3J CONSULTING

CIVIL ENGINEERING | WATER RESOURCES | COMMUNITY PLANNING

PRELIMINARY STORMWATER MANAGEMENT REPORT

PLANNED UNIT DEVELOPMENT
Rhododendron Dr & 35th Ave
Florence, OR

Submittal Date: April 29, 2020
Revised from: February 14, 2020

REGISTERED PROFESSIONAL ENGINEER
74498PE
PRELIMINARY
OREGON
Jan. 8, 2009
KATHLEEN E. FREEMAN
EXPIRES: 12/31/2021

Owner:

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Exhibit F

TABLE OF CONTENTS

DESIGNER'S CERTIFICATION & STATEMENT 1
EXECUTIVE SUMMARY 2
PROJECT OVERVIEW & DESCRIPTION 3
METHODOLOGY 4
- Existing Conditions 4
- Infiltration Testing Results 5
- Proposed Conditions 5
- Stormwater Management 6
- Conveyance Design Criteria 7

ANALYSIS 7
- Design Assumptions 7
- Pollution Reduction 8
- Water Quality Basin Sizing 8
- Infiltration Basin Sizing 8
- Drywell System Sizing 8
- Soakage Trench Sizing 9
- Stormwater Escape Route 9
- Conveyance Performance 10

DOWNSTREAM ANALYSIS 10
ENGINEERING CONCLUSIONS 11
TECHNICAL APPENDIX 12
REFERENCES 12

LIST OF FIGURES

Figure 1 - Vicinity Map 3
Figure 2 - Site Location 4

LIST OF TABLES

Table 1 – Existing Basin Areas 4
Table 2 – Hydrologic Soils Group 5
Table 3 – Proposed Basin Areas 6
Table 4 – Proposed Frontage Improvements 6
Table 5 – 24-hr Rainfall Depths 7
Table 6 – Proposed Drywell System Dimensions 9
Table 7 – Soakage Trench Details 9

DESIGNER'S CERTIFICATION & STATEMENT

I hereby certify that this Stormwater Management Report for the Florence Master Plan has been prepared by me or under my supervision and meets minimum standards of the City of Florence and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

EXECUTIVE SUMMARY

The project site is approximately 9.275 ac and is located along Rhododendron Dr in Florence, OR (Tax Lots 18s12w15 700, 3800, & 1900). The site is zoned for multi-family use. The project falls within the jurisdiction of the City of Florence and will comply with the City's Stormwater Design Manual, issued in November 2010, revised September 2011.

The existing site is currently undeveloped and covered with trees and vegetation. There is a conveyance ditch onsite, that carries stormwater from the east side of the site to the west and discharges to the drainage system in Rhododendron Dr. The site typically slopes from the northeast to the southwest.

The proposed project will construct a new residential subdivision, including 81 new single family dwellings, 2 apartment complexes, roads, and utilities. Additionally, a new sidewalk will be constructed along Rhododendron Dr. All runoff from the proposed development will be managed and infiltrated onsite. Runoff from all roof area will be conveyed directly to soakage trenches, drywells and an infiltration basin to be retained and infiltrated; all other impervious area will be treated in a new rain garden that overflows to the infiltration basin. The existing conveyance ditch onsite will be piped and conveyed to the storm drainage system in Rhododendron Dr. The City of Florence requires that new developments infiltrate runoff to the maximum extent feasible. All runoff from the proposed project is designed to be managed, retained and infiltrated onsite; no runoff will leave the site.

Per the Stormwater Design Manual, pollution reduction facilities must perform at the required efficiency as follows: 70 percent total suspended solids (TSS) removal from 90 percent of the average annual runoff. Pollution reduction BMPs are required for all impervious area, except for roof area, if infiltrated and not combined with other impervious area runoff. Runoff from all roads, sidewalks and paths will be conveyed to a proposed water quality basin to be treated. The proposed basin was sized using the City of Portland Presumptive Approach Calculator (PAC), which used a pollution reduction storm event of 0.83 inches of rainfall over 24 hours.

This Stormwater Management Report was prepared to show that the proposed project will follow the City of Florence's Stormwater Design Manual.

PROJECT OVERVIEW & DESCRIPTION

The project site is approximately 9.275 ac and is located along Rhododendron Dr in Florence, OR (Tax Lots 18s12w15 700, 3800, & 1900). The site is zoned for multi-family use. The project falls within the jurisdiction of the City of Florence and will comply with the City's Stormwater Design Manual, issued in November 2010, revised September 2011.

The existing site is currently undeveloped and covered with trees and vegetation. There is a conveyance ditch onsite, that carries water from the east to the west and discharges to the drainage system in Rhododendron Dr. The site typically slopes from the northeast to the southwest.

The proposed project will construct a new residential subdivision, including 81 new single family dwellings, 2 apartment complexes, roads, and utilities. Additionally, a new sidewalk will be constructed along Rhododendron Dr. All runoff from the proposed development will be managed and infiltrated onsite. Runoff from all roof area will be conveyed directly to soakage trenches, drywells and an infiltration basin to be retained and infiltrated; all other impervious area will be treated in a new rain garden that overflows to the infiltration basin. The existing conveyance ditch onsite will be piped and conveyed to the storm drainage system in Rhododendron Dr.

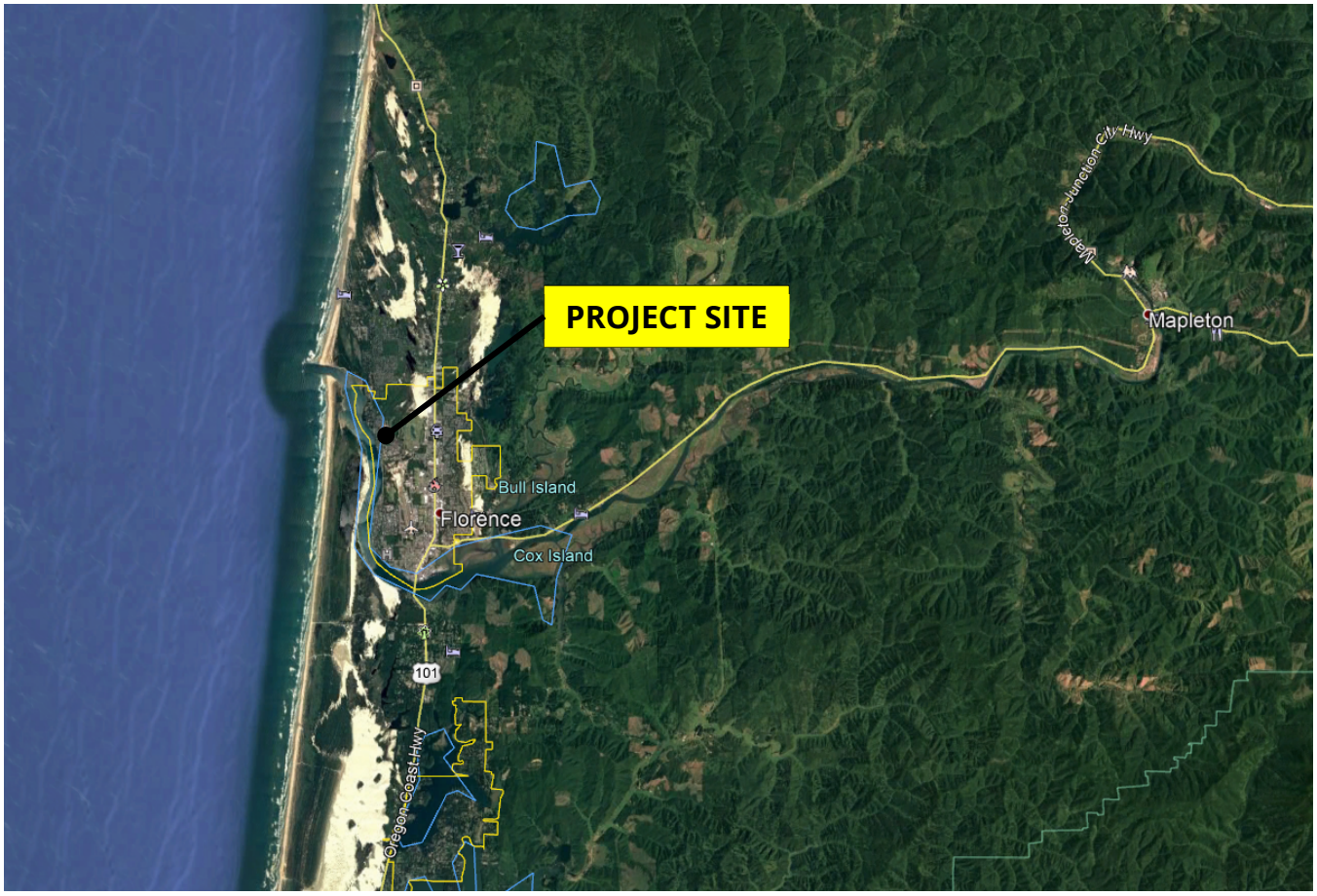


Figure 1 - Vicinity Map

Figure 2 - Site Location

METHODOLOGY

Existing Conditions

Existing Basins

The existing site is located on the east side of Rhododendron Dr between 35th St and Coast Guard Rd in Florence, OR (See Technical Appendix: Exhibits – Existing Conditions). The site is currently undeveloped and covered in trees and vegetation. Table 1 outlines the onsite impervious and pervious areas in the existing conditions.

Existing Basin	sf	ac
Impervious Area	1,674	0.038
Pervious Area	402,351	9.237
Total Area	*404,025*	*9.275*

Table 1 – Existing Basin Areas

Existing Drainage

In existing conditions, the site generally drains from the northeast to the southwest. Runoff sheet flows to Rhododendron Dr or to a ditch located onsite. Runoff eventually goes to the drainage system in Rhododendron Dr and outfalls to an unnamed drainage channel that discharges to the Siuslaw River.

Flood Map

The site is located within Zone X (un-shaded) per flood Insurance Rate Map (FIRM) community panel numbers 41039C0938F & 41039C1426F. FEMA's definition of Zone X (un-shaded) is an area of minimal flood hazard.

Hydrologic Soil Group

The soil types as classified by the United States Department of Agriculture Soil Survey of Lane County, Oregon are identified in Table 2 (See Technical Appendix: Exhibits – Hydrologic Soils Group – Lane County Area, Oregon).

Soil Type	Hydrologic Group	Percent Coverage (%)
Waldport Fine Sand	A	91.3
*Yaquina Loamy Fine Sand	A/D	8.7

*Modeled as Hydrologic Soils group D

Table 2 – Hydrologic Soils Group

Infiltration Testing Results

A Geotechnical Report performed by Branch Engineering on January 28, 2020 (See Technical Appendix: Geotechnical Report) evaluated onsite percolation rates using the encased falling head infiltration test at 3 locations; testing was performed at 54 & 56 inches below ground surface (BGS). The percolation rates were evaluated to be 92, 49, & 80 in/hr. The average infiltration rate for the proposed site is 73.67 in/hr, which was used to size the infiltration basin. A factor of safety of 2 was added to the design infiltration rate. The proposed water quality basin was sized using the City of Portland PAC, which has a maximum infiltration rate of 20 in/hr for native soils.

No groundwater was observed in the exploratory test pits which were advanced to a maximum of 10 ft BGS. Well logs from nearby sites were obtained from the Oregon Water Resources Department by the Geotechnical Engineer. The well logs list static water levels at 6.2 ft and 21 feet BGS. Variations in the depth to water is typical in stabilized dune environments with raised dunal areas and deflation zones with water close to the surface. The Geotechnical Engineer expects that ground water levels will fluctuate with the season and should be expected to be highest during the late winter and spring months. The presence of ground water is not expected to impact the proposed development, provided the recommendations of the Geotechnical Report are implemented in the design and construction of the project.

Proposed Conditions

Proposed Basins

In proposed conditions, the site will be the location of a new sub-division with 81 single family dwellings and 2 apartments complexes (See Technical Appendix: Exhibits - Post-Construction Conditions). Table 3 outlines the onsite impervious and pervious areas in proposed conditions.

Proposed Basin	sf	ac
Impervious Area Roof Area = 130,625 sf Nonroof Imp. Area = 101,108 sf	231,733	5.320
Pervious Area	172,292	3.955
Total Area	*404,025*	*9.275*

Table 3 – Proposed Basin Areas

Additionally, the project will construct a new sidewalk along the frontage of the site. The proposed sidewalk was included in the City of Florence Master Plan and was identified as a future project of the City's. Runoff from the sidewalk will be captured via catch basins and conveyed to the existing drainage system in Rhododendron Dr. Table 4 below shows the total impervious area constructed for the sidewalks.

Proposed Basin	sf	ac
Impervious Area	9,675	0.222

Table 4 – Proposed Frontage Improvements

Proposed Drainage

In proposed conditions, all runoff from the site will be managed and infiltrated onsite. Runoff from all roof area will be conveyed directly to soakage trenches, drywells and an infiltration basin to be retained and infiltrated; all other impervious area will be treated in a new rain garden that overflows to the infiltration basin. The existing conveyance ditch onsite will be piped and conveyed to the storm drainage system in Rhododendron Dr.

Runoff from the proposed sidewalk will be captured and conveyed to the existing drainage system in the right-of-way. The existing grade of the road and surrounding area do not provide the adequate slope to capture the runoff and convey it to a treatment facility to be treated/detained without providing additional improvements to the road, which is outside the scope of this project. Additionally, the surrounding area is developed and does not provide adequate area to construct a vegetated treatment facility. There is capacity in the downstream system to receive undetained flow from the sidewalk.

Stormwater Management

The City of Florence requires that new developments infiltrate runoff to the maximum extent feasible. All runoff from onsite is designed to be managed, retained and infiltrated onsite; no runoff will leave the site.

Per section 5.7 of the City of Florence Stormwater Design Manual, pre-treatment for soakage trenches are not required when runoff is exclusively from residential roof runoff. Runoff from roof areas will be conveyed directly to soakage trenches, drywells or an infiltration basin to be infiltrated. Soakage trenches were designed using the Presumptive Approach shown in Detail SW-180. The proposed drywells were sized using Exhibit 2-36 in detail SW-170. The proposed infiltration basin will manage more 15,000 sf of impervious area and a performance approach was applied to that facility.

All concrete and asphalt will be conveyed to a proposed water quality basin to be treated. The water quality basin was designed for only water quality treatment using the City of Portland Presumptive Approach Calculator (PAC).

An overflow drain will be installed in the rain garden so that storm events larger than the water quality event will be conveyed directly below into the infiltration basin.

The roof runoff from the proposed single family dwellings adjacent to the raingarden will be conveyed directly to the infiltration basin. All other roof runoff will be conveyed to a number of different soakage trenches.

Conveyance Design Criteria

The City of Florence requires that runoff be infiltrated to the maximum extent feasible. The proposed site will manage, retain and infiltrate all runoff from the proposed development.

The existing ditch onsite will be piped and conveyed to the stormwater system in Rhododendron Dr. The proposed pipe will match the existing pipe that captures runoff in the ditch (36" diameter). The proposed pipe is designed to convey the 100-year design storm with no out of system flooding.

ANALYSIS

Design Assumptions

Design Storms

The City of Florence has unique rainfall distributions where instead of a quick buildup with heavy intensity precipitation, rainfall tends to have broad peaks with several continuous hours of heavy rainfall. Due to this, a SCS Type 1a hyetographs is the most appropriate rainfall distribution for the area. Table 5 below shows the Design Storms used to design the proposed stormwater system.

Recurrence Interval (yr)	24-hr Depth (in)
WQ	0.83
2	3.46
10	4.48
25	5.06
100	5.95

Table 5 – 24-hr Rainfall Depths

Computation Methods & Software

In conformance with the City's Stormwater Design Manual, the Santa Barbara Urban Hydrograph (SBUH) Method via XPSTORM was used to evaluate stormwater runoff volume to size the proposed infiltration basin located under the water quality basin. Additionally, XPSTORM was utilized to model the proposed conveyance pipe replacing the existing ditch and analyze the downstream system.

Presumptive Approach

The presumptive approach was used to design the soakage trenches. The soakage trenches were design in accordance with detail SW-180 in Appendix I of the City of Florence Stormwater Design Manual.

The City of Portland PAC was used to size the Water Quality Basin only.

Time of Concentration

The time of concentration for the proposed site was calculated using the TR-55 method. The calculated time of concentration for the predeveloped site is 57 minutes (See Technical Appendix: Calculations – Time of Concentrations). A time of concentration of 5 minutes was assumed for proposed conditions.

Curve Numbers

Per Table A-2 of the SWMM, the runoff curve numbers (CN) by the Natural Resources Conservation Service (NRCS) for impervious and pervious areas (open space, fair condition) were 98 and 52 (weighted based on percent coverage of each Hydrologic Soils Group, see Table 2), respectively, for the proposed conditions.

Pollution Reduction

Per the SWMM, pollution reduction facilities must perform at the required efficiency as follows: 70 percent total suspended solids (TSS) removal from 90 percent of the average annual runoff. Pollution reduction BMPs are required for all impervious area, except for roof area. Runoff from all roads, sidewalks and paths will be conveyed to a proposed water quality basin to be treated. The proposed basin was sized using the City of Portland PAC, which used a pollution reduction storm event of 0.83 inches of rainfall over 24 hours.

Water Quality Basin Sizing

All runoff from proposed impervious area, other than roof area, will be treated in a proposed Water Quality Basin located on the west side of the property. The basin was sized using the City of Portland PAC. The proposed rain garden has the following dimensions (See Technical Appendix: Calculations – PAC Report);

Bottom Area = 700 sf
Bottom Width = 4 ft
Side Slopes = 3:1
Storage Depth 1 = 12 in
Growing Medium Depth = 18 in
Freeboard Depth = 6 in
Top Area = 2,375 sf

The proposed water quality basin will overflow to a proposed infiltration basin located under the basin.

Infiltration Basin Sizing

The proposed infiltration basin is sized to fully infiltrate runoff from all concrete and asphalt and 9 of the single family dwelling on the west side of the site during the 25-year design storm. The volume of runoff was calculated using the SBUH method and the computer software XPSTORM. The proposed infiltration basin will meet the dimensions shown below (See Technical Appendix: Calculations – Infiltration Basins Design);

Drawdown Time: 10 Hours
Porosity: 0.3
Depth = 3.0 ft
Area = 1,423 sf

Drywell System Sizing

Runoff from the apartment complex located in the southern corner of the site will be conveyed to three drywells to be infiltrated. The proposed drywells were sized using the simplified approach shown in Exhibit 2-

36 in Detail SW-170. Table 6 below shows the required number of drywells to infiltrate the impervious area draining to it.

Infiltration Facility	Impervious Area (sf)	Required Number of Drywells	Drywell Diameter (in)	Drywell Sump Depth (ft)
Drywell System	6,971	[1]3	48	5'

[1]The roof runoff will be split between the three drywells. Each drywell will be responsible for infiltrated a total of 2,324 sf of impervious area.

Table 6 – Proposed Drywell System Dimensions

Soakage Trench Sizing

All roof area, outside of what is being conveyed to drywells, shall be conveyed to a number of soakage trenches onsite to be retained and infiltrated. Each soakage trench was designed in accordance with Detail SW-180 in the City of Florence Stormwater Design Manual. The Post-Construction Conditions exhibit in the Technical Appendix shows the amount of impervious area draining to each soakage trench. The length (l) of the soakage trench was calculating using 30 ft of length per 1,000 sf of impervious area. The required area (A) of each soakage trench was calculated using the equation below;

$$A = l * (3\ ft)^{1}$$

[1]Per detail SW-180, the 30 ft length per 1,000 sf of impervious area assumes a 36 inch width.

Table 7 below shows the required area and the actual area of each soakage trench.

Infiltration Facility	Impervious Area Draining to Facility (sf)	Required Length (ft)	Required Area (sf)	Proposed Area (sf)
Soakage Trench #1	6,971	209	627	670
Soakage Trench #2	6,971	209	627	670
Soakage Trench #3	3,900	117	351	394
Soakage Trench #4	11,232	337	1,011	1,148
Soakage Trench #5	11,232	337	1,011	1,148
Soakage Trench #6	11,232	337	1,011	1,148
Soakage Trench #7	8,160	245	734	778
Soakage Trench #8	5,088	153	459	523
Soakage Trench #9	6,971	209	627	673
Soakage Trench #10	12,120	364	1,091	1,213
Soakage Trench #11	12,060	362	1,085	1,273
Soakage Trench #12	14,517	436	1,307	1,348
Soakage Trench #13	2,400	72	216	313

Table 7 – Soakage Trench Details

Stormwater Escape Route

All runoff from the proposed project will managed, retained and infiltrated onsite.

Conveyance Performance

Demonstration of conveyance capacity will be detailed in the Final Stormwater Management Report.

DOWNSTREAM ANALYSIS

The City of Florene requires any development requiring a Drainage Plan onsite and offsite drainage concerns, both up gradient and down gradient (minimum of 1/4 mile) of the proposed site. The analysis shall determine if;

1. Modification to the existing onsite stormwater drainage and management facilities and drainage patterns shall not restrict or redirect flows creating backwater or direct discharge onto offsite property to levels greater that the existing conditions unless approved by the affected offsite property owners and the City.
2. Stormwater facilities shall be designed and constructed to accommodate all flows generated from the project's property in accordance with the land use zoning as shown in the most recent approved City Code.
3. Capacity of the downstream drainage system to determine if increase in peak flow rates resulting from the proposed development can be accommodated.

All runoff from onsite will be managed and infiltrated onsite; no runoff will leave the site. The only increase in runoff to the downstream system will be the new sidewalk constructed along Rhododendron Dr. The downstream system was analyzed assuming the proposed site will discharge to it.

Runoff from the proposed site and sidewalk was added to the existing drainage system in Rhododendron Dr. Runoff enters the system where the existing ditch onsite discharges to. Water is then conveyed approximately 30' south via a 36" storm line and approximately 70' west in a 36" pipe. The pipe then outfalls to an unnamed drainage channel approximately 660' upstream of the Siuslaw River. The downstream system was analyzed up to the Siuslaw River.

Although efforts to gather asbuilts for the upstream and downstream basins were pursued by the City of Florence and EGR & Associated, Inc (Consultants that previously worked on site located upstream of the proposed project site), no asbuilts were acquired. The basins draining to the system analyzed was delineated using contours from publicly available LIDAR Data online (DOGAMI Lidar Viewer) and the layout of contributing properties.

Each sub basin's time of concentrations was assumed based on the slope of the land and cover type. The CN of each sub basins was determined by the type of cover for each basin and weighted by the Hydrologic Soils Group Type present for each sub basin. The downstream system was modeled using the SBUH method and the computer software XPSTORM. All pipe inverts and lengths were surveyed by S&F Land Services on September 19, 2019. The cross section for the unnamed drainage channel was determined using the LIDAR Data collected for the basin delineation. The Manning's Coefficient (n) for all drainage pipe is 0.013 and the n for the unnamed drainage channel is 0.048.

The model shows that the downstream system has capacity to handle the increased flow from the proposed development. The downstream system has capacity to convey the 25-year design storm without surcharging any pipes and maintaining a minimum freeboard of 3.00' (See Technical Appendix: Downstream Analysis – XPSTORM Conveyance Data). Additionally, the system can convey the 100-year design storm without

surcharging any pipes and maintaining a minimum freeboard of 2.88'. Given that the existing downstream system has capacity for the entire site plus the frontage improvements, the increased in runoff from the proposed sidewalk will not have an adverse effect on the downstream system.

ENGINEERING CONCLUSIONS

This report demonstrates that the proposed stormwater management system for the Florence Master Plan follows the City's Stormwater Design Manual. The proposed site takes advantage of infiltration and all runoff will be managed and infiltrated onsite. Additionally, pollution reduction in accordance with the City's Stormwater Design Manual were used to provide treatment from all concrete and asphalt.

An Operations & Maintenance Plan for the stormwater facilities will be provided in the Technical Appendix in the final design phase of the project.

TECHNICAL APPENDIX

Exhibits

National Flood Hazard Layer FIRMette
Hydrologic Soils Group – Lane County Area, Oregon
Table A-2 – Runoff Curve Numbers for Urban Areas
Table A-3 – Runoff Curve Numbers for Other Agricultural Lands
Existing Conditions
Post-Construction Conditions

Drawings

Sheet C1 – Existing Conditions & Demolition Plan
Sheet C7 – Grading Plan
Sheet C8 – Composite Utility Plan

Calculations

Time of Concentration
PAC Report
Infiltration Basin Design

Downstream Analysis

Downstream Basins
Hydraulic Soil Group (Basin 2-5)
XPSTORM Hydraulic Layout
XPSTORM Runoff Data
XPSTORM Conveyance Data

Geotechnical Report

Geotechnical Engineering Recommendations and Site Evaluation, Branch Engineering, Inc., January 28, 2020

Operations & Maintenance (To be completed in final design phase)

REFERENCES

Stormwater Design Manual issued September 2011 – City of Florence

Stormwater Management Manual issued 2016 – City of Portland

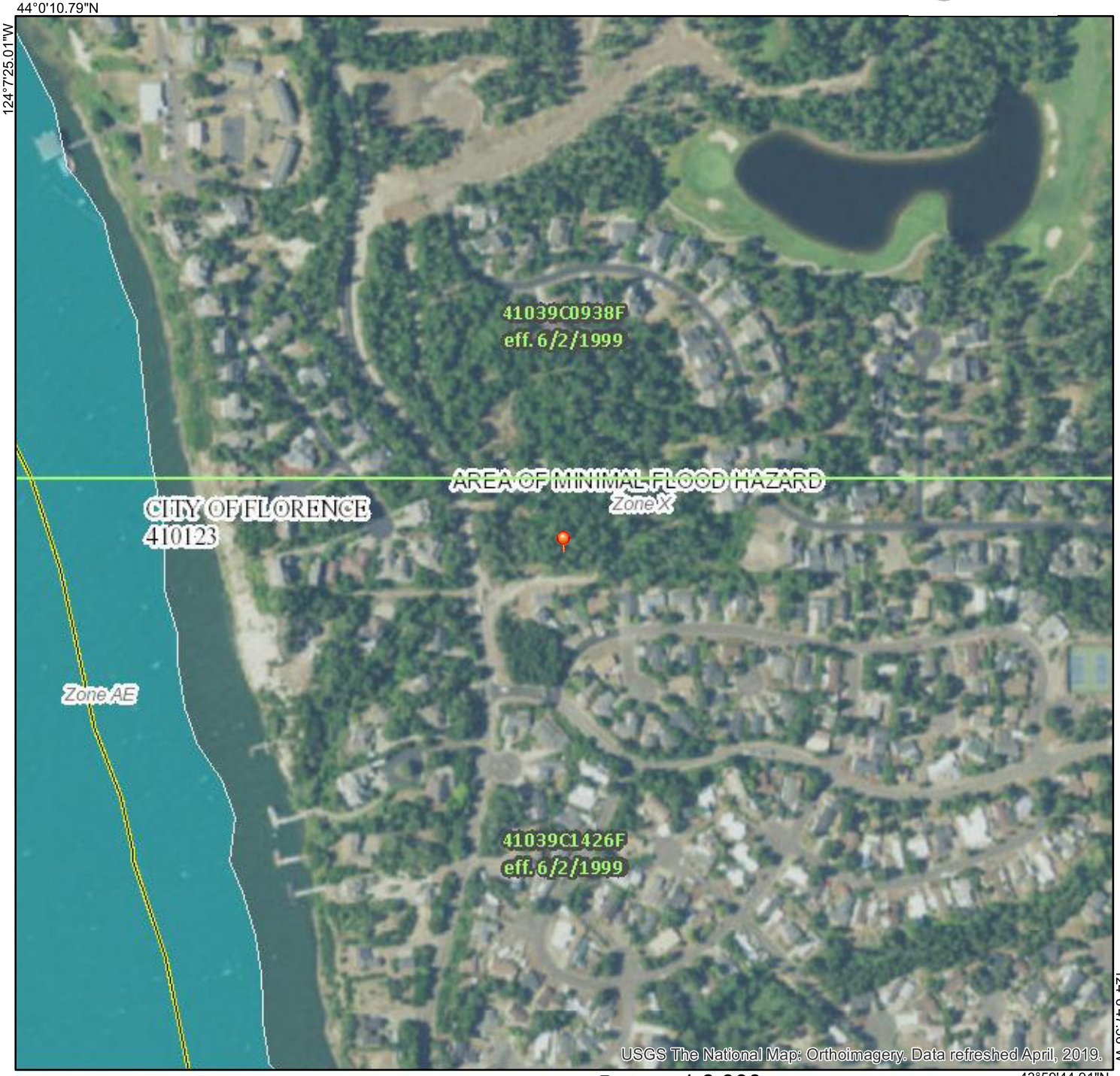
EXHIBITS

National Flood Hazard Layer FIRMette

FEMA

44°0'10.79"N

124°7'25.01"W



124°6'47.56"W

43°59'44.91"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

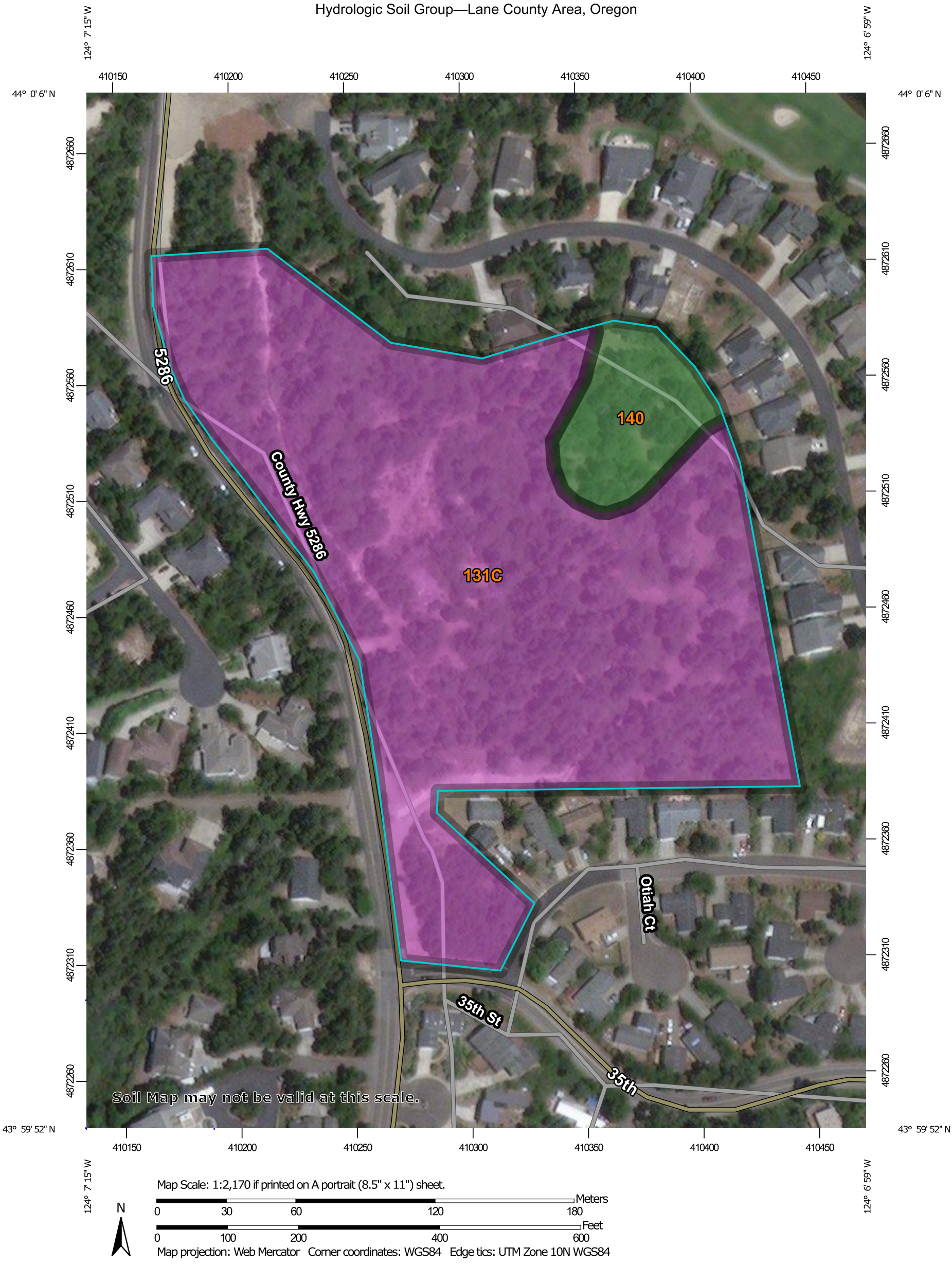
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/15/2020 at 4:43:03 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—Lane County Area, Oregon



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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	A	10.2	91.3%
140	Yaquina loamy fine sand	A/D	1.0	8.7%
Totals for Area of Interest			**11.2**	**100.0%**

Description

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.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Table A-2. Curve Numbers for Urban Areas

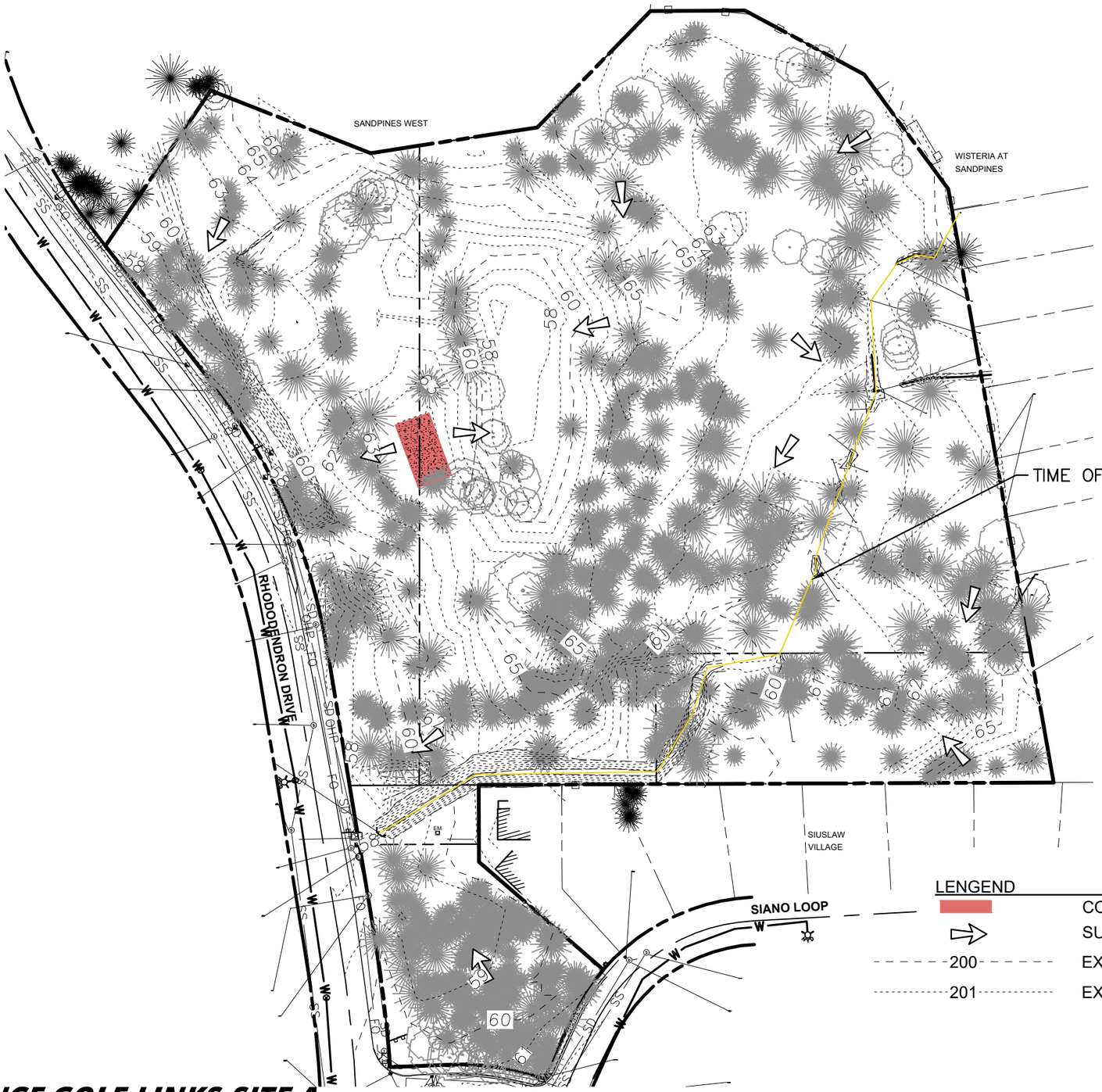
Cover type and hydrological condition	Average percent impervious area	Curve Numbers by Hydrologic Soil Group			
		A	B	C	D
Open Space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover <50%)		68	79	86	89
Fair condition (grass cover 50-75%)		49	69	79	84
Good condition (grass cover >75%)		39	61	74	80
Impervious Area:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	93
Urban Districts:					
Commercial and business	85	85	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	82
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

Soil Conservation Service, Urban Hydrology for Small Watersheds, Technical Release 55, pp. 2.5-2.8, June 1986.

Table A-3. Runoff Curve Numbers for Other Agricultural Lands

Cover type and hydrological condition	Hydrologic Condition	Curve Numbers by Hydrologic Soil Group			
		A	B	C	D
Pasture, grassland, or range-continuous forage for grazing:					
<50% ground cover or heavily grazed with no mulch	Poor	68	79	86	89
50 to 75% ground cover and not heavily grazed	Fair	49	69	79	84
>75% ground cover and lightly or only occasionally grazed	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush-weed-grass mixture with brush as the major element:					
<50% ground cover	Poor	48	67	77	83
50-75% ground cover	Fair	35	56	70	77
>75% ground cover	Good	30	48	65	73
Woods-grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods					
Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning	Poor	45	66	77	83
Woods are grazed by not burned, and some forest litter covers the soil	Fair	36	60	73	79
Woods are protected from grazing and litter and brush adequately cover the soil	Good	30	55	70	77

Soil Conservation Service, Urban Hydrology for Small Watersheds, Technical Release 55, pp. 2.5-2.8, June 1986.



TOTAL SITE = 404,025 SF = 9.275 ACRES
IMPERVIOUS AREA = 1,674 SF = 0.038 ACRES
PERVIOUS AREA = 402,351 SF = 9.237 ACRES

CN = 39.7 (WOODS FAIR CONDITIONS, WEIGHTED BASED OF HSG)

LENGEND

- CONCRETE / ASPHALT
- SURFACE RUN-OFF FLOW ARROW
- 200 EXISTING MAJOR CONTOUR
- 201 EXISTING MINOR CONTOUR

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W E
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SCALE: 1" = 100'
0 100 FT

FLORENCE GOLF LINKS-SITE A

02/14/2020

APIC FLORENCE HOLDINGS, LLC

EXISTING CONDITIONS

3J CONSULTING
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FACILITY	CONCRETE / AC (SF)	[1]ROOF AREA (SF)	[2]CALC'D LENGTH (FT)	REQUIRED AREA (SF)	ACTUAL AREA (SF)
SOAKAGE TRENCH #1	0	6,971	209	627	670
SOAKAGE TRENCH #2	0	6,971	209	627	670
SOAKAGE TRENCH #3	0	3,900	117	351	394
SOAKAGE TRENCH #4	0	11,232	337	1,011	1,148
SOAKAGE TRENCH #5	0	11,232	337	1,011	1,148
SOAKAGE TRENCH #6	0	11,232	337	1,011	1,148
SOAKAGE TRENCH #7	0	8,160	245	734	778
SOAKAGE TRENCH #8	0	5,088	153	459	523
SOAKAGE TRENCH #9	0	6,971	209	627	673
SOAKAGE TRENCH #10	0	12,120	364	1,091	1,213
SOAKAGE TRENCH #11	0	12,060	362	1,085	1,273
SOAKAGE TRENCH #12	0	14,517	436	1,307	1,348
SOAKAGE TRENCH #13	0	2,400	72	216	313
INFILTRATION BASIN	[3]101,108	10,800	-	1,389	
DRYWELLS	0	6,971	-		

[1]DOES NOT REQUIRE TREATMENT.

[2]ASSUMED WIDTH OF 36".

[3]RUNOFF FROM CONCRETE AND AC WILL BE TREATED IN A WATER QUALITY BASINS BEFORE THE INFILTRATION BASIN.

TOTAL SITE = 404,025 SF = 9.275 ACRES
IMPERVIOUS AREA = 231,733 SF = 5.320 ACRES
PERVIOUS AREA = 172,292 SF = 3.955 ACRES

FRONTAGE IMPROVEMENTS
IMPERVIOUS AREA = 9,675 SF = 0.222 ACRES

CN = 52.0 (OPEN SPACE FAIR CONDITIONS, WEIGHTED BASED OF HSG)

LENGEND

- CONCRETE / ASPHALT
- ROOF AREA
- PROPOSED FRONTAGE IMPROVEMENTS
- 110 — PROPOSED MAJOR CONTOUR
- 108 — PROPOSED MINOR CONTOUR
- SURFACE RUN-OFF FLOW ARROW

FLORENCE GOLF LINKS-SITE A

04/29/2020

APIC FLORENCE HOLDINGS, LLC

POST-CONSTRUCTION CONDITIONS

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CIVIL ENGINEERING . WATER RESOURCES . COMMUNITY PLANNING

DRAWINGS

SURVEYOR'S NOTES

1. LOCATION OF UNDERGROUND UTILITY FACILITIES SHOWN HEREON ARE BASED ON LOCATE MARKS REQUESTED FOR THIS SURVEY PER ONE CALL PUBLIC LOCATE TICKETS. UTILITY LOCATES MAY NOT BE COMPLETE. THE SURVEYOR MAKES NO GUARANTEE AS TO THE EXACT LOCATION, EXISTENCE, NON-EXISTENCE OR COMPLETENESS OF ANY SUBSURFACE UTILITIES SHOWN, OR NOT SHOWN ON THE MAP. ALL UTILITY LOCATIONS SHOULD BE FIELD VERIFIED PRIOR TO CONSTRUCTION. CALL 811 BEFORE DIGGING.
2. FIELD WORK WAS PERFORMED ON AUGUST 19-23 AND SEPTEMBER 10-13, 2019.
3. STORM DRAINAGE AND SANITARY SEWER PIPE SIZES AND MATERIALS WERE VISUALLY NOTED AND MEASURED IN THE FIELD FROM THE RIM OF STRUCTURES. NOTED PIPE SIZES MAY VARY.
4. EXISTING TAX LOT LINES IF SHOWN ARE FOR REFERENCE FROM RECORD DATA. NOT ALL ADJOINING TAX LOT LINES ARE SHOWN HEREON.
5. PROPERTY PARCEL DESIGNATION IS PER THAT PRELIMINARY TITLE REPORT PREPARED BY FIDELITY NATIONAL TITLE HAVING ORDER NO. 60461640170, SUPLT 7, DATED 14, 2019.
6. PROPERTY IS SUBJECT TO BLANKET EASEMENTS AND RESTRICTIONS PER DOCUMENTS OF RECORD AS NOTED IN SAID PRELIMINARY TITLE REPORT.
7. PROPERTY IN GENERAL IS AN UNDEVLOPED LOT CONSISTING OF SANDY SOIL, DENSE UNDERBRUSH, AND COASTAL PINES OF VARYING SIZES.
8. THE PROPERTY IS LOCATED IN THE S.W. 1/4 OF SECTION 15 AND N.W. 1/4 OF SECTION 22, T.18.S., R.12.W., W.M. LANE COUNTY, OREGON
9. THE BASIS OF BEARINGS AND HORIZONTAL POSITIONS: OREGON NORTH STATE PLANE COORDINATE SYSTEM NAD 83 (2011) AS MEASURED AND OUTPUTTED ON THE OREGON COORDINATE REFERENCE FRAME, OREGON COAST ZONE.
10. ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

- PROJECT BOUNDARY
- EXISTING RIGHT OF WAY
- EXISTING RIGHT OF WAY CENTERLINE
- EXISTING LOT LINE
- EXISTING EASEMENT LINE
- EXISTING CONCRETE
- EXISTING CURB
- EXISTING FENCE LINE
- EXISTING TELECOM. LINE
- EXISTING GAS LINE
- EXISTING CABLE LINE
- EXISTING OVERHEAD POWER
- EXISTING SANITARY SEWER
- EXISTING STORM DRAIN
- EXISTING WATER MAIN
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE
- EXISTING SIGN
- EXISTING STREET LIGHT
- EXISTING UTILITY POLE
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY CLEANOUT
- EXISTING STORM MANHOLE
- EXISTING STORM CATCH BASIN
- REMOVE EXISTING FENCE
- PROPOSED GRADING LIMITS

DEMOLITION GENERAL NOTES

1. PROTECT EXISTING PAVEMENT ADJACENT TO WORK LIMITS. REPLACE DAMAGED CONCRETE IN WHOLE PANELS.
2. PROTECT EXISTING BUILDING ADJACENT TO WORK LIMITS. REPAIR DAMAGE TO SATISFACTION OF OWNER, AT NO EXPENSE TO OWNER.
3. PROTECT EXISTING FENCE ADJACENT TO WORK LIMITS. REPAIR DAMAGE TO SATISFACTION OF OWNER, AT NO EXPENSE TO OWNER.
4. CONTRACTOR TO VERIFY PRESENCE, LOCATION AND DEPTH OF EXISTING UTILITIES PRIOR TO COMMENCING WORK. NOTIFY OWNER AND ENGINEER FOR ANY CONFLICTS WITH PROPOSED DESIGN.
5. REMOVE TREES WITHIN GRADING LIMITS.

ZONE X (UN-SHADED) THE SITE IS LOCATED WITHIN ZONE X (UN-SHADED) PER FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY-PANEL NUMBER **41039C0938F & 41039C1426F** FEMA'S DEFINITION OF ZONE X (UN-SHADED) IS AN AREA OF MINIMAL FLOOD HAZARD, USUALLY DEPICTED ON FIRMS AS ABOVE THE 500-YEAR FLOOD LEVEL. ZONE X IS THE AREA DETERMINED TO BE OUTSIDE THE 500-YEAR FLOOD AND PROTECTED BY LEVEE FROM 100-YEAR FLOOD. IN COMMUNITIES THAT PARTICIPATE IN THE NFIP, FLOOD INSURANCE IS AVAILABLE TO ALL PROPERTY OWNERS AND RENTERS IN THESE ZONES.

N W E S

SCALE: 1" = 50'
0 50 100 FT

811 Know what's below. Call before you dig.

REGISTERED PROFESSIONAL ENGINEER 70657PE OREGON JUNE 16, 2017 JESSE T. EMERSON
EXPIRES: 12/31/21

PUBLISH DATE
04-29-2020
ISSUED FOR
LAND USE SUBMITTAL
REVISIONS

apic

EXISTING CONDITIONS PLAN
RHODODENDRON DR & 35TH ST
PLANNED UNIT DEVELOPMENT

APIC FLORENCE HOLDINGS, LLC
FLORENCE, OR

LRS ARCHITECTS
PLACE
3J CONSULTING

PROJECT INFORMATION
PRCJECT # | 19555
LAND USE # | TBD
TAX LOT(S) | 18121534 700, 1900, 3800
DESIGNED BY | JTE, TEG
CHECKED BY | AJM

SHEET NUMBER
C1

P:\19555-FLORENCE MASTER PLAN\CAD\DD\19555-EXISTING CONDITIONS.DWG

LEGEND

110	PROPOSED MAJOR CONTOUR
108	PROPOSED MINOR CONTOUR
110	EXISTING MAJOR CONTOUR
108	EXISTING MINOR CONTOUR
	ZONE OF PROPOSED FILL
	PROPOSED RETAINING WALL

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W E
S

SCALE: 1" = 50'
0 50 100 FT

811
Know what's below.
Call before you dig.

REGISTERED PROFESSIONAL ENGINEER
7065/PE
OREGON
JUNE 16, 2017
JESSE T. EMERSON
EXPIRES: 12/31/21

PUBLISH DATE
04-29-2020
ISSUED FOR
LAND USE SUBMITTAL
REVISIONS

apic

GRADING PLAN
RHODODENDRON DR & 35TH ST
PLANNED UNIT DEVELOPMENT
APIC FLORENCE HOLDINGS, LLC
FLORENCE, OR

LRS ARCHITECTS
PLACE
3J CONSULTING

PROJECT INFORMATION
PROJECT # | 19555
LAND USE # | TBD
TAX LOT(S) | 18121534 700, 1900, 3800
DESIGNED BY | JTE, TEG
CHECKED BY | AJM

SHEET NUMBER
C7

P:\19555-FLORENCE MASTER PLAN CAD\DD\19555-GRADING & EC.DWG

LEGEND

- PROPOSED LOT LINE
- PROPOSED EASEMENT LINE
- PROPOSED RIGHT OF WAY
- PROPOSED CENTERLINE
- PROPOSED SETBACK LINE
- PROPOSED CURB FACE
- PROPOSED CURB BACK
- PROPOSED ASPHALT
- PROPOSED CONCRETE
- PROPOSED HEAVY DUTY CONCRETE
- PROPOSED CONCRETE SCORING
- PROPOSED RETAINING WALL
- PROPOSED SOAKAGE TRENCH
- PROPOSED STORM TOP OF BANK
- PROPOSED STORM BOTTOM OF BANK
- PROPOSED STORM PIPE
- PROPOSED BYPASS STORM PIPE
- PROPOSED SANITARY PIPE
- PROPOSED WATER MAIN
- PROPOSED STORM MANHOLE
- PROPOSED CURB INLET
- PROPOSED ROUND AREA INLET
- PROPOSED SEWER MANHOLE
- PROPOSED HYDRANT
- PROPOSED VALVE
- BLOW-OFF / AIR RELEASE ASSY.
- PROPOSED LIGHTING

WATER SYSTEM KEY NOTES

1. INSTALL 8" WATER MAIN.
2. INSTALL 6" WATER MAIN.
3. INSTALL 4" WATER MAIN.
4. CONNECT PROPOSED 8" WATER MAIN TO EXISTING 8" WATER MAIN.

STORM DRAIN KEY NOTES

1. INSTALL 12" PRIVATE STORM MAIN.
2. CONSTRUCT INFILTRATION BASIN.
3. CONSTRUCT INFILTRATION SOAKAGE TRENCH.
4. INSTALL 36" BYPASS STORM MAIN FOR RUN-ON FLOWS.

SANITARY SEWER KEY NOTES

1. INSTALL 8" SANITARY SEWER MAIN.
2. INSTALL 6" SANITARY SEWER MAIN.
3. CONNECT PROPOSED 8" SANITARY SEWER MAIN TO EXISTING 12" SANITARY SEWER VIA PROPOSED SANITARY SEWER MANHOLE.
4. CONNECT PROPOSED 8" SANITARY SEWER MAIN TO EXISTING SANITARY SEWER MANHOLE.

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W E
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SCALE: 1" = 50'
0 50 100 FT

811
Know what's below.
Call before you dig.

REGISTERED PROFESSIONAL ENGINEER
70657PE
OREGON
JUNE 16, 2017
JESSE T. EMERSON
EXPIRES: 12/31/21

PUBLISH DATE
04-29-2020
ISSUED FOR
LAND USE SUBMITTAL
REVISIONS

apic

COMPOSITE UTILITY PLAN
RHODODENDRON DR & 35TH ST
PLANNED UNIT DEVELOPMENT
APIC FLORENCE HOLDINGS, LLC
FLORENCE, OR

LRS ARCHITECTS
PLACE
3J CONSULTING

PROJECT INFORMATION
PRCJECT # | 19555
LAND USE # | TBD
TAX LOT(S) | 18121534 700, 1900, 3800
DESIGNED BY | JTE, TEG
CHECKED BY | AJM

SHEET NUMBER
C8

P:\19555-FLORENCE MASTER PLAN\CAD\DD\19555-COMPOSITE UTILITY.DWG

CALCULATIONS

TIME OF CONCENTRATION

PROJECT NO. Florence Master Plan	BY JBC	DATE 1/24/2020

SHEET FLOW			
INPUT	**PREDEVELOPED**		
Surface Description	**Type 9 Woods (light_underbrush)**	**Type 5 Grass (short prairie)**	**Type 5 Grass (short prairie)**
Manning's "n"	**0.4**	**0.15**	**0.15**
Flow Length, L	**300** ft	**0** ft	**0** ft
2-Yr 24 Hour Rainfall, P_2	**3.5** in	**2.5** in	**2.5** in
Land Slope, s	**0.018** ft/ft	**0.0000** ft/ft	**0.0000** ft/ft
OUTPUT			
Travel Time	0.86 hr	0.00 hr	0.00 hr

SHALLOW CONCENTRATED FLOW			
INPUT	**VALUE**	**VALUE**	**VALUE**
Surface Description	**Unpaved**	**Unpaved**	**Unpaved**
Flow Length, L	**538** ft	**0** ft	**0** ft
Watercourse Slope*, s	**0.0124** ft/ft	**0** ft/ft	**0** ft/ft
OUTPUT			
Average Velocity, V	1.80 ft/s	0.00 ft/s	0.00 ft/s
Travel Time	0.083 hr	0.000 hr	0.000 hr

CHANNEL FLOW			
INPUT	**VALUE**	**VALUE**	**VALUE**
Cross Sectional Flow Area, a	**0** ft^2	**0** ft^2	**0** ft^2
Wetted Perimeter, P_w	**0** ft	**0** ft	**0** ft
Channel Slope, s	**0** ft/ft	**0** ft/ft	**0** ft/ft
Manning's "n"	**0.24**	**0.24**	**0.24**
Flow Length, L	**0** ft	**0** ft	**0** ft
OUTPUT			
Average Velocity	0.00 ft/s	0.00 ft/s	0.00 ft/s
Hydraulic Radius, r = a / P_w	1.00 ft	1.00 ft	1.00 ft
Travel Time	0.00 hr	0.00 hr	0.00 hr
Watershed or Subarea T_c =	**0.94 hr**	**0.00 hr**	**0.00 hr**
Watershed or Subarea T_c =	**57 minutes**	**0 minutes**	**0 minutes**

PAC Report

Project Name Florence Golf Links-Site A (Biorentention)	Permit No.	Created 1/23/20 1:36 PM
Project Address 18S12W15 700 & 3800 Florence, OR, OR 97439	Designer Joe Conner	Last Modified 4/24/20 10:46 AM
	Company 3J Consulting	Report Generated 4/24/20 10:46 AM

Project Summary

Florence Golf Links-Site A (Biorentention)

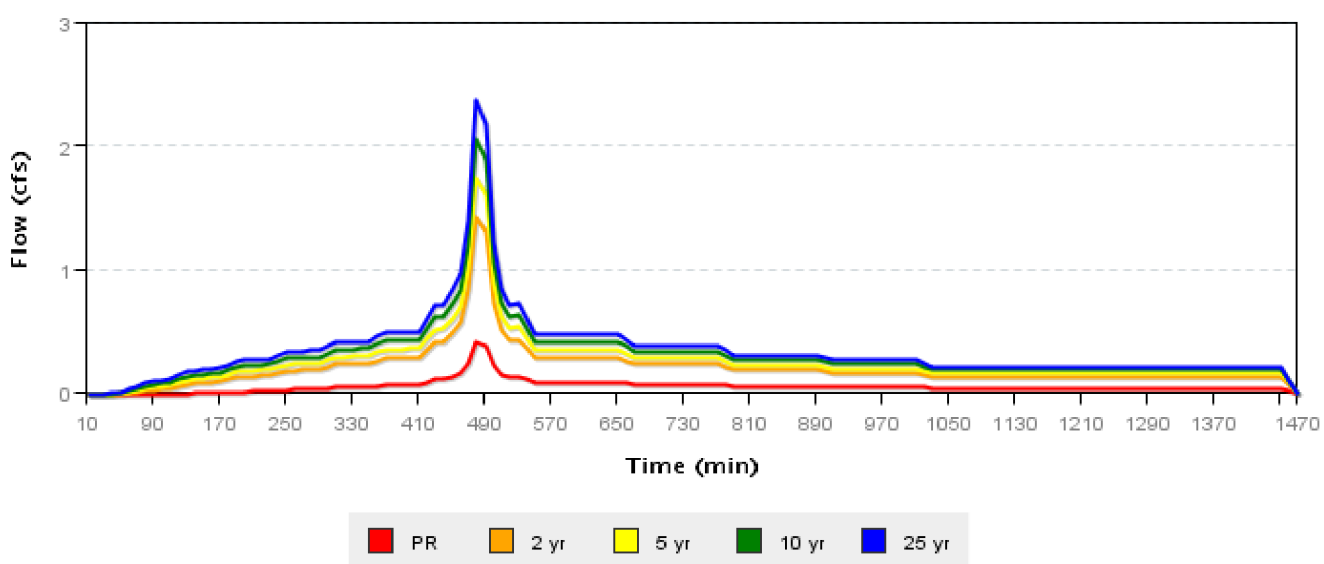
Catchment Name	Impervious Area (sq ft)	Native Soil Design Infiltration Rate	Hierarchy Category	Facility Type	Facility Config	Facility Size (sq ft)	Facility Sizing Ratio	PR Results	Flow Control Results
Biorentention Pond	101108	74.00	1	Basin	A	700	2.3%	Pass	Not Used

Catchment Biorentention Pond

Site Soils & Infiltration Testing Data	Infiltration Testing Procedure	**Encased Falling Head**
	Native Soil Infiltration Rate (I_{test})	**74.00** ⚠
Correction Factor	CF_{test}	**2**
Design Infiltration Rates	Native Soil (I_{dsgn})	**20.00 in/hr**
	Imported Growing Medium	**2.00 in/hr**
Catchment Information	Hierarchy Category	**1**
	Hierarchy Description	**On-site infiltration with a surface infiltration facility**
	Pollution Reduction Requirement	**Pass**
	10-year Storm Requirement	**Pass**
	Flow Control Requirement	**Pass**
	Impervious Area	**101108 sq ft** ⚠ **2.321 acre**
	Time of Concentration (Tc)	**5**
	Post-Development Curve Number (CN_{post})	**98**

⚠ Indicates value is outside of recommended range

SBUH Results



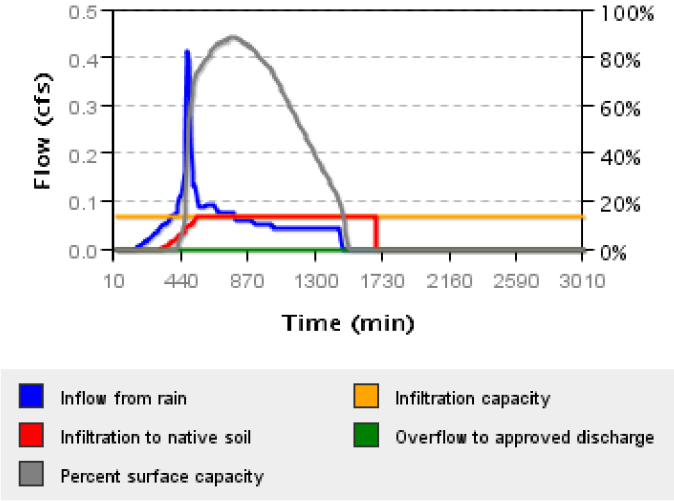
	Peak Rate (cfs)	Volume (cf)
PR	0.417	5283.177

2 yr	1.428	18295.076
5 yr	1.744	22485.563
10 yr	2.058	26682.322
25 yr	2.371	30883.036

Facility Biorentention Pond

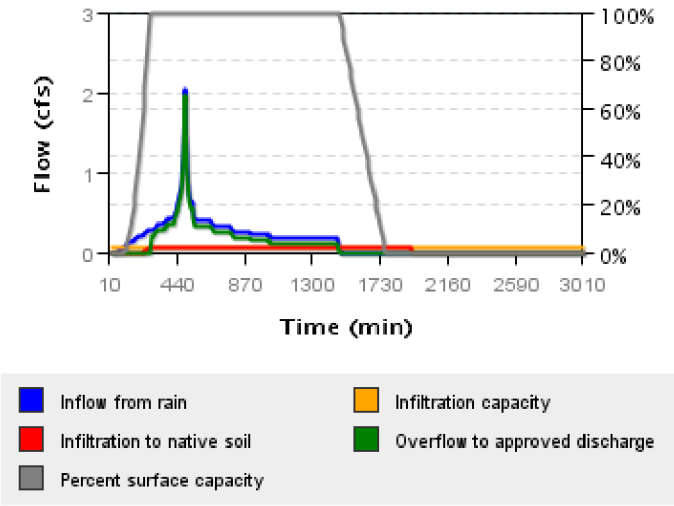
Facility Details	Facility Type	**Basin**
	Facility Configuration	**A: Infiltration (Infl.)**
	Facility Shape	**Rectangle**
	Above Grade Storage Data	
	Bottom Area	**700 sq ft**
	Bottom Width	**4.00 ft**
	Side Slope	**3.0:1**
	Storage Depth 1	**12.0 in**
	Growing Medium Depth	**18 in**
	Freeboard Depth	**6.00 in**
	Surface Capacity at Depth 1	**1246.4 cu ft**
	Design Infiltration Rate for Native Soil	**0.704 in/hr**
	Infiltration Capacity	**0.070 cfs**
Facility Facts	Total Facility Area Including Freeboard	**2374.62 sq ft**
	Sizing Ratio	**2.3%**
Pollution Reduction Results	Pollution Reduction Score	**Pass**
	Overflow Volume	**0.000 cf**
	Surface Capacity Used	**89%**
10 Year Results	10 Year Score	**Fail**
	Overflow Volume	**19534.458 cf**
	Surface Capacity Used	**100%**

Pollution Reduction Event Surface Facility Modeling



Pollution Reduction Event Below Grade Modeling

10 Year Event Surface Facility Modeling



10 Year Event Below Grade Modeling

INFILTRATION BASIN DESIGN

PROJECT NAME	Florence Site A	**BY** JBC		**DATE**	4/24/2020
PROJECT NUMBER	19555				

Impervious Catchment Area

Impervious Area	111,908	sq ft
Volume from storm (V_s)	44,963	ft^3

Infiltration Calculation

Measured Infiltration Rate *i*	73.67	in/hr
Design Infiltration Rate I_D (SF=2)	36.84	in/hr
Drawdown Time (T)	10	hours

Storm Event Information

Return Period (yr)	25	Santa Barbara Unit Hydrograph (See 25-Year Runoff Rate Hydrograph)
24-hr precip. (in)	5.06	
Location	Florence	
Hydrologic Soil Group	A	

Infiltration Trench

Length (L)	**150.0 ft**	
Width (W)	**9 ft**	$W = A_t/L$
Area (A_t)	See Calculation below	
Porosity (n)	0.3	
Depth (D)	3.0 **ft**	

Infiltration Volume (V_i) **$V_i=V_s$**

$$V_i = A_t * i * T * (1/12)$$

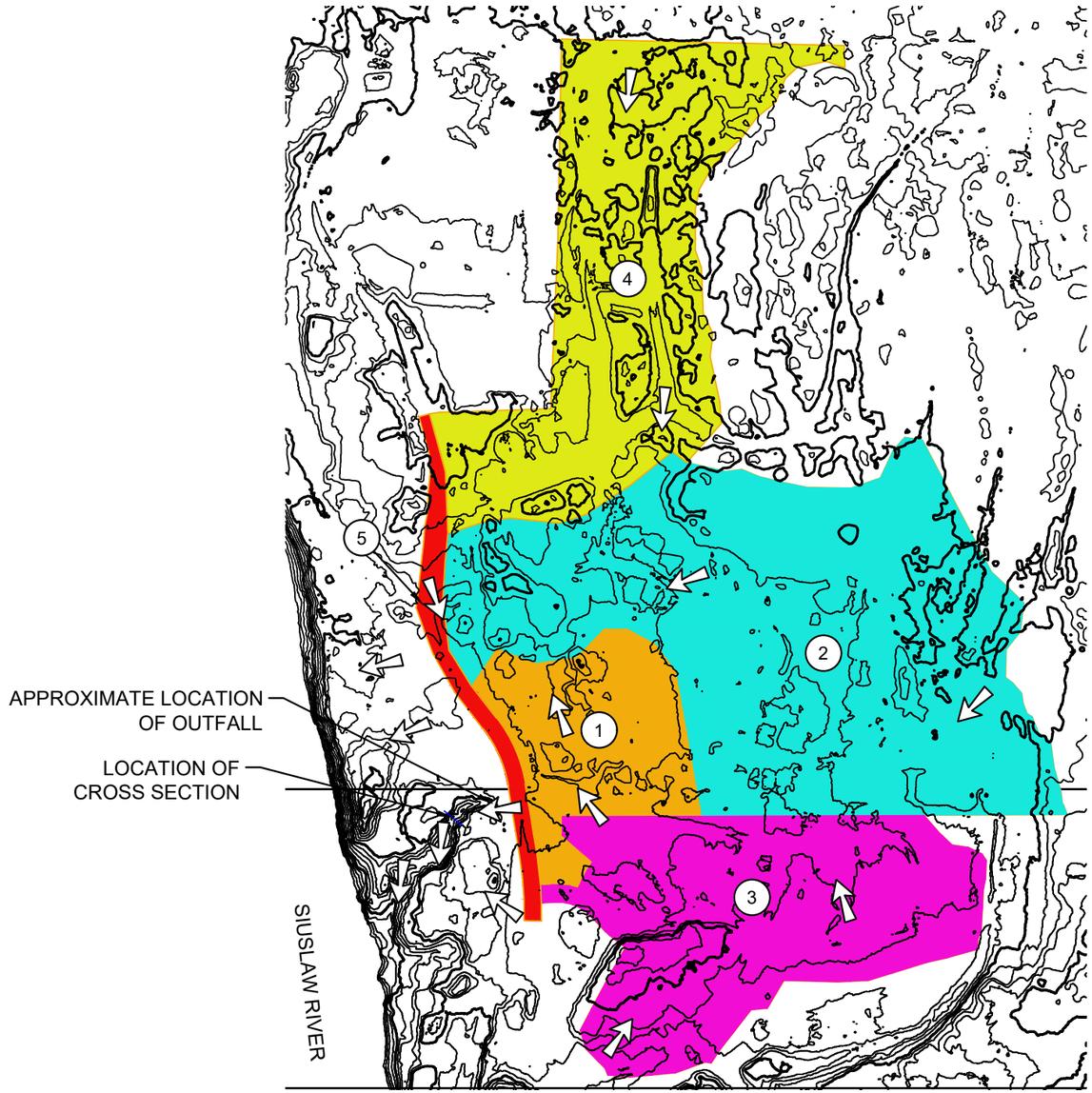
$$A_t = \frac{V_i}{((n*D)+I_D*T/12)} = 1423 \text{ sq ft}$$

Bottom surface area required to infiltrate within required drawdown time.

Volume of runoff computed in XPSTORM:

```
*****************************************************
* Table R6. Continuity Check for Channel/Pipes      *
*           You should have zero continuity error   *
*           if you are not using runoff hydraulics  *
*****************************************************
                                                      Inches over
                                   cubic feet         Total Basin
Initial Channel/Pipe Storage...............        0.000000E+00          0.000
Final Channel/Pipe Storage.................        0.000000E+00          0.000
Surface Runoff from Watersheds.............        4.496258E+04          4.821
Groundwater Subsurface Inflow or Diversion..        0.000000E+00          0.000
Evaporation Loss from Channels.............        0.000000E+00          0.000
Groundwater Flow Diverted Out of Network....        0.000000E+00          0.000
Channel/Pipe/Inlet Outflow.................        4.496258E+04          4.821
Initial Storage + Inflow...................        4.496258E+04          4.821
Final Storage + Outflow + Diverted GW.......        4.496258E+04          4.821
*********************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ---------------------------------    *
*  Final Storage + Outflow  + Evaporation  *
*********************************************
Percent Continuity Error...................                        0.0000
```

DOWNSTREAM ANALYSIS



LEGEND

⇨ SURFACE RUN-OFF FLOW ARROW

BASIN	TOTAL AREA (AC)	% IMPERVIOUS	CN	TIME OF CONCENTRATION (MIN)	DRAINS TO
1	PROPOSED SITE (SEE EXHIBIT)				1
2	40.430	45	66.3	45	1
3	20.882	65	49.0	20	2
* 4	24.069	65	49.0	20	1
5	2.667	100	98.0	5	1

*ASSUMED FULL BUILD.

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W E
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SCALE: 1" = 500'
0 500 FT

FLORENCE GOLF LINKS-SITE A

01/23/2020

LRS ARCHITECTS, INC.

DOWNSTREAM BASINS

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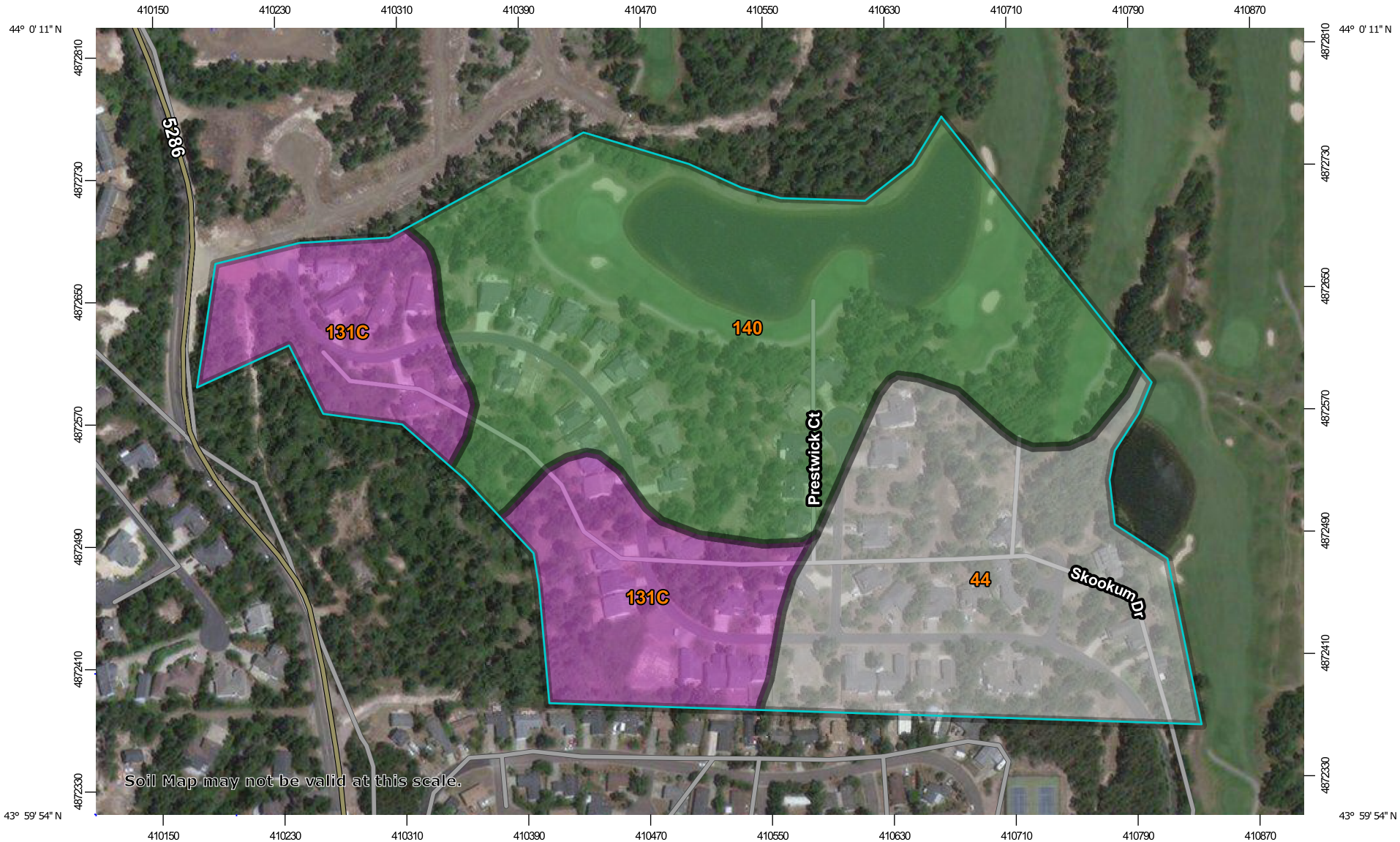
CIVIL ENGINEERING . WATER RESOURCES . COMMUNITY PLANNING

Hydrologic Soil Group—Lane County Area, Oregon
(BASIN 2)



Map Scale: 1:3,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
44	Dune land		11.3	27.7%
131C	Waldport fine sand, 0 to 12 percent slopes	A	9.4	23.0%
140	Yaquina loamy fine sand	A/D	20.2	49.3%
Totals for Area of Interest			**41.0**	**100.0%**

Description

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.

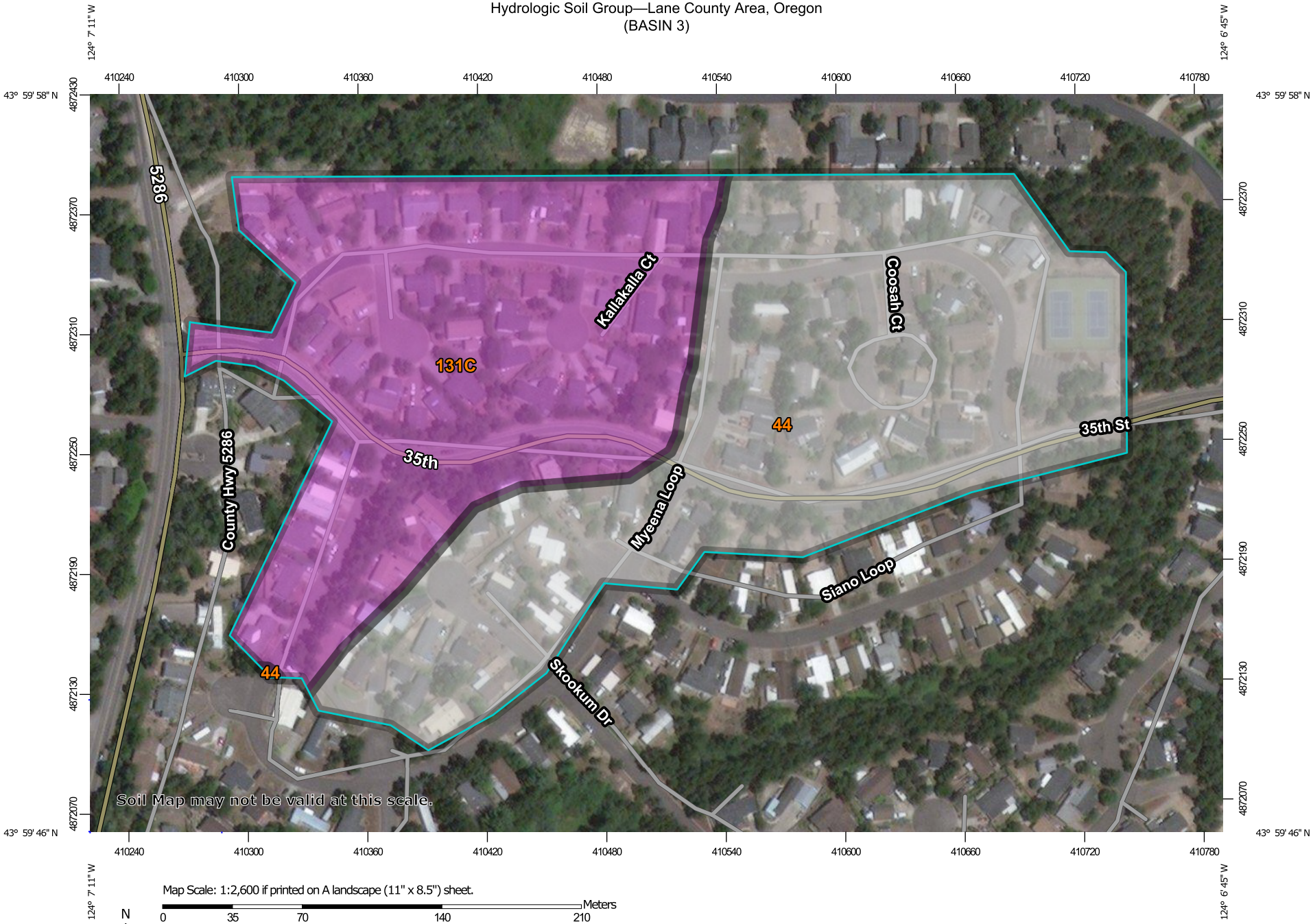
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group—Lane County Area, Oregon
(BASIN 3)



Map Scale: 1:2,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

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Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
44	Dune land		12.1	54.9%
131C	Waldport fine sand, 0 to 12 percent slopes	A	9.9	45.1%
Totals for Area of Interest			**22.0**	**100.0%**

Description

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.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group—Lane County Area, Oregon
(BASIN 4)

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.

Warning: Soil Map may not be valid at this scale.

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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)

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Survey Area Data: Version 16, Sep 10, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	A	2.7	10.7%
140	Yaquina loamy fine sand	A/D	22.2	89.3%
Totals for Area of Interest			**24.8**	**100.0%**

Description

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:

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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.

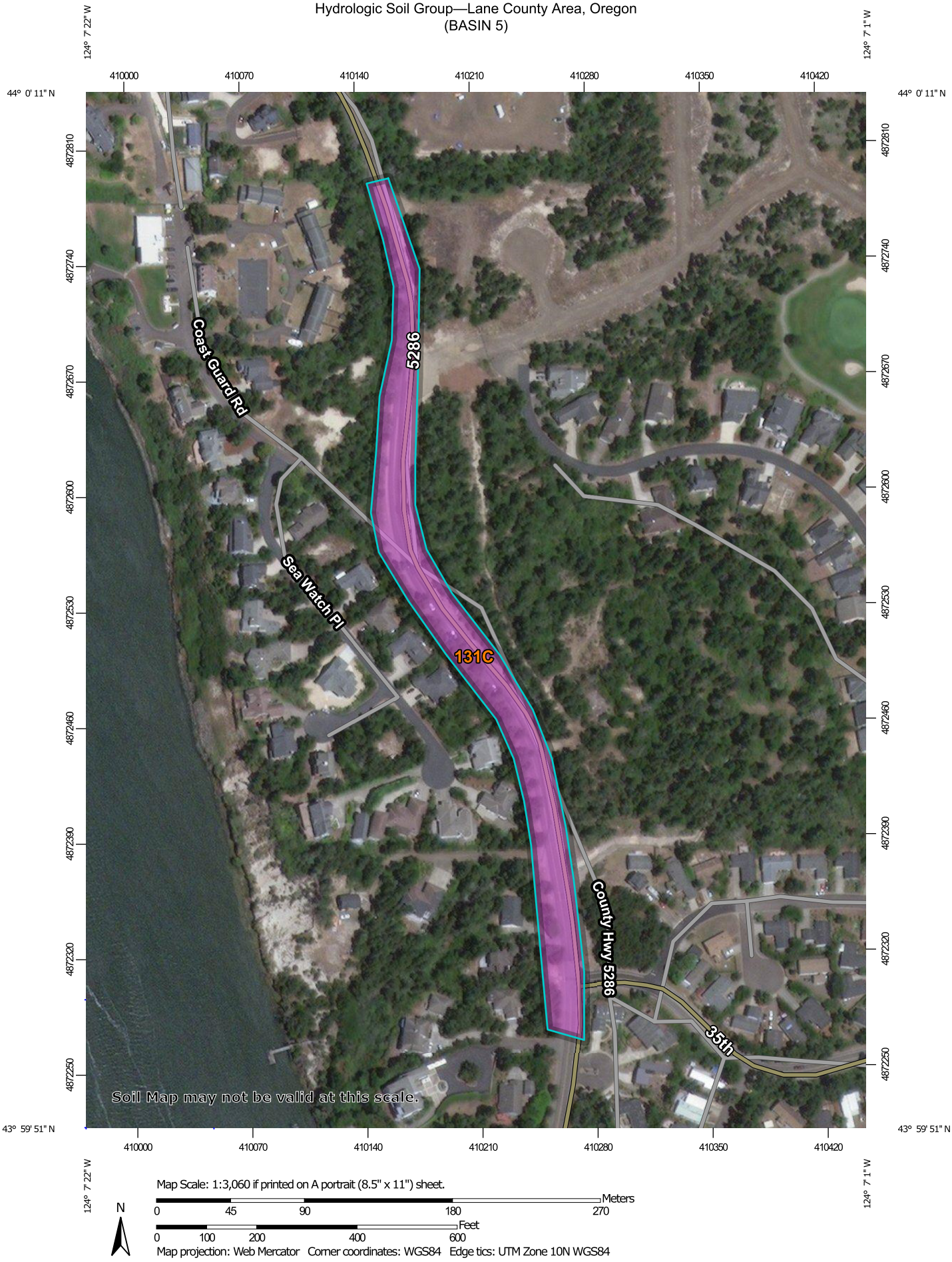
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group—Lane County Area, Oregon
(BASIN 5)



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

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Lane County Area, Oregon
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Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	A	3.0	100.0%
Totals for Area of Interest			**3.0**	**100.0%**

Description

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:

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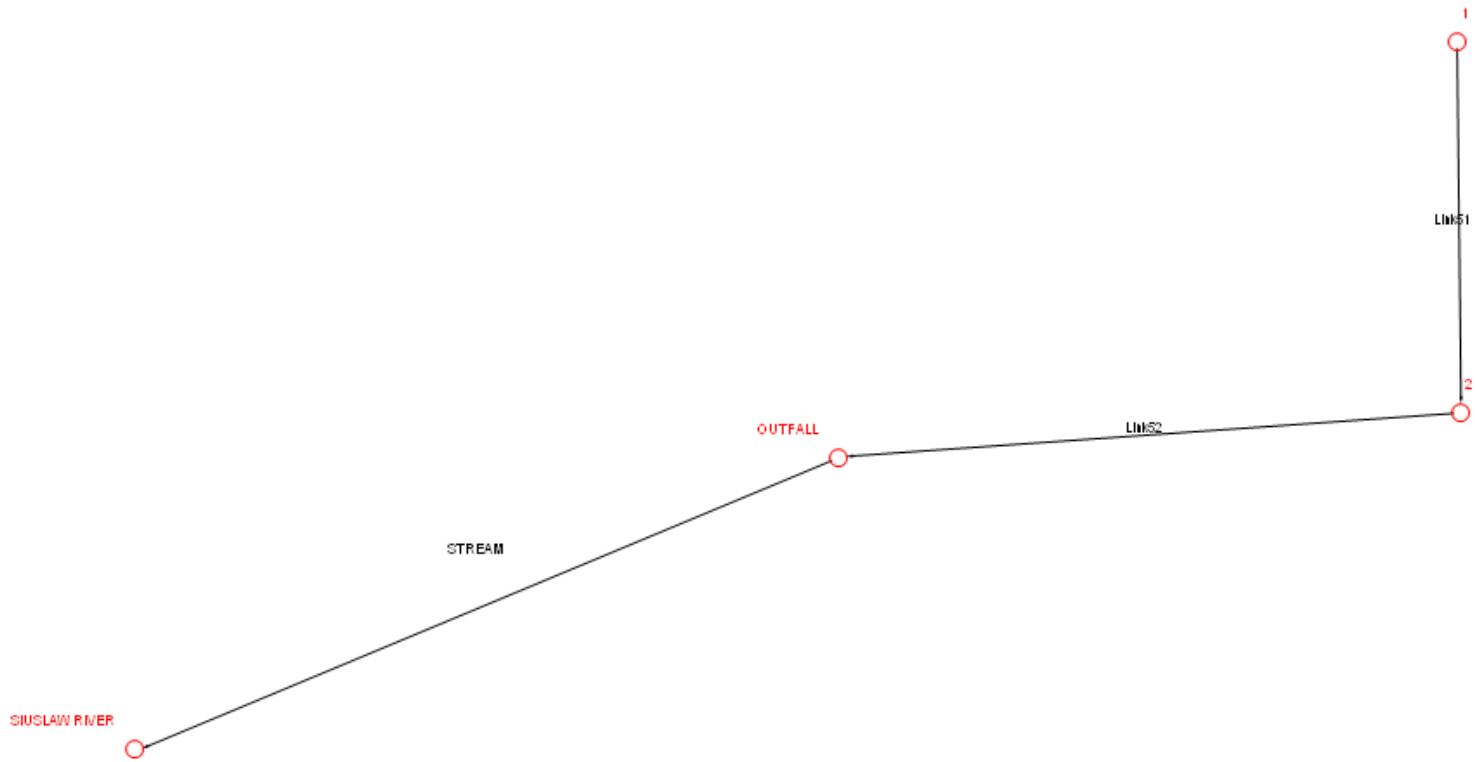
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Downstream Analysis – XPSTORM Hydraulic Layout



XPSTORM-RUNOFF DATA PROPOSED - 25 YR - STORM EVENT								
DOWNSTREAM ANALYSIS - FLORENCE MASTER PLAN								
Node Information					Runoff Information			
Node Name	Area	Impervious	Curve Number	Tc	Rainfall	Infiltration	Surface Runoff	
	acre	%		min.	in	in	in	cfs
1	40.43	45	66.3	45	5.06	1.26	3.80	43.71
	24.067	65	49.0	20				
	2.667	100	98.0	5				
	9.275	80	52.0	5				
2	20.882	65	49.0	20	5.06	2.065	3.00	12.63

XPSTORM-RUNOFF DATA PROPOSED - 100 YR - STORM EVENT								
DOWNSTREAM ANALYSIS - FLORENCE MASTER PLAN								
Node Information					Runoff Information			
Node Name	Area	Impervious	Curve Number	Tc	Rainfall	Infiltration	Surface Runoff	
	acre	%		min.	in	in	in	cfs
1	40.43	45	66.3	45	5.95	1.296	4.65	55.85
	24.067	65	49.0	20				
	2.667	100	98.0	5				
	9.275	80	52.0	5				
2	20.882	65	49.0	20	5.95	2.163	3.79	16.35

XPSTORM CONVEYANCE DATA - PROPOSED CONDITIONS (25-YEAR STORM EVENT)

DOWNSTREAM ANALYSIS - FLORENCE MASTER PLAN

Location			Conduit Properties			Conduit Results						Conduit Profile							
Link	Station																		
	From	To	Diameter	Length	Slope	Design Capacity	Qmax/ Qdesign	Max Flow	Max Velocity	Max Flow Depth	y/d0	US Ground Elev.	DS Ground Elev.	US IE	DS IE	US Freeboard	DS Freeboard	US HGL	DS HGL
			ft	ft	%	cfs		cfs	ft/s	ft		ft	ft	ft	ft	ft	ft	ft	ft
Link51	1	2	3.00	33.00	12.3	234.24	0.19	43.70	16.89	1.54	0.51	57.18	58.23	53.30	49.23	3.00	7.46	54.18	50.77
Link52	2	OUTFALL	3.00	67.00	2.6	108.41	0.52	56.35	15.49	1.54	0.51	58.23	54.00	49.23	33.77	7.46	18.60	50.77	35.40
STREAM	OUTFALL	SIUSLAW RIVER	CHANNEL	620.00	5.1	22303.77	0.00	55.99	6.56	1.63	0.08	54.00	35.00	33.77	0.00	18.60	33.38	35.40	1.62

XPSTORM CONVEYANCE DATA - PROPOSED CONDITIONS (100-YEAR STORM EVENT)

DOWNSTREAM ANALYSIS - FLORENCE MASTER PLAN

Location			Conduit Properties			Conduit Results						Conduit Profile							
Link	Station																		
	From	To	Diameter	Length	Slope	Design Capacity	Qmax/ Qdesign	Max Flow	Max Velocity	Max Flow Depth	y/d0	US Ground Elev.	DS Ground Elev.	US IE	DS IE	US Freeboard	DS Freeboard	US HGL	DS HGL
			ft	ft	%	cfs		cfs	ft/s	ft		ft	ft	ft	ft	ft	ft	ft	ft
Link51	1	2	3.00	33.00	12.3	234.24	0.24	55.85	17.95	1.79	0.60	57.18	58.23	53.30	49.23	2.88	7.21	54.30	51.02
Link52	2	OUTFALL	3.00	67.00	2.6	108.41	0.67	72.22	16.42	1.79	0.60	58.23	54.00	49.23	33.77	7.21	18.41	51.02	35.59
STREAM	OUTFALL	SIUSLAW RIVER	CHANNEL	620.00	5.1	22303.77	0.00	71.78	6.98	1.82	0.09	54.00	35.00	33.77	0.00	18.41	33.23	35.59	1.77

GEOTECHNICAL REPORT

Branch ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

January 28, 2020

Ashlee Sorber
American Pacific International Capital
Via Email: asorber@apicincus.com

RE: GEOTECHNICAL ENGINEERING RECOMMENDATIONS AND SITE EVALUATION
FLORENCE HOUSING DEVELOPMENT – SITE A
RHODODENDRON DRIVE AND 35TH STREET
FLORENCE, OREGON
BRANCH ENGINEERING INC. PROJECT NO. 19-510

Pursuant to your authorization Branch Engineering Inc. (BEI) performed a geotechnical engineering investigation at the subject site for the proposed development of a multi-family residential apartment complex.

On December 17, 2019 ten (10) exploratory test pits were advanced using a metal tracked excavator to a maximum depth of 10-feet below ground surface (BGS). The subsurface soil conditions in the test pits were logged in accordance the USCS (Unified Soil Classification System) ASTM D2488 and field tests consisting of portable dynamic cone penetrometer (DCP) tests, and falling head infiltration tests were performed. The accompanying report presents the results of our site research, field exploration and testing, data analysis, our conclusions and geotechnical engineering recommendations for the project. The site is suitable for the planned development, provided the recommendations of this report are implemented in the design and construction of the project.

Sincerely,
Branch Engineering Inc.

REGISTERED PROFESSIONAL ENGINEER
#6,170
OREGON
SEPT 15, 1992
RONALD J. DERRICK

Ronald J. Derrick

Digitally signed by Ronald J. Derrick
Date: 2020.01.28 14:16:11 -08'00'

EXPIRES: 12/31/2021

Ronald J. Derrick, P.E., G.E.
Principal Geotechnical Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION **3**
1.1 Project and Site Description 3
1.2 Scope of Work 3
1.3 Site Information Resources 4

2.0 SITE SUBSURFACE CONDITIONS **4**
2.1 Site Soils 4
2.2 Ground Water 5

3.0 GEOLOGIC SETTING **5**
3.1 Seismic Site Classification 6

4.0 CONCLUSIONS **7**

5.0 RECOMMENDATIONS **7**
5.1 Site Preparation, and Foundation Subgrade Requirements 7
5.2 Engineered Fill Recommendations 8
5.3 Cut/Fill Slopes and Slope Stabilty 9
5.4 Lateral Earth Pressures and Friction Coeffecient 9
5.5 Drainage and Infiltration Testing 10
5.6 Soil Bearing Capacity 10
5.7 Settlement 11
5.8 Slabs-On-Grade 11
5.9 Pavement Design Recommendations 11
5.10 Wet Weather/Dry Weather Construction Practices 12

6.0 REPORT LIMITATIONS **12**

FIGURE 1 – Site Map

APPENDIX A – Test Pit Logs & Field Test Summaries, Infiltration Testing Data, Well Logs, USDA NRCS Soil Mapping

APPENDIX B – Geotechnical Specifications

1.0 INTRODUCTION

The subject site is located along and east of Rhododendron Drive in Florence, Oregon at latitude 44.000000° north and longitude 124.118365° west. The site consists of vacant land with 7 separate parcels totaling approximately 9.2-acres in size.

This report presents the results and findings of Branch Engineering, Inc. (BEI) field observations, testing, and research for the subject site. Our investigation included the evaluation of the subsurface conditions at the site to provide geotechnical recommendations for the design and construction of proposed residential buildings and site improvements for access and parking.

1.1 Project and Site Description

Our understanding of the project is a residential development consisting of multi-unit and detached housing units with associated site improvements such as utility installation, paved access roads, and parking is proposed. Access to the site is expected to be taken from Rhododendron Drive.

The site is surrounded by single-family residential development with Rhododendron Drive running roughly north-south along the western perimeter of the site and the Florence Golf Links golf course present behind adjacent single-family residences.

At the time of our visit, the site surface was covered with vegetation consisting of scattered shore pines, manzanita, salal, rhododendrons, and other vegetation typical of the Oregon Coast dune ecology. Several partially overgrown former driveways, or pathways were used to access the interior of the site. Review of historical photos available from Google Earth ™ indicate that in the 1990's the site was used as an RV park/campground. During our site visit we observed several areas of debris indicating the site had been used for dumping household waste items, and in other areas trash from unauthorized camp sites was observed. Water and wastewater pipes from the former RV park were observed in various locations on the site and there is potential for slabs or septic tanks to remain buried on the property. Areas of undocumented sand fill are also likely to be encountered during site clearing activities.

The site topography is relatively flat, with elevations ranging from 58-feet to 67-feet above sea level. Several swales, or drainage ditches were observed on the southeastern portion of the site and the northwestern portion of the site, north of an existing driveway from Rhododendron Drive. The southeastern drainage features appear to be part of an existing surface drainage pattern transporting surface runoff from the adjacent Wisteria at Sandpines development across the southern portion of the site to a recently (2015 +/-) constructed drainage swale and box culvert crossing Rhododendron Drive to the west.

1.2 Scope of Work

Our scope of work included a site reconnaissance and subsurface investigation on December 17, 2019. Ten (10) exploratory test pits were advanced at the locations shown on the attached Figure-1 Site Exploration Map with the observed soil stratigraphy classified in accordance with the American Society of Testing and Materials (ASTM) Method D-2488.

A portable dynamic cone penetrometer which consists of graduated steel rods driven into the soil by dropping a 35-lb slide hammer a vertical distance of 18-inches was used to assess the consistency of the site soil at select locations and depths in the test pits.

In addition to the exploratory test pits, three (3) Falling Head Infiltration Tests were performed at the locations shown on the attached Figure-1 with results summarized below and field data attached.

Field log summaries of the site exploratory test pits, including field test results, are presented in Appendix A. Also included in Appendix A are copies of nearby well logs from the Oregon Department of Water Resources on-line database, and the soil survey mapping of the site. Field and laboratory test results are summarized on the test pit log summaries.

1.3 Site Information Resources

The following site investigation activities were performed and literature resources were reviewed for pertinent site information:

- Review of the United States Department of the Interior Geological Survey (USGS) 2017 Mercer Lake, Oregon Quadrangle Map and the 2017 Florence, OR Quadrangle Map.
- Ten exploratory test pits were advanced to a maximum depth of 10-feet below ground surface (BGS), and three Falling Head Infiltration Tests were performed on the site at the approximate locations shown on Figure-1.
- Review of the Lane County area Web Soil Survey, United States Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS), see Appendix A.
- Review of the USGS Geologic Map of Oregon, (USGS 1991, Walker & MacLeod).
- Review of Oregon Department of Water Resources Well Logs from nearby locations, see Appendix A.
- Review of DOGAMI online hazard view for the subject site vicinity.

2.0 SITE SUBSURFACE CONDITIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they presently exist and assume the exploratory test pit excavations, presented in Appendix A, are representative of the subsurface conditions throughout the site. If, during construction, subsurface conditions differ from those encountered in the exploratory test pits; BEI requests that we be informed to review the site conditions and adjust our recommendations, if necessary.

2.1 Site Soils

The NRCS Web Soil Survey maps two soil units across the site area; Waldport fine sand, 0 to 12 percent slopes and Waldport fine sand is mapped across the majority of the site area with Yaquina

loamy fine sand mapped across the northeast portion of the site. Both soil units are described as well drained fine grain eolian sand.

In the exploratory test pits, medium dense, tan, moist, fine grain sand was observed underlying existing topsoil, or root zones. In several test pits, clayey gravel fill was observed near the ground surface which we attribute to previous development on the site. Sidewall caving was observed as excavation depths increased below approximately 3-feet to 5-feet BGS.

Blow counts recorded during DCP testing at depths from 3-feet to 4-feet BGS indicate a loose consistency of the sand which becomes medium dense with depth.

2.2 Ground Water

No groundwater was observed in the exploratory test pits which were advanced to a maximum of 10-feet BGS or to about a bottom elevation of 50-feet (mean sea level) MSL. Well logs from nearby sites were obtained from the Oregon Water Resources Department and list static water levels at 6.2-feet and 21-feet BGS, see attached logs. Variations in the depth to water is typical in stabilized dune environments with raised dunal areas and deflation zones with water closer to the surface. Historically the subject site had received more surface and near surface water flow before up slope development to the north and west have collected and diverted stormwater away from the site. Ponds remain on the golf course property that also retain water.

We expect that ground water levels (from the regional water table or perched lenses) will fluctuate with the seasons and should be expected to be highest during the late winter and spring months when rainstorms are more intense and frequent, and soils are near saturation. Due to the presence of relatively clean sand on the site, it is likely well drained with remnants of surface water channels in the southeast are of the site.

The presence of ground water is not expected to impact the proposed development, provided the recommendations of this report are implemented in the design and construction of the project. Perched lenses of water may be encountered but impacts can be mitigated by the recommendations within this report. If excavations do encounter the static water table dewatering measures will be required for work such as utility installation below the water table elevation.

3.0 GEOLOGIC SETTING

The 1991 Geologic map of Oregon by Walker and MacLeod maps the site geology as dune sand. The subject site is located near the northern extent of the longest coastal strip of dunes on the Oregon Coast. The dunes in the area were likely formed post ice-age during the Holocene epoch by eolian processes associated with the activity of wind. The typical pattern seen in the area is transverse dunes (running parallel to the ocean) caused by the varying on, and off shore winds. The area is mapped as sedimentary deposits of the Holocene and or Pleistocene, unconsolidated to poorly consolidated eolian sands. The subject site is underlain by Holocene-aged sedimentary deposits of unconsolidated to poorly consolidated fine-grained sands.

The site is located on the Oregon Coast, the entire Oregon Coast is located near the Cascadia Subduction Zone, which is a zone of converging tectonic plates that historically produces major

earthquake events, a depiction of the historical Subduction Zone earthquake events is shown below.

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes

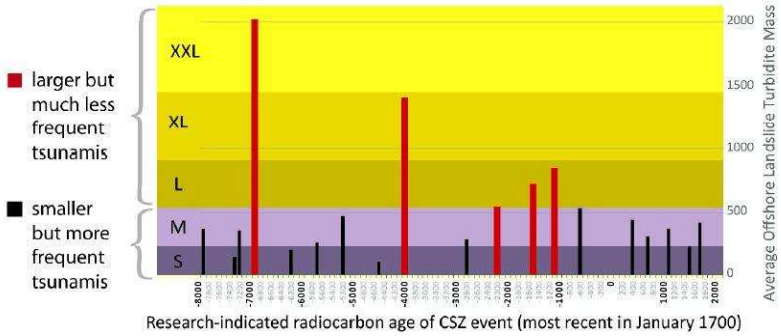


Figure 3: This chart depicts the timing, frequency, and magnitude of the last 19 great Cascadia Subduction Zone events over the past 10,000 years. The most recent event occurred on January 26, 1700. The 1700 event is considered to be a "medium sized" event. The data used to create this chart came from research that examined the many submarine landslides, known as "turbidites," that are triggered only by these great earthquakes (Witter and others, 2011). The loose correlation is "the bigger the turbidite, the bigger the earthquake."

3.1 Seismic Site Classification

Based on the soil properties encountered in our site pits and on-site well log information, Site Class D (Table 20.1-1 ASCE 7) is recommended for the medium dense sand encountered in the test pits. Pursuant to the 2019 Oregon Structural Specialty Code the following potential geologic and seismic hazards are addressed.

- Slope Instability: The site topography is relatively flat with isolated high and low areas typical of stabilized dune topography. Our review of the online Department of Geologic and Mining Industries (DOGAMI) hazard viewer does not map any areas of high landslide hazard risk, or existing landslides in the vicinity of the site, or in a location that may affect the site. Provided the earthwork recommendations in this report are incorporated into design and construction of the project the risk of landslides impacting the site is low.

- Liquefaction: Near surface sands are loose and susceptible to liquefaction and settlement if saturated at the time of a seismic event; however, based on our investigation findings and review of area well logs, it appears that the high ground water level is at least 10-feet below most areas of the site, at or below an elevation of 50-feet MSL. The sand at this depth becomes a medium dense consistency. Based on an anticipated lateral acceleration of 0.4g in the event of CSZ earthquake resulting in a cyclic stress ratio of 0.26 the sands within 20-feet BGS, liquefaction may occur (Boulanger & Idriss, University of California, Davis 2014) in saturated conditions; however, the risk of ground surface effects due to liquefaction are considered to be low. The potential from tsunami and ground shaking at the site in the event of a CSZ earthquake are considered to be the primary potential site impacts.

- There are no known active faults on the site, other normal faults are mapped in the hills in the site vicinity, however, these faults are not known to be active. The risk of surface rupture is low.

- There are no abrupt changes in ground elevation on or near the site that would present a potential for lateral spreading to occur during a seismic event; the risk for lateral spread on the site is low, provided any embanked fill on the site is constructed per the recommendations in this report.

4.0 CONCLUSIONS

Based on our field observations, subsurface explorations, and data analyses, we conclude that the site is geologic and geotechnically suitable for the proposed development provided that the recommendations of this report are incorporated into the design and construction of the project. Our investigation did not reveal any specific site features or subsurface conditions that would impede the proposed design and construction of the project. We conclude that no further geotechnical analysis is required on the subject site for the proposed site improvements.

5.0 RECOMMENDATIONS

The following sections present site-specific recommendations and design parameters for site preparation, drainage, foundations, utility excavations, and slab/pavement design. General material and construction specifications for the items discussed herein are provided in Appendix B.

The subsurface conditions observed in our site investigation are consistent; however, our field explorations only represent a very small portion of the site. Should loose or unsuitable soils extend to a depth greater than that described herein, or areas of distinct soil variation be discovered, this office shall be notified to perform site observation and additional excavation may be required.

5.1 Site Preparation and Foundation Subgrade Requirements

The following recommendations are for earthwork in the building foundation areas, roadways, and parking areas. Earthwork shall be performed in general accordance with the standard of practice as described in Appendix J of the 2019 Oregon Structural Specialty Code and as specified in this report.

All areas intended to directly or laterally support structures or roadways shall be stripped of vegetation, organic soil, unsuitable fill, and/or other deleterious material. These stripping's shall be removed from the site or reserved for use in landscaping or non-structural areas. Once subgrade is exposed, expected to be loose to medium dense sand, the recommended subgrade preparation is as follows:

Foundation Subgrade Preparation
In areas of foundation footings, organic topsoil and loose sand shall be removed to consistently medium dense sand either for the placement of foundation forms or structural fill. Upon excavation to suitable subgrade, the subgrade shall be wetted and rolled with a vibratory smooth drum roller until no additional visual settlement of the subgrade is detected. Conventional strip and spread footings may be used for the foundation system of the proposed structures.

Foundation footings shall be placed at least 5-feet from the competent face of downward slopes below footings.

If footings are not constructed immediately upon subgrade preparation, we recommend that the subgrade be covered with a minimum of 3-inches of compacted aggregate to mitigate wind and water erosion. After construction of footings, the perimeter of the footings shall be protected from erosion to mitigate undermining of footings. If structural fill is required to raise subgrade elevations, the fill shall conform to the recommendations in Sections 5.2 below.

Pavement Subgrade Preparation
In areas of pavement for vehicle access or parking, we recommend that the existing vegetation, topsoil, and areas of loose soil be removed to consistent subgrade material as described above. The expected depth of excavation to the subgrade material described above is approximately 10- to 16-inches. Upon excavation to suitable subgrade, the subgrade shall be wetted and rolled with a vibratory smooth drum roller until no additional visual settlement of the subgrade is detected. Fill placed to raise pavement subgrade elevations shall be placed on suitable subgrade, and conform to the recommendations below. We recommend that a minimum of 6-inches of compacted aggregate be placed on the subgrade in light vehicle pavement areas. Heavy construction traffic will require additional aggregate thickness, a minimum of 12-inches, to mitigate rutting of the subgrade.

During subgrade excavation in foundation and pavement areas we recommend the Geotechnical Engineer of Record, or designated representative visit the site to observe the subgrade material prior to placement of structural fill or aggregate.

5.2 Engineered Fill Recommendations

All engineered fill placed on the site shall consist of homogenous material and shall meet the following recommendations. Clean, native sand is suitable for use as structural fill material.

- Areas of structural fill placement shall be stripped of organic material, loose soil, and subgrade approved by the Geotechnical Engineer prior to the placement of fill materials. Sloped areas in excess of 20% shall be properly keyed and benched horizontally into competent material as the fill height progresses. Proof-rolling or hand-probing of the subgrade may be required to assess competence.

- Prior to placement, fill material shall be approved by the Geotechnical Engineer. Acceptable fill shall be free of organics or other deleterious materials. The sand present on the site is acceptable for use as engineered fill upon removal of any organic material.

- The fill shall be moisture conditioned within 2% +/- of optimum moisture content and compacted in lifts with loose lift thickness not exceeding 8- inches with appropriate equipment for the fill material.

- Periodic visits to the site to verify lift thickness, source material, and compaction efforts shall be conducted by the Geotechnical Engineer or designated representative and documented.

- The recommended compaction level for engineered fill is 90% of ASHTO T-180/ASTM 1557-D (modified Proctor) unless otherwise specified. Compaction shall be measured by testing with nuclear densometer ASTM D-6938, or D-1556 sand cone method. If compaction testing by nuclear densometer is not possible due to the nature of the approved fill material, proof rolling with a fully loaded 10 CY dump truck observed by the Geotechnical Engineer or designated representative shall be conducted.

5.3 Cut/Fill Slopes

Fill slopes may be constructed up to a slope of 2:1 (H:V) and should be protected from erosion. See the attached Figure 2, Fill Slope Detail, for benching and drainage details. Fill shall be placed on subgrade consisting of level benches excavated through near surface topsoil or other unsuitable subgrade materials. All fill slopes in excess of 5 feet in height shall contain a keyway as shown on Figure 2. Temporary cut slopes may be excavated up to 1.5:1 (H:V) in steepness. but permanent slopes shall not exceed 2:1. All slopes shall be protected from erosion by timely placement of vegetation, or other means, and runoff should not be allowed to flow down the face of slopes.

Cut and/or fill slopes shall be no steeper than 2:1 and shall be compacted to their outer edge by either back rolling or being over built and cut to grade. All slopes shall be protected with erosion control measures and surface water shall not be allowed to drain over the top of a slope. Foundations shall be placed such that there is at least 5 lateral feet from the face of slope or outside a 1:1 plane projected from the toe of slope; whichever is greater.

5.4 Lateral Earth Pressures and Friction Coefficient

The following equivalent fluid pressure parameters can be used for design of site retaining structures that are free draining with no hydrostatic pressures.

Table-1 Lateral Earth Pressures

Material	Passive Earth Pressure (Kp)*1	Active Earth Pressure (Ka)*3	At-Rest Earth Pressure (Ko)*2
Sand (Level Backfill)	250 pcf	30 pcf	45 pcf
Sand (2:1 Backfill Slope)	250 pcf	40 pcf	55 pcf

*1 – Neglect upper foot of material unless covered by footing or pavement.
*2 – For walls restrained at the top from movement
*3 – For seismic design increase Ka by 0.7 of the peak ground acceleration (PGA) and apply at 0.4H above the base of the wall, where H is the wall height.

The coefficient of friction for concrete poured neat against undisturbed or compacted sand subgrade is 0.45 and 0.5 may be used for concrete poured on a minimum of 12-inches of compacted aggregate.

5.5 Drainage & Infiltration Testing

An on-site storm drainage system is expected to be engineered for this project. Three encased falling head infiltration tests were performed on December 17, 2019. Infiltration tests were conducted with 6-inch diameter pipes set and sealed in native soil. Infiltration test locations are shown on the attached Figures 1. The recorded field test measurements are provided in Appendix A. No factor of safety has been applied to the measured rates of vertical hydraulic conductivity.

Test Location	*Test Depth (Inches)*	*Measured Hydraulic Conductivity, k (in/hr)*
IT-1	54	92
IT-2	54	49
IT-3	56	80

Alteration of existing grades for this project will likely change drainage patterns but should not adversely affect adjacent properties. We recommend that areas of structural fill be evaluated to ensure proper drainage away from structures is maintained. Accumulation of drainage near structural fills may result in saturation and softening of material. Final perimeter landscape grades shall slope away from the foundation and surface water shall not be allowed to pond adjacent to foundations.

5.6 Soil Bearing Capacity

Based on our site observations and review of proposed building plans, conventional spread footings or continuous strip footings are suitable for the proposed site development provided the building pad area preparation is in conformance with the recommendations described above in Section 5.1. The allowable bearing capacity for foundation elements placed on undisturbed sand subgrade or prepared structural fill is 1,500 psf. The allowable bearing capacity may be increased by 1/3 for short-term loading such as wind and seismic.

Additionally, structural fill should extend laterally, from all foundation edges, a minimum distance or 5-feet or within a 1:1 plane from at least 1-foot outside the edge of footing. Perimeter landscape grades shall be sloped away from all foundations and water should not be allowed to pond within 10-feet of footings.

The following recommendations shall be implemented in the design and construction of the project. Periodic site observations by a geotechnical representative of Branch Engineering, Inc. are recommended during the construction of the project. The specific phases of construction that should be observed are:

Table 3:

Recommended Construction Phases to be Observed by the Geotechnical Engineer	
Phase	*Observation*
At completion of street excavation	Subgrade observation by the geotechnical engineer before fabric and aggregate placement.
Imported fill material	Observation of material or information on material type and source.
Placement or compaction of fill material	Observation by geotechnical engineer or test results by qualified testing agency.

5.7 Settlement

The maximum building foundation loads are estimated to be less than 1.5 kip/linear foot for wall loads and/or 3 kips for column loads. Site-specific consolidation testing was not performed; however, based on soil observations and test results in similar soil conditions, the estimated total settlement at the site is not expected to exceed 0.75-inches with a differential settlement up to 0.5-inches over a span of 20 feet. The settlement estimates are based on the building load effects and area expected to occur over a short-term, generally by the time construction is completed. These settlement estimates do not account for seismic induced settlement, which may be as much as 2+ inches, but is expected to be relatively uniform across a building footprint. Foundations should be placed a minimum distance from each other to prevent overlapping of stress distributions defined as a 1:1 (H:V) slope projection from all foundation edges to a minimum depth of two (2) times the foundation width of the largest footing.

5.8 Slabs-On-Grade

After site preparation to expose suitable subgrade prepared in accordance with Section 5.1, load bearing concrete slabs shall be underlain by a compacted sand subgrade or leveling course of compacted, crushed aggregate, if necessary. A modulus of subgrade reaction of 150 pci may be used for design of slabs on approved native subgrade material or structural fill. Non-load bearing slabs or pavements do not require geotechnical design criteria; however, BEI recommends a stable subgrade to mitigate un-controlled cracks. The edges of slabs shall be protected from erosion and undermining of the slab; a vapor barrier system shall be selected by the project architect and may be dependent on slab cover materials.

5.9 Pavement Design Recommendations

The estimated California Bearing Raito (CBR) for the near surface loose sand is 3 based on blow count correlations; however, once the pavement section subgrade is exposed and compacted, the consistency of the sand can typically be increased to at least medium dense to depths of at least 3-feet thereby increasing the CBR of 8, which is a “Fair” classification. Our recommendations used the guidance of the 1993 AASHTO Guide for Design of Pavement Structures, the 2003 revised Asphalt Pavement Design Guide, published by the Asphalt Pavement Association of Oregon, and the 2019 ODOT Pavement Design Guide as well as results from engineered structural pavement sections developed for sites with similar soils and anticipated traffic loads. Based on an estimated

equivalent 18-kip single axle loading (ESAL) of 50,000 over 20-years, a subgrade resilient modulus of 5000 psi, and 90% reliability, a Structural Number of 3.0 has been used for design of the pavement sections for the driveway portions of the site. Pavement may consist of 4-inches of Asphalt Concrete (AC) over 12-inches of base aggregate. The above section is recommended for areas of anticipated heavy traffic, including refuse, delivery, and furniture moving trucks. In areas that will be restricted to light passenger vehicle travel or parking, the recommended pavement section can be reduced to 3-inches of AC pavement over 8-inches of base aggregate. A geotextile separation fabric is recommended in wet areas where pumping of the sand may cause intrusion into the base aggregate.

A bi-axial geogrid system may be used to reduce base aggregate thicknesses, if necessary, for design grades. The surface must then be smooth and free of obstructions, depressions, and debris. Geogrid placement must be in accordance with 2018 ODOT Standard Specifications 00331.41. The aggregate size atop the geogrid shall not exceed 1.5-inches.

The above recommended structural pavement sections are designed for the type of vehicle use on the site after construction completion, not for construction vehicle traffic which is generally heavier, occurs over a short time, and impacts the site before full pavement sections are constructed. The construction traffic may cause subgrade failures and the site contractor should consider over-building designated haul routes through the site to mitigate soft areas at the time of final paving.

5.10 Wet Weather/Dry Weather Construction Practices

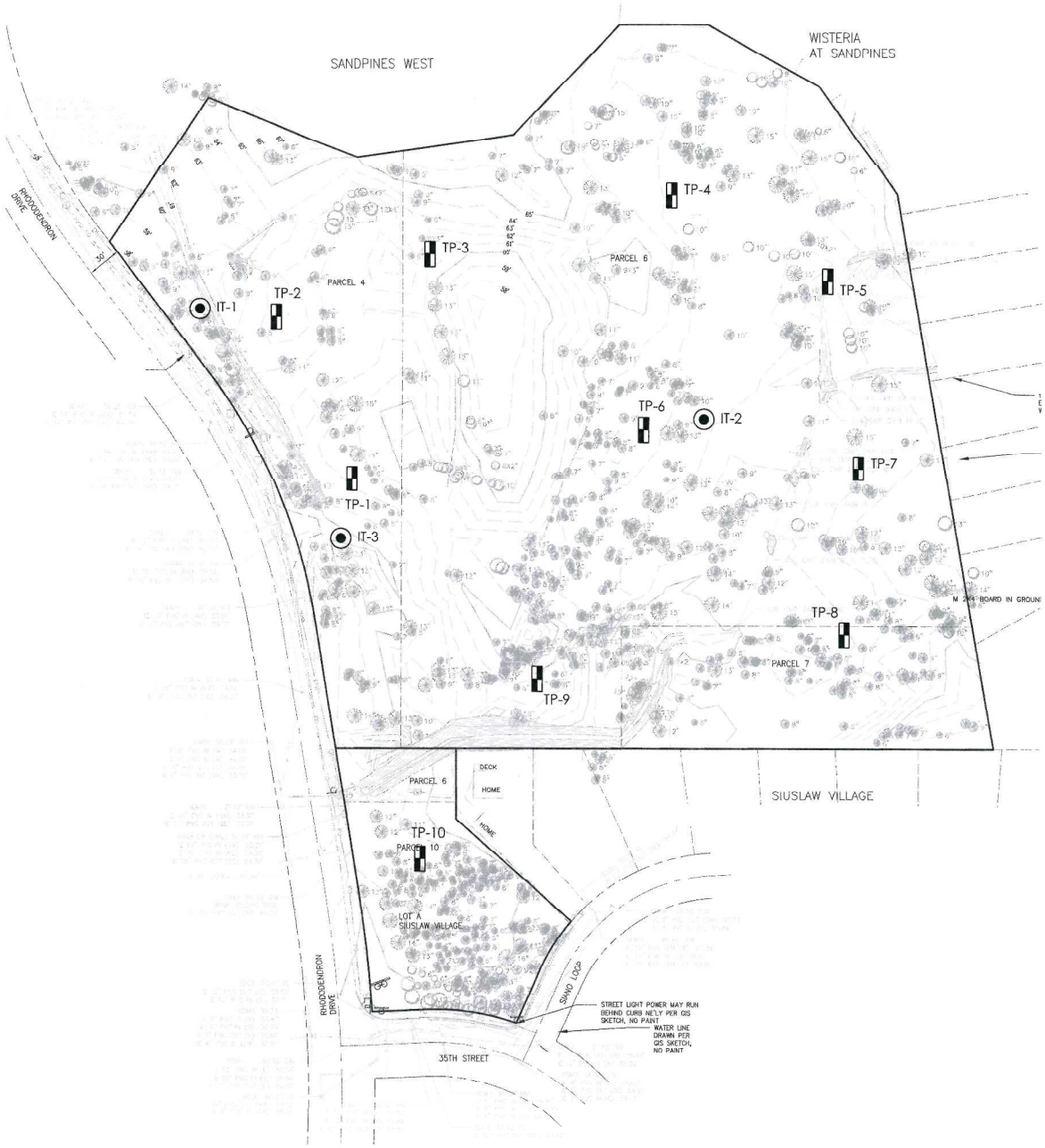
The site material is sand to depths over 70-feet and is relatively free-draining. Precipitation will not adversely impact site earthwork; however, high groundwater levels during the wet season may impact site trenching activities and cause “pumping” of the subgrade with repeated heavy vehicle traffic. Dewatering and/or shoring of excavation sidewalls may be required during construction. Construction traffic routes should have a minimum of 12-inches of aggregate, with preferably 3-inch minus angular aggregate in the lower 8-inches of the temporary road section to mitigate subgrade degradation during wet weather conditions. Final design pavement sections and foundation subgrade recommendations do not account for repeated heavy truck traffic associated with construction.

6.0 REPORT LIMITATIONS

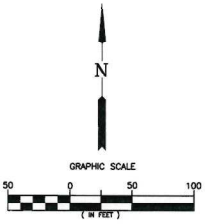
This report has presented BEI’s site observations and research, subsurface explorations, geotechnical engineering analyses, and recommendations for the proposed site development. The conclusions in this report are based on the conditions described in this report and are intended for the exclusive use of American Pacific International Capital and their representatives for use in design and construction of the development described herein. The analysis and recommendations may not be suitable for other structures or purposes.

Services performed by the geotechnical engineer for this project have been conducted with the level of care and skill exercised by other current geotechnical professionals in this area. No warranty is herein expressed or implied. The conclusions in this report are based on the site conditions as they currently exist and it is assumed that the limited site locations that were

physically investigated generally represent the subsurface conditions at the site. Should site development or site conditions change, or if a substantial amount of time goes by between our site investigation and site development, we reserve the right to review this report for its applicability. If you have any questions regarding the contents of this report please contact our office.



SITE SURVEY DRAWING PROVIDED BY S&F LAND SERVICES, 2019



LEGEND

TP-4 — INDICATES APPROXIMATE LOCATION OF EXPLORATORY TEST PIT EXCAVATION

IT-1 — INDICATES APPROXIMATE LOCATION OF INFILTRATION TEST

Branch ENGINEERING Inc
Since 1977

SCALE: 1:100 (11"x17")

SITE EXPLORATION MAP - APIC - FLORENCE SITE A

FLORENCE, OREGON

FIGURE-1

12-17-2019

PROJECT NO. 19-510

310 5th Street, Springfield, Oregon 97477 | p: 541.746.0637 | www.branchengineering.com

APPENDIX A:

- TEST PIT SUMMARIES
- DCP TEST LOGS
- INFILTRATION TESTING RESULTS
- OWRD WELL LOGS
- USDA SOIL SURVEY

RELATIVE DENSITY - COARSE GRAINED SOILS

RELATIVE DENSITY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)
VERY LOOSE	< 4	< 11	< 4
LOOSE	4 - 10	11 - 26	4 - 10
MEDIUM DENSE	10 - 30	26 - 74	10 - 30
DENSE	30 - 50	74 - 120	30 - 47
VERY DENSE	> 50	> 120	> 47

USCS GRAIN SIZE

FINES		< #200 (.075 mm)
SAND	Fine	#200 - #40 (.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
GRAVEL	Fine	#4 - 0.75 inch
	Coarse	0.75 - 3 inch
COBBLES		3 - 12 inches

CONSISTENCY - FINE GRAINED SOILS

CONSISTENCY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)	POCKET PEN. / UNCONFINED (TSF)	MANUAL PENETRATION TEST
VERY SOFT	< 2	< 3	< 2	< 0.25	Easy several inches by fist
SOFT	2 - 4	3 - 6	2 - 5	0.25 - 0.50	Easy several inches by thumb
MEDIUM STIFF	4 - 8	6 - 12	5 - 9	0.50 - 1.00	Moderate several inches by thumb
STIFF	8 - 15	12 - 25	9 - 19	1.00 - 2.00	Readily indented by thumb
VERY STIFF	15 - 30	25 - 65	19 - 31	2.00 - 4.00	Readily indented by thumbnail
HARD	> 30	> 65	> 31	> 4.00	Difficult by thumbnail

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GROUP SYMBOLS AND TYPICAL NAMES	
COARSE-GRAINED SOILS: More than 50% retained on No. 200 sieve	GRAVELS: 50% or more *retained* on the No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS: 50% or more *passing* the No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly-graded sands and gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS: Less than 50% retained on No. 200 sieve	SILT AND CLAY	LIQUID LIMIT LESS THAN 50	ML	Inorganic silts, rock flour, clayey silts.
			CL	Inorganic clays of low to medium plasticity, lean clays.
			OL	Organic silt and organic silty clays of low plasticity.
		LIQUID LIMIT 50 OR GREATER	MH	Inorganic silts, clayey silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat, muck, and other highly organic soil.

MOISTURE CONTENT

DRY: Absence of moisture, dusty, dry to the touch
DAMP: Some moisture but leaves no moisture on hand
MOIST: Leaves moisture on hand
WET: Visble free water, usually saturated

	PLASTICITY	DRY STRENGTH	DILATANCY	TOUGHNESS
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Med.	Med. to High	None to Slow	Medium
MH	Med. to High	Low to Med.	None to Slow	Low to Med.
CH	Med. to High	High to V.High	None	High

STRUCTURE

STRATIFIED: Alternating layers of material or color > 6mm thick.
LAMINATED: Alternating layers < 6mm thick.
FISSURED: Breaks along definate fracture planes.
SLICKENSIDED: Striated, polished, or glossy fracture planes.
BLOCKY: Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
LENSES: Has small pockets of different soils, note thickness.
HOMOGENEOUS: Same color and appearance throughout.

LIST OF ABBREVIATION & EXPLANATIONS

SPT Standard Penetration Test split barrel sampler
D&M Dames and Moore sampler
LL Atterberg Liquid Limit
PL Atterberg Plastic Limit
PP Pocket Penetrometer
VS Vane Shear
G Grab sample
MC Moisture Content
MD Moisture Density
UC Unconfined Compressive Strength

TABLE A-1

Branch ENGINEERING INC. Since 1997
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SURVEYING

Borehole ID: TP-1

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
1		(Fill) Loose, light brown, Sand with fine roots, slightly moist					
2		(Fill) Dark brown, Clayey Gravel, former road bed					
3		(SW) Medium dense, slightly moist, light tan, fine grain Sand, laminated structure, former dune					
4							
5							
6							
7							
8							
9							
10							
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SURVEYING

Borehole ID: TP-2

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type: 35 lb Slide Hammer
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(Fill) Compacted clayey crushed rock Aggregate over organic soil					
1–7		(SW) Tan, slightly moist, medium dense fine grain Sand, some sidewall caving	BAG	0			
8–30							

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SURVEYING

Borehole ID: TP-3

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(OL-SC) Organic Topsoil with roots to 3' below surface					
1–4		(SW) Light reddish brown, slightly moist, medium dense, fine grain Sand					
5–9		(SW) Fine grain Sand grades to tan color with sidewall caving					
10–30							

Branch ENGINEERING INC.
civil · transportation
structural · geotechnical
SURVEYING

Borehole ID: TP-4

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type: 35 lb Slide Hammer
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
1		(Fill) Dark Brown Silt and crushed rock Aggregate					
2		(Fill) Reddish brown, Silty Clay and crushed rock Aggregate					
3		(SW) Tan, slightly moist, medium dense, fine grain Sand, root zone at 48"					
4							
5							
6							
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Borehole ID: TP-5

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(Fill) Silty Clay with crushed rock Aggregate and roots					
1		(OL/OH Significant root zone					
2		(SW) Tan, slightly moist, medium dense, fine grain Sand					
3							
4							
5							
6							
7							
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Borehole ID: TP-6

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(OL-OH) Organic duff and leaf litter					
1		(SW) Reddish brown to tan, slightly moist, medium dense, fine grain Sand, roots extending to 24" below surface					
2							
3							
4							
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6							
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Borehole ID: TP-7

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(Fill) Dark brown Silty Clay and crushed rock Aggregate, trace roots					
1		(SW) Tan, slightly moist, medium dense, fine grain Sand, caving sidewalls at 24"					
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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30							

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Borehole ID: TP-8

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(Ol-OH) Organic duff and leaf litter					
1		(SW) Tan, slightly moist, medium dense, fine grain Sand, sidewall caving at 24" and roots to 48"					
2							
3							
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Borehole ID: TP-9

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(OL-OH) Organic duff and roots					
1		(SW) Tan, slightly moist, medium dense, fine grain Sand, roots to 24" below surface					
2							
3							
4							
5			BAG	0			
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Borehole ID: TP-10

Client: American Pacific International Capital
Project Name: Florence Housing Development - Site A
Project Number: 19-510
Project Location: 35th Street and Rhododendron Drive, Florence, Oregon
Date Started: Dec 17 2019 **Completed:** Dec 17 2019
Logged By: RJD **Checked By:** RJD
Drilling Contractor: Ray Wells Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Metal Tracked Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
		(OL-OH) Topsoil and roots					
1		(SW) Light brown, slightly moist, loose, fine grain Sand					
2		(SW) Tan, slightly moist, medium dense, fine grain Sand					
3							
4							
5							
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DYNAMIC CONE LOG

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PROJECT NUMBER: 19-510
DATE STARTED: 12-17-2019
DATE COMPLETED: 12-17-2019

HOLE #: TP-2
CREW: RJD
PROJECT: APIC Florence Site A
ADDRESS: Rhododendron Drive
LOCATION: Florence, Oregon

SURFACE ELEVATION: 64'
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
1 ft						
2 ft						
3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
1 m	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
4 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
5 ft						
6 ft						
2 m						
7 ft						
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

DYNAMIC CONE LOG

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PROJECT NUMBER: 19-510
DATE STARTED: 12-17-2019
DATE COMPLETED: 12-17-2019

HOLE #: TP-4
CREW: RJD
PROJECT: APIC Florence Site A
ADDRESS: Rhododendron Drive
LOCATION: Florence, Oregon

SURFACE ELEVATION: 63'
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
1 ft						
2 ft						
3 ft						
1 m	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
4 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
5 ft						
6 ft						
2 m						
7 ft						
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

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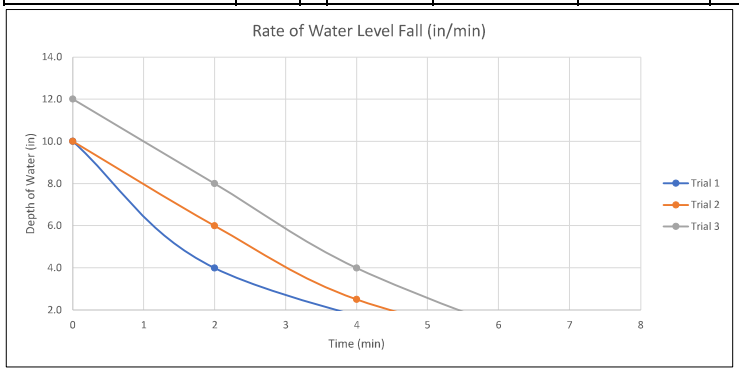
Infiltration Test Results

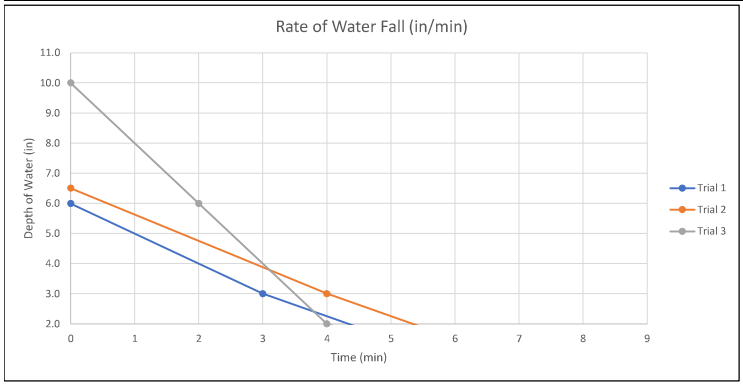
Project: American Pacific International Capital - Florence Site
Testing Date: December 17, 2019
BEI Project Number: 19-510
Test Type: Encased Falling Head Infiltration
Time = 0 at addition of H2O

Infiltration Test 1 Trial 1			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-1 (in/hr)**
Standpipe Diameter (in)	6		0	44.0	10.0			
Standpipe Height AGS (in)	0		2	50.0	4.0	3.00	180.0	
Test Depth BGS (in)	54		6	54.0	0.0	1.00	60.0	120.0
Volume of Water Added (gal)	1							
Clocktime at Start	12:08							
ASTM Soil Type	(SW)							
Infiltration Test 1 Trial 2			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-2 (in/hr)**
Volume of Water Added (gal)	1		0	44.0	10.0			
Clocktime	12:16		2	48.0	6.0	2.00	120.0	
			4	51.5	2.5	1.75	105.0	
			7	54.0	0.0	0.83	50.0	91.7
Infiltration Test 1 Trial 3			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-3 (in/hr)**
Volume of Water Added (gal)	1		0	42.0	12.0			
Clocktime	12:24		2	46.0	8.0	2.00	120.0	
			4	50.0	4.0	2.00	120	
			7	54.0	0.0	1.33	80.0	106.7



Reccomended Rate (in/hr)
92.0

Infiltration Test 2 Trial 1			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-1**
Standpipe Diameter (in)	6		0	48.0	6.0			
Standpipe Height AGS (in)	0		3	51.0	3.0	1.00	60.0	
Test Depth BGS (in)	54		7	54.0	0.0	0.75	45.0	52.5
Volume of Water Added (gal)	1							
Clocktime	13:09							
ASTM Soil Type	(SW)							
Infiltration Test 2 Trial 2			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**AVG Rate of Fall T-2**
Volume of Water Added (gal)	0.75		0	47.5	6.5			
Clocktime	13:17		4	51.0	3.0	0.88	52.5	
			8	54.0	0.0	0.75	45.0	48.8
Infiltration Test 2 Trial 3			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**AVG Rate of Fall T-2**
Volume of Water Added (gal)	1		0	44.0	10.0			
Clocktime	13:33		2	48.0	6.0	2.00	120.0	
			4	52.0	2.0	2.00	120.0	
			7	54.0	0.0	0.67	40.0	120.0

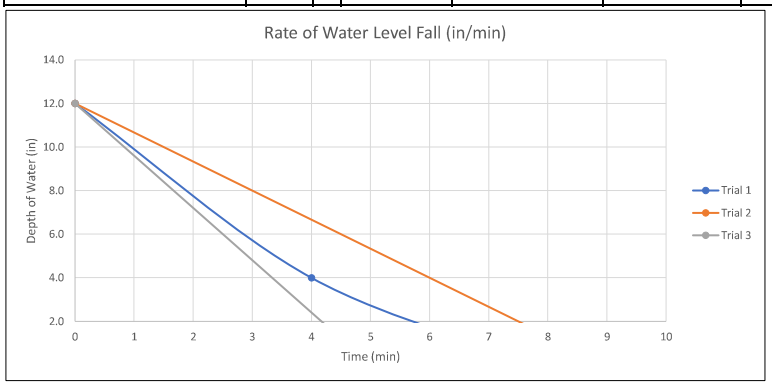


Reccomended Rate (in/hr)
49.0

Infiltration Test Results

Project: American Pacific International Capital - Florence Site
Testing Date: December 17, 2019
BEI Project Number: 19-510
Test Type: Encased Falling Head Infiltration
Time = 0 at addition of H2O

Infiltration Test 3 Trial 1			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-1 (in/hr)**
Standpipe Diameter (in)	6		0	44.0	12.0			
Standpipe Height AGS (in)	0		4	52.0	4.0	2.00	120.0	
Test Depth BGS (in)	56		8	56.0	0.0	1.00	60.0	90.0
Volume of Water Added (gal)	1							
Clocktime at Start	13:52							
ASTM Soil Type	(SW)							
Infiltration Test 3 Trial 2			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-2 (in/hr)**
Volume of Water Added (gal)	1		0	44.0	12.0			
Clocktime	14:01		9	56.0	0.0	1.33	80.0	80.0
Infiltration Test 3 Trial 3			**Elapsed Time (min)**	**Depth to Water Surface (in)**	**Depth of Water (in)**	**Rate of Fall (in/min)**	**Rate of Fall (in/hr)**	**Avg Rate of Fall T-3 (in/hr)**
Volume of Water Added (gal)	1		0	44.0	12.0			
Clocktime	14:11		5	56.0	0.0	2.40	144.0	144.0



Reccomended Rate (in/hr)
80.0

Replacement Log

RECEIVED

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

LANE 50937

DEC 1 1 1992

(START CARD) # 41065

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number 2

Name Florence Resort Community

Address 1050 35th St.

City Florence State OR Zip 97439

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:

☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger

☐ Other

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☒ Yes ☐ No Depth of Completed Well 105 ft.

Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
16"	0'	20'	Bentonite	0'	20'	24 sacks
12"	20'	108'				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12"	+2'	33'	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	10"	25'	45'	.250	☒	☐	☒	☐
	10"	95'	105'	.250	☒	☐	☒	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☒ Screens Type V-Wire Material Stainless

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
45'	95'	.008		12"	Tele	☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

well output may fluctuate

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
430	62		10.5 hrs.

Temperature of water 51° Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Lane Latitude Longitude

Township 18 S N or S Range 12 W E or W. WM.

Section 15 SW 1/4 SE 1/4

Tax Lot 800 Lot Block Subdivision

Street Address of Well (or nearest address) 1050 35th St. Florence, OR

(10) STATIC WATER LEVEL:

21 ft. below land surface. Date 9/23/92

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL
21	105	430	21

(12) WELL LOG:

Ground Elevation

Material	From	To	SWL
Sand brown	0	64	21
Sand to blue	64	105	21
Sand + blue clay	105	108	21

Date started 5/9/92 Completed 9/22/92

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 97

Signed [signature] Date 9/29/92

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

Replacement Log

LANE 50936

RECEIVED DEC 1 1 1995 WATER RESOURCES DEPARTMENT SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

(START CARD) # 41058

(1) OWNER: Well Number 1

Name Florence Resort Community

Address 1050 35th St.

City Florence State OR Zip 97439

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:

☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger

☐ Other

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☒ Yes ☐ No Depth of Completed Well 70.5 ft.

Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
16"	0'	9'	Bentonite	0'	9'	12 Sacks
12"	9'	70.5'				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12"	+2'	26'	.250	☒	☐	☒	☐
Liner:	10"	20.5'	25.5'	.250	☒	☐	☒	☐
	10"	65.5'	70.5'	.250	☒	☐	☒	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☒ Screens Type V. Wire Material Stainless

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
25.5'	65.5'	.008		12"	Tele	☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

well output may fluctuate

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
175	42'	—	12 hr.

Temperature of water 51° Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Lane Latitude Longitude

Township 18 S N or S Range 12 W E or W. WM.

Section 15 SW 1/4 SE 1/4

Tax Lot 800 Lot Block Subdivision

Street Address of Well (or nearest address) 1050 35th St. Florence, OR

(10) STATIC WATER LEVEL:

6.2 ft. below land surface. Date 7/30/92

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL
12	70	175	6.2

(12) WELL LOG:

Ground Elevation

Material	From	To	SWL
Sand	0	41	6.2
Sand w/ peat	41	47	6.2
sand lts blue	47	72	6.2
Steel plate welded on bottom			

Date started 4/26/92 Completed 9/22/92

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 97

Signed Date 9/29/92

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

Map Scale: 1:2,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2007—Sep 15, 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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
131C	Waldport fine sand, 0 to 12 percent slopes	10.4	92.5%
140	Yaquina loamy fine sand	0.8	7.5%
Totals for Area of Interest		**11.2**	**100.0%**

Lane County Area, Oregon

131C—Waldport fine sand, 0 to 12 percent slopes

Map Unit Setting

National map unit symbol: 234r
Elevation: 0 to 150 feet
Mean annual precipitation: 60 to 100 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 165 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Waldport and similar soils: 85 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waldport

Setting

Landform: Dunes
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sand of mixed origin

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
H1 - 3 to 8 inches: fine sand
H2 - 8 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 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 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Heceta

Percent of map unit: 4 percent

Landform: Interdunes
Hydric soil rating: Yes

Yaquina
Percent of map unit: 4 percent
Landform: Marine terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

Lane County Area, Oregon

140—Yaquina loamy fine sand

Map Unit Setting

National map unit symbol: 2359
Elevation: 20 to 130 feet
Mean annual precipitation: 70 to 80 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Yaquina and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yaquina

Setting

Landform: Dune slacks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sand of mixed origin

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 9 inches: loamy fine sand
H2 - 9 to 30 inches: fine sand
H3 - 30 to 60 inches: fine sand

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): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Forage suitability group: Somewhat Poorly Drained (G004AY017OR)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 16, Sep 10, 2019

APPENDIX B:

Recommended Earthwork Specifications

GEOTECHNICAL SPECIFICATIONS

General Earthwork

1. All areas where structural fills, fill slopes, structures, or roadways are to be constructed shall be stripped of organic topsoil and cleared of surface and subsurface deleterious material, including but limited to vegetation, roots, or other organic material, undocumented fill, construction debris, soft or unsuitable soils as directed by the Geotechnical Engineer of Record. These materials shall be removed from the site or stockpiled in a designated location for reuse in landscape areas if suitable for that purpose. Existing utilities and structures that are not to be used as part of the project design or by neighboring facilities, shall be removed or properly abandoned, and the associated debris removed from the site.

2. Upon completion of site stripping and clearing, the exposed soil and/or rock shall be observed by the Geotechnical Engineer of Record or a designated representative to assess the subgrade condition for the intended overlying use. Pits, depressions, or holes created by the removal of root wads, utilities, structures, or deleterious material shall be properly cleared of loose material, benched and backfilled with fill material approved by the Geotechnical Engineer of Record compacted to the project specifications.

3. In structural fill areas, the subgrade soil shall be scarified to a depth of 4-inches, if soil fill is used, moisture conditioned to within 2% of the materials optimum moisture for compaction, and blended with the first lift of fill material. The fill placement and compaction equipment shall be appropriate for fill material type, required degree of blending, and uncompacted lift thickness. Assuming proper equipment selection, the total uncompacted thickness of the scarified subgrade and first fill lift shall not exceed 8-inches, subsequent lifts of uncompacted fill shall not exceed 8-inches unless otherwise approved by the Geotechnical Engineer of Record. The uncompacted lift thickness shall be assessed based on the type of compaction equipment used and the results of initial compaction testing. Fine-grain soil fill is generally most effectively compacted using a kneading style compactor, such as a sheeps-foot roller; granular materials are more effectively compacted using a smooth, vibratory roller or impact style compactor.

4. All structural soil fill shall be well blended, moisture conditioned to within 2% of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. Soil fill shall not contain more than 10% rock material and no solid material over 3-inches in diameter unless approved by the Geotechnical Engineer of Record. Rocks shall be evenly distributed throughout each lift of fill that they are contained within and shall not be clumped together in such a way that voids can occur.

5. All structural granular fill shall be well blended, moisture conditioned at or up to 3% above of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. 95% relative compaction may be required for pavement base rock or in upper lifts of the granular structural fill where a sufficient thickness of the fill section allows for higher compaction percentages to be achieved. The granular fill shall not contain solid particles over 2-inches in diameter unless special density testing methods or proof-rolling is approved by the Geotechnical Engineer of Record. Granular fill is generally considered to be a crushed aggregate with a fracture surface of at least 70% and a maximum size not exceeding 1.5-inches in diameter, well-graded with less than 10%, by weight, passing the No. 200 Sieve.

6. Structural fill shall be field tested for compliance with project specifications for every 2-feet in vertical rise or 500 cy placed, whichever is less. In-place field density testing shall be performed by a competent individual, trained in the testing and placement of soil and aggregate fill placement, using either ASTM Method D-1556/4959/4944 (Sand Cone), D-6938 (Nuclear Densometer), or D-2937/4959/4944 (Drive Cylinder). Should the fill materials not be suitable for testing by the above methods, then observation of placement, compaction and proof-rolling with a loaded 10 cy dump-truck, or equivalent ground pressure equipment, by a trained individual may be used to assess and document the compliance with structural fill specifications.

Utility Excavations

1. Utility excavations are to be excavated to the design depth for bedding and placement and shall not be over-excavated. Trench widths shall only be of sufficient width to allow placement and proper construction of the utility and backfill of the trench.
2. Backfilling of a utility trench will be dependent on its location, use, depth, and utility line material type. Trenches that are required to meet structural fill specifications, such as those under or near buildings, or within pavement areas, shall have granular material strategically compacted to at least the spring-line of the utility conduit to mitigate pipeline movement and deformation. The initial lift thickness of backfill overlying the pipeline will be dependent on the pipeline material, type of backfill, and the compaction equipment, so as not to cause deflection or deformation of the pipeline. Trench backfill shall conform to the General Earthwork specifications for placement, compaction, and testing of structural fill.

Geotextiles

1. All geotextiles shall be resistant to ultraviolet degradation, and to biological and chemical environments normally found in soils. Geotextiles shall be stored so that they are not in direct sunlight or exposed to chemical products. The use of a geotextile shall be specified and shall meet the following specification for each use.

<u>Subgrade/Aggregate Separation</u>

Woven or nonwoven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	180 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	371 lb
• Elongation	ASTM Method D-4632	15%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.05 s^{-1}

<u>Drainage Filtration</u>

Woven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	110 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	220 lb
• Elongation	ASTM Method D-4632	50%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.5 s^{-1}

<u>Geogrid Base Reinforcement</u>

Extruded biaxially or triaxially oriented polypropylene conforming to the following physical properties:

• Peak tensile strength lb/ft	ASTM Method D-6637	925
• Tensile strength at 2% strain lb/ft	ASTM Method D-6637	300
• Tensile strength at 5% strain lb/ft	ASTM Method D-6637	600
• Flexural Rigidity	ASTM Method D-1388	250,000 mg-cm
• Effective Opening Size rock size	ASTM Method D-4751	1.5x

OPERATIONS & MAINTENANCE

(To be completed in the final design phase)

July 24, 2020

Branch ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

Ashlee Sorber
American Pacific International Capital
Via Email: asorber@apicincus.com

RE: GEOTECHNICAL EVALUATION OF GROUNDWATER HYDRAULICS
FLORENCE HOUSING DEVELOPMENT – SITE A
RHODODENDRON DRIVE AND 35TH STREET
FLORENCE, OREGON
BRANCH ENGINEERING INC. PROJECT NO. 19-510

Pursuant to your request, Branch Engineering Inc. (BEI) geotechnical engineering staff has collected information regarding the historic surface and subsurface flow of stormwater on and in the vicinity of the subject site (Site). The information contained herein is based on our geologic knowledge of the area, discussions with a long-time local excavation contractor, review of the December 2018 Stormwater Master Plan Update for the City of Florence, and discussions with City of Florence Public Works staff.

The Site, formerly a KOA campground prior to the year 2000, lies on the southern end of a north to south drainage path that begins in the open dune area north of Heceta Beach Road creating a series of shallow lakes between these open dunes and those located behind the Fred Meyer store on the north end of the Sand Pines Golf Course at which point the flow of water bends west towards the Siusalw River with various surface water outlets to the river and groundwater flow atop a cemented sand lense near low tide river level. It is our understanding the lakes within the golf course are lined manmade reservoirs.

Findings

Historically, several areas of Florence have experienced extended periods of standing surface water during times of heavily, sustained rainfall as is evidenced by conditions documented in 1996/1997 and 2016/2017. Continued improvements over the years by the City of Florence and developers have mitigated some of the high-water conditions, but it is our understanding that Federal agency oversight has limited the number of direct outfalls and flow volumes to the Siuslaw River requiring the implementation of detention/retention and infiltration systems to be employed.

Recent stormwater system improvements in the vicinity of the Site include:

- Construction of retention facilities in the Mariners Village development north of the Site;
- Installation of detention and flow control structures for stormwater in the Fairway Estates subdivision directly north of the Site; and

Exhibit F1

- Construction of the Siano Ditch and enhancement of Bud's Ravine on the south end of the Site to mitigate surface water that was directed onto the Site by development of the Sand Pines and Sand Pines West subdivision.

Our geotechnical site investigation in December 2019 did not encounter any groundwater the test pits that were excavated to a maximum depth of 10-feet below the surface grade nor was there oxidation staining of the sand that would indicate a fluctuating water level observed. No flowing surface water was present, although surface soil on the east side of the site, adjacent to the Sand Pines development, had a noticeably elevated moisture content and is believed to be yard and roof drain runoff from the adjacent houses.

The Site is currently forested with some remaining remnants of the former campground; since it appears that a majority of the surface water that had originally been diverted towards the Site has been mitigated, and the amount of precipitation falling on the Site cannot be controlled, we researched factors that may contribute to the pre- and post-development stormwater conditions. These factors include changes in vegetation cover and concentrated infiltration of stormwater from impervious surface areas. A United States Department of Agriculture[1] (USDA) study indicates tree canopies detain an average of 20% to 30% of the rainfall and that vegetation provides a reduction in water through transpiration. Modeling by the United States Geological Survey[2] (USGS) of groundwater mounding effects from concentrated infiltration basins indicates that mounding is most sensitive to the vertical hydraulic conductivity of the soil. Higher rates of infiltration show less mounding of groundwater levels in aquifers but increased lateral spread of the mounding effect. At the highest rate of infiltration modeled (5-inches/hour), with a design storm of 0.625-inches/hour and a 40% impervious cover over a 10-acre site, the maximum mounding height was 1.85-feet with a maximum extent of 185 feet for a mounding of 0.25-feet. Our previous infiltration testing on the Site showed rates of 49- to 92-inches/hour and the Site is located approximately 600-feet from the bank of the Siuslaw River.

Conclusions

Based on our research of the hydraulics of the Site and general vicinity we conclude the following:

- Recent stormwater improvements in the area of the Site have reduced the flow of surface water onto the site.

- The rate of stormwater detention and transpiration may change due to alteration of vegetative cover but estimation of quantity is beyond the scope of this evaluation.

- Groundwater mounding may occur as a result of concentrated infiltration of stormwater; however, the degree of mounding is expected to be negligible.

The proposed design for infiltration of Site stormwater is consistent with the area and local regulations, and does not appear it will have an adverse impact on the current subsurface flow of water on or offsite of the property.

Sincerely,
Branch Engineering Inc.

Ronald J. Derrick, P.E., G.E.
Principal Geotechnical Engineer

1: USDA Forest Service 1146, Urban Forest Systems and Green Stormwater Infrastructure, February 2020.

2: USGS, Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins, Scientific Investigations Report 2010-5102.

Civil West Engineering Services, Inc.

South Coast Office
486 E Street
Coos Bay, OR 97420

Willamette Valley Office
213 Water Ave. NW, Suite 100
Albany, OR 97321

Rogue Valley Office
830 O'Hare Parkway, Suite 102
Medford, OR 97501

North Coast Office
609 SW Hurbert Street
Newport, OR 97365

July 9, 2020

City of Florence Public Works Department
2675 Kingwood Street
Florence, OR 97439

RE: Rhododendron Dr. & 35th Ave. Planned Unit Development
Preliminary Stormwater Management Report Review

Mike,

Civil West Engineering has reviewed the Preliminary Stormwater Management Report (the Report) for the Rhododendron Dr. and 35th Ave. Planned Unit Development (PUD) on behalf of the City of Florence. The report, prepared by 3J Consulting shows a submittal date on the cover page of April 29, 2020.

The report is well prepared and, for the most part, meets the requirements of the City of Florence – Stormwater Management Design Manual (FSWMDM). We did identify some areas of concern, however, which are identified below.

1. The Report should show a comparison table of the flow rates for pre and post construction. In particular, we would like to see the flow rates and volumes in each soakage trench, drywell, water quality basin, and infiltration basin to compare to the assumed runoff from the site currently.
2. The Post-Construction Conditions plan presented in the exhibits section of the report presents a color-coded map broken down by facility type. Please provide additional detail for each of the Soakage Trenches facilities so it is clear the "Basin" or buildings that each facility is associated with. The frontage area highlighted appears to only include the new improvements. Please verify if any of the adjacent existing road section drains toward the proposed improvements and if so, make sure to include that area in your drainage calculations.
3. The Report indicates that runoff from concrete and AC will be treated in a water quality basin before it enters the infiltration basin. Sheet C8 only shows an infiltration trench please clarify the configuration and or location of the water quality basins relative to the infiltration basin.
4. The Report, on page 5, discusses the infiltration rates as measured by the Geotechnical Engineer and states that the average infiltration rate is 73.76 in/hr. The Report then states that a factor of safety of 2 was used to size the infiltration basin. It further states that an infiltration rate of 20 in/hr was used to size the water quality basin according to the City of Portland PAC. Per the FSWMDM section 5.5 "*Design infiltration rate shall be demonstrated with testing certified by a professional Engineer or Geologist and shall not exceed 10 inches per hour".* Using this guide, infiltration should be no more than 10 in/hr.
5. For the Soakage Trenches, per the FSWMDM section 5.7.1 (16)(c) *"Regardless of methodology used, the measured infiltration rate shall be the lesser of 6 inches per hour or the measured infiltration rate divided by 2"* Using this guide, infiltration used should be 6" per hour.
6. Comments 2 and 3 above refer to design infiltration rates. The Report, and preliminary plans, seem to use the size (footprint) of the basins/trenches as the basis for allowable infiltration. The City's Standard Details demonstrate that the size of the facility is dependent on the area of impervious cover that the unit is collecting water from. As noted in Standard Detail SW-170, the size of the facility should be used as a minimum criteria only, and should be calculated by the design engineer based on maximum allowable (or measured) infiltration rates.
7. Groundwater measurements were done December 17, 2019. Looking back at rainfall measurements, this was a period of relatively dry weather, with little or no rainfall in the previous week. We are not confident that the

EXHIBIT O

geotechnical investigation provided a "high ground water" analysis, and We are not confident that ground water is not an issue.

8. Based on community comments, increasing flow to the groundwater is a concern. Although the FSWMDM directs developers to maximize infiltration, we recommend that in this instance, the City require flows to be released to match predeveloped conditions (both overland flows, and percolation flows). Per Florence City Code Title 9, Chapter 5, section 9-5-3-2-D *"The development of any land requiring a Drainage Plan shall address onsite and off-site drainage concerns, both up and down gradient (minimum of ¼-mile) of project…"* We interpret this to include groundwater drainage. The Report should address the potential impacts of increasing groundwater discharge.
9. The report indicates that all storm water will be retained on site except for the frontage improvements along Rhododendron Drive, 35th Street and Siano Loop. Sheet C8 presents the preliminary utility plan and it appears 35th Street and Siano Loop will utilize the existing drainage catch basins and collection system but please provide additional detail on how and where the development proposes to connect to and utilize the existing 14" storm drain line in Rhododendron Drive.
10. Although the system is sized per the Standard Details, with the concerns identified above, we recommend that the infiltration facilities all have an overflow connected to the surface water discharge pipe. If the overflow is directed to "Bud's Ravine" or another outfall, please provide detail on how the overflow will be conveyed and identify any impacts up and down gradient in accordance with City Code.

In addition to the above concerns regarding the preliminary stormwater design, we also noted that the other public utilities (water and sewer) in the site appear to be very tight to the proposed buildings. Please ensure that the utilities (particularly sewer) are installed in a location that facilitates future maintenance. In general, we recommend that no structures are closer to the sewer than the depth of the sewer. It was also noted that on Sheet C4 the street sections presented for Rhododendron Drive, 35th Street and Siano Loop all appear to present road widening sections that do not use a curb with a gutter and the sidewalks/paths are presented as asphalt concrete which does not appear to be in conformance with City Standards.

Sincerely,
Civil West Engineering Services, Inc.

Matt Wadlington, P.E.

August 13, 2020

Mike Miller
City of Florence Public Works Director
250 Highway 101
Florence, Oregon 97439

RE: Impacts of Storm Water Infiltration, Rhododendron Drive and 35th Avenue, Florence, Oregon

Dear Mike,

At your request, we conducted a review of three documents you forwarded to us regarding the permitting of a proposed storm water infiltration system associated with a 9.7 acre subdivision in Florence. The proposed subdivision is located along the east side Rhododendron Drive, opposite of the Sea Watch Subdivision that is located on the west side of Rhododendron Drive.

The documents reviewed are:

- Excerpt from: *Sea Watch Estates Slope Study, Florence Oregon*. Prepared by Foundation Engineering Inc., July 18, 1997.
- *Preliminary Storm water Management Report. Planned Unit Development Rhododendron Drive and 35th Ave, Florence Oregon*. Prepared by: 3J Consulting Inc., April 29, 2020.
- *Review of Preliminary Storm water Management Report. Planned Unit Development Rhododendron Drive and 35th Ave, Florence Oregon.* Prepared by Civil West Engineering Services Inc., July 9, 2020.

Project Understanding

The developers of the proposed subdivision submitted a preliminary storm water management report (3J Consulting, 2020) that describes a new residential subdivision consisting of 91 houses, 2 apartment complexes, roads and utilities. All runoff from the proposed development would be infiltrated onsite. The property is currently undeveloped and is covered with trees and other vegetation. The property is nearly 100% pervious surface and it is anticipated that *most* of the rainfall infiltrates into the sandy soils. The 3J report also indicates that a portion of rainfall runs off the property as sheet flow into local channels which discharge to the Siuslaw River. Once in the soil, water is either up taken by vegetation, or will continue to move downward to the water table and flows as groundwater toward the Siuslaw River where it discharges into the river.

Exhibit P

Problem Statement

There are seeps and springs along the toe of the bluff which borders the Siuslaw River directly west of the proposed development. The Sea Watch Subdivision is located on top of this bluff and the home owners are concerned about slumping and erosion of the bluff. Past engineering evaluations (Foundation Engineers, 1997) concluded that the scarp and slumping observed on the bluff is due to internal erosion of the sand by the springs

along the toe of the slope, which are created by discharging groundwater. Erosion of the sand by springs is called "sand piping." Furthermore, Foundation Engineers (1997) concluded that increased rainfall or infiltration would increase groundwater levels, which would in turn would increase spring flow, sand piping and ultimately slumping along the bluff.

Findings and Recommendations

Multiple mechanisms likely contribute to erosion of the toe of the slope beneath the Sea Watch Subdivision. By far the greatest mechanism is likely erosion from river currents during peak tidal stages and wave action from boat wakes. Additionally, the hydrodynamic effect of the 'wing jetties' located on the western (opposite) bank of the Siuslaw River likely exasperate erosion of the toe of the bluff by directing water toward the eastern bank where the concern is focused. In our opinion it is not accurate to point to seeps and springs as the only erosional mechanism when in fact there are others that are likely more significant.

That said, it is likely that shallow groundwater discharges along the toe of the slope – a phenomena that is commonly observed along many portions of the Oregon coast. The saturated conditions in the immediate vicinity of the springs would lower the cohesive strength of the sands which could contribute to undermining of the bluff and slumping on the slopes above the springs as indicated in the 1997 report (sand piping). Increasing groundwater recharge may increase spring flow, which may increase sand piping, but it cannot be quantified without a significant amount of study.

At this point, we suggest the most straight forward approach is to require the developer to design the storm water infiltration system so that there is no net increase of infiltration post-development. Specifically, the developer would estimate the amount of storm water runoff that currently occurs from the property, and design the storm water collection system to match or even exceed that amount. If it can be demonstrated that less storm water would infiltrate under the proposed development than under current conditions, then spring flows would not increase as a result of the project. In fact, it could be argued that the project may improve the condition that has the Home Owners Association concerned.

We hope our observations and suggestions are helpful to the City of Florence. Please give either Dave or Matt a call to discuss further.

Sincerely,

Dave Livesay, RG
Principal Hydrogeologist

(541) 868-5777

Matt Kohlbecker, RG
Supervising Hydrogeologist

(503) 877-8086