Exhibit E

Preliminary Drainage Report

Kellogg Creek Planned Development

2322.14258.01

Prepared for

Brownstone Development, Inc.

47 S State Street

PO Box 2375

Lake Oswego, Oregon 97934

February 8, 2017

Prepared for	Brownstone Development, Inc.
Project Name	Preliminary Drainage Report
Job Number	2322.14258.01
Date	February 8, 2017

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Name	Title	Date	Revision	Reviewer
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Executive Summary

The proposed Kellogg Creek residential development is located at 13333 Rusk Road in Milwaukie, Oregon (See Figure 1-1 Vicinity Map. The subdivision is approximately 14 acres and will include the construction of 92 new lots intended for single-family attached homes (rowhouses). Four public streets are proposed, these streets are identified as Street A and B. Frontage improvements to SE Kellogg Creek Drive will also be completed as part of this project.

Stormwater Management Standards

The proposed storm design will meet the requirements of the City of Milwaukie as listed in the *Public Works Standards* dated February 2015. The City of Milwaukie follows the current City of Portland's *Stormwater Management Manual* for water quality facility design.

The proposed project will fill wetlands located on the site. Therefore, the project must comply with the National Marine Fisheries Service (NMFS) criteria as part of the March 2014 Programmatic Biological Opinion and Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species (SLOPES V) as part of the Wetland Fill Permit with the Army Corp of Engineers.

Additionally, the project is located within the 100-year floodplain of Mt. Scott Creek. All fill placed on the site will be balanced with an equal amount of soil removed per City of Milwaukie Municipal Code 18.04.150 F Balanced Cut and Fill. Excavation will occur within the property boundary.

Water Quality

The project will discharge into Mt. Scott Creek, a tributary of Kellogg Creek and the Willamette River. Mt. Scott and Kellogg Creek are not listed as water quality limited and the Willamette River is listed for E. Coli. Typical pollutants from single -family residential projects include: nutrients, pesticides, metals, oil, grease and other petroleum products, and sediment. Dissolved copper, dissolved zinc, and PAHs are generally the primary constituents of concern for stormwater runoff in Oregon streams for their impact on ESA listed species. These pollutants are specially targeted for treatment in the selected stormwater management systems.

Water quality treatment will occur through stormwater bioretention basins, swales and planters. These facilities are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They provide pollution reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers. Specific elements are incorporated into the design to increase the effectiveness of this stormwater facility type. Design elements include trapped catch basins to remove coarse sediment, using soil media to provide stormwater filtration, and vegetation to will provide plant uptake.

The basins are designed using the BMP Sizing Tool developed by Clackamas County. This continuous simulation software is a regional tool for the Portland metro area. City of Milwaukie standards were checked using an xpswmm hydraulic model. The stormwater facilities were designed to the standards below:

- Water Quality: 50% of the cumulative rainfall from the 2-year storm event. (Using a continuous rainfall/runoff model).

The calculated peak water quality flow from the 5.58 ac of new impervious area is 1.10 cfs with an approximate 15,787 cf runoff volume.

Water Quantity

Water quantity control will occur within the proposed bioretention facilities. Control structures will be placed within each facility to limit runoff to the SLOPES V criteria listed below. The facilities were reviewed to confirm conformance with City of Milwaukie standards.

- City of Milwaukie = Match existing flow rate to proposed flow from the 2 through 25-year storm event.
- SLOPES V = limit pre-developed discharge rates using a continuous simulation for flows between 42% of the 2-year event and the 10-year flow event.

The calculated water quantity volume is approximate 12,175 cf volume.

Conveyance

The proposed conveyance system will be designed using the 100-year storm event in the final Drainage Report.

Table of Contents

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Figures

1 Project Overview

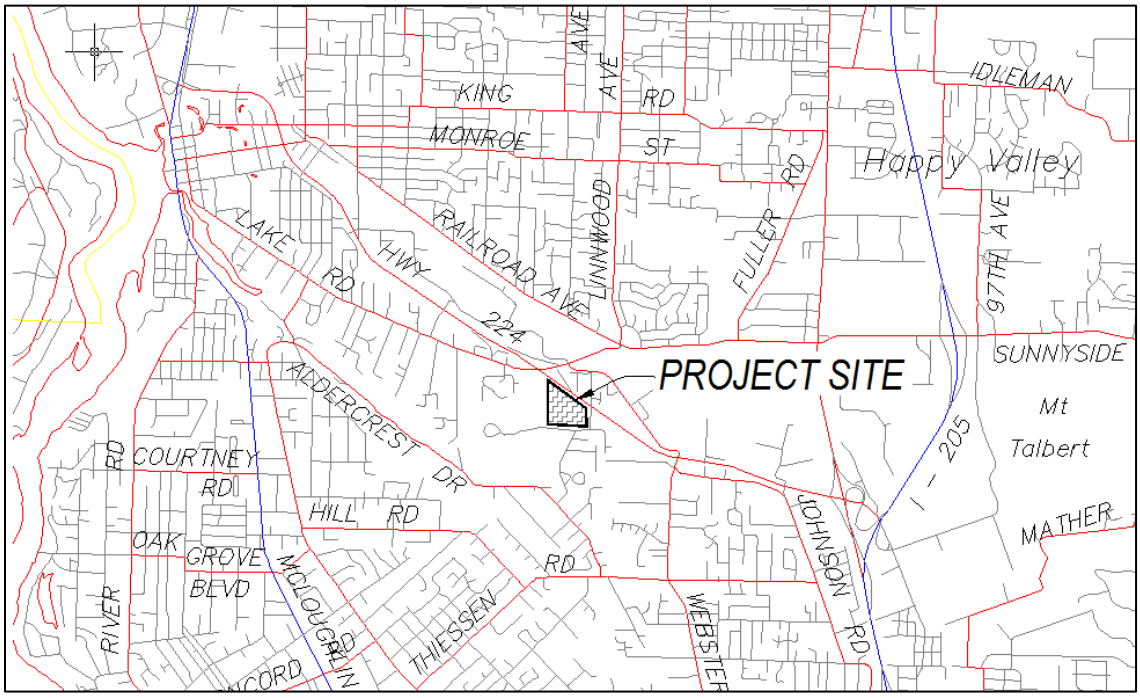
1.1 Project Overview

The Kellogg Creek residential subdivision is approximately 14 acres and will include the construction of 92 new lots intended for single-family attached homes (rowhouses). Four public streets are proposed, these streets are identified as Street A and B. Frontage improvements to SE Kellogg Creek Drive will also be completed as part of this project.

1.2 Location

The proposed project is located at 13333 Rusk Road in Milwaukie, Oregon (See Figure 1-1 Vicinity Map). The property includes the following tax lots: TL 22E 06AD 600, TL 22E 06AD 700, TL 22E 06AD 900, and TL 22E 06AD 901.

Figure 1-1 Vicinity Map



1.3 Methodology

The proposed storm design will meet the requirements of the City of Milwaukie as listed in the *Public Works Standards* dated February 2015. The City of Milwaukie follows the current City of Portland's *Stormwater Management Manual* for water quality facility design.

Additionally, the project must conform to Standard Local Operating Procedures for Endangered Species (SLOPES V) as part of the Wetland Fill Permit with the Army Corp of Engineers.

2 Existing Conditions

2.1 Topography

The existing site contains a driveway entrance for the adjacent Turning Point Church, grass, blackberry bushes and a scattering of trees. Fill material was previously placed at the site adjacent to the church parking lot. Mt. Scott Creek runs through the northern portion of the site. The site has gradual slopes between 0.5 and 5% and generally drains towards the northwest - west. Steeper slopes occur at the end of fill placed at the site and along Mt. Scott Creek. The highest elevation within the project area is 78; located along the southeast property corner. The lowest elevation of 66 is located in the western property boundary.

2.2 Climate

The site is in Milwaukie, Oregon and is located approximately 65 miles inland from the Pacific Ocean. There is a gradual change in seasons with defined seasonal characteristics. Average daily temperatures range from 36°F to 83°F. Record temperatures recorded for this region of the state are -3°F and 107°F. Average annual rainfall recorded in this area is 42-inches. Average annual snowfall is approximately 1-inches between December and February.

2.3 Site Geology

The underlying soil types on the site, as classified by the United States Department of Agriculture Soil Survey of Clackamas County, Oregon are identified in Table 2-1 (See Technical Appendix: Hydrologic Soils Map - Clackamas County).

Table 2-1 Soil Characteristics

Soil Type	Hydrologic Group
Cove Silty Clay Loam	D
Salem Silt Loam	B
Wapato Silty Clay Loam	C/D
Woodburn Silt Loam	C

A majority of the site is classified as Cove Silty Clay Loam. Therefore, the entire site has conservatively been assigned a soil Group D. Group D soils have very slow infiltration rates when thoroughly saturated.

Groundwater was encountered during the geotechnical evaluation completed by GEO Consultants Northwest. Groundwater depths varied across the site from 3 to12 below the ground surface. This variation of groundwater depths is a result of the varying amount of existing fill at the site. The elevation of groundwater is approximately 65 ft across the site.

2.4 Curve Number

The curve number represents runoff potential from the soil. The major factors for determining the curve number values are hydrologic soil group, cover type, hydrologic condition and antecedent runoff condition. The pervious curve numbers of 79 representing Woods-Grass Combination in Good Condition was used at the site. (See Technical Appendix: Table 2-2c – Technical Release 55-Urban Hydrology for Small Watersheds).

2.5 Time of Concentration

The time of concentration (T_C) as described in NEH-4 Chapter 15 is defined in two ways; the time for runoff to travel from the furthermost point of the watershed to the point in question, and the time from the end of excess rainfall to the point of inflection on the trailing limb of the unit hydrograph. Time of concentration can be estimated from the following formulas. The time of concentration was calculated to be 24 minutes (See Technical Appendix: Time of Concentration Calculation).

Sheet Flow

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

T_t = Travel Time (hours) n = Manning's "n" of slope
L = Length of flow (ft) P_2 = 2-Year, 24-hour rainfall (in)
s = Slope (ft / ft)

Shallow Concentrated Flow

$$T_t = \frac{L}{3600V}$$

T_t = Travel Time (hours) L = Flow Length (ft)
V = Average Velocity (ft / s) 3600 = seconds / hour

2.6 Hydrology

Stormwater runoff from the site sheet flows north to Mt. Scott Creek with the exception of the church driveway entrance and a small area of pervious area. Catch basins collect this impervious area and the adjacent church and sends runoff south to a public storm sewer in SE Kellogg Creek Dr. The SE Kellogg Creek Dr. storm sewer heads south and outfalls into a tributary of Kellogg Creek. Water quality treatment is not provided at the site.

2.7 Basin Area

Impervious and pervious surface areas for the existing conditions are shown in Table 2-2. The site is 1.4% impervious. Approximately 1.466 acres of the site drains south to Kellogg Creek (See Technical Appendix: Figure 1 – Existing Basin Delineation).

Table 2-2 Existing Basin Areas

Basin	Impervious Area, ac	Pervious Area, ac	Total Area, ac
Site (Mt Scott Creek)	0.201	13.815	14.016
Kellogg Creek Dr.	0.321	0.043	0.364
Total	0.522	13.858	14.380

3 Proposed Conditions

3.1 Curve Number

The pervious curve numbers of 80 representing Open Space in Good Condition was used at the site. (See Technical Appendix: Table 2-2a – Technical Release 55-Urban Hydrology for Small Watersheds).

3.2 Time of Concentration

A time of concentration of 5 minutes was used for the delineated basins.

3.3 Hydrology

Stormwater runoff outside the limits of work will continue to sheet flow to Mt. Scott Creek. Floodplain grading will occur so that floodwaters will recede back into the creek channel. Two new outfalls are proposed as part of this project. These outfalls are included as part of the wetland fill permit. The church entrance will be modified as part of this project.

Water quality treatment and quantity facilities will be added to the site. A summary of each facility is provided below.

- North Pond: Bioretention Pond, Outfall to Mt. Scott Creek
- South Pond: Bioretention Pond, Outfall to Mt. Scott Creek through a flow dispersion trench
- Southwest Pond: Extended Dry Pond to the tributary of Kellogg Creek
- Planters A through D and Swale: Four Bioretention Planters, Outfall to Kellogg Creek. Planters A, B, C will treat proposed onsite streets. Site grading constraints prohibit this portion of the streets from flowing to one of the ponds. Planter D is located along Kellogg Creek Drive.

3.4 Basin Area

Impervious and pervious surface areas for proposed conditions are shown in Table 3-1. The site is 37.2% impervious in proposed conditions. The majority of the project will occur at the site, although some work is being done within church property. Street improvements to SE Kellogg Creek Dr. will also occur as part of this project. The Creek basin will not be developed but includes grading to balance the floodplain. The amount of area draining to the tributary of Kellogg Creek is 1.03 acres, slightly less than in existing conditions (See Technical Appendix: Figure 2 – proposed Basin Delineation).

Table 3-1 Proposed Basin Areas

Basin	Impervious Area, ac	Pervious Area, ac	Total Area, ac
North	2.328	0.973	3.301
South	2.218	0.739	2.957
Southwest	0.156	0.138	0.294
Planter A	0.043	0.015	0.058
Planter B	0.038	0.021	0.059
Planter C	0.037	0.017	0.054
Planter D	0.151	0.126	0.277
Mt. Scott Creek	0.000	6.798	6.798
Kellogg Creek	0.371	0.211	0.582
Total	5.342	9.038	14.380

4 Hydrologic and Hydraulic Analysis

4.1 Design Guidelines

The proposed storm design will meet the requirements of the City of Milwaukie as listed in the *Public Works Standards* dated February 2015. Section 2.0013 describes the allowable flow determination methods including the selected Unity Hydrograph Method.

4.2 Hydrologic Method

The Santa Barbara Urban Hydrograph (SBUH) was used for this analysis. The SBUH method is based on the curve number (CN) approach, and uses the Natural Resources Conservation Service's (NRCS) equations for computing soil absorption and precipitation excess.

The SBUH method converts the incremental runoff depths into instantaneous hydrographs, which are then routed through an imaginary reservoir with a time delay equal to the basin time of concentration.

The runoff function of xpswmm generates surface and subsurface runoff based on design or measured rainfall conditions, land use and topography. xpswmm Version 17.1 was used for our hydrology and hydraulics analysis. xpswmm is based on the public EPA SWMM program. xpswmm is an approved method of analysis by City of Milwaukie.

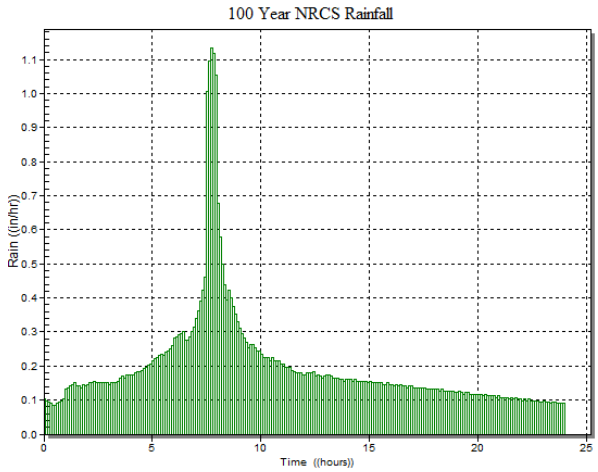
4.3 Design Storm

The rainfall distribution to be used within the City of Milwaukie jurisdiction is the design storm of 24-hour duration based on the standard Type 1A rainfall distribution. Table 4-1 shows total precipitation depths for different storm events. The NRCS Distribution for a type 1A 24-hour rainfall distribution for a 25-year storm event is shown in Figure 4-1.

Table 4-1 Precipitation Depth

Recurrence interval (years)	Total Precipitation Depth (in)
2	2.40
10	3.50
25	4.00
100	4.70

Figure 4-1 100-Year Type 1A Rainfall Ditribution



4.4 Basin Runoff

Table 4-2 lists the runoff rates for existing and proposed conditions for the site during the 2, 10, 25 and 100-year storm events. These values do not include onsite detention. (See Technical Appendix: Existing and Proposed Hydrographs).

Table 4-2 Runoff Rates

Recurrence Interval (years)	Existing Peak Runoff Rate (cfs)	Proposed Peak Runoff Rate (cfs)
2	1.307	4.197
5	2.464	5.982
10	3.562	7.552
25	4.739	9.176
100	6.485	11.521

5 Conveyance Analysis

5.1 Design Guidelines

The analysis and design criteria described in this section will follow the City of Milwaukie's *Public Works Standards.* The manual requires storm drainage system and facilities be designed to convey the 100-year storm event.

5.2 System Capacity

The proposed conveyance system was designed to convey and contain the peak runoff from a 100-year design storm.

5.3 System Performance

A complete conveyance analysis will be completed in the final Drainage Report.

6 Water Quality & Quantity

6.1 Design Guidelines

The proposed water quality and quantity facilities were designed per the City of Milwaukie requirements as listed in the *Public Works Standards* dated February 2015. The City of Milwaukie follows the current City of Portland's *Stormwater Management Manual* for water quality facility design. The City of Milwaukie requires the proposed discharge rate for the 2, 5, 10, and 25-year events to be that of the existing discharge rate.

Detention is also required to meet SLOPES V criteria. SLOPES V limits the proposed discharge rates using a continuous simulation for flows between 42% of the 2-year event and the 10-year flow event of existing flows. Existing conditions are assumed to be forested.

6.2 Water Quality and Quantity Facilities

The project will discharge into Mt. Scott Creek, a tributary of Kellogg Creek and the Willamette River. Mt. Scott and Kellogg Creek are not listed as water quality limited and the Willamette River is listed for

E. Coli. Typical pollutants from single-family residential projects include: nutrients, pesticides, metals, oil, grease and other petroleum products, and sediment. Dissolved copper, dissolved zinc, and PAHs are generally the primary constituents of concern for stormwater runoff in Oregon streams for their impact on ESA listed species. These pollutants are specially targeted for treatment in the selected stormwater management systems.

Water quality treatment will occur through stormwater bioretention basins, swales and planters. These facilities are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They provide pollution reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers. Specific elements are incorporated into the design to increase the effectiveness of this stormwater facility type. Design elements include trapped catch basins to remove coarse sediment, using soil media to provide stormwater filtration, and vegetation to will provide plant uptake.

The basins are designed using the BMP Sizing Tool developed by Clackamas County. This continuous simulation software is a regional tool for the Portland metro area. City of Milwaukie standards were checked using an xpswmm hydraulic model and will be included within the final Drainage Report.

Bioretention facilities are designed to incorporate the following criteria:

- Water Depth: 10 to 18 inches
- Drain Rock Depth: 6 to 18 inches
- Growing Medium Depth: 18 inches
- Minimum Freeboard: 2 inches
- Perforated Pipe Under Drain
- Minimum Orifice Size: 1 inch

There are seven (7) proposed bioretention facilities located in the proposed project. Each facility was designed to maximize water contact with vegetation for biological treatment. A control structure with one or two orifices will control the allowable release rate. Appropriate vegetation will be planted in the basin as specified by the City of Portland's *Stormwater Management Manual* (See Technical Appendix: WES BMP Sizing Report). Table 6-1 provides a summary of each facility.

Table 6-1 Bioretention Facility Summary

Basin ID	Facility Type	Minimum Top Area (not including Freeboard) (sf)	Minimum Bottom Area (sf)	Water Depth (in)	Rock Depth (in)	Soil Depth (in)	Total Depth (in)
North	Pond	4,100	2,119	12	6	18	36
South	Pond	3,900	1,976	12	6	18	36
Southwest	Dry Pond	570	-	18	0	0	18
Planter A	Planter	75	-	10	7	18	35
Planter B	Planter	58	-	12	12	18	42
Planter C	Planter	55	-	12	12	18	42
Planter D	Planter	312	-	10	7	18	35

6.3 Flow Dispersion

A flow dispersion trench will be used at the outfall of the South Pond. This flow spreader was designed to disperse flow over a large area in an effort to reduce erosive velocities of the stormwater discharge entering the wetland during the 100-year event. The flow spreader will be a gravel filled trench with a perforation pipe in the bottom of the trench.

Soils in the proposed landscaped slopes were conservatively assumed to consist of silty clay loam with a maximum permissible velocity of 0.5-fps which was used to determine if facility length (See Technical Appendix: Chow – Fig. 7-3 U.S. and U.S.S.R. data on Permissible Velocities for Non-cohesive Soils). The flow spreader was treated as a broad crested weir. A weir coefficient of 2.4 was used in the calculations. The broad crested weir equation is shown below.

$$q = 2.4H^{3/2}$$

Where:

q= Volumetric flow rate per unit length, cfs/ft

H= Depth of flow over weir

Table 6-2 Flow Dispersion Trench

Length (ft)	Discharge (cfs)	Depth (ft)	q (cfs/ft)	Velocity (fps)
130	2.88	0.04	0.02	0.50

7 Floodplain Analysis

FEMA Flood Insurance Rate Maps were used to determine the 10, 25 and 100-year flood stage for Mt. Scott Creek. The site is located on map number FM41005C0036D, with an effective date of June 17, 2008. Elevations are provided in the NAVD 1988 datum, the same as used for this project. The upstream most cross section is C located just downstream of Hwy 224. The 100-year elevation at cross section C is 69.9.

The 25-year elevation was interpolated from the FEMA profile. These elevations were used to balance the floodplain and determine the elevation of the stormwater facilities. FEMA determined elevations are listed in Table 7-1 (See Technical Appendix: Flood Insurance Study, Clackamas County - Mt. Scott Creek Profile).

Table 7-1 Mt. Scott Creek Water Surface Elevations

Recurrence Interval (years)	Water Surface Elevation	
	Upstream Property Boundary	Downstream Property Boundary
10	69.4	67.5
25	69.7	67.3
100	69.9	67.3

8 Operation & Maintenance

Maintenance of water quality and quantity facilities is very important to ensure they operate as designed. Inadequate maintenance can be attributed to premature failures of these facilities. Stormwater facilities for the site will be maintained and operated privately by the homeowners. Prior to creation of an HOA, please contact Randy Myers at 503-358-4460 or Randy@Brownstonehomes.net about inspection and maintenance of the proposed stormwater facilities.

The owners must insure the water quality systems efficiently perform their function of removing petroleum hydrocarbons, sediments, metals, bacteria and nutrients from stormwater runoff and that the water quantity system performs their function of regulating the rate and volume of stormwater runoff leaving the property.

The Operation and Maintenance Plan is provided within the Technical Appendix.

9 Summary

The proposed water quality and quantity facility design follows the City of Milwaukie's *Public Works Standards* dated February 2015. The City of Milwaukie follows the current City of Portland's *Stormwater Management Manual* for water quality facility design.

Additionally, the project must comply with the National Marine Fisheries Service (NMFS) criteria as part of the March 2014 Programmatic Biological Opinion and Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species (SLOPES V) as part of the Wetland Fill Permit with the Army Corp of Engineers.

Bioretention facilities are proposed to provide a high level of treatment and detention.

Technical Appendix

Technical Appendix

- Figure 1 – Existing Basin Delineation
- Figure 2 – Proposed Basin Delineation

- Hydrologic Soil Map – Washington County
- Table 2-2c – Runoff Curve Numbers for Other Agricultural Lands
- Table 2-2a – Runoff Curve Numbers for Urban Areas
- Time of Concentration
- WES BMP Sizing Report
    - Pond
    - Swale and Planters
- Existing & Proposed Hydrographs
- Flood Insurance Study, Clackamas County - Mt. Scott Creek Profile
- Chow – Fig. 7-3 U.S. and U.S.S.R. data on Permissible Velocities for Non-cohesive Soils
- Operation and Maintenance Plan
- Geotechnical Evaluation – Kellogg Creek Development, GEO Consultants Northwest, October 7, 2016.

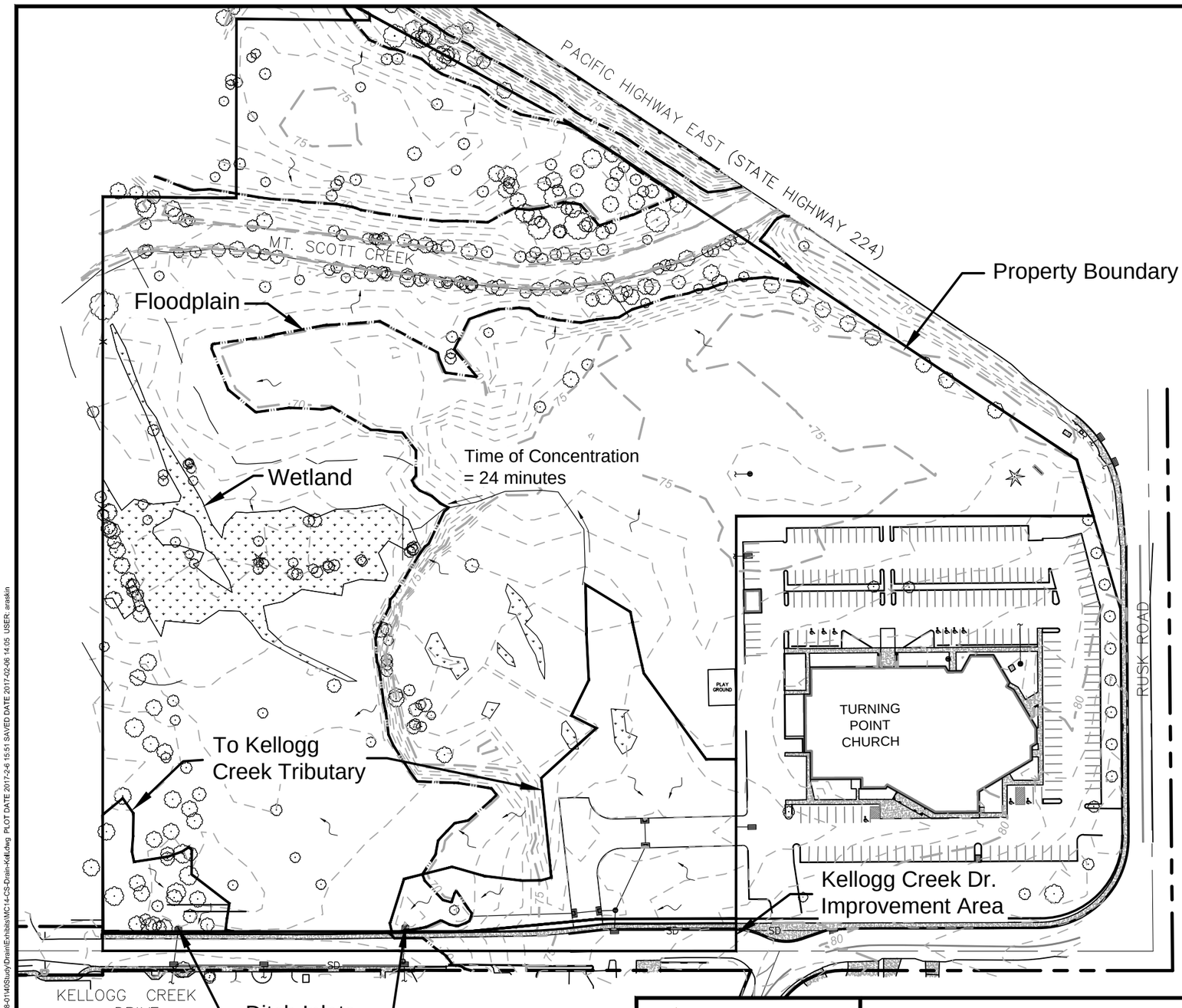
References

Flood Insurance Study (FIS) – Clackamas County, Oregon and Incorporated Areas, FEMA, June 17, 2008.

Public Works Standards, City of Milwaukie, February 2015.

Stormwater Management Manual, City of Portland, August 2016.

Programmatic Biological Opinion and Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species (SLOPES V), National Marine Fisheries Service (NMFS), March 2014.



Existing Basin Area
Impervious Area = 0.201 acres
Pervious Area = 13.815 acres
Total Area = 14.016 acres

Kellogg Creek Dr. Improvement Area
Impervious Area = 0.321 acres
Pervious Area = 0.043 acres
Total Area = 0.364 acres

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SCALE IN FEET

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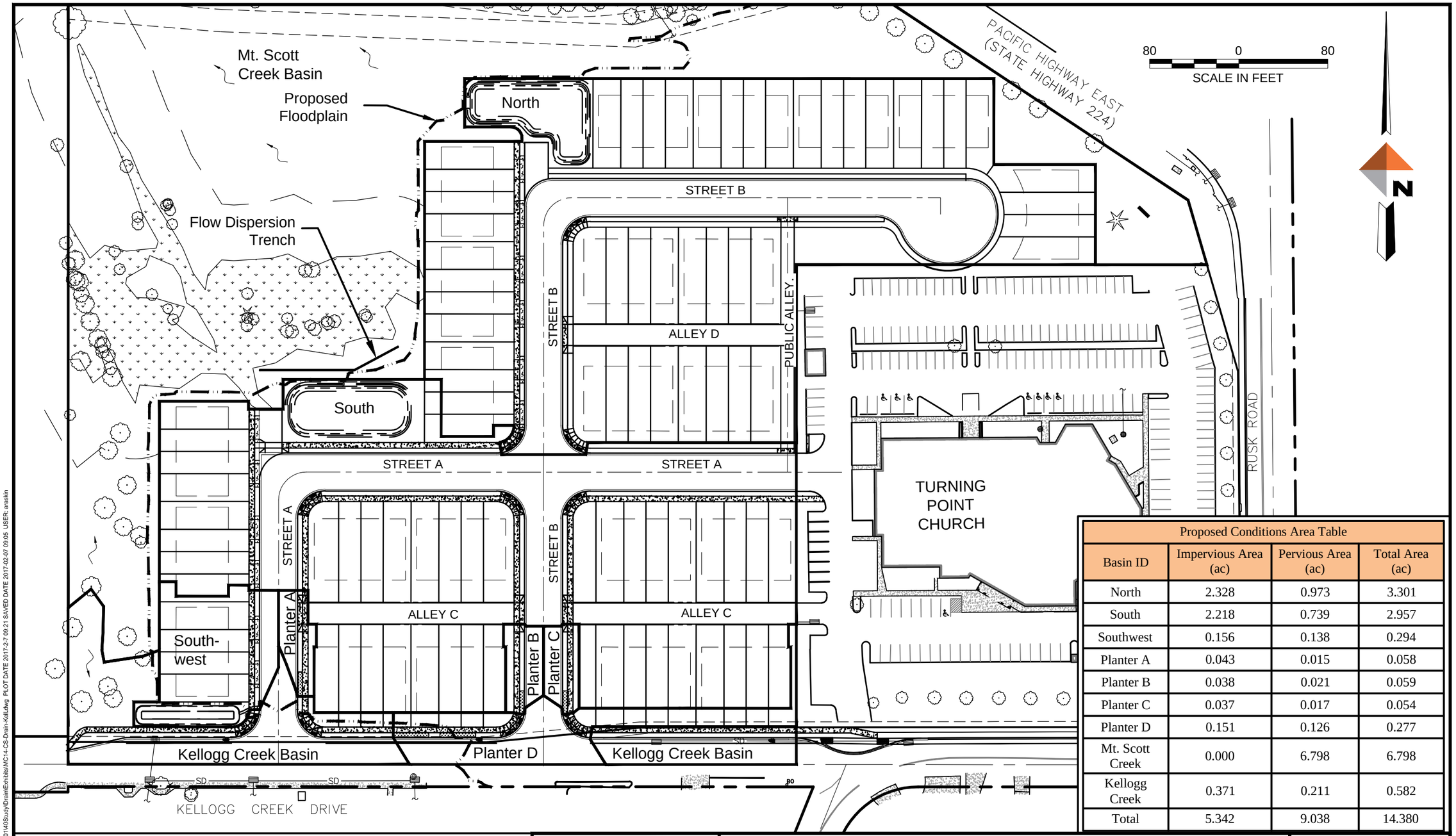
EXISTING BASIN DELINEATION
KELLOGG CREEK SUBDIVISION
MILWAUKIE, OREGON

PROJECT	14258.01
DATE	02/08/2017
	ASR

FIGURE 1



Proposed Conditions Area Table			
Basin ID	Impervious Area (ac)	Pervious Area (ac)	Total Area (ac)
North	2.328	0.973	3.301
South	2.218	0.739	2.957
Southwest	0.156	0.138	0.294
Planter A	0.043	0.015	0.058
Planter B	0.038	0.021	0.059
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Planter D	0.151	0.126	0.277
Mt. Scott Creek	0.000	6.798	6.798
Kellogg Creek	0.371	0.211	0.582
Total	5.342	9.038	14.380

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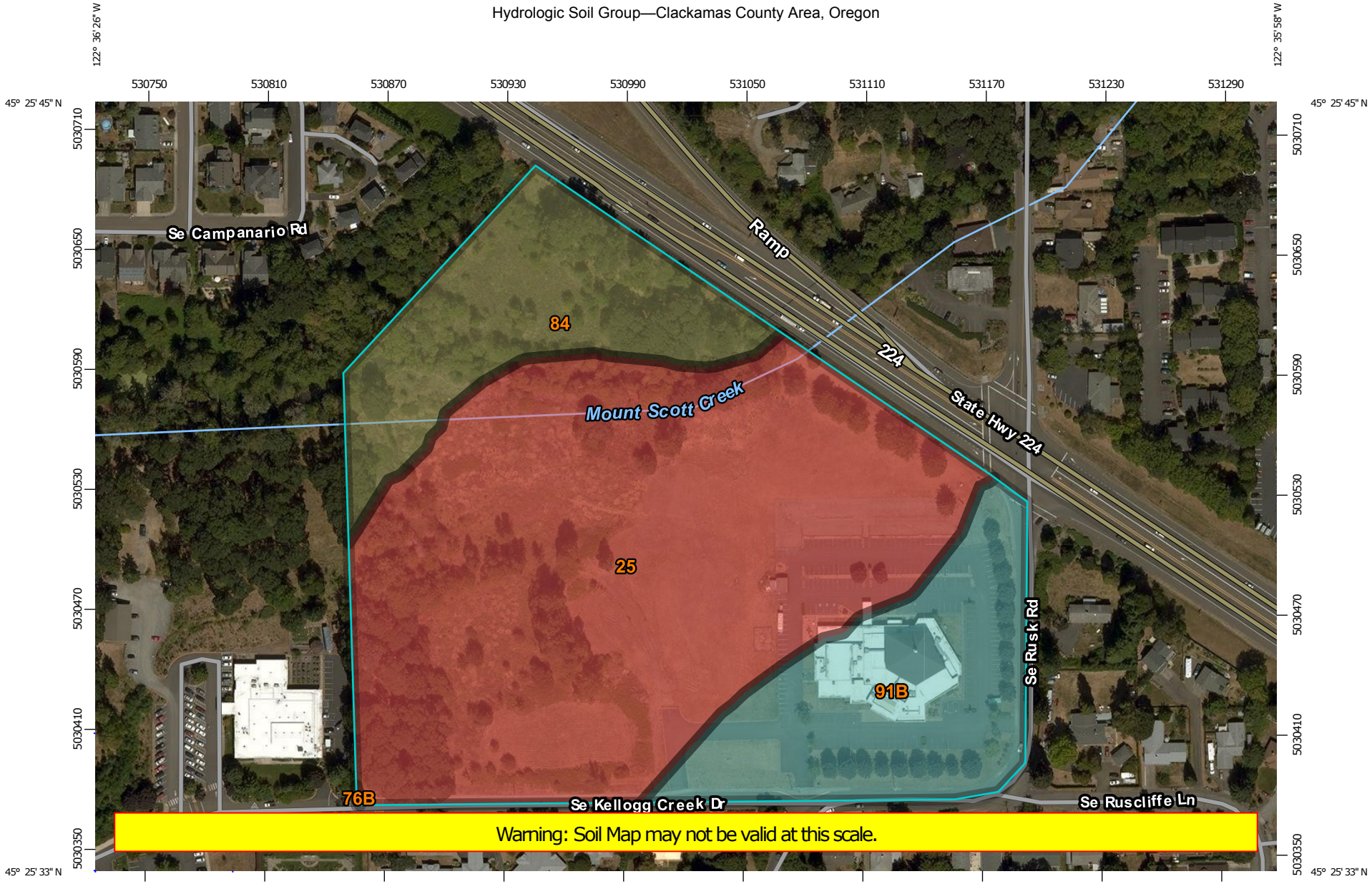
PROPOSED BASIN DELINEATION
KELLOGG CREEK SUBDIVISION
MILWAUKIE, OREGON

PROJECT	14258.01
DATE	02/08/2017
	ASR

FIGURE 2



Map Scale: 1:2,710 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

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

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: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 10, Sep 18, 2015

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

Date(s) aerial images were photographed: Jul 26, 2014—Sep 5, 2014

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

Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
25	Cove silty clay loam	D	12.9	63.1%
76B	Salem silt loam, 0 to 7 percent slopes	B	0.0	0.0%
84	Wapato silty clay loam	C/D	3.6	17.6%
91B	Woodburn silt loam, 3 to 8 percent slopes	C	4.0	19.3%
Totals for Area of Interest			**20.5**	**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.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
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	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	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	92
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
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Time of Concentration

SUBJECT	Time of Concentration				
PROJECT NO.	2322.14258.01	**BY**	ASR	**DATE**	2/8/2017

	Existing	
SHEET FLOW		
INPUT	**VALUE**	
Surface Description	**Type**	**5**
	Grass (short prairie)	
Manning's "n"	**0.15**	
Flow Length, L (<300 ft)	**163**	ft
2-Yr 24 Hour Rainfall, P_2	**2.6**	in
Land Slope, s	**0.01**	ft/ft
OUTPUT		
Travel Time	0.35	hr
SHALLOW CONCENTRATED FLOW		
INPUT	**VALUE**	
Surface Description	**Unpaved**	
Flow Length, L	**100**	ft
Watercourse Slope*, s	**0.615**	ft/ft
OUTPUT		
Average Velocity, V	12.65	ft/s
Travel Time	0.002	hr
SHALLOW CONCENTRATED FLOW		
INPUT	**VALUE**	
Surface Description	**Unpaved**	
Flow Length, L	**219**	ft
Watercourse Slope*, s	**0.01**	ft/ft
OUTPUT		
Average Velocity, V	1.61	ft/s
Travel Time	0.038	hr
Watershed or Subarea T_c =	**0.39**	**hr**
Watershed or Subarea T_c =	**24**	**minutes**

WES BMP Sizing Software Version 1.6.0.1, August 2015

WES BMP Sizing Report

Project Information

Project Name	Kellogg Creek
Project Type	SingleFamily
Location	13333 Rusk Road in Milwaukie, Oregon
Stormwater Management Area	0
Project Applicant	Brownstone Development, Inc.
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
North - Imp	101,408	Forested	ConventionalConcrete	D	Bioretention Pond North
North - Perv	42,384	Forested	Grass	D	Bioretention Pond North
South - Imp	96,616	Forested	ConventionalConcrete	D	Bioretention Pond South
South - Perv	32,191	Forested	Grass	D	Bioretention Pond South

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Bioretention Pond North	FCWQT	Lined	3.00	6,190.0	3	14,646.1	5,858.4	Yes
Bioretention Pond South	FCWQT	Lined	3.00	5,500.0	3	12,819.0	5,127.6	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Bioretention Pond North
Design: FlowControlAndTreatment

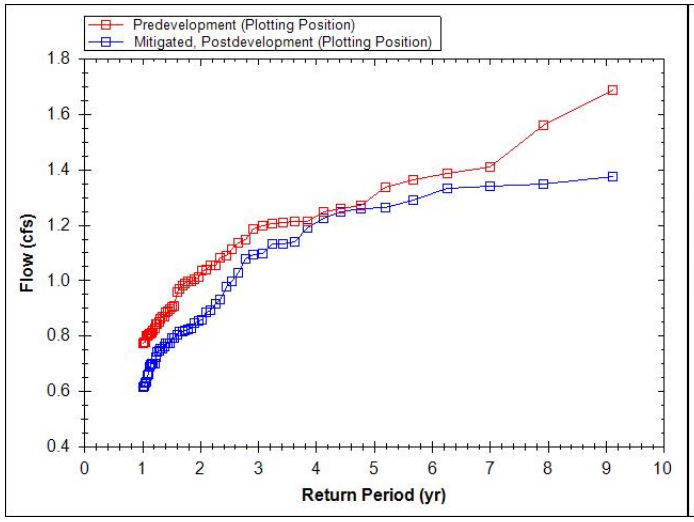
Shape Curve

Depth (ft)	Area (sq ft)
3.0	6,190.0

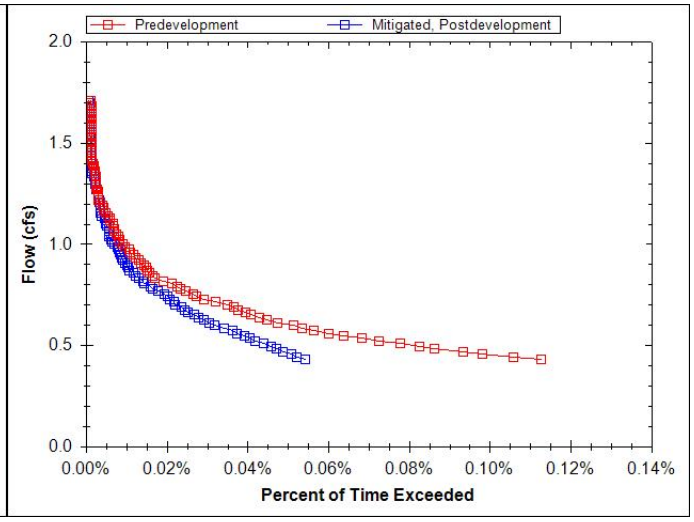
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	3.1
Upper Orifice Invert(ft)	2.0
Upper Orifice Dia (in)	7.0
Overflow Weir Invert(ft)	3.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



Simple Pond Geometry Configuration

Pond ID: Bioretention Pond South
Design: FlowControlAndTreatment

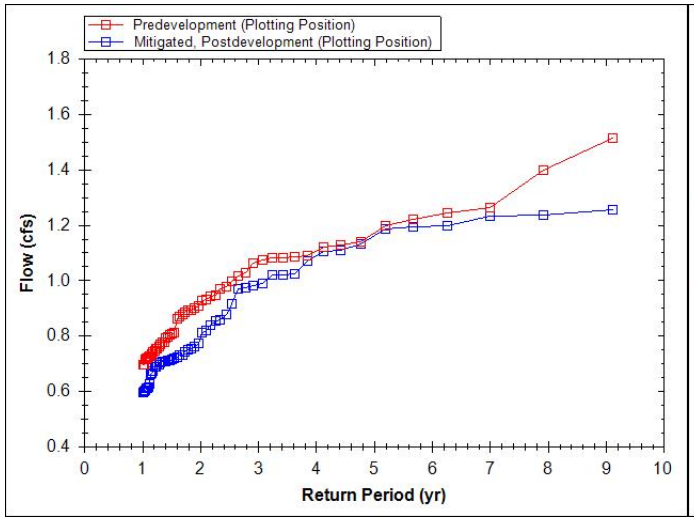
Shape Curve

Depth (ft)	Area (sq ft)
3.0	5,500.0

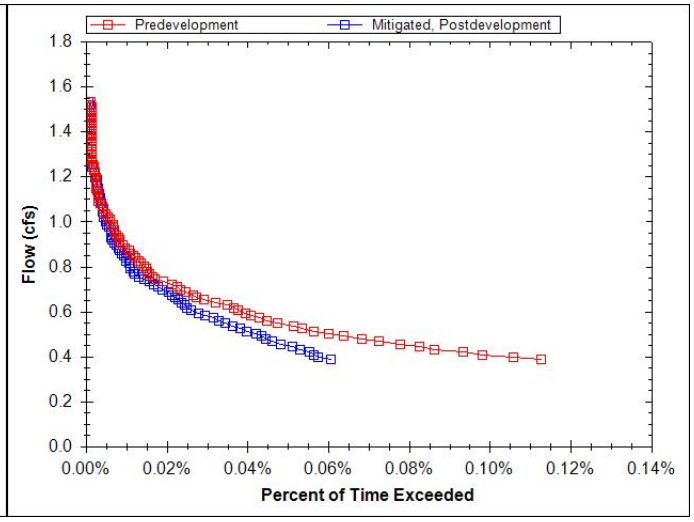
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	2.9
Upper Orifice Invert(ft)	2.0
Upper Orifice Dia (in)	6.7
Overflow Weir Invert(ft)	3.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.1, August 2015

WES BMP Sizing Report

Project Information

Project Name	Kellogg Creek
Project Type	SingleFamily
Location	13333 Rusk Road in Milwaukie, Oregon
Stormwater Management Area	0
Project Applicant	Brownstone Development, Inc.
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Planter A - Imp	1,873	Forested	ConventionalConcrete	D	Planter A
Planter A - Per	653	Forested	Grass	D	Planter A
Planter B - Imp	1,655	Forested	ConventionalConcrete	D	Planter B
Planter B - Per	915	Forested	Grass	D	Planter B
Planter C - Imp	1,612	Forested	ConventionalConcrete	D	Planter C
Planter C - Per	741	Forested	Grass	D	Planter C
Southwest - Imp	6,795	Forested	ConventionalConcrete	D	Southwest Extended Pond
Southwest - Per	6,011	Forested	Grass	D	Southwest Extended Pond
Planter D - Imp	6,578	Forested	ConventionalConcrete	D	Planter D
Planter D - Per	5,489	Forested	Grass	D	Planter D

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
Planter C	FlowControlAndTreatment	Stormwater Planter - Filtration	Lined	54.8	83.0	0.5
Planter A	FlowControlAndTreatment	Stormwater Planter -	Lined	61.9	88.0	0.6

		Filtration				
Planter B	FlowControlAndTreatment	Stormwater Planter - Filtration	Lined	57.6	83.0	0.6
Planter D	FlowControlAndTreatment	Stormwater Planter - Filtration	Lined	245.1	256.0	1.2

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Southwest Extended Pond	FCWQT	Lined	3.00	1,446.0	3	2,608.5	1,043.4	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Southwest Extended Pond
Design: FlowControlAndTreatment

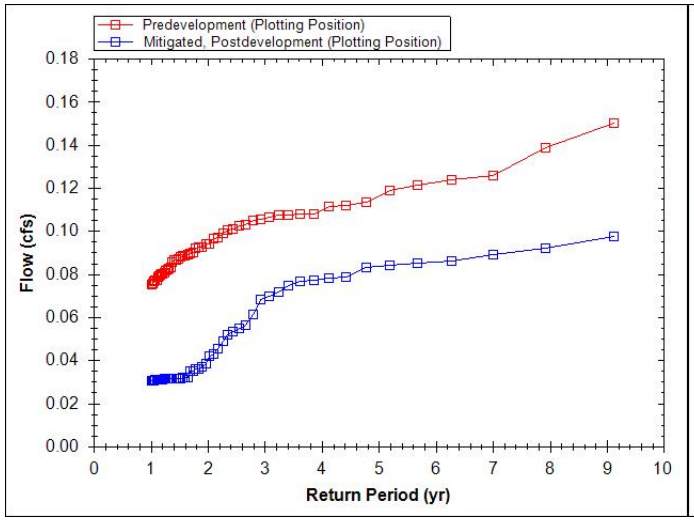
Shape Curve

Depth (ft)	Area (sq ft)
3.0	1,446.0

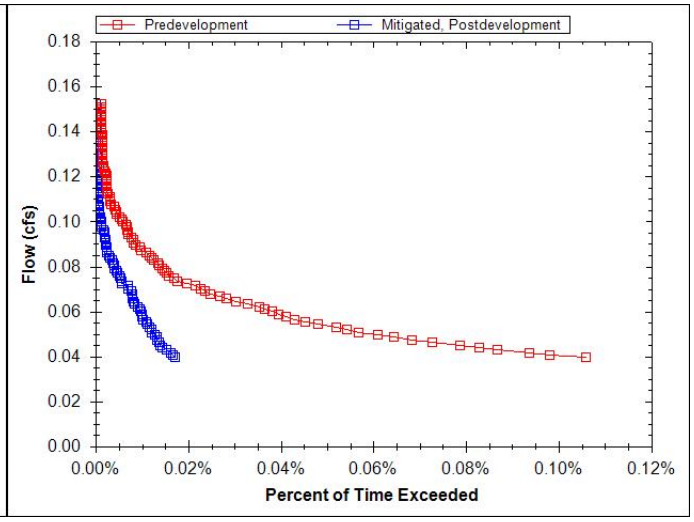
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	0.9
Upper Orifice Invert(ft)	2.0
Upper Orifice Dia (in)	2.1
Overflow Weir Invert(ft)	3.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart

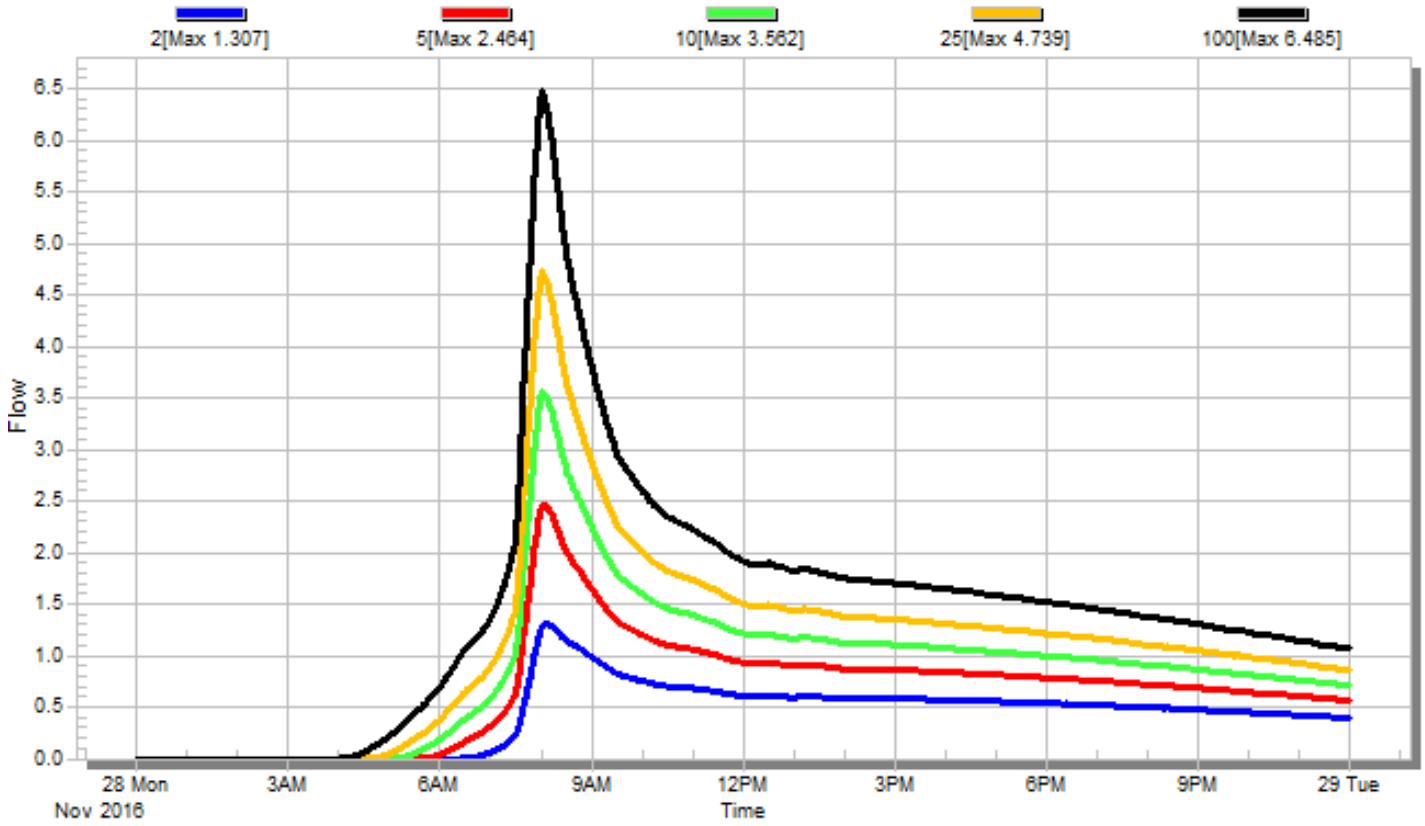


Flow Duration Chart

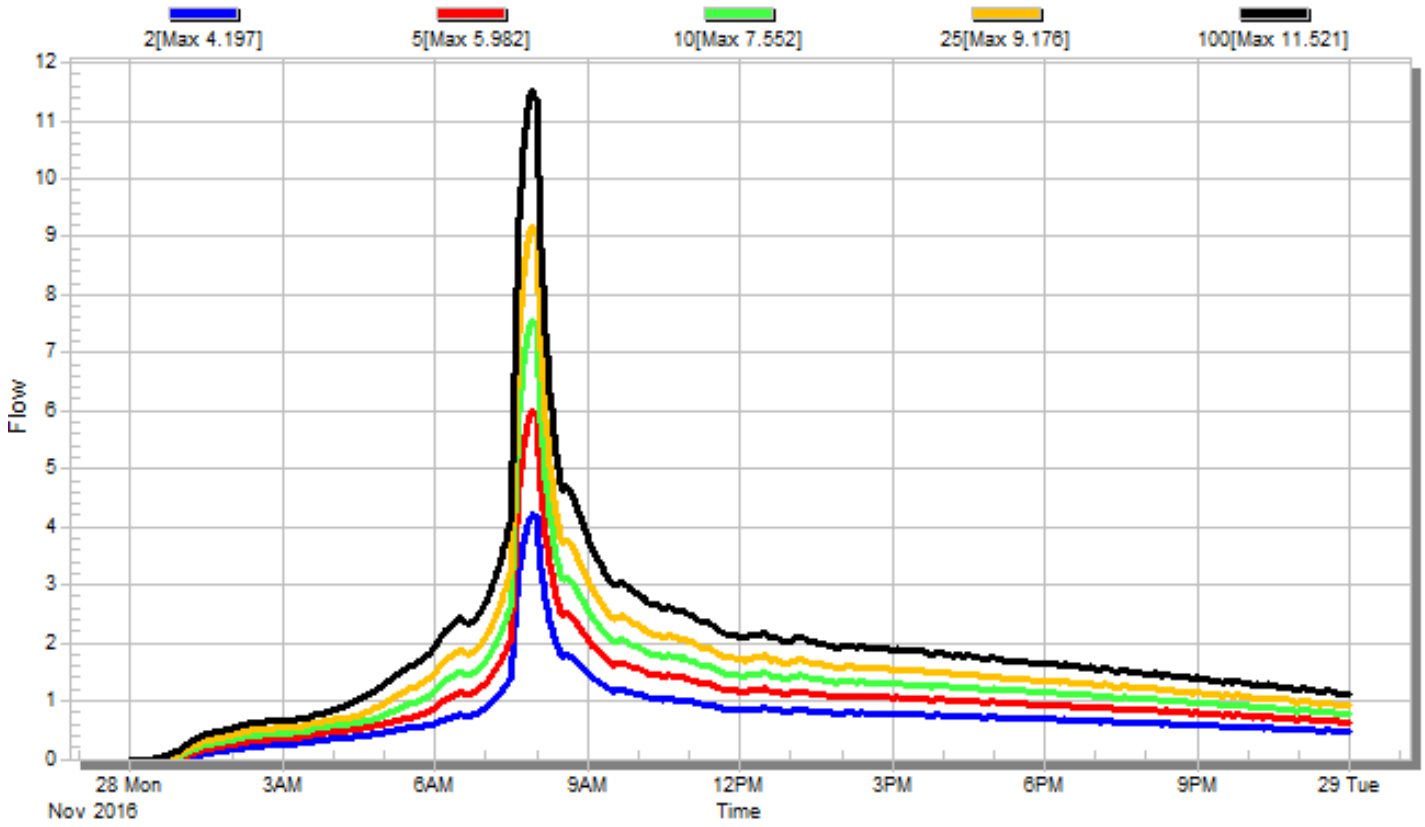


Kellogg Creek Planned Development — Hydrographs

Existing



Proposed



ELEVATIONS INFLUENCED BY KELLOGG CREEK

CONFLUENCE WITH KELLOGG CREEK

CLACKAMAS COUNTY
CITY OF MILWAUKIE

CITY OF MILWAUKIE
CLACKAMAS COUNTY

CLACKAMAS COUNTY
CITY OF MILWAUKIE

STATE HIGHWAY 224

RUSK ROAD

LAKE ROAD

Project Limits

SOUTHERN PACIFIC RAILROAD

CITY OF MILWAUKIE
CLACKAMAS COUNTY

CLACKAMAS COUNTY
CITY OF MILWAUKIE

CITY OF MILWAUKIE
CLACKAMAS COUNTY

ELEVATION (FEET NAVD 88)

80
75
70
65
60
55
50
45

0
1,000
2,000
3,000
4,000
5,000
6,000
6,500

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH KELLOGG CREEK

A
B
C
D

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

MT SCOTT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLACKAMAS COUNTY, OR

AND INCORPORATED AREAS

53P

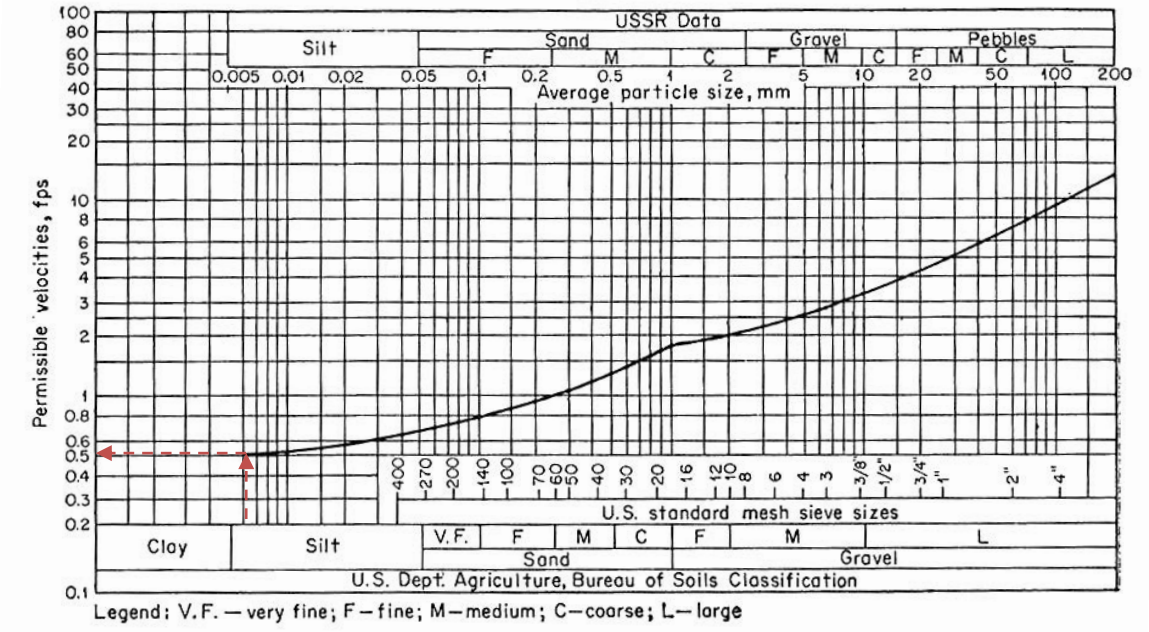


FIG. 7-3. U.S. and U.S.S.R. data on permissible velocities for noncohesive soils.

Source: Chow, V.T., 1959: *Open-channel hydraulics*. New York: McGraw-Hill. Page 166

Operation & Maintenance Plan

Kellogg Creek Planned Development

2322.14258.01

Prepared for

Brownstone Development, Inc.

47 S State Street
PO Box 2375
Lake Oswego, Oregon 97934

January 10, 2017

Prepared for	Brownstone Development, Inc.
Project Name	Operation & Maintenance Plan
Job Number	2322.14258.01
Date	January 10, 2017

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Name	Title	Date	Revision	Reviewer
Atalia Raskin	WR Project Manager	01/10/2017	1	Scott Emmens

EXECUTIVE SUMMARY

Maintenance of water quality facilities is very important to ensure they operate as designed. Inadequate maintenance can be attributed to premature failures of these facilities. This Operation and Maintenance Plan provides guidance on how to maintain your facility, control source pollution, frequency of inspection and maintenance, potential problems with each facility, different conditions to check for, and the actual conditions that should exist. Maintenance guidelines and checklists have been provided in the Technical Appendix of this document.

The purpose of this Operation and Maintenance Plan is to describe the required type and frequency of long-term maintenance of the stormwater facilities and to identify the responsible maintenance organization. Several sources were used for obtaining maintenance information including City of Portland's *Stormwater Management Manual* dated August 2016.

This Plan should be kept onsite or within reasonable access to the site. Maintenance logs must be kept and made available for City inspection.

I. STORMWATER APPROACH DECRIPTION

I.1 Stormwater Approach

Water quality treatment and flow control at Kellogg Creek site will be accomplished through bioretention ponds and planters. All stormwater runoff will be released to Mt. Scott Creek and the public storm sewer in Kellogg Creek Drive. The Technical Appendix of this manual contains stormwater plans showing facility locations.

Table I-1 Stormwater Facility Summary

Facility	Facility Type	Facility Parameters	Stormwater Source	Contributing Impervious Area (ac)	Latitude	Longitude	Discharge Point
North	Pond	Volume: 5,923 cf Depth: 36 inch	Roof & Roadway	2.55	45.42782	-122.60406	Mt. Scott Creek
South	Pond	Volume: 5,161 cf Depth: 36 inch	Roof & Roadway	2.23	45.42713	-122.60453	Mt. Scott Creek
Southwest	Pond	Volume: 860 cf Depth: 12 inch	Roof & Roadway	0.16	45.42629	-122.60488	SE Kellogg Creek Dr.
Planter A	Planter	Area: 75 sf	Roadway	0.04	45.42648	-122.60477	SE Kellogg Creek Dr.
Planter B	Planter	Area: 58 sf	Roadway	0.04	45.42648	-122.60379	SE Kellogg Creek Dr.
Planter C	Planter	Area: 55 sf	Roadway	0.04	45.42649	-122.60368	SE Kellogg Creek Dr.
Planter D	Planter	Area: 312 sf	Roadway	0.15	45.42626	-122.60432	SE Kellogg Creek Dr.

II. INSPECTION

II.1 Inspection Schedule

In accordance with SLOPES V, inspection and maintenance will be required at least

- Quarterly for the first three (3) years.
- Twice a year thereafter.
- Within 48 hours of major rainfall events (defined as more than one inch of rain over a 24-hour period).

A recommended maintenance calendar is provided below.

Recommended Maintenance Schedule													
Purpose of Visit	**Frequency**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Routine inspection	Min. 4/year (first 3 years)			✓		✓					✓		✓
Vegetation	Min. 12/year	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Soil	Min. 8/year	✓	✓	✓	✓	✓					✓	✓	✓
Sediment & Trash	Min. 2/year				✓						✓		
Flow Control Structures	Min. 2/year				✓						✓		

III. MAINTENANCE ACTIVIES AND VISUAL INDICATORS OF DIMINISHED PERFORMANCE

Site Best Management Practices

Onsite maintenance practices can reduce maintenance needs for stormwater facilities. Good housekeeping procedures such as trash or source control practices can reduce spills and prevent pollutants from entering facilities.

Remove trash, debris and sediment from catch basins. Identify sources of visible pollutants or spills and clean up sources to protect the stormwater system. Sweep or vacuum driveways or other ground-level surfaces. Report all spills that threaten or enter the public sanitary or storm system.

Sediment and Oil Removal and Disposal

Stormwater facilities are designed to remove pollutants by capturing sediment, dirt, leaves and litter. Removing sediment and oil helps maintain facility infiltration rates, provide good water quality treatment, and prevent clogging and flooding.

In vegetated facilities, sediment should be removed when it reaches a depth of four inches, when the quantity reaches 30 percent of total capacity (as designed or measured) or when accumulated sediment is impeding facility function. Examples include when sediment is damaging vegetation, preventing the facility from draining, blocking inlets or causing bypass.

Remove sediment by hand unless professionals are needed because of confined space entry requirements or the need for a vactor truck. Dispose of sediment per solid waste disposal requirements. Removing sediment during dry periods is easier because the material weighs substantially less.

Vegetation Management

Healthy plants play important roles: the root systems absorb stormwater, help maintain infiltration rates, prevent erosion, and capture pollutants. If a vegetated stormwater facility has bare soil, or if vegetation is stressed, unhealthy, or dead, replant per the approved planting plan and/or address cause of stress. Remove nuisance and invasive plants.

Healthy vegetation must cover at least 90% of stormwater facility surface area. Grass must be mowed to keep it four to nine inches tall. Prune or trim vegetation or roots to ensure free conveyance of stormwater or improve sight lines. Remove leaves or other debris. Use weed-free mulch to inhibit weeds. Irrigate as needed.

The use of fertilizers and pesticides (including herbicides) is strongly discouraged in stormwater management facilities because of the potential for negative impacts to downstream systems. Integrated Pest Management strategies are encouraged to reduce or eliminate the need for pesticides. If pesticides are required, use the services of a licensed applicator and products approved for aquatic use.

Erosion, Bank Failure, and Channel Formation

Erosion in the flow path, inside or outside a facility, can clog inlets and outlets and reduce both conveyance efficiency and infiltration rates. Forms of erosion include channels, undercutting, scouring, and slumping. Any area with erosion more than two inches deep must be addressed. Install long-term erosion control practices and fill the eroded areas.

Structural Repairs

Structural components control the conveyance of stormwater. Examples include inlets, outlets, trash racks, concrete curbs, retaining walls, manholes and check dams. Repair or replace items when damaged, loose, broken, cracked, or askew. Monitor minor damage such as dents, rust, or minor cracks in concrete for indications of when repair or replacement is required.

Ponding Water

Most stormwater facilities are designed to drain in a certain amount of time. The facilities have an anticipated ponding depth of 10 to 12 inches are designed to have a long-term infiltration rate of 2 inches/hour. The anticipated drawdown time is approximately 24 hours, after the completion of the storm event. When the facility does not drain as anticipated, inspect the facility to determine the cause. Clearly clogged inlets or outlets, remove sediment that may be preventing infiltration, or add vegetation.

Pests

Stormwater facilities are designed to drain quickly enough to avoid providing breeding areas for pests. If mosquitos are found, the stormwater facility may be ponding water longer than the approved design but also search for nearby sources of standing water. If rodents are found, remove plant debris, fruit or nuts that are providing shelter and food and contact the appropriate county vector control office for trapping and removal.

Safety

Stormwater facilities must be maintained to protect workers, visitors, and the general public. Vegetation should be pruned for adequate visual clearance. Avoid maintenance in wet weather to reduce potential injuries from slipping and always use appropriate safety gear. Only personnel approved for confined space entry should enter underground stormwater facilities.

IV. FINANCIAL RESPONSIBILITY

Stormwater facilities for the property site will be maintained and operated privately by the home owners association (HOA). The proposed property is located at 13333 Rusk Road in Milwaukie, Oregon.

The owner must ensure that the water quality systems efficiently perform their function of removing petroleum hydrocarbons, sediments, metals, bacteria and nutrients from stormwater runoff and that detention systems perform their function of detaining runoff onsite.

All appropriate property owners should be knowledgeable regarding stormwater operation and maintenance. They should recognize that protection and successful operation of the stormwater drainage system is essential to the continued successful operation of the system and to protecting the natural environment.

This plan should be reviewed and adjusted as needed. After the first year, evaluate if additional maintenance practices are necessary.

V. INSPECTION AND MAINTENANCE LOG

Maintenance Logs are to be kept for stormwater facilities by the property owner. Maintenance logs should be completed at the time of stormwater facility maintenance, and must be kept onsite.

The checklist included in the Technical Appendix should be used to determine the frequency of inspection/maintenance, the different drainage system feature to be inspected/maintained, the potential problem with the particular drainage feature, different conditions to check for and the actual conditions that should exist for that drainage feature.

The Maintenance Log has been included in this manual that can be used for catch basins, pipes, landscaping and detention facilities. Additionally, manufacture maintenance guidance documents have been included in the Technical Appendix.

VI. TECHNICAL APPENDIX

- *Operations and Maintenance Specifications – Catch Basins* – 2008 City of Portland Stormwater Management Manual
- *Standard O&M Plan and Maintenance Log - Planters* - 2016 City of Portland Stormwater Management Manual
- *Standard O&M Plan and Maintenance Log - Basins* - 2016 City of Portland Stormwater Management Manual

- Civil Plans

Catch Basins

The performance of catch basins for removing sediment and other pollutants depends on routine maintenance to retain the storage available in the sump in order to capture sediment and most floatables.

- Remove debris and sediment every 6 months (or when one-third full of sediment).
- Dewater and dispose of sediment properly. Test sediment that has a heavy oil sheen and/or odors to determine the appropriate disposal.
- Maintain the hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system.
- Maintain the grate as designed for safety reasons and to prevent trash and debris from collecting in the catch basin.
- Repair/seal cracks. Replace when repair is insufficient.
- Keep a log of the amount of sediment collected and the date of removal.

3.1.1.8. Planters

Structural components must be operated and maintained in accordance with the design specifications.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Clogged inlets or outlets	Remove sediment and debris from catch basins, trench drains, curb inlets, and pipes; maintain at least 50% conveyance at all times.
	Broken inlets or outlets	Repair/replace broken downspouts, curb cuts, standpipes, and screens.
	Damaged liners and walls	Extend and secure liner to planter walls above the high water mark. The facility must be water tight to protect abutting foundations from moisture damage.
	Cracked or exposed drain pipes	Repair or seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage
Vegetation must cover at least 90% of the facility at maturity.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Dead or stressed vegetation	Replant per original planting plan, or substitute from the plant list in Section 2.4.1. Irrigate and mulch as needed; prune tall, dry grasses and remove clippings.
	Tall grass and vegetation	Maintain grass height at 6”-9”. Trim to allow sight lines and foot traffic, also to ensure inlets and outlets freely convey stormwater into and/or out of facility.
	Weeds	Manually remove weeds.
Growing medium must sustain healthy plant cover and infiltrate within 48 hours.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Gullies, erosion, exposed soils, sediment accumulations	Fill in and lightly compact areas of erosion with City-approved soil mix (see Section 2.3.6) and replant according to planting plan or substitute from the plant list in Section 2.4.1. Sediment more than 4 inches deep must be removed.
	Scouring at the inlet(s)	Ensure splash blocks or inlet gravel/rock are adequate.
	Ponding	Rake, till, or amend soil surface with City-approved soil mix to restore infiltration rate. Remove and replace sediment at entrances.

Annual Maintenance Schedule

Summer	Make structural repairs; clean gutters and downspouts; remove any build-up of weeds or organic debris.
Fall	Replant exposed soil and replace dead plants. Remove sediment and plant debris.
Winter	Clear gutters and downspouts.
Spring	Remove sediment and plant debris. Replant exposed soil and replace dead plants.
All seasons	Weed as necessary.

Maintenance Records: All facility operators are required to keep an inspection and maintenance log. Record date, description, and contractor (if applicable) for all repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Fertilizers/Pesticides/Herbicides: Their use is strongly discouraged because of the potential for damage to downstream systems. If pesticides or herbicides are required, use the services of a licensed applicator and products approved for aquatic use.

Access: Maintain ingress/egress per design standards.

Infiltration/Flow Control: All facilities must drain within 48 hours. Record time/date, weather, and conditions when ponding occurs.

Pollution Prevention: All sites must implement Best Management Practices to prevent contamination of stormwater. Call 503-823-7180 to report spills. Never wash spills into a stormwater facility. If contamination occurs, document the circumstances and the corrective action taken; include the time/date, weather, and site conditions.

Vectors (Mosquitoes and Rats): Stormwater facilities must not harbor mosquito larvae or rodents that pose a threat to public health or that undermine facility structures. Record the time/date, weather, and site conditions when vector activity observed. Record when vector abatement started and ended.

Operations and Maintenance Log

Date	Work Performed By	Type of Work Performed					Notes	Initials
		Clean inlets and Outlets	Sediment and Trash Removal	Plant Replacement type, location	Structural Repairs – type, location	Other		

3.1.1.9. Basins

Structural components must be operated and maintained in accordance with the design specifications.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Clogged inlets or outlets	Remove sediment, debris, and blockages from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance at all times
	Broken inlets or outlets, including grates	Repair or replace broken downspouts, curb cuts, standpipes, and screens as needed.
	Cracked or exposed drain pipes	Repair or seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage.
	Check dams missing/broken	Maintain or replace rock check dams as per design specifications.
	Perforated liner	Replace or repair liner as needed.
Vegetation must cover at least 90% of the facility at maturity.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Dead or stressed vegetation	Replant per original planting plan, or substitute from the plant list in Section 2.4.1. Irrigate and mulch as needed; prune tall, dry grasses and remove clippings.
	Tall grass and vegetation	Maintain grass height at 6”-9”. Trim to allow sight lines and foot traffic, also to ensure inlets and outlets freely convey stormwater into and/or out of facility.
	Weeds	Manually remove weeds.
Growing medium must sustain healthy plant cover and infiltrate within 48 hours.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Gullies, erosion, exposed soil, sediment accumulation	Fill in and lightly compact areas of erosion with City-approved soil mix (see Section 2.3.6) and replant according to planting plan or substitute from the plant list in Section 2.4.1. Erosion more than 2 inches deep must be addressed. Sediment more than 4 inches deep must be removed.
	Scouring at the inlet(s)	Ensure splash blocks or inlet gravel/rock are adequate.
	Slope slippage	Stabilize 3:1 slopes/banks with plantings from the original planting plan or from the plant list in Section 2.4.1.
	Ponding	Rake, till, or amend soil surface with City-approved soil mix to restore infiltration rate. Remove sediment at entrance.

Annual Maintenance Schedule

Summer	Make structural repairs; clean gutters and downspouts; remove any build-up of weeds or organic debris.
Fall	Replant exposed soil and replace dead plants. Remove sediment and plant debris.
Winter	Clear gutters and downspouts.
Spring	Remove sediment and plant debris. Replant exposed soil and replace dead plants.
All seasons	Weed as necessary.

Maintenance Records: All facility operators are required to keep an inspection and maintenance log. Record date, description, and contractor (if applicable) for all repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Fertilizers/Pesticides/Herbicides. Their use is strongly discouraged because of the potential for damage to downstream systems. If pesticides or herbicides are required, use the services of a licensed applicator and products approved for aquatic use.

Access: Maintain ingress/egress per design standards.

Infiltration/Flow Control: All facilities must drain within 48 hours. Record time/date, weather, and conditions when ponding occurs.

Pollution Prevention: All sites must implement Best Management Practices to prevent contamination of stormwater. Call 503-823-7180 to report spills. Never wash spills into a stormwater facility. If contamination occurs, document the circumstances and the corrective action taken; include the time/date, weather, and site conditions.

Vectors (Mosquitoes and Rats): Facilities must not harbor mosquito larvae or rodents. Record the time/date, weather, and site conditions when vector activity is observed. Record when vector abatement started and ended.

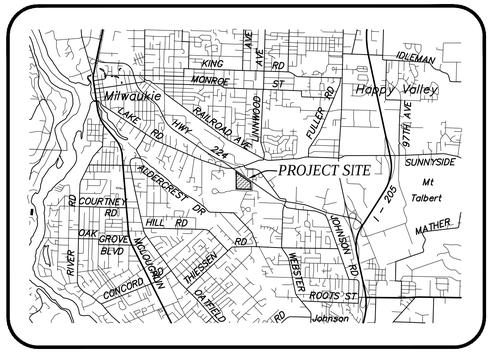
Operations and Maintenance Log

Date	Work Performed By	Type of Work Performed					Notes	Initials
		Clean inlets and Outlets	Sediment and Trash Removal	Plant Replacement type, location	Structural Repairs – type, location	Other		

KELLOGG CREEK

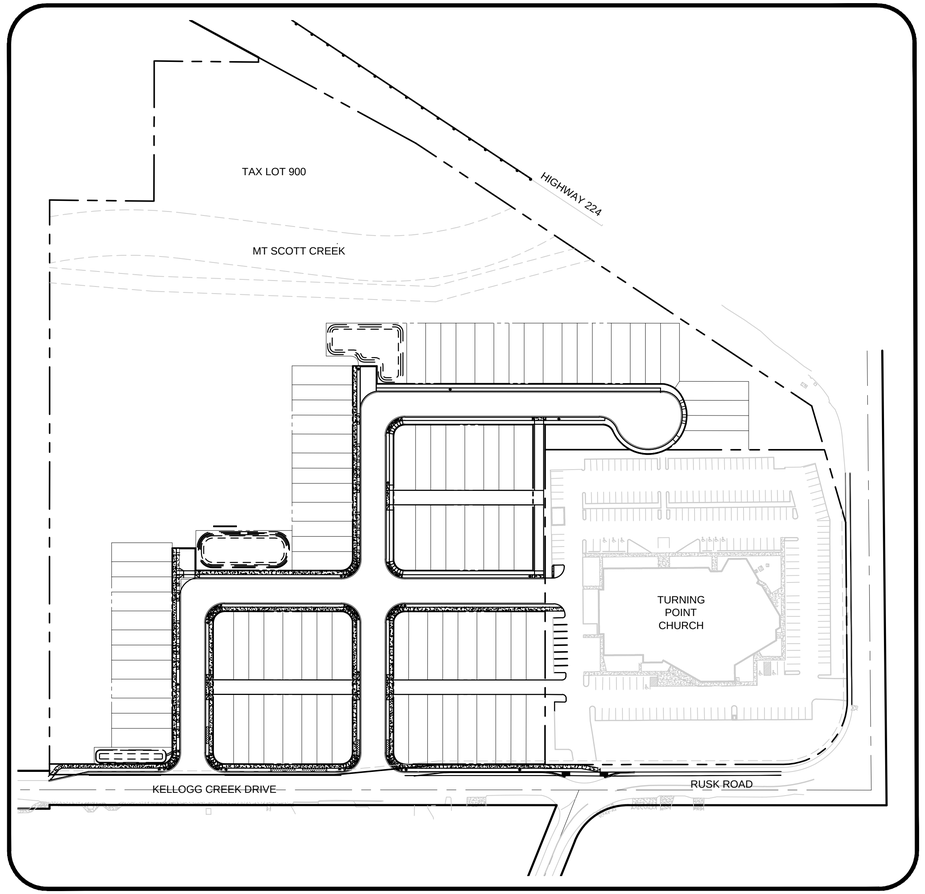
Planned Development Subdivision Application
Milwaukie, Oregon

February, 2017



VICINITY MAP

SCALE: NTS



SITE MAP

SCALE: NTS

SHEET INDEX

PROJECT TEAM

APPLICANT/OWNER
BROWNSTONE DEVELOPMENT, INC.
ATTN:RANDY MYERS
47 S. STATE ST
P.O. BOX 2375
LAKE OSWEGO, OR 97934
(503) 358-4460

CIVIL ENGINEER
DOWL
ATTN:SCOTT EMMENS, P.E.
720 SW WASHINGTON AVE SUITE 750
PORTLAND OR 97205
(971) 280-8641

LAND USE PLANNER
DOWL
ATTN:SERAH BREAKSTONE
720 SW WASHINGTON AVE SUITE 750
PORTLAND OR 97205
(971) 280-8641

LANDSCAPE ARCHITECT
DOWL
ATTN:PAT GAYNOR, PLA
720 SW WASHINGTON AVE SUITE 750
PORTLAND OR 97205
(971) 280-8641

SURVEYOR
TERRACALC LAND SURVEYING, INC.
ATTN: DARREN HARR, PLS
1615 N.E. MILLER STREET
MCMINNVILLE, OR 97128
OFFICE: (503) 857-0935

TRAFFIC ENGINEER
KITTELSON & ASSOCIATES, INC.
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PORTLAND, OR 97205
503-228-5230

ENVIRONMENTAL
PACIFIC HABITAT SERVICES
ATTN:JOHN VAN STAVEREN
9450 SW COMMERCE CIRCLE, SUITE 180
WILSONVILLE, OR 97070
(503) 570-0800

GEOTECHNICAL ENGINEER
GEO CONSULTANTS NORTHWEST
ATTN:BRAD HUPY, P.E., G.E.
824 SE 12TH AVE
PORTLAND, OR 97214
(503) 616-9425

REGISTERED PROFESSIONAL ENGINEER
OREGON
J. SCOTT EMMENS
FOR REVIEW ONLY
EXPIRES: 12/31/2017

DOWL
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KELLOGG CREEK SUBDIVISION

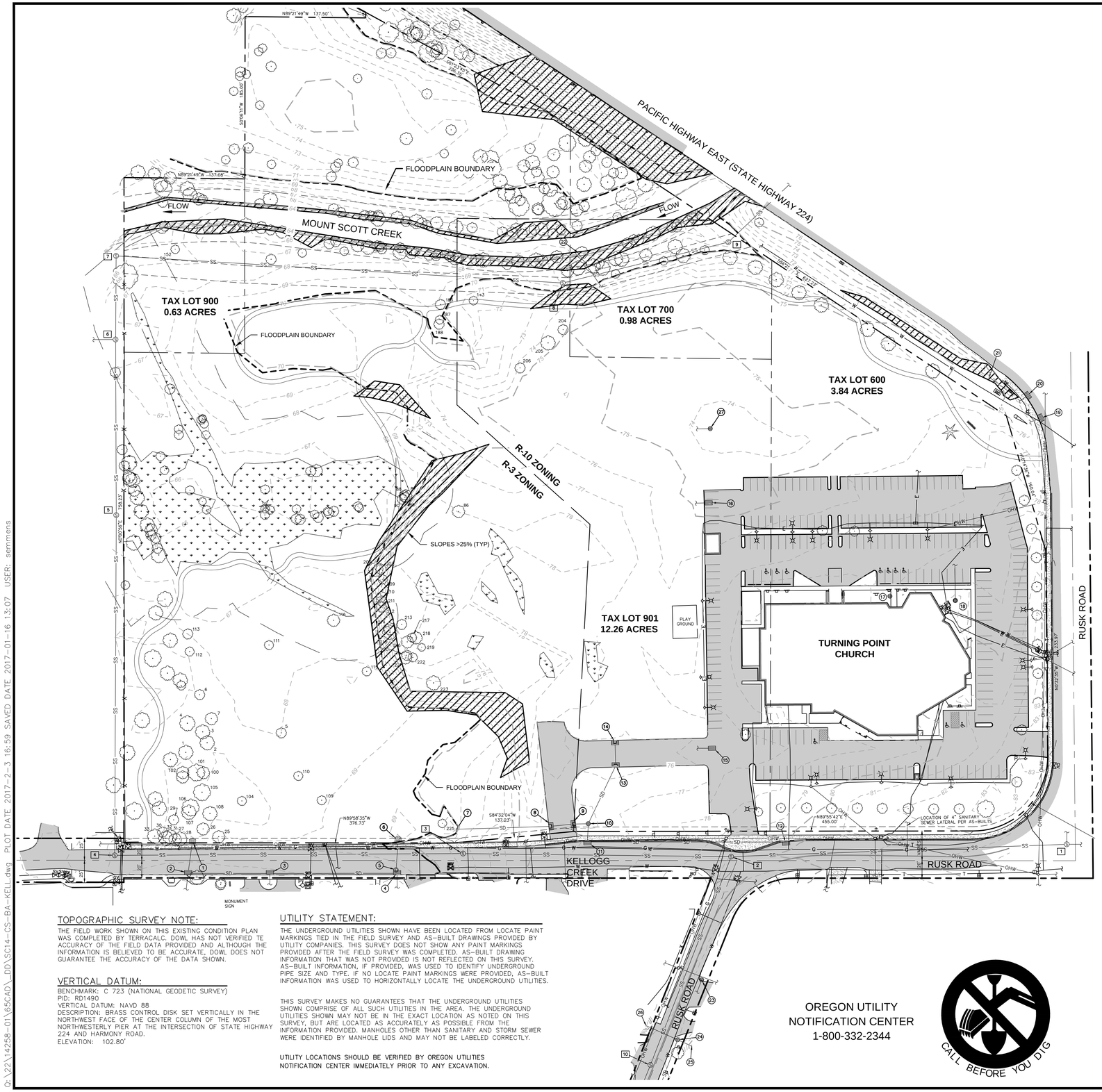
COVER SHEET

BROWNSTONE DEVELOPMENT
MILWAUKIE, OREGON
SE1/7 NE1/4 SEC. 6 T2S R2E W.M. EXISTING TAXLOTS 600, 700, 900, 901

PROJECT	14258-01
DATE	02/08/2017

SHEET

C000



LEGEND:

- EXISTING ASPHALT
- EXISTING CONCRETE
- EXISTING GRAVEL
- EXISTING SLOPES GREATER THAN 25%
- EXISTING EXISTING WETLAND
- SD — STORM DRAINAGE LINE
- SS — SANITARY SEWER LINE
- T — UNDERGROUND TELECOMMUNICATION LINE
- E — UNDERGROUND ELECTRIC LINE
- W — UNDERGROUND WATER LINE
- X — FENCE
- OHW — OVERHEAD POWER LINE
- G — GAS LINE
- DECIDUOUS TREE
- CONIFEROUS TREE
- SIGN
- TRAFFIC SIGNAL POLE
- SANITARY SEWER MANHOLE
- STORM DRAINAGE MANHOLE
- CATCH BASIN
- AREA DRAIN
- DITCH INLET
- ELECTRICAL VAULT
- COMMUNICATIONS VAULT
- WATER VAULT
- ELECTRICAL METER
- ELECTRICAL RISER
- WATER VALVE
- WATER METER
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- SPRINKLER VALVE
- GAS VALVE
- COMMUNICATIONS RISER
- ELECTRIC JUNCTION BOX
- SIGNAL JUNCTION BOX
- BOLLARD
- LIGHT POLE
- SIGNAL POLE
- PEDESTRIAN SIGNAL POLE
- UTILITY POLE
- GUY ANCHOR
- HANDICAPPED PARKING SPACE
- EXTG MAJOR CONTOUR
- EXTG MINOR CONTOUR
- FLOOD PLAIN (100 YEAR)
- LOT LINE
- BOUNDARY LINE
- RIGHT OF WAY LINE
- CENTERLINE
- ZONING DELINEATION

SANITARY SEWER TABLE:

1. SANITARY SEWER MANHOLE
   RIM=82.78'
   IE 8" CONC (N)=68.77'
   IE 12" CONC (E)=68.54'
   IE 12" CONC (W)=68.50'
2. SANITARY SEWER MANHOLE
   RIM=79.05'
   IE 8" CONC (S)=68.12'
   IE 12" CONC (E)=67.60'
   IE 12" CONC (W)=67.55'
3. SANITARY SEWER MANHOLE
   RIM=71.50'
   IE 12" CONC (E)=63.83'
   IE 12" CONC (W)=63.83'
4. SANITARY SEWER MANHOLE
   RIM=68.97'
   IE 12" CONC (E)=62.99'
   IE 12" CONC (N)=62.54'
5. SANITARY SEWER MANHOLE
   RIM=66.79'
   IE 12" CONC (S)=60.82'
   IE 12" CONC (N)=60.78'
6. SANITARY SEWER MANHOLE
   RIM=66.57'
   IE 12" CONC (S)=53.59'
   IE 42" CONC (N)=51.77'
   IE 42" CONC (W)=51.68'
7. SANITARY SEWER MANHOLE
   RIM=65.51'
   IE 42" CONC (E)=',
   IE 42" CONC (S)='
8. SANITARY SEWER MANHOLE
   RIM=69.73'
   IE 42" CONC (E)=52.94'
   IE 42" CONC (W)=52.94'
9. SANITARY SEWER MANHOLE
   RIM=70.91'
   IE 42" CONC (NE)=53.40'
   IE 42" CONC (W)=53.21'

STORM DRAINAGE TABLE:

1. DITCH INLET
   GRATE=-'
   IE 12" CPP (S)=66.15'
2. CATCH BASIN
   GRATE=67.40'
   IE 6" PVC (S)=65.95'
   IE 12" CPP (N)=65.93'
   IE 12" CONC (E)=65.88'
3. CATCH BASIN
   GRATE=67.79'
   IE 8" PVC (S)=65.72'
   IE 12" CONC (W)=65.62'
   IE 12" CONC (E)=65.62'
4. CATCH BASIN
   GRATE=68.47'
   IE 12" CONC (W)=65.22'
   IE 12" CONC (NW)=65.42'
   IE 12" CONC (S)=65.17'
5. STORM DRAINAGE MANHOLE
   RIM=68.65'
   IE 12" CONC (N)=65.29'
   IE 12" CONC (SE)=65.58'
6. DITCH INLET
   GRATE=67.83'
   IE 12" CONC (S)=65.69'
7. IE 12" CPP (E)=69.69'
8. CATCH BASIN
   GRATE=75.17'
   IE 12" CPP (E)=70.89'
   IE 12" CPP (W)=70.89'
9. CATCH BASIN
   GRATE=75.11'
   IE 12" CPP (E)=71.41'
   IE 12" CPP (W)=71.41'
10. AREA DRAIN
    GRATE=75.57'
    IE 12" CPP (N)=72.36'
    IE 12" CONC (S)=72.23'
    IE 12" CPP (W)=71.86'
11. CATCH BASIN
    GRATE=76.05'
    IE 12" CONC (E)=74.27'
    IE 12" CONC (N)=73.25'
12. CATCH BASIN
    GRATE=79.51'
    IE 12" CONC (W)=76.32'
13. CATCH BASIN
    GRATE=75.01'
    IE 12" CPP (N)=72.42'
    IE 12" CPP (S)=72.59'
14. CATCH BASIN
    GRATE=75.03'
    IE 12" CPP (S)=72.70'
15. CATCH BASIN/OIL TRAP
    GRATE=76.12'
    WATER LEVEL=75.00'
    COULD NOT OPEN TRAP
16. CATCH BASIN/OIL TRAP
    GRATE=73.86'
    WATER LEVEL=73.16'
    COULD NOT OPEN TRAP
17. AREA DRAIN
    GRATE=77.52'
18. AREA DRAIN/OIL TRAP
    GRATE=77.60'
    WATER LEVEL=76.89'
    COULD NOT OPEN TRAP
19. CATCH BASIN
    GRATE=76.41'
    IE 12" CONC (SW)=74.65'
20. CATCH BASIN
    GRATE=76.14'
    IE 12" CONC (SW)=74.09'
21. IE 16" CPP (E)=72.59'
22. IE 12" PVC (SE)=64.71'
23. AREA DRAIN
    GRATE=77.39'
    IE 3" PVC (S)=76.74'
24. AREA DRAIN
    GRATE=76.08'
    IE 24" CONC (E&W)=71.42'
25. IE 24" CONC (W)=71.63'
26. IE 24" CONC (E)=70.95'
27. AREA DRAIN
    GRATE=72.78'
    WATER LEVEL=72.03'
    COULD NOT OPEN TRAP

TOPOGRAPHIC SURVEY NOTE:

THE FIELD WORK SHOWN ON THIS EXISTING CONDITION PLAN WAS COMPLETED BY TERRACALC. DOWL HAS NOT VERIFIED TE ACCURACY OF THE FIELD DATA PROVIDED AND ALTHOUGH THE INFORMATION IS BELIEVED TO BE ACCURATE, DOWL DOES NOT GUARANTEE THE ACCURACY OF THE DATA SHOWN.

VERTICAL DATUM:

BENCHMARK: C 723 (NATIONAL GEODETIC SURVEY)
PID: RD1490
VERTICAL DATUM: NAVD 88
DESCRIPTION: BRASS CONTROL DISK SET VERTICALLY IN THE NORTHWEST FACE OF THE CENTER COLUMN OF THE MOST NORTHWESTERLY PIER AT THE INTERSECTION OF STATE HIGHWAY 224 AND HARMONY ROAD.
ELEVATION: 102.80'

UTILITY STATEMENT:

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM LOCATE PAINT MARKINGS TIED IN THE FIELD SURVEY AND AS-BUILT DRAWINGS PROVIDED BY UTILITY COMPANIES. THIS SURVEY DOES NOT SHOW ANY PAINT MARKINGS PROVIDED AFTER THE FIELD SURVEY WAS COMPLETED. AS-BUILT DRAWING INFORMATION THAT WAS NOT PROVIDED IS NOT REFLECTED ON THIS SURVEY. AS-BUILT INFORMATION, IF PROVIDED, WAS USED TO IDENTIFY UNDERGROUND PIPE SIZE AND TYPE. IF NO LOCATE PAINT MARKINGS WERE PROVIDED, AS-BUILT INFORMATION WAS USED TO HORIZONTALLY LOCATE THE UNDERGROUND UTILITIES.

THIS SURVEY MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE OF ALL SUCH UTILITIES IN THE AREA. THE UNDERGROUND UTILITIES SHOWN MAY NOT BE IN THE EXACT LOCATION AS NOTED ON THIS SURVEY, BUT ARE LOCATED AS ACCURATELY AS POSSIBLE FROM THE INFORMATION PROVIDED. MANHOLES OTHER THAN SANITARY AND STORM SEWER WERE IDENTIFIED BY MANHOLE LIDS AND MAY NOT BE LABELED CORRECTLY.

UTILITY LOCATIONS SHOULD BE VERIFIED BY OREGON UTILITIES NOTIFICATION CENTER IMMEDIATELY PRIOR TO ANY EXCAVATION.

OREGON UTILITY NOTIFICATION CENTER
1-800-332-2344

CALL BEFORE YOU DIG

N

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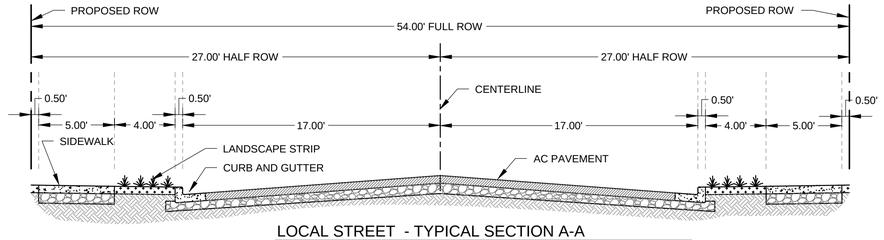
KELLOGG CREEK SUBDIVISION

EXISTING CONDITIONS

BROWNSTONE DEVELOPMENT
MILWAUKIE, OREGON
SE1/7 NE1/4 SEC. 6 T2S R2E W.M. EXISTING TAXLOTS 600, 700, 900, 901

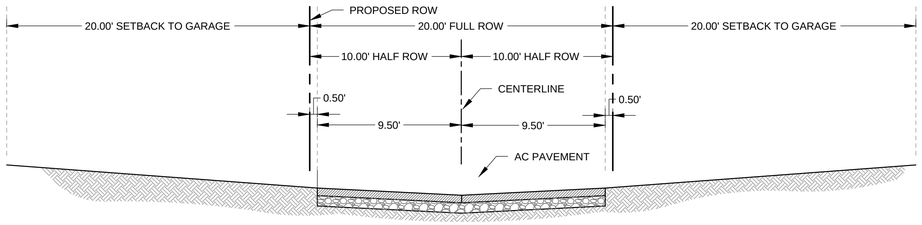
PROJECT	14258-01
DATE	02/08/2017

SHEET
C100



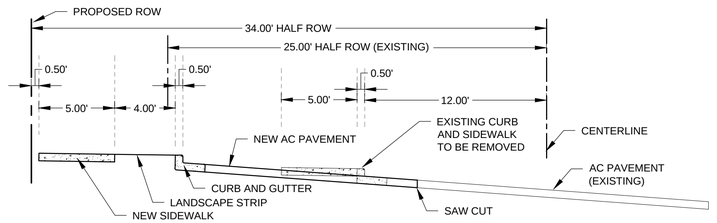
LOCAL STREET - TYPICAL SECTION A-A

HORIZONTAL SCALE: 1" = 5'



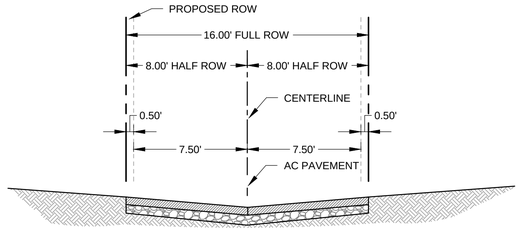
ALLEY - TYPICAL SECTION B-B

HORIZONTAL SCALE: 1" = 5'



KELLOGG CREEK DRIVE - TYPICAL SECTION C-C

HORIZONTAL SCALE: 1" = 5'



PUBLIC ALLEY - TYPICAL SECTION D-D

HORIZONTAL SCALE: 1" = 5'

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 27, 2007
J. SCOTT EMMENS
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EXPIRES: 12/31/2017

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KELLOGG CREEK SUBDIVISION

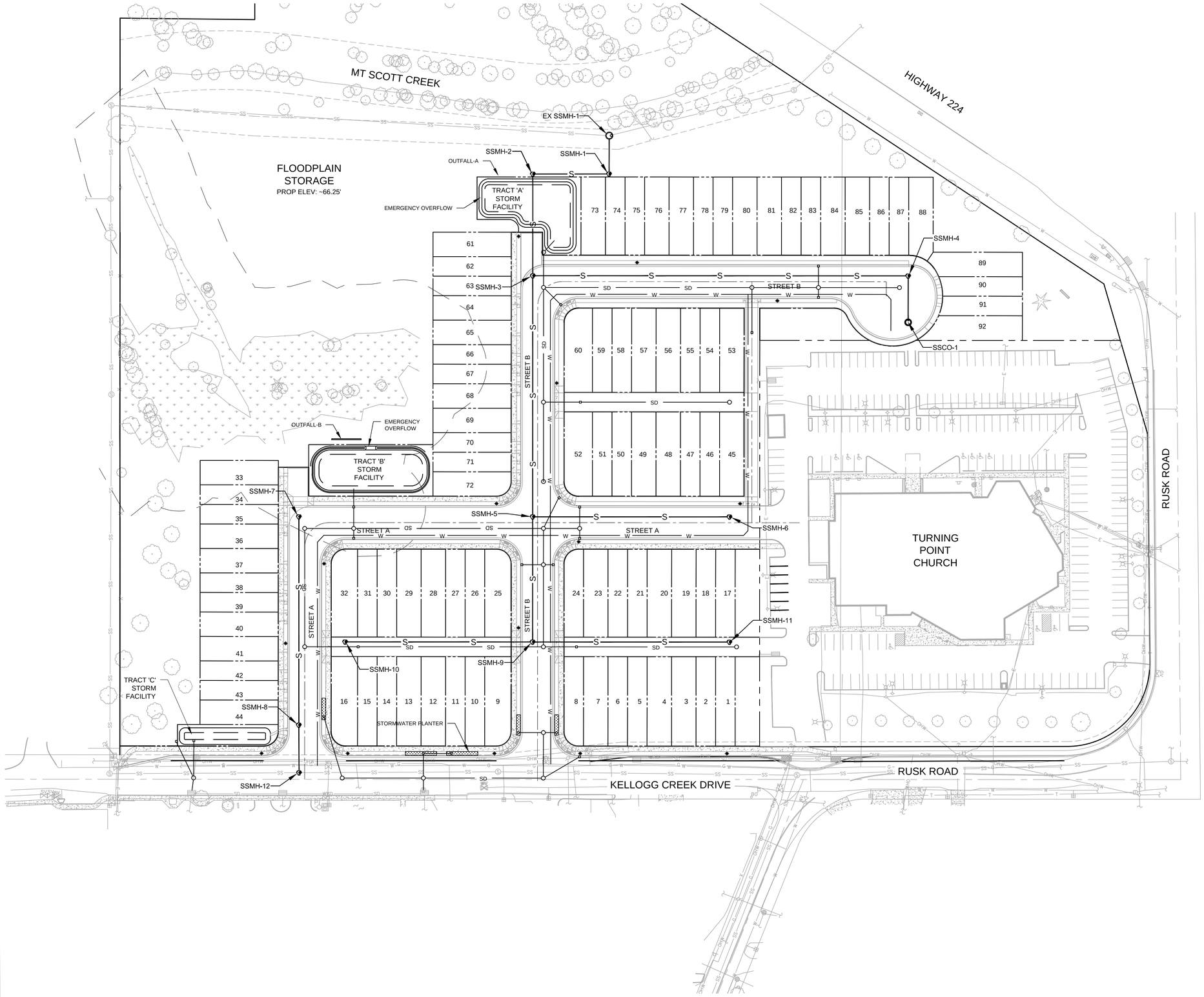
TYPICAL STREET SECTIONS

BROWNSTONE DEVELOPMENT
MILWAUKIE, OREGON
SE1/7 NE1/4 SEC. 6 T2S R2E W.M. EXISTING TAXLOTS 600, 700, 900, 901

PROJECT	14258-01
DATE	02/08/2017

SHEET

C202



LEGEND:

- S - EXISTING SANITARY SEWER LINE
- SD - EXISTING STORM LINE
- W - EXISTING WATER LINE
- EXISTING STORM MAN HOLE
- EXISTING SANITARY MAN HOLE
- EXISTING CATCH BASIN
- EXISTING WATER VALVE
- S - PROPOSED SANITARY SEWER LINE
- SD - PROPOSED STORM LINE
- W - PROPOSED WATER LINE
- PROPOSED SANITARY MAN HOLE
- PROPOSED STORM MAN HOLE
- PROPOSED CATCH BASIN
- PROPOSED STORMWATER PLANTER

NOTES:

1. OUTFALL A AND B: SEE SECTION '6.3 FLOW DISPERSION' OF THE STORM WATER REPORT DATED JANUARY 12, 2017 PREPARED BY DOWL.

MANHOLE DATA

EX SSMH-1
RIM: 69.06
IE IN (8"S) = 55.04
IE IN (42"W) = 52.94
IE OUT (42"E) = 52.94

SSCO-1
RIM: 76.47
IE OUT (8"N) = 67.80

SSMH-1
RIM: 72.57
IE IN (8"W) = 55.28
IE OUT (8"N) = 55.28

SSMH-2
RIM: 73.00
IE IN (8"S) = 55.75
IE OUT (8"E) = 55.75

SSMH-3
RIM: 73.69
IE IN (8"E) = 64.64
IE IN (8"S) = 56.37
IE OUT (8"N) = 56.37

SSMH-4
RIM: 76.49
IE IN (8"S) = 67.52
IE OUT (8"W) = 67.52

SSMH-5
RIM: 74.54
IE IN (8"E) = 65.22
IE IN (8"S) = 63.51
IE OUT (8"N) = 57.85

SSMH-6
RIM: 77.28
IE OUT (8"W) = 68.61

SSMH-7
RIM: 73.52
IE OUT (8"S) = 65.57

SSMH-8
RIM: 70.14
IE IN (8"N) = 64.29
IE OUT (8"S) = 64.09

SSMH-9
RIM: 74.93
IE IN (8"E) = 65.64
IE IN (8"W) = 64.28
IE OUT (8"N) = 64.28

SSMH-10
RIM: 74.10
IE OUT (8"E) = 65.43

SSMH-11
RIM: 76.32
IE OUT (8"W) = 67.65

SSMH-12
RIM: 68.66
IE IN (8"N) = 63.60

50 0 50
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
OREGON
J. SCOTT EMMENS
FOR REVIEW ONLY
EXPIRES: 12/31/2017

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KELLOGG CREEK SUBDIVISION

COMPOSITE UTILITY PLAN

BROWNSTONE DEVELOPMENT
MILWAUKIE, OREGON
SE1/7 NE1/4 SEC. 6 T2S R2E W.M. EXISTING TAXLOTS 600, 700, 900, 901

PROJECT	14258-01
DATE	02/08/2017

SHEET
C400

LEGEND:

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR

OREGON HWY 224

PARCEL II

SHED

EXISTING CHURCH BUILDING

VEHICLES THAT ARE EXITING THE CHURCH PROPERTY WILL BE DIRECTED TO USE THE PUBLIC STREET THAT LEADS TO SE KELLOGG CREEK DRIVE.

INSTALL GATE TO PRIVATE ALLEY.

INSTALL 'NO EXIT' SIGN AND DEMOLISH THE EXIT LANE. INSTALL CURB AND STRIPING TO DETER MOTORISTS FROM EXITING.

SOUTH BOUND TRAVEL LANE

NORTH BOUND TRAVEL LANE

14.50'

14.00'

10.00'

15.50'

5.00'

5.00'

END BIKE LANE STRIPING

PROVIDE BIKE LANE STRIPING

PROVIDE BIKE LANE STRIPING

SE KELLOGG CREEK DR

SE RUSK RD

SE RUSK RD

INSTALL BICYCLE RAMP FOR WEST BOUND TRAFFIC.

INSTALL BICYCLE RAMP FOR WEST BOUND TRAFFIC.

N

10 0 10

SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 2006
J. SCOTT EMMENS
FOR REVIEW ONLY
EXPIRES: 12/31/2017

DOWL
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KELLOGG CREEK SUBDIVISION

PUBLIC INTERSECTION

BROWNSTONE DEVELOPMENT
MILWAUKIE, OREGON
SE1/7 NE1/4 SEC. 6 T2S R2E W.M. EXISTING TAXLOTS 600, 700, 900, 901

PROJECT	14258-01
DATE	02/08/2017

SHEET

C500