.013	3.42	4.35	0.14	12	270.50	270.39	ok	
"Ln" 783+68.80	"Ln" 783+66.59	0.00	0.90	0.00		0.83	9.29	0.22	9.51	1.81	1.49		1.49	18	1.25%	0.013	11.77	6.65	0.13	88	261.19	260.09	ok	Ditch travel time added
"Ln" 783+66.59	"Ln" 783+65.66	0.77	0.90	0.69		1.52	9.51	0.04	9.55	1.81	2.75		2.75	18	0.83%	0.013	9.61	5.43	0.29	12	258.95	258.85	ok	
"Ln" 783+65.66	"Ln" 782+13.00	0.00	0.90	0.00		1.52	9.55	0.26	9.81	1.78	2.71		2.71	18	2.63%	0.013	17.08	9.65	0.16	153	258.85	254.82	ok	
"Ln" 782+13.41	"Ln" 782+13.00	0.32	0.90	0.29		0.29	5.00	0.02	5.02	2.26	0.65		0.65	12	4.92%	0.013	7.91	10.06	0.08	12	257.41	256.82	ok	
"Ln" 782+13.00	"Ln" 780+59.25	0.00	0.90	0.00		1.81	9.81	0.26	10.08	1.77	3.20		3.20	18	2.46%	0.013	16.51	9.33	0.19	148	254.62	250.98	ok	
"Lnc" 780+60.09	"Lnc" 780+59.25	0.26	0.90	0.23		0.23	5.00	0.02	5.02	2.26	0.53		0.53	12	6.67%	0.013	9.22	11.72	0.06	12	253.68	252.88	ok	
"Lnc" 780+59.25	"Lnc" 777+58.88	0.00	0.90	0.00		2.04	10.08	0.51	10.59	1.74	3.54		3.54	18	2.69%	0.013	17.26	9.76	0.21	300	250.78	242.71	ok	
"Lnc" 777+59.72	"Lnc" 777+58.88	0.53	0.90	0.48		0.48	5.00	0.01	5.01	2.26	1.08		1.08	12	24.36%	0.013	17.62	22.40	0.06	11	245.39	242.71	ok	
"Lnc" 777+58.88	"Lnc" 774+57.81	0.00	0.90	0.00		2.52	10.59	0.62	11.21	1.69	4.26		4.26	18	1.85%	0.013	14.33	8.10	0.30	301	242.51	236.93	ok	
"Lnc" 774+57.81	"Lnc" 771+56.27	0.45	0.90	0.41		2.93	11.21	0.52	11.73	1.67	4.87		4.87	18	2.68%	0.013	17.23	9.74	0.28	301	236.73	228.66	ok	
"Lnc" 771+56.27	"Lc2" 768+55.24	0.40	0.90	0.36		3.29	11.73	0.50	12.23	1.64	5.39		5.39	18	2.81%	0.013	17.64	9.97	0.31	301	228.46	220.00	ok	
"Lc2" 768+55.24	"Lc2" 766+67.81	0.46	0.90	0.41		3.70	12.23	0.35	12.58	1.63	6.01		6.01	18	2.35%	0.013	16.13	9.12	0.37	189	219.80	215.36	ok	

I-205 CW: Phase 1 - Hilltop to OR43
Preliminary Design Conveyance Calculations

Station From	Station To	Hydrology												Pipe Design									Comments	
		Area (acres)	C	CA	F (for diversion MH)	sum CA	Tc to from STA (min)	Tc in pipe (min)	sum Tc (min)	I (in/hr)	Q (cfs)	Addt'l Inflow* (cfs)	Total Q (cfs)	Diameter (inch)	Slope	Manning's n	Capacity (cfs)	Velocity (fps)	Q/Qf	Length (feet)	Invert Elevation			
																					US	DS		
"Lc2" 766+67.81	Riprap pad	0.34	0.90	0.31		4.01	12.58	0.62	13.20	1.60	6.39		6.39	18	2.08%	0.013	15.19	8.59	0.42	321	215.16	208.47	ok	
"L" 749+26.39	Riprap pad	0.68	0.90	0.61		0.61	5.00	0.05	5.05	2.26	1.38		1.38	12	1.00%	0.013	3.57	4.54	0.39	14	166.21	166.07	ok	
"Lc2" 747+79.20	"L" 747+99.34	0.32	0.90	0.29		0.29	5.00	0.17	5.17	2.25	0.65		0.65	12	2.99%	0.013	6.17	7.84	0.10	81	164.15	161.73	ok	
"L" 747+99.34	Riprap pad	0.23	0.90	0.21		0.50	5.17	0.06	5.24	2.23	1.11		1.11	12	0.94%	0.013	3.46	4.40	0.32	17	161.73	161.57	ok	
"B4" 744+39.54_DITCH	"B4" 743+31.78	0.00	0.90	0.00		6.56	17.54	0.13	17.66	1.42	9.29		9.29	24	3.84%	0.013	44.42	14.12	0.21	106	154.02	149.95	ok	
"B4" 743+31.78	"B4" 741+73.01	0.38	0.90	0.34		6.90	17.66	0.16	17.82	1.42	9.77		9.77	24	4.51%	0.013	48.16	15.31	0.20	148	143.68	137	ok	
"B4" 741+73.00	"B4" 741+73.01	0.10	0.90	0.09		20.32	63.01	0.02	63.03	0.58	11.78		11.78	24	3.33%	0.013	41.39	13.16	0.28	15	139.5	139	ok	
"B4" 741+73.01	"B4" 740+19.00		0.90	0.00		27.22	63.03	0.15	63.18	0.58	15.79		15.79	24	4.69%	0.013	49.09	15.61	0.32	145	137	130.2	ok	
"B4" 740+19.01	"B4" 740+19.00	0.11	0.90	0.10		0.10	5.00	0.02	5.02	2.26	0.22		0.22	12	7.14%	0.013	9.54	12.13	0.02	14	132.2	131.2	ok	
"B4" 740+19.00	"B4" 739+10.44		0.90	0.00		27.32	63.18	0.11	63.29	0.58	15.85		15.85	24	4.30%	0.013	46.99	14.94	0.34	101	130.20	125.86	ok	
"B4" 739+13.79	"B4" 739+10.44	0.07	0.90	0.06		0.06	5.00	0.06	5.06	2.26	0.14		0.14	12	1.86%	0.013	4.86	6.18	0.03	21	129.05	128.66	ok	
"B4" 739+10.44	"E3" 739+15.44		0.90	0.00		27.38	63.29	0.54	63.83	0.58	15.88		15.88	24	0.61%	0.013	17.70	5.63	0.90	182	126.41	125.3	ok	
"E3" 739+15.44	"OR43" 12+64.91	0.28	0.90	0.25		27.63	63.83	0.17	64.00	0.58	16.03		16.03	24	1.46%	0.013	27.40	8.71	0.59	89	125.30	124.00	ok	
"OR43" 12+64.91	"OR43" 12+35.36		0.90	0.00	0.00	0	64.00	0.06	64.07	0.58	0.00		0.00	24	3.04%	0.013	39.55	12.57	0.00	46	123.90	122.50	ok	
"OR43" 12+64.91	"OR43" 12+49.77		0.90	0.00	1.00	27.63	64.00	0.05	64.05	0.58	16.03		16.03	24	0.95%	0.013	22.12	7.03	0.72	21	123.90	123.70	ok	
"OR43" 12+49.77	"OR43" 12+35.14		0.90	0.00	0.00	0	64.05	0.07	64.13	0.58	0.00		0.00	12	0.63%	0.013	2.82	3.59	0.00	16	123.70	123.60	ok	
"OR43" 12+49.77	"OR43" 12+15.17		0.90	0.00	1.00	27.63	64.05	0.12	64.18	0.58	16.03		16.03	24	0.96%	0.013	22.23	7.07	0.72	52	123.30	122.80	ok	
"L" 739+68.75_EXTG	"L" 739+69.26	0.33	0.90	0.30		0.30	5.00	0.12	5.12	2.25	0.67		0.67	12	4.09%	0.013	7.22	9.18	0.09	66	154.16	151.46	ok	
"L" 739+69.26	"L" 739+65.94	0.32	0.90	0.29		0.59	5.12	0.02	5.14	2.25	1.31		1.31	12	4.58%	0.013	7.64	9.72	0.17	12	151.55	151.00	ok	
"L" 739+65.94	"L" 737+92.84		0.90	0.00		2.27	63.54	0.55	64.09	0.58	1.32		1.32	24	0.50%	0.013	16.03	5.10	0.08	168	148.54	147.70	ok	
"L" 735+83.55	"L" 735+83.86	0.20	0.90	0.18		0.18	5.00	0.14	5.14	2.25	0.40		0.40	12	2.19%	0.013	5.29	6.72	0.08	57	150.26	149.01	ok	
"L" 735+83.86	"L" 737+34.33	0.29	0.90	0.26		0.44	5.14	0.59	5.73	2.17	0.96		0.96	18	0.50%	0.013	7.44	4.21	0.13	148	149.01	148.27	ok	
"L" 737+37.54_EXTG	"L" 737+34.33	0.30	0.90	0.27		0.27	5.00	0.13	5.13	2.25	0.61		0.61	12	2.64%	0.013	5.80	7.38	0.10	59	150.03	148.47	ok	
"L" 737+34.33	"L" 737+92.84	0.29	0.90	0.26		0.71	5.73	0.23	5.96	2.14	1.52		1.52	18	0.50%	0.013	7.44	4.21	0.20	58	148.01	147.72	ok	
"L" 737+92.84	Swale 8		0.90	0.00		2.98	64.09	0.15	64.25	0.58	1.73		1.73	21	0.48%	0.013	10.96	4.55	0.16	42	147.70	147.50	ok	
"B4" 738+92.17_DITCH	"B4" 738+75.49_DITCH		0.90	0.00		2.98	64.25	0.03	64.28	0.58	1.73		1.73	18	2.63%	0.013	17.07	9.65	0.10	19	141.50	141.00	ok	
"B4" 738+75.49_DITCH	"E3" 738+62.32_DITCH		0.90	0.00		2.98	64.28	0.02	64.30	0.58	1.73		1.73	18	5.26%	0.013	24.15	13.65	0.07	19	141.00	140.00	ok	
"E3" 738+62.32_DITCH	"E3" 738+61.43		0.90	0.00		2.98	64.30	0.04	64.34	0.58	1.73		1.73	18	5.07%	0.013	23.70	13.39	0.07	29	138.47	137.00	ok	
"E3" 738+61.43	"E3" 738+63.13		0.90	0.00		2.98	64.34	0.08	64.42	0.58	1.73		1.73	18	4.60%	0.013	22.58	12.76	0.08	63	131.90	129.00	ok	
"E3" 738+63.13	"OR43" 12+15.17		0.90	0.00		2.98	64.42	0.10	64.53	0.58	1.73		1.73	18	5.47%	0.013	24.60	13.90	0.07	86	127.80	123.10	ok	
"OR43" 12+15.17	"OR43" 8+90.34		0.90	0.00		30.62	64.53	0.42	64.95	0.58	17.76		17.76	24	1.58%	0.013	28.53	9.07	0.62	231	122.80	119.14	ok	
"OR43" 12+35.14	Swale 7		0.90	0.00		0	64.13	0.02	64.15	0.58	0.00		0.00	12	4.55%	0.013	7.61	9.68	0.00	11	124.00	123.50	ok	
"OR43" 9+50.68_DITCH	"OR43" 9+52.79_DITCH		0.90	0.00		0	64.15	0.06	64.21	0.58	0.00		0.00	18	0.47%	0.013	7.19	4.06	0.00	15	118.68	118.61	ok	
"OR43" 9+52.79_DITCH	"OR43" 8+90.34		0.90	0.00		0	64.21	0.24	64.45	0.58	0.00		0.00	18	0.50%	0.013	7.44	4.21	0.00	60	118.61	118.31	ok	
"OR43" 8+90.34	"OR43" 7+06.05		0.90	0.00		30.62	64.95	0.50	65.45	0.51	15.46		15.46	30	0.50%	0.013	29.15	5.93	0.53	179	118.31	117.41	ok	
"OR43" 7+06.05	"OR43" 5+96.78		0.90	0.00		30.62	65.45	0.31	65.76	0.51	15.46		15.46	30	0.50%	0.013	29.20	5.94	0.53	109	117.41	116.86	ok	
"OR43" 5+96.78	Outfall		0.90	0.00		70.70	65.76	0.05	65.81	0.51	35.70		35.70	36	8.38%	0.013	193.52	27.34	0.18	89	118.16	110.70	ok	
"B4" 736+95.67	"OR43" 12+35.36	0.13	0.90	0.12		0.12	5.00	0.21	5.21	2.23	0.26		0.26	18	3.58%	0.013	19.91	11.25	0.01	142	127.58	122.50	ok	
"OR43" 12+35.36	"OR43" 11+11.99	0.14	0.90	0.13		0.24	64.07	0.33	64.39	0.58	0.14		0.14	24	0.53%	0.013	16.56	5.27	0.01	103	122.3	121.75	ok	
"OR43" 11+11.99	"OR43" 10+02.36	0.06	0.90	0.05		0.30	64.39	0.31	64.70	0.58	0.17		0.17	24	0.49%	0.013	15.94	5.07	0.01	93	121.75	121.29	ok	
"OR43" 7+11.01	"OR43" 7+59.10	0.15	0.90	0.14		0.14	5.00	0.25	5.25	2.23	0.30		0.30	12	0.50%	0.013	2.52	3.21	0.12	48	118.98	118.74	ok	
"OR43" 7+59.10	"OR43" 8+41.86	0.25	0.90	0.23		0.36	5.25	0.41	5.65	2.18	0.79		0.79	12	0.50%	0.013	2.52	3.21	0.31	78	118.74	118.35	ok	
"OR43" 8+41.86	"OR43" 9+35.10	0.16	0.90	0.14		0.50	5.65	0.46	6.11	2.12	1.07		1.07	12	0.51%	0.013	2.54	3.23	0.42	89	118.35	117.90	ok	
"OR43" 9+35.10	"OR43" 10+02.36	0.10	0.90	0.09		0.59	6.11	0.31	6.42	2.08	1.24		1.24	12	0.49%	0.013	2.50	3.18	0.49	59	117.90	117.61	ok	
"OR43" 10+02.36	"OR43" 10+29.84	0.21	0.90	0.19		1.08	6.42	0.35	6.78	2.05	2.21		2.21	24	0.50%	0.013	16.03	5.10	0.14	108	117.61	117.07	ok	
"OR43" 13+61.62	"OR43" 13+49.43	0.24	0.90	0.22		0.22	5.00	0.06	5.06	2.26	0.49		0.49	12	0.50%	0.013	2.52	3.21	0.19	12	120.20	120.14	ok	
"OR43" 13+49.43	"OR43" 13+39.72		0.90	0.00		0.22	5.06	0.06	5.12	2.25	0.49		0.49	12	0.50%	0.013	2.52	3.21	0.19	12	120.14	120.08	ok	
"OR43" 13+39.72	"OR43" 12+62.73	0.21	0.90	0.19		0.41	5.12	0.29	5.42	2.21	0.89		0.89	12	0.51%	0.013	2.55	3.24	0.35	57	120.08	119.79	ok	
"OR43" 12+62.73	"OR43" 10+29.84	0.12	0.90	0.11		0.51	5.42	1.41	6.83	2.03	1.04		1.04	12	0.50%	0.013	2.52	3.20	0.41	271	119.79	118.44	ok	
"D2" 733+38.11	"D2" 733+64.02	0.35	0.90	0.32		0.32	5.00	0.10	5.10	2.26	0.71		0.71	12	1.00%	0.013	3.57	4.54	0.20	26	120.08	119.82	ok	
"D2" 733+64.02	"D2" 733+92.05	0.02	0.90	0.02		0.33	5.10	0.07	5.16	2.25	0.75		0.75	12	2.21%	0.013	5.31	6.75	0.14	28	119.82	119.2	ok	
"D2" 733+92.05	"D2" 733+73.30	0.02	0.90	0.02		0.35	5.16	0.18	5.35	2.22	0.78		0.78	18	0.51%	0.013	7.52	4.25	0.10	47	119.20	118.96	ok	
"OR43" 6+45.95_EXTG	"D2" 733+73.30	0.14	0.90	0.13		0.13	5.00	0.13	5.13	2.25	0.28		0.28	12	0.61%	0.013	2.78	3.54	0.10	28	119.37	119.20	ok	
"D2" 733+73.30	"OR43" 7+02.39		0.90	0.00		0.48	5.35	0.26	5.61	2.18	1.04		1.04	18	0.50%	0.013	7.44	4.21	0.14	66	118.96	118.63	ok	
"OR43" 7+02.39	"OR43" 9+31.77		0.90	0.00		0.48	5.61	0.95	6.56	2.07	0.99		0.99	18	0.50%	0.013	7.46	4.21	0.13	239	118.63	117.43	ok	
"OR43" 9+31.77	"OR43" 10+29.84		0.90	0.00		0.48	6.56	0.44	6.99	2.02	0.96		0.96	18	0.50%	0.013	7.48	4.22	0.13	111	117.43	116.87	ok	
"OR43" 10+29.84	"OR43" 10+26.64		0.90	0.00		2.07	6.99	0.09	7.08	2.01	4.16		4.16	24	1.43%	0.013	27.12	8.62	0.15	44	115.63	115.00	ok	
"OR43" 10+26.64	Swale 6		0.90	0.00		2.07	7.08	0.06	7.13	2.00	4.14		4.14	24	0.56%	0.013	16.90	5.37	0.25	18	112.5	112.4	ok	
"OR43" 8+90.90_DITCH	"OR43" 9+05.27_DITCH		0.90	0.00		2.07	7.13	0.05	7.19	2.00	4.14		4.14	24	0.90%	0.013	21.56	6.85	0.19	21	104.99	104.80	ok	
"OR43" 9+05.27_DITCH	FREE_EXT		0.90	0.00		2.07	7.19	0.12	7.30	1.99	4.11		4.11	24	16.19%	0.013	91.22	29.00	0.05	203	101.32	68.45	ok	

I-205 CW - SW Leg
Preliminary Design Conveyance Calculations

		Hydrology												Pipe Design										
Station From	Station To	Area (acres)	C	CA	F (for diversion MH)	sum CA	Tc to from STA (min)	Tc in pipe (min)	sum Tc (min)	I (in/hr)	Q (cfs)	Addt'l Inflow (cfs)	Total Q (cfs)	Diameter (inch)	Slope	Manning's n	Capacity (cfs)	Velocity (fps)	Q/Qf	Length (feet)	Invert Elevation US	Invert Elevation DS	Comments	
"Ln" 797+99.30	"Ln" 799+77.68	0.36	0.90	0.32		0.32	5.00	0.65	5.65	2.18	0.71		0.71	12	1.00%	0.013	3.57	4.54	0.20	177	274.5	272.73	ok	
"Ln" 799+77.68	"Ln" 802+79.53	0.25	0.90	0.23		0.55	5.65	1.05	6.70	2.05	1.12		1.12	12	1.10%	0.013	3.74	4.75	0.30	300	272.56	269.27	ok	
"Ln" 802+79.53	"Ln" 805+81.61	0.42	0.90	0.38		0.93	6.70	0.90	7.61	1.96	1.82		1.82	12	1.49%	0.013	4.35	5.53	0.42	300	269.1	264.64	ok	
"Ln" 805+81.61	"Ln" 808+83.32	0.49	0.90	0.44		1.37	7.61	0.90	8.51	1.89	2.58		2.58	12	1.49%	0.013	4.36	5.55	0.59	300	264.48	260.00	ok	
"Ln" 808+83.32	"Ln" 811+75.35	0.43	0.90	0.39		1.76	8.51	0.87	9.38	1.82	3.19		3.19	12	1.49%	0.013	4.36	5.55	0.73	290	259.84	255.51	ok	
"Ln" 811+75.35	"Ln" 811+85.08	0.00	0.90	0.00		1.76	9.38	0.02	9.40	1.81	3.18		3.18	12	2.70%	0.013	5.86	7.46	0.54	10	255.54	255.27	ok	
"Ls" 800+49.62	"Ls" 803+45.57	0.49	0.90	0.44		0.44	5.00	1.07	6.07	2.13	0.94		0.94	12	1.02%	0.013	3.60	4.58	0.26	293	280.7	277.72	ok	
"Ls" 803+45.57	"Ls" 806+00.75	0.41	0.90	0.37		0.81	6.07	0.77	6.83	2.03	1.65		1.65	12	1.48%	0.013	4.34	5.51	0.38	254	277.52	273.77	ok	
"Ls" 806+00.75	"Ls" 808+28.16	0.36	0.90	0.32		1.13	6.83	0.72	7.55	1.97	2.23		2.23	12	1.35%	0.013	4.14	5.26	0.54	226	273.57	270.53	ok	
"Ls" 808+28.16	"Ls" 811+02.95	0.32	0.90	0.29		1.42	7.55	0.71	8.26	1.91	2.72		2.72	12	1.98%	0.013	5.02	6.38	0.54	272	270.53	265.15	ok	
"Ls" 811+02.95	"Ln" 811+85.08	0.38	0.90	0.34		1.76	8.26	0.14	8.40	1.90	3.36		3.36	12	7.51%	0.013	9.78	12.44	0.34	104	264.95	257.14	ok	
"Ln" 811+85.08	MH1	0	0.90	0.00		3.52	9.40	0.27	9.67	1.80	6.33		6.33	18	0.49%	0.013	7.33	4.14	0.86	68	255.00	254.67	ok	
"Ls" 814+22.78	"Ls" 816+86.77	0.50	0.90	0.45		0.45	5.00	0.79	5.79	2.17	0.98		0.98	12	1.49%	0.013	4.35	5.54	0.22	262	260.70	256.80	ok	
"Ls" 816+86.77	"Ls" 819+90.29	0.42	0.90	0.38		0.83	5.79	0.88	6.66	2.06	1.70		1.70	12	1.59%	0.013	4.51	5.73	0.38	301	256.80	252.00	ok	
"Ls" 819+90.29	"Ls" 822+92.01	0.47	0.90	0.42		1.25	6.66	0.95	7.62	1.96	2.45		2.45	12	1.33%	0.013	4.12	5.24	0.60	300	252.00	248.00	ok	
"Ls" 822+92.01	"Ls" 825+92.20	0.44	0.90	0.40		1.65	7.62	0.84	8.46	1.89	3.12		3.12	12	1.71%	0.013	4.67	5.93	0.67	300	248.00	242.87	ok	
"Ls" 825+92.20	"Ln" 826+94.48	0.39	0.90	0.35		2.00	8.46	0.14	8.60	1.88	3.75		3.75	12	7.75%	0.013	9.93	12.63	0.38	106	242.67	234.46	ok	
"Ln" 814+87.95	"Ln" 817+90.21	0.43	0.90	0.39		0.39	5.00	0.92	5.92	2.14	0.83		0.83	12	1.43%	0.013	4.27	5.43	0.19	300	249.83	245.54	ok	
"Ln" 817+90.21	"Ln" 820+92.09	0.42	0.90	0.38		0.77	5.92	0.94	6.86	2.03	1.56		1.56	12	1.36%	0.013	4.17	5.30	0.37	300	245.34	241.25	ok	
"Ln" 820+92.09	"Ln" 823+93.70	0.42	0.90	0.38		1.14	6.86	0.93	7.80	1.95	2.23		2.23	12	1.40%	0.013	4.22	5.36	0.53	300	241.05	236.86	ok	
"Ln" 823+93.70	"Ln" 825+93.38	0.41	0.90	0.37		1.51	7.80	0.62	8.42	1.89	2.86		2.86	12	1.40%	0.013	4.22	5.36	0.68	199	236.66	233.88	ok	
"Ln" 825+93.38	"Ln" 826+43.80	0.27	0.90	0.24		1.76	8.42	0.17	8.58	1.89	3.31		3.31	12	1.18%	0.013	3.88	4.93	0.85	50	233.68	233.09	ok	
"Ln" 826+43.80	"Ln" 826+94.48	0.07	0.90	0.06		1.82	8.58	0.16	8.75	1.87	3.39		3.39	12	1.35%	0.013	4.15	5.28	0.82	51	232.89	232.20	ok	
"Ln" 826+94.48	"Ln" 827+40.96	0.06	0.90	0.05		3.87	8.75	0.24	8.98	1.85	7.16		7.16	18	0.69%	0.013	8.74	4.94	0.82	71	232.00	231.51	ok	
"Ln" 827+40.96	"Ln2" 830+30.43	0.00	0.90	0.00		3.87	8.98	0.55	9.54	1.81	6.99		6.99	18	2.13%	0.013	15.38	8.69	0.45	289	231.51	225.34	ok	
"Ln2" 830+30.43	"Ln2" 833+06.36	0.46	0.90	0.41		4.28	9.54	0.49	10.03	1.77	7.58		7.58	18	2.47%	0.013	16.53	9.34	0.46	276	225.34	218.53	ok	
"Ln2" 833+06.36	"Ln2" 836+62.86	0.42	0.90	0.38		4.66	10.03	0.56	10.59	1.74	8.09		8.09	18	3.14%	0.013	18.64	10.54	0.43	355	218.53	207.39	ok	
"Ln2" 836+62.06	"Ln2" 836+62.86	0.51	0.90	0.46		0.46	5.00	0.02	5.02	2.26	1.04		1.04	12	6.83%	0.013	9.33	11.86	0.11	12	208.71	207.89	ok	
"Ln2" 836+62.86	"Ln2" 838+74.55	0			0.50	2.56	10.59	0.40	11.00	1.71	4.37		4.37	18	2.21%	0.013	15.65	8.84	0.28	214	207.19	202.46	ok	
"Ln2" 838+74.55	"Ln2" 841+52.35	0				2.56	11.00	0.57	11.56	1.68	4.29		4.29	18	1.87%	0.013	14.40	8.14	0.30	276	202.46	197.29	ok	
"Ln2" 838+75.93	"Ln2" 841+27.32	0.33	0.90	0.30		0.30	5.00	0.64	5.64	2.18	0.65		0.65	12	2.06%	0.013	5.12	6.51	0.13	250	203.99	198.84	ok	
"Ln2" 841+27.32	"Ln2" 843+27.33	0.41	0.90	0.37		0.67	5.64	0.54	6.18	2.12	1.41		1.41	12	1.81%	0.013	4.81	6.11	0.29	199	198.68	195.07	ok	
"Ln2" 843+27.33	"Ln2" 845+91.45	0.32	0.90	0.29		0.95	6.18	0.72	6.90	2.02	1.93		1.93	12	1.79%	0.013	4.78	6.07	0.40	263	194.91	190.20	ok	
"Ln2" 845+91.45	"A2" 847+43.18	0.49	0.90	0.44		1.40	6.90	0.47	7.37	1.99	2.77		2.77	12	1.39%	0.013	4.21	5.35	0.66	151	190.00	187.90	ok	
"A2" 847+43.18	"A2" 848+03.87	0.22	0.90	0.20		1.59	7.37	0.14	7.52	1.97	3.14		3.14	12	2.40%	0.013	5.53	7.03	0.57	60	187.70	186.26	ok	
"A2" 848+03.87	"A2" 848+80.88	0.04	0.90	0.04		1.63	7.52	0.21	7.73	1.95	3.18		3.18	12	1.75%	0.013	4.73	6.01	0.67	77	186.06	184.71	ok	
"A2" 848+80.88	"A2" 851+81.63	0.05	0.90	0.05		1.67	7.73	0.67	8.40	1.90	3.19		3.19	12	2.74%	0.013	5.91	7.52	0.54	301	184.51	176.25	ok	
"A2" 851+81.63	"A2" 852+00.51	0.18	0.90	0.16		1.84	8.40	0.08	8.48	1.89	3.48		3.48	12	1.35%	0.013	4.14	5.27	0.84	26	176.25	175.90	ok	
"Ln2" 852+00.03	"A2" 852+00.51	0.68	0.90	0.61		0.61	5.00	0.19	5.19	2.25	1.38		1.38	12	3.99%	0.013	7.13	9.07	0.19	105	180.52	176.33	ok	
"A2" 852+00.51	Ditch	0	0.90	0.00		2.45	8.48	0.13	8.61	1.88	4.59		4.59	18	4.64%	0.013	22.66	12.81	0.20	99	175.9	171.31	ok	
"Ls2" 828+24.24	"Ls2" 830+17.30	0.29	0.90	0.26		0.26	5.00	0.48	5.48	2.21	0.58		0.58	12	2.19%	0.013	5.28	6.72	0.11	193	238.99	234.76	ok	
"Ls2" 830+17.30	"Ls2" 831+48.88	0.26	0.90	0.23		0.50	5.48	0.43	5.91	2.14	1.06		1.06	12	1.26%	0.013	4.00	5.09	0.27	132	234.56	232.90	ok	
"Ls2" 831+48.88	"Ls2" 831+68.26	0.15	0.90	0.14		0.37	5.91	0.13	6.04	2.13	0.79		0.79	12	2.59%	0.013	5.74	7.30	0.14	58	232.70	231.20	ok	
"Ls2" 831+68.26	"Ls2" 833+99.72		0.90	0.00		0.37	6.04	0.53	6.57	2.07	0.76		0.76	12	2.61%	0.013	5.76	7.33	0.13	231	231.20	225.18	ok	
"Ls2" 833+99.72	Ditch	0.39	0.90	0.35		0.72	6.57	0.06	6.63	2.06	1.48		1.48	12	3.84%	0.013	7.00	8.90	0.21	32	224.18	222.95	ok	
"Ls2" 836+00.39	Ditch	0.29	0.90	0.26		0.26	5.00	0.05	5.05	2.26	0.59		0.59	12	4.87%	0.013	7.87	10.01	0.07	30	220.11	218.65	ok	
"Ls2" 837+86.82	Ditch	0.26	0.90	0.23		0.23	5.00	0.07	5.07	2.26	0.53		0.53	12	2.14%	0.013	5.22	6.64	0.10	29	215.01	214.39	ok	
"Ls2" 840+63.09	"Ls2" 840+64.22		0.90	0.00		1.22	7.63	0.14	7.77	1.95	2.37		2.37	12	0.50%	0.013	2.53	3.22	0.94	27	203.74	203.60	ok	Estimated ditch t_t = 1 min
"Ls2" 840+64.22	"Ls2" 841+91.78	0.40	0.90	0.36		1.58	7.77	0.51	8.28	1.91	3.01		3.01	18	0.50%	0.013	7.41	4.19	0.41	128	203.60	202.97	ok	
"Ls2" 841+91.78	"Ls2" 843+65.22	0.17	0.90	0.15		1.73	8.28	0.68	8.96	1.85	3.20		3.20	18	0.51%	0.013	7.49	4.23	0.43	172	202.97	202.10	ok	
"Ls2" 843+65.22	"Ls2" 846+65.26	0.18	0.90	0.16		1.89	8.96	0.95	9.90	1.78	3.36		3.36	18	0.79%	0.013	9.33	5.28	0.36	300	202.1	199.74	ok	
"Ls2" 846+65.26	"Ls2" 846+63.83	0	0.90	0.00		1.89	9.90	0.21	10.11	1.76	3.33		3.33	18	1.08%	0.013	10.92	6.17	0.31	78	199.54	198.70	ok	
"Ls2" 846+63.83	"Ls2" 847+63.10	0.21	0.90	0.19		2.08	10.11	0.19	10.30	1.75	3.64		3.64	18	2.27%	0.013	15.86	8.96	0.23	100	198.70	196.43	ok	
"Ls2" 847+63.10	"D2" 849+45.81	0.47	0.90	0.42		2.50	10.30	0.32	10.62	1.73	4.32		4.32	18	2.51%	0.013	16.68	9.43	0.26	180	196.43	191.91	ok	
"D2" 849+45.81	"D2" 851+81.16	0.34	0.90	0.31		2.81	10.62	0.37	10.99	1.71	4.79		4.79	18	3.16%	0.013	18.72	10.58	0.26	234	191.91	184.51	ok	
"D2" 851+81.16	Ditch	0.14	0.90	0.13		2.93	10.99	0.12	11.11	1.70	4.97		4.97	18	0.58%	0.013	7.99	4.51	0.62	33	184.51	184.32	ok	

Appendix I. Operation and Maintenance Manuals

Table 1: General Maintenance			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
Annual Visual Inspection and Maintenance	Routine inspection	**Facilities should be inspected annually prior to fall rains**. If appropriate, also inspect the facility after the first significant rain event following dry spell (e.g. the first 24-hour rainfall greater then 0.5 inches after summer)	Identify existing and potential operational problems. Repair damaged components that are critical to the operation of the feature (e.g. flow control valves, liners, underdrains, and pipes) as soon as practical. Schedule routine maintenance such as mowing, sump cleanout, lube moving parts, repairs, etc. If the facility is problematic, schedule additional inspections or maintenance. Repair or replace facility field markers according to Technical Bulletin GE10-01(B). A marked facility has an O&M Plan.
	Maintenance of ancillary structures, if present Examples include • Flow splitter manhole • Diversion manhole • Catch basin • Shut-off valve assembly • Pretreatment or primary treatment manhole • Large detention pipe • Vault • Outfall	Damage or problems are observed or anticipated during the annual inspection.	Grease moving parts to ensure proper operation. Remove sediment from sumps, vaults, catch basins, and structures to prevent the release of oil or sediment. Annual cleaning is recommended. The use of a Vactor® truck is allowed unless prohibited in the facility's O&M manual Repair or replace damaged orifice assembly/riser pipe. Restore to design standards. Be aware of possible confined space requirements. Repair or replace damaged gates, locks, chains, etc that are used to secure valves and access points to prevent vandalism
General	Temporary erosion control hampers maintenance	Erosion control remains from project construction (contractor did not remove)	Contact contractor to complete work OR remove temporary erosion control that is not specified in the O&M Plan.

Table 1: General Maintenance

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Spilled material has entered the pond or structures	Oil, fuel, or other pollutants are evident following a spill event or accident.	Utilize valves or other features, if present, to contain the spilled material. Remove and properly manage spilled material and contaminated soil. Contact Region HazMat or spill response company for spill cleanup assistance where appropriate. Contact a Region Hydraulic Engineer for technical assistance with pond restoration, if necessary.
	Litter (trash and debris)	Trash poses a hazard, inhibits function, or is aesthetically unacceptable (e.g. evidence of dumping).	Remove problematic trash and debris as soon as practical. There should be no evidence of dumping. Remove non-problematic trash in accordance with District litter practices.
	Insects	Insects interfere with maintenance activities.	Implement vector control in accordance with County Health and District practices.
	Vegetation growth (mowing and brushing)	Vegetation growth restricts access, limits sight distance, obstructs water flow, or interferes with maintenance activity.	Mow access, berms, bottom, and side-slopes of the facility as noted in the District Integrated Vegetation Management (IVM) Plan. Remove vegetation in or around grates that obstruct (or could obstruct) flow. Avoid mowing or removing vegetation that does not need to be controlled. Avoid removing vegetation too low to the ground. NOTE: Removing vegetation too near to the ground may result in scalping of the soil, unwanted damaged to vegetation, or growth of unwanted plant species. Heavy equipment is allowed within aboveground water quality and detention facilities unless access restrictions are listed in the O&M Manual.

Table 1: General Maintenance			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
	Noxious weed growth	Control of noxious weeds is required by law or prescribed in the District IVM Plan	Remove noxious weeds in accordance with the District IVM Plan. Follow Environmental Protection Agency (EPA) label and ODOT policies on herbicide usage.
General	Hazard trees	Trees are found to be weakened, unsound, undermined, leaning, or exposed and may fall across the highway	Remove hazard trees as soon as practical. Where appropriate, consult an ODOT Forester for help identifying or removing hazard trees.
	Tree growth	Tree growth restricts access, obstructs function, jeopardizes infrastructure, or interferes with maintenance actions.	Prune or remove as needed to maintain access, function, and tree health. Manage potentially problematic woody material before the trees reach 6 inches diameter at breast height (DBH). Consult an ODOT Forester for the removal or management of trees greater than 6 inches DBH. Obtain permits where appropriate. Refer to the District IVM Plan for the management of smaller trees. Avoid removing trees that will not interfere with the operation or maintenance of the facility.

Table 2: Maintenance of Stormwater Ponds

Stormwater ponds should retain water and slowly release by either infiltration or outflow.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Follow applicable Guidance from Table 1 AND applicable guidance from this table.		
	Vegetation growth in **dry ponds** (mowing and brushing)	Vegetation growth restricts access, limits sight distance, obstructs water flow, or interferes with maintenance activity. Collected water should drain.	Dry ponds need vegetation on the bottom and sides. Vegetation management typically occurs around and within the facility. Mow access, berms, bottom, and side-slopes as noted in the District Integrated Vegetation Management (IVM) Plan. (typically annually) Heavy equipment is allowed on dry pond bottoms unless access restrictions are listed in the O&M Manual.
	Vegetation growth in **wet ponds** (mowing and brushing) NOTE: Wet ponds are not typical.	Vegetation growth restricts access, limits sight distance, obstructs water flow, or interferes with maintenance activity. Water may be stored year-round without draining.	Wet ponds need vegetation on the bottom and sides. Vegetation management typically occurs around the facility. Mow access and berms as noted in the District Integrated Vegetation Management (IVM) Plan. Ponds bottoms are intended to capture and store water. Vegetation removal from pond bottoms is infrequent.
	Sediment accumulation in pre-treatment features (e.g. forebays, basins, or fully exposed impermeable liners) NOTE: Exposed liners are not typical.	Sediment affects flow. Sediment jeopardizes infrastructure.	Remove sediment from ponds and pipe ends as needed to ensure adequate drainage into treatment pond (grassy or wet pond). Use methods that minimize disturbance to surrounding vegetation. Heavy equipment is allowed on dry pond bottoms unless access restrictions are listed in the O&M Manual. Sediment may contain oil and other pollutants, especially in areas with high ADT. Refer to the ODOT Maintenance Environmental Management System (EMS) Manual for the disposal of contaminated sediment. Note: Pollutant concentrations may increase if sediment is not routinely removed.

Table 2: Maintenance of Stormwater Ponds

Stormwater ponds should retain water and slowly release by either infiltration or outflow.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Storage areas	Sediment accumulation along bottom of grassy ponds	Sediment inhibits the flow of water through the grass (>12 inches deep). Sediment inhibits grass growth.	Where practical use a Vactor® truck to remove sediment from grassy areas. When Vactoring® is not practical, follow ditch cleaning practices. Restore slope and geometry to design standards, if necessary. Reseed grass cover where needed. Stormwater should infiltrate or flow toward outlet once inflow has ceased. Refer to the general section of this table for side-slope mowing and other routine maintenance actions.
	Sediment accumulation in wet ponds or channels. NOTE: Currently there is limited use of wet ponds to treat stormwater.	Capacity has noticeably decreased (examples below) • low and medium flows go through the bypass, • the ordinary high water level has increased, • flooding occurs when the outflows are not blocked, • pond bottom is level with outlets.	Remove sediment build-up from pipe ends as needed to ensure flow. Use methods that minimize disturbance to surrounding vegetation. Remove sediment to restore designed shape and depth. In high ADT areas, pond dredging may be required every 5 to 10 years to restore the capacity. Cease sediment removal when riprap or liner is encountered. Reseed if necessary to control erosion.
	Erosion	Side slopes show evidence of erosion greater than 4 inches deep and the potential for continued erosion is evident.	Promptly address erosion that causes immediate problems (e.g. damage to highway or highway structure) Schedule non-urgent repairs with routine work. Stabilize slope using appropriate erosion control and repair methods. Repair the cause of the erosion where possible. If necessary, contact the ODOT Erosion Control Coordinator to evaluate the condition.

Table 2: Maintenance of Stormwater Ponds

Stormwater ponds should retain water and slowly release by either infiltration or outflow.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Storage areas	Beaver dams	Dam inhibits function or jeopardizes the infrastructure.	Dispose of dam debris offsite or outside of the riparian area. Coordinate the removal or relocation of beaver with Oregon Department of Fish and Wildlife (ODFW). Consider installing deterrents where appropriate.
	Flooding	Water is flowing over or is approaching the top of the pond	Check storm drain pipes and structures for blockage. Ensure valves are open. Remove obstructions to restore flow. Evaluate and remove excessive sediment from pond storage areas. Contact the Region Hydraulic Engineer to evaluate the source of flooding or provide design modifications.
Treatment Components	Poor vegetation coverage	Vegetation (grass) is sparse or eroded patches occur in more than 10 percent of pond bottom.	Repair and reseed as appropriate to restore coverage. Install erosion control measures as needed. Trim overhanging limbs and remove brushy vegetation that limit grass growth (provide too much shade).
	Missing or eroded amended soil mix	Bare soil is observed over 10 percent of the amended area.	Identify and resolve erosion problem Add amended soil. Contact a Region Hydraulics Engineer for required material specifications.
	Amended soil mix along pond bottom is clogged	Standing water is observed for seven (7) consecutive days or longer from May through October.	Remove and replace amended soil mix. Contact a Region Hydraulics Engineer for required material specifications. Replace or repair damaged underlying drainage geotextile, impermeable liner, drain piping, and granular drain backfill material when applicable.
	Granular drain backfill material for underdrain pipe plugged	Amended soil mix has been replaced and standing water is still observed for seven (7) consecutive days or longer from May through October.	Remove and replace granular drain backfill material. Contact a Region Hydraulics Engineer for required material specifications. Install new drainage geotextile over new granular drain backfill material. Replace amended soil mix.

Table 2: Maintenance of Stormwater Ponds Stormwater ponds should retain water and slowly release by either infiltration or outflow.			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
Treatment Components	Impermeable liner damage NOTE: Liners (if installed) are typically below the grass surface and may not be visible.	Liner is damaged (e.g. during sediment removal or by motoring public). Liner is damaged when condition allows potential contamination to be released to the subsurface.	Repair or replace the liner with similar material. In many cases, rigid plastic liners may be repaired by welding a similar material over the damaged portion or using a non-toxic, waterproof epoxy. If necessary, contact a Region Hydraulics Engineer for technical assistance regarding permanent repair.
Berms and Dikes	Settlement	Any part of the berm has settled 4 inches or lower. Note: Settlement may indicate potential problems with the facility.	Repair berm to design height with similar materials. Contact a Region Hydraulics and Geotechnical Engineer as needed to evaluate the source of the settlement and determine repair options.
	Flow-through	Water is flowing through the pond berm.	Correct cause of flow through (e.g. eliminate burrowing rodents) Install erosion control measures where appropriate. Repair berm with similar materials. If necessary, contact a Region Geotechnical Engineer to evaluate the condition.
	Sloughing	Ongoing erosion is observed with potential for erosion to continue.	Where possible correct the cause of the erosion. Install or replace energy dissipaters where appropriate. Install erosion control measures where appropriate Repair berm with similar materials. If necessary, contact the ODOT Erosion Control Coordinator to evaluate the condition.

Table 2: Maintenance of Stormwater Ponds Stormwater ponds should retain water and slowly release by either infiltration or outflow.			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
Structures and piping Includes • flow splitters • vaults • inlets • bypasses • valves • catch basins • gates	Damaged or missing components	Flow control assembly is not working properly (e.g. loose, bent, unattached, etc.).	Repair or replace valves, gates, orifices and pipes as necessary with similar components. Divert flows when needed.
	Obstruction or blockage	Water does not flow in, through, or out of the structure or piping.	If valves are part of the flow control assembly, verify the valves are open. Refer to the O&M for the location of control valves. Remove obstructions to restore flow (e.g. remove trash, debris, sediment, or vegetation as necessary). Jet rodders may be used to clean piping unless specifically prohibited in the O&M plan.
Outfalls	Insufficient rock armoring at outlets • along channel side slopes and bottom • pipe outlet • along the length of spillway	Minimal layer of rock exists Rock missing along armored area Flow channelization or high flows exposed native soil around the rock armored area	Install erosion control measures Repair or replace rock armoring to original design standard Repair, re-grade, and reseed eroded areas adjacent to rock armoring. Contact a Region Hydraulics Engineer for technical assistance if rock armoring problems continue or a highway structure is at risk

Table 3: Maintenance of Water Quality or Biofiltration Swales Swales should provide even sheet flow that moves water from the inlet to the outlet.			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
General	Follow applicable Guidance from Table 1 AND applicable guidance from this table.		
	Vegetation growth (mowing and brushing)	Vegetation growth restricts access, limits sight distance, obstructs water flow, or interferes with maintenance activity. **Swales should be mowed annually.**	Mow access, berms, swale, and side-slopes as noted in the District Integrated Vegetation Management (IVM) Plan. The use of heavy equipment is allowed unless access restrictions are listed in the O&M Manual.
Swale Components	Sediment accumulation in pre-treatment areas or ancillary structures (e.g. manholes)	Sediment affects flow. Sediment jeopardizes infrastructure.	Remove sediment that prevents adequate drainage into swale. Use methods that minimize disturbance to surrounding vegetation. The use of heavy equipment is allowed unless access restrictions are listed in the O&M Manual. Sediment may contain oil and other pollutants, especially in areas with high ADT. Refer to the ODOT Maintenance Environmental Management System (EMS) Manual for the disposal of contaminated sediment. Note: Pollutant concentrations may increase if sediment is not routinely removed.
	Sediment accumulation along swale bottom	Sediment inhibits the flow of water through the grass (e.g. water is ponding or cutting a channel).	Remove sediment from grassy areas. The use of a Vactor® truck is allowed unless access restrictions are listed in the O&M Manual. Restore slope and geometry to design standards, if necessary. Reseed grass cover where needed. Stormwater should infiltrate or flow toward outlet once inflow has ceased.

Table 3: Maintenance of Water Quality or Biofiltration Swales

Swales should provide even sheet flow that moves water from the inlet to the outlet.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Swale Components	Erosion	Side slopes show evidence of erosion greater than 2 inches deep and the potential for continued erosion is evident.	Promptly address erosion that causes immediate problems (e.g. damage to highway or highway structure) Schedule non-urgent repairs with routine work. Stabilize slope using appropriate erosion control and repair methods. Repair the cause of the erosion where possible. If necessary, contact the ODOT Erosion Control Coordinator to evaluate the condition.
	Poor vegetation coverage	Vegetation (grass) is sparse or eroded patches occur in more than 10 percent of swale. NOTE: A single incident (e.g. vehicle accident) typically effects less than 10 percent of the area and is unlikely to trigger a repair.	Repair and reseed as appropriate to restore coverage. Install erosion control measures as needed. Trim overhanging limbs and remove brushy vegetation that limit grass growth (provide too much shade).
	Missing or eroded amended soil mix	Bare soil is observed over 10 percent of the amended area.	Identify and resolve erosion problem Add amended soil. Contact a Region Hydraulics Engineer for required material specifications.
	Amended soil mix along swale bottom is clogged	Standing water is observed for seven (7) consecutive days or longer from May through October.	Remove and replace amended soil mix. Contact a Region Hydraulics Engineer for required material specifications. Replace or repair damaged underlying drainage geotextile, impermeable liner, drain piping, and granular drain backfill material when applicable.
	Granular drain backfill material for underdrain pipe plugged	Amended soil mix has been replaced and standing water is still observed for seven (7) consecutive days or longer from May through October.	Remove and replace granular drain backfill material. Contact a Region Hydraulics Engineer for required material specifications. Install new drainage geotextile over new granular drain backfill material. Replace amended soil mix.

Table 3: Maintenance of Water Quality or Biofiltration Swales Swales should provide even sheet flow that moves water from the inlet to the outlet.			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
Swale Components	Impermeable liner damage NOTE: Liners may not be visible. If present, liners are typically below the grass surface along the bottom of the swale Fabric wrapped around underdrains is not a liner.	Liner is damaged (e.g. during sediment removal or by motoring public). Liner is damaged when condition allows potential contamination to be released to the subsurface.	Repair or replace the liner with similar material. Replace top soil and grass as appropriate. Features with liners, typically have maintenance option limitations; check the O&M Manual. If necessary, contact a Region Hydraulics Engineer for technical assistance.
	Obstruction or blockage of pipes	Water does not flow in, through, or out of the swale.	Remove obstructions to restore flow (e.g. remove trash, debris, sediment, or vegetation as necessary). Jet rodders may be used to clean piping unless specifically prohibited in the O&M plan.
	Flow spreader is uneven or clogged	Water does not flow evenly across the structure	Clean sump or forebay as needed to maintain capacity. Clean or repair spreader as needed to provide a uniform flow and prevent erosion. Level portions of the flow spreader that have settled.

Table 5: Bioslopes Bioslopes should provide even sheet flow that moves water from edge of pavement.			
Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
General	Follow applicable Guidance from Table 1 AND applicable guidance from this table.		
	Vegetation growth (mowing and brushing)	Vegetation growth restricts access, limits sight distance, obstructs water flow, or interferes with maintenance activity. **Slopes should be mowed annually.**	Mow as noted in the District Integrated Vegetation Management (IVM) Plan. The use of heavy equipment is allowed unless access restrictions are listed in the O&M Manual.
Bioslope Components	Sediment accumulation	Sediment inhibits the flow of water to the bioslope (e.g. water is ponding or cutting a channel).	Remove sediment from grassy areas. The use of a Vactor® truck is allowed unless access restrictions are listed in the O&M Manual. Restore slope and geometry to design standards, if necessary. Reseed grass cover where needed.
	Ecology mix is clogged	Standing water is observed for seven (7) consecutive days or longer from May through October.	Remove and replace ecology mix. Contact a Region Hydraulics Engineer for required material specifications. Replace or repair damaged underlying drainage geotextile, impermeable liner, drain piping, and granular drain backfill material when applicable.
	Granular drain backfill material for underdrain pipe plugged	Ecology mix has been replaced and standing water is still observed for seven (7) consecutive days or longer from May through October.	Remove and replace granular drain backfill material. Contact a Region Hydraulics Engineer for required material specifications. Install new drainage geotextile over new granular drain backfill material. Replace amended soil mix.
	Poor vegetation coverage	Vegetation (grass) is sparse or eroded patches occur in more than 10 percent of the strip	Repair and reseed as appropriate to restore coverage. Install erosion control measures as needed.

Table 7: Detention Tank (or Large Diameter Pipe)

Detention tanks should temporarily hold water and slowly release through the outlet.

Detention tanks and pipes may be classified as confined space. Refer to the ODOT Confined Space program (PRO96003) before entering.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Follow applicable Guidance from Table 1 AND applicable guidance from this table.		
Components	Sediment accumulation	Sediment exceeds (or could exceed) the capacity of the sump. Sediment is observed at the outlet.	Remove sediment from sump and bottom of tank floor. **Annual cleaning is recommended.** The use of a Vactor® truck is allowed unless prohibited in the facility's O&M manual. Sediment may contain oil and other pollutants, especially in areas with high ADT. Refer to the ODOT Maintenance Environmental Management System (EMS) Manual for the disposal of contaminated sediment. Note: Pollutant concentrations may increase if sediment is not routinely removed.
	Damaged or missing components	Flow control assembly is not working properly (e.g. loose, bent, unattached, etc.).	Repair or replace valves, gates, orifices and pipes as necessary with similar components. Divert flows when needed.
	Obstruction or blockage	Water does not flow in, through, or out of the structure or piping.	If valves are part of the flow control assembly, verify the valves are open. Refer to the O&M for the location of control valves. Remove obstructions to restore flow (e.g. remove trash, debris, sediment, or vegetation as necessary). Jet rodders may be used to clean piping unless specifically prohibited in the O&M plan.
	Structure or access is hidden	Site condition conceal the location of the facility	Mark facilities that may become hidden
	Clogged air vent	Pressure or a vacuum is created within the tank.	Clean air vents as needed to ensure air flows into and out of the tank.

Attachment H. Compiled Permits

DSL Removal-Fill Permit #62035-RF

Department of State Lands
775 Summer Street, Suite 100
Salem, OR 97301-1279
☎ 503-986-5200

Permit No.:	**62035-RF**
Permit Type:	**Removal/Fill**
Waters:	**Wetland/Willamette River/ Abernethy Creek/ McLoughlin Creek**
County:	**Clackamas**
Expiration Date:	**July 15, 2020**

ODOT

IS AUTHORIZED IN ACCORDANCE WITH ORS 196.800 TO 196.990 TO PERFORM THE OPERATIONS DESCRIBED IN THE REFERENCED APPLICATION, SUBJECT TO THE SPECIAL CONDITIONS LISTED ON ATTACHMENT A AND TO THE FOLLOWING GENERAL CONDITIONS:

1. This permit does not authorize trespass on the lands of others. The permit holder must obtain all necessary access permits or rights-of-way before entering lands owned by another.
2. This permit does not authorize any work that is not in compliance with local zoning or other local, state, or federal regulation pertaining to the operations authorized by this permit. The permit holder is responsible for obtaining the necessary approvals and permits before proceeding under this permit.
3. All work done under this permit must comply with Oregon Administrative Rules, Chapter 340; Standards of Quality for Public Waters of Oregon. Specific water quality provisions for this project are set forth on Attachment A.
4. Violations of the terms and conditions of this permit are subject to administrative and/or legal action, which may result in revocation of the permit or damages. The permit holder is responsible for the activities of all contractors or other operators involved in work done at the site or under this permit.
5. Employees of the Department of State Lands (DSL) and all duly authorized representatives of the Director must be permitted access to the project area at all reasonable times for the purpose of inspecting work performed under this permit.
6. Any permit holder who objects to the conditions of this permit may request a hearing from the Director, in writing, within twenty-one (21) calendar days of the date this permit was issued.
7. In issuing this permit, DSL makes no representation regarding the quality or adequacy of the permitted project design, materials, construction, or maintenance, except to approve the project's design and materials, as set forth in the permit application, as satisfying the resource protection, scenic, safety, recreation, and public access requirements of ORS Chapters 196, 390, and related administrative rules.
8. Permittee must defend and hold harmless the State of Oregon, and its officers, agents and employees from any claim, suit, or action for property damage or personal injury or death arising out of the design, material, construction, or maintenance of the permitted improvements.
9. Authorization from the U.S. Army Corps of Engineers may also be required.

NOTICE: If removal is from state-owned submerged and submersible land, the permittee must comply with leasing and royalty provisions of ORS 274.530. If the project involves creation of new lands by filling on state-owned submerged or submersible lands, you must comply with ORS 274.905 to 274.940 if you want a transfer of title; public rights to such filled lands are not extinguished by issuance of this permit. This permit does not relieve the permittee of an obligation to secure appropriate leases from DSL, to conduct activities on state-owned submerged or submersible lands. Failure to comply with these requirements may result in civil or criminal liability. For more information about these requirements, please contact Department of State Lands, 503-986-5200.

Kirk Jarvie, Southern Operations Manager
Aquatic Resource Management
Oregon Department of State Lands

Kirk Jarvie
Digitally signed by Kirk Jarvie
Date: 2019.07.15 14:49:49
-07'00'

Authorized Signature

ATTACHMENT A

Permit Holder: ODOT

Project Name: I-205: I-5 – OR 213, Phase I Sec. Abernethy

Special Conditions for Removal/Fill Permit No. 62035-RF

READ AND BECOME FAMILIAR WITH CONDITIONS OF YOUR PERMIT.

The project site may be inspected by the Department of State Lands (DSL) as part of our monitoring program. A copy of this permit must be available at the work site whenever authorized operations are being conducted.

1. **Responsible Party:** By proceeding under this permit, ODOT agrees to comply with and fulfill all terms and conditions of this permit, unless the permit is officially transferred to another party as approved by DSL. In the event information in the application conflicts with these permit conditions, the permit conditions prevail.

2. **Authorization to Conduct Removal and/or Fill:** This permit authorizes removal and fill of material in T2S R2E Sections 29/30, many tax lots, in Clackamas County, as referenced in the application, map and drawings (See Attachment B for project location), complete on June 6, 2019 and summarized as follows:

Summary of Authorized Wetland Impacts

Wetland #	Permanent			Temporary		
	Acres	Removal (cy)	Fill (cy)	Acres	Removal (cy)	Fill (cy)
Wetland 37	**--**	**--**	**--**	**0.003**	**9**	**9**

Summary of Authorized Waterway Impacts

Waterway Name	Permanent			Temporary		
	Linear Ft.	Removal (cy)	Fill (cy)	Linear Ft.	Removal (cy)	Fill (cy)
Willamette River	30	40,185	28,696	120	4,305	4,305
Abernathy Creek	30	4,405	3,284	175	420	420
McLoughlin Creek	340	899	784	340	2,437	2,552
Total:	**400**	**45,489**	**32,764**	**635**	**7,162**	**7,277**

*These volumes include removal and fill activities necessary to complete the required restoration and mitigation.

3. **Work Period in Jurisdictional Areas:** Fill or removal activities below the ordinary high water elevation of Abernathy Creek must be conducted between July 1 and October 31; other than for the activities noted below, fill or removal activities below the ordinary high water elevation of Willamette River must be conducted between July 1 and October 31; drilled shaft oscillation work in the Willamette River behind the constructed coffer dams may occur between July 1 and December 31; use of the barge in the Willamette may occur year round. Extensions to these periods may only occur if coordinated with Oregon Department of Fish and Wildlife and approved

in writing by DSL. If fish eggs are observed within the project area, work must cease, and DSL contacted immediately.

4. **Changes to the Project or Inconsistent Requirements from Other Permits:** It is the permittee's responsibility to ensure that all state, federal and local permits are consistent and compatible with the final approved project plans and the project as executed. Any changes made in project design, implementation or operating conditions to comply with conditions imposed by other permits resulting in removal-fill activity must be approved by DSL prior to implementation.

5. **DSL May Halt or Modify:** DSL retains the authority to temporarily halt or modify the project or require rectification in case of unforeseen adverse effects to aquatic resources or permit non-compliance.

6. **DSL May Modify Conditions Upon Permit Renewal:** DSL retains the authority to modify conditions upon renewal, as appropriate, pursuant to the applicable rules in effect at the time of the request for renewal or to protect waters of this state.

Pre-Construction

7. **Local Government Approval Required Before Beginning Work:** Prior to the start of construction, the permittee must obtain a Development permit and Site Plan and Design Review, Variance and Natural Resource Review application required from Oregon City and a development permit from West Linn.

8. **DSL Proprietary Authorization Required Before Beginning Work:** Prior to the start of work within state-owned submerged and submersible lands, the permittee must obtain an easement from the Department of State Lands.

9. **Stormwater Management Approval Required Before Beginning Work:** Prior to the start of construction, the permittee must obtain a National Pollution Discharge Elimination System (NPDES) permit from the Oregon Department of Environmental Quality (DEQ), if one is required by DEQ.

10. **Authorization to Use Property for Linear Projects**: For linear facility projects, the removal-fill activity cannot occur until the person obtains:

    a. The landowner's consent;
    b. A right, title or interest with respect to the property, that is sufficient to undertake the removal or fill activity; or
    c. A court order or judgment authorizing the use of the property

11. **Pre-construction Resource Area Fencing or Flagging:** Prior to any site grading, the boundaries of the avoided wetlands, waterways, and riparian areas adjacent to the project site must be surrounded by noticeable construction fencing or flagging. The marked areas must be maintained during construction of the project and be removed immediately upon project completion.

General Construction Conditions

12. **Water Quality Certification:** The Department of Environmental Quality (DEQ) may evaluate this project for a Clean Water Act Section 401 Water Quality Certification (WQC). If the evaluation results in issuance of a Section 401 WQC, that turbidity condition will govern any allowable turbidity exceedance and monitoring requirements.

13. **Erosion Control Methods:** The following erosion control measures (and others as appropriate) must be installed prior to construction and maintained during and after construction as appropriate, to prevent erosion and minimize movement of soil into waters of this state.

    a. All exposed soils must be stabilized during and after construction to prevent erosion and sedimentation.
    b. Filter bags, sediment fences, sediment traps or catch basins, leave strips or berms, or other measures must be used to prevent movement of soil into waterways and wetlands.
    c. To prevent erosion, use of compost berms, impervious materials or other equally effective methods, must be used to protect soil stockpiled during rain events or when the stockpile site is not moved or reshaped for more than 48 hours.
    d. Unless part of the authorized permanent fill, all construction access points through, and staging areas in, riparian and wetland areas must use removable pads or mats to prevent soil compaction. However, in some wetland areas under dry summer conditions, this requirement may be waived upon approval by DSL. At project completion, disturbed areas with soil exposed by construction activities must be stabilized by mulching and native vegetative plantings/seeding. Sterile grass may be used instead of native vegetation for temporary sediment control. If soils are to remain exposed more than seven days after completion of the work, they must be covered with erosion control pads, mats or similar erosion control devices until vegetative stabilization is installed.
    e. Where vegetation is used for erosion control on slopes steeper than 2:1, a tackified seed mulch must be used so the seed does not wash away before germination and rooting.
    f. Dredged or other excavated material must be placed on upland areas having stable slopes and must be prevented from eroding back into waterways and wetlands.
    g. Erosion control measures must be inspected and maintained as necessary to ensure their continued effectiveness until soils become stabilized.
    h. All erosion control structures must be removed when the project is complete, and soils are stabilized and vegetated.

14. **Fuels, Hazardous, Toxic, and Waste Material Handling:** Petroleum products, chemicals, fresh cement, sandblasted material and chipped paint, wood treated with leachable preservatives or other deleterious waste materials must not be allowed to enter waters of this state. Machinery and equipment staging, cleaning, maintenance, refueling, and fuel storage must be at least 150 feet from OHW or HMT and wetlands to prevent contaminates from entering waters of the state. Refueling is to be confined to a designated area to prevent spillage into waters of this state. Barges must have containment system to effectively prevent petroleum products or other deleterious material from entering waters of this state. Project-related spills into waters of this state or onto land with a potential to enter waters of this state must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311.

15. **Archaeological Resources:** If any archaeological resources, artifacts or human remains are encountered during construction, all construction activity must immediately cease. The State Historic Preservation Office must be contacted at 503-986-0674. You may be contacted by a Tribal representative if it is determined by an affected Tribe that the project could affect Tribal cultural or archeological resources.

16. **Construction Corridor:** There must be no removal of vegetation or heavy equipment operating or traversing outside the designated construction corridor or footprint (Figures 5-3A through 5-18).

17. **Hazards to Recreation, Navigation or Fishing:** The activity must be timed so as not to unreasonably interfere with or create a hazard to recreational or commercial navigation or fishing.

18. **Operation of Equipment in the Water:** Heavy equipment may be positioned below ordinary high water or highest measured tide if the area is isolated from the waterway and aquatic organism salvage is completed. All machinery operated below ordinary high water (OHW) or highest measured tide (HMT) elevation must use vegetable-based hydraulic fluids, be steam cleaned and inspected for leaks prior to each use, and be diapered to prevent leakage of fuels, oils, or other fluids below OHW or HMT elevation. Any equipment found to be leaking fluids must be immediately removed from and kept out of OHW or HMT until repaired.

19. **Work Area Isolation:** The work area must be isolated from the water during construction by using a coffer dam or similar structure. All structures and materials used to isolate the work area must be removed immediately following construction and water flow returned to pre-construction conditions.

20. **Fish Salvage Required:** Fish must be salvaged from the isolation area. Permits from NOAA Fisheries and Oregon Department of Fish and Wildlife, Fish Research are required to salvage fish. Fish salvage permit information may be obtained by contacting ODFW Fish Research at 503-947-6254 or Fish.Research@state.or.us.

21. **Fish Passage Required:** The project must meet Oregon Department of Fish and Wildlife requirements for fish passage.

22. **Raising or Redirecting Water:** The project must not cause water to rise or be redirected and result in damage to structures or property on the project site as well as adjacent, nearby, upstream, and downstream of the project site.

Pilings

23. **Method of Piling Placement:** Pilings must be placed by means of vibratory hammer. An impact hammer is allowed only as necessary for proofing the pile.

24. **Sound Reduction:** To reduce sound impacts to fish from an impact hammer, a fully-confined bubble curtain will be used if installation requires impact proofing.

25. **Method of Piling Removal:** Removal of pile must be conducted by means of vibratory removal and pulling. Piles that cannot be extracted by this method must be cut off 3 feet below the stream bed.

26. **Leachable Preservatives Prohibited:** There must be no wood products treated with creosote or other leachable preservatives in the new structure.

27. **Waste Pilings Disposal:** Old piling and other waste material must be disposed of in a disposal facility approved for this purpose. There must be no temporary storage of piling or other waste material below top of bank or in any wetland, Federal Emergency Management Administration designated floodway, or an area historically subject to landslides.

Site Rectification

28. **Abernathy Creek Rectification and Improvements:** The existing riprap and streambed must be reconfigured to create a low flow channel; fish rocks and large woody material must be added to provide fish passage and stabilize the channel. The large wood must be incorporated in the form and manner described in the application and Figures 5-14 and 5-15.

29. **McLoughlin Creek and Wetland 37 Rectification and Improvements:** The final completed contours of the wetland and stream will be restored and planted as described in the application. The slope of the McLoughlin Creek channel must be the same or flatter the pre-construction conditions; the width must be equal to or greater than pre-construction conditions.

30. **Trenching in Wetland 37:** During trenching or excavation, the top layer of soil must be separated from the rest of the excavated material and put back on top when the trench or pit is back-filled. If the native underlying soils are not used as bedding material and a coarser, non-native soil or other material is used, preventative measures such as clay or concrete plugs must be used so that underground hydraulic piping does not dewater the site and adjacent wetlands.

31. **Pre-construction Elevations Must Be Restored Within the Same Construction Season:** Construction activities within areas identified as temporary impact must not exceed two construction seasons and rectification of temporary impacts must be completed within 24 months of the initiation of impacts. However, if the temporary impact only requires one construction season, re-establishment of pre-construction contours must be completed within that same construction season, before the onset of fall rains.

32. **Planting in Soils and Riprap Required:** Disturbed areas above OHW must be planted and seeded immediately following establishment of final contours. Planting of native woody vegetation must be completed during the time of year that provides the optimal chances of survival immediately following construction (Figure FA13 [Abernathy Creek], FA14 and FA15 [McLoughlin Creek and Wetland 37]).

33. **Woody Vegetation Planting Required:** Planting of native woody vegetation must be completed before the next growing season after re-establishment of the pre-construction contours (Figure FA13 [Abernathy Creek], FA14 and FA15 [McLoughlin Creek and Wetland 37]).

Monitoring and Reporting Requirements

34. **Post-Construction Report Required:** A post-construction report demonstrating as-built conditions and discussing any variation from the approved plan must be provided to DSL with the first monitoring report. The post-construction report must include:

a. A scaled drawing, accurate to 1-foot elevation, clearly showing the following:
    1. Finished contours of the site.
    2. The riprap removal area pre- and post-project contours
    3. The streambed as reconfigured, including low flow channel, fish rocks, and large woody material
    4. Photo point locations.
b. Photos from fixed photo points. This should clearly show the site conditions
c. A narrative that describes any deviation from the plan.

35. **Annual Monitoring Reports Required:** Monitoring is required until DSL has officially released the site from further monitoring. The permittee must monitor the site to determine whether the site is meeting performance standards for a minimum period of 3 growing seasons after completion of all the initial plantings. Annual monitoring reports are required and are due by December 31. Failure to submit the required monitoring report by the due date may result in an extension of the monitoring period or enforcement action.

36. **Extension of the Monitoring Period:** The monitoring period may be extended, at the discretion of DSL, for failure of the site to meet performance standards for the final two consecutive years without corrective or remedial actions (such as irrigation, significant weed/invasive plants treatment or replanting) or when needed to evaluate corrective or remedial actions.

37. **Contents of the Annual Monitoring Report:** The annual monitoring report must include the following information:

    a. Completed Monitoring Report Cover Sheet, which includes permit number, permit holder name, monitoring date, report year, performance standards, and a determination of whether the site is meeting performance standards.
    b. Site location map(s) that clearly shows the site boundaries.
    c. Site Plan that clearly shows at least the following.
        1. The area seeded, with the square foot area listed.
        2. The area planted with trees and shrubs, with the square foot area listed.
        3. Permanent monitoring plot locations that correspond to the data collected and fixed photo-points. These points should be overlaid on the as-built map.
    d. A brief narrative that describes maintenance activities and recommendations to meet success criteria. This includes when irrigation occurred and when the above ground portion of the irrigation system was or will be removed from the site.
    e. Data collected to support the conclusions related to the status of the site relative to the performance standards listed in this permit (include summary/analysis in the report and raw data in the appendix). Data should be submitted using the DSL Mitigation Monitoring Vegetation Spreadsheet or presented in a similar format as described in DSL's Routine Monitoring Guidance for Vegetation.
    f. Photos from fixed photo points (include in the appendix).
    g. Other information necessary or required to document compliance with the performance standards listed in this permit.

38. **Corrective Action May Be Required:** DSL retains the authority require corrective action in the event the performance standards are not accomplished at any time within the monitoring period.

Performance Standards for Wetland 37 Rectification

39. **Establishment of Permanent Monitoring Locations Required:** Permanent plot locations must be established during the first annual monitoring in sufficient number and locations to be representative of the site. The permanent plot locations must be clearly marked on the ground.

40. **Wetland 37 Acreage Required:** The proposed impacts at Wetland 37 will have a minimum 0.003 acres as determined by hydrology data collected during spring of a year when precipitation has been near normal, vegetation has been established, and irrigation has been removed for at least two years.

41. **Native Species Cover:** The cover of native species, as defined in the USDA Plants Database, in the herbaceous stratum is at least 60%.

42. **Invasive Species Cover:** The cover of invasive species is no more than 20%. A plant species should automatically be labeled as invasive if it appears on the current Oregon Department of Agriculture noxious weed list.

Performance Standards for McLoughlin and Abernethy Creeks Rectification

43. **Woody Vegetation:** The density of woody vegetation is at least 1 live native shrubs or tree every 6 linear feet on each disturbed waterway bank. Native species volunteering on the site may be included, dead plants do not count, and the standard must be achieved for 2 years without irrigation.

Monitoring and Reporting Schedule

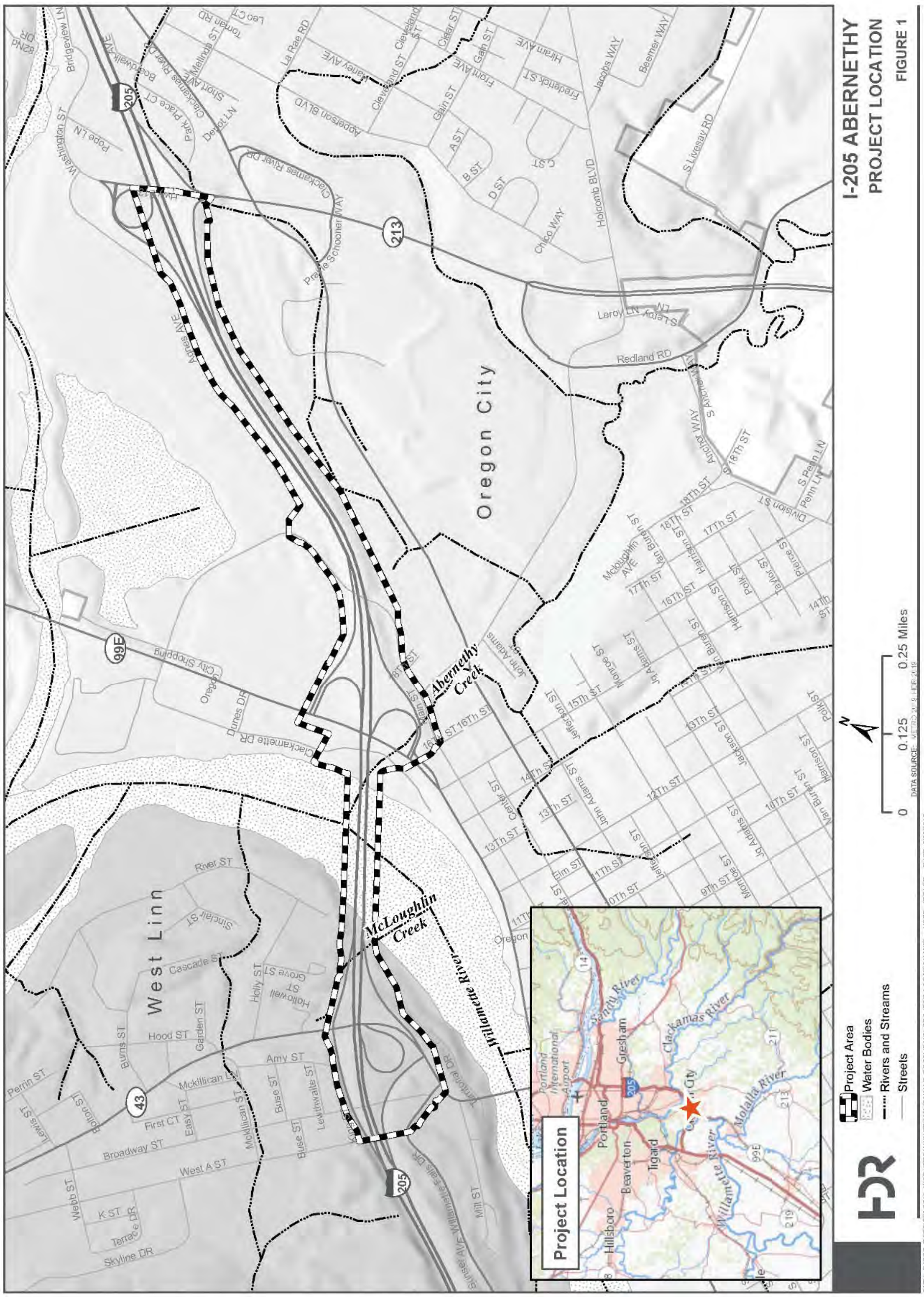
Report	Requirements	Schedule
Post-Construction and First Annual Report	Post-construction report Establishment of permanent monitoring locations Vegetation performance standards Demonstration that wetland hydrology has been accomplished	After one growing season of all proposed plantings
Second Annual Report	Vegetation performance standards	After two growing seasons
Third Annual Report (or final report if the monitoring period has been extended)	Vegetation performance standards Actual acreage achieved by HGM and Cowardin class[1].	After three or final monitoring season

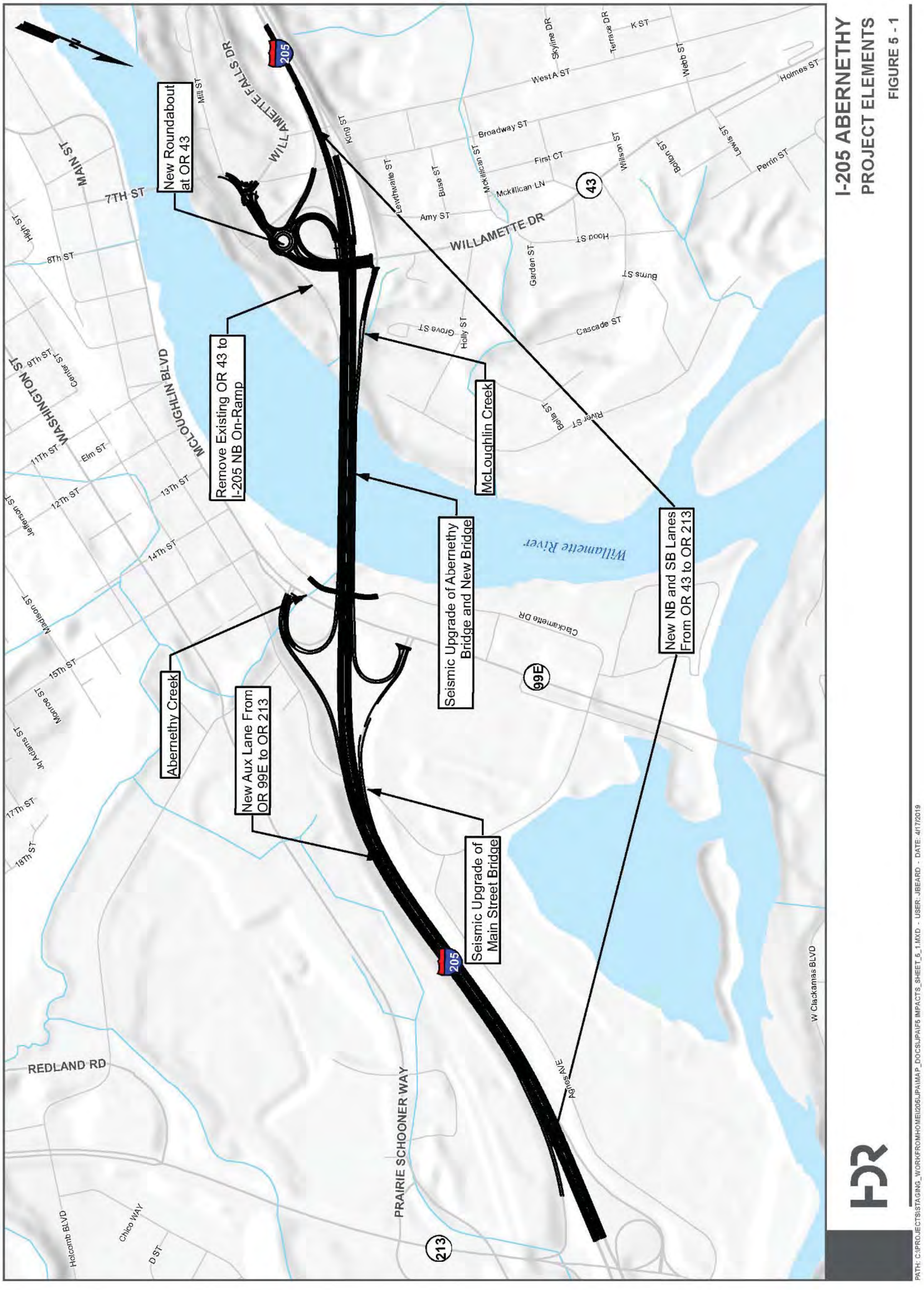
ATTACHMENT B

Permit Holder: ODOT

Project Name: I-205: I-5 – OR 213, Phase I Sec. Abernethy

Maps and Drawings for Removal/Fill Permit No. 62035-RF




New Roundabout at OR 43
Remove Existing OR 43 to I-205 NB On-Ramp
McLoughlin Creek
Seismic Upgrade of Abernethy Bridge and New Bridge
New NB and SB Lanes From OR 43 to OR 213
Abernethy Creek
New Aux Lane From OR 99E to OR 213
Seismic Upgrade of Main Street Bridge
Willamette River
WILLAMETTE FALLS DR
WILLAMETTE DR
MAIN ST
7TH ST
WASHINGTON ST
MCLOUGHLIN BLVD
REDLAND RD
PRAIRIE SCHOONER WAY
Clackamette DR
W Clackamas BLVD
Agnes AVE
205
43
99E
213
I-205 ABERNETHY
PROJECT ELEMENTS
FIGURE 5 - 1

DEQ 401 Water Quality Certification

Oregon
Kate Brown, Governor

Department of Environmental Quality
Northwest Region Portland Office/Water Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232-4100
(503) 229-5263
FAX (503) 229-6957
TTY 711

November 26, 2019

Denis Reich, Environmental Manager
Oregon Department of Transportation (ODOT), Region 1
123 NW Flanders Street
Portland, OR 97209-4012

RE: NWP-2016-00458-4; I-205: I-5 – OR 213, Phase I Sec. Abernethy 401 Water Quality Certification

The Oregon Department of Environmental Quality (DEQ) has reviewed the U.S. Army Corps of Engineers (USACE) permit application #NWP-2016-458-4 (Department of State Lands [DSL] #62035), pursuant to a request for a Clean Water Act Section 401 Water Quality Certification (WQC) received on July 30, 2019. DEQ's 401 Water Quality Certification circulated with the Corps' public notice, and DEQ received no water quality comments.

According the Joint Permit Application, The Oregon Department of Transportation (the "Applicant") proposes to impact the Willamette River, McLoughlin Creek, Abernethy Creek, and a wetland adjacent to McLoughlin Creek, by excavating 52,660 cubic yards (cy) of earthen material and discharging 40,050 cy of fill material. The purpose of the project is to seismically retrofit and widen the Abernethy and Main Street Bridges, and create auxiliary lanes proximal to these bridges. The project is located in wetlands adjacent, and tributaries that discharge to the Willamette River at river mile 25, West Linn, Clackamas County, Oregon (Sections 29 and 30, Township 2S/ Range 2E).

Project Description: The proposed project work will impact 1.85 acres of waterbodies in order to seismically retrofit and widen the Abernethy and Main Street Bridges. The Applicant will construct five new in-water support piers adjacent to existing piers. The existing piers will then be cut to a depth of approximately 5 feet below existing ground. Riprap will be removed from the existing pier sites as well, to a depth of 5-feet below ground surface and 10-feet in diameter around each removed in-water pier. Approximately 33,375 to 50,733 square feet of riprap is expected to be removed from the Willamette River to allow for pile and drilled shaft installation. The Applicant will also widen the bridge, adding northbound and southbound lanes to I-205 between the OR 43 Interchange and the OR 99 Interchange, and an auxiliary lane on I-205 between OR 99 and OR 213. The purpose of this project is to reduce congestion and provide necessary seismic upgrades to the structural supports to the Abernethy and Main Street Bridges. In addition, Abernathy Creek will be re-aligned and riprap will be removed to accommodate the Pier 3 drilled shaft. A temporary work bridge will be required for work within the Willamette River, and is expected to remain in place for up to 4 years. Construction activities will result in a total of 21 acres of ground disturbance.

The project will create 31.336-acres of impervious surface. As mitigation for this loss, the Applicant has proposed compensatory wetland mitigation through on-site permittee responsible mitigation, including riparian bank work along Abernethy Creek, the realignment of Abernethy

Creek with improved fish passage and enhancements, the realignment of McLoughlin Creek, and the restoration of a wetland identified as Wetland 37.

Status of Affected Waters of the State: The Willamette River is classified as water quality limited under the Federal Clean Water Act and is listed on the Section 303(d) List of impaired water bodies for the parameters of aldrin, biological criteria, chlordane, chlorophyll a, copper, cyanide, DDE 4,4, DDT 4,4, dieldrin, hexachlorobenzene, iron, lead, pentachlorophenol, PCBs, and PAHs; and has Environmental Protection Agency Total Maximum Daily Loads (TMDLs) developed for the parameters of temperature, dioxin, mercury, and *E.coli*.

The above listed parameters impair the following beneficial uses in the Willamette River: public domestic water supply, private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, and wildlife and hunting. Additional beneficial uses include: fishing, boating, water contact recreation, and aesthetic quality, hydropower, commercial navigation and transportation.

Certification Decision: Based on the information provided by the Applicant and the USACE, DEQ is reasonably assured that implementation of the project will be consistent with applicable provisions of Sections 301, 302, 303, 306 and 307 of the federal Clean Water Act, state water quality standards set forth in Oregon Administrative Rules Chapter 340 Division 41 and other requirements of state law, provided the following conditions are strictly adhered to by the Applicant.

401 WQC GENERAL CONDITIONS

1) **Responsible parties:** This 401 WQC applies to the Applicant. The Applicant is responsible for the work of its contractors and subcontractors, as well as any other entity that performs work related to this Water Quality Certification.

2) **Work Authorized:** Work authorized by this 401 Water Quality Certification is limited to the work described in the Joint Permit Application signed on May 9, 2019 and additional application materials (hereafter "the permit application materials"), unless otherwise authorized by DEQ. If the project is operated in a manner that's not consistent with the project description in the permit application materials, the Applicant is not in compliance with this 401 Water Quality Certification and may be subject to enforcement.

3) **Duration of Certificate:** This 401 Water Quality Certification for impacts to waters, including dredge and fill activities, is valid until closure of the in-water timing window (see Condition 2) of the fifth year from the date of issuance of the USACE 404 permit. A new or modified 401 certification must be requested before any modification of the US Army Corps of Engineers 404 permit. Post construction stormwater facilities must be maintained for the life of the facility.

4) **401 WQC on Site:** A copy of this 401 Water Quality Certification letter must be kept on the job site and readily available for reference by the Applicant and its contractors and subcontractors, as well as by DEQ, USACE, National Marine Fisheries Service, Oregon Department of Fish and Wildlife and other state and local government inspectors.

5) **Modification:** Any approved modifications to this certification will incur a Tier 1 fee of $985 at a minimum. Complex modifications may be charged a higher fee.

6) **Notification:** The Applicant must notify DEQ of any change in ownership or control of this project within 30 days, and obtain DEQ review and approval before undertaking any change to the project that may potentially affect water quality.

7) **Project Changes:** DEQ may modify or revoke this certification, in accordance with Oregon Administrative Rules 340-048-0050, if the project changes or project activities are having an adverse impact on state water quality or beneficial uses, or if the Applicant violates any of the conditions of this certification.

8) **Access:** The Applicant and its contractors must allow DEQ access to the project site with or without prior notice, including staging areas, and mitigation sites to monitor compliance with these certification conditions, including:
   a. Access to any records, logs, and reports that must be kept under the conditions of this certification
   b. To inspect best management practices, monitoring or equipment or methods
   c. To collect samples or monitor any discharge of pollutants.

9) Failure of any person or entity to comply with this order may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce its terms.

CONSTRUCTION SPECIFIC CONDITIONS

10) **Erosion Control**: During construction, erosion control measures must be implemented to prevent soil from entering waters of the state. The Applicant is required to develop and implement an effective erosion and sediment control plan. Refer to DEQ's Oregon Sediment and Erosion Control Manual, January, 2013 at: https://www.oregon.gov/deq/FilterPermitsDocs/ErosionSedimentControl.pdf **Any project that disturbs more than one acre is required to obtain a National Pollutant Discharge Elimination System 1200-C construction stormwater general permit from DEQ.** Contact DEQ for more information (Contact information can be found at: https://www.oregon.gov/deq/wq/wqpermits/Pages/Stormwater-Construction.aspx

In addition, the Applicant must do the following, unless otherwise authorized by DEQ:

   a. Maintain an adequate supply of materials necessary to control erosion at the construction site
   b. Deploy compost berms, impervious materials, or other effective methods during rain or when stockpiles are not moved or reshaped for more than 48 hours. Erosion of stockpiles is prohibited
   c. Inspect erosion control measures daily and maintain erosion control measures as often as necessary to ensure the continued effectiveness of measures. Erosion control measures must remain in place until all exposed soil is stabilized;
      i. If monitoring or inspection shows that the erosion and sediment controls are ineffective, the Applicant must act immediately to make repairs, install replacements, or install additional controls as necessary.
      ii. If sediment has reached a third of the exposed height of a sediment or erosion control, the Applicant must remove the sediment to its original contour.
   d. Use removable pads or mats to prevent soil compaction at all construction access points through, and staging areas in, riparian or wetland areas to prevent soil compaction, unless otherwise authorized by DEQ.

e. Flag or fence off wetlands not specifically authorized to be impacted to protect from disturbance and/or erosion.
f. Place dredged or other excavated material on upland areas with stable slopes to prevent materials from eroding back into waterways or wetlands.
g. Place clean aggregate at all construction entrances, and utilize other best management practices, including, but not limited to truck or wheel washes, when earth-moving equipment is leaving the site and traveling on paved surfaces. Vehicles are prohibited from tracking sediment off site.
h. This certification *does not* authorize the placement of best management practices into waters of the state unless specifically outlined in the application and authorized by DEQ.
i. Upon completion of construction activities, stormwater facilities must be inspected and tested to ensure they are working and adequately prepared for post-construction stormwater treatment.

11) **Deleterious waste materials**: The Applicant is prohibited from placing biologically harmful materials and construction debris including, but not limited to: petroleum products, chemicals, cement cured less than 24 hours, welding slag and grindings, concrete saw cutting by-products, sandblasted materials, chipped paint, tires, wire, steel posts, and asphalt and waste concrete where such materials could enter waters of the state, including wetlands (wetlands are waters of the state).

The Applicant must:

a. Cure concrete, cement, or grout for at least 24 hours before any contact with flowing waters;
b. Use only clean fill, free of waste and polluted substances
c. Employ all practicable controls to prevent discharges of spills of harmful materials to surface or groundwater
d. Maintain at the project construction site, and deploy as necessary, an adequate supply of materials needed to contain deleterious materials during a weather event
e. Remove all foreign materials, refuse, and waste from the project area
f. Employ general good housekeeping practices at all times

12) **Spill Prevention:** The Applicant must have a spill prevention and control plan. The Applicant must fuel, operate, maintain and store vehicles and equipment, and must store construction materials, in areas that will not disturb habitat directly or result in potential discharges. In general, reasonable precautions and controls must be used to prevent any discharges of petroleum products or other harmful or toxic materials from entering the water as a result of any in-water activities. In addition, the following specific requirements apply:

a. Vehicle and motorized equipment staging, cleaning, maintenance, refueling, and fuel storage must take place in a vehicle staging area 150 feet or more from any waters of the state. DEQ may approve in writing exceptions to this distance if all practical prevention measures are employed and this distance is not possible because of any of the following site conditions:
    i. Physical constraints that make this distance not feasible (e.g., steep slopes, rock outcroppings)
    ii. Natural resource features would be degraded as a result of this setback

iii. Equal or greater spill containment and effect avoidance is provided even if staging area is less than 150 feet away from waters of the state

b. If staging areas are within 150 feet of any waters of the state, as allowed under subsection (a)(iii) of this condition, full containment of potential contaminants must be provided to prevent soil and water contamination, as appropriate
c. All vehicles operated within 150 feet of any waters of the state must be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected in the vehicle-staging area must be repaired before the vehicle resumes operation
d. Before operations begin and as often as necessary during operation, equipment must be steam cleaned (or undergo an approved equivalent cleaning) until all visible oil, grease, mud, and other visible contaminants are removed if the equipment will be used below the bank of a waterbody
e. All stationary power equipment (e.g., generators, cranes, stationary drilling equipment) operated within 150 feet of any waters of the state must be covered by an absorbent mat to prevent leaks, unless other suitable containment is provided to prevent potential spills from entering any waters of the state
f. An adequate supply of materials (such as straw matting/bales, geotextiles, booms, diapers, and other absorbent materials) needed to contain spills must be maintained at the project construction site and deployed as necessary
g. All equipment operated in state waters must use bio-degradable hydraulic fluid
h. A maintenance log documenting equipment maintenance inspections and actions must be kept on-site and available upon request

13) **Spill & Incident Reporting**:

a. In the event that petroleum products, chemicals, or any other harmful materials are discharged into state waters, or onto land with a potential to enter state waters, the Applicant must promptly report the discharge to the Oregon Emergency Response System (800-452-0311). The Applicant must immediately begin containment and complete cleanup as soon as possible.
b. If the project operations cause a water quality problem which results in distressed or dying fish, the Applicant must immediately:
   - Cease operations
   - Take appropriate corrective measures to prevent further environmental damage
   - Note condition of fish (dead, dying, decaying, erratic, or unusual behavior)
   - Note the number, species, and size of fish in each condition
   - Note the location of fish relative to operations
   - Note the presence of any apparently healthy fish in the area at the same time
   - Collect fish specimens and water samples
   - Notify DEQ, Oregon Department of Fish and Wildlife, National Marine Fisheries Service and U.S. Fish and Wildlife Service as appropriate (reporting of listed fish mortality to National Marine Fisheries Service is required).

14) **Vegetation Protection and Restoration:**

a. The Applicant must protect riparian, wetland, and shoreline vegetation in the authorized project area (as defined in the permit application materials) from disturbance through one or more of the following:
   i. Minimization of project and impact footprint
   ii. Designation of staging areas and access points in open, upland areas
   iii. Fencing and other barriers demarcating construction areas
   iv. Use of alternative equipment (e.g., spider hoe or crane)

b. If authorized work results in vegetative disturbance and the disturbance has not been accounted for in planned mitigation actions, the Applicant must successfully reestablish vegetation to a degree of function equivalent or better than before the disturbance. The standard for success is 80 percent cover for native plant species. The vegetation must be reestablished by the completion of authorized work and include:
   i. Restoring damaged streambanks to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation, unless precluded by pre-project conditions (e.g., a natural rock wall)
   ii. Replanting or reseeding each area requiring revegetation before the end of the first planting season following construction
   iii. Planting disturbed areas with native plants and trees in all cases except where the use of non-native plant materials may be essential for erosion control
   iv. The use of invasive species to re-establish vegetation is prohibited
   v. Herbicides, pesticides and fertilizers must be applied per manufacturer's instructions, and only if neccesary for vegetation establishment. If chemical treatment is necessary, the Applicant is responsible for ensuring that pesticide application laws, including with the National Pollutant Discharge Eliminations System 2300-A general permit are met. Please review the information on the following website for more information: https://www.oregon.gov/deq/wq/wqpermits/Pages/Pesticide.aspx

      Additionally:

      1. Unless otherwise approved in writing by DEQ, applying surface fertilizer within stormwater treatment facilities or within 50 feet of any stream channel is prohibited.
      2. Other than spot application to cut stems, no herbicides are allowed within stormwater treatment facilites or within 150 feet of waters of the state. Mechanical, hand, or other methods may be used to control weeds and unwanted vegetation within stormwater treatment facilites or within 150 feet of waters of the state; and
      3. No pesticides may be used within stormwater treatment facilities or within 150 feet of waters of the state.
   vi. Install wildlife-friendly fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons
   vii. Minimize soil compaction, especially in areas that are designated for replanting. If soils are compacted, Loosen and aerate compacted soil in staging areas and work construction areas prior to replanting. Leave

topsoil when possible. Chip materials from clear and grub operation and spread on soil surface, unless cleared areas contained invasive species.

15) Maintain existing vegetative buffers to a minimum of 50 feet during construction and post-construction to protect riparian areas and wetlands, unless described in the application and authorized in writing by DEQ.

16) **Previously Contaminated Soil and Groundwater:** If any contaminated soil or groundwater is encountered, it must be handled and disposed of in accordance with the soil and groundwater management plan for the site, as well as local, state and federal regulations. The Applicant must notify the Environmental Cleanup Section of DEQ at 800-452-4011 Ex.6258.

17) **Notification to DEQ:** The Applicant must provide pre-construction notification to DEQ one week before construction starts. Contact information can be found at the end of the certification.

SPECIFIC CONDITIONS FOR IN-STREAM WORK

18) **Fish Protection/ Oregon Department of Fish and Wildlife Timing:** The Applicant must perform in-water work only within the Oregon Department of Fish and Wildlife preferred time window as specified in the *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources* (please follow the link: https://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_Work2008.pdf) or as authorized otherwise under a Department of State Lands removal/fill permit. Exceptions to the timing window must be recommended by Oregon Department of Fish and Wildlife and/or the National Marine Fisheries Services as appropriate.

19) **Aquatic Life Movements:** Any activity that may disrupt the movement of aquatic life living in the water body, including those species that normally migrate through the area, is prohibited. The Applicant must provide unobstructed fish passage at all times during any authorized activity. Exceptions must be reviewed and recommended by Oregon Department of Fish Wildlife and/or the National Marine Fisheries Service as appropriate.

20) **Isolation of In-Water Work Areas:** The Applicant must isolate in-water work areas from the active flowing stream, unless otherwise authorized as part of the approved application, or authorized by DEQ.

21) **Cessation of Work:** The Applicant must cease project operations under high-flow conditions that will result in inundation of the project area. Only efforts to avoid or minimize turbidity or other resource damage as a result of inundation of the exposed project area are allowed during high-flow conditions.

22) **Turbidity**: The Applicant must implement best management practices to minimize turbidity during in-water work. Any activity that causes turbidity to exceed 10 percent above natural stream turbidity is prohibited except as specifically noted below:

   a. **Monitoring**: Turbidity monitoring must be conducted and recorded as described below. Monitoring must occur at two-hour intervals each day when in-water work is being conducted. A properly calibrated turbidimeter is required. Visual gauging may be acceptable with prior written approval from DEQ; however, *turbidity that is visible over background is prohibited.*

i. **Representative Background Point**: The Applicant must take and record a turbidity measurement every two hours during in-water work at an undisturbed area 100 feet up-current from the in-water disturbance, in order to establish background turbidity levels. The background turbidity, location, date, tidal stage (if applicable) and time must be recorded immediately prior to monitoring down-current at the compliance point described below.
ii. **Compliance Point**: The Applicant must monitor every two hours, 100 feet downcurrent from the disturbance, at approximately mid-depth of the waterbody and within any visible plume. The turbidity, location, date, tidal stage (if applicable) and time must be recorded for each measurement.

b. **Compliance**: The Applicant must compare turbidity monitoring results from the compliance points to the representative background levels taken during each two hour monitoring interval. Pursuant to Oregon Administrative Rules 340-041-0036, short-term exceedances are allowed as followed:

MONITORING WITH A TURBIDIMETER		
ALLOWABLE EXCEEDANCE TURBIDITY LEVEL	ACTION REQUIRED AT 1ST MONITORING INTERVAL	ACTION REQUIRED AT 2ND MONITORING INTERVAL
0 to 5 NTU above background	Continue to monitor every 2 hours	Continue to monitor every 2 hours
6 to 29 NTU above background	Modify BMPs & continue to monitor every 2 hours	Stop work after 4 hours at 6-29 NTU above background
30 to 49 NTU above background	Modify BMPs & continue to monitor every 2 hours	Stop work after 2 confirmed hours at 30-49 NTU above background
50 NTU or more above background	Stop work	Stop work immediately and inform DEQ

If an exceedance occurs at: 50 NTU or more over background; 30 NTU over background for two hours; or 5-29 NTU over background for four hours, the activity must stop immediately and the Applicant must inform DEQ.

c. **Reporting**: The Applicant must record all turbidity monitoring required by subsections (a) and (b) above in daily logs. The daily logs must include calibration documentation; background NTUs; compliance point NTUs; comparison of the points in NTUs; location; date; time; and tidal stage (if applicable) for each reading. Additionally, a narrative must be prepared discussing all exceedances with subsequent monitoring, actions taken, and the effectiveness of the actions. Applicant must make available copies of daily logs for turbidity monitoring to DEQ, USACE, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Oregon Department of Fish and Wildlife upon request. An example turbidity log is attached to this certification.

If turbidity monitoring cannot be conducted due to dry conditions, the Applicant must provide photo documentation with a date and time stamp.

d. **Best Management Practices to Minimize In-stream Turbidity:** The Applicant must implement the following best management practices, unless accepted in writing by DEQ:
   i. Sequence/Phasing of work – The Applicant must schedule work activities to minimize in-water disturbance and duration of in-water disturbances.
   ii. Bucket control - All in-stream digging passes by excavation machinery and placement of fill in-stream using a bucket must be completed to minimize turbidity. All practical techniques such as employing an experienced equipment operator, not dumping partial or full buckets of material back into the wetted stream, adjusting the volume, speed, or both of the load, or using a closed-lipped environmental bucket must be implemented.
   iii. The Applicant must limit the number and location of stream-crossing events. Establish temporary crossing sites as necessary at the least sensitive areas and amend these crossing sites with clean gravel or other temporary methods as appropriate, to discharge sediments to the waterbody.
   iv. Machinery may not be driven into the flowing channel, unless authorized in writing by DEQ.
   v. Excavated material must be placed so that it is isolated from the water's edge or wetlands, and not placed where it could re-enter waters of the state uncontrolled.
   vi. Containment measures such as silt curtains, geotextile fabric, and silt fences must be in place and properly maintained in order to minimize in-stream sediment suspension and resulting turbidity.

SPECIFIC CONDITIONS FOR POST CONSTRUCTION STORMWATER MANAGEMENT

23) **Post Construction Stormwater Management:** The Applicant must implement and comply with the terms of the approved post construction stormwater management plan, which describes best management practices to prevent or treat pollution in stormwater anticipated to be generated by the project, in order to comply with state water quality standards. The Applicant must implement best management practices as proposed in the stormwater management plan, including operation and maintenance, dated October 1, 2019. If proposed stormwater facilities change due to site conditions, the Applicant must receive approval in writing from DEQ to make changes.

Stormwater Facility Description: The Appplicant will implement nine water quality treatment facilities (WQF) to adequately treat stormwater runoff generated by this project.

WQF #1 is a vegetated bioinfiltration swale/detention basin that discharges to Abernathy Creek.
WQF #2 is a bioslope that discharges to an existing roadside ditch before conveyance to the Clackamas River.
WQF #3 is a bioinfiltration swale that discharges to the Clackamas River.
WQF #4 is a bioinfiltration swale that discharges to the Willamette River.
WQF #5 is a bioinfiltration swale that discharges to the Willamette river.
WQF #6 is a bioinfiltration swale that discharges upland of an unnamed creek.
WQF #7 and #8 are bioinfiltration swales that discharges to a proposed riprap pad underneath the Abernathy Bridge before entering the Willamette River.

WQF #9 is a stormwater planter that discharges into the Willamette River.

Stormwater facilities designed to infiltrate runoff must be delineated with orange construction fencing to avoid compaction until completion of the project.

Within 30 days of project completion, the Applicant must submit a copy of the "as-builts" or red-lined construction drawings showing all stormwater management facilities.

24) **Stormwater Management & System Maintenance:** The Applicant is required to implement effective operation and maintenance practices for the lifetime of the proposed facility. These include but are not limited to:
  a. Maintenance techniques and frequency for each system component must follow appropriate recommendations in accepted manuals.
  b. Long-term operation and maintenance of stormwater treatment facilities will be the responsibility of ODOT, unless and until an agreement transferring that responsibility to another entity is submitted to DEQ.

25) **Corrective Action May Be Required:** DEQ retains the authority to require corrective action in the event the stormwater management facilities are not built or performing as described in the plan.

If the Applicant is dissatisfied with the conditions contained in this certification, a contested case hearing may be requested in accordance with Oregon Administrative Rule 340-048-0045. Such requests must be made in writing to the DEQ Office of Compliance and Enforcement at 700 NE Multnomah St, Suite 600, Portland Oregon 97232 within 20 days of the mailing of this certification.

DEQ hereby certifies this project, with the above conditions, in accordance with the Clean Water Act and state rules. If you have any questions, please contact Noosheen Pouya at Pouya.Noosheen@DEQ.state.or.us, by phone at (503)229-5785, or at the address on this letterhead.

Sincerely,

Steve Mrazik
Water Quality Manager
Northwest Region

ec: Melody White, USACE
Melinda Butterfield, DSL
Cory Gieseke, HDR

USACE Permit # NWP-2016-458-2

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, PORTLAND DISTRICT
P.O. BOX 2946
PORTLAND, OR 97208-2946

December 18, 2019

Regulatory Branch
Corps No. NWP-2016-458-2

Denis Reich
ODOT Region 1
123 NW Flanders Street
Portland OR 97209
Denis.A.Reich@odot.state.or.us

Dear Mr. Reich:

Enclosed is your fully executed Department of the Army Permit. Please carefully read the permit and its conditions. This permit is based on the project description and construction methods provided in your permit application. If you propose changes to the project, you must submit revised plans to this office and receive our approval of the revisions prior to performing the work.

The time limit to complete the authorized work is in General Condition 1. If the work cannot be completed prior to the time limit, you may apply for a time extension. We recommend you apply for a time extension at least 90 days before the time limit is reached.

Failure to comply with all terms and conditions of this permit could result in a violation of Section 404 of the Clean Water Act. You must also obtain all local, State, and other Federal permits that apply to this project.

We would like to hear about your experience working with the Portland District Regulatory Branch. Please complete a customer service survey form at the following address: http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey.

If you have any questions, please contact me at the letterhead address, by telephone at (503) 808-4387, or email Carrie.L.Bond@usace.army.mil.

Sincerely,

Kristen Hafer
Policy and Compliance Section Chief

Enclosures

cc:
Oregon Department of Transportation (Sargent)
Oregon Department of State Lands (Klassen)
Oregon Department of Environmental Quality (401applications@deq.state.or.us)
HDR, Inc. (Brian Bauman, Brian.Bauman@hdrinc.com)

DEPARTMENT OF THE ARMY PERMIT

Permittee: Oregon Department of Transportation, Region 1
123 NW Flanders Street
Portland, Oregon 97209

Permit No: NWP-2016-458-2

Issuing Office: U.S. Army Corps of Engineers, Portland District

NOTE: The term "you" and its derivatives as used in this permit means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the U.S. Army Corps of Engineers (Corps) having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

The project would result in construction related activities below the ordinary high water mark (OHWM) in a total of 1.8 acres of tributaries and wetlands to seismically retrofit and widen two bridges while reducing traffic congestion in the project area with additional through lanes. The I-205 Abernethy Bridge across the Willamette River and the I-205 Bridge over Main Street would be seismically retrofitted to withstand the Cascadia Seismic Event. Additionally, the project would add a northbound and southbound travel lane to I-205 between the OR 43 interchange and OR 99 interchange, and an I-205 northbound auxiliary lane between OR 99 and OR 213. The Abernethy Bridge would be widened to include an additional through-lane and wider shoulder in both northbound and southbound lanes (additional 16 feet of roadway width in both directions). The widening would be supported by larger in-water support piers upstream and downstream of current piers.

Willamette River: The applicant would construct new drill shafts and columns that would result in permanent fill of 0.146 acre below the OWHM of the Willamette River. Each pier will consist of two, 12-foot diameter drilled shafts. Prior to drilling, a casing will be placed to contain sediment generated during drilling activities; the casings would affect 0.18 acre below the OHWM of the Willamette River. When drilled shafts and columns are constructed, a 30-square-foot coffer dam would be placed around each structure, and sediments within each coffer dam will be removed.

Each pile footing cap for the bridge has existing riprap in place. Construction of the new drilled shafts may require the removal of the riprap. Riprap would be removed using a clamshell bucket and placing the removed material in uplands. Removal activities would affect up to 1.16 acres of the Willamette River around the existing piers.

Construction of the new piers would require a temporary work bridge to be constructed. The temporary bridge would remain in place for 4 years and would require the installation of 740, 24-inch-diameter steel piles installed and removed with the use of a vibratory hammer.

Upon completion of the new piers, the existing piers would be removed. Removal activities include removing the columns to five feet below the existing substrate and leaving the footings in place. Any remaining existing riprap would also be removed to five feet below the existing ground surface within a ten-foot diameter around each pier. This would result in the removal of 0.14 acre of pier material and an additional 1.16 acres of riprap, as described above.

Abernethy Creek: Pier three is located within the Abernethy Creek channel. Construction of the new pier and channel grading activities would result in a total discharge of fill material into 0.48 acre below the OHWM of Abernethy Creek. The applicant would remove the existing rip-rap and 0.25 acres of soil to reconstruct and grade the new stream channel. The reconstructed stream channel would become a low flow channel and will include rocks with large wood to stabilize the channel. A temporary work bridge with steel piles would be constructed and in place for 4 years within Abernethy Creek .

McLoughlin Creek and adjacent wetland: The proposed project would place permanent foundations below the OWHM of the creek for the required footing expansions for Pier 10. The permanent discharge of fill would be placed below the OHWM in 53 square feet of the creek. McLoughlin Creek would be temporarily piped for 340 linear feet to avoid and minimize sedimentation during pier construction. A diversion pipe to redirect flow during construction will be placed in Wetland 37 (W-37). A 145 square foot temporary construction pad for the crane will also be placed in W-37 for the duration of the construction period. W-37 will be restored to preconstruction conditions following the completion of construction activities and removal of the temporary fills. Sandbag barriers would be placed upstream and downstream of McLoughlin Creek. The diversion pipe and sandbags constitute a temporary discharge of 28 cubic yards of fill material over 2 square feet below the OHWM. Pier C3-3 would be removed and re-installed in the creek resulting in 1489 square feet of fill below the OWHM.

In-water work window (IWW) extensions were requested for the following activities:
1) Use of a barge all year long.
2) To complete drilled shafts - July 1 to December 31, 2020 (extending preferred IWW of October 31 to December 31)
3) Drilled shaft construction below the OHWM of the Willamette River but outside and above the actively flowing channel – any time during the year. Outside of the preferred IWW will occur within an isolation structure.

Purpose: To reduce congestion and provide seismic upgrades to the structural supports of the Abernethy and Main Street Bridges.

Project Location: The project is located in the Willamette River, McLoughlin Creek, Abernethy Creek, and Wetland-37 (W-37) at I-205 from the OR 43 interchange north to the OR 213 interchange, near West Linn in Clackamas County, Oregon at Latitude/Longitude 45.3644, -122.6045.

Drawings: Twenty (20) drawings/maps (Attachment 1)

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on December 18, 2024. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition No. 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions (Attachment 2).

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

a. Upon starting the activities authorized by this permit, Permittee shall notify the U.S. Army Corps of Engineers, Portland District, Regulatory Branch that the work has started. Notification shall be provided by e-mail to cenwp.notify@usace.army.mil and the email subject line shall include: NWP-2016-458-2, ODOT Clackamas County.

b. Permittee shall complete and sign the enclosed Compliance Certification (Attachment 3). Permittee shall submit the completed certification to the U.S. Army Corps of Engineers, Portland District, Regulatory Branch within 30 days of completion of the authorized activity. The completed certification shall be provided by e-mail to cenwp.notify@usace.army.mil and the email subject line shall include: NWP-2016-458-2, ODOT Clackamas County. If you are submitting files larger than 10 MB, contact your county Regulatory Project Manager for instructions.

c. All in-water work shall be performed during the in-water work period of July 1 to December 31, to minimize impacts to aquatic species. Exceptions to this time period requires specific approval from the Corps and the National Marine Fisheries Service.

d. This Corps permit does not authorize you to take an endangered species. In order to legally take a listed species, you must have separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit, or a biological opinion under ESA Section 7, with "incidental take" provisions with which you must comply). The Federal Highway Administration (FHWA) is the lead federal agency for ESA consultation for this project. The FHWA, or its designee, has determined the proposed project meets the requirements of the programmatic opinion prepared by the National Marine Fisheries Service (NMFS), titled *Endangered Species Act Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response Federal-Aid Highway Program in the State of Oregon* dated November 28, 2012 (NMFS Reference Number 2011/02095) which contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with the "incidental take" that is also specified in the opinions. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take of the referenced opinion, which terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the opinion, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute noncompliance with your Corps permit. It is your responsibility to obtain a copy of the terms and conditions from the lead federal agency. The NMFS is the appropriate authority to determine compliance with the terms and conditions its opinion, and with the ESA.

e. Permittee shall dispose of excavated materials at a suitable upland location, and materials shall be adequately stabilized to minimize increases in turbidity levels and indirect impacts to wetlands and other aquatic systems. The material shall be placed in a location and manner that prevents its discharge into waterways or wetlands. In the event of spills, affected material shall be taken to an appropriate upland location (and properly disposed of in accordance with any state standards or requirements).

f. Permittee shall ensure all appropriate sediment and erosion control devices are installed and in proper working order prior to construction. Devices shall remain in place until the area is stabilized and construction is complete. If necessary, sediment and erosion control may be left in place after construction is complete to facilitate stabilization. However, upon stabilization all devices shall be removed from the area and disposed of in and upland location.

g. Permittee shall isolate and confine the worksite from the active channel to minimize turbidity and prevent pollutants from entering the waterbody, except in the Willamette River.

h. Permittee shall take the necessary precautions to prevent any petroleum products, chemicals, or deleterious or toxic materials from entering waterways during construction.

i. Heavy equipment shall be clean and free of leaks when operated in or near the active channel. All vehicles shall be stored and fueled a minimum of 150 feet from any waterbody unless there is secondary containment.

j. All practicable erosion control devices shall be installed and maintained in good working order throughout construction to prevent the unauthorized discharge of material into a wetland or tributary and minimize increases in turbidity resulting from the work. The devices shall be installed in a manner to maximize their effectiveness, e.g., sediment fences shall generally be buried or similarly secured. These controls shall be maintained until permanent erosion controls are in-place or are no longer necessary.

k. Permittee shall inspect the erosion control devices on a frequency basis to confirm that they are in proper working order. Any maintenance necessary shall be implemented immediately prior to the continuation of construction activities.

l. Immediately upon completion of the work in wetlands, permittee shall fully remove the temporary fill, restore the grade and re-vegetate the project area, including the specific area to prevent degradation of the aquatic habitat/resource.

m. Permittee shall fully implement the Restoration Plan included in

Attachment 4.

n. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the U.S Army Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).
( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this Authorization:

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

	12-18-19
(PERMITTEE SIGNATURE)	**(DATE)**
DENIS REICH	ODOT REGION 1 ENVIRONMENTAL MANAGER
(PRINTED NAME)	**(TITLE)**

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

FOR THE COMMANDER, AARON L. DORF, COLONEL, CORPS OF ENGINEERS, DISTRICT COMMANDER:

	18 December 2019
(DISTRICT COMMANDER)	**(DATE)**

William D. Abadie
Chief, Regulatory Branch

When the structures or work authorized by this permit are still in existence at the time the property is transferred , the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign below.

PERMIT TRANSFEREE:

____ ________________________
Transferee Signature **DATE**

____
Name (Please print)

____
Address

____
City, State, and Zip Code

Attachment I. ODFW Fish Passage

From:	MURTAGH Tom
To:	WHITE Benjamin; MURTAGH Tom; BAKI Pete
Cc:	THOMPSON Josie E; SIMMONS Devin
Subject:	RE: Stafford to Abernathy
Date:	Monday, October 9, 2017 5:48:02 PM

Hi Ben, Finally getting back with fish presence information in regards to the list of culverts that will be affected by the proposed I-205 highway widening project between Stafford Road and the Abernethy Bridge. From the list and subsequent site visits, I identified three culverts where fish passage will need to be addressed; 1) Abernethy Creek culvert (No. 4 on list), and 2) Athey Creek culvert (No. 5 on list), and 3) No 10 or 11 on the Excel list, needs to be confirmed. Native migratory fish associated with the Abernethy Creek culvert (No. 1), located on the east side of the Willamette River, include ESA listed winter steelhead, coho salmon and chinook, and State Vulnerable Pacific lamprey, as well as cutthroat trout. This culvert conveys Abernethy Creek under Highway 99E and some smaller collector roads, so it is uncertain how any proposed bridge work conducted on I-205 above Highway 99E and the culvert crossing will trigger the State Fish Passage Law, or if the current culvert meets fish passage criteria as it functions today. For Athey Creek (No. 2), the only native migratory fish of concern are resident cutthroat trout. It is unknown if these fish are present today in the reach above the culvert. More evaluation of this small watershed and discussion will be needed prior to determining the appropriate approach to addressing fish passage, as there is a small barrier dam downstream that is assumed to be a full barrier. It is also unknown if the Borland Road culvert just upstream from the dam is fish passable, as well. There is approximately . miles of viable fish habitat upstream of the highway culvert. Fritchie Creek is the stream conveyed under I-205 by either culvert No. 10 or No. 11 (couldn't verify). Resident cutthroat trout are the NMF of concern at this location. There is approximately .25 miles of viable habitat upstream of the Highway crossing.

Native migratory fish and the State Fish Passage Law will not have to be addressed for all other culverts on the Excel spread sheet given gradient, hydrology, size of the stream, and lack of fish. Thanks for coordinating and please don't hesitate to contact me for further discussion or clarification. A site visit may be useful. ODFW looks forward to assisting ODOT as this large project moves forward.

Tom Murtagh
District Fish Biologist
ODFW – Clackamas
W – 971.673.6044
C – 971.678.4871

From: WHITE Benjamin [mailto:Benjamin.WHITE@odot.state.or.us]
Sent: Monday, September 18, 2017 8:47 AM
To: MURTAGH Tom; BAKI Pete
Cc: THOMPSON Josie E; SIMMONS Devin
Subject: RE: Stafford to Abernathy

Hey Tom,

I had a feeling you would be hearing something about this soon. Last week I received the information to request a fish presence determinations for the waterways and now that I've wrapped up all the IWW extension work I'm moving on to this. They would like a determination on the list of crossings with culverts over 24in within the project area. We have had them prepare a map of all drainages and a spreadsheet of the known presence information they were able to find (not much). Due to topography I have a feeling many of these are not fish bearing but we have had surprises recently so not making any assumptions. Note the map is missing Mclean Creek which is under the west end of the I-205 bridge.

I also see there are a couple of drainages on the east side. Will I need to reach out to Todd as well?

Pete, it ok. I figured you would be stuck in only culvert agreement work, especially with the planned expansion. I look forward to meeting you soon though!

Let me know what else you will need and whether we need to get out and look at these! We'd prefer to squeeze something in sooner rather than later with the consultant if at all possible.

Thanks so much Tom!

Ben White
ODOT Region 1 Biologist
123 NW Flanders
Portland, OR 97209

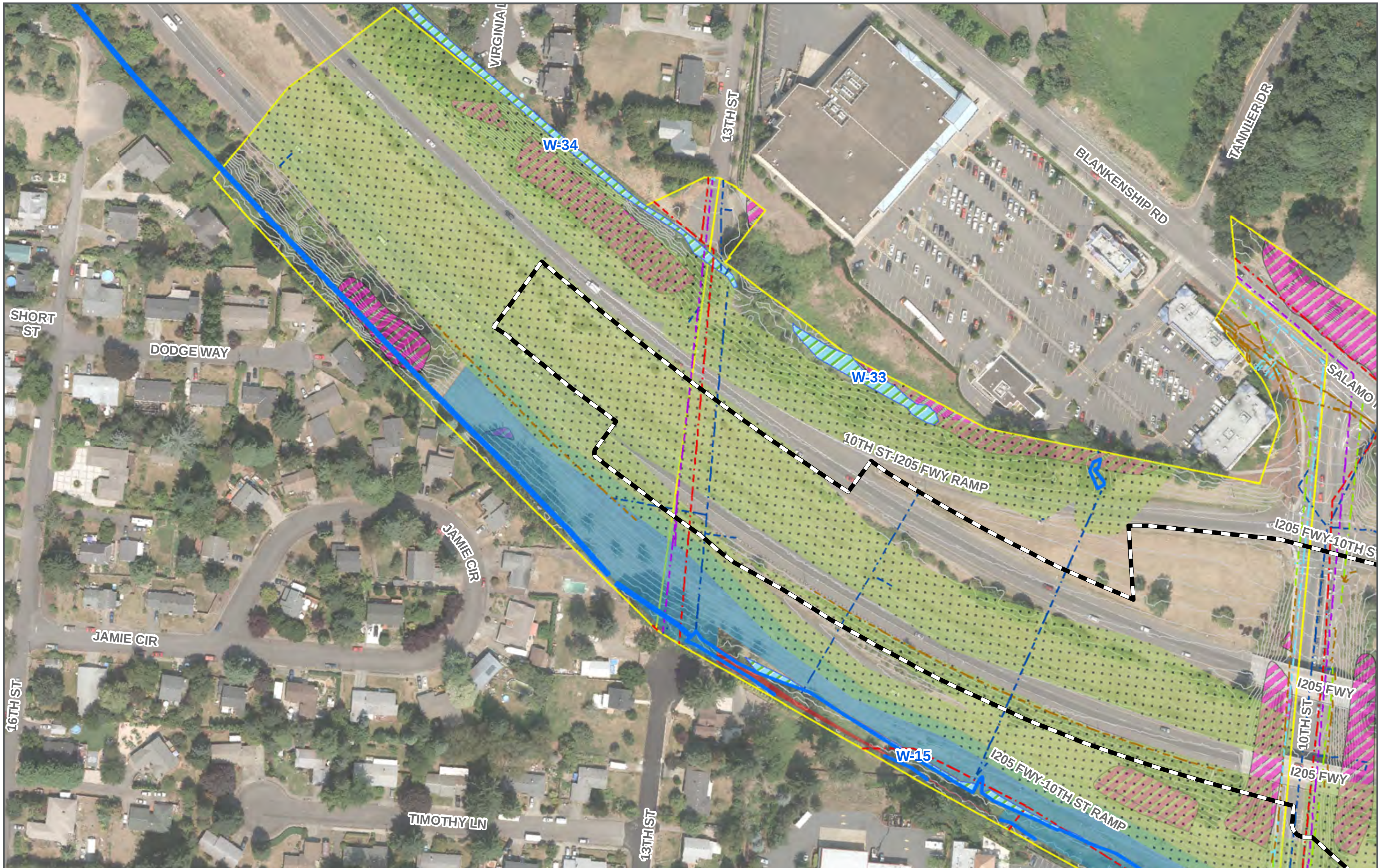
503-731-8517

From: Tom Murtagh [mailto:tom.murtagh@state.or.us]
Sent: Thursday, September 14, 2017 9:38 AM
To: WHITE Benjamin; BAKI Pete
Cc: THOMPSON Josie E
Subject: Stafford to Abernathy

Hey Ben – just got wind that ODOT is moving on the I-205 highway widening project between Stafford Road and the Abernathy Bridge. There will be some resource concerns, both fish and wildlife, so let me know when you want to engage on this. Note that Pete Baki (included) is the new ODFW/ODOT Liaison and I assume that he will be involved as well, but not sure when his start date is. Thanks. Tom.

Tom Murtagh
District Fish Biologist
ODFW – Clackamas
W – 971.673.6044
C – 971.678.4871

Attachment J. Ch. 28 Site Plan



HDR

N

0 100 200 Feet

- Construction Impact Area
- Delineated Wetland
- Taxlot
- Habitat and Impact Areas Not Designated as HCAs
- HCA - Low
- HCA - High
- Slope Greater than 25%

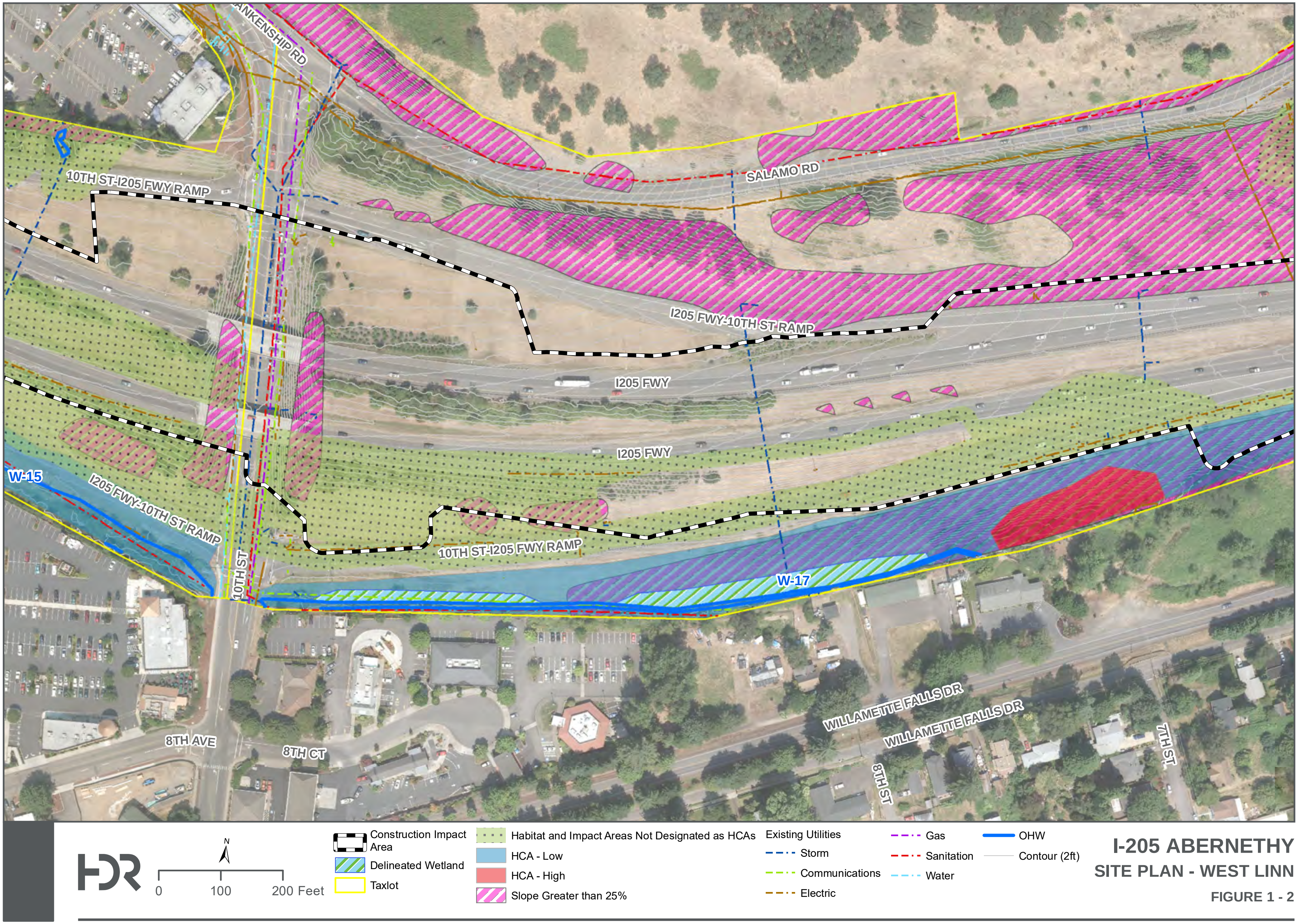
Existing Utilities
- Storm
- Communications
- Electric
- Gas
- Sanitation
- Water
- OHW
- Contour (2ft)

I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 1

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021

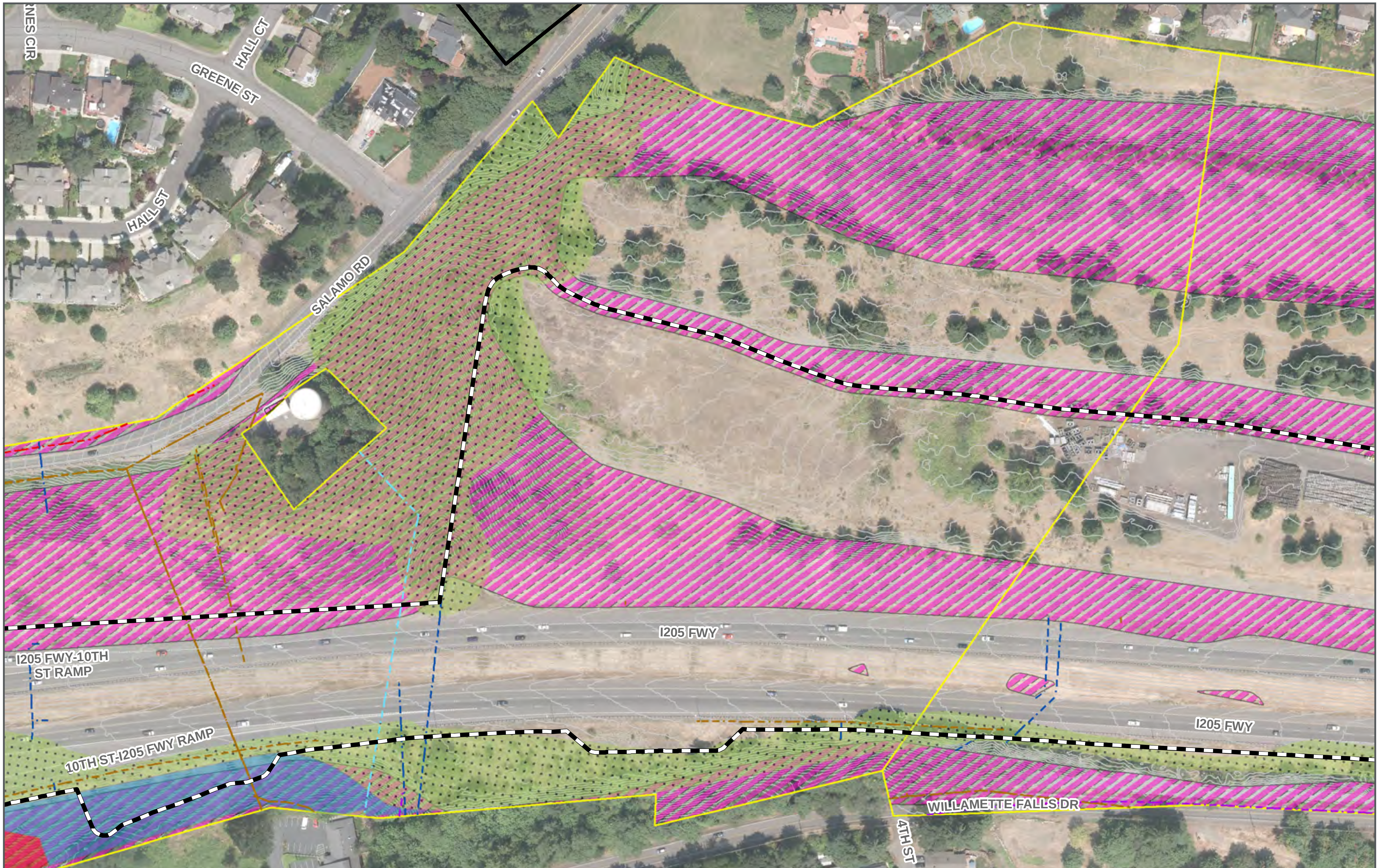


I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 2

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021



HDR

0 100 200 Feet

N

Construction Impact Area
Taxlot
Building Structure

Habitat and Impact Areas Not Designated as HCAs
HCA - Low
HCA - High
Slope Greater than 25%

Existing Utilities
Storm
Electric
Gas
Sanitation
Water
Contour (2ft)

I-205 ABERNETHY
SITE PLAN - WEST LINN
FIGURE 1 - 3

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021

HDR

0 100 200 Feet

Construction Impact Area
Delineated Wetland
Taxlot
Building Structure
Habitat and Impact Areas Not Designated as HCAs
Slope Greater than 25%
Existing Utilities
Storm
Electric
Gas
OHW
Contour (2ft)

I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 4

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021

0 100 200 Feet

Construction Impact Area
Delineated Wetland
Taxlot

Habitat and Impact Areas Not Designated as HCAs
HCA - Low
HCA - High
Slope Greater than 25%

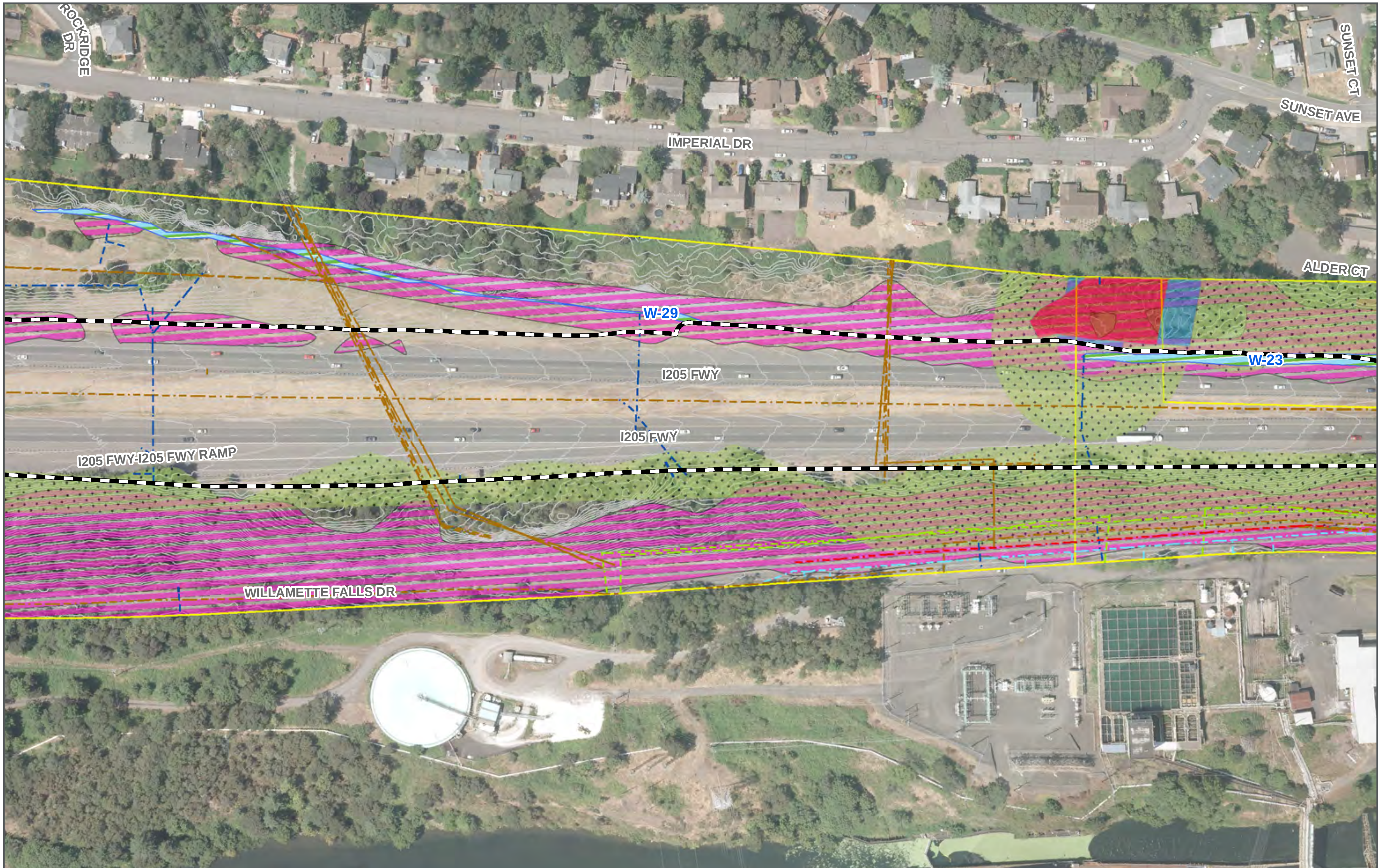
Existing Utilities
Storm
Communications
Electric
Gas
Sanitation
Water
OHW
Contour (2ft)

I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 5

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021



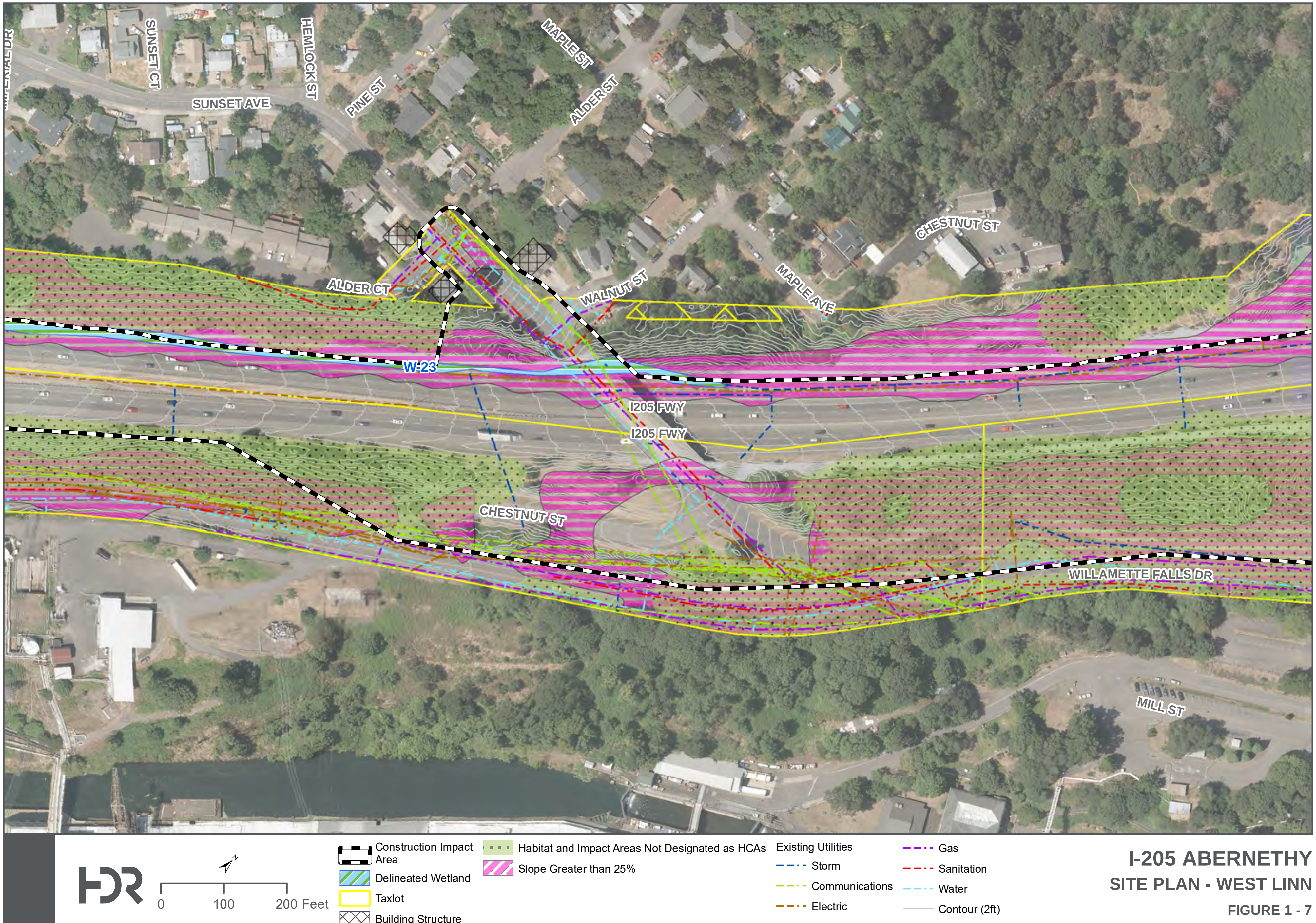
0 100 200 Feet

Construction Impact Area
Delineated Wetland
Taxlot
Habitat and Impact Areas Not Designated as HCAs
HCA - Low
HCA - High
Slope Greater than 25%

Existing Utilities
Storm
Communications
Electric
Sanitation
Water
Contour (2ft)

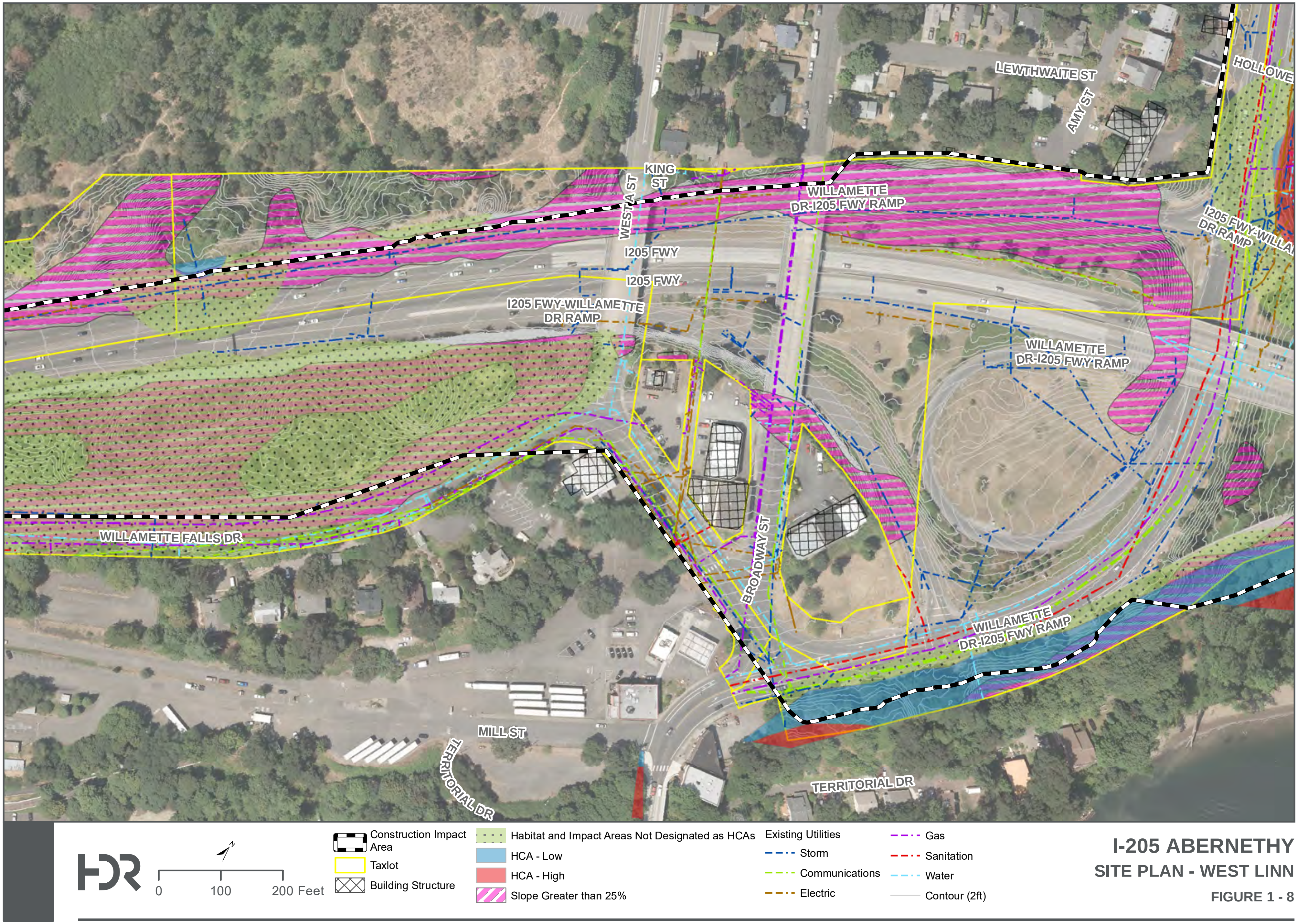
I-205 ABERNETHY
SITE PLAN - WEST LINN
FIGURE 1 - 6

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021



I-205 ABERNETHY
SITE PLAN - WEST LINN
FIGURE 1 - 7

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021

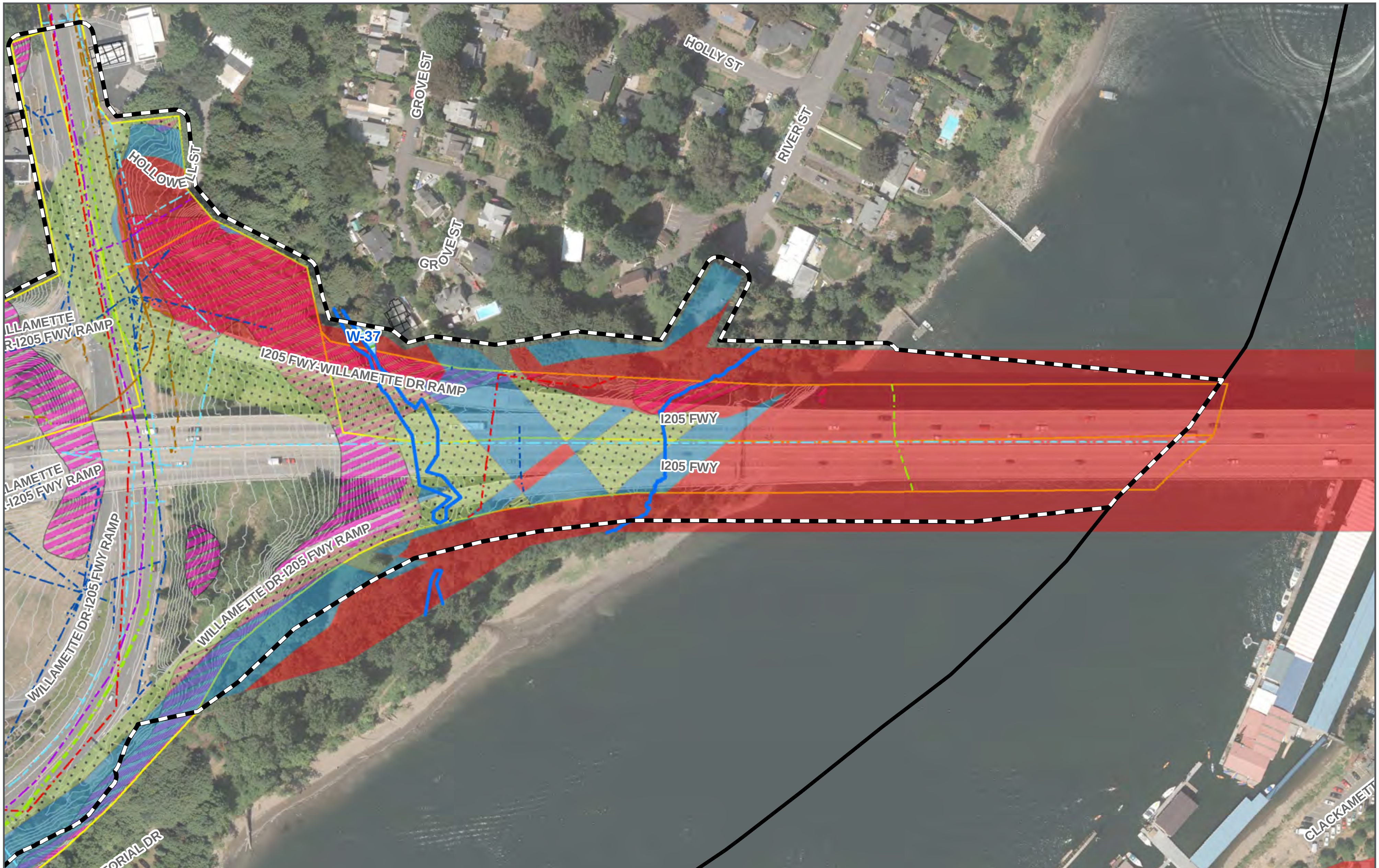


I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 8

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021



HDR

0 100 200 Feet

Construction Impact Area	Habitat and Impact Areas Not Designated as HCAs
Delineated Wetland	HCA - Low
Taxlot	HCA - High
Building Structure	Slope Greater than 25%

Existing Utilities

- Storm
- Communications
- Electric
- Gas
- Sanitation
- Water
- OHW
- Contour (2ft)

I-205 ABERNETHY

SITE PLAN - WEST LINN

FIGURE 1 - 9

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\LAND_USE_PERMIT\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021

Attachment K. Mitigation Plan

HCA & WRA Mitigation Plan

Date:	Monday, February 08, 2021
Project:	ODOT | K19786 I-205 Improvements: Stafford Road to OR 213
To:	Allen Hendy, ODOT – PM
From:	Stephanie Serpico, HDR – PM
Subject:	West Linn Land Use Application – Mitigation Plan

Mitigation Required

Disturbance is proposed in multiple Habitat Conservation Areas (HCAs) and Water Resource Areas (WRAs) within the project area, requiring mitigation consistent with Community Development Code (CDC) Chapter 31.200.

Mitigation Plan Requirements

As outlined in CDC 32.090.E, the following items are required in the mitigation plan:

List of all parties responsible for work on development site

The Oregon Department of Transportation (ODOT) is the party responsible for work on the development site.

Map showing where specific adverse impacts will occur and where mitigation will occur

See Attachment T for a map of proposed impacts to WRAs, Attachment O for a map of proposed impacts to HCAs, and Attachment L for the Revegetation Plan, which shows where mitigation will occur. See Table 1 for proposed impacts and mitigation WRAs and Table 2 for proposed impacts and mitigation in HCAs. In total, 17,918 square feet of WRA is proposed to be permanently impacted. Following the mitigation and revegetation standards of Chapter 32, 17,918 square feet of mitigation is required as the proposed impacts are not to previously developed areas (PDAs), requiring a 1:1 mitigation ratio. Based on density requirements outlined in 32.100.A.3.a, 17,918 square feet of disturbance requires 178 trees and 896 shrubs to be planted. Temporarily impacted areas will be restored and revegetated. On-site mitigation is proposed by restoring and enhancing existing WRAs on-site.

Table 1. Proposed disturbance and mitigation in WRAs

WRA #	PDA disturbance (sq. ft.)	Non-PDA disturbance (sq. ft.)	Mitigation required
1			
2	0	0	None
3	0	6,432	6,432 sq. ft., 64 trees, 322 shrubs
4	0	0	None
5	0	948	948 sq. ft., 9 trees, 47 shrubs
6	0	10,538	10,538 sq. ft., 105 trees, 527 shrubs
Total	**0**	**17,918**	**17,918 sq. ft., 178 trees, 896 shrubs**

Proposed temporary impacts to HCAs will be restored and revegetated as with the WRAs. Permanent impacts to HCAs total 22,126 square feet, requiring planting of 221 trees and 1,106 shrubs.

Table 2. Proposed disturbance and mitigation in HCAs

HCA #	Permanent disturbance (sq. ft.)	Mitigation required
1	10,726	10,726 sq. ft., 107 trees, 536 shrubs
2	0	0
3	0	0
4	11,400	11,400 sq. ft, 114 trees, 570 shrubs
Total	**22,126**	**22,126 sq. ft., 221 trees, 1,106 shrubs**

Impacted areas of HCAs that overlap with WRAs were counted as WRA impacts as to not double count (only non-overlapping HCAs with impacts were counted). WRA 5 and HCA 4 are both located underneath the Abernethy Bridge and overlap with the proposed mitigation area in compliance with the Department of State Lands (DSL) and U.S. Army Corps of Engineers (USACE) Joint Permit Application mitigation requirements. See Attachment L for the Landscaping/Revegetation Plan. It should be noted that additional area under the bridge is proposed to be landscaped and reseeded as part of the project in addition to the proposed mitigation. Only the areas highlighted in orange on Sheets FA15 and FA16 in Attachment L are the areas proposed for HCA and WRA mitigation in compliance with CDC Chapters 28 and 32.

Disturbance areas were calculated using ArcMap with the proposed project design overlaid with the WRAs (Attachment T) and HCAs (Attachment O). Some of the WRAs in the project area overlap with existing roadway, which are exempt from WRA permit requirements per CDC 32.040.B.1. Areas determined by the applicant to be exempt are shown in Attachment T, and neither temporary nor permanent impacts were calculated in those areas. Permanent impacts were from proposed excavation and fill associated with widening I-205, installation of stormwater facilities, and installation of drilled shafts associated with the Abernethy Bridge seismic retrofit. Temporary impacts include staging of materials, excavation and fill that will be restored at grade and revegetated, and access roads. In HCAs that overlap with existing roadways, an HCA Map Amendment was created (Attachment W), which documents the areas that do not provide any habitat elements typical of HCA designations. Impacts from the project were not calculated in these areas.

Mitigation for all HCA and WRA permanent disturbance is proposed to be located under and adjacent to the Abernethy Bridge. The total disturbance of permanent impacts to WRAs and HCAs requires 40,044 square feet of mitigation, including 399 trees and 2,002 shrubs to be planted. The total proposed mitigation area is 190,732 square feet, with 704 trees and 2,067 shrubs (see Attachment L, Landscaping Plan).

A revegetation plan for the areas to be mitigated that meets the standards of CDC 32.100
The proposed landscaping plan (Attachment L) meets most of the standards listed in CDC 32.100.

1. All trees, shrubs, and ground cover proposed for planting are native plants selected from the Portland Plant List. The revegetation plan meets this standard.
2. Plant size: Bareroot material is proposed to plant most of the mitigated areas. Bareroot shrubs are equivalent to one-gallon containers. The revegetation plan meets this standard.
3. Plant coverage: Trees are proposed to be planted at a rate of 5 trees and 25 shrubs per 500 square feet of disturbance. Proposed mitigation amounts, including trees and shrubs, are included above in Tables 1 and 2. Trees are proposed to be planted at an average of 15 feet on center. Shrubs will be installed 5 feet on center, in groups of 3 to 9 plants per species. Shrub groups will be spaced no closer than 15 feet apart and no closer than 5 feet to an adjacent tree. Planting at a more open density will yield a healthier, more self-sustaining ecosystem. Overplanting will require removals or result in tree-fall as species crowd each other out. The revegetation plan does not meet this standard; however, to make up for the lower density plantings, the applicant proposes additional mitigation area, trees, and shrubs that will exceed the required amounts based on disturbance. Overall, the amount of proposed mitigation is equal to 190,732 square feet, including 704 trees and 2,067 shrubs.
4. Plant diversity: Proposed shrubs consist of 11 different species and trees consist of 18 species (see Sheet FA03 in Attachment L, Landscaping Plan). The revegetation plan meets this standard.
5. Invasive vegetation: The revegetation plan meets this standard as invasive vegetation and noxious weeds will be removed within the mitigation area prior to planting.

6. Tree and shrub survival: Proposed density in mitigation areas is 80% survival rate after 3 years. Mulching and irrigation will be applied to ensure 80% survival after 3 years of monitoring. The applicant will also provide weed control throughout the maintenance period, and planting is proposed to occur during the planting season
7. Monitoring and reporting: The applicant will provide a 3-year monitoring and maintenance plan, including a report to be submitted at the end of the third year documenting 80% survival of mitigation areas, including native volunteers. ODOT will be responsible for monitoring and maintaining the mitigation areas.

Implementation schedule (timeline for construction, mitigation, mitigation maintenance, monitoring, reporting)

Construction will begin in Fall of 2022 and continue until Fall of 2025. Restoration will be implemented Fall of 2025 and continue through Spring of 2026. Monitoring and maintenance will begin in Spring 2026 and continue through 2031.

Assurances shall be established to rectify mitigation actions not successful within the first 3 years. This may include bonding or other surety.

The State of Oregon, acting though the Department of Transportation, shall include contractual obligations with the selected contractor to fulfill the mitigation criteria as presented. Mitigation plantings will be monitored for success consistent with the Stream and Water Restoration Plan. Through the issuance of permits from both DSL and USACE, ODOT is legally obligated to 5 years of mitigation monitoring and success criteria found within the Stream and Water Restoration Plan. See Attachment Z for the DSL and USACE permits.

A monitoring report will be submitted to the City's planning division, documenting plant survival rates of shrubs and trees on the mitigation sites after the third year of monitoring and maintenance. The report will also include photographs of the mitigation sites. ODOT will conduct active maintenance to reduce non-native vegetation coverage. Routine maintenance may include limited spot herbicide treatments, mulching undesirable trees and shrubs, and replanting and/or reseeding with native species. Site maintenance will occur on an as-need basis. Informal hydrology and natural resource observations will be included along with an assessment of performance standards. If performance standards are not met, then remedial actions will be proposed in the monitoring report.

Attachment L. HCA Map Amendment Narrative

HCA Map Errors and Amendment

Date:	Monday, February 08, 2021
Project:	ODOT | K19786 I-205: I-5 to OR 213, Phase 1
To:	Allen Hendy, ODOT – PM
From:	Stephanie Serpico, HDR – PM
Subject:	West Linn Land Use Application – HCA Map Amendment

HCA Map Errors

Habitat Conservation Areas (HCAs) are mapped by Metro and combine regionally significant riparian and upland wildlife habitat, which supports riparian functions and wildlife values. As outlined in Metro Code Chapter 3.01.1310, the purposes of Metro's HCA program are "to 1) conserve, protect, and restore a continuous ecologically viable streamside corridor system, from the streams' headwaters to their confluence with other streams and rivers, and with their floodplains in a manner that is integrated with upland wildlife habitat and with the surrounding urban landscape; and 2) to control and prevent water pollution for the protection of the public health and safety, and to maintain and improve water quality throughout the region." As stated in West Linn CDC Chapter 28.070.A, "it is inevitable, given the large area that Metro's HCA Map covers, that there may be some errors." This document outlines the HCA map errors in the proposed project area and serves as an application to amend the HCA map.

HCAs in Project Area

HCAs in the project area were mapped by Metro in 2004 based on a three-step process as outlined in Metro Code Chapter 3.07.1340.d.3. The process includes determining boundaries of riparian habitat areas, determining the urban development value of the property, and cross-referencing the habitat classes with the urban development value. There are four separate HCAs in the project area, all of which are partially mapped in error. Figures 1-4 of Appendix A show each HCA in the project area.

HCA 1

HCA 1 is located both east and west of 10th Street and overlaps two wetlands and a stream on the shoulder of I-205 northbound (NB). There are areas of moderate and low HCA designations present. Portions of the HCA overlap with existing roadway (I-205 NB), the median between the I-205 on ramp and I-205 NB, and existing roadway on 10th Street.

HCA 1 appears to have been established to protect the functions and values associated with a small manipulated jurisdictional stream and adjoining degraded wetland. The stream is an intermittent stream, five feet in width at its widest point located south of 10th street on-ramp to I-205 NB. Beginning west of 10th Street the stream flows into and out of several culverts, eventually discharging into the Willamette River further downstream. The wetland is immediately adjacent to the stream (to the north), and is dominated by invasive plant species, including Himalayan blackberry and reed canary grass. Functions provided by the stream and wetland include water quality treatment of stormwater runoff and low-quality habitat for macroinvertebrates, birds, and wildlife.

Portions of HCA 1 fall entirely within the engineered roadway prism of I-205 and 10th Street and are surrounded on both sides by existing roadway, disrupting habitat connectivity. The applicant proposes to remove the sections that overlap with the existing engineered roadway prism. The roadway prism is engineered to support traffic. While the prism does provide a minor functional value to a natural system that is directly adjacent to the roadway prism, those beneficial functions would be limited to water quality treatment for stormwater entering the degraded and altered water resources for which HCA 1 appears to have been established. The area of moderate HCA 1 found between the I-205 northbound mainline and the 10th Street on-ramp to I-205 provides no functional benefit to the degraded jurisdictional feature. Stormwater runoff from the proposed additional impervious surfaces adjacent to HCA 1 will be treated to current design standards using bioretention ponds. Two bioretention ponds are proposed to be located east of 10th Street, in between I-205 NB and I-205 SB (See Attachment P, Water Quality Facilities). The proposed stormwater facilities are designed to control runoff, protect against erosion, and provide high quality treatment of runoff before it discharges into water features downstream.

Not only do these erroneously-mapped areas not provide wildlife values consistent with the intent of HCAs, it would be inappropriate to encourage wildlife use in such close proximity to a major freeway, as it would add a substantial safety concern for both wildlife and road users. Given these areas, HCA 1 does not provide riparian benefits, floodplain connection, wildlife habitats, or improvements to the quality of water within a jurisdictional feature. These areas are mapped in error and the applicant requests those areas shown as “HCA Map Amendment (removal)” on Figure 1 (Appendix A) be removed from HCA 1.

HCA 2

HCA 2 is located north of I-205 southbound (SB), east of the ODOT maintenance yard. It consists of low, moderate, and high designations. Gravel roads cross through the entire HCA. It appears HCA 2 was mapped to protect and enhance water quality of Tanner Creek. Tanner Creek enters a culvert north of the I-205 SB shoulder, just south of a row of houses on Imperial Drive (Appendix

A, Figure 2). The culvert extends below both lanes of I-205 and daylights south of Willamette Falls Drive. There is a short daylighted portion north of the culvert inlet, approximately 80 feet long. The creek is between 3 to 6 feet wide at its widest point. Tanner Creek is perennial, and provides moderate habitat for birds, wildlife, and macroinvertebrates. Dominant vegetation surrounding the daylighted portion of the stream includes native vegetation such as sitka willow, but also invasive vegetation such as reed canarygrass. The limited area of the creek not within a culvert provides water quality functions and macroinvertebrate production. The stream does not support fish.

Because the stream is contained in an underground culvert, HCA 2 does not provide any riparian functions or wildlife values to Tanner Creek within the project area. The culvert disrupts habitat connectivity in the area. A portion of HCA 2 also overlaps with the existing lanes of I-205 SB and NB. These portions of HCA 2 are not providing any functions or benefits to Tanner Creek or its surrounding riparian area as they are contained within engineered facilities. For these reasons, the applicant proposes an HCA map amendment to remove the area downstream of the culvert inlet that overlaps with existing developed facilities and engineered roadways.

HCA 3

HCA 3 is located north of I-205 SB, west of the Sunset Avenue Bridge overcrossing of I-205, and consists of both moderate and high HCA designations. It is associated with Sunset Creek, which is piped underneath I-205 in a stormwater pipe. Sunset Creek is daylighted for a short distance north of the project area, south of Imperial Drive, where it enters a stormwater pipe approximately 100 feet south that crosses underneath I-205. The creek daylights again south of I-205 NB for a short distance and enters another pipe north of Willamette Falls Drive (Figure 3). Similar to Tanner Creek described in HCA 2 above, Sunset Creek is providing water quality and habitat functions but is limited to the daylighted portion of the stream. Most of Sunset Creek is contained within the stormwater pipe, which prevents any riparian benefits intended by HCA mapping.

Part of the "moderate" designated HCA overlaps with the existing I-205 roadway and is mapped in error. The applicant proposes to amend the HCA map and remove the portion that overlaps with I-205 and the stormwater pipe, since this area is not providing any habitat functions or values to Sunset Creek.

HCA 4

HCA 4 is located southeast of OR43 across from the I-205 NB on-ramp (Appendix A Figure 4). It consists of both moderate and high designations and is associated with the Willamette River. The Willamette River provides many moderate to high functions related to water quality, aquatic habitat and riparian habitat. Some of these functions include fish and wildlife habitat (including

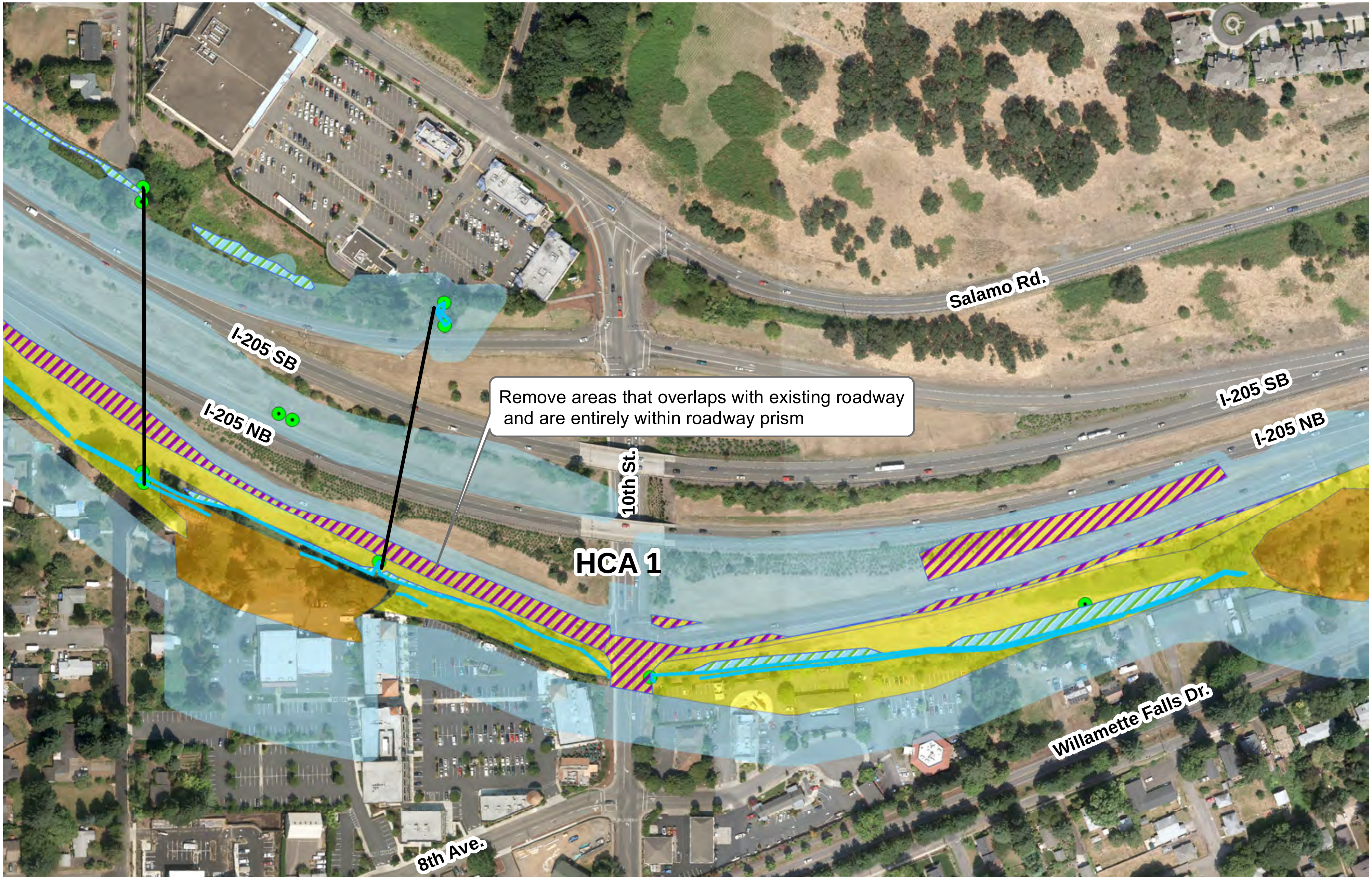
ESA-listed aquatic species), low water flow moderation, substrate mobility, and nutrient cycling. HCA 4 extends from the Willamette River up to the roadway of OR-43.

The majority of HCA 4 appears to be mapped correctly except for an area of moderate HCA that overlaps with the existing roadway on OR-43. HCA 4 was mapped to protect the water quality and riparian habitat associated with the Willamette River; however, a portion has been previously disturbed during the construction of OR-43. The natural vegetation has been replaced with grasses that are easy to mow and maintain. The existing roadway does not provide suitable habitat for wildlife. The full boundary of the original HCA was mapped in error, and the applicant proposes an amendment to remove the portion that overlaps with existing roadway as it is not providing riparian habitat functions or values originally intended with HCA designations.

Additional Documentation

In addition to the figures below showing the HCA mapping errors within the project area, HDR completed a wetland delineation and received concurrence from the Oregon Department of State Lands in 2019. The wetland delineation confirmed the boundaries of the jurisdictional waters the HCAs were established to protect. See Attachment X for DSL Concurrence and Wetland Delineation Report.

Appendix A. Figures



HDR

0 Miles 0.05

HIGH HCA
MODERATE HCA
LOW HCA

Stream
Wetland
HCA Map Amendment (removal)

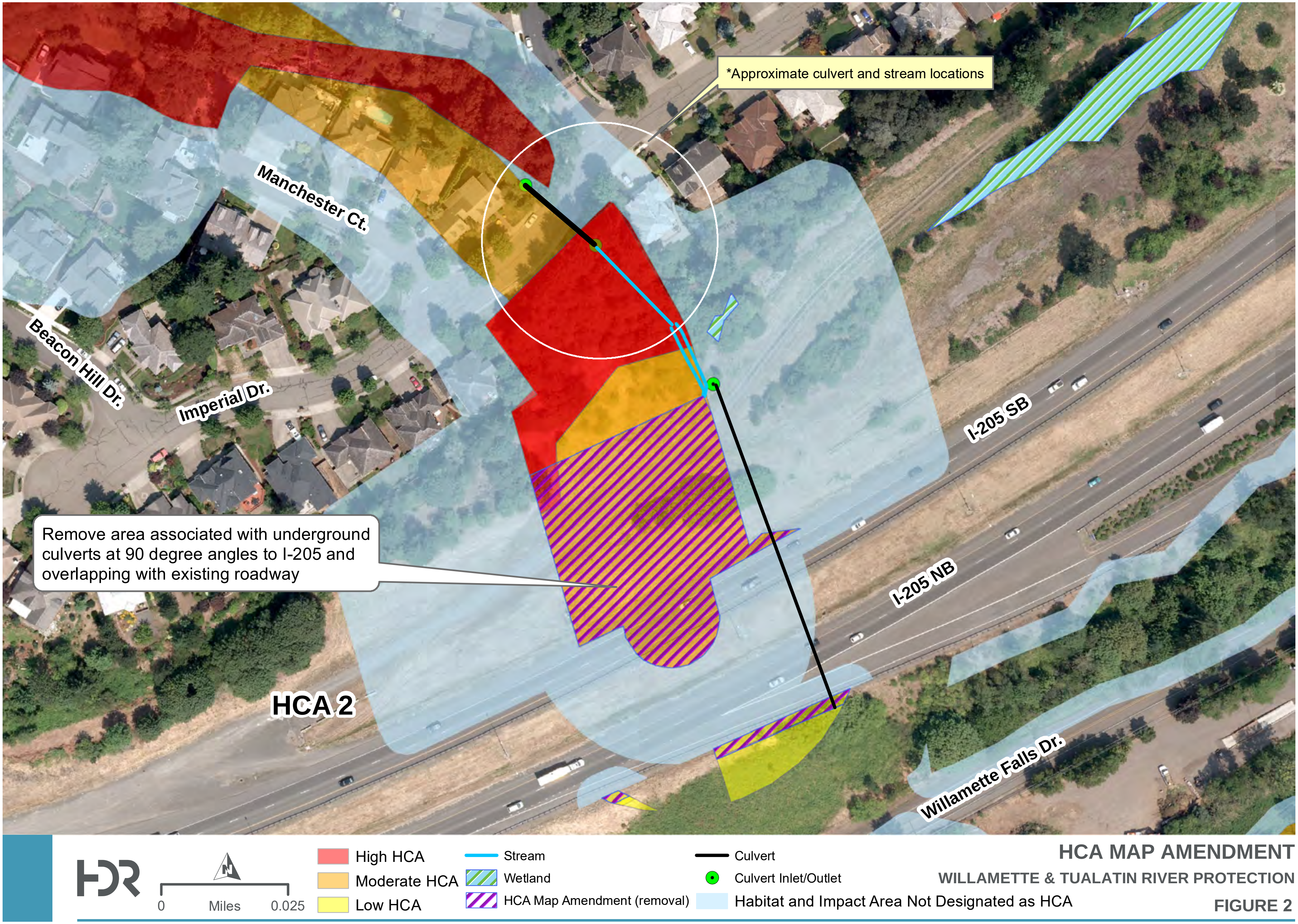
Culvert
Culvert Inlet/Outlet
Habitat and Impact Area not Designated as HCA

HCA MAP AMENDMENT

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 1

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA MAP AMENDMENT.MXD - USER: RBARKSDALE - DATE: 1/21/2021



HDR

HCA MAP AMENDMENT

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 2

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA MAP AMENDMENT.MXD - USER: RBARKSDALE - DATE: 12/30/2020

High HCA
Moderate HCA
Low HCA
Stream
Wetland
HCA Map Amendment (removal)
Culvert
Culvert Inlet/Outlet
Habitat and Impact Area Not Designated as HCA

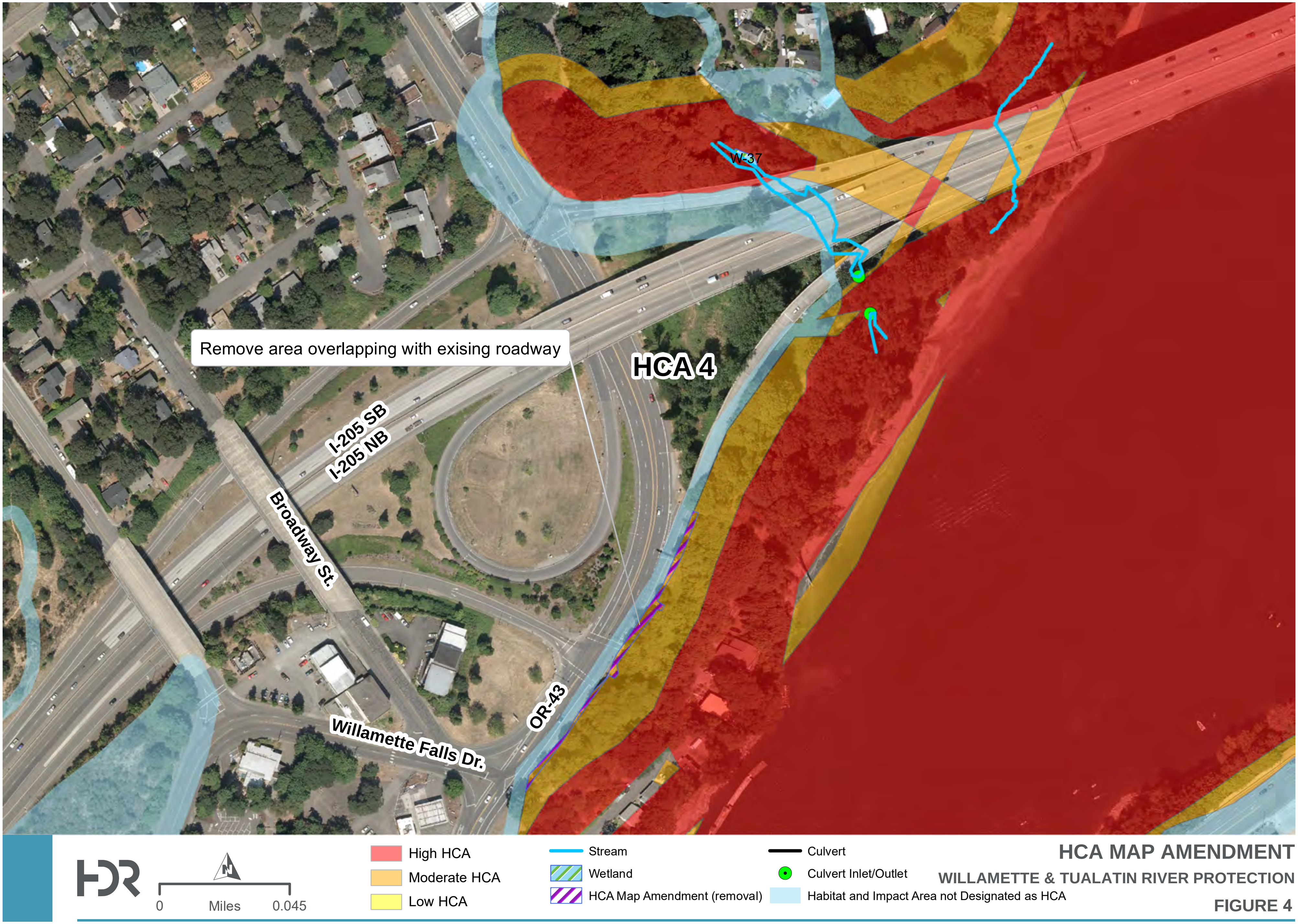
0 Miles 0.02

HCA MAP AMENDMENT

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 3

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA MAP AMENDMENT.MXD - USER: RBARKSDALE - DATE: 12/10/2020



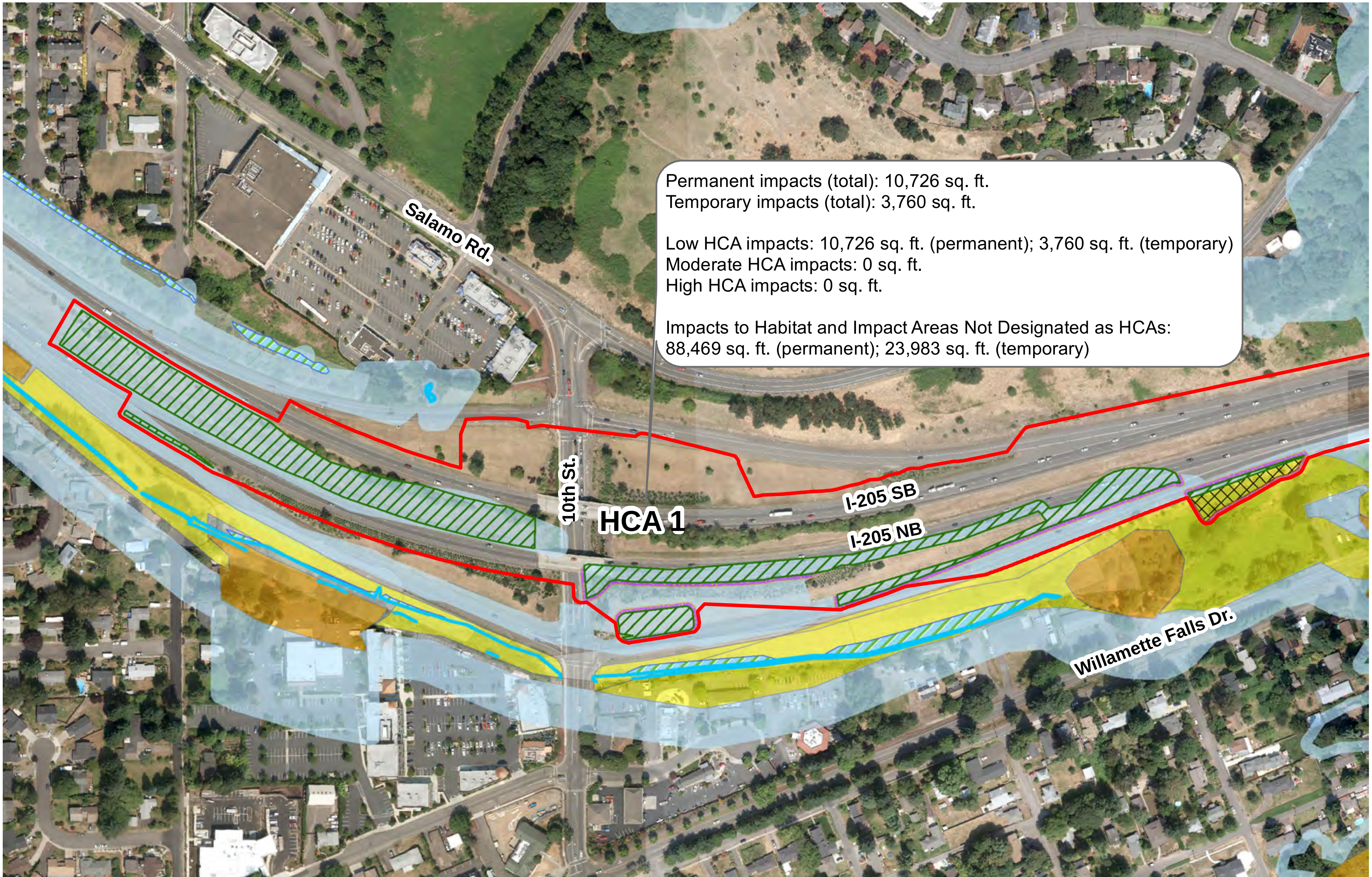
HCA MAP AMENDMENT

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 4

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA MAP AMENDMENT.MXD - USER: RBARKSDALE - DATE: 1/25/2021

Attachment M. HCA Impacts



0 Miles 0.065

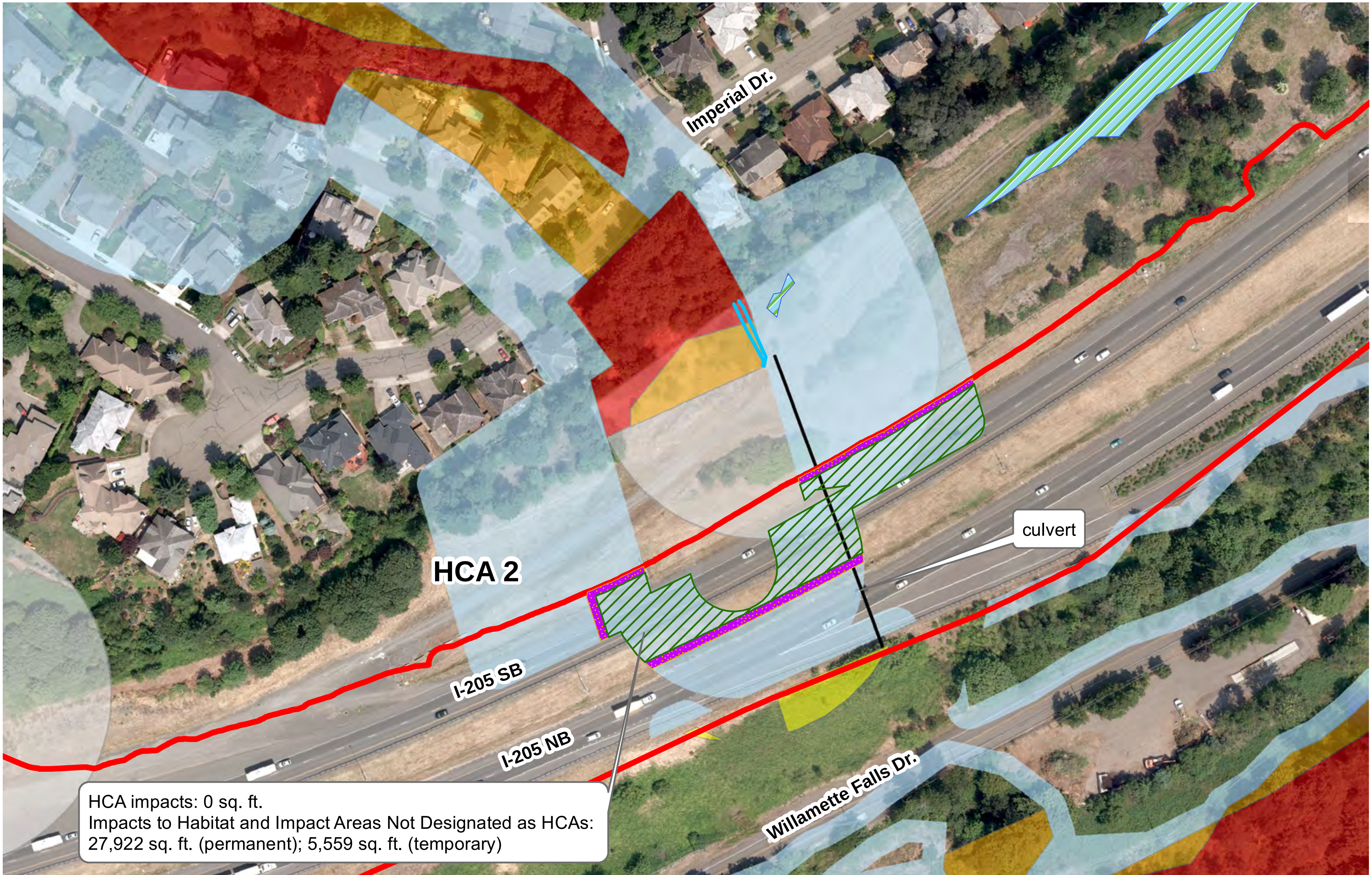
Construction Impact Area
WRAs (overlap)
Temporary Impacts
High HCA
Moderate HCA
Low HCA
Permanent Impacts
Non-HCA Impacts
Habitat and Impact Area Not Designated as HCA

HCA IMPACT AREAS

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 1

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA IMPACTS.MXD - USER: RBARKSDALE - DATE: 1/27/2021



0 Miles 0.03

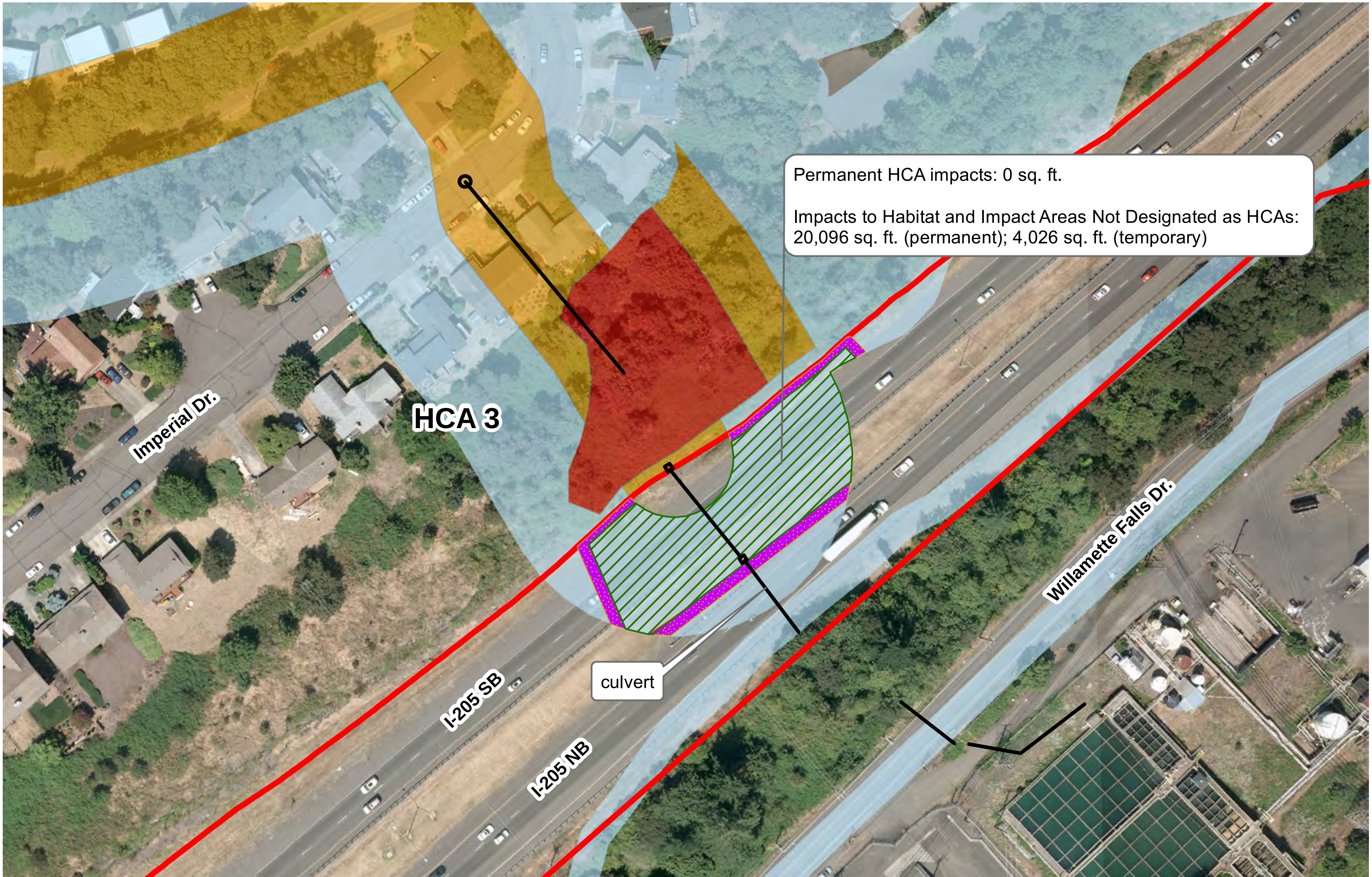
Construction Impact Area
WRAs (overlap)
Temporary Impacts
High HCA
Moderate HCA
Low HCA
Permanent Impacts
Non-HCA Impacts
Habitat and Impact Area Not Designated as HCA

HCA IMPACT AREAS

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 2

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA IMPACTS.MXD - USER: RBARKSDALE - DATE: 12/30/2020



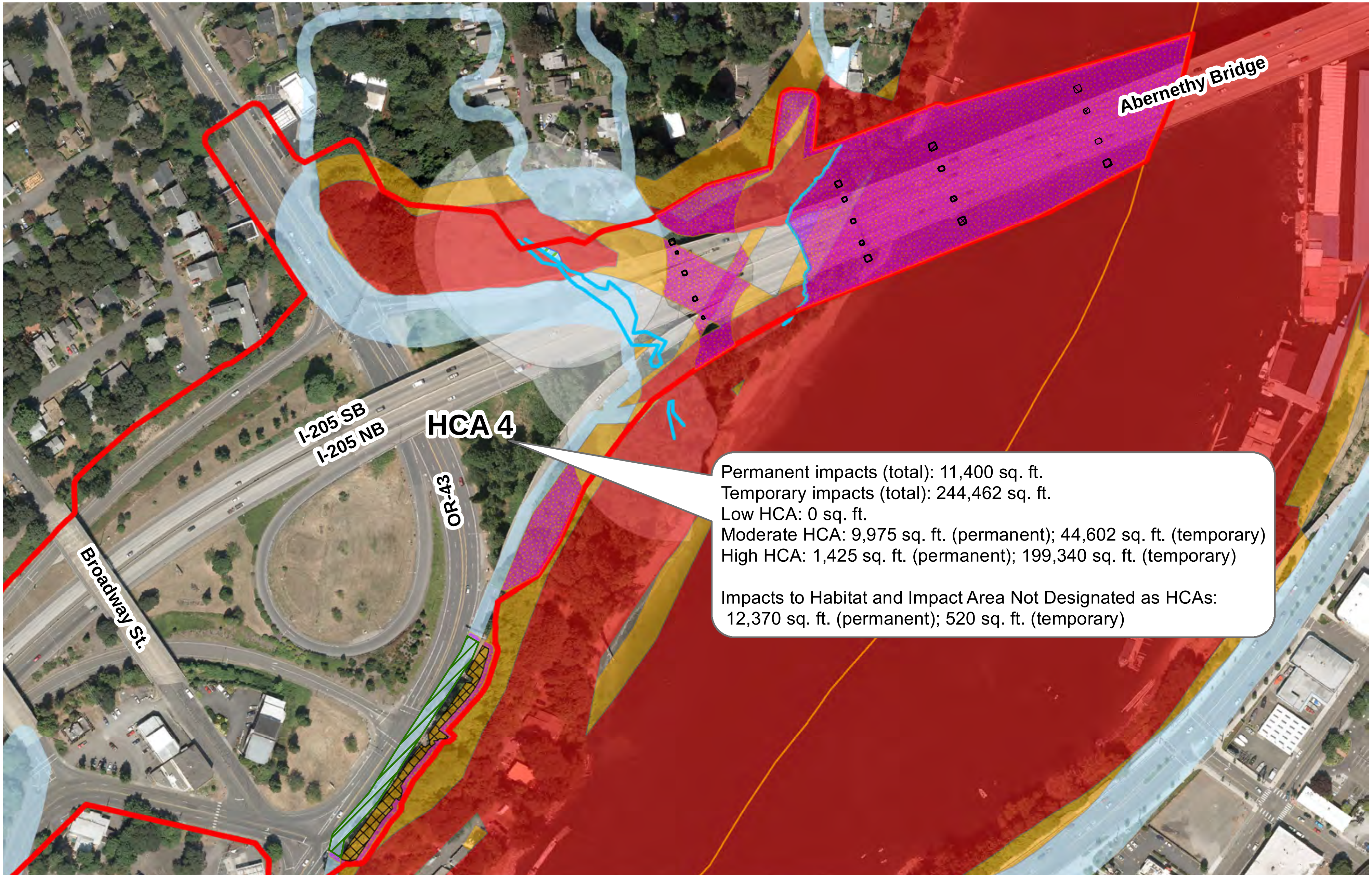
Construction Impact Area
WRAs (overlap)
Temporary Impacts
High HCA
Moderate HCA
Low HCA
Permanent Impacts
Non-HCA Impacts
Habitat and Impact Area Not Designated as HCA

0 Miles 0.02

HCA IMPACT AREAS
WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 3

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA IMPACTS.MXD - USER: RBARKSDALE - DATE: 12/30/2020



0 Miles 0.05

Construction Impact Area
WRAs (overlap)
Temporary Impacts
High HCA
Moderate HCA
Low HCA
Permanent Impacts
Non-HCA Impacts
Habitat and Impact Area Not Designated as HCA

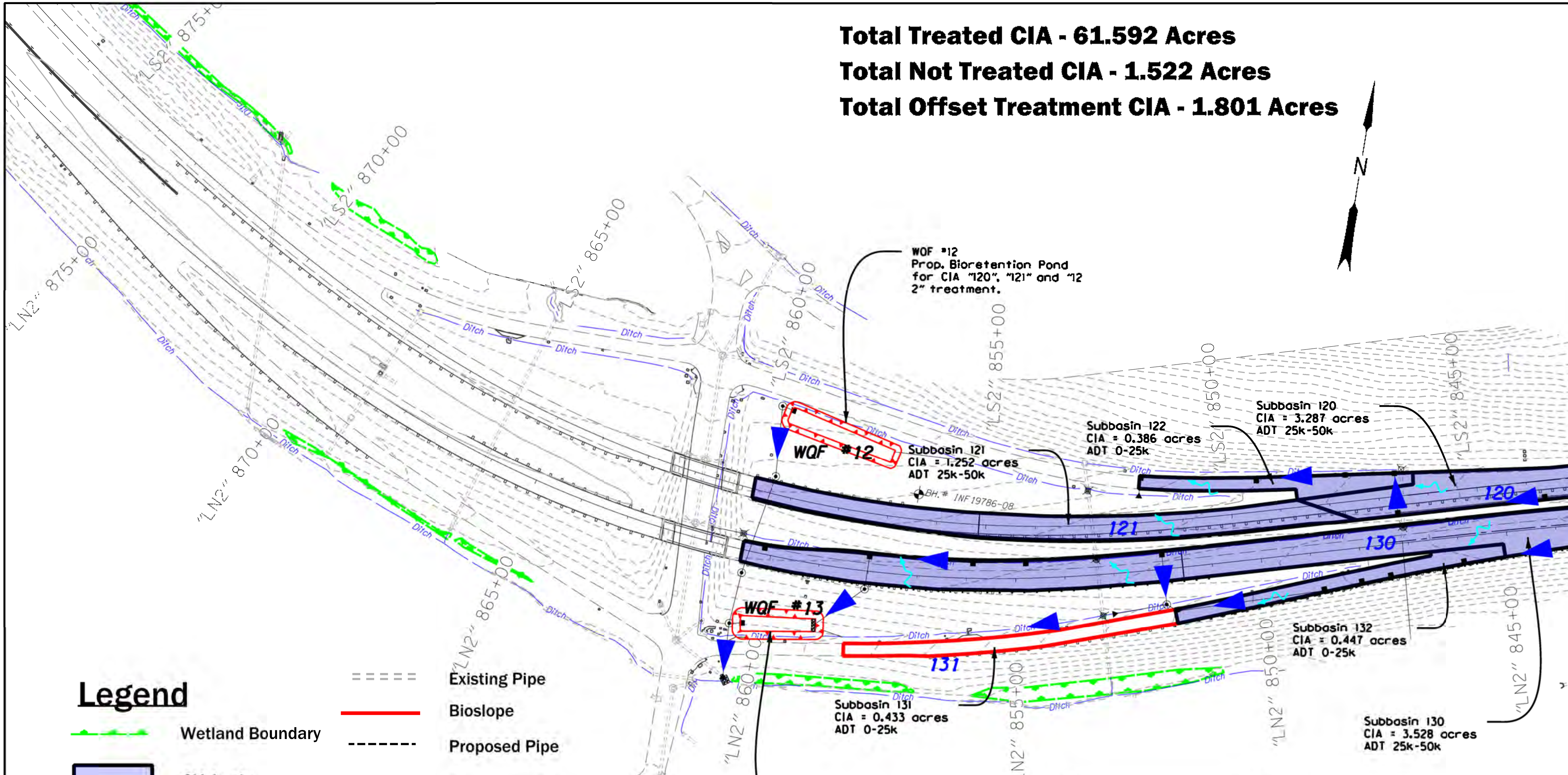
HCA IMPACT AREAS

WILLAMETTE & TUALATIN RIVER PROTECTION

FIGURE 4

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN HCA IMPACTS.MXD - USER: RBARKSDALE - DATE: 12/30/2020

Attachment N. Water Quality Facilities



Legend

	Wetland Boundary		Existing Pipe
	CIA basin		Bioslope
	Non-triggered treated areas		Proposed Pipe
	Not Treated CIA		Proposed Inlet
	Water quality swale boundary		Proposed Manhole
			Conveyance Direction
			Surface Flow
			Combination detention pond/ water quality swale boundary

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

I-205: I-5 - OR213, PHASE 1 SEC.

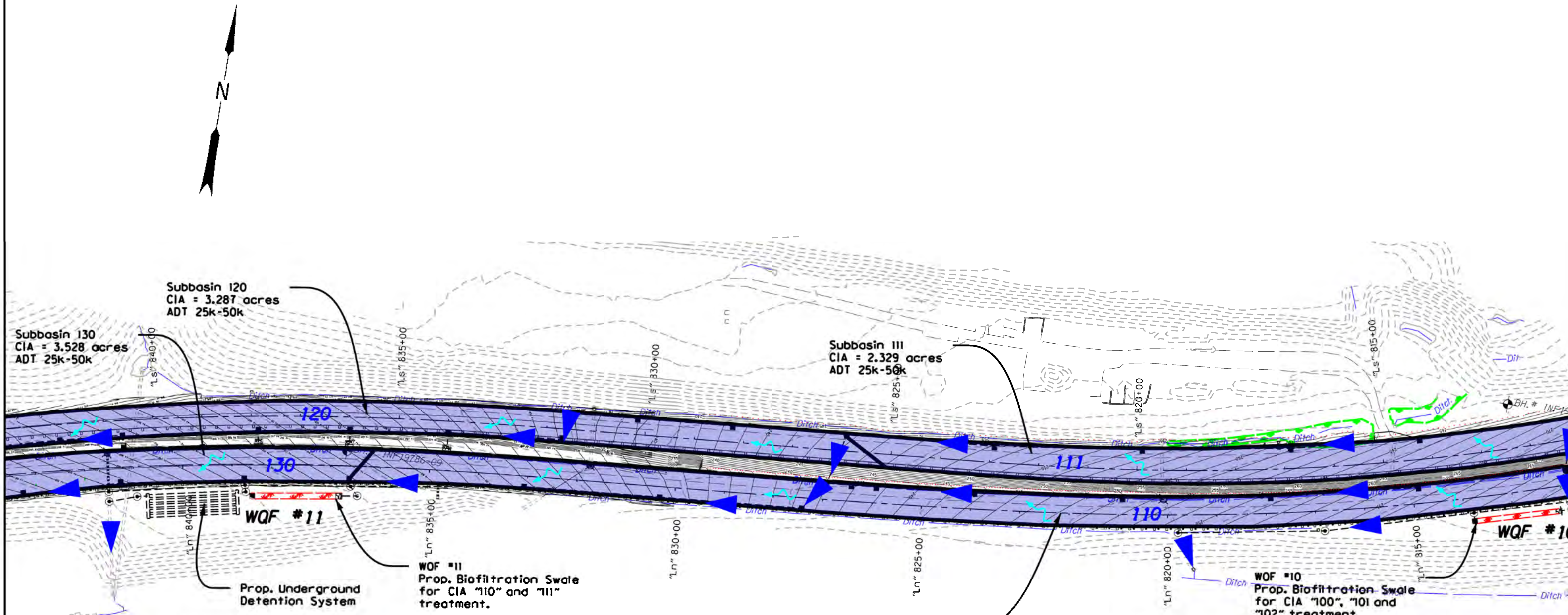
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

STORMWATER CIA EXHIBIT

SHEET NO.
1

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST



Legend

	Wetland Boundary		Existing Pipe
	CIA basin		Bioslope
	Non-triggered treated areas		Proposed Pipe
	Not Treated CIA		Proposed Inlet
	Water quality swale boundary		Proposed Manhole
			Conveyance Direction
			Surface Flow
			Combination detention pond/ water quality swale boundary

Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

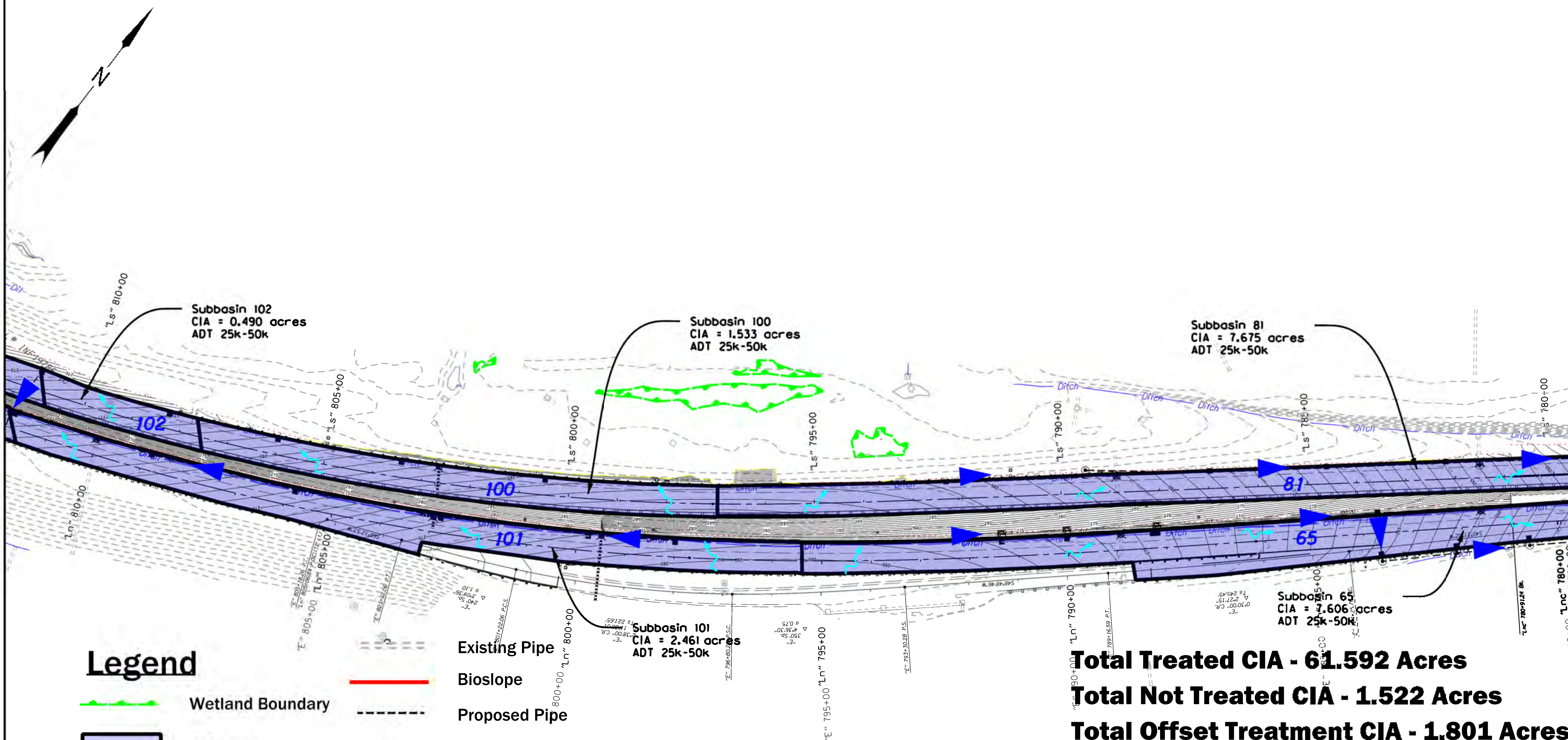
I-205: I-5 - OR213, PHASE 1 SEC.

EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer: Reviewer:
Drafter: Checker:

STORMWATER CIA EXHIBIT

SHEET NO. 2



Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

Legend

- Wetland Boundary
- CIA basin
- Non-triggered treated areas
- Not Treated CIA
- Water quality swale boundary
- Existing Pipe
- Bioslope
- Proposed Pipe
- Proposed Inlet
- Proposed Manhole
- Conveyance Direction
- Surface Flow
- Combination detention pond/ water quality swale boundary

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

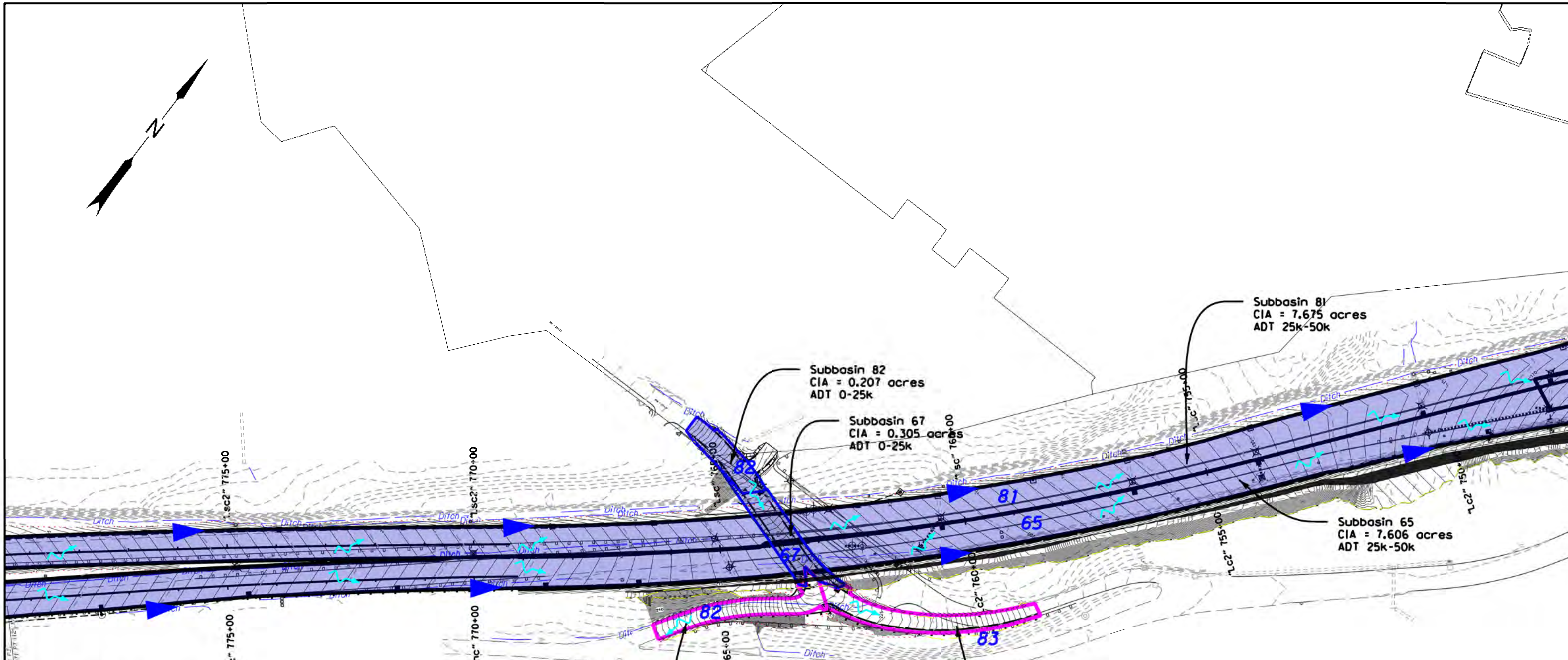
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:
Reviewer:
Drafter:
Checker:

STORMWATER CIA EXHIBIT

SHEET NO.
3

FINAL ELECTRONIC DOCUMENT
AVAILABLE UPON REQUEST



Total Treated CIA - 61.592 Acres

Total Not Treated CIA - 1.522 Acres

Total Offset Treatment CIA - 1.801 Acres

Legend

- Wetland Boundary
- CIA basin
- Non-triggered treated areas
- Not Treated CIA
- Water quality swale boundary
- Existing Pipe
- Bioslope
- Proposed Pipe
- Proposed Inlet
- Proposed Manhole
- Conveyance Direction
- Surface Flow
- Combination detention pond/ water quality swale boundary

PRELIMINARY COPY
INFORMATION ONLY

HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700

OREGON DEPARTMENT OF TRANSPORTATION

I-205: I-5 - OR213, PHASE 1 SEC.

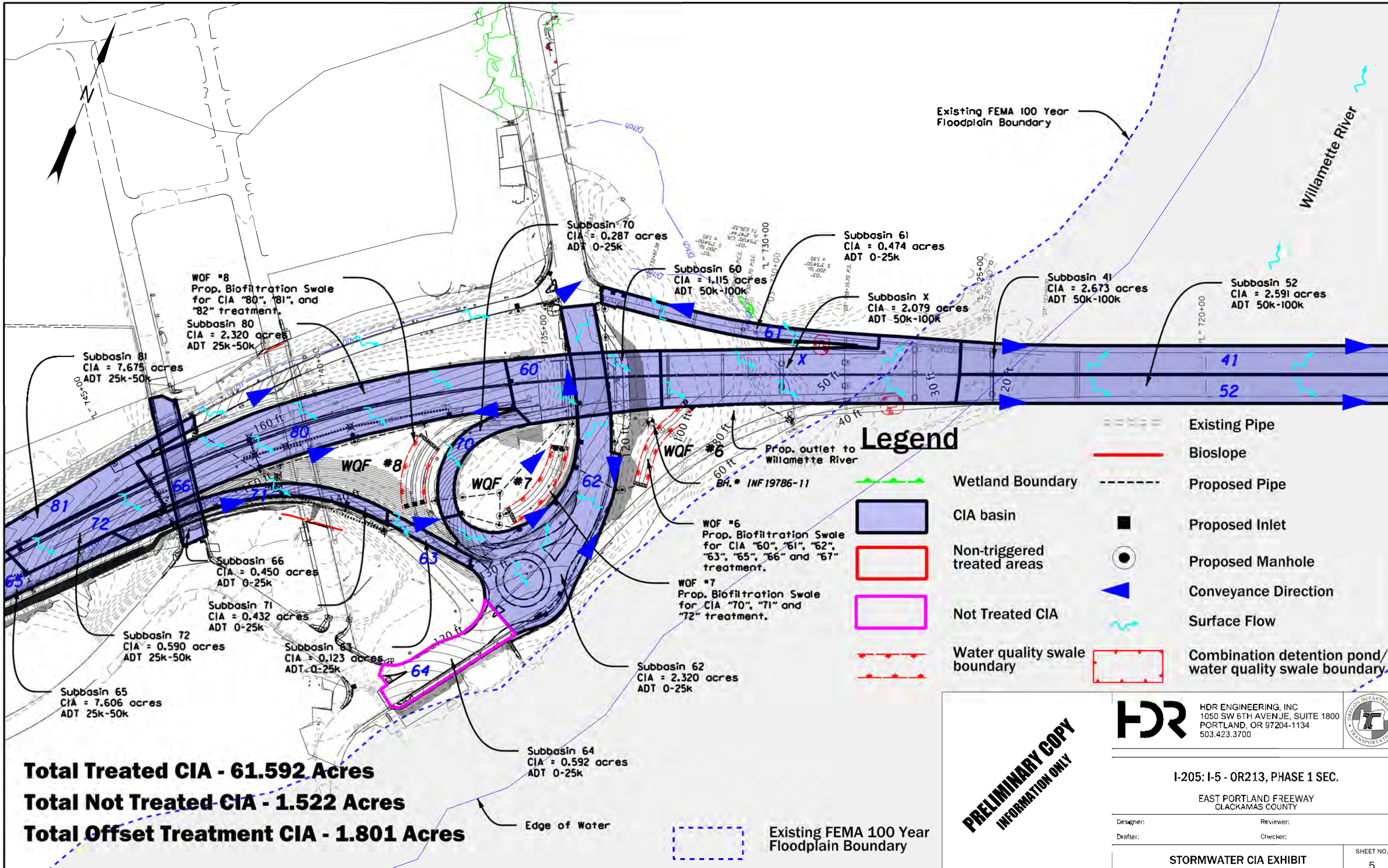
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY

Designer:
Reviewer:
Drafter:
Checker:

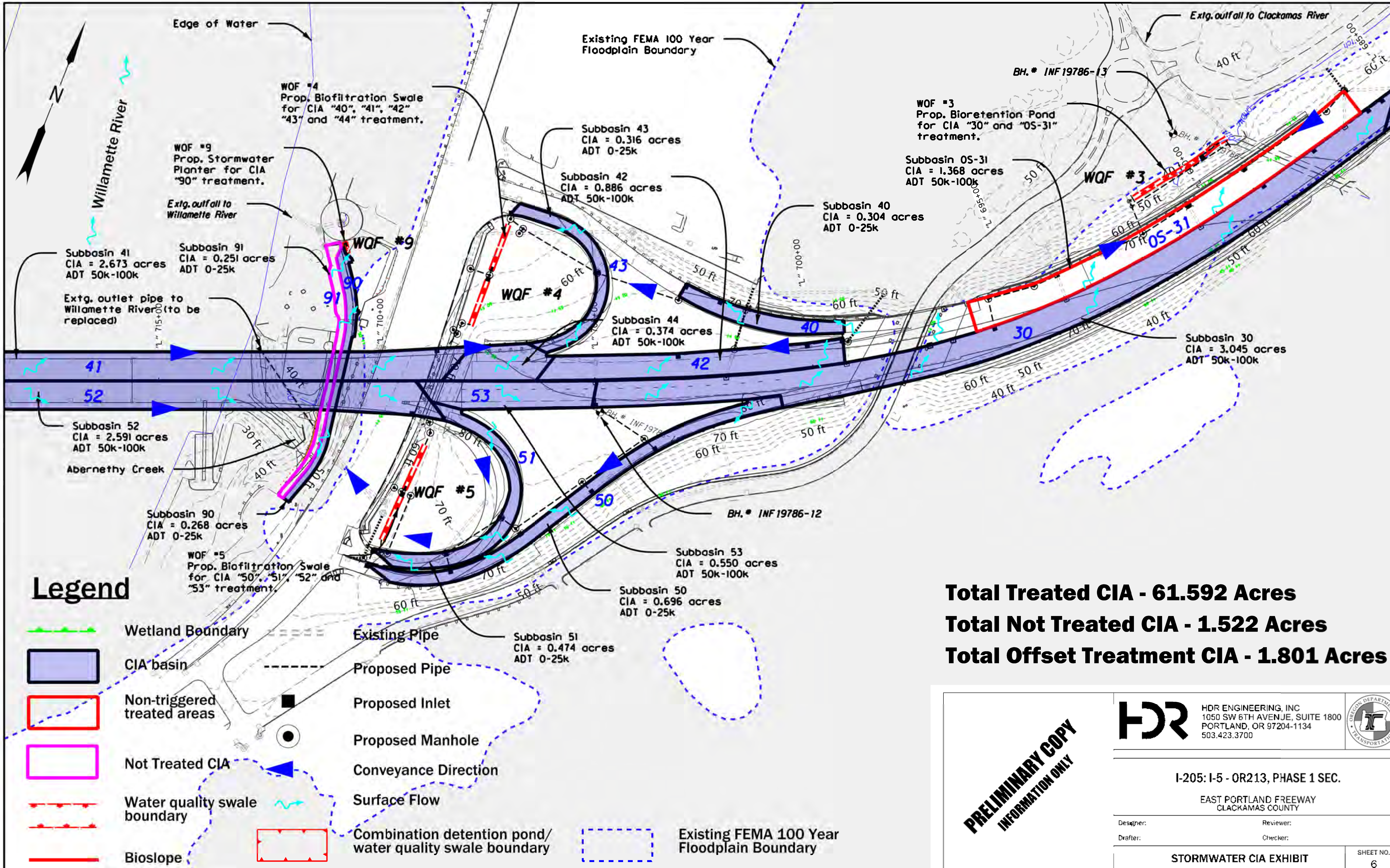
STORMWATER CIA EXHIBIT

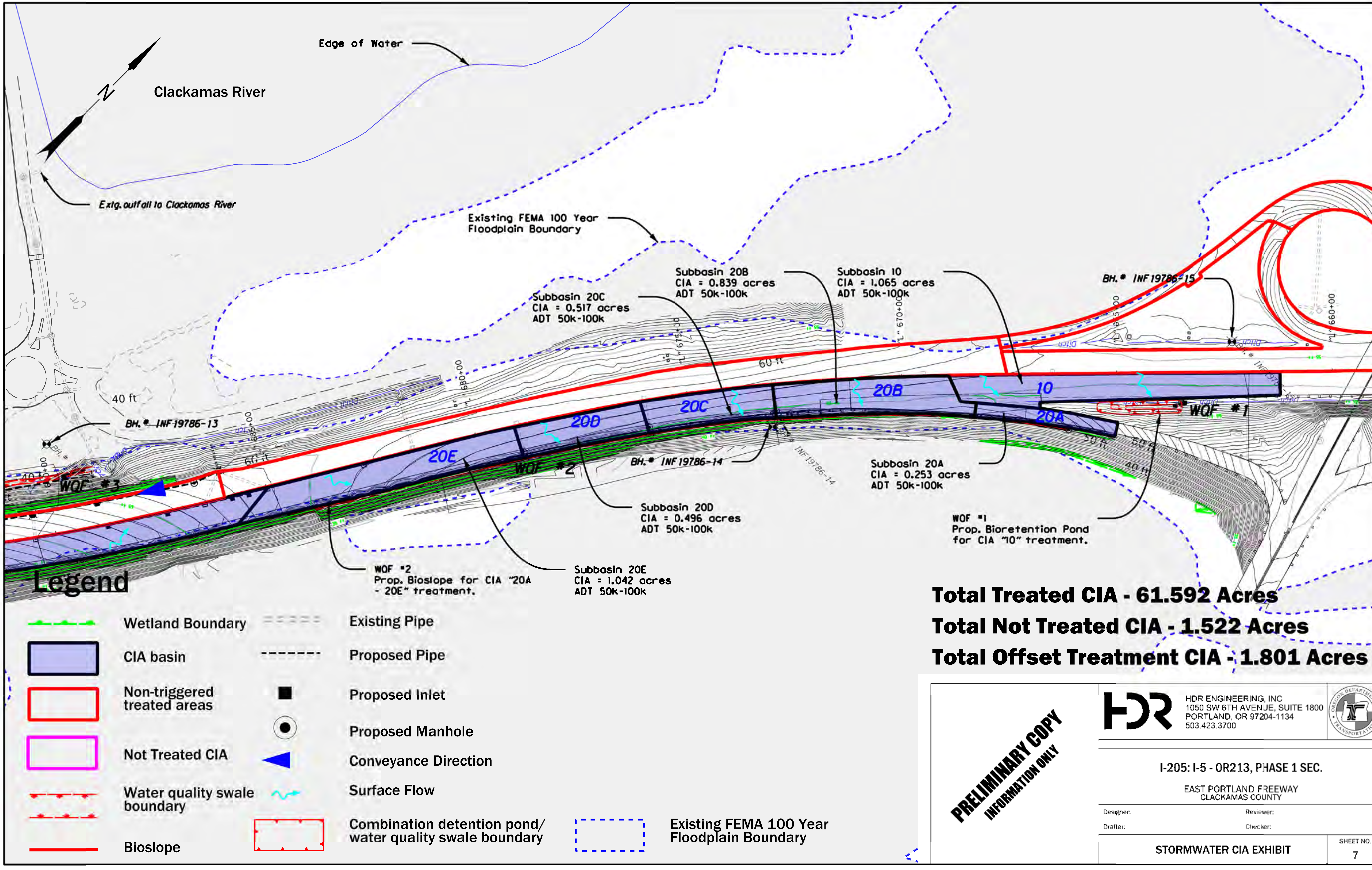
SHEET NO. 4

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST



N
Existing FEMA 100 Year Floodplain Boundary
Willamette River
Subbasin 70
CIA = 0.287 acres
ADT 0-25k
Subbasin 61
CIA = 0.474 acres
ADT 0-25k
Subbasin 60
CIA = 1.115 acres
ADT 50k-100k
Subbasin X
CIA = 2.079 acres
ADT 50k-100k
Subbasin 41
CIA = 2.673 acres
ADT 50k-100k
Subbasin 52
CIA = 2.591 acres
ADT 50k-100k
WQF #8
Prop. Biofiltration Swale for CIA "80", "81", and "82" treatment.
Subbasin 80
CIA = 2.320 acres
ADT 25k-50k
Subbasin 81
CIA = 7.675 acres
ADT 25k-50k
WQF #8
WQF #7
WQF #6
Prop. outlet to Willamette River
BH.# INF 19786-11
WQF #6
Prop. Biofiltration Swale for CIA "60", "61", "62", "63", "65", "66" and "67" treatment.
WQF #7
Prop. Biofiltration Swale for CIA "70", "71" and "72" treatment.
Subbasin 66
CIA = 0.450 acres
ADT 0-25k
Subbasin 71
CIA = 0.432 acres
ADT 0-25k
Subbasin 72
CIA = 0.590 acres
ADT 25k-50k
Subbasin 63
CIA = 0.123 acres
ADT 0-25k
Subbasin 65
CIA = 7.606 acres
ADT 25k-50k
Subbasin 62
CIA = 2.320 acres
ADT 0-25k
Subbasin 64
CIA = 0.592 acres
ADT 0-25k
Edge of Water
Legend
Existing Pipe
Bioslope
Wetland Boundary
Proposed Pipe
CIA basin
Proposed Inlet
Non-triggered treated areas
Proposed Manhole
Conveyance Direction
Not Treated CIA
Surface Flow
Water quality swale boundary
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
PRELIMINARY COPY
INFORMATION ONLY
HDR
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
5


Edge of Water
Willamette River
N
Existing FEMA 100 Year Floodplain Boundary
Extg. outfall to Clackamas River
WQF #4 Prop. Biofiltration Swale for CIA "40", "41", "42" "43" and "44" treatment.
WQF #9 Prop. Stormwater Planter for CIA "90" treatment.
Extg. outfall to Willamette River
Subbasin 43 CIA = 0.316 acres ADT 0-25k
Subbasin 42 CIA = 0.886 acres ADT 50k-100k
Subbasin 40 CIA = 0.304 acres ADT 0-25k
BH.# INF 19786-13
WOF #3 Prop. Bioretention Pond for CIA "30" and "OS-31" treatment.
Subbasin OS-31 CIA = 1.368 acres ADT 50k-100k
WQF #3
Subbasin 41 CIA = 2.673 acres ADT 50k-100k
Subbasin 91 CIA = 0.251 acres ADT 0-25k
WQF #9
Extg. outlet pipe to Willamette River (to be replaced)
WQF #4
Subbasin 44 CIA = 0.374 acres ADT 50k-100k
Subbasin 30 CIA = 3.045 acres ADT 50k-100k
Subbasin 52 CIA = 2.591 acres ADT 50k-100k
Abernethy Creek
WQF #5
BH.# INF 19786-12
Subbasin 90 CIA = 0.268 acres ADT 0-25k
WOF #5 Prop. Biofiltration Swale for CIA "50", "51", "52" and "53" treatment.
Subbasin 53 CIA = 0.550 acres ADT 50k-100k
Subbasin 50 CIA = 0.696 acres ADT 0-25k
Subbasin 51 CIA = 0.474 acres ADT 0-25k
41
52
53
42
43
40
30
OS-31
51
50
90
91
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
Legend
Wetland Boundary
CIA basin
Non-triggered treated areas
Not Treated CIA
Water quality swale boundary
Bioslope
Existing Pipe
Proposed Pipe
Proposed Inlet
Proposed Manhole
Conveyance Direction
Surface Flow
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
PRELIMINARY COPY INFORMATION ONLY
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
6


Edge of Water
Clackamas River
N
Extg. outfall to Clackamas River
Existing FEMA 100 Year Floodplain Boundary
Subbasin 20B
CIA = 0.839 acres
ADT 50k-100k
Subbasin 10
CIA = 1.065 acres
ADT 50k-100k
Subbasin 20C
CIA = 0.517 acres
ADT 50k-100k
BH. # INF 19786-15
BH. # INF 19786-13
BH. # INF 19786-14
20B
10
20C
20D
20A
20E
WQF #1
WQF #2
WQF #3
40 ft
60 ft
50 ft
Subbasin 20A
CIA = 0.253 acres
ADT 50k-100k
Subbasin 20D
CIA = 0.496 acres
ADT 50k-100k
WQF #1
Prop. Bioretention Pond for CIA "10" treatment.
WQF #2
Prop. Bioslope for CIA "20A - 20E" treatment.
Subbasin 20E
CIA = 1.042 acres
ADT 50k-100k
Legend
Wetland Boundary
CIA basin
Non-triggered treated areas
Not Treated CIA
Water quality swale boundary
Bioslope
Existing Pipe
Proposed Pipe
Proposed Inlet
Proposed Manhole
Conveyance Direction
Surface Flow
Combination detention pond/ water quality swale boundary
Existing FEMA 100 Year Floodplain Boundary
Total Treated CIA - 61.592 Acres
Total Not Treated CIA - 1.522 Acres
Total Offset Treatment CIA - 1.801 Acres
PRELIMINARY COPY
INFORMATION ONLY
HDR
HDR ENGINEERING, INC
1050 SW 6TH AVENUE, SUITE 1800
PORTLAND, OR 97204-1134
503.423.3700
I-205: I-5 - OR213, PHASE 1 SEC.
EAST PORTLAND FREEWAY
CLACKAMAS COUNTY
Designer:
Reviewer:
Drafter:
Checker:
STORMWATER CIA EXHIBIT
SHEET NO.
7
Rotation: 44.768°
Scale: 1"=200'

Attachment O. Geotech Report

November 30, 2020

Michael Bertram
HDR, Inc.
1001 SW 5th Avenue, #1800
Portland, Oregon 97204

RE: DRAFT GEOTECHNICAL HAZARD ASSESSMENT OF PROPOSED CONSTRUCTION AREA
I-205: STAFFORD ROAD TO OR99E WIDENING PHASE 1 (K#19786)
CLACKAMAS COUNTY, OREGON

Dear Mr. Bertram:

This letter presents Shannon & Wilson, Inc.'s assessment of the geologic hazards that are expected to be encountered within the City of West Linn along the proposed construction area currently being considered by Oregon Department of Transportation (ODOT) as part of the I-205: Stafford Road to OR99E Widening Project, Phase 1. HDR, Inc. (HDR) is the lead consultant for this project and contracted Shannon & Wilson to perform geotechnical services in accordance with Amendment No. 4 (B35005), dated November 1, 2018.

This letter summarizes the typical geology along the project alignment and known geologic hazards within the project area. The evaluations provided in this letter are based on a preliminary review of the geologic hazard maps and our field exploration program for the project. The proposed project area is shown on Figure 1, Vicinity Map. The maps, designated Figure 2, Sheets 1 through 11, are included with this letter. The maps include the City of West Linn's Habitat Conservation Areas and Water Resource Areas, provided by. HDR on November 27, 2020. The approximate locations of relevant geotechnical borings are also shown on Figure 2, for reference.

Based on our review of existing information, our field exploration program, and our engineering analyses and judgement, the proposed work will not cause slope failure or increased erosion/sedimentation and will not adversely impact surface or modify groundwater flow or hydrologic conditions.

Shannon & Wilson has prepared three reports that discuss the design for the impacted bridges and construction considerations for these structures in West Linn and have been provided to ODOT for review:

3990 Collins Way ▪ Suite 100 ▪ Lake Oswego, Oregon 97035-3437 ▪ 503 210-4750
▪ www.shannonwilson.com ▪

- Draft Geotechnical Engineering Report, I-205: Stafford Road to OR99E Widening, Abernethy Bridge (Key #19786), Clackamas County, Oregon, dated August 2020;
- Draft Geotechnical Engineering Report, I-205: Stafford Road to OR99E Widening, West A Street Bridge #09704 (Key #19786), Clackamas County, Oregon, dated July 2020; and
- Draft Geotechnical Engineering Report, I-205: Stafford Road to OR99E Widening, Sunset Avenue Bridge #09724 (Key #19786), Clackamas County, Oregon, dated July 2020.

Shannon & Wilson also prepared a report to discuss the design for retaining walls and embankment fill and a report addressing the rock cut; both identify construction considerations for the designs:

- Draft Geotechnical Report, I-205: Stafford Road to OR99E Widening, Retaining Walls and Embankment Fill (Key #19786 and 21401), Clackamas County, Oregon, dated July 2020; and
- Draft Geotechnical Report, I-205: Stafford Road to OR99E Widening, Rock Cut, Clackamas County, Oregon, dated May 2020.

These reports will be referred to in the letter as the *I-205 60% Design Reports*.

GEOLOGY AND SEISMIC SETTING

Regional Geology

The project area is located in the Portland Basin. The most prevalent basement rock of the Portland Basin is a sequence of lava flows of the Columbia River Basalt Group (CRBG), which flowed into the area between about 17 million and 6 million years ago (Beeson and others, 1991). Columbia River Basalt Group flows also underlie the hillsides that border the I-205 alignment north and west of the Willamette River (Madin, 2009; Schlicker and Finlayson, 1979).

The Columbia, Willamette, and Clackamas Rivers converge within the Portland Basin and, with their tributaries, have contributed to an extensive sedimentary fill that overlies the basement rock formations. These basin-fill sediments range in age from approximately 6 million years to the present. Late Miocene to Pliocene-age (6 million- to 2.6-million-year-old) sedimentary units (greater than 2.6 million years old) within the project area include the Troutdale Formation (Mudstone and Siltstone Member).

Toward the end of the Pleistocene, a tremendous load of sediment was deposited in the Portland Basin, Tualatin Basin, and Willamette Valley by a series of catastrophic glacial outburst floods. During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly crossed and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula (Allen and others, 2009). Periodically, the ice dam was breached and flood waters from Lake Missoula flowed southwest across portions of eastern Washington and into the Columbia River drainage. Forty or more repetitive outburst floods have been documented (Allen and others, 2009). These repeated floods are collectively referred to as the Missoula Floods.

Missoula flood waters were channeled through the Columbia River Gorge and then spread out over the Portland Basin. Missoula flood waters scoured off thick soil deposits along high energy channels that connected the Portland Basin with the Tualatin Basin and Willamette Valley. One of these channels is located along the Willamette River between Oregon City and West Linn (Allen and others, 2009).

The Missoula Flood deposits are divided into three facies: Fine-Grained Facies, Coarse-Grained Facies, and Channel Facies (Beeson and others 1989, 1991; Madin 1990). Only the Fine-Grained Facies of the Missoula flood deposits, consisting of layered silt and sand beds, have been mapped in the project area (Madin, 2009).

During and after the Missoula Floods, rivers, streams, and wind have moved and deposited surficial sediment throughout the Portland and Tualatin Basins. In more recent times, humans have changed the landscape, grading cuts and fills for development.

Seismic Setting

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within Pacific Northwest, typically within the upper 4 to 19 miles of the continental crust. Mabey and others (1993) concluded from their analysis of local geologic features that a crustal earthquake of up to Mw 6.5 could occur virtually anywhere in the Portland area. Based on their fault model, Wong and others (2000) determined that an earthquake of up to Mw 6.8 is possible on the Portland Hills Fault, which is mapped within 2.4 miles of the project area. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at approximate Mw 6.5 to 7.0. Other examples include the 1993 Mw 5.6 Scotts Mill earthquake and the 1993 Mw 6.0 Klamath Falls earthquake.

Shallow crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

Potential Seismic Hazards

According to the USGS Quaternary Fault and Fold database (USGS, 2017), there are surface traces of four Class A features within approximately 6 miles of the project site:

- The Oatfield Fault, USGS Fault No. 875, is located approximately 1.28 miles from the project site with a Slip Rate Category < 0.2mm/yr and most recent deformation occurring < 1.6 Ma;
- The Portland Hills Fault, USGS Fault No. 877, is located approximately 2.0 miles from the project site with a Slip Rate Category < 0.2mm/yr and most recent deformation occurring < 1.6 Ma;
- The Damascus-Tickle Creek Fault Zone, USGS Fault No. 879, is located approximately 4.0 miles from the project site with a Slip Rate Category < 0.2mm/yr and most recent deformation occurring < 750 ka; and
- The Canby-Molalla Fault, USGS Fault No. 716, is located approximately 5.1 miles from the project site with a Slip Rate Category < 0.2mm/year and most recent deformation occurring < 15 ka.

The Cascadia Subduction Zone itself is mapped approximately 137 miles west of the project area, with an average slip rate of approximately 40 millimeters (~1.5 inches) per year and the most recent deformation occurring about 300 years ago (Personius and Nelson, 2006).

The northwest-trending Bolton Fault, which parallels the West Linn hillside north of the Abernethy Bridge, is mapped along Highway 43 beneath the Abernethy Bridge. Although some researchers consider the Bolton Fault potentially active, it is considered a Class B Fault by the USGS, since no unequivocal Quaternary-age displacement has been identified (Personius, 2002e). Due to the uncertainty of the fault classification and contradictory published material on the Bolton Fault, special consideration has been made to evaluate the effects of seismic activity from this source.

SUBSURFACE CONDITIONS

Geotechnical Units

The construction for the current phase of this project will take place in West Linn from the Abernethy Bridge to just north of 10th Street.

We grouped the materials encountered in our field explorations within this area into 14 geotechnical units. Our interpretation of the subsurface conditions is based on the explorations, historic borehole data, and regional geologic information from published sources. The geotechnical units are as follows (USCS group symbols are provided in parentheses for respective soil types):

- **Fill:** highly variable mixture of loose to very dense gravel and sand with variable amounts of stiff to very stiff silt and clay, and cobbles and boulders (GP, GM, GC, GP-GM, GW-GC, SM, SP-SM, SC); lesser layers of clay (CH, CL) and silt (ML); cobbles are common; trace to few organics and wood debris; includes roadway pavement sections and topsoil;
- **Rip Rap Fill:** angular boulder and cobble fill placed around the base of Abernethy Bridge Piers 3 through 8 according to as-built drawings; unit not definitively observed in borings;
- **Fine-Grained Alluvium:** very soft to very hard / very loose to very dense Silt to Sandy Silt (ML); lesser amounts of Clayey Silt (MH), Silty Clay (CL), Clay (CH), and Organic clayey Silt (OH) with varying amounts of sand; contains interbeds of Sand with some Silt (SP-SM), Silty Sand (SM), and Clayey Sand (SC); includes trace organics and scattered thin gravel lenses;
- **Sand Alluvium:** very loose to very dense Sand to Silty Sand (SP, SP-SM, SM) and lesser amounts of medium stiff to stiff Silt to Sandy Silt (ML); minor amounts of Silty Gravel (GM), trace gravel in some intervals and scattered thin gravely lenses; unit includes trace organics and wood debris;
- **Gravel Alluvium:** loose to very dense Gravel with varying amounts of silt, sand, cobbles, and boulders (GP, GP-GM, GM); contains interbeds of Gravelly Sand with some silt (SP-SM, SW-SM), Silty Sand (SM), Clayey Sand with trace gravel (SC), Silt with some sand to Gravelly Silt with some sand (ML), and Silty Clay with some sand (CL); some weakly cemented layers; trace organics (wood); some open gravel and cobble zones with little matrix material;

- **Matrix-Supported Colluvium:** medium dense to very dense Silty Gravel with some sand to Sandy Silty Gravel (GM); lesser amounts of soft to very hard Gravelly Clay with some sand (CH) and Silt with some sand and some gravel to Gravelly Silt with some sand (ML); cobbles and possible boulders;
- **Clast-Supported Colluvium:** very dense Gravel to Gravel with trace sand and trace silt (GP), Sandy Gravel with trace to some silt (GP, GP-GM), and Silty Gravel with some sand to Sandy silty Gravel (GM); cobbles and boulders;
- **Missoula Flood Deposits - Fine**: loose to medium dense / medium stiff to very stiff Silty Sand, Sandy Silt, Silt, and Silty Clay with variable amounts of sand (SM, ML, CL);
- **Missoula Flood Deposits - Coarse**: very dense Sandy clayey Gravel with cobbles (GC);
- **Decomposed Columbia River Basalt Group (Decomposed Basalt):** stiff to very hard mixtures of Silt and Clay with variable amounts of sand and gravel (MH, ML, CH, CL); very dense Clayey Silty Sand (SM), Silty Sand with trace to some Gravel (SM), Sandy Gravel with some Silt (GP-GM), and Clayey Gravel with some Sand (GC); lesser amounts of loose to very dense Silty Sand (SM) and Clayey Sand (SC); visible decomposed relict rock structure, including joint surfaces, interflow breccia, and phenocrysts; multi-colored;
- **Weathered Columbia River Basalt Group (Weathered Basalt):** extremely soft to medium hard (R0-R3), moderately weathered to predominantly decomposed basalt; some zones remold under finger pressure to soil such as Clayey Sand with trace gravel (SC);
- **Fault Breccia:** extremely soft to soft (R0 to R2), moderately weathered to predominantly decomposed basalt; brecciated, sheared, and altered; slickensides and fault gouge are common; multi-colored;
- **Vantage:** sedimentary interbed consisting of Sandy Mudstone; slightly weathered to decomposed; intact rock strength from extremely soft to medium hard (R0 to R3). The unit is thin (approximately 0.5 to 2.5 feet thick) and difficult to sample; and
- **Columbia River Basalt Group (Basalt):** very soft to very hard (R1 to R5), fresh to slightly weathered (occasionally moderately weathered) basalt; flow contact zones are commonly more weathered and softer; basalt flow tops are vesicular, oxidized, and often overlain by a thin basalt breccia; flow bottoms also show vesicular texture, but the zone of vesicularity is thinner than at the flow top.

Groundwater

The geotechnical borings performed by Shannon & Wilson for this project were drilled using mud rotary and rock coring drilling techniques, which make it difficult to discern depth to groundwater, if it is encountered, due to the use of drilling fluid in the boreholes.

Groundwater measurements made near the west end of Abernethy Bridge indicate the groundwater table ranges from elevation 16.2 feet to elevation 27.4 feet in that area.

Based on measurements and observations at the rock cut location, we expect a layer of perched water to be present on top of the Vantage layer year-round. This layer of perched water could be at least 10 feet thick, particularly near the southwest end of the cut, where the Vantage layer is below the ground surface along both I-205 and Willamette Falls Drive.

Groundwater levels at the project site should be expected to vary with topography, seasonally, and with changes in precipitation. Zones of perched water are likely to be encountered on top of fine-grained sedimentary layers, bedrock, or sedimentary interbeds within the bedrock such as the Vantage layer. Locally, groundwater highs typically occur in the late fall to spring and groundwater lows typically occur in the late summer and early fall.

KEY GEOTECHNICAL ISSUES

The key geotechnical issues addressed for the project construction in our I-205 60% Design Reports are outlined below:

Earthquake-Induced Geologic Hazards

Based on the on our investigation, we evaluated the potential for earthquake-induced geologic hazards, including liquefaction and associated effects such as lateral spreading, liquefaction-induced settlement, slope instability, and ground surface fault rupture. Figure 2 includes relative earthquake hazard map zones provided with DOGAMI publication IMS-1 and used in the West Linn Natural Hazards Mitigation Plan. These generalized zones are intended to factor together the hazards of ground motion amplification, liquefaction, and slope instability (Mabey, 1997). During our investigation we evaluated the slope stability of the riverbank at the Abernethy Bridge site and concluded that during a seismic event lateral spreading could occur in the direction of the Willamette River. Shannon & Wilson has recommended ground improvement and provided seismic mitigation alternatives near the Abernethy Bridge site to control slope stability along the riverbank.

Most faults that are located near the project site have not shown evidence of activity in the Quaternary period (within the last 1.8 million years) and it is our opinion that the risk of fault rupture along these faults is relatively low. The mapped trace of the Class B Bolton Fault is within the project area. However, we consider the potential for fault rupture low as the recurrence interval for movement of the Bolton Fault appears to be on the order of several hundreds of thousands of years, much longer than the return period for the "Life-Safety" seismic design criteria.

Other than lateral spreading of the Willamette River riverbank at the Abernethy Bridge, the primary seismic hazard at this site is ground shaking.

Unstable Slopes (Static)

DOGAMI mapping indicates the slopes in this area north of around Sunset Avenue generally have moderate to high susceptibility for slope failure; however, Shannon & Wilson evaluated the static slope stability specific to the areas that will be impacted by construction and does not have concerns about this geological hazard during construction. This area does have seismic hazards along the Willamette River. Please refer to the Earthquake-Induced Geologic Hazards Section above for seismic slope instability. Within the project alignment, seismic mitigation solutions are developed for this project.

There is a historically active landslide on the north side of I-205 between Salamo Road and Beacon Hill Drive, in the City of West Linn. The approximate extents of the landslide area, as mapped by Burns (2009) and shown in the Statewide Landslide Information Database for Oregon (SLIDO, release 4.2), are shown on Figure 1 and Figure 2. Based on review of ODOT files, we understand that slide activity was first observed in 1969, as construction of I-205 was in progress. Subsequent studies in the late 1960s and early 1970s determined that the movement was occurring along a fine-grained sedimentary layer between two basalt flows. Initial attempts to stabilize the slide included excavation of unloading trenches. Some material from the area was used as borrow for other parts of the I-205 project under construction around that time. After continued movement, the landslide was ultimately mitigated with a 2,000-foot-long rock buttress and other earthwork, which was completed in 1972.

Our design of the bridges, retaining walls, and rock cut through this area have factored in the slope instability concerns and we have provided construction considerations in the areas where the design is impacted. Project areas that exist within the area of unstable slopes are addressed in the I-205 60% Design Reports.

SUMMARY OF GEOTECHNICAL DESIGN RECOMMENDATIONS

Based on our field investigation, Shannon & Wilson provided design recommendations in the I-205 60% Design Reports for the following structures:

- Abernethy Bridge
- Wall A4 (OR43)
- West A Street Bridge
- Rock Cut
- Sunset Avenue Bridge
- Wall B1 (Barrier with Backfill)

The sections below describe our overall design recommendations at each feature.

Abernethy Bridge

Foundation recommendations for the retrofit/widening and seismic mitigation design were selected for each pier based on the results of field exploration, identified geologic hazards, in situ testing, and laboratory testing program in conjunction with relations presented in the AASHTO LRFD Bridge Design Specifications (BDS) and our engineering judgment and experience. The retrofit and widening strategy described in this section is the result of an interactive design process which included analysis of several superstructure, foundation, and ground improvement alternatives. This process is ongoing, and the recommendations provided in this section are subject to change.

SHANNON & WILSON

Exhibit 1: Summary of Proposed Foundations for Retrofit and Widening by Pier and Abutment

Location	Drilled Shafts for Widening	Drilled Shafts for Pier Replacement	Spread Footings for Widening	Notes
Pier 5		X		12-foot-diameter shafts
Pier 6		X		12-foot-diameter shafts
Pier 7		X		10-foot-diameter shafts
Pier 8		X		Dual 8-foot-diameter shafts (4 total)
Pier 9	X			Incorporates A3-1 to south and new 8-foot-diameter shaft for widening to north
Pier 10				Micropile retrofit
Pier 11	X			6-foot-diameter shafts
Pier 12	X			7-foot-diameter shafts
Pier 13	X			7-foot-diameter shafts
Pier 14			X	18-foot square footings
Abutment 2			X	Extend continuous footing
Pier C3-1				Existing Pier removed
Pier C3-2		X		8-foot-diameter shafts
Pier C3-3		X		8-foot-diameter shafts
Pier C3-4				Uses existing driven pile foundations
Pier C3-5				Uses existing driven pile foundations
Abutment 4				Uses existing driven pile foundations

Pier 14 and Abutment 2 will be supported by spread footings founded on bedrock. We understand that one new footing will be constructed on each side of the existing bridge at Pier 14, and the existing continuous footing at Abutment 2 will be widened 30 feet on the NB side of I-205 and 16 feet on the SB side. Exhibit 2 illustrates our understanding of the general design concept proposed by the design team. In general, the spread footings will be founded in the weathered basalt bedrock. In order to construct a level footing on rock, some rock excavation will be required.

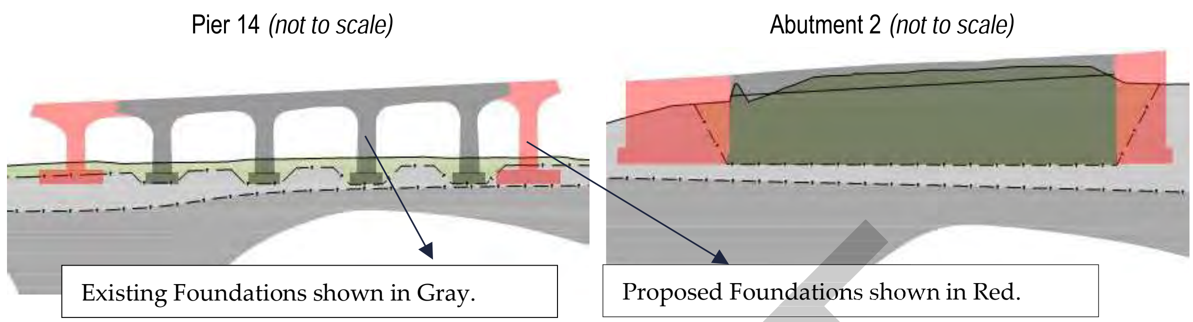


Exhibit 2: Illustrations of Proposed Spread Footing Foundations for Retrofit and Widening. See Figure 2 for locations of the piers.

At Pier 10, the design team plans to increase uplift and compressive resistance by installing micropiles around the perimeter of the existing pile cap then enlarging the pile cap to incorporate the micropiles. Exhibit 3 illustrates our understanding of the general design concept proposed by the design team.

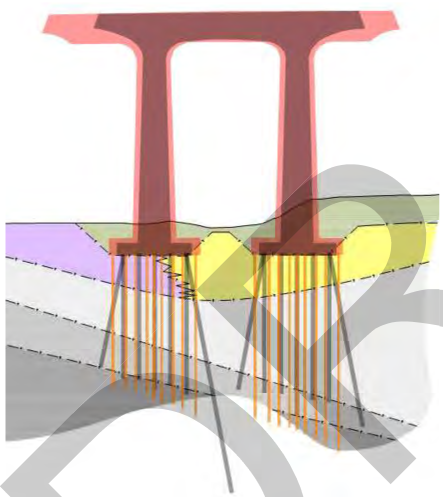


Exhibit 3: Illustration of Proposed Micropile Foundations for Retrofit at Pier 10. See Figure 2 For locations of the piers.

The majority of the proposed new foundations consist of 6- to 12-foot-diameter drilled shafts that are bearing in rock. Exhibit 4 presents a summary of drilled shaft diameters, lengths, and tip elevations at each pier location. The shaft lengths and tip elevations are preliminary, and generally correspond to the base of shaft embedded 2 feet into intact Basalt. Exhibit 5 illustrates the drilled shaft layout proposed by the design team for widening and retrofit at Piers 5 through 13. See Figure 2 for the locations of the piers along the Abernethy Bridge structure.

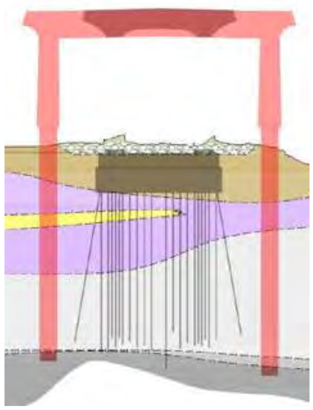
SHANNON & WILSON

Exhibit 4: Summary of Drilled Shaft Dimensions by Pier

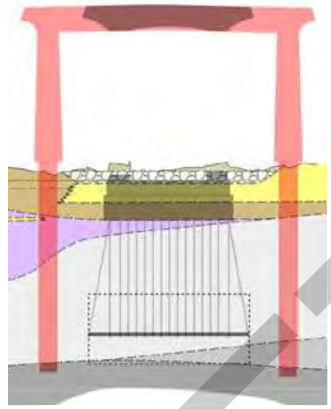
Location	Diameter	Length	Tip Elevation (NAVD 88)
Pier 5 Left	12 ft	162.5	-158
Pier 5 Right	12 ft	171.5	-167
Pier 6 Left	12 ft	134.5	-130
Pier 6 Right	12 ft	137.5	-133
Pier 7 Left	10 ft	131	-120
Pier 7 Right	10 ft	137	-115
Pier 8 Left 1	8 ft	124.5	-93
Pier 8 Left 2	8 ft	124.5	-93
Pier 8 Right 1	8 ft	134	-92
Pier 8 Right 2	8 ft	134	-92
Pier 9 Right	8 ft	135	-86
Pier 11 Left	6 ft	49	33
Pier 11 Right	6 ft	42	40
Pier 12 Left	7 ft	35	65
Pier 12 Right	7 ft	49	49
Pier 13 Left	7 ft	30	92
Pier 13 Right	7 ft	15	103
Pier C3-2 Left	8 ft	115	-64
Pier C3-2 Right	8 ft	118	-63
Pier C3-3 Left	8 ft	86.5	-24
Pier C3-3 Right	8 ft	97	-48

SHANNON & WILSON

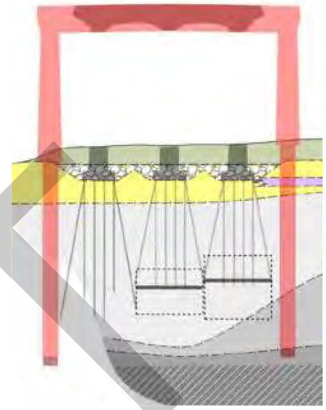
Exhibit 5: Illustrations of Proposed Drilled Shaft Foundations for Retrofit and Widening at Piers 5 through 13. See Figure 2 for locations of the piers.



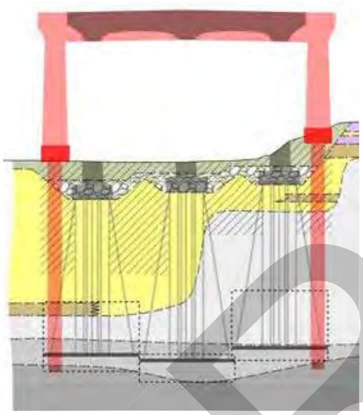
Pier 5 *(not to scale)*



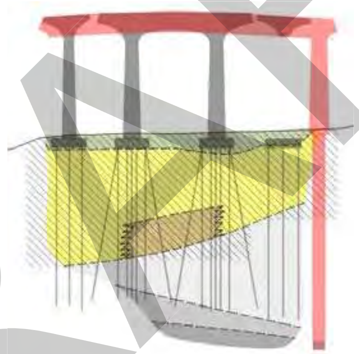
Pier 6 *(not to scale)*



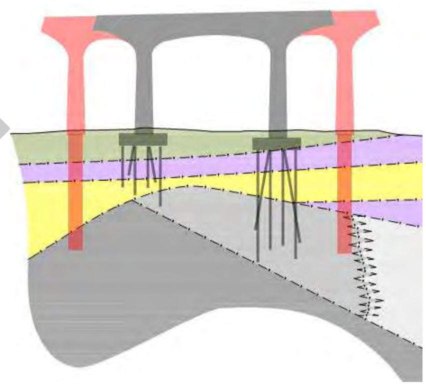
Pier 7 *(not to scale)*



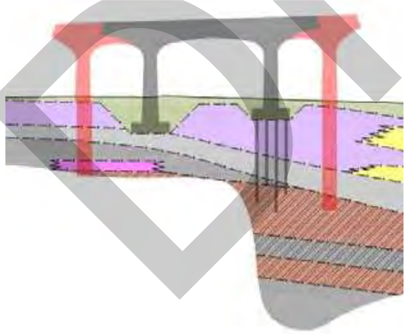
Pier 8 *(not to scale)*



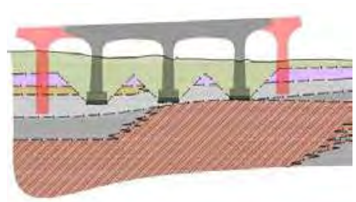
Pier 9 *(not to scale)*



Pier 11 *(not to scale)*



Pier 12 *(not to scale)*



Pier 13 *(not to scale)*

Ground Improvement

The results of the seismic hazard evaluation indicate that seismic hazard ground improvement mitigation at the west river bank in West Linn will be needed to achieve the required performance criteria of the foundations located at the riverbank and river channel due to lateral spreading, and flow failure. To mitigate these hazards, we considered a variety of ground improvement alternatives such as jet grouting, stone columns, and cement deep soil mixing. Ground improvement is planned at Pier 8 and between Piers 8 and 9. These ground improvement methods contribute to improving performance of the slope by reinforcing the lateral spreading zones to alter the properties of the soil and reduce ground slope lateral movement during the design seismic events. The existing Piers 8 and 9 are supported by pile groups including battered piles. The existing battered piles could be potential obstructions for stone column and deep soil mixing ground improvement. In addition, a layer of riprap was placed around Pier 8 during the original bridge construction. Penetrating through the riprap layer will be difficult with deep soil mixing. In our opinion, construction of an improved soil mass (combination of cement deep soil mixing and jet grouting) is the preferred technical approach and method for seismic mitigation at the west riverbank. The ground improvement will be constructed to maintain slope stability at this location.

Wall A4 (OR43)

To accommodate roadway realignment, a retaining wall is proposed along the slope beyond the southeast extents of OR43, as shown on the Geologic Hazard Map, Figure 2. We understand the new roadway alignment will include a roundabout and a multiuse path. An MSE wall is the preferred design alternative for the proposed retaining wall. The wall will be approximately 156 feet long with a maximum exposed wall height of 9.5 feet. The backslope behind the MSE wall is approximately level and the maximum slope of the existing ground in front of the wall is approximately 1.8H:1V (Horizontal:Vertical). Retaining Wall A4 is in a Habitat Conservation Area, as shown in the Geologic Hazard Map, Figure 2. The wall will be constructed to maintain slope stability at this location.

West A Street Bridge

We understand the existing bridge is currently proposed to be replaced by a two-span structure located along the same alignment as the existing bridge with the interior bent located in the new median area between the northbound and southbound lanes of I-205. The new bridge will be constructed in two stages to maintain one lane of travel across the existing bridge during construction.

The proposed south abutment (Bent 1) will be located immediately south of (behind) the existing south abutment to allow for the new I-205 widening. Hard-rock excavation may be required to accommodate the I-205 widening in front of Bent 1. The Bent 1 abutment wall and foundations will be combined into the same system by using drilled-in soldier piles socketed into rock to support the bridge and installing lagging between the piles and a full height permanent concrete fascia to form the abutment wall. Hard-rock excavation may also be required for the new spread footings at Bents 2 and 3.

Roadway Rock Cut Widening

The proposed rock cut area is located along the northbound (southeast) side of I-205 and the northbound Exit 8 off-ramp to Highway 43, as shown on Figure 2. This portion of I-205 and the northbound Exit 8 off-ramp are in an existing through cut in basalt bedrock. The existing rock cut on the southeast side of I-205 is up to about 70 feet in height with most of the slope inclined at about 76 degrees or 0.25 horizontal to 1 vertical (0.25H:1V); some portions of the slope that contain weathered rock or colluvial soils have flatter slopes. Willamette Falls Drive parallels most of the existing rock cut to the southeast forming an isolated, northeast-trending topographic ridge between I-205 and Willamette Falls Drive that is bounded by West A Street on the northeast end and Sunset Avenue on the southwest end.

The proposed cut is approximately 2,565 feet in length, beginning at the Broadway Street Bridge (I-205 MP 8.69) and extending about 525 feet southwest of the Sunset Avenue Bridge to approximately I-205 MP 8.38. Both the Sunset Avenue and West A Street Bridges are within the extents of the proposed cut.

The general design criteria for the proposed rock cut slope, based on the ODOT GDM, are: 1) that the slope be at the steepest inclination that satisfies stability considerations and 2) that the base of the slope includes a catchment area sufficient to provide 90 percent retention of all rockfall (including rollout) and 99 percent retention of free-falling rocks.

Sunset Avenue Bridge

We understand the existing bridge is currently proposed to be replaced by a two-span structure located along a new alignment immediately south of the existing bridge. The proposed west abutment (new Bent 1) will be located immediately south of the existing west abutment; the proposed interior bent (new Bent 2) will be located in the new I-205 median area; and the proposed east abutment (new Bent 3) will be located approximately 120 feet southwest of the existing east abutment centerline. Refer to Figure 2 for the proposed bridge bent locations.

SHANNON & WILSON

Spread footings are anticipated to be used as foundation support at the abutments, while drilled shaft foundations are anticipated at the interior bent. Drilled shafts also remain feasible foundation design options at Bents 1 and 3.

Wall B1 (Barrier with Backfill)

A concrete barrier with backfill is the preferred design alternative for the proposed retaining wall along the median between the northbound and southbound I-205 travel lanes to provide a narrower median and accommodate roadway widening. The barrier will be an ODOT standard 42-inch concrete barrier and will be pinned to the underlying pavement. We understand that the proposed median slope behind the barrier is up to 1.8H:1V, with a minimum 4-foot-wide horizontal bench of material directly behind the barrier. The maximum height of the horizontal bench of barrier backfill is less than 4 feet. The exposed wall height of less than 4 feet and minimum 4-foot-wide flat bench behind the wall qualifies it as a minor retaining wall in accordance with the ODOT GDM Section 15.2.1.1 (ODOT, 2018). Although the barrier will be pinned to the underlying pavement instead of being embedded the minimum required 2 feet for retaining walls, and use of a pinned median barrier is not an approved permanent retaining wall system according to the ODOT GDM (ODOT, 2018), we understand a design deviation is not being required because the barrier qualifies as a minor retaining wall.

The proposed backfilled concrete barrier extends from south of Sunset Avenue to just east of 10th Street for approximately 3,188 feet, as shown on Figure 2 (Sheets 8 through 10).

LIMITATIONS

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they reportedly exist, and further assume that the information included on the drawings is representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those inferred from the drawings. For previous explorations, we did not review soil samples and cannot confirm that these previous explorations are representative of the site conditions. The analysis, conclusions, and recommendations contained in this report are also based on the available as-constructed structure information.

Our evaluations were performed for preliminary design purposes and should not be relied upon for final design or construction. Additional explorations are required to develop final design recommendations for this project.

Within the limitations of scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied. These conclusions and recommendations were based on our understanding of the project as described in this report and the site conditions interpreted from the drawings.

This report was prepared for the exclusive use of West Linn and **HDR, Inc.,** and their design team in the design of the I-205: Stafford Rd to OR99E Corridor Widening project. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions, such as those interpreted from the drawings, and discussions of subsurface conditions included in this report.

The scope of our present work did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air, on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered. Please read the Important Information section at the back of this report to reduce your project risks.

Sincerely,

SHANNON & WILSON

Aimee Holmes, PE, CEG
Senior Engineer/Engineering Geologist

Risheng "Park" Piao, PE, GE
Vice President | Geotechnical Engineer

AEH:RPP/las

Enc. Figure 1 – Vicinity Map
Figure 2 – Geologic Hazard Map
Important Information about your Geotechnical/Environmental Report

REFERENCES

Allen, J.E., Burns, M., and Burns, S., 2009, Cataclysms on the Columbia: The Great Missoula Floods (2nd ed.): Portland, Oregon, Ooligan Press, 204 p.

Beeson, M.H., Tolan, T.L., and Madin, I.P., 1991, Geologic Map of the Portland Quadrangle, Multnomah and Washington Counties, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-75, scale 1:24,000.

Beeson, M.H., Tolan, T.L., and Madin, I.P., 1989, Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-59, scale 1:24,000.Burns, W.J., Mickelson, K.A., and Madin, I.P., 2016, Landslide Susceptibility Overview Map of Oregon: Oregon Department of Geology and Mineral Industries, Open-File Report O-16-02, scale 1:500,000.

Burns, W. J., 2009, Landslide inventory maps for the Canby quadrangle, Clackamas, Marion, and Washington Counties: Oregon Department of Geology and Mineral Industries Interpretive Map 29, scale 1:8,000.

Mabey, M.A., Madin, I.P., Youd, T.L., and Jones, C.F., 1993, Earthquake hazard maps of the Portland Quadrangle, Multnomah and Washington Counties, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries Geologic Map Series GMS-79.

Mabey, M.A., and others, 1997, Relative earthquake hazard map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon: Oregon Department of Geology and Mineral Industries Interpretive Map Series IMS-1.

Madin, I.P., 2009, Geologic Map of the Oregon City 7.5 Minute Quadrangle, Clackamas County, Oregon: State of Oregon Department of Geology and Mineral Industries Geologic Map Series GMS-119, 46 p, 1 plate, scale 1:24,000.

Madin, I.P., 1990, Earthquake Hazard and Geology maps of the Portland Metropolitan Area, Oregon: U.S. Geological Survey Open File Report 0-90-2

ODOT, 2018, Geotechnical Design Manual: Salem, Oregon, available: https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Geotech-Manual.aspx.

SHANNON & WILSON

Personius, S.F., compiler, 2002c, Fault number 716, Canby-Molalla fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2017 01:59 PM.

Personius, S.F., compiler, 2002f, Fault number 875, Oatfield fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2017 12:09 PM.

Personius, S.F., compiler, 2002i, Fault number 879, Damascus-Tickle Creek fault zone, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2017 01:47 PM.

Personius, S.F., compiler, 2002e, Fault number 874, Bolton fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/17/2017 01:59 PM.

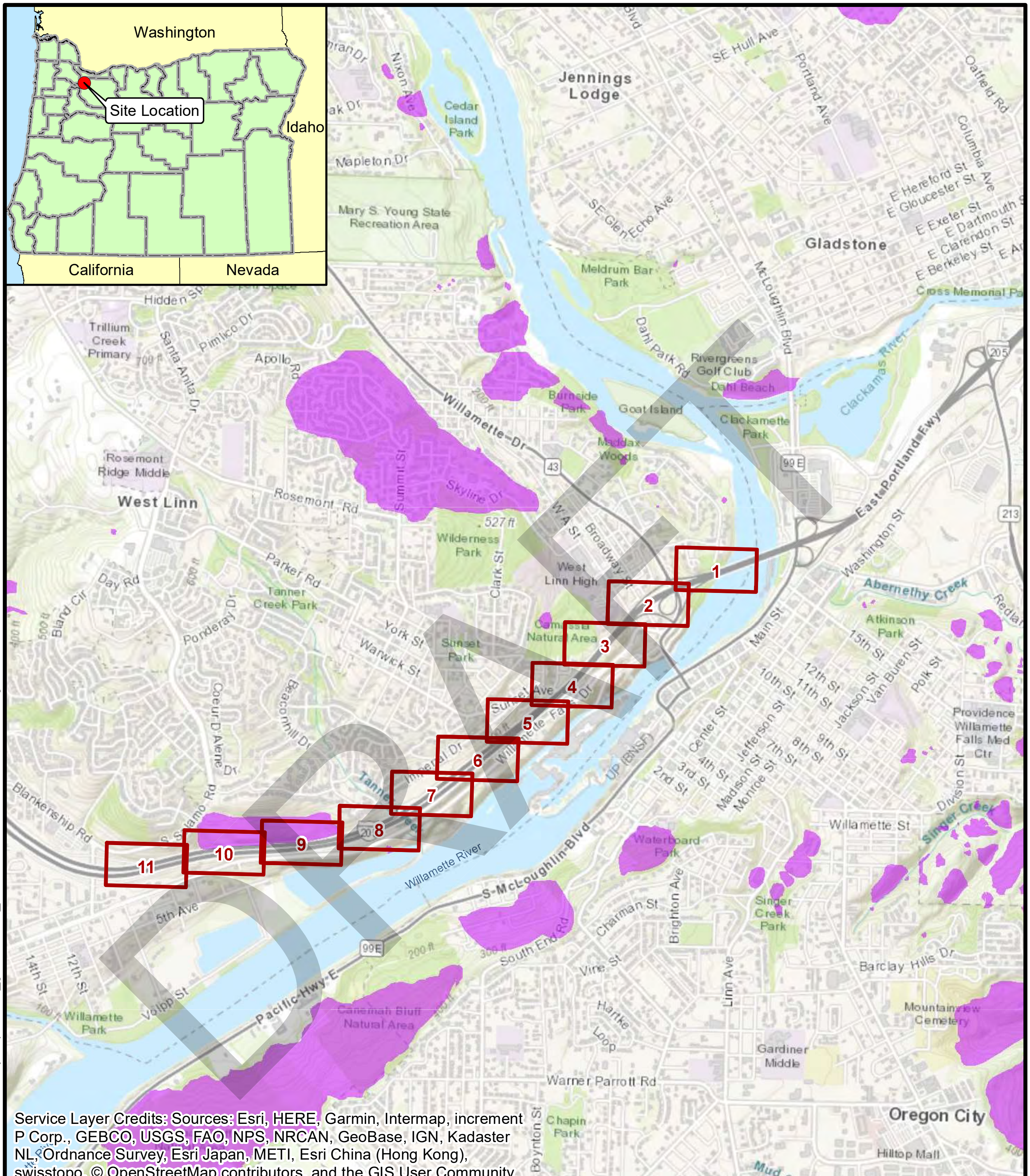
Personius, S.F., and Haller, K.M., compilers, 2017, Fault number 877, Portland Hills fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2017 01:15 PM.

Personius, S.F., and Nelson, A.R., compilers, 2006, Fault number 781, Cascadia megathrust, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults.

Schlicker, H.G., and Finlayson, C.T., 1979, Geology and Geologic Hazards of Northwestern Clackamas County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 99, 79p.

United States Geological Survey, 2017, Quaternary fault and fold database of the United States: U.S. Geological Survey website, http://earthquake.usgs.gov/hazards/qfaults/map/#qfaults, accessed 07/01/2019.

Wong, I., Silva, W., Bott, J., Wright, D., Thomas, P., Gregor, N., Li, S., Mabey, M., Sojourner, A., and Wang, Y., 2000, Earthquake scenario and probabilistic ground shaking maps for the Portland, Oregon, metropolitan area: Oregon Department of Geology and Mineral Industries Interpretive Map Series IMS-16.



0 0.25 0.5 1

Scale in Miles

N

LEGEND

Figure 2 Sheets

Landslide Deposit

NOTES

1. Mapped landslide deposits provided with DOGAMI publication SLIDO-4.2.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

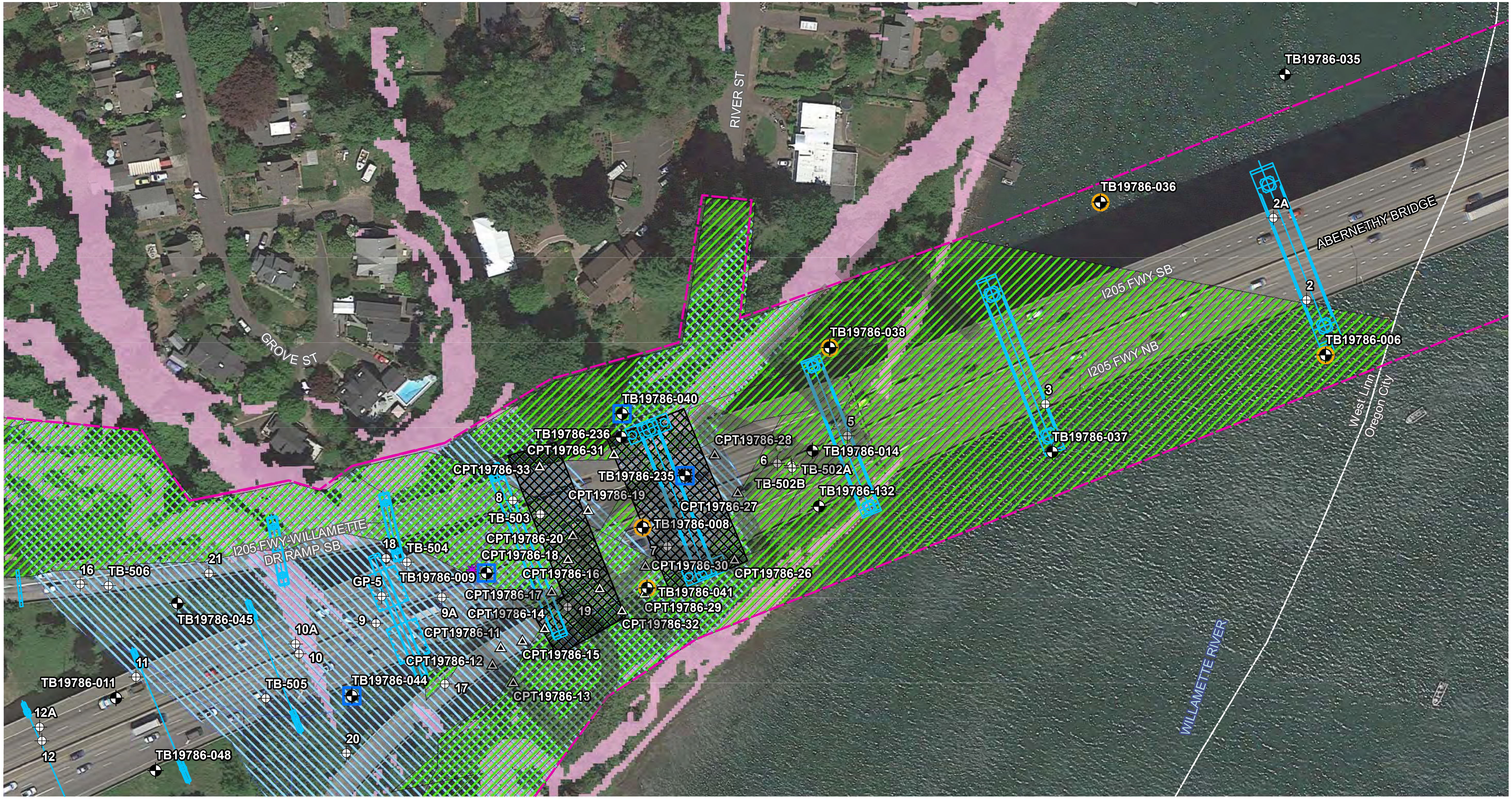
VICINITY MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\VicinityMap-WLP1_geohazards_10.6.mxd Date: 11/25/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

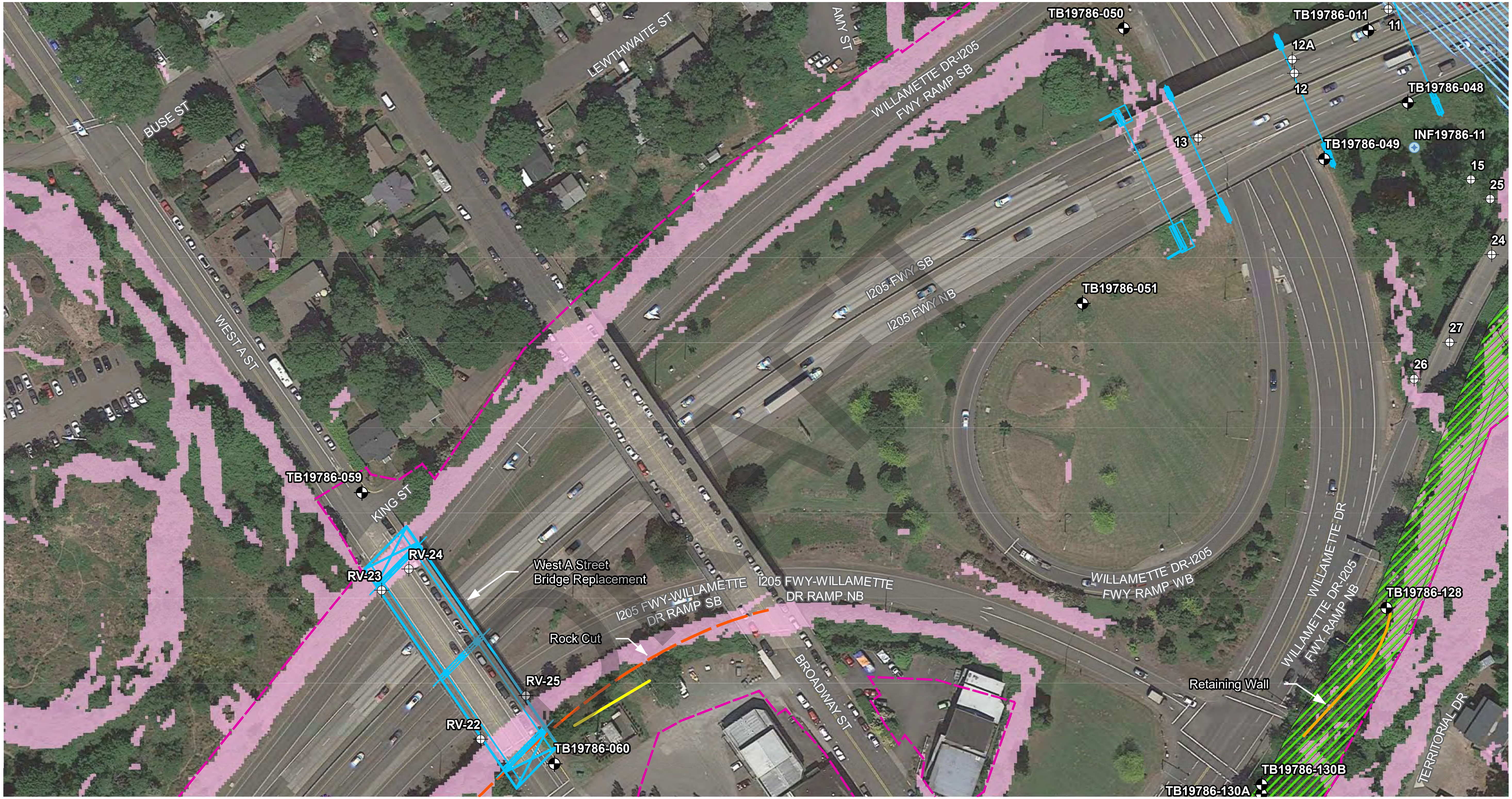
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 1 of 11

Filename: T:\Projects\24-1\4165_I-205 Stafford\A-vmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

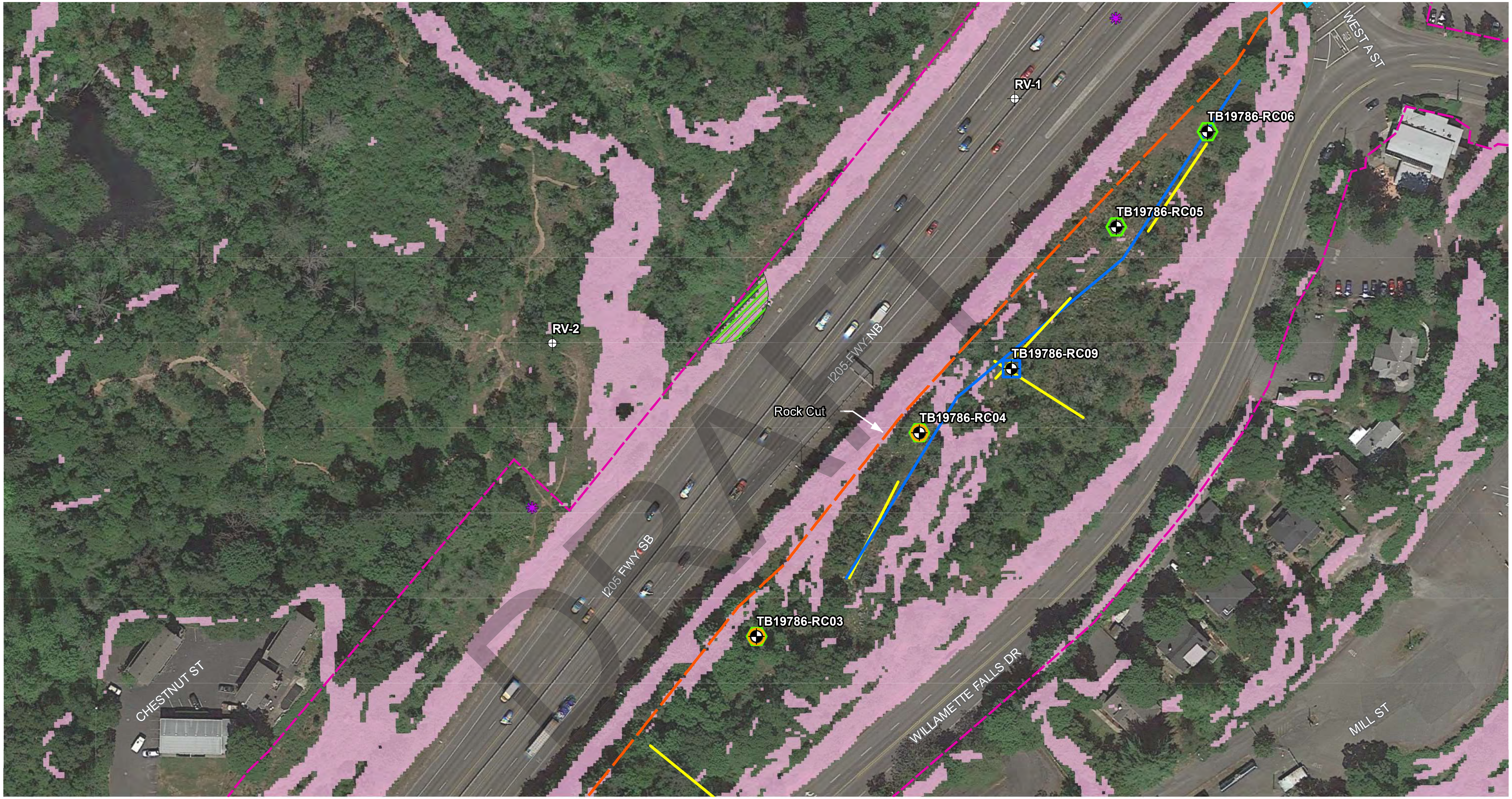
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 2 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

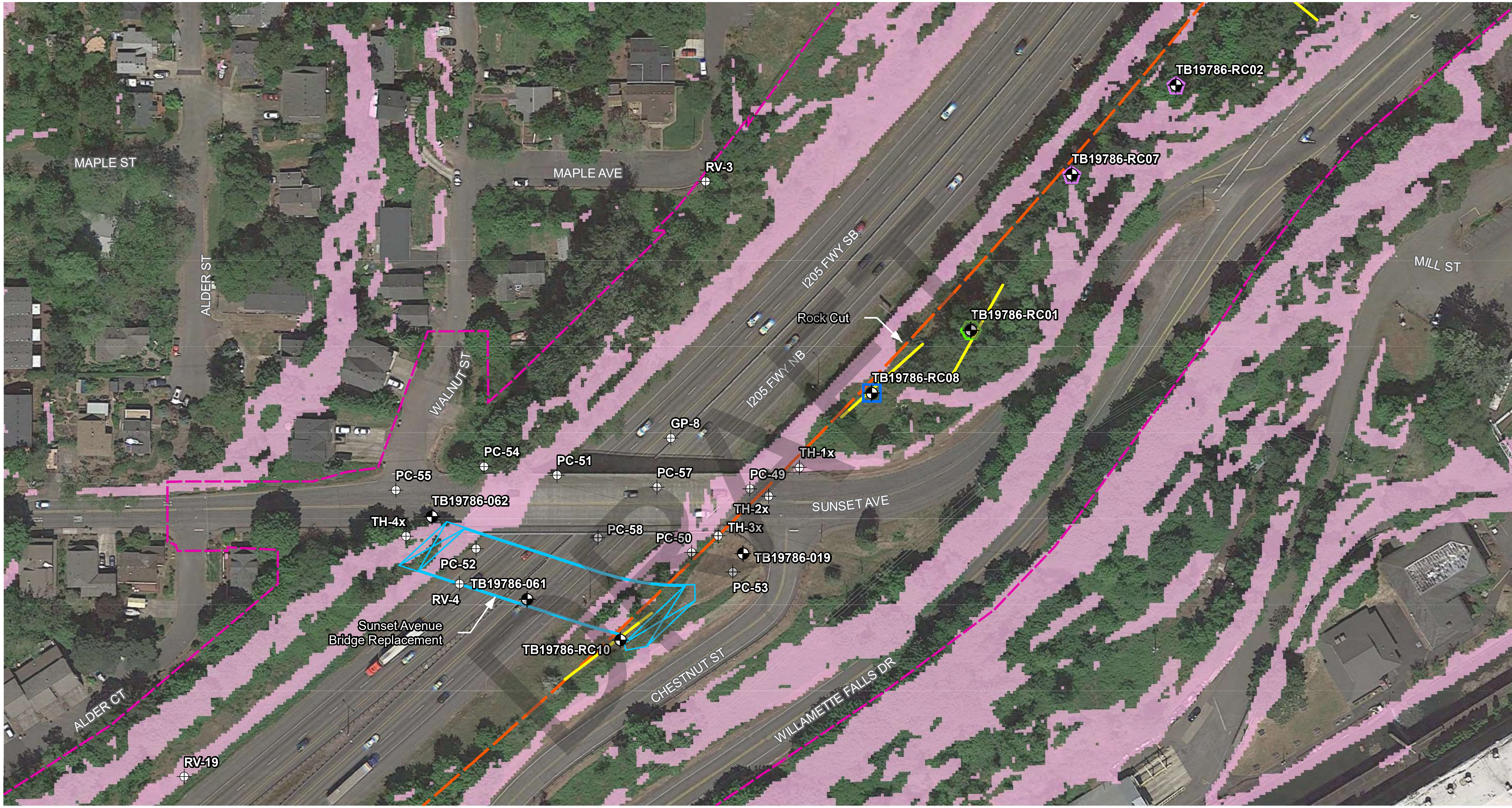
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 3 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

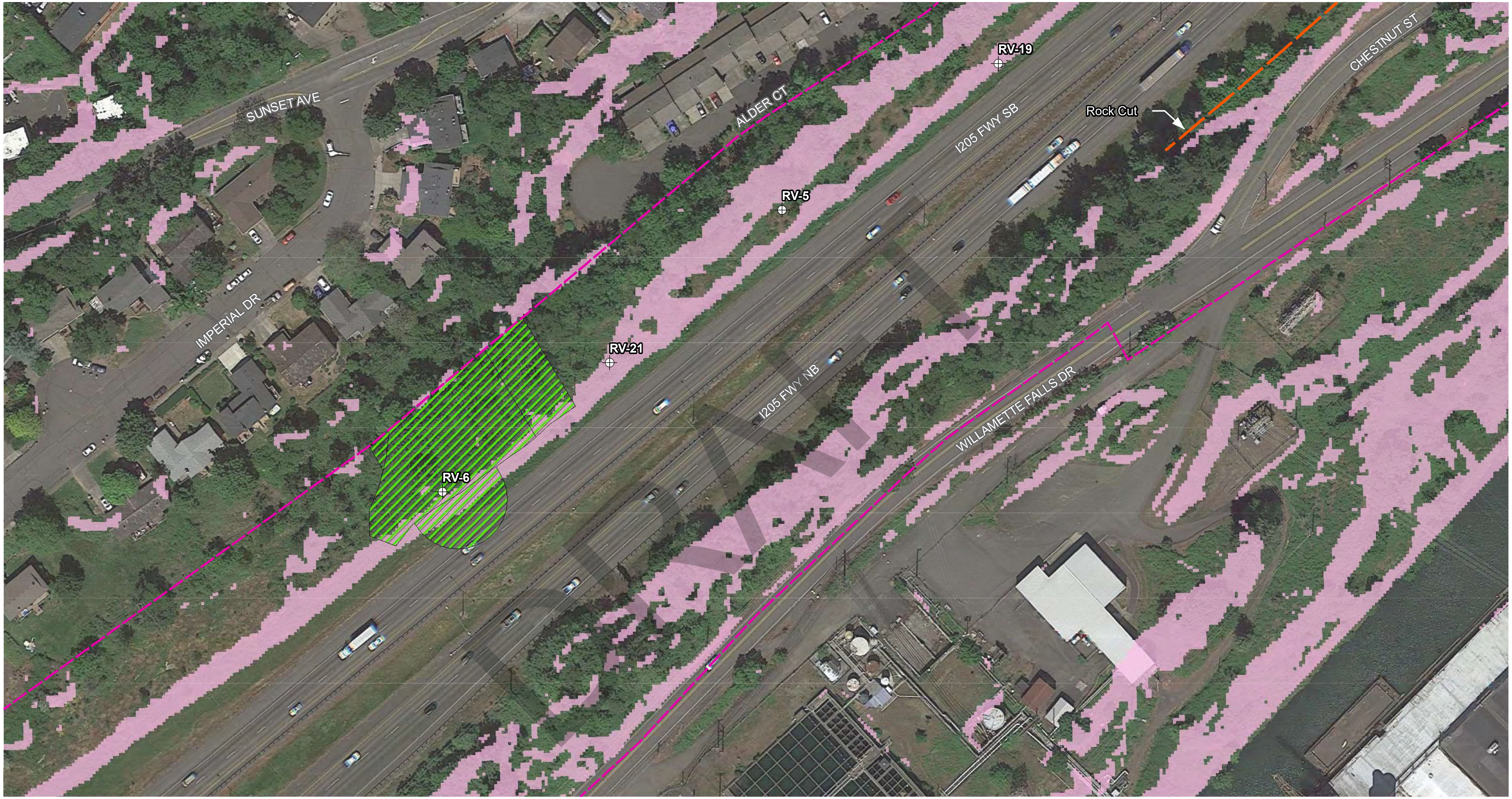
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 4 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200
Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

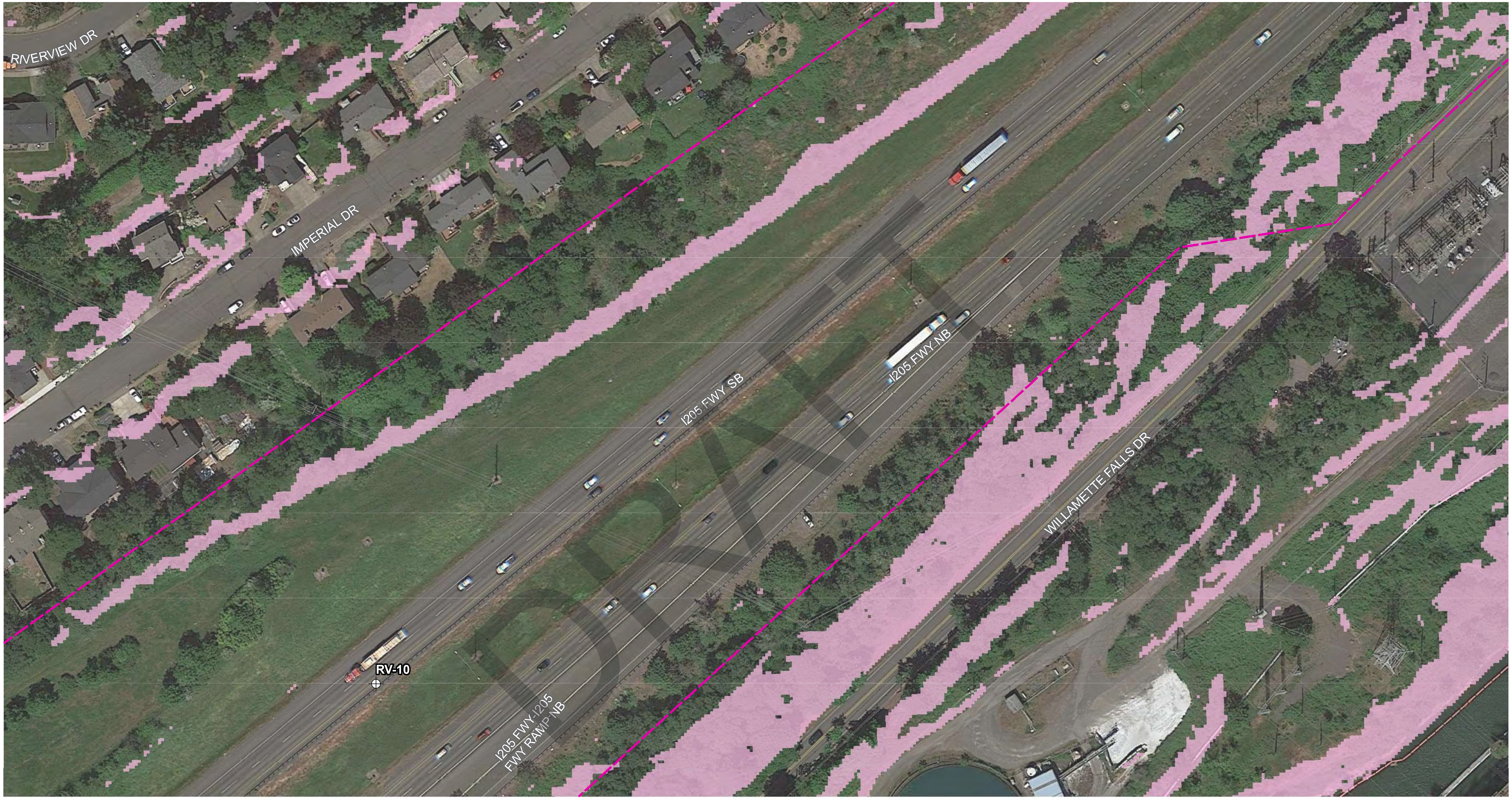
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 5 of 11

Filename: T:\Projects\24-1\4165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 6 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH

LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200
Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

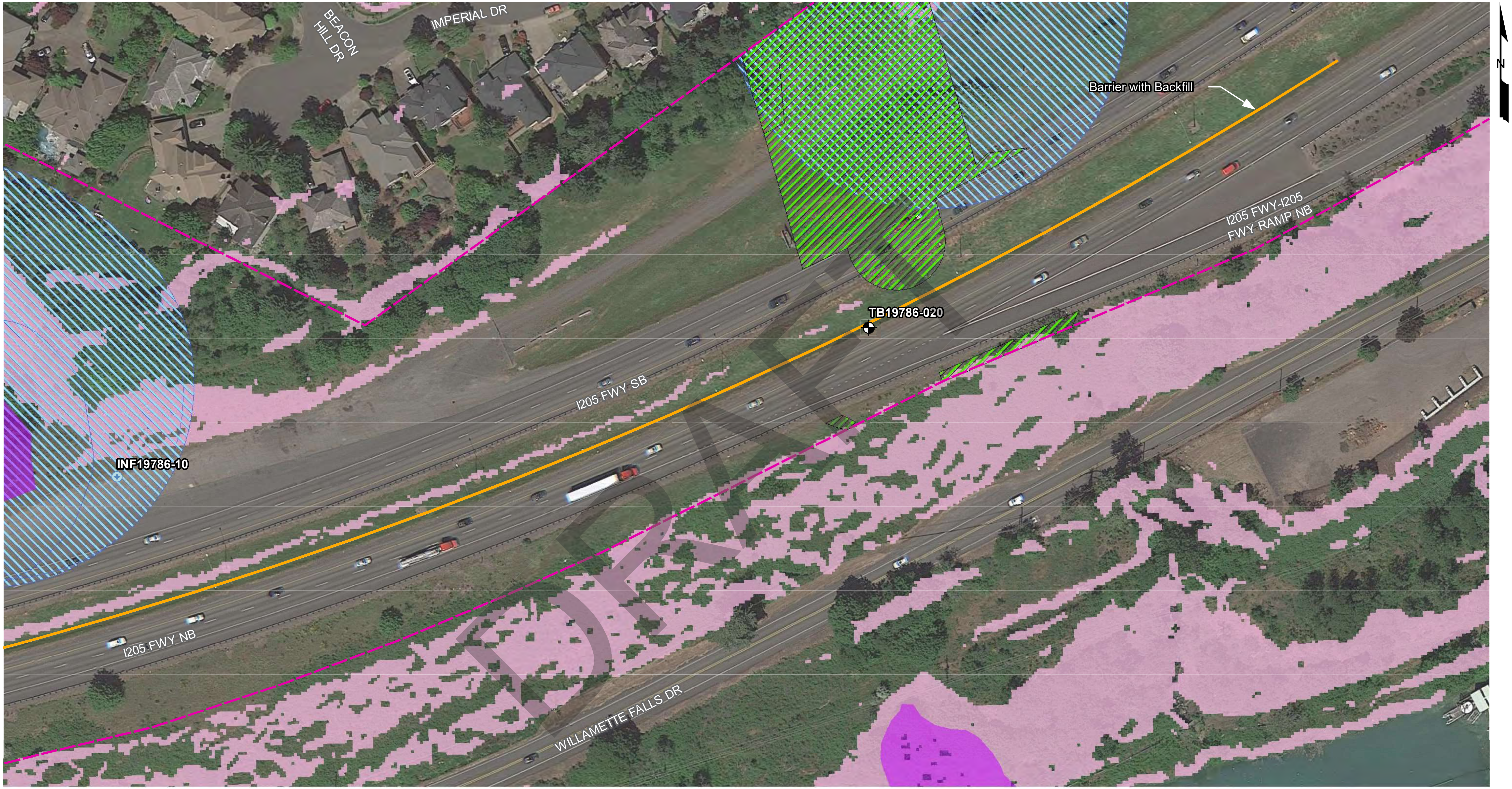
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 7 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

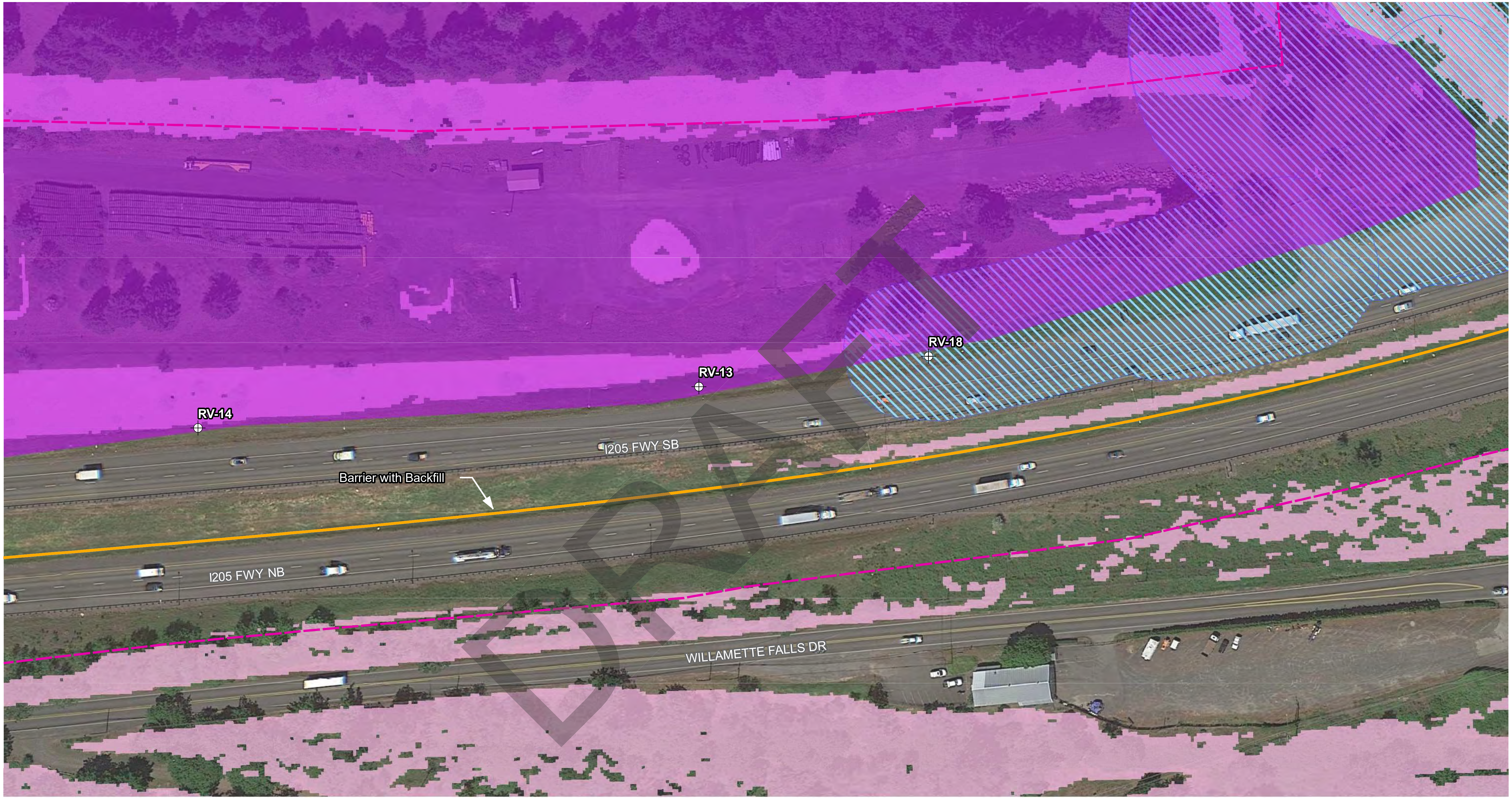
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 8 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH

LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200
Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

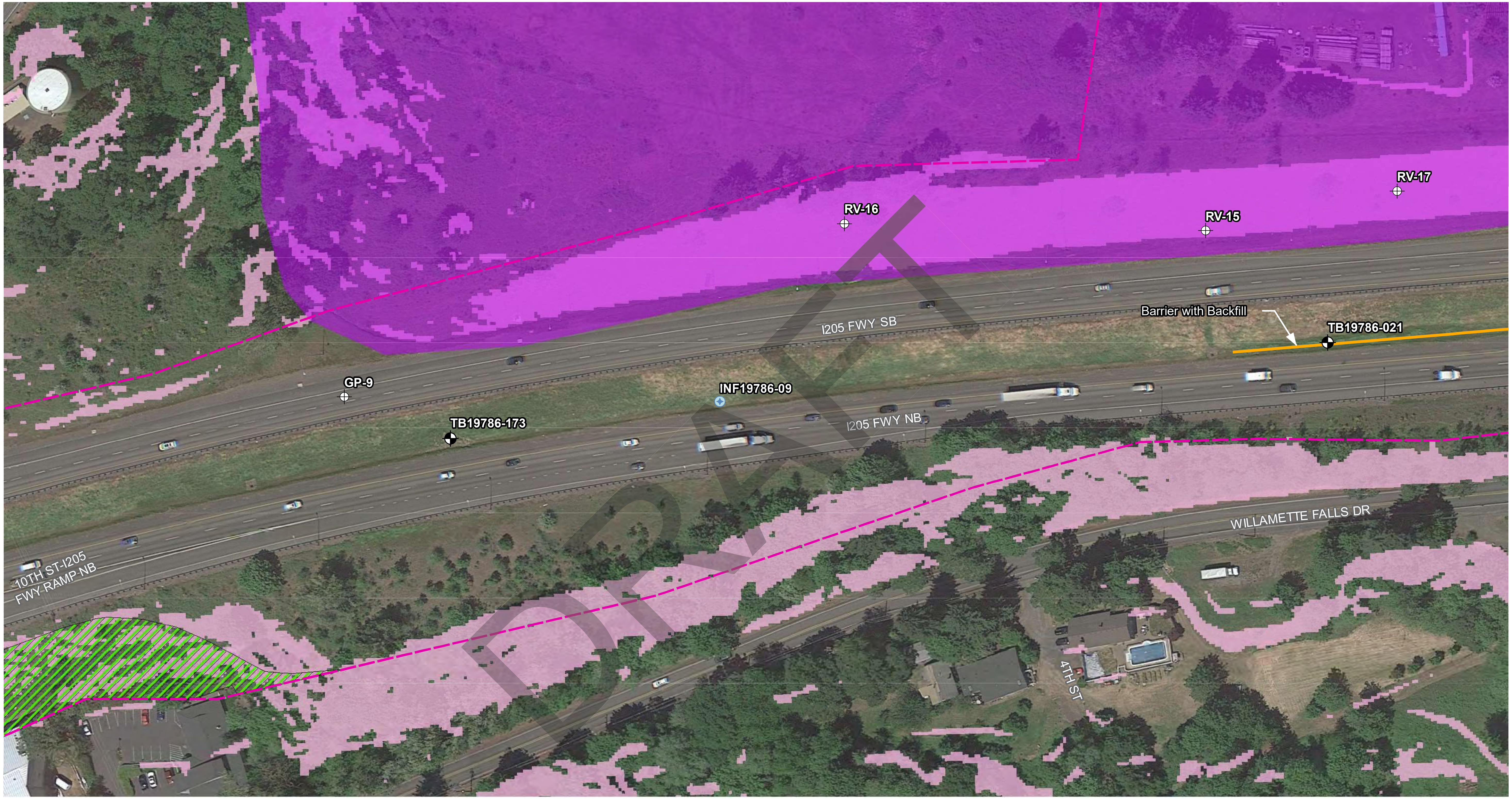
I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

GEOLOGIC HAZARD MAP

November 2020 | 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 9 of 11



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

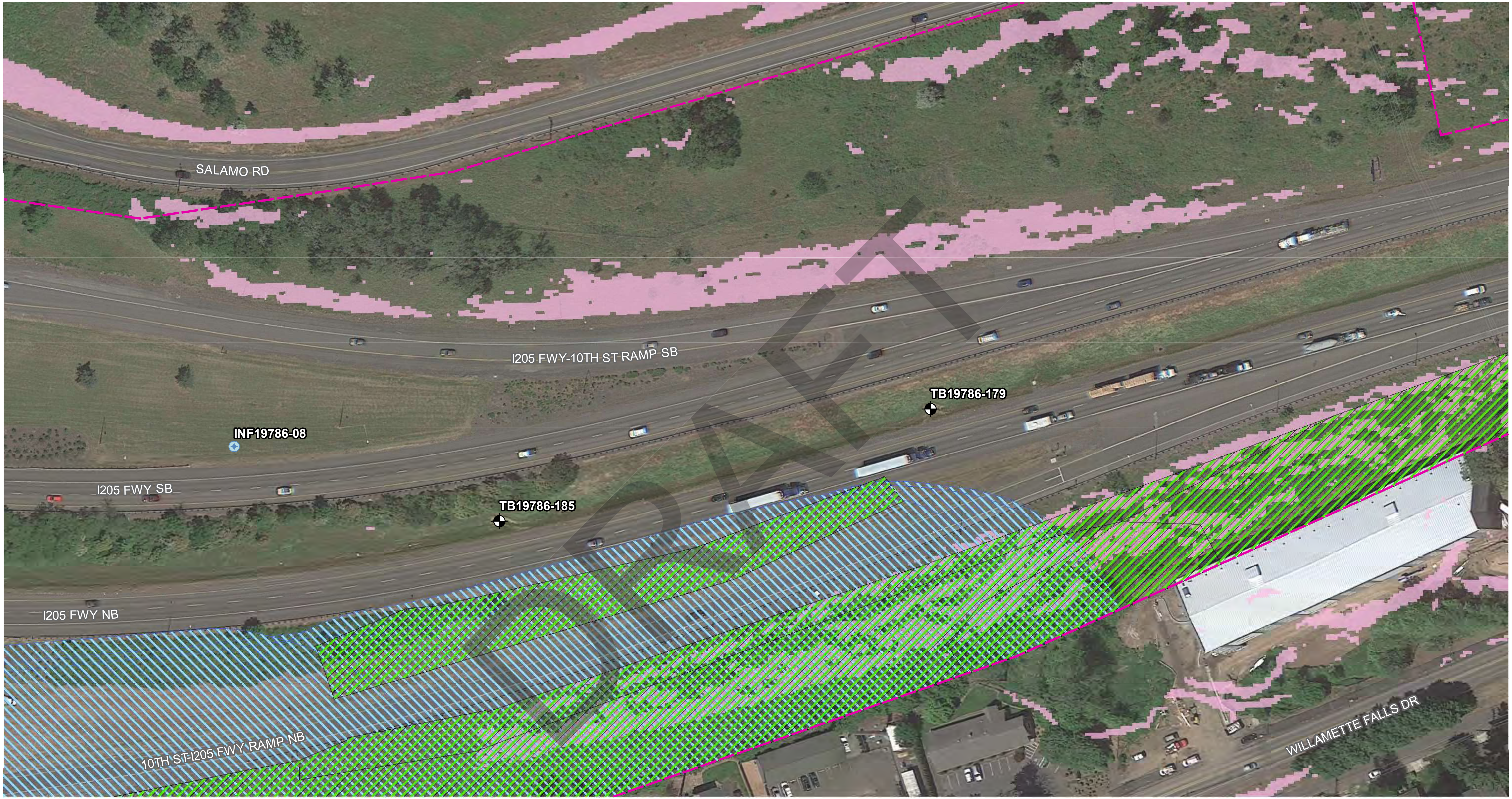
GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 10 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH



LEGEND

- Boring (Shannon & Wilson, 2017-2020)
- CPT (Shannon & Wilson, 2017-2020)
- Historic Boring (ODOT or Dames & Moore)
- Infiltration Test (Shannon & Wilson, 2017)
- Vibrating Wire Piezometer
- Shear Wave Velocity Profile
- Borehole Televiewer
- Downhole Camera
- Seismic Refraction Profile
- Electrical Resistivity Profile
- Area of Potential Impact (API)
- Proposed Bridge Features
- Proposed Retaining Wall or Barrier with Backfill
- Approximate Proposed Toe of Rock Cut
- Proposed Ground Improvement Zone
- Landslide or Unstable Slope
- Landslide Deposit
- Habitat Conservation Area
- Water Resource Area
- Slopes > 25%

0 50 100 200

Scale in Feet

NOTES

1. Proposed Phase 1 features as of November 2020.
2. 25% slope areas derived from 2014 LiDAR.
3. Existing landslide location provided with DOGAMI publication SLIDO-4.2.
4. Earthquake hazard zones provided with DOGAMI publication IMS-1.
5. Habitat conservation and water resource areas provided by HDR on November 27, 2020.

I-205: Stafford Road to OR99E Widening
West Linn Geologic Hazards
Clackamas County, Oregon

GEOLOGIC HAZARD MAP

November 2020 24-1-04165-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 11 of 11

Filename: T:\Projects\24-14165_I-205 Stafford\Avmxd\WL_geohazards_10.6.mxd Date: 11/30/2020 Login: AEH

SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Attachment to and part of Report: 24-1-04165-012
Date: November 30, 2020
To: Michael Bertram
HDR, Inc.

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

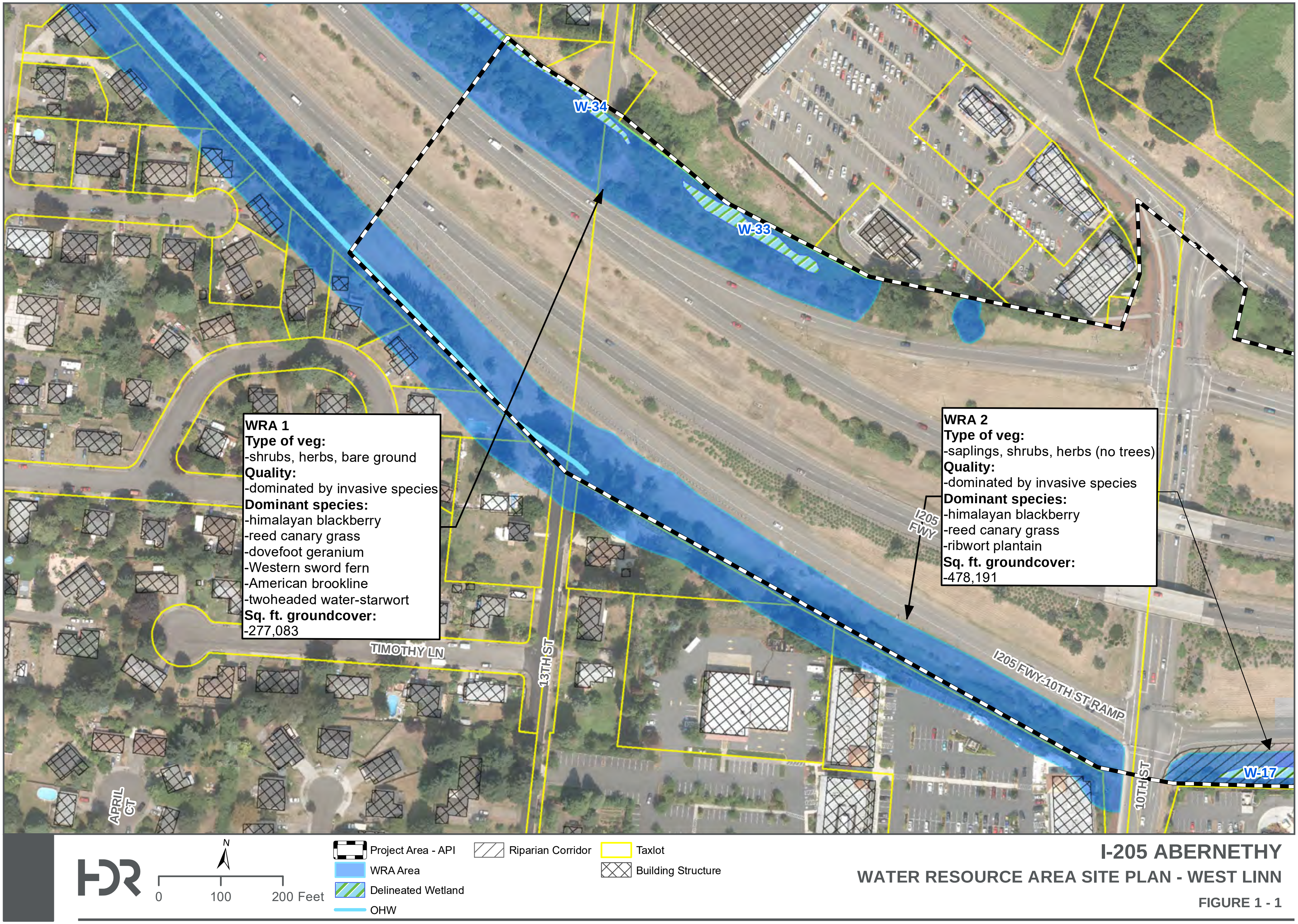
To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Attachment P. WRA Site Plan

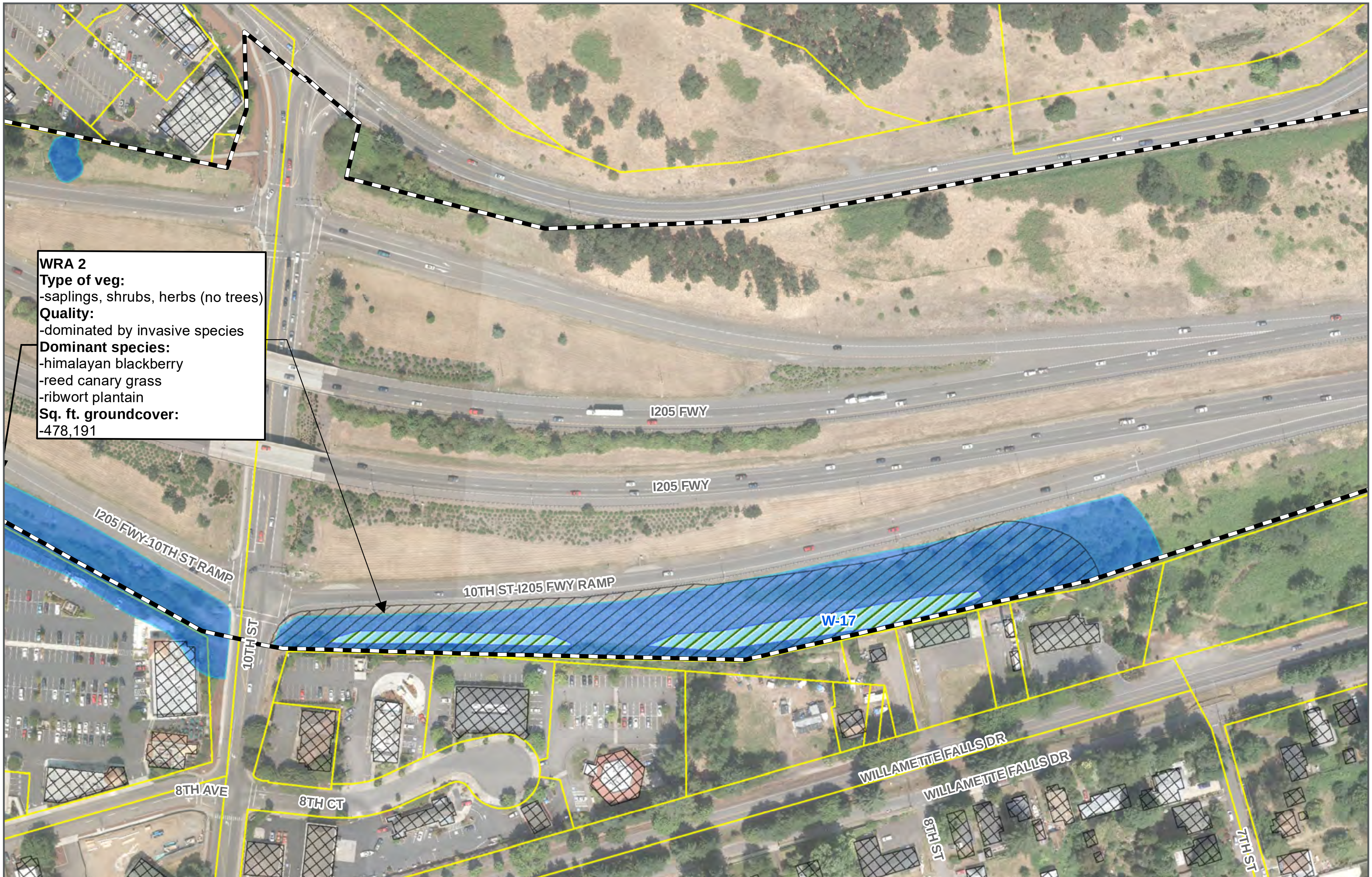


I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 1

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/27/2021



N

0 100 200 Feet

Project Area - API

WRA Area

Delineated Wetland

Riparian Corridor

Taxlot

Building Structure

I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 2

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/27/2021

N

0 100 200 Feet

Project Area - API

Taxlot

Building Structure

I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 3

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/27/2021

0 100 200 Feet

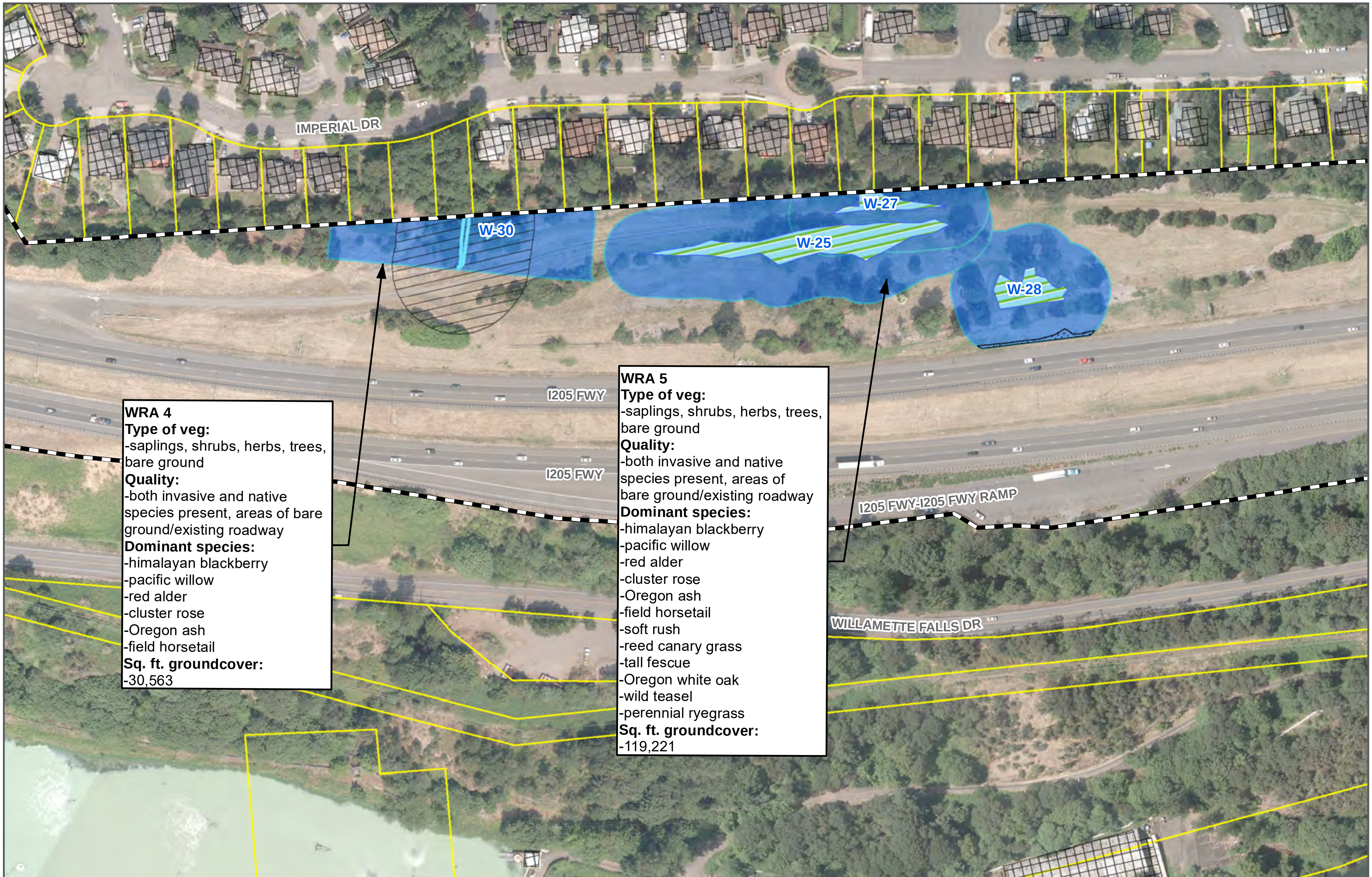
Project Area - API
WRA Area
Delineated Wetland
OHW
Impact Area
Taxlot
Building Structure

I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 4

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/27/2021



HDR

0 100 200 Feet

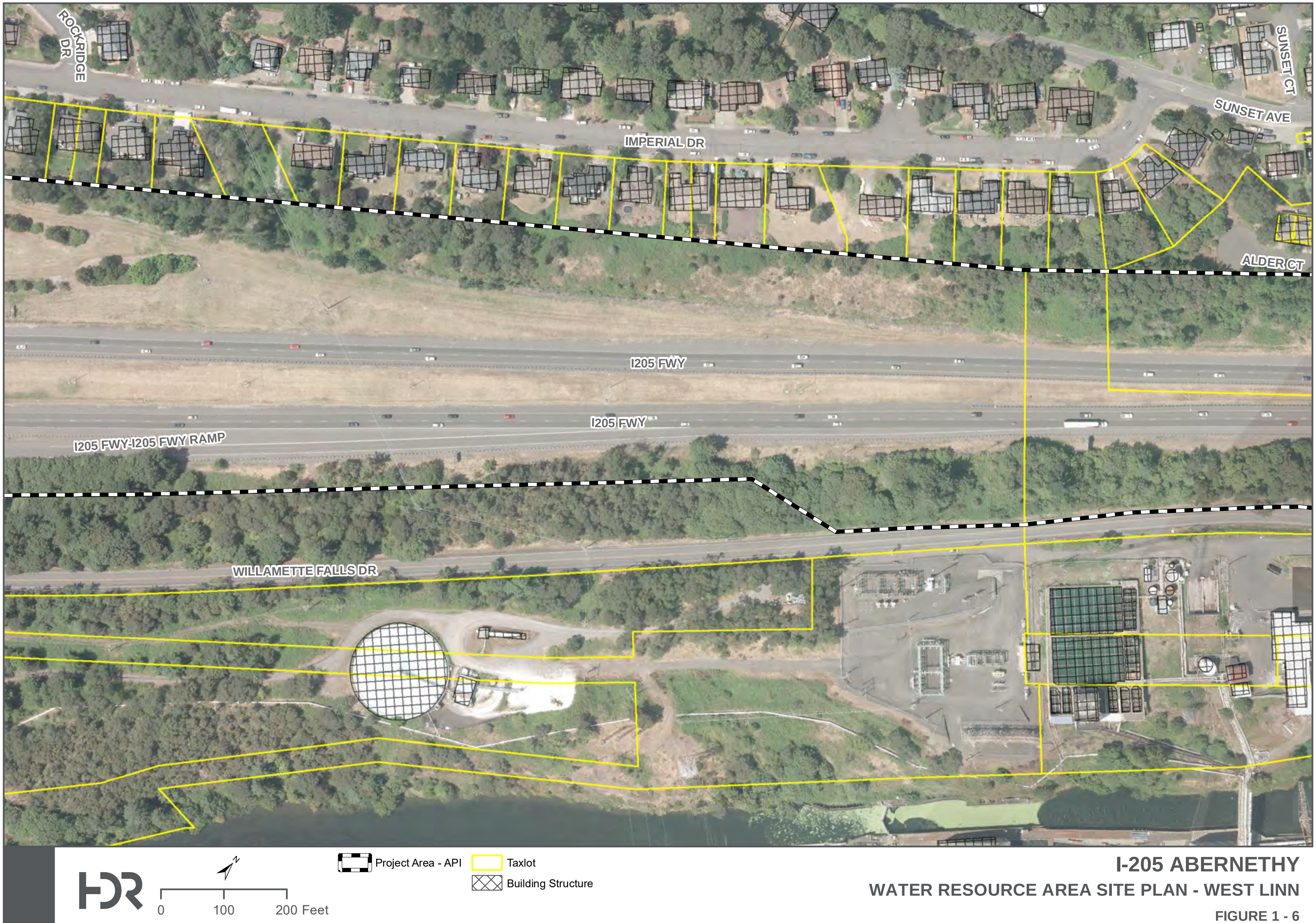
Project Area - API
WRA Area
Delineated Wetland
OHW
Riparian Corridor
Taxlot
Building Structure

I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 5

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/28/2021



I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 6

HDR

N

0 100 200 Feet

Project Area - API

Taxlot

Building Structure

I-205 ABERNETHY

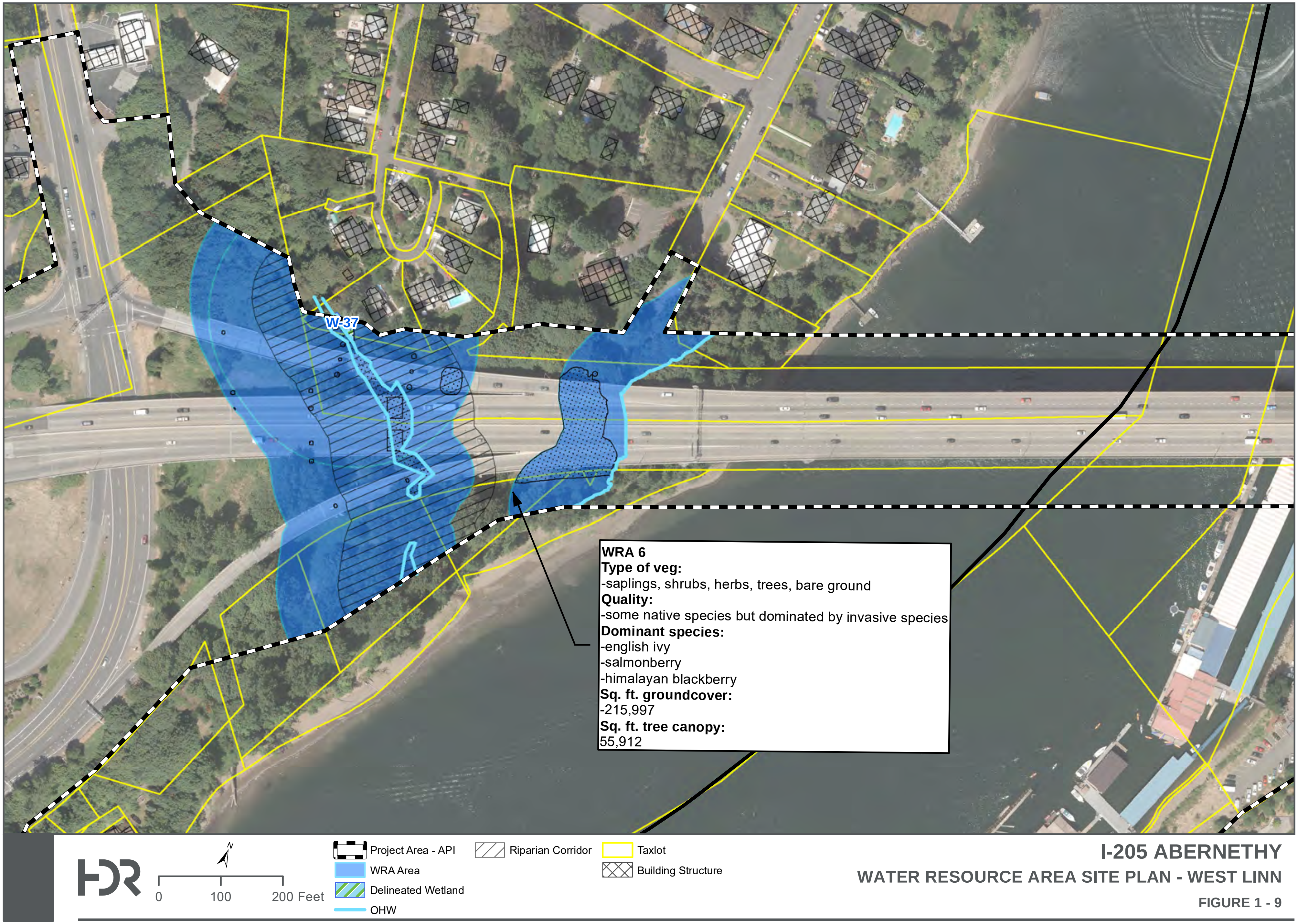
WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 7

I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 8



HDR

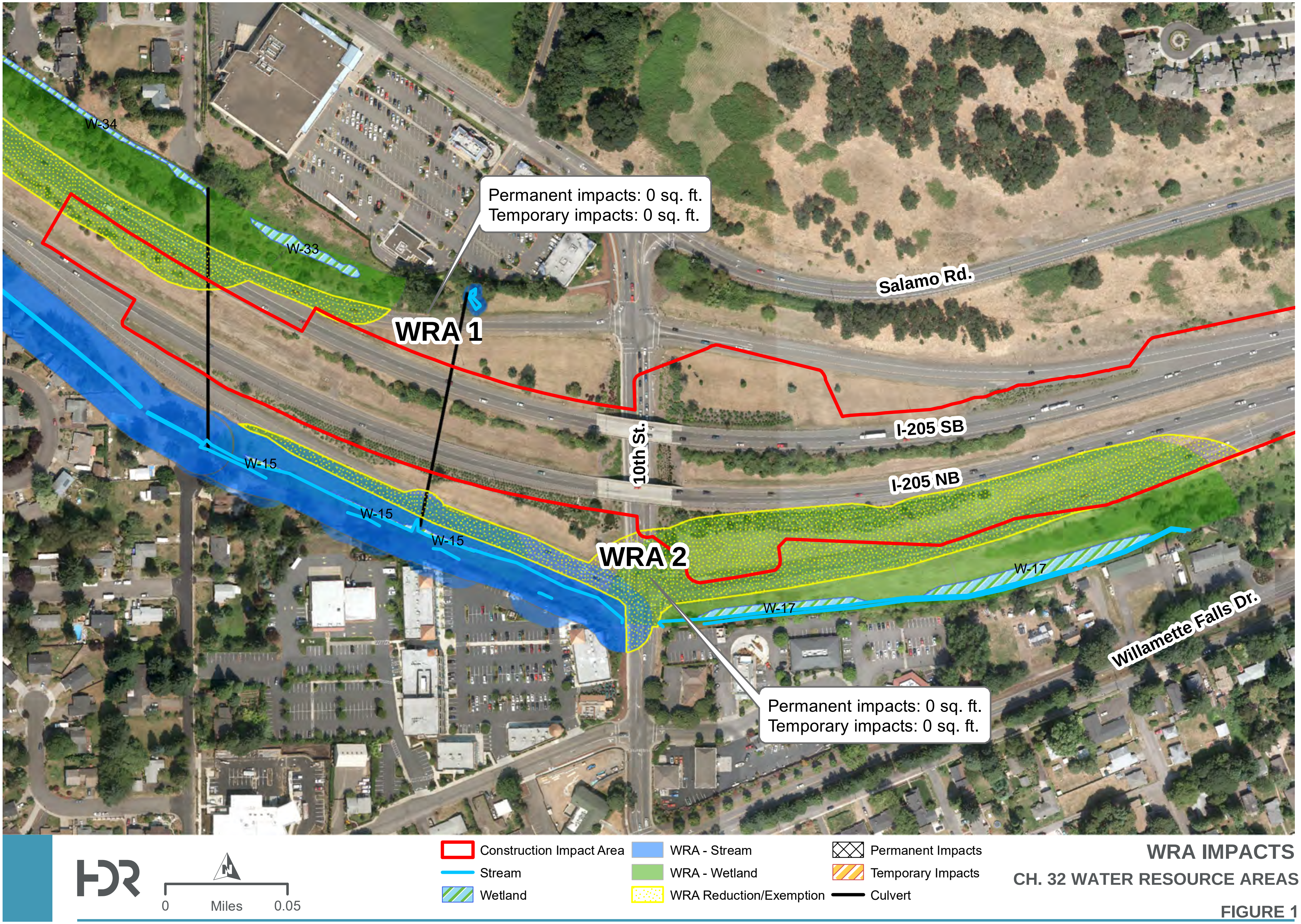
I-205 ABERNETHY

WATER RESOURCE AREA SITE PLAN - WEST LINN

FIGURE 1 - 9

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\DRAFT\WRA\WESTLINN.MXD - USER: JBEARD - DATE: 1/27/2021

Attachment Q. WRA Impacts

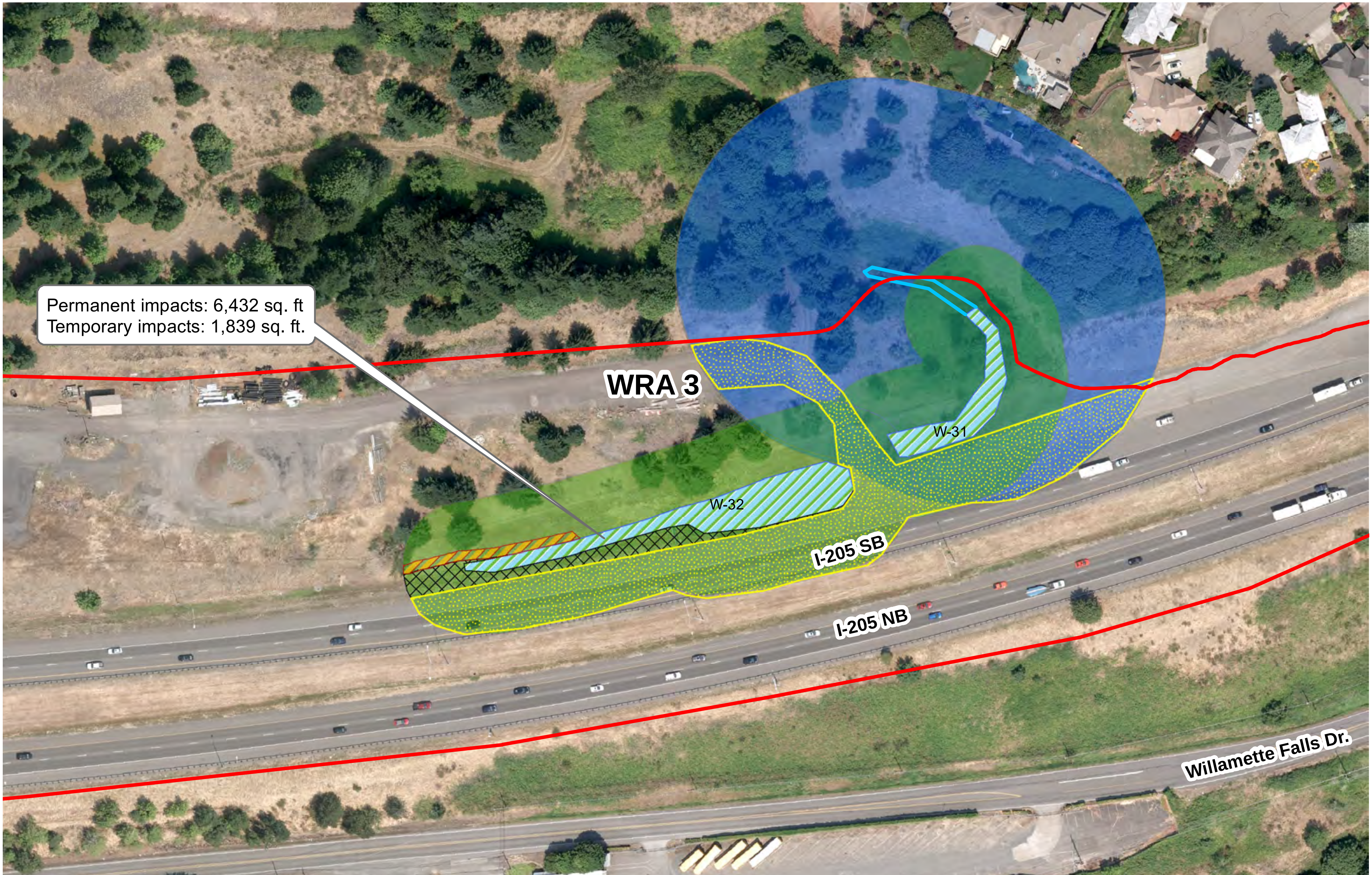


WRA IMPACTS

CH. 32 WATER RESOURCE AREAS

FIGURE 1

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA IMPACTS_WRAUPDATED.MXD - USER: RBARKSDALE - DATE: 1/26/2021



HDR

0 Miles 0.025

Construction Impact Area
Stream
Wetland
WRA - Stream
WRA - Wetland
WRA Reduction/Exemption
Permanent Impacts
Temporary Impacts
Culvert

WRA IMPACTS

CH. 32 WATER RESOURCE AREAS

FIGURE 2

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA IMPACTS_WRAUPDATED.MXD - USER: RBARKSDALE - DATE: 2/5/2021

HDR

0 Miles 0.025

Construction Impact Area
Stream
Wetland
WRA - Stream
WRA - Wetland
WRA Reduction/Exemption
Permanent Impacts
Temporary Impacts
Culvert

WRA IMPACTS

CH. 32 WATER RESOURCE AREAS

FIGURE 3

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA IMPACTS_WRAUPDATED.MXD - USER: RBARKSDALE - DATE: 1/26/2021

0 Miles 0.03

Construction Impact Area
Stream
Wetland
WRA - Stream
WRA - Wetland
WRA Reduction
Permanent Impacts
Temporary Impacts

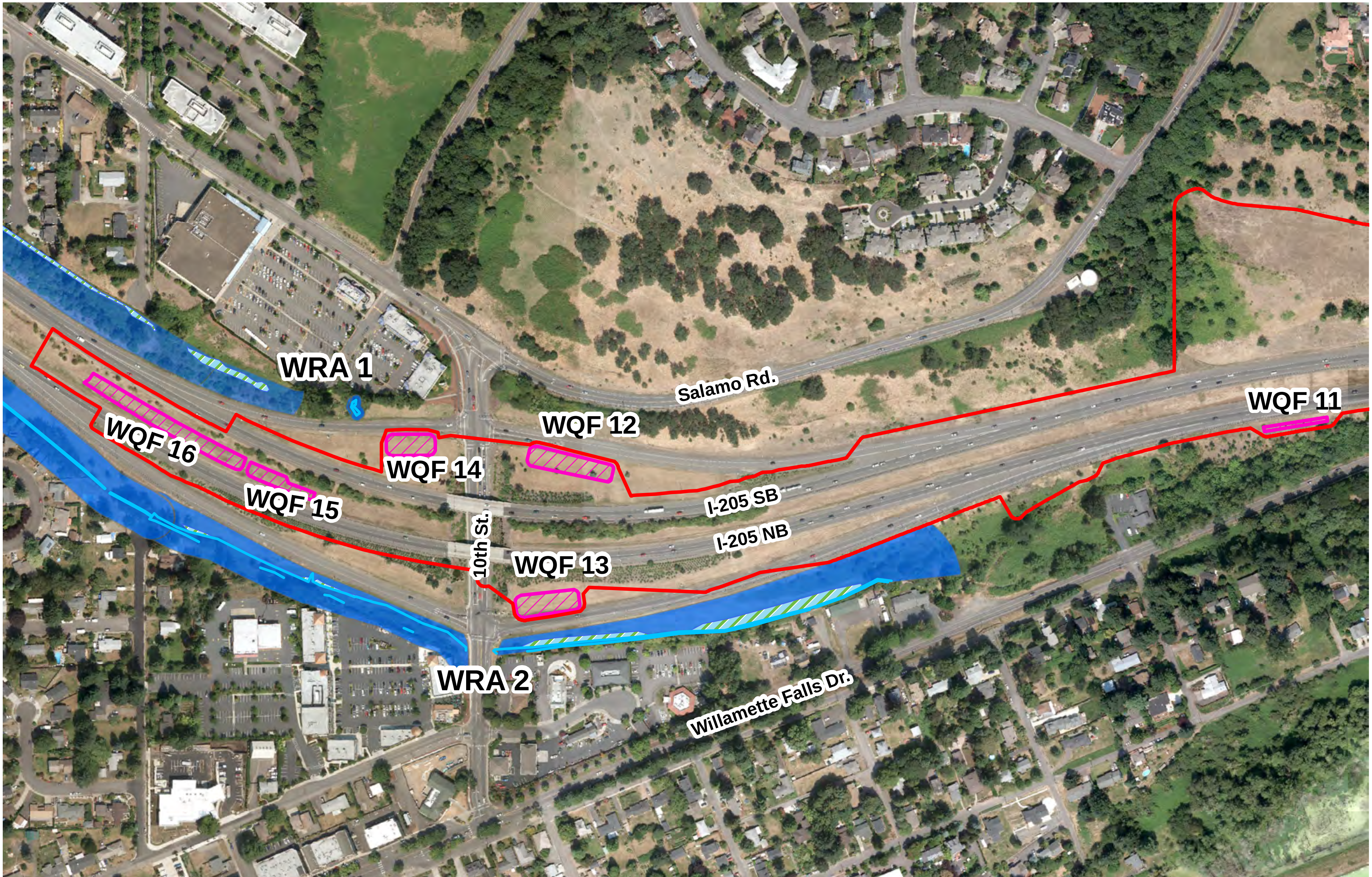
WRA IMPACTS

CH. 32 WATER RESOURCE AREAS

FIGURE 4

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA IMPACTS_WRAUPDATED.MXD - USER: RBARKSDALE - DATE: 1/25/2021

Attachment R. Water Quality Facilities & WRAs



HDR

0 Miles 0.075

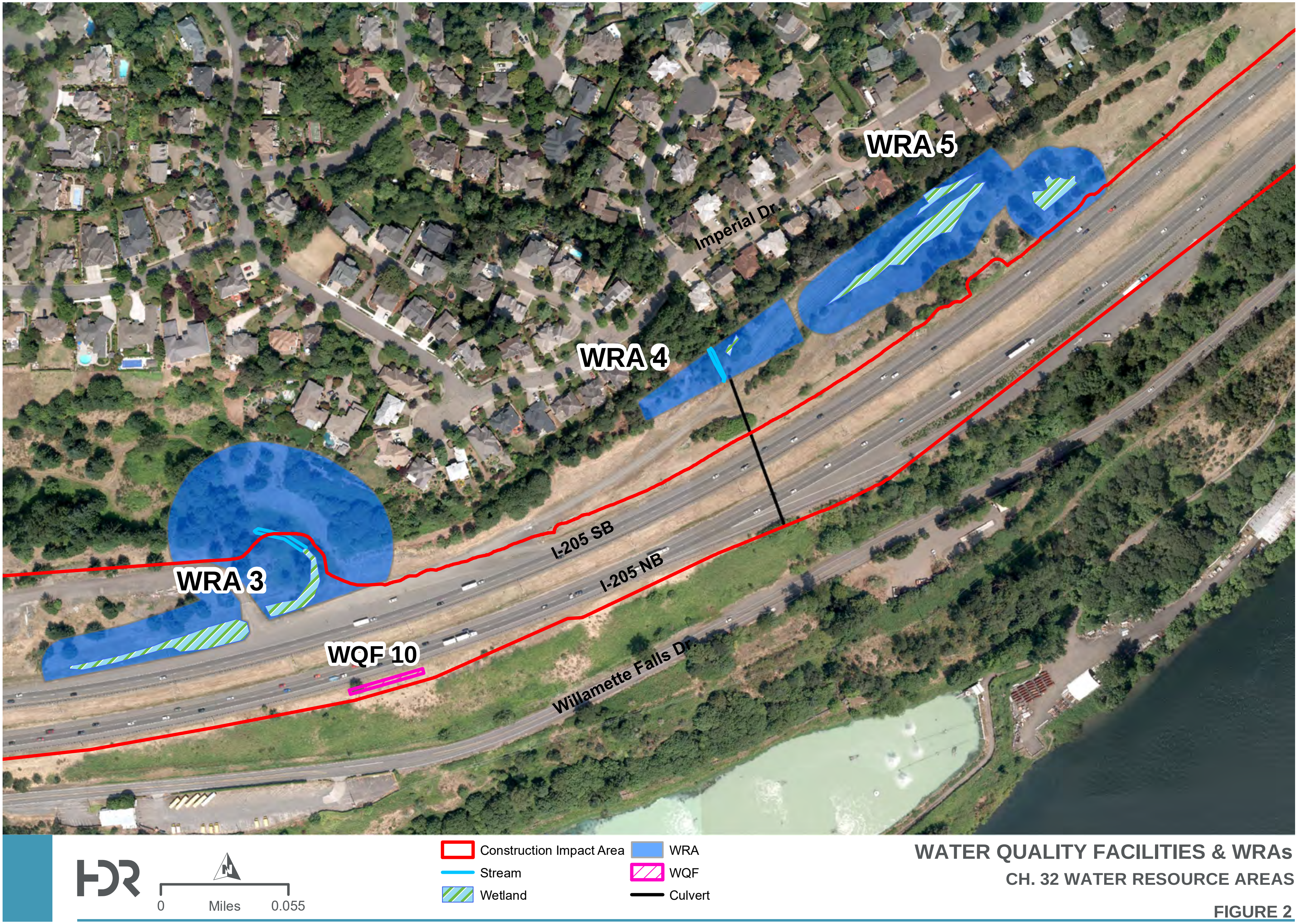
Construction Impact Area
Stream
Wetland
WRA
WQF

WATER QUALITY FACILITIES & WRAs

CH. 32 WATER RESOURCE AREAS

FIGURE 1

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WQF&WRA.MXD - USER: RBARKSDALE - DATE: 1/27/2021

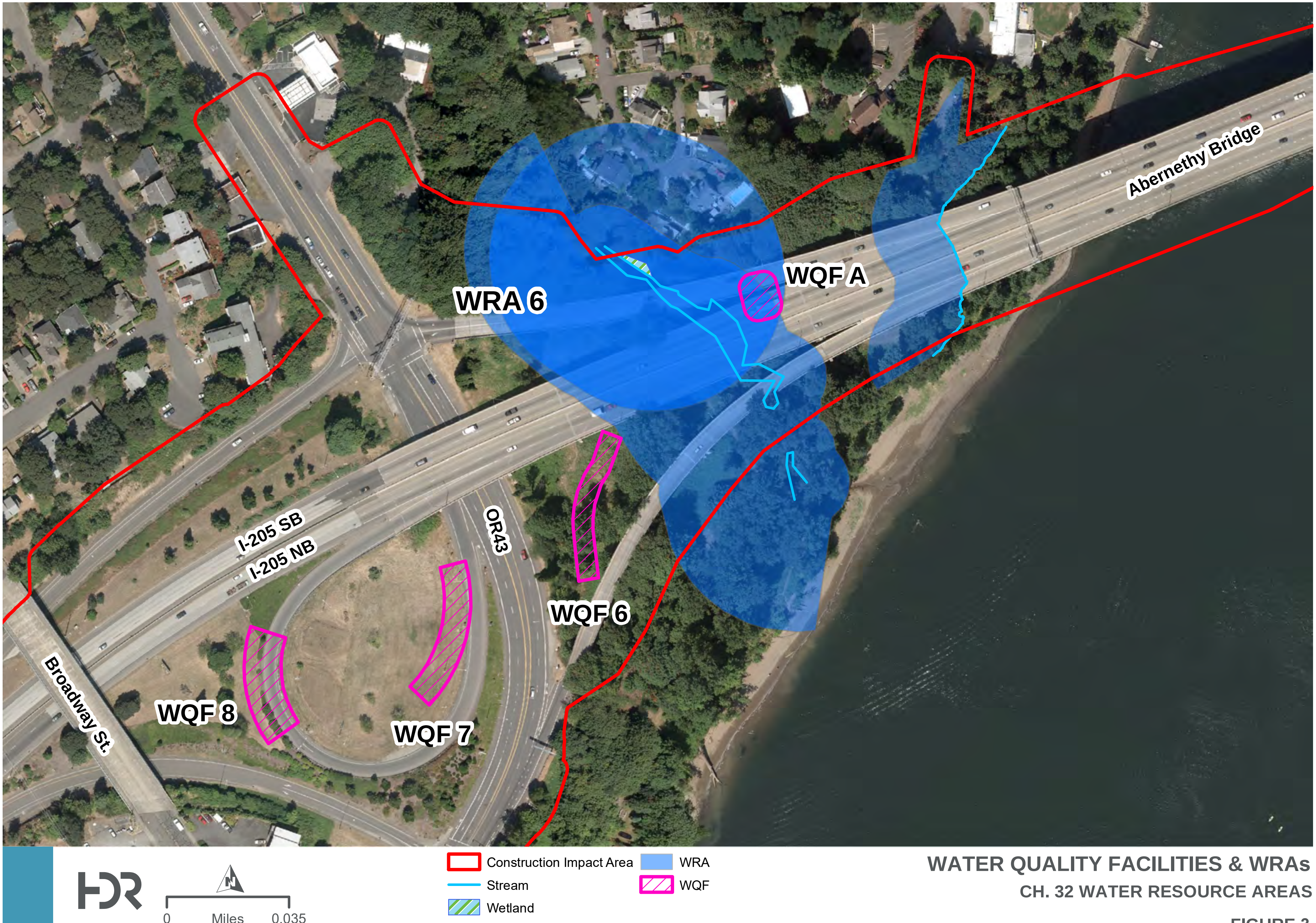


WATER QUALITY FACILITIES & WRAs

CH. 32 WATER RESOURCE AREAS

FIGURE 2

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA TEMPLATE.MXD - USER: RBARKSDALE - DATE: 12/15/2020



WATER QUALITY FACILITIES & WRAs

CH. 32 WATER RESOURCE AREAS

FIGURE 3

PATH: C:\USERS\RBARKSDALE\DOCUMENTS\PROJECTS\205 - 10063137\WEST LINN\WEST LINN WRA IMPACTS.MXD - USER: RBARKSDALE - DATE: 1/26/2021

Attachment S. DSL Concurrence and Wetland Delineation

Oregon
Kate Brown, Governor

Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
(503) 986-5200
FAX (503) 378-4844
www.oregon.gov/dsl

February 21, 2019

ODOT
Attn: Stephen Hay
123 NE Flanders Street
Portland, Oregon 97209

Re: WD # 2018-0209 Wetland Delineation Report for K19786 I-205 Corridor Widening; Clackamas County; T2S R1W Sec. 25; T2S R1E Sec. 27, 28, 29, 30, 34, 35, and 36; T2S R2E Sec. 16, 20, 29, 30, and 31, in ROW and Many Tax Lots

Dear Stephen:

The Department of State Lands has reviewed the wetland delineation report prepared by HDR Engineering, Inc. for the site referenced above. Please see the attached maps for site location information. Based upon the information presented in the report, a site visit on June 28, 2018, and revised report submitted on February 12, 2019, we concur with the wetland and waterway boundaries as mapped in Figures 5-1 through 5-39 of the report.

Within the study area 43 wetlands, 18 waterways, and 18 ditches were identified (see attached table of features). Thirty-three wetlands (Wetlands 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 17, 19, 22, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, and 43 (totaling approximately 5.92 acres)); 16 waterways (Willamette and Tualatin Rivers; Tanner, McLoughlin, Wilson, Abernathy, and Athey Creeks; Streams 1, 3, 5, 6, 7, 9, 11, 12, and 13); and 4 ditches (Ditches 3, 4, 12, and 17) are subject to the permit requirements of the state Removal-Fill Law. Under current regulations, a state permit is required for cumulative fill or annual excavation of 50 cubic yards or more in wetlands or below the ordinary high-water line (OHWL) of the waterway. (See attached tables)

However, Willamette River and Abernathy Creek are essential salmonid streams; therefore, fill or removal of any amount of material within the OHWL may require a state permit. Eight wetlands (Wetlands 6, 14, 16, 18, 20, 23, 29 and 40) are exempt stormwater features per OAR 141-085-0515(7); 2 wetlands (Wetlands 2 and 21) are exempt created wetlands per 141-085-0515(6); 2 waterways (Streams 4 and 10) are ephemeral and are exempt per OAR 141-085-0515(3), 14 ditches (Ditch 1, 2, 5, 6, 7, 8, 10, 11, 14, 15, 18, 19, 20 and ditch to Athey Creek) were not constructed in wetland or are roadside ditches and are exempt per OAR 141-085-0515(8) and (10); therefore, are not subject to current state Removal-Fill requirements.

This concurrence is for purposes of the state Removal-Fill Law only. Federal or local permit requirements may apply as well. The Army Corps of Engineers will determine jurisdiction for purposes of the Clean Water Act.

This concurrence is based on information provided to the agency. The jurisdictional determination is valid for five years from the date of this letter unless new information necessitates a revision. Circumstances under which the Department may change a determination are found in OAR 141-090-0045 (available on our web site or upon request). In addition, laws enacted by the legislature and/or rules adopted by the Department may result in a change in jurisdiction; individuals and applicants are subject to the regulations that are in effect at the time of the removal-fill activity or complete permit application. The applicant, landowner, or agent may submit a request for reconsideration of this determination in writing within six months of the date of this letter.

This area of Willamette River is a state-owned waterway; any activity encroaching within the submerged and submersible land may require a lease, registration, or easement to occupy state-owned land. Please contact Justin Russell at (503) 986-5219 for more information.

Thank you for having the site evaluated. Please phone me at 503-986-5244 if you have any questions.

Sincerely,

Approved by

Russell W. Klassen
ODSL-ODOT Liaison
Aquatic Resource Coordinator

Peter Ryan
Aquatic Resource Specialist

Enclosures

ec: Natalie Edwards, Corps of Engineers
Brad Livingston, ODOT
Ken Sargent, ODOT
Leandra Cleveland, HDR Engineering, Inc.

WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

Fully completed and signed report cover forms and applicable fees are required before report review timelines are initiated by the Department of State Lands. Make checks payable to the Oregon Department of State Lands. To pay fees by credit card, go online at https://apps.oregon.gov/DSL/EPS/program?key=4.

Attach this completed and signed form to the front of an unbound report or include a hard copy with a digital version (single PDF file of the report cover form and report, minimum 300 dpi resolution) and submit to: **Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.** A single PDF of the completed cover from and report may be e-mailed to **Wetland_Delineation@dsl.state.or.us**. For submittal of PDF files larger than 10 MB, e-mail DSL instructions on how to access the file from your ftp or other file sharing website.

Contact and Authorization Information

☒ Applicant ☒ Owner Name, Firm and Address:
Stephen Hay
ODOT Region 1
123 NW Flanders Street, Portland, OR 97209

Business phone # (503) 731-8306
Mobile phone # (optional)
E-mail: stephen.hay@odot.state.or.us

☒ Authorized Legal Agent, Name and Address (if different):
Ken Sargent
ODOT Region 1
123 NW Flanders Street, Portland, OR 97209

Business phone # (503) 731-8427
Mobile phone # (optional)
E-mail: kenneth.w.sargent@odot.state.or.us

I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact.

Typed/Printed Name: Stephen Hay **Signature:**
Date: 03/27/2018 Special instructions regarding site access:

Project and Site Information

Project Name: K19786 I-205 Corridor Widening

Latitude: see attached Longitude:
decimal degree - centroid of site or start & end points of linear project

Proposed Use: Widening I-205 between roughly Stafford Rd and OR213.

Tax Map # See attached
Tax Lot(s)
Tax Map #
Tax Lot(s)
Township Range Section QQ
Use separate sheet for additional tax and location information

Project Street Address (or other descriptive location):
I-205 between Stafford Rd and OR213 interchanges.

City: West Linn, Oregon City County: Clackamas

Waterway: Willamette River River Mile: 26

Wetland Delineation Information

Wetland Consultant Name, Firm and Address:
Leandra Cleveland, HDR Engineering, Inc.
1001 SW 5th Avenue Suite 1800
Portland, OR 97204

Phone # (360) 901-1410
Mobile phone # (if applicable)
E-mail: leandra.cleveland@hdrinc.com

The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge.
Consultant Signature: Date: 01/08/2018

Primary Contact for report review and site access is ☐ Consultant ☒ Applicant/Owner ☐ Authorized Agent

Wetland/Waters Present? ☐ Yes ☐ No Study Area size: 506 Total Wetland Acreage: 10

Check Applicable Boxes Below

☐ R-F permit application submitted
☐ Mitigation bank site
☐ Industrial Land Certification Program Site
☐ Wetland restoration/enhancement project (not mitigation)
☐ Previous delineation/application on parcel
If known, previous DSL #

☐ Fee payment submitted **$**
☐ Fee ($100) for resubmittal of rejected report
☐ Request for Reissuance. See eligibility criteria. (no fee)
DSL # Expiration date
☐ LWI shows wetlands or waters on parcel
Wetland ID code

For Office Use Only

DSL Reviewer: Fee Paid Date: / / DSL WD #

Date Delineation Received: / / Scanned: ☐ Electronic: ☐ DSL App.#

Wetland Delineation Report Cover Form Additional Information

Project:

K19786 how I-205: Stafford Rd to OR 213 Corridor Widening and Abernethy Bridge Seismic Retrofit / Widening

Latitude and Longitude:

West end of Project: 45.369107, -122.754285

East end of Project: 45.379477, -122.581428

Township Range Section:

Township 2 South, Range 1 West, Section 25

Township 2 South, Range 1 East, Section 27, 28, 29, 30, 34, 35, 36

Township 2 South, Range 2 East, Section 20, 29, 30, 31

Tax Map#	Tax Lots
21E30B	Roads
21E30A	Roads
21E29B	Roads
21E29A	Roads
21E28	Roads
21E28C	Roads
21E28D	Roads
21E28DA	Roads
21E28DD	Roads
21E27C	00200, Roads
21E27B	Roads
21E27D	Roads
21E34A	Roads
21E34AC	Roads
21E34AD	Roads
21E34DA	Roads
21E35CB	Roads
21E35CC	Roads
21E35C	Roads
21E35D	Roads
21E36	Roads
22E31	Roads
22E31BB	05200, Roads
22E30CD	Roads
22E31BA	Roads
22E30DB	Roads
22E30	Roads
22E29CB	00300, 00500, Roads
22E30DD	00401, Roads
22E29	01510, 02100, 02300, Roads
22E20	Roads
22E20DC	01600, Roads
22E20DD	Roads
22E20DA	Roads
22E20S1	Roads

Table 1. Wetland Features Identified in the Study Area

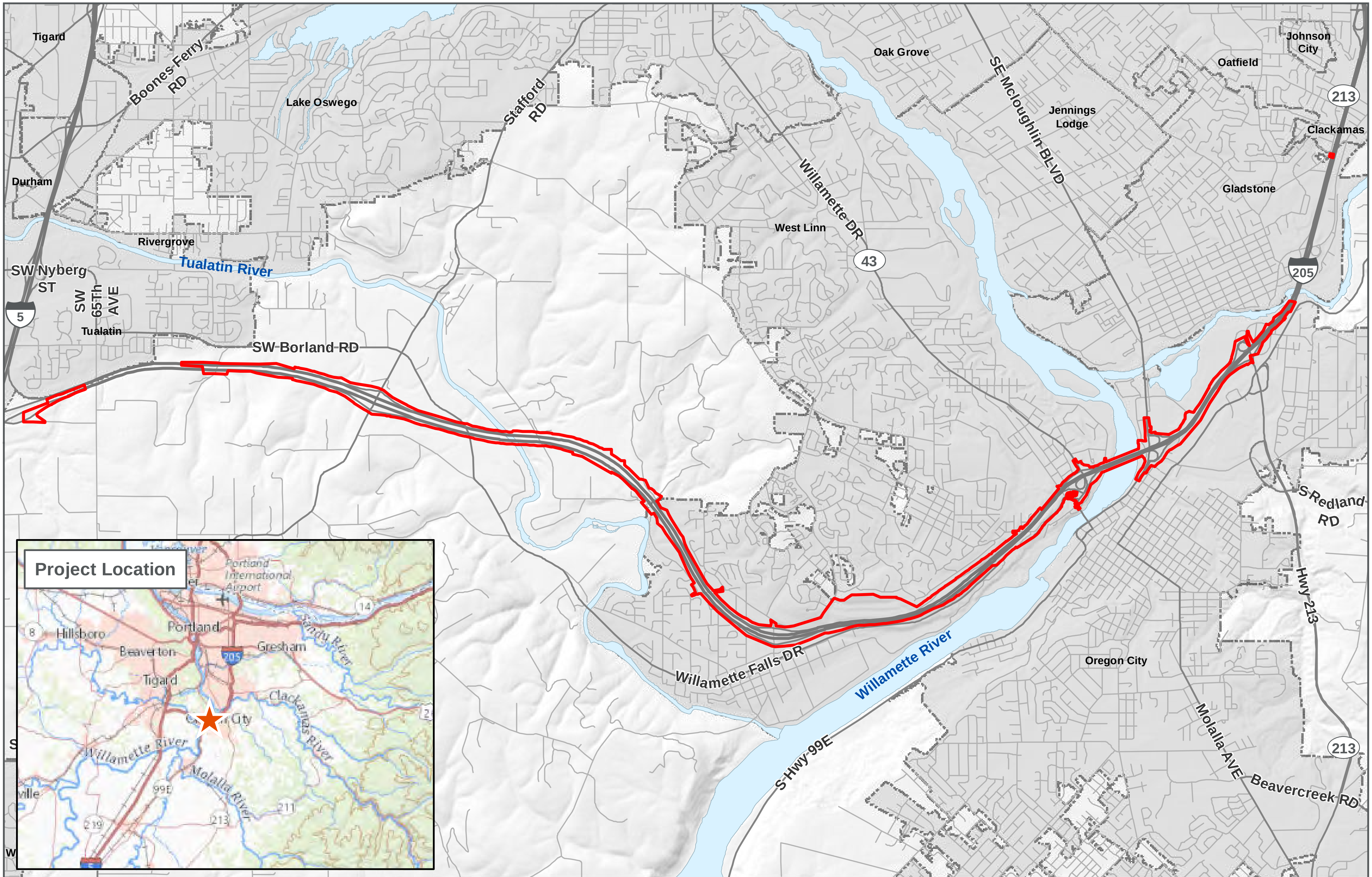
Wetland ID	Size (acres)	Cowardin	HGM	Stormwater Feature or Wetland	DSL Jurisdiction	Figure Number	Photo Number	Latitude and longitude
W-1	0.09	PEM	slope	Wetland	Yes	5-6	P-W1	45.37081528 -122.7102356
W-2	0.03	PEM	depressional	Created Wetland	No	5-3	P-W2	45.37326813 -122.7217026
W-3	0.04	PEM	slope	Wetland	Yes	5-8	P-W3	45.37048340 -122.7093582
W-4	0.03	PEM	depressional	Wetland	Yes	5-9	P-W4	45.37014389 -122.7055283
W-5	0.01	PEM	depressional	Wetland	Yes	5-8	P-WW5 / D3	45.36986160 -122.7086182
W-6	00.01	PEM	depressional	Stormwater feature	No	5-13	P-W6	45.36697006 -122.6915894
W-7	0.68	PEM	depressional	Wetland	Yes	5-9	P-W7	45.36888504 -122.7055435
W-8	0.08	PEM	depressional	Wetland	Yes	5-14	P-W8	45.36697006 -122.6915894
W-9	0.01	PFO	slope	Wetland	Yes	5-17	P-W9	45.36888504 -122.7055435
W-10	0.06	PFO/PSS	depressional	Wetland	Yes	5-14	P-W10	45.36615753 -122.6879883
W-11	0.02	PFO	riverine	Wetland	Yes	5-20	P-W11	45.35829926 -122.6673508
W-12	0.01	PEM	depressional	Wetland	Yes	5-15	P-W12	45.36610794 -122.6811752
W-13	0.04	PFO	Riverine	Wetland	Yes	5-21	P-W13	45.35651779 -122.6655655
W-14	0.18	PEM	depressional	Stormwater feature	No	5-24	P-W14	45.34877396 -122.6563721
W-15	0.07	PEM	riverine	Wetland	Yes	5-24 5-25	P-WW15	45.34706497 -122.6534348
W-16	0.22	PEM	depressional	Stormwater feature	No	5-25	P-W16	45.34766769 -122.6532898
W-17	0.48	PEM	riverine	Wetland	Yes	5-26	P-W17	45.34689713 -122.6484833
W-18	0.29	PEM	depressional	Stormwater feature	No	5-26	P-W18	45.34745026 -122.6501160
W-19	2.40	PEM	depressional	Wetland	Yes	5-39	PW-19	45.37318802 -122.5884171
W-20	0.06	PEM	depressional	Stormwater feature	No	5-18	P-W20	45.36209869 -122.6704788
W-21	0.13	PEM/PSS	depressional	Created Wetland	No	5-38	P-W21	45.36985016 -122.5925140
W-22	0.52	PEM/PFO	depressional	Wetland	Yes	5-17	P-W22	45.36362839 -122.6730270
W-23	0.83	PSS	depressional	Stormwater feature	No	5-33 5-34	P-W23	45.35669327 -122.6194000
W-24	0.03	PSS	depressional	Wetland	Yes	5-17	P-W24	45.36421585 -122.6739273
W-25	0.31	PFO/PEM	depressional	Wetland	Yes	5-30	P-W25	45.35209274 -122.6284561
W-26	0.95	PSS	depressional	Wetland	Yes	5-16	P-W26	45.36549377 -122.6781616
W-27	0.06	PSS/PFO	depressional	Wetland	Yes	5-30	P-W27	45.35237503 -122.6282501
W-28	0.10	PEM	depressional	Wetland	Yes	5-30	P-W28	45.35238266 -122.6272507
W-29	0.14	PEM/PSS	depressional	Stormwater feature	No	5-31 5-32	P-W29	45.35374451 -122.6251602
W-30	0.01	PFO	depressional	Wetland	Yes	5-30	P-W30	45.35142136 -122.6301041
W-31	0.11	PFO	depressional	Wetland	Yes	5-29	P-W1	45.34978485 -122.6340866
W-32	0.25	PEM	depressional	Stormwater feature	Yes	5-29	P-W32	45.34956741 -122.6349640
W-33	0.11	PEM	depressional	Wetland	Yes	5-24	P-W33	45.34879303 -122.6546402
W-34	0.42	PFO/PSS	depressional	Wetland	Yes	5-23 5-24	P-W34	45.35037231 -122.6578064
W-35	0.77	PFO	depressional	Wetland	Yes	5-17	P-W35	45.36416626 -122.6726685
W-36	0.04	PFO/PSS	depressional	Wetland	Yes	5-19	P-W36	45.36116409 -122.6677246
W-37	0.01	PFO	riverine	Wetland	Yes	5-36	none	45.36369324 -122.6085815
W-38	0.13	PFO/PSS	depressional	Wetland	Yes	5-19	P-W38	45.35955048 -122.6664200
W-39	0.01	PFO	depressional	Wetland	Yes	5-15	P-W39	45.36672974 -122.6806870

W-40	0.35	PEM	depressional	Stormwater feature	No	5-10	P-W40	45.36967087 -122.7018661
W-41	0.01	PFO/PSS	depressional	Wetland	Yes	5-7	P-W41	45.37165070 -122.7081223
W-42	0.03	PSS/EM	depressional	Wetland	Yes	5-15	P-W42	45.3661500 -122.689390
W-43	0.36	PFO/EM	depressional	Wetland	Yes	5-15	P-W43	45.3667400 -122.681250

Table 2. Waterways Identified in the Study Area

Waterway Reach ID	Flow Regime	Width @ Widest Point (feet)	DSL Jurisd-iction	Figure Number	Photo Number	Latitude and longitude
Willamette River	Perennial	1,500	Yes	5-36, 5-37	P-11	45.36377335 -122.6067429
Tualatin River	Perennial	200	Yes	5-14	P-5	45.36661148 -122.6881561
Abernethy Creek	Perennial	50	Yes	5-37	P-12	45.36493301 -122.6015396
Athey Creek	Perennial	30	Yes	5-6	P-3	45.37218857 -122.7103195
Tanner Creek	Perennial	6.5	Yes	5-30	P-9	45.35130692 -122.6302185
McLoughlin Creek	Intermittent	10	Yes	5-36	P-10	45.36351395 -122.6080933
Stream 1	Intermittent	14	Yes	5-12 and 5-13	P-S1	45.36784363 -122.6934586
Stream 2 (Wilson Creek)	Intermittent	3	Yes	5-14	none	45.36707687 -122.6876221
Stream 3	Intermittent	2.5	Yes	5-17	P-S3	45.36375427 -122.6750259
Stream 4	Ephemeral	6	No	5-25	P-S4	45.34849548 -122.6532593
Stream 5	Intermittent	45	Yes	5-19, 5-20	P-S5a P-S5b	45.35834503 -122.6673508
Stream 6	Intermittent	6	Yes	5-19	P-W36	-45.36115646 -122.6677628
Stream 7	Intermittent	10	Yes	5-21	P-S7a P-S7b	45.35720062 -122.6644516
Stream 9	Intermittent	5	Yes	5-24, 5-25, 5-26	P-S9	45.34718323 -122.6536942
Stream 10	Ephemeral	15	No	5-7	P-W41	45.37166214 -122.7081451
Stream 11	Intermittent	3	Yes	5-22, 5-23, 5-24, 5-25, 5-26, 5-27	P-D9	45.35359192 -122.6618881
Stream 12	Intermittent	3	Yes	5-29	P-S12	45.35024900 -122.6340720
Stream 13	Intermittent	5	Yes	5-2	P-S13	45.37286500 -122.7274740
Ditch 1	Ephemeral	1.5	No	5-5	P-D1	45.37159729 -122.7130966

Ditch 2 and 2b	Ephemeral	6.5	No	5-3, 5-4, 5-5, 5-6, 5-7, 5-8	P-D2	45.37285233 -122.7176285
Ditch 3	Intermittent	3	Yes	5-8	P-WW5/D3	45.36985779 -122.7085280
Ditch 4	Intermittent	5	Yes	5-17	P-D4a	45.36325073 -122.6735229
Ditch 5	Ephemeral	1.5	No	5-9	P-D5A	45.36874008 -122.7043457
Ditch 6	Ephemeral	6	No	5-15	P-D6	45.36585236 -122.6806793
Ditch 7	Ephemeral	4	No	5-18	P-D7	45.36110687 -122.6701584
Ditch 8	Ephemeral	5	No	5-12	P-D8	45.36803055 -122.6976318
Ditch 10	Ephemeral	5	No	5-34, 5-35	P-D10	45.35934067 -122.6156006
Ditch 11	Ephemeral	1	No	5-20	P-D11	45.35982895 -122.6689148
Ditch 12	Intermittent	4	Yes	5-24	none	45.34905243 -122.6553574
Ditch 14	Ephemeral	5	No	5-28	P-D14	45.34898376 -122.6420517
Ditch 15	Intermittent	65	No	5-38	P-D15	45.36874771 -122.5946960
Ditch 17	Ephemeral	8	Yes	5-15	P-D17	45.36658478 -122.6808243
Ditch 18	Ephemeral	2	No	5-3	P-D18	45.37366486 -122.7209549
Ditch 19	Ephemeral	4	No	5-2	P-D19	45.37360382 -122.7272568
Ditch 20	Intermittent	8	No	5-22	P-D20	45.35247803 -122.6608505
Ditch to Athey Creek	Intermittent	2	No	5-6	P-2	45.37108231 -122.7113495



Legend

Area of Potential Impact (API)

DATA SOURCE: METRO 2018, HDR 2018

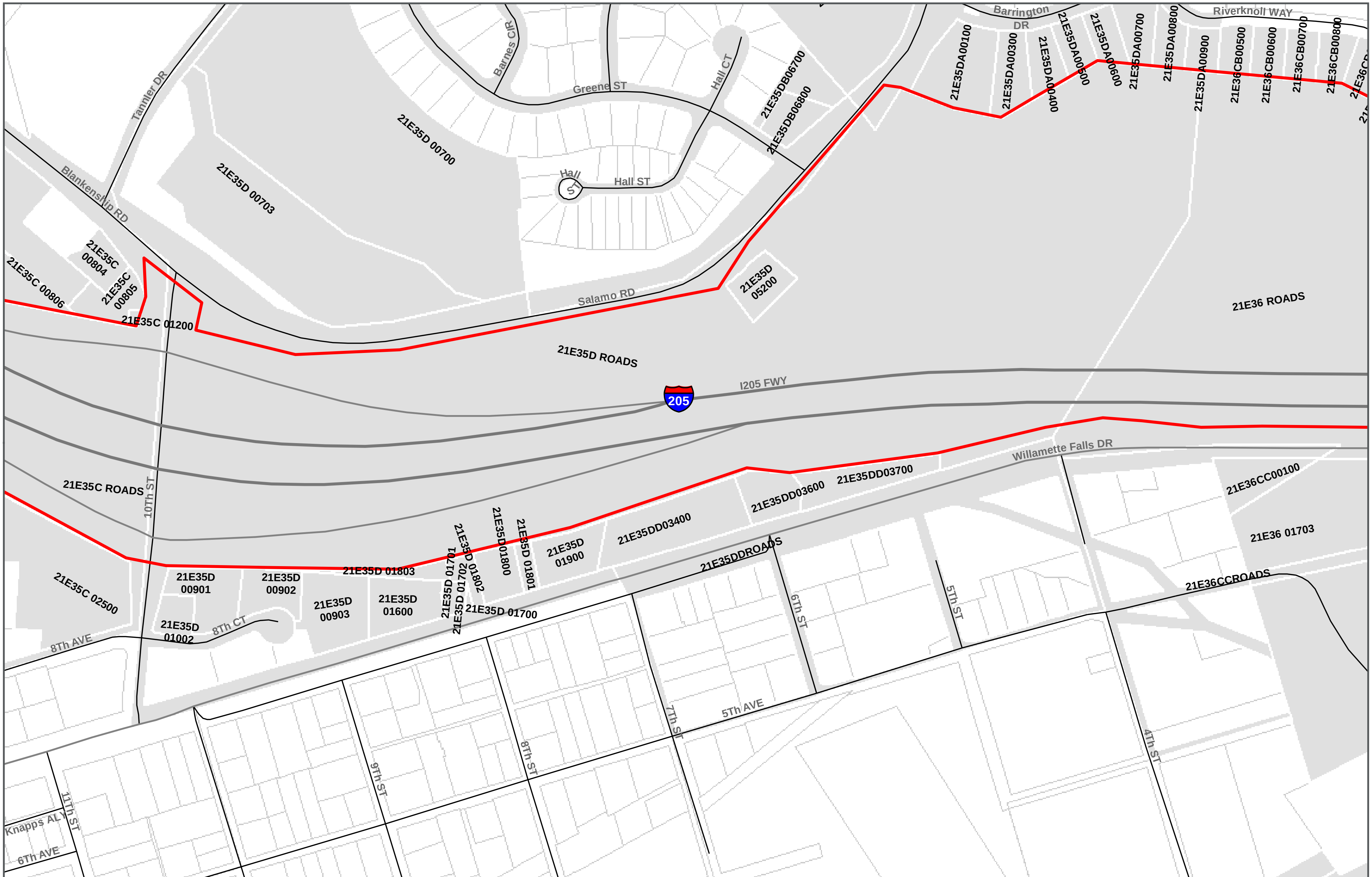
0 0.5 1 Miles

I-205 ABERNETHY

PROJECT LOCATION

FIGURE 1

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\F1 PROJECT_LOCATION.MXD - USER: LLSMITH - DATE: 1/9/2019



Legend

Area of Potential Impact (API)

Tax Lots with in 100 feet to API

DATA SOURCE: METRO 2018, HDR 2018

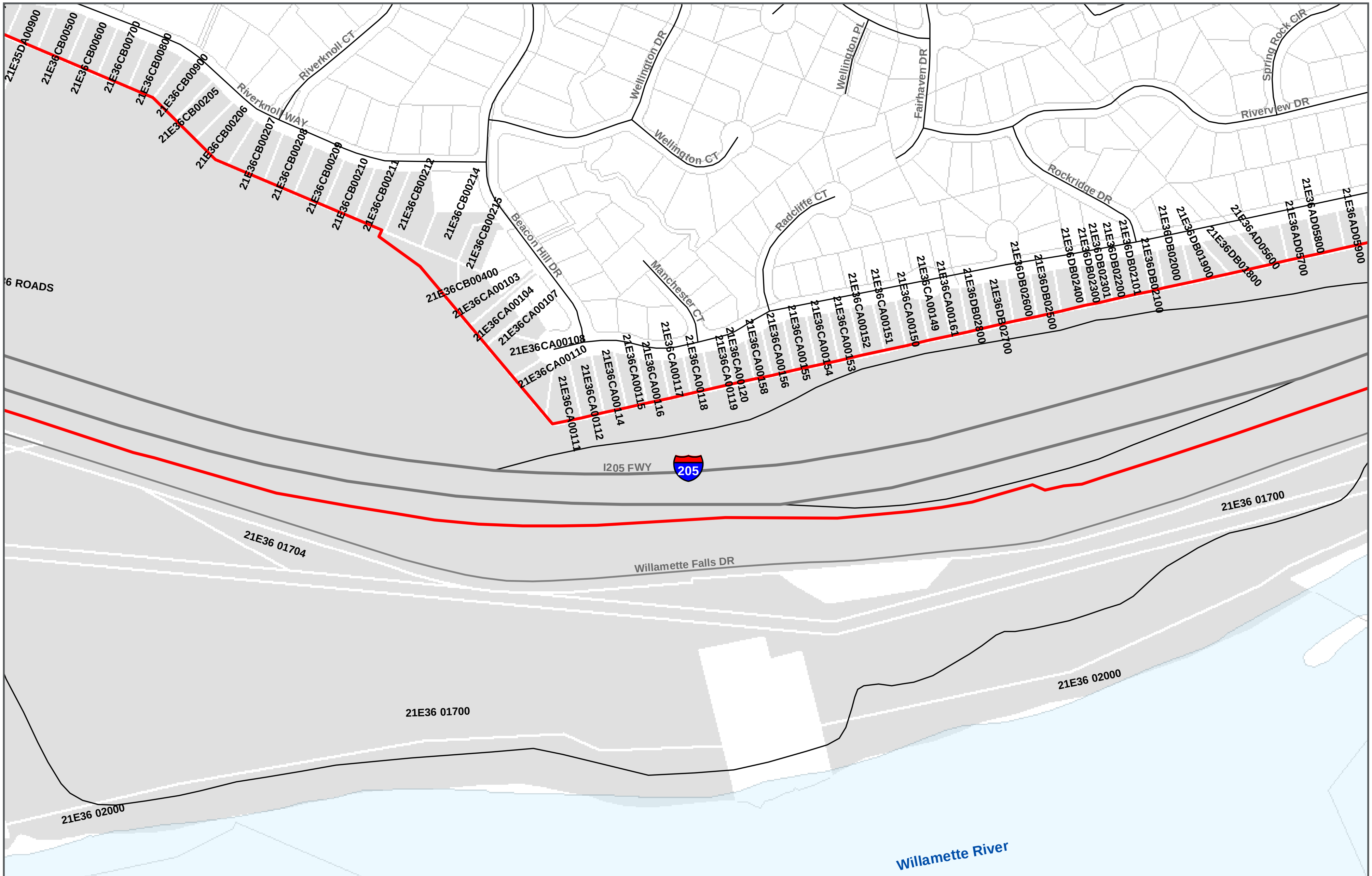
0 250 500 Feet

I-205 ABERNETHY

TAX LOTS

FIGURE 2-8

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNETHY\MAP_DOCS\FINAL\F2 TAXLOTS.MXD - USER: LLSMITH - DATE: 1/9/2019



Legend

Area of Potential Impact (API)

Tax Lots with in 100 feet to API

DATA SOURCE: METRO 2018, HDR 2018

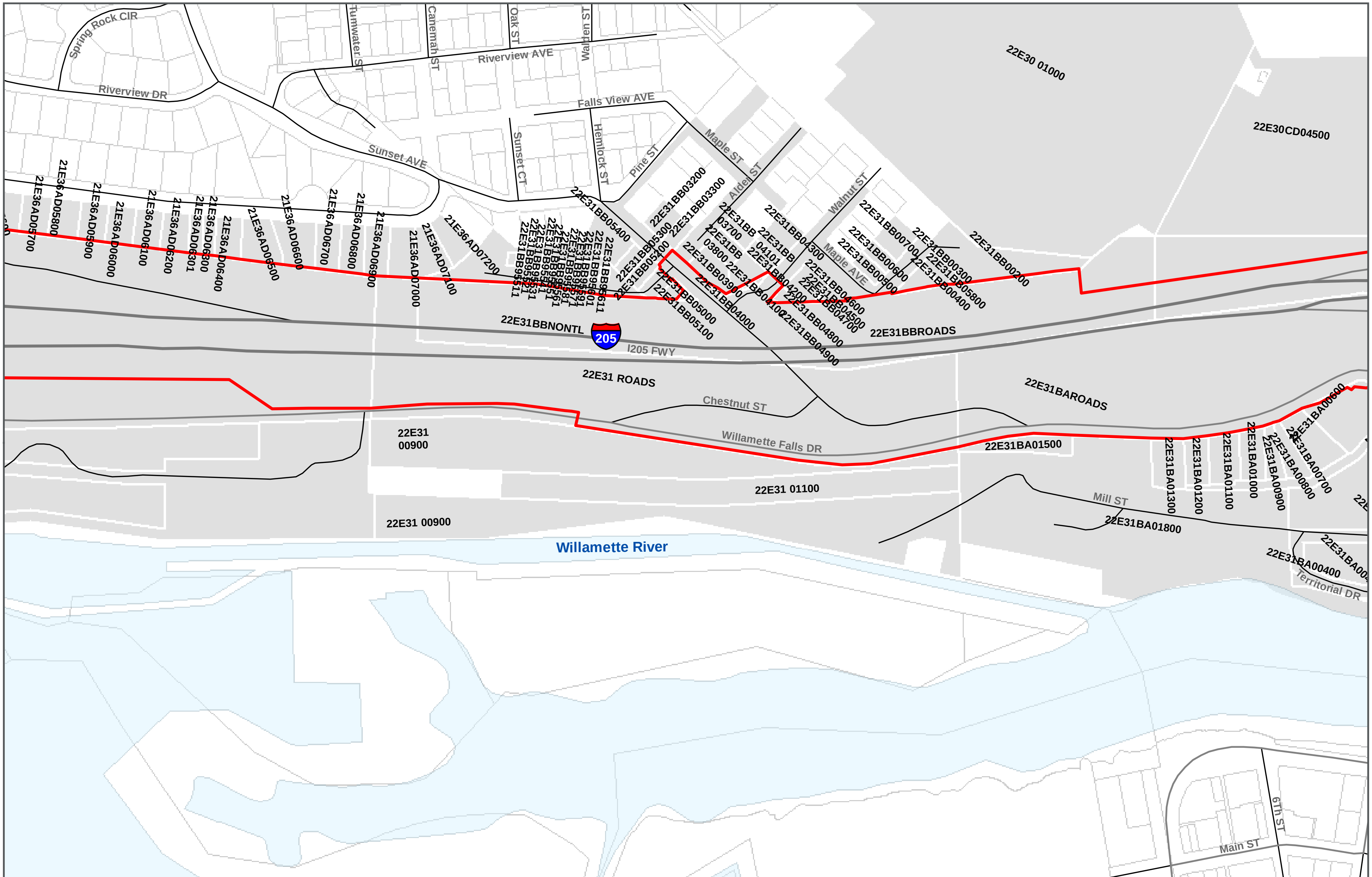
0 250 500 Feet

I-205 ABERNETHY

TAX LOTS

FIGURE 2-9

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\F2 TAXLOTS.MXD - USER: LLSMITH - DATE: 1/9/2019



Legend

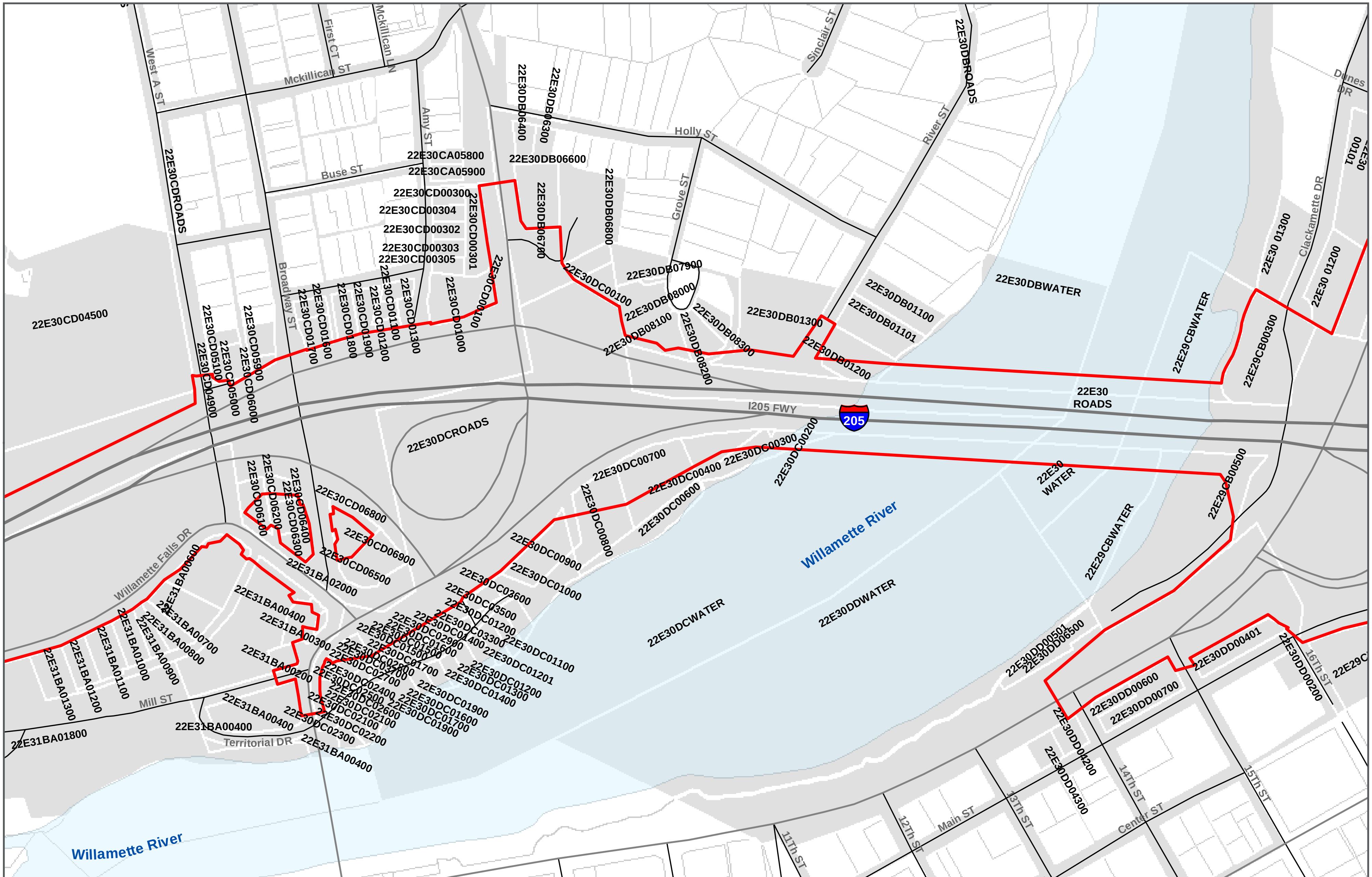
Area of Potential Impact (API)

Tax Lots with in 100 feet to API

DATA SOURCE: METRO 2018, HDR 2018

0 250 500 Feet

I-205 ABERNETHY
TAX LOTS
FIGURE 2-10



I-205 ABERNETHY

TAX LOTS

FIGURE 2-11

Legend

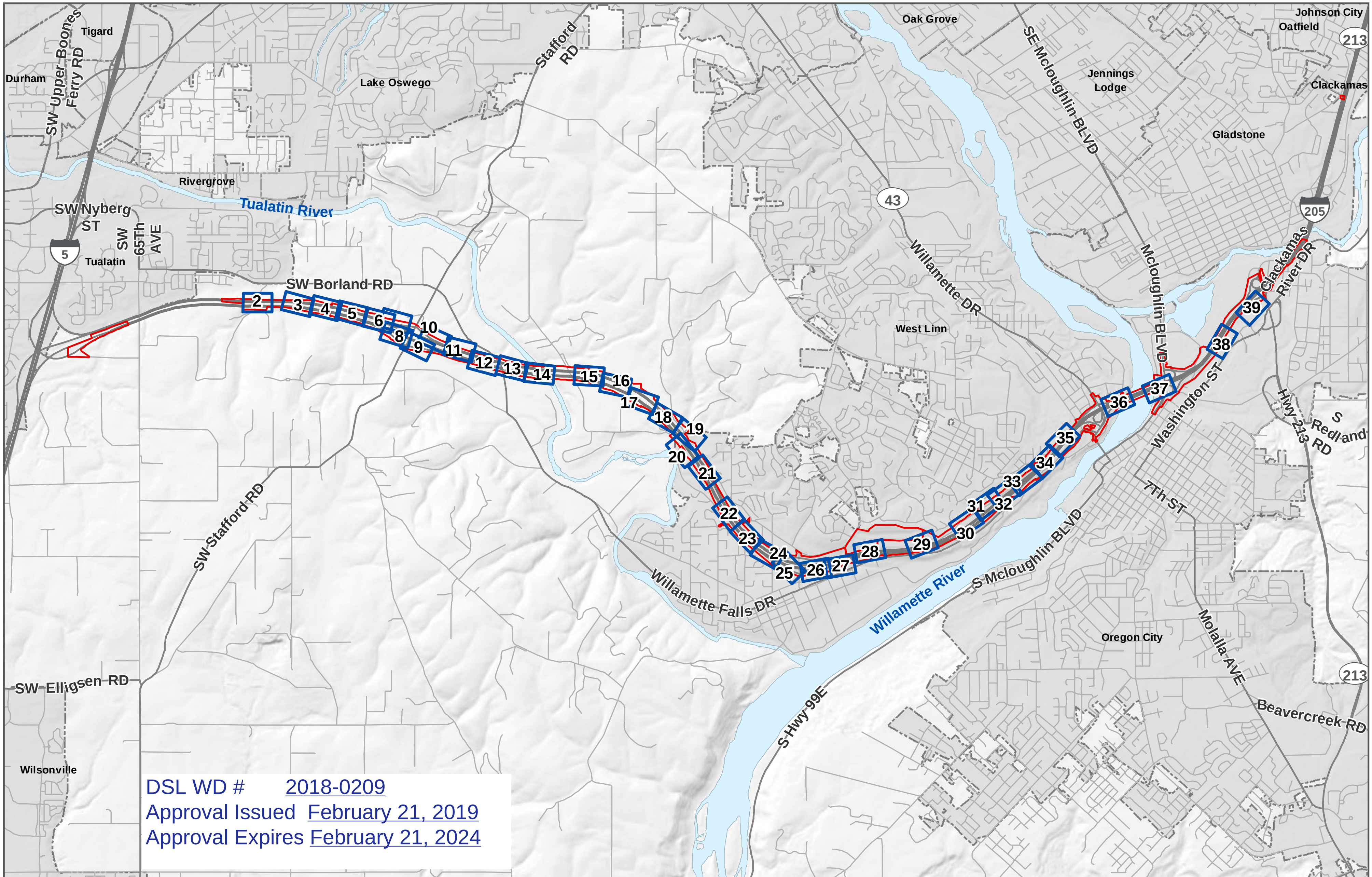
Area of Potential Impact (API)

Tax Lots with in 100 feet to API

DATA SOURCE: METRO 2018, HDR 2018

0 250 500 Feet

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\F2 TAXLOTS.MXD - USER: LLSMITH - DATE: 1/9/2019



HDR

Area of Potential Impact (API)

Sheet Location

N

0 0.5 1 Miles

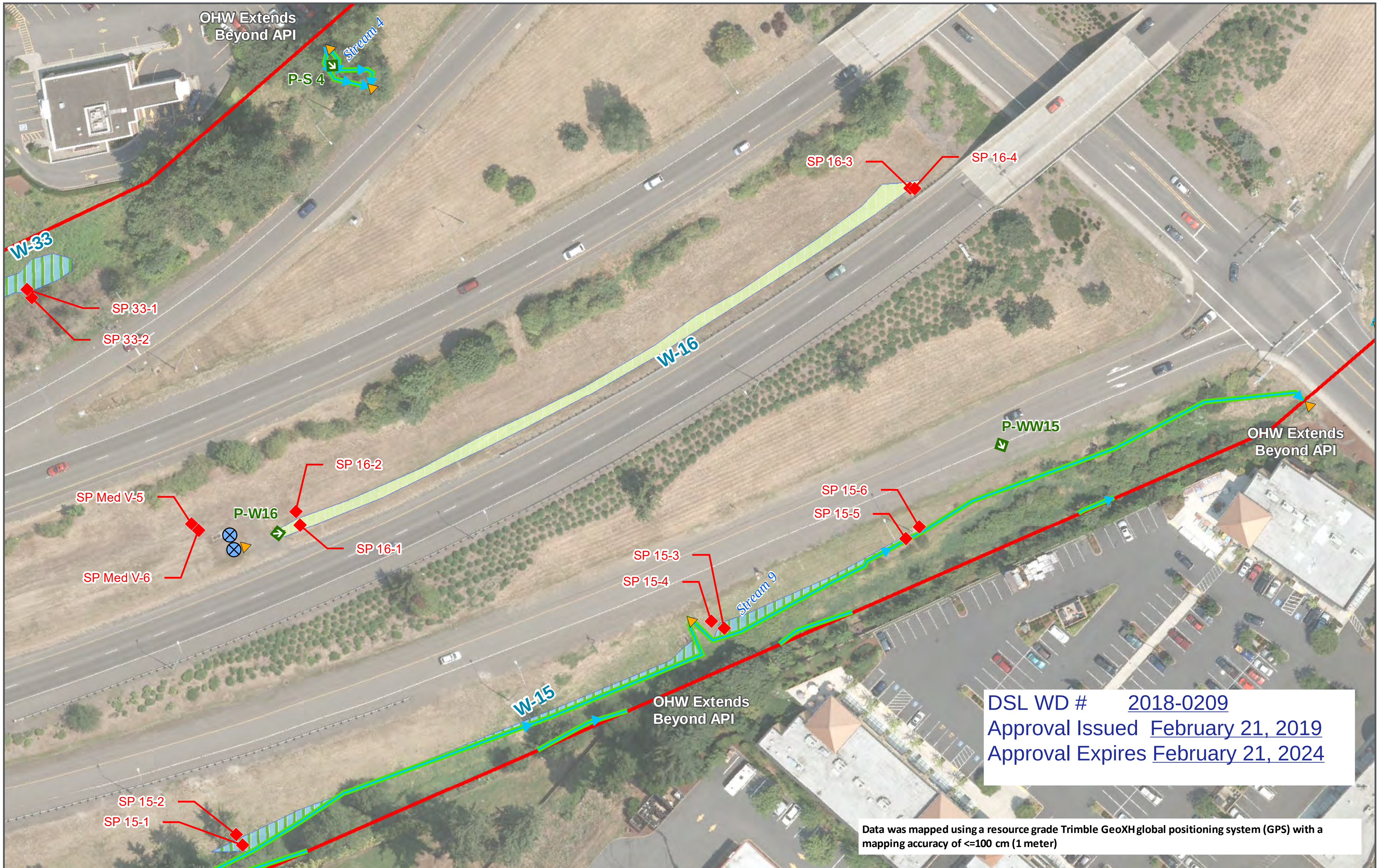
DATA SOURCE: METRO 2018, HDR 2018

I-205 ABERNETHY

WETLANDS AND WATERBODIES INDEX

FIGURE 5-1

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_EXTENT_SHEET.MXD - USER: LLSMITH - DATE: 12/3/2018



HDR

- Photo Point
- Sample Plots
- Storm Drain
- Culvert
- Ordinary High Water - Not Regulated*
- Ordinary High Water - Regulated*
- Ditch-Not Regulated*
- Ditch-Regulated*
- API
- <all other values>
- Stormwater Facility - Not Regulated*
- Wetland, Not Regulated*
- Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY

WETLANDS AND WATERBODIES

FIGURE 5-25

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_INSETS\WETLAND_SURVEY_ADJUSTED_FIGURE25.MXD - USER: LLSMITH - DATE: 12/12/2018

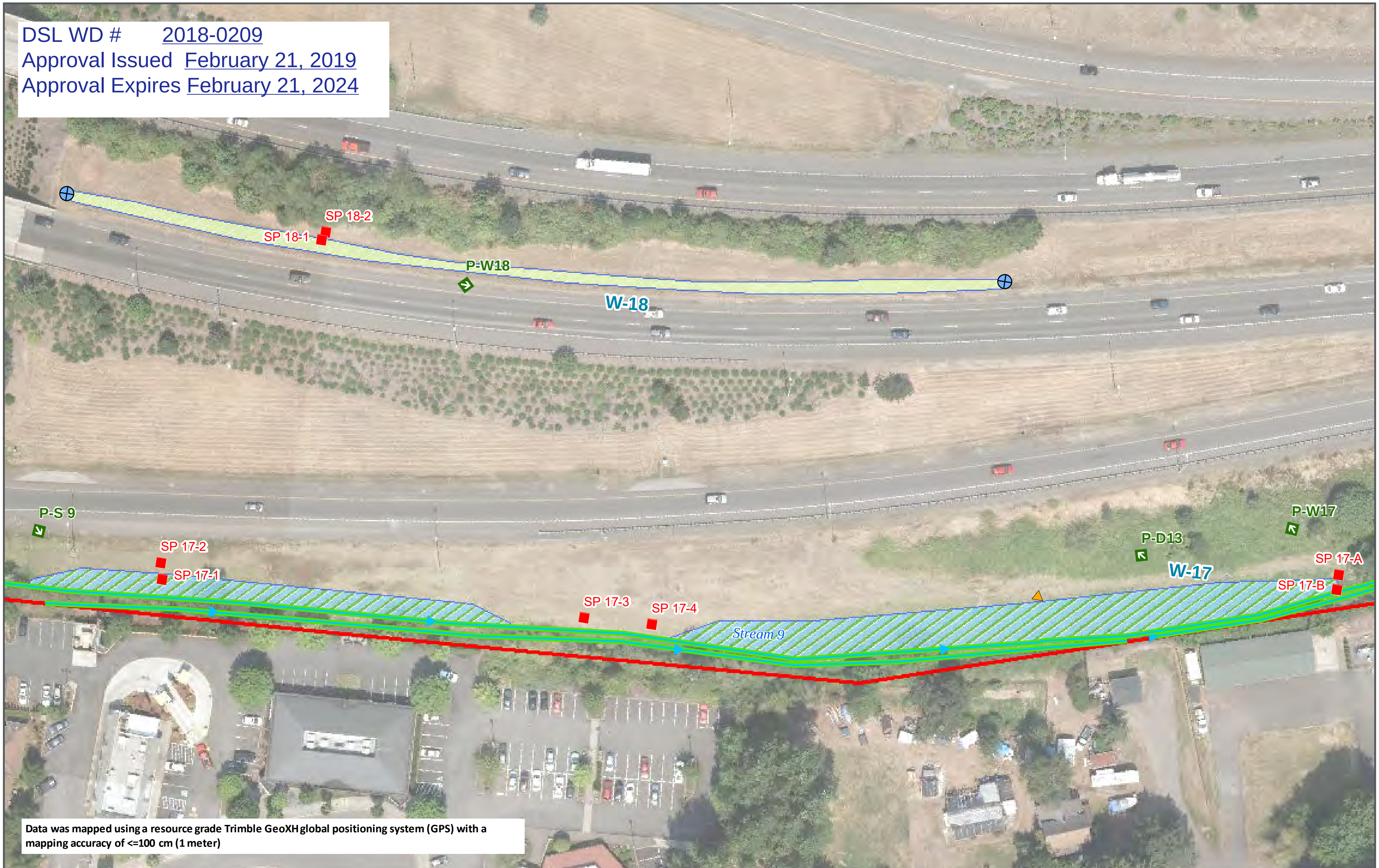


Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES

FIGURE 5-26

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-27

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

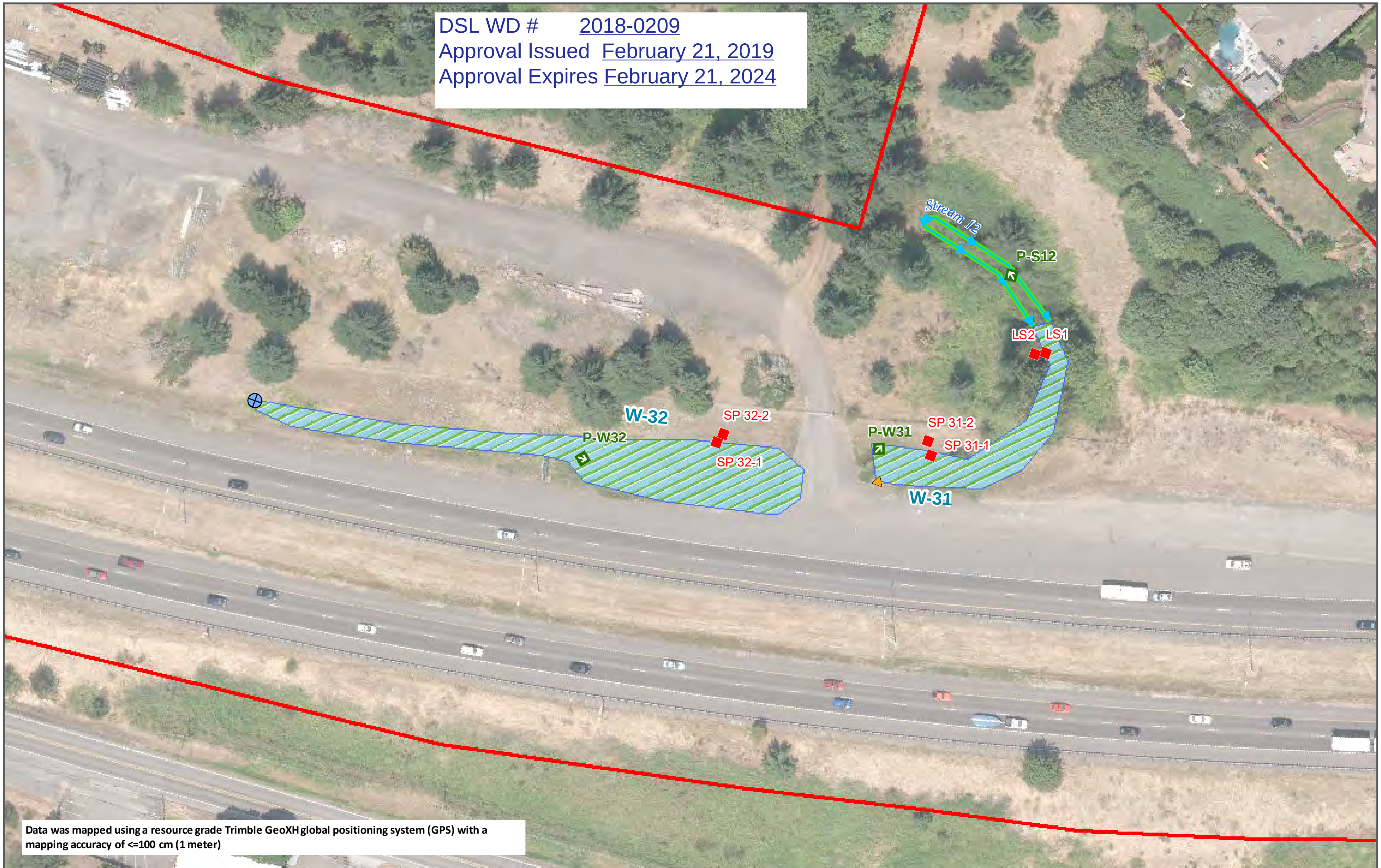
I-205 ABERNETHY

WETLANDS AND WATERBODIES

FIGURE 5-28

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

DSL WD # 2018-0209
Approval Issued February 21, 2019
Approval Expires February 21, 2024



Data was mapped using a resource grade Trimble GeoXH global positioning system (GPS) with a mapping accuracy of <=100 cm (1 meter)

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-29

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

DSL WD # 2018-0209
Approval Issued February 21, 2019
Approval Expires February 21, 2024

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-30

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

DSL WD # 2018-0209
Approval Issued February 21, 2019
Approval Expires February 21, 2024

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

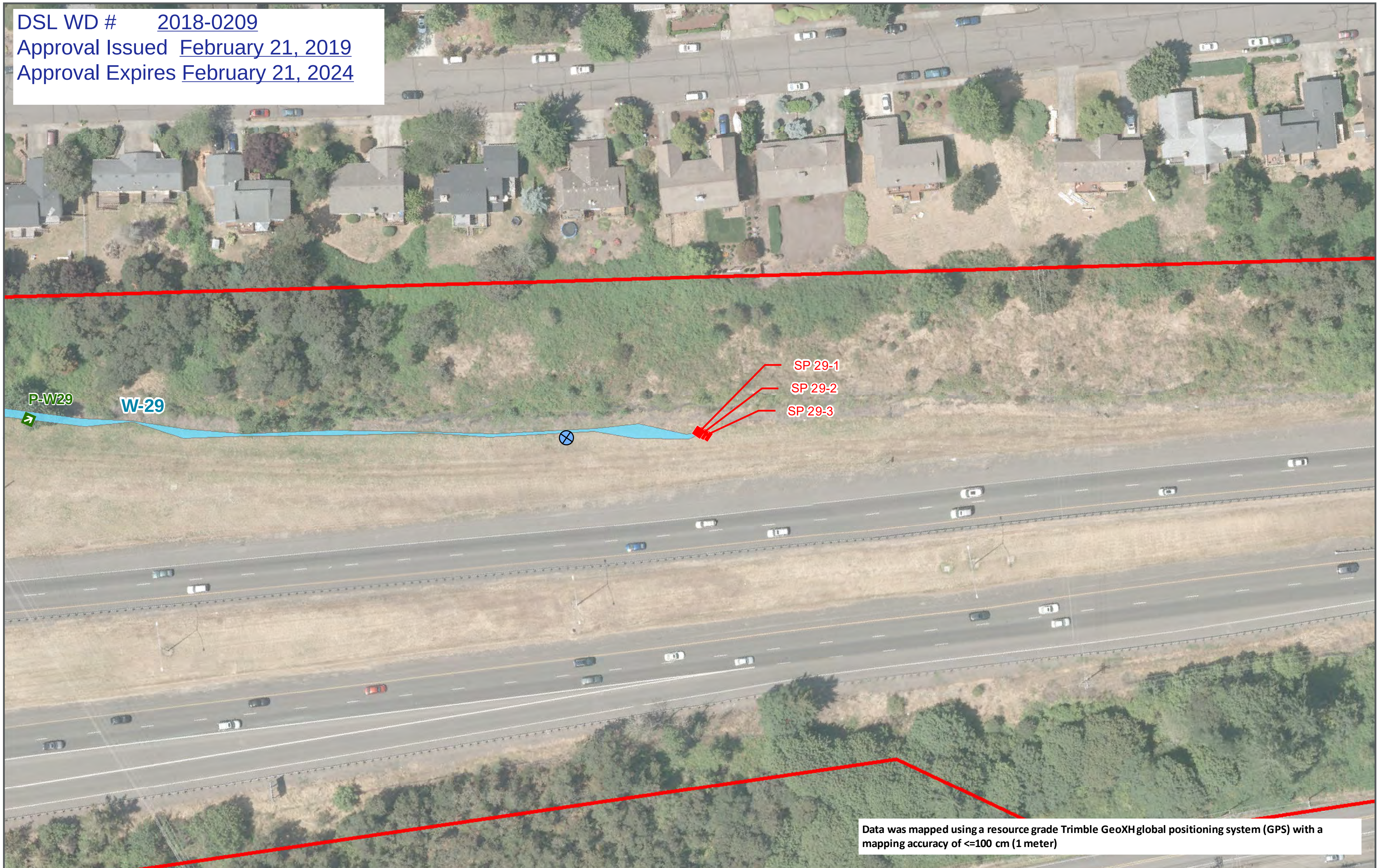
*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES

FIGURE 5-31

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

DSL WD # 2018-0209
Approval Issued February 21, 2019
Approval Expires February 21, 2024



HDR

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
<all other values>
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES

FIGURE 5-32

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNETHY\MAP_DOCS\FINAL\WETLAND_INSETS\WETLAND_SURVEY_ADJUSTED_FIGURE32.MXD - USER: LLSMITH - DATE: 12/12/2018

DSL WD # 2018-0209
Approval Issued February 21, 2019
Approval Expires February 21, 2024

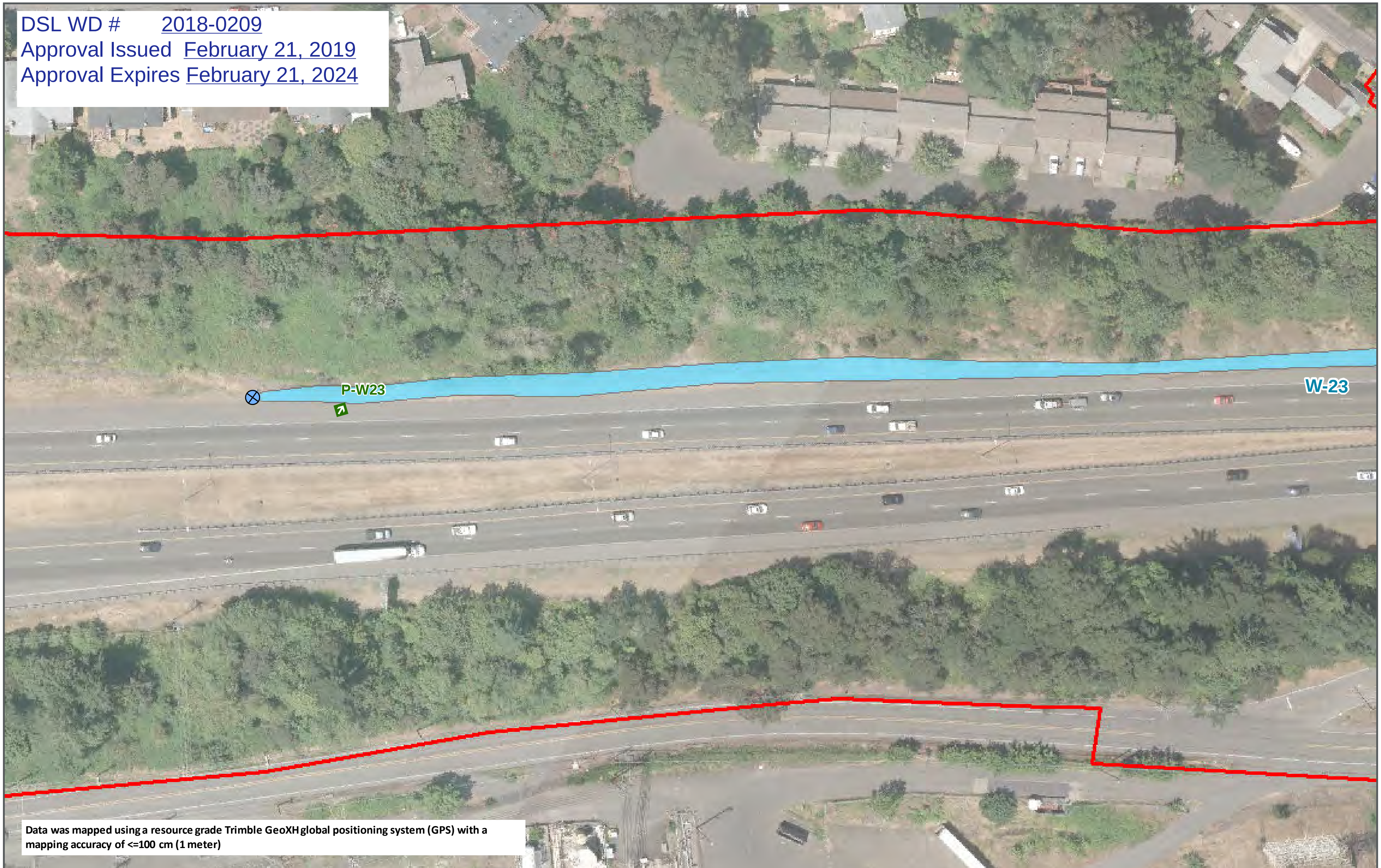


Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-33

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

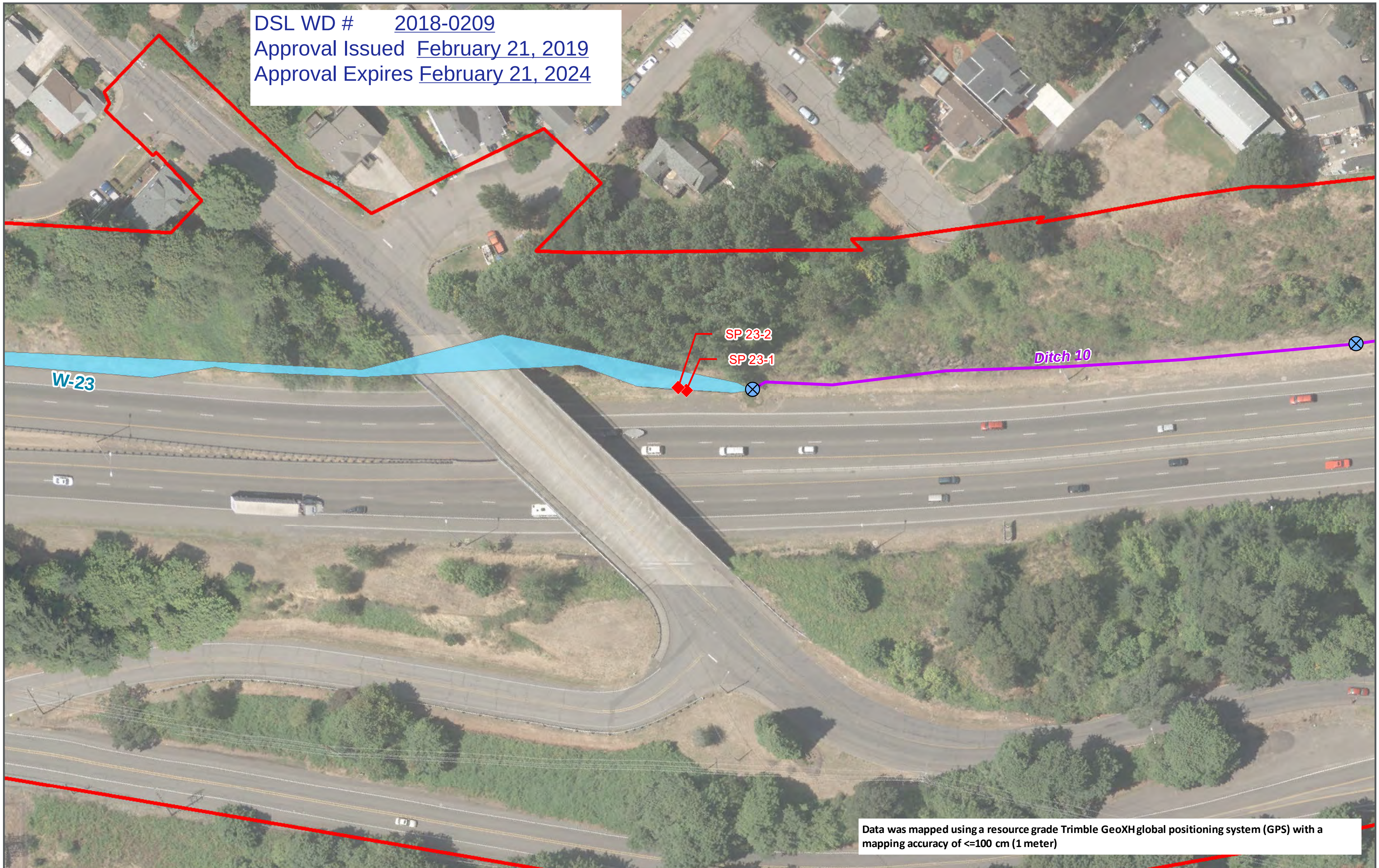


Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
<all other values>
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-34

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_INSETS\WETLAND_SURVEY_ADJUSTED_FIGURE34.MXD - USER: LLSMITH - DATE: 12/12/2018

Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland, Not Regulated*
Wetland - Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES

FIGURE 5-35

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_SURVEY.MXD - USER: LLSMITH - DATE: 1/8/2019

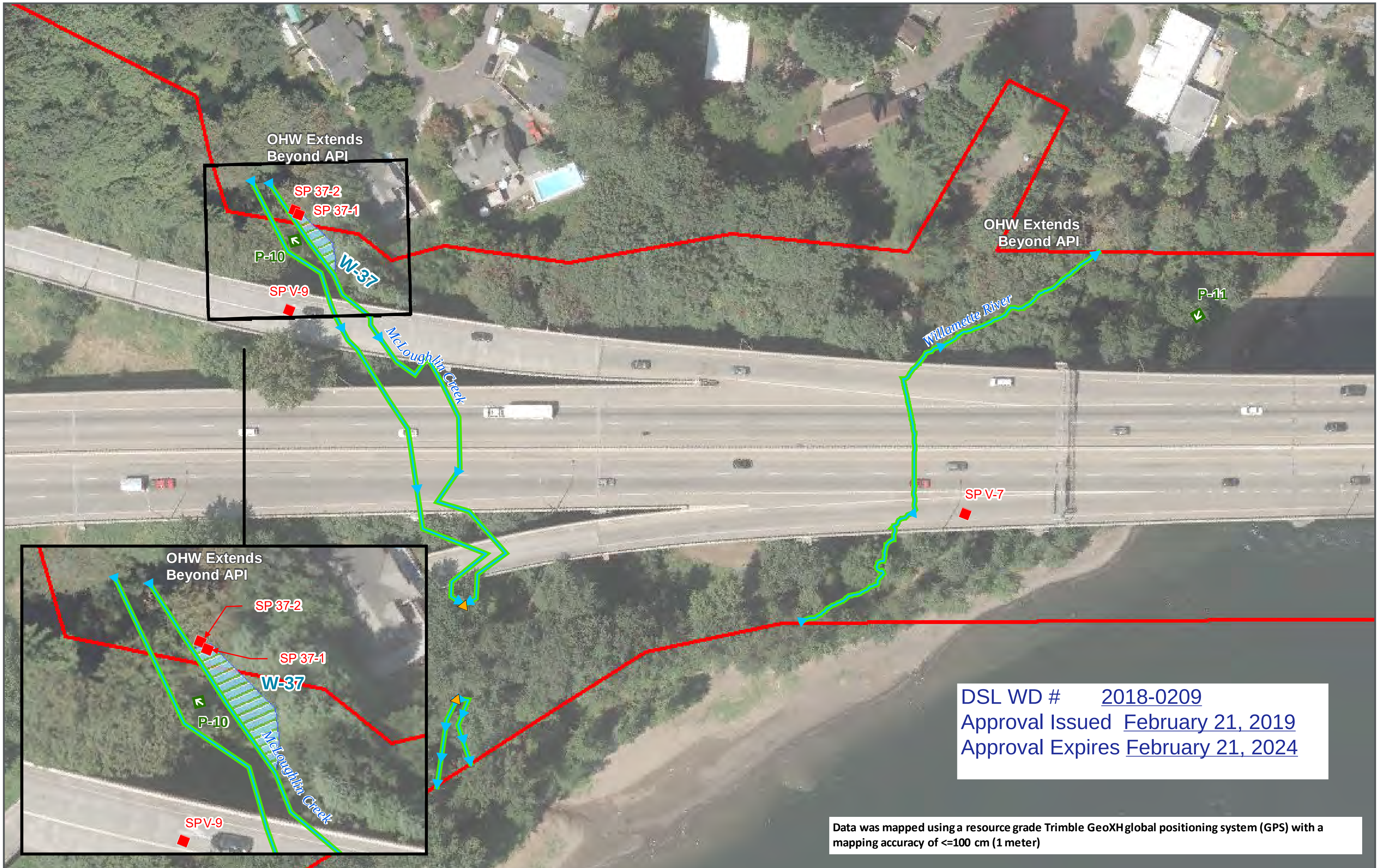


Photo Point
Sample Plots
Storm Drain
Culvert
Ordinary High Water - Not Regulated*
Ordinary High Water - Regulated*
Ditch-Not Regulated*
Ditch-Regulated*
API
Stormwater Facility - Not Regulated*
Wetland - Regulated*
Wetland, Not Regulated*

0 50 100 Feet

DATA SOURCE: USFWS, METRO 2018, HDR 2018

*Regulated and Non-Regulated features are based on the Preliminary Jurisdictional Determination in Tables 5-1 and 5-2 and should be considered preliminary until concurrence is received by the USACE and DSL.

I-205 ABERNETHY
WETLANDS AND WATERBODIES
FIGURE 5-36

PATH: X:\PROJECTS\ODOT\10063137_I205_ABERNATHY\MAP_DOCS\FINAL\WETLAND_INSETS\WETLAND_SURVEY_ADJUSTED_FIGURE36.MXD - USER: LLSMITH - DATE: 12/12/2018

Attachment T. Tree Removal Plan

HDR

DATA SOURCE: HDR 2019

I-205 ABERNETHY
TREE IMPACTS
FIGURE 5-19

PATH: C:\PROJECTS\STAGING_WORKFROMHOME\I205\JPA\MAP_DOCS\JPA\F5 IMPACTS_SHEET_5_19.MXD - USER: JBEARD - DATE: 4/17/2019

Attachment U. NMFS Consultation

October 19, 2018

FAHP Review and Verification– ODOT R1 I-205: Stafford Road to OR 213, On-site SW Treatment Deficit, increase in artificial fill, IWW extension, un-vegetated riprap above OHW, stream channel modification, 170900120104 - Willamette River-Oswego Creek and 170900100504 - Saum Creek-Lower Tualatin River, Clackamas County (KN#19786) (NMFS#2011-02095)

To: Cindy.Callahan@dot.gov

Cc: FAHP_ESA@odot.state.or.us , emily.cline@dot.gov , mike.morrow@dot.gov , tom.loynes@noaa.gov, jennifer.mcdonald@noaa.gov , Stephen.HAY@odot.state.or.us , Thomas.m.loynes@odot.state.or.us , devin.l.simmons@odot.state.or.us , Benjamin.WHITE@odot.state.or.us , mary.e.young@odot.state.or.us , brian.bauman@hdrinc.com , Thomas.Hamstra@odot.state.or.us ,

Ms. Callahan:

I read the notification form submitted to NMFS on Oct 19, 2018, requesting that NMFS review and verify the action named above as consistent with the Federal-Aid Highway Program biological opinion issued to the Federal Highway Administration on Nov 28, 2012 (the FAHP opinion), for project elements related to an onsite stormwater treatment deficit, increase in artificial fill, IWW extension, un-vegetated riprap above OHW, and a stream channel modification.

Based on information included on the form and from discussion with Tom Loynes, ODOT liaison for NMFS, including these facts:

- The proposed action will discharge post-construction runoff into the Willamette River; which is occupied by ESA-listed species and their designated critical habitat.
- Contributing impervious area (CIA) for the proposed project is 121.379 ac, including a net addition of 31.336 acres of net new impervious surface.
- Due to site constraints 120.226 acres will be treated onsite and 1.943 acres of CIA will be treated off-site for a total of 122.269 acres. This gives an overtreatment of 1.026 acres to be used on future projects that are constrained.
- Based in information provided with the notification:
    - The proposed project will generate 528,727 cf of post-construction stormwater runoff (PCR) estimated via the rational method.
        - PCR = contributing impervious area (CIA) x design storm (DS)
        - CIA = 121,379 ac (~5,287.269 sq ft) of impervious surface
        - DS = 50% of 2-yr, 24-hr storm = 1.22 in (0.10 ft)
        - PCR = 5,287.269 sq ft x 0.10 ft = ~528,727 cf
        - This project will over-treat and have an opportunistic credit of 1.026 acres post project.

        - A future Regional Stormwater Treatment facility will be created using one of the existing BMP's on this project. Once the value of the credits created is developed, a project change form will be submitted to document this.
- Flow control is not required because the receiving water is the Willamette Rover, a "large water body."
- At each of the existing internal bents some artificial fill will remain in the channel post project. However, FHWA agreed to remove 5 feet of depth of existing riprap around the footings before cutting off the bents. Also, FHWA is likely to remove additional fill and, if so, will report this on the project completion form.
- A stream channel modification will be necessary in Abernathy Creek to allow the channel to flow around a drilled shaft. During high flows this area is a backwater. This modification will allow for ample room for the channel to flow around the new shaft.
- An in-water work extension (IWWE) has been requested to use a barge all year long. The barge will only use spuds when necessary outside of the normal IWWE work period of Jul 1 to Oct 31.
- FHWA is proposing to oscillate drilled shafts from Jul 1 through Dec 31, 2018
- NOAA is verifying that this is consistent with the FAHP programmatic, with the following condition – FHWA work with NOAA to develop and carry out a monitoring plan to collect data on the underwater noise produced during the oscillation and drilling activity. This data will be used to better understand the impacts of sound caused by this type of activity. The final monitoring plan will be submitted to NOAA before the project will be offered for bid.
- Todd Alsbury approved this IWWE for ODFW based on the following considerations:
    - Year-round Barge Use
        - The published ODFW timing guidelines for the Willamette River below Willamette Falls include Jul 1-Oct 31.
        - Per the FAHP, anchoring barges outside of this window require approval from NMFS.
        - Year-round use is required to support all phases of the project.
        - The barges would use spud anchors and if needed push then to depth after deployment (drop) by jacking against the barge's weight.
        - This activity is unlikely to result in direct take, and indirect take is not expected due to: (1) The majority of the crossing is deep swift water habitat; (2) Fish that may be present in the more favorable habitat along the west-bank around Pier #6 may respond to the initial anchor set through avoidance. However, this behavior is not likely to affect their fitness of those individuals, or expose them to increased predation by piscivorous fish or birds.
    - ESA Species Likely to be Present: UWR adult and juvenile Chinook salmon, UWR steelhead, and LCR coho salmon (all coho are considered to be ESA-listed until they pass over Willamette Falls).
        - Juvenile rearing is assumed to be year-round but in low abundance due to limited suitable habitat only being present along the west-bank.
        - Juvenile presence is assumed to be year-round and brief except for fall Chinook which should be absent from mid-Sep to mid-Nov.

        - Juvenile coho will be present year around and adult coho will be present from late Aug through Nov.
        - Adult coho returning to the Clackamas may bypass the river early in the season, but are unlikely to hold in or around the bridge work area.
        - Adult coho will hold below the mouth of the Clackamas, approximately 0.5 miles downstream from work area, until fall rains encourage movement upstream.
    - Drilled Shaft Casing Oscillation. Extending the end of the window from 10/31 to 12/31 is required to complete installation of the drilled shaft outer casings via oscillation. Per request by ODFW, the construction of southern pier of Bent #3 (Abernethy Creek) will not occur during this period to avoid conflicts with upstream migrating adults and juveniles likely entering Abernethy Creek. Oscillation is not likely to affect fish beyond the immediate vicinity of installation. Oscillation does not generate injurious levels of sound and their placement and advancement is expected to have effects similar to what is described for spud placement. Note: Construction includes oscillation, drilling, and rebar installation.
        - ESA Species Likely to be Present: Adult LCR coho, juvenile UWR Chinook, juvenile and adult LCR Chinook Fall-Run, and juvenile and adult LCR and UWR steelhead. Juvenile UWR Chinook and Steelhead are considered to be present year-round. Juvenile and adult coho are likely to be present. There is low risk to these fish due to scheduled drilling of Bent #3 which is nearest to Abernethy Creek after adult fish have left the area. Adult coho waiting to enter Abernethy will hold until fall rains encourage, and allows, movement through the long culvert at the mouth of Abernethy Creek.
- All other relevant design criteria for construction practices will be used.

Therefore, I verify this proposed action as consistent with the FAHP opinion.

Please note that FAHP opinion requires FHWA to submit a project completion report for this action within 60-days of end of construction to verify the number and type of stormwater management practices installed, inspected and maintained by ODOT, as described in the FAHP opinion in section 2(b) at p.120-121, to ensure that this stormwater mitigation is effective.

Reinitiation of consultation on this action is required and shall be requested by the FHWA where discretionary Federal involvement or control over the action has been retained or is authorized by law and (a) the amount or extent of taking specified in the Incidental Take Statement is exceeded, (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (c) the identified action is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Please direct questions regarding this email to Tom Loynes, ODOT liaison with NMFS in the Willamette Branch, at 503-231-2243.

Marc Liverman
Willamette Branch Chief
West Coast Region
NOAA Fisheries