Preliminary Storm Drainage Report

Springs at Sherwood

City of Sherwood, Oregon

April 18, 2014

Prepared for:

LRS ARCHITECTS
720 NW Davis, Suite 300
Portland, Oregon 97209

Prepared by:

KITTREDGE ENGINEERS, LLC
Site Development and Infrastructure Design
Civil Engineering and Land Use Services
Specializing in Commercial, Residential and Public Utility Projects

6565 SW 207th Avenue
Aloha, Oregon 97223
Office: 503. 708-3942
www.kitengs.com

REGISTERED PROFESSIONAL ENGINEER
CHRIS P. KITTREDGE
6-30-2015

PUD 14-02
SP 14-01
CUP 14-04

APR 23 2014

Table of Contents:

Appendices:

KITTREDGE ENGINEERS, LLC

STORM DRAINAGE REPORT

SPRINGS at SHERWOOD
15677 SW Oregon Street
TAX LOTS 400, 401, 402, 600, 4400

Purpose

The purpose of this analysis is to:

- Describe existing and proposed site conditions.
- Provide data and analysis for the stormwater impacts due to the proposed Springs at Sherwood IL Development.
- Provide detention and water quality infromation for the proposed site.
- Provide upstream and downstream analysis for the site.
- Demonstrate that the proposed Springs at Sherwood site does not significantly impact adjacent properties.

Introduction/Project Overview

This report describes the stormwater impacts and criteria used to complete the stormwater design for the proposed Springs at Sherwood senior care facility. The proposed project will be an expansion of the existing Springs at Sherwood facility and will be connected to the existing building. Stormwater improvements are proposed for the expansion in order to meet Clean Water Services and City of Sherwood design requirements.

Existing Conditions

There is currently an existing senior care facility located on the north side of the tax lots involved in the proposed project. See the top of this page for a list of all project tax lots. Along with the existing building, there is a large parking area to the east and service drive to the west that extends from Oregon Street northward about 2/3 of the way into the development property. There is an existing swale located on the property near the northwest corner. Unfortunately this swale cannot be used to treat the proposed site storm water due to its location and depth. There is an existing private drive that extends north and south just beyond east property line. This private driveway will remain in place with only additional west side sidewalk improvements to be made with redevelopment.

There is an existing church located directly north of the project site. No improvements will be made along the north side of the property. To the west is a large existing school property which will not be impacted by proposed development. Oregon Street is located directly south of the proposed property. No improvements are proposed directly to SW Oregon Street with exception of road side sidewalk and landscape improvements. There will also be a pedestrian crossing added at the south. Lastly, there are three existing houses located along the south end of the property that are directly along the Oregon Street site frontage. These three homes will be demolished as part of site redevelopment construction.

Stormwater from the proposed site is collected and routed into the existing storm system the leaves the site and continues to the west. The currently proposed expansion will be the third and last expansion to be completed on-site. As part of the stormwater calculations completed with the second phase of project construction in 2006, it was determined by the project design engineer that the existing western storm line was near capacity during the 25 year storm event. Upon review of these calculations, I am in agreement with the previous engineer's evaluation.

Since the previous second phase of construction in 2006, a very large development project has been constructed to the north east of the Springs at Sherwood site. A manhole for the off-site storm system is located in Oregon Street just south east of the eastern private drive. Unfortunately the basin analysis for this project stopped just east of the Springs at Sherwood property line. It was assumed that the Springs site would be part of the existing western drainage basin. Due to this, stormwater from the Springs site cannot be routed to the existing eastern storm line. This storm line is very shallow near the Springs site, and additionally was not designed to convey stormwater runoff from the Springs site.

There are two potential stormwater runoff directions for the Springs site, to the east and to the west. After evaluating both stormwater systems, it was determined that in either direction the existing storm water systems have insufficient conveyance capacity to convey stormwater runoff from the site unless on-site detention is used. A storm connection to the east is impossible if any type of on-site detention is used due to the existing shallow manhole depth at the would be connection point. This leaves only the western direction as a viable stormwater connection point. Shallow underground detention can be accomplished on-site while still allowing for the western stormwater connection to be made.

Proposed Conditions

The proposed Springs at Sherwood building will connect to the existing building on the property at the south side. The proposed building will extend southward, taking up the majority of the southern property with the exception of a new parking expansion to the east. A new swale is proposed directly along the eastern property line and will run north and south. The new swale will treat the eastern half of the site and proposed building.

The existing western service drive will remain, although it will be significantly reconfigured and re-graded. The western service drive and western roof drain laterals will be treated via Contech stormwater treatment catch basins and a Contech stormwater treatment manhole.

The Contech vaults are a mechanical water quality treatment method approved by both Clean Water Services and The City of Sherwood when used on private development sites.

Once stormwater from the proposed building along with the eastern and western parking and service areas has been treated for water quality, it will be routed to an on-site underground detention facility located in the western service drive. The proposed detention facility will be 30" in diameter and approximately 550 lf in length. See Appendix "D" for detention calculations.

Hydraulic Basin Analysis

Storm flows were calculated for both pre and post developed basins. Basin maps and summary basin calculations are included with this report as Appendix "D".

The Criteria for drainage basin calculations were based on requirements shown in the Clean Water Services design and construction standards (R&O 07-20).

The basin design criteria are as follows;

Design Criteria:

- Open channel flow
- 2-year, 24-hour event = 2.50 inches
- 10-year, 24-hour event = 3.45 inches
- 25-year, 24-hour event = 3.90 inches
- Conveyance system design storm = 25-year event
- Santa Barbara Urban Hydrograph methodology – SCS Type 1A

Time of Concentration

Pre-developed Time of Concentration was calculated to be 30 minutes – See Appendix "D" Post developed Time of concentration was assumed to be 10 minutes. Since design residence time in the water quality swale is required to be 9 minutes, a post developed Tc of 10 minutes appears to be a conservative estimate for post development.

Water Quality Design

WATER QUALITY DESIGN:

The proposed swale will treat stormwater runoff from the eastern portion of the site. The water quality treatment swale will be approximately 10' wide and 240' long. The swale will be split in half with a ditch inlet located near the midpoint. Stormwater will enter the swale at both the north and south ends where it will be collected in the ditch inlet at the midpoint and then enter the site storm system. The slope of the swale will be 0.50% in both directions. The swale will be designed and planted to meet both Clean Water Services and City of Sherwood design standards. Once water has been treated and collected in the proposed swale it will be routed to the west where it will enter the proposed detention system.

As stated on the preceding page, Contech Stormwater filter catch basins and a stormwater treatment manhole will provide water quality treatment for the western building and service drive areas.

Currently it has not been determined exactly which portions of the building will be routed east and west. This will be determined with the final building design. The water quality system as described should have no issues treating the required on-site water quality runoff and will do so while meeting Clean Water Services and City of Sherwood standards.

Formal water quality calculations will be provided with the final storm water report once the final building design is completed and it is known exactly which portions of the site contribute to either the eastern or western water quality treatment basins.

Detention Design

PRE AND POST-DEVELOPMENT FOR DETENTION DESIGN:

A 30" detention pipe has been designed on-site due to the downstream conveyance restrictions and the lack of fall to the existing storm system downstream. The on-site detention system consists of 550 LF of 30" pipe.

The Pre and Post-developed site was broken down into drainage basins which are detailed on the enclosed Basin Maps – Appendix "D". The following table shows the Pre and Post-Developed runoff amounts calculated for the 2 Year, 10 Year, and 25 Year design storm events along with actual detention release rates for each. Rainfall intensities used to calculate runoff rates were taken from the Clean Water Services Design Standards (R&O 7-20)

The following flows represent pre and post development runoff rates for the Springs at Sherwood development.

Storm Event	Pre-Development Run-off rate	Post-Development Run-off rate	Actual Detention Release Run-off rate
2 Year-24 hour	0.72 cfs	1.05 cfs	0.72 cfs
10 Year-24 hour	1.19 cfs	1.57 cfs	1.15 cfs
25 Year-24 hour	1.45 cfs	1.85 cfs	1.44 cfs

Computations and Routing - Detention:

The Pre and Post-Development flows have been routed through the proposed detention pipe. Detention and release rates have been designed to avoid any negative impacts to surrounding properties.

The Detention Pipe has been designed so that Post-Developed release rates do not exceed the Pre-Developed rates for the 2, 10, and 25 Year Storm events. See Appendix "D" for stage-storage routing. The HydroCAD Modeling program was used to calculate detention volumes.

Basin summary:

Post development	Predevelopement
Post Developed Impervious 2.22 Acres	Pre Developed Impervious 0.88 Acres
Post Developed Pervious 0.995 Acres	Pre Developed Pervious 2.34 Acres

The following table details the required calculated detention volumes for the 2, 10, and 25 year storms:

Storm Event	Detention Volume Provided
2 Year-24 hour	1,292 cu.ft.
10 Year-24 hour	2,278 cu.ft.
25 Year-24 hour	2,658 cu.ft.

Calculated orifice sizes and elevations – see Appendix "D"

2 Year Storm: 5.0" orifice

10 Year Storm: 4.6" orifice

25 Year Overflow: 12" Diameter

Conveyance System Design and Analysis

Storm Drainage from the proposed Springs at Sherwood Subdivision development will be collected in inlet structures and storm drain laterals, where it will enter the storm pipe conveyance system.

Pipe conveyance for the project will be analyzed and designed to convey the peak 25-Year, 24-Hour storm event as part of the final construction drawing submittal per Clean Water Services design guidelines.

Methodology: The site conveyance calculations will be performed using the SHUH - SCS Type 1-A unit hydrograph method.

Upstream Analysis

A small portion of runoff from the church to the north of the project will continue to enter the existing swale located at the northwest corner of the property. Runoff from the existing north portion of the property will continue to flow through the site via the on-site western conveyance system and flow into the downstream conveyance system. The existing north portion of the building site and stormwater runoff will not be detained on-site. Detention will be provided for the new site development area only.

Downstream Analysis

As stated above, the existing north stormwater runoff will continue to enter the western conveyance system as it does currently and will not be detained. The proposed on-site redevelopment area will be detained for the 2, 10 and 25 year design storms. With the addition of this on-site detention, the downstream western conveyance system should continue to function as it does currently.

Conclusions

- The conveyance system for the proposed Springs at Sherwood site will be sized to convey the peak 25-Year, 24-Hour storm as per City of Sherwood and Clean Water services stormwater standards.
- Water Quality will be provided on-site per City of Sherwood and Clean Water services stormwater standards.
- Detention on-site has been provided to maintain existing downstream stormwater runoff characteristics as per City of Sherwood and Clean Water services stormwater standards.
- Stormwater runoff from the proposed site will not adversely impact the downstream basin area or adjacent neighboring properties.

Hydrologic Methodology

Appendix B is the Soils Survey Information for the Springs at Sherwood property, which includes the Hydrologic Soils Classification for the site as found in The USDA Soil Conservation Services "Soil Survey of Washington County". The majority of the soil on-site is classified as Aloha Silt Loam - Hydrologic Soils Group C/D. In soils with dual classifications the first letter is for drained areas and the second for undrained areas. In this case the soils on-site are drained and therefore a Hydrologic Soils Group of C was assumed.

Appendix B is the SCS Runoff Curve Numbers as found in the Soil Conservation Services Manual "Urban Hydrology for Small Watersheds" (TR-55 Method). A very conservative SCS Curve Number of 86 was assumed for pre-developed on-site pervious surfaces based on the assumption of grass in poor condition. In all likelihood the grass cover will be in much better condition than this, however a more conservative estimation was deemed best in this case to ensure proper detention volumes. Lastly, An SCS Curve Number of 98 was assumed for all impervious surfaces.

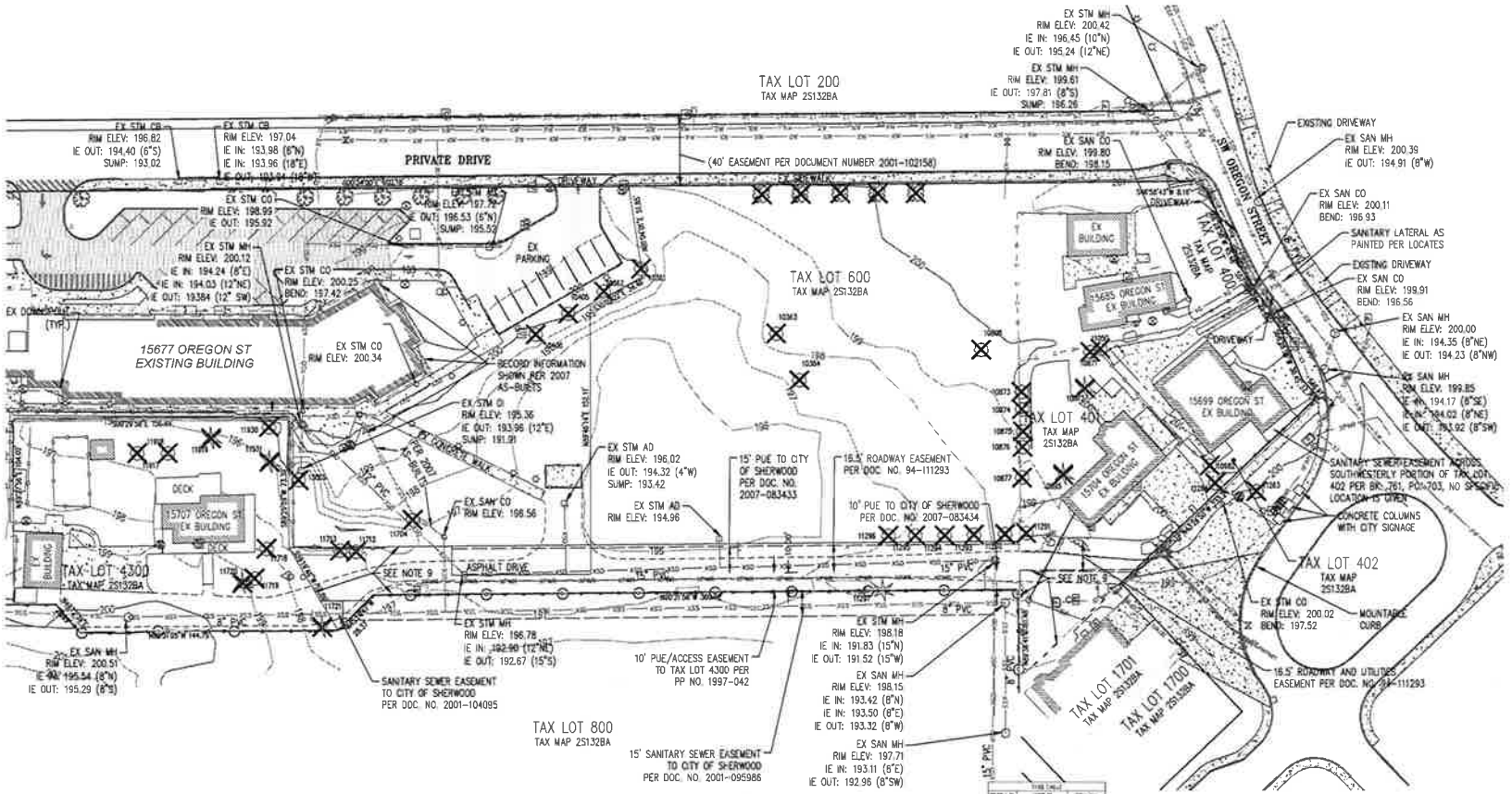
Appendix D The Santa Barbara Urban Hydrograph SCS-Type 1A Method was used to compute the tributary basins peak flows for the 2, 10 and 25-Year, 24-Hour, design storm event. Precipitation for the storm events was taken from Clean Water Services stormwater design standards.

Appendix D Details the computer modeled Stage-Storage, Stage-Discharge and Orifice Design calculations for the 30" detention pipe. The detention pipe was designed to release Post-Developed flows for the 2, 10, and 25 -Year storm events at Pre-Developed rates or less. These runoff rates were based on Clean Water Services stormwater design standards.

Appendix A:

Vicinity Map
Existing Conditions Plan

SW Sherwood Blvd
SW Washington St
SW Pine St
Sherwood
SW Century Dr
SW Baler Way
SW Langer Farms Pkwy
SW Lincoln St
SW Willamette St
SW Oregon St
SW Forest Ave
SW Hall St
SW Lower Roy St
SW Orland St



LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

PROJECT NUMBER:

The Springs at Sherwood
Sherwood, Oregon

SHEET TITLE:
EXISTING CONDITIONS / TREE REMOVAL

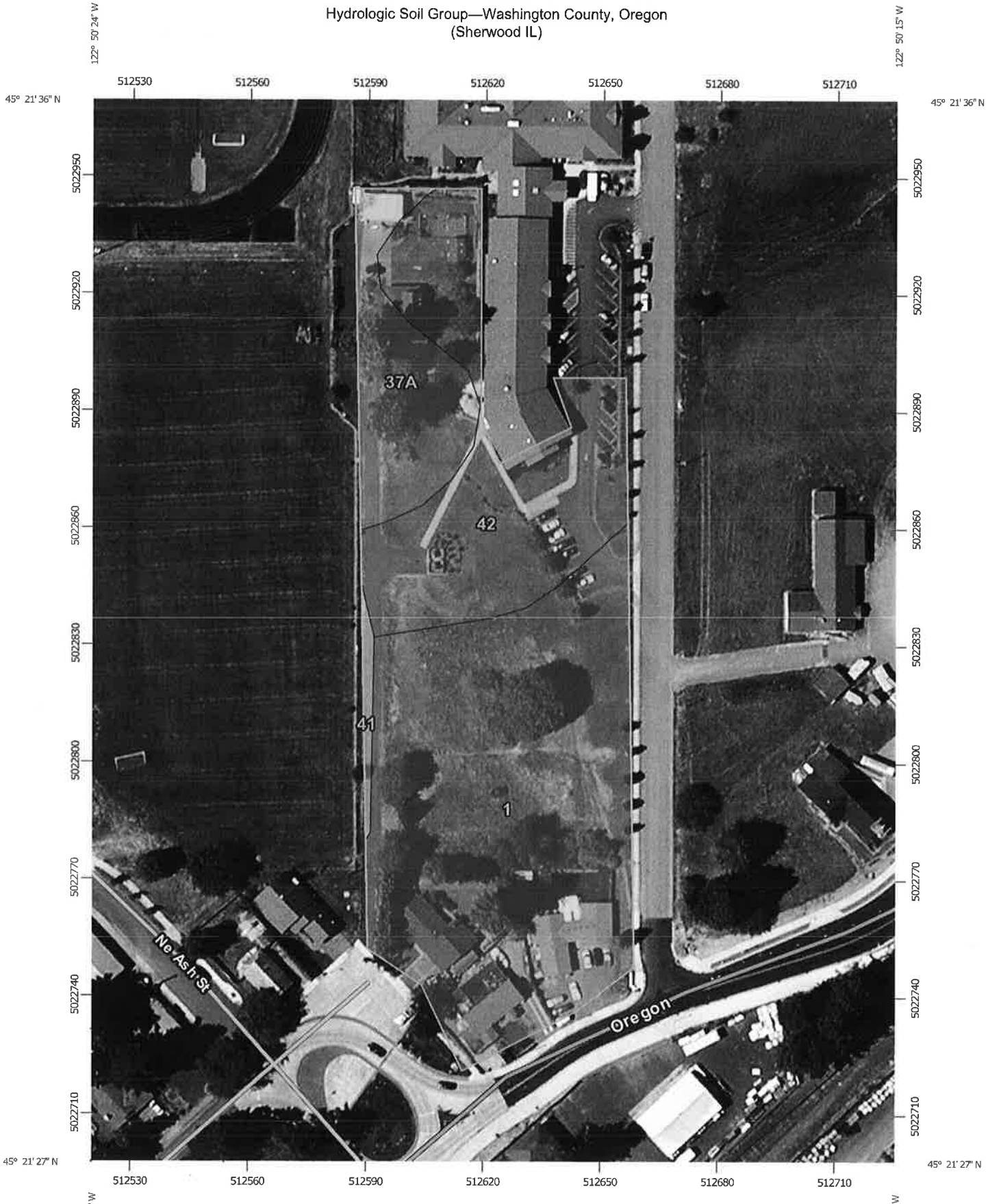
DRAWN BY:
DATE ISSUED:

SHEET: **C101**

Appendix B:

Soil Maps & Classification
Runoff Curve Number Designation

Hydrologic Soil Group—Washington County, Oregon
(Sherwood IL)



Map Scale: 1:1,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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: Washington County, Oregon
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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 — Washington County, Oregon (OR067)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Aloha silt loam	C/D	1.8	57.4%
37A	Quatama loam, 0 to 3 percent slopes	C	0.4	12.8%
41	Urban land		0.0	1.0%
42	Verboort silty clay loam	D	0.9	28.7%
Totals for Area of Interest			**3.1**	**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 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.

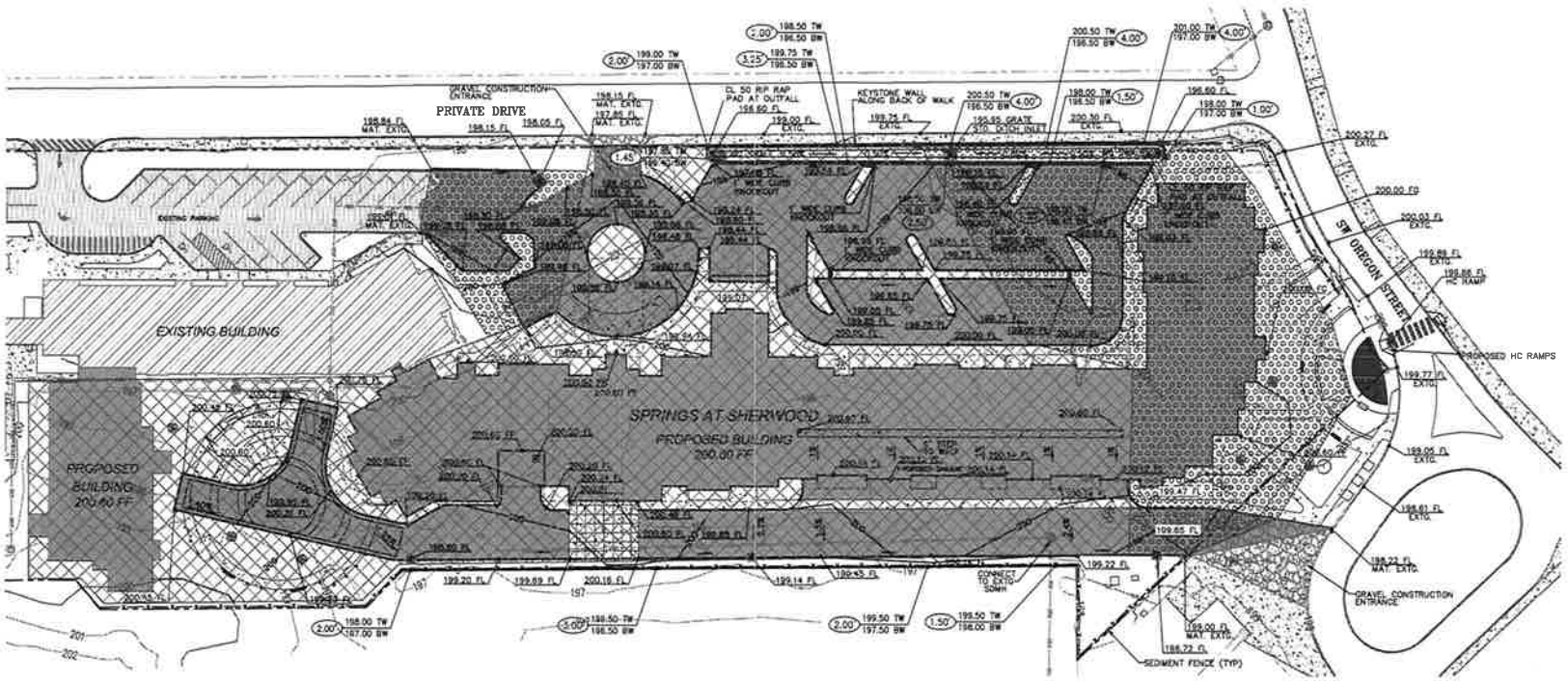
[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[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.

Appendix C:

Prelim. Storm Design
and Grading Plans



EXISTING LEGEND

- DECIDUOUS TREE
- CONIFEROUS TREE
- DECIDUOUS TREE REMOVED
- CONIFEROUS TREE REMOVED
- FIRE HYDRANT
- WATER BLOWOFF
- WATER METER
- WATER VALVE
- DOUBLE CHECK VALVE
- AIR RELEASE VALVE
- SANITARY SEWER CLEAN OUT
- SANITARY SEWER MANHOLE
- SIGN
- STREET LIGHT
- MAILBOX
- STORM SEWER CLEAN OUT
- STORM SEWER CATCH BASIN
- STORM SEWER AREA DRAIN
- STORM SEWER MANHOLE
- GAS METER
- GAS VALVE
- GUY WIRE ANCHOR
- POWER POLE
- POWER VAULT
- POWER JUNCTION BOX
- POWER PEDESTAL
- COMMUNICATIONS VAULT
- COMMUNICATIONS JUNCTION BOX
- COMMUNICATIONS RISER
- RIGHT-OF-WAY LINE
- BOUNDARY LINE
- PROPERTY LINE
- CENTERLINE
- DITCH
- CURB
- EDGE OF PAVEMENT
- EASEMENT
- FENCE LINE
- GRAVEL EDGE
- POWER LINE
- OVERHEAD WIRE
- COMMUNICATIONS LINE
- FIBER OPTIC LINE
- GAS LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- WATER LINE

PROPOSED LEGEND

- EXISTING 5 FT. CONTOUR INTERVAL
- EXISTING 1 FT. CONTOUR INTERVAL
- EXISTING EASEMENT
- PROPOSED 5FT. CONTOUR INTERVAL
- PROPOSED 1FT. CONTOUR INTERVAL
- SEDIMENT FENCE
- BIOFILTER BAG SEDIMENT BARRIER AT PROPOSED LYNCH TYPE CATCH BASINS
- DIRECTION OF STORM WATER FLOW
- CONSTRUCTION ENTRANCE
- 232.64 TC — TOP OF CURB ELEVATION
- 232.64 FF — FINISH FLOOR ELEVATION
- 232.64 FL — FLOW LINE CURB ELEVATION
- 232.64 TG — TOP OF GRATE ELEVATION
- KEYSTONE BLOCK OR CONCRETE RETAINING WALL TO BE DETERMINED WITH CONSTRUCTION PLANS

NOTE:
SEE EXISTING CONDITIONS PLAN FOR EXISTING TREES TO BE REMOVED

- AREAS OF PROPOSED FILL
- AREAS OF PROPOSED CUT

1 inch = 30 ft.

PRE AND POST DEVELOPMENT AREAS
(RE-DEVELOPMENT AREA ONLY)

PRE-DEVELOPED IMPERVIOUS AREA: 0.88 ACRES
PRE-DEVELOPED PERVIOUS AREA: 2.34 ACRES

POST-DEVELOPED IMPERVIOUS AREA: 2.22 ACRES
POST-DEVELOPED PERVIOUS AREA: 0.995 ACRES

LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

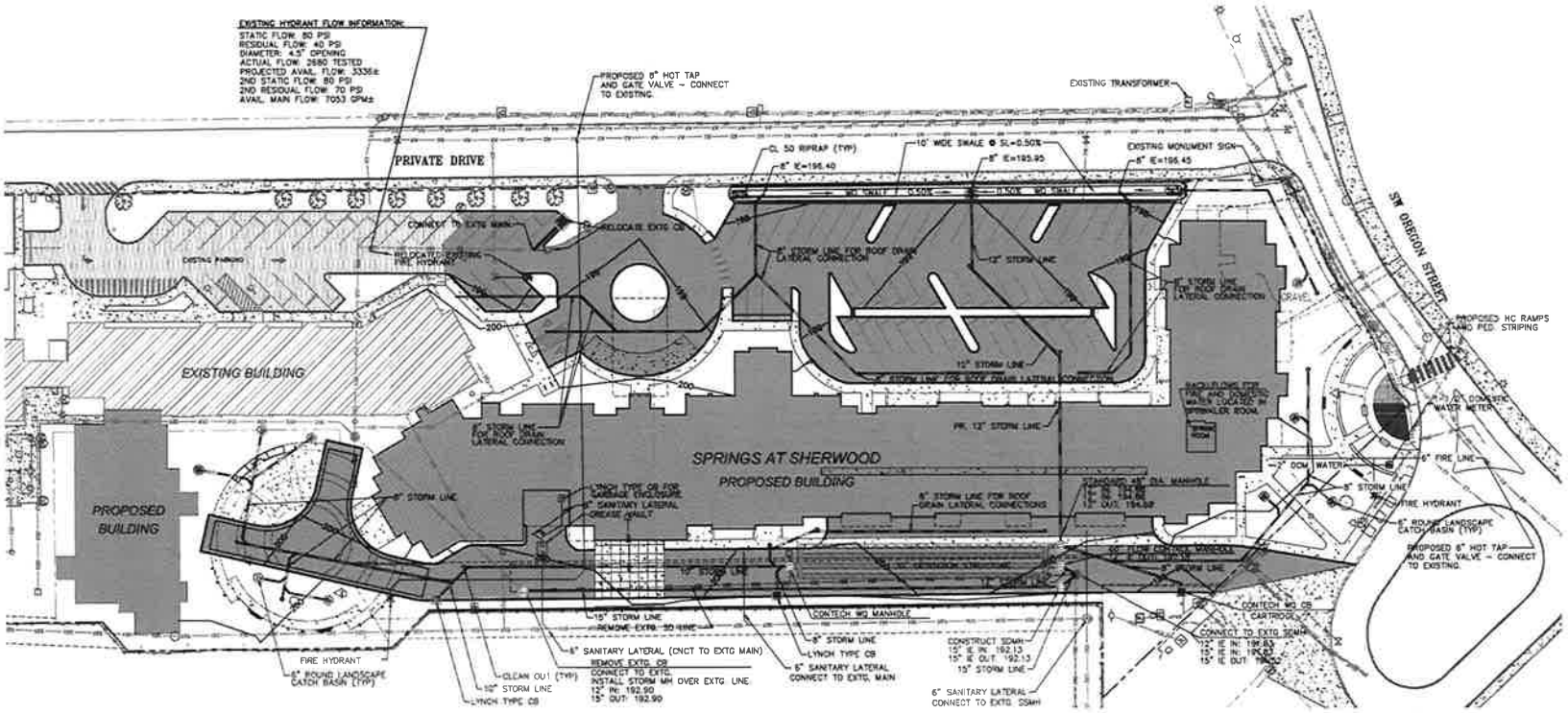
PROJECT NUMBER: 212003

The Springs at Sherwood
Sherwood, Oregon

SHEET TITLE:
EROSION CONTROL AND GRADING PLAN

DRAWN BY: DM
DATE ISSUED: 02.22.2019

SHEET: **C102**



EXISTING LEGEND

DECIDUOUS TREE	STORM SEWER CLEAN OUT	RIGHT-OF-WAY LINE
CONIFEROUS TREE	STORM SEWER CATCH BASIN	BOUNDARY LINE
FIRE HYDRANT	STORM SEWER AREA DRAIN	PROPERTY LINE
WATER BLOWOFF	STORM SEWER MANHOLE	CENTERLINE
WATER METER	GAS METER	DITCH
WATER VALVE	GAS VALVE	CURB
DOUBLE CHECK VALVE	GUY WIRE ANCHOR	EDGE OF PAVEMENT
AIR RELEASE VALVE	POWER POLE	EASEMENT
SANITARY SEWER CLEAN OUT	POWER VAULT	FENCE LINE
SANITARY SEWER MANHOLE	POWER JUNCTION BOX	GRAVEL EDGE
SIGN	POWER PEDESTAL	POWER LINE
STREET LIGHT	COMMUNICATIONS VAULT	OVERHEAD WIRE
MAILBOX	COMMUNICATIONS JUNCTION BOX	COMMUNICATIONS LINE
	COMMUNICATIONS RISER	FIBER OPTIC LINE
		GAS LINE
		STORM SEWER LINE
		SANITARY SEWER LINE
		WATER LINE

PROPOSED LEGEND

- 5FT – PROPOSED 5FT. CONTOUR INTERVAL
- 1FT – PROPOSED 1FT. CONTOUR INTERVAL
- PROPOSED STORM DRAIN LINE
- PROPOSED SANITARY LATERAL
- PROPOSED WATER LINE
- PROPOSED 6" ROUND LANDSCAPE CATCH BASIN
- PROPOSED STORM "LYNCH" STYLE CATCH BASIN
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM SEWER CLEAN OUT
- PROPOSED SANITARY SEWER CLEAN OUT
- PROPOSED FIRE HYDRANT
- PROPOSED WATER METER
- KEYSTONE BLOCK OR CONCRETE RETAINING WALL TO BE DETERMINED WITH CONSTRUCTION PLANS

1 inch = 30 ft.

PRE AND POST DEVELOPMENT AREAS
(RE-DEVELOPMENT AREA ONLY)

PRE-DEVELOPED IMPERVIOUS AREA: 0.88 ACRES
PRE-DEVELOPED PERVIOUS AREA: 2.34 ACRES

POST-DEVELOPED IMPERVIOUS AREA: 2.22 ACRES
POST-DEVELOPED PERVIOUS AREA: 0.995 ACRES

LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

PROJECT NUMBER:

The Springs at Sherwood
Sherwood, Oregon

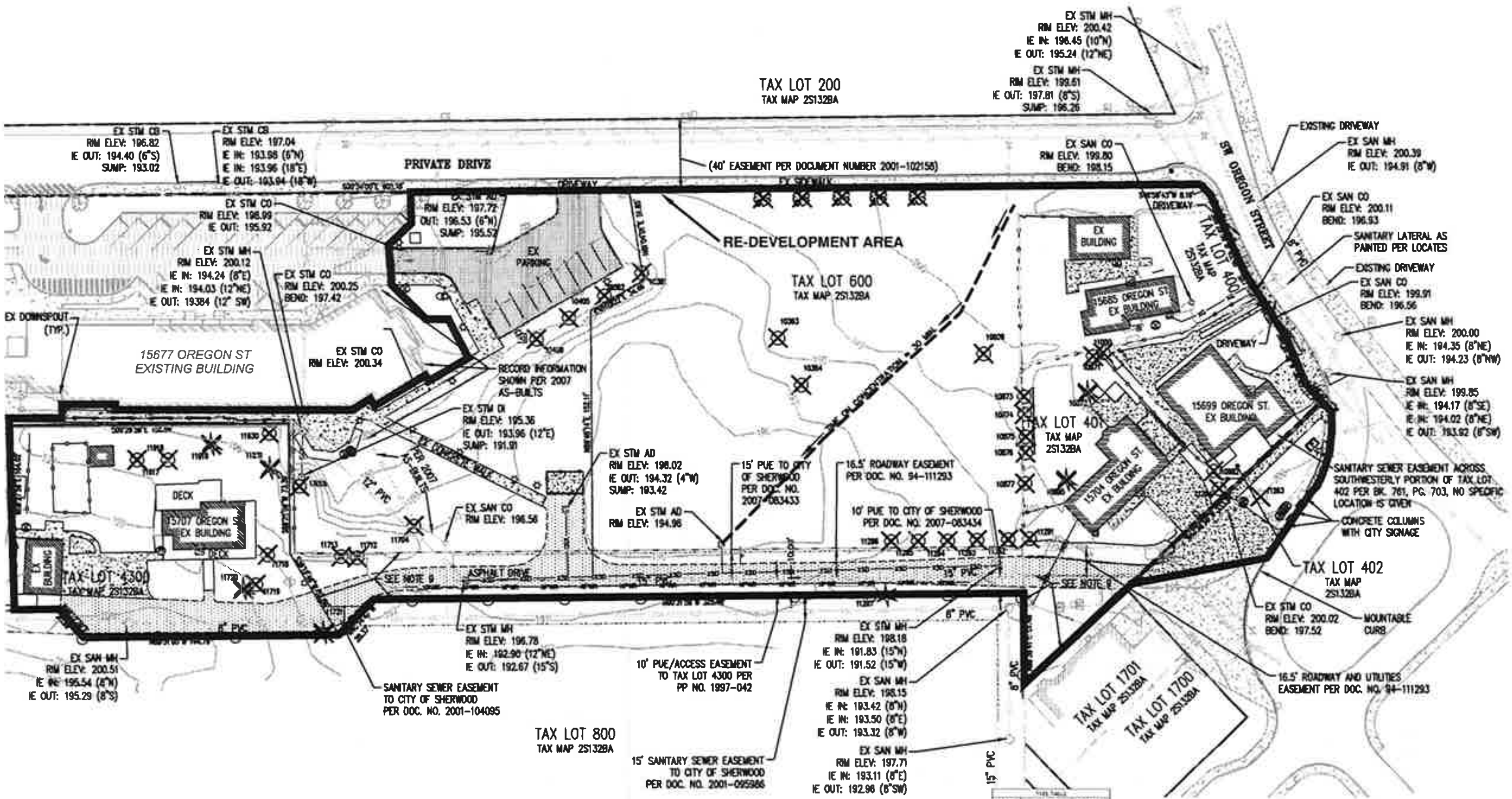
SHEET TITLE:
PRELIMINARY UTILITY PLAN

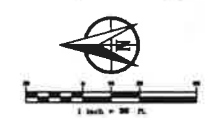
DRAWN BY:
DATE ISSUED:

SHEET: **C103**

Appendix D:

On-site Basin Maps
Pre & Post Development Calcs (2 – 25 Yr)
Pre-developed Tc
Detention Calcs (2 - 25 Year)





EXISTING LEGEND

- DECIDUOUS TREE
- CONIFEROUS TREE
- DECIDUOUS TREE REMOVED
- CONIFEROUS TREE REMOVED
- FIRE HYDRANT
- WATER BLOWOFF
- WATER METER
- WATER VALVE
- DOUBLE CHECK VALVE
- AIR RELEASE VALVE
- SANITARY SEWER CLEAN OUT
- SANITARY SEWER MANHOLE
- SIGN
- STREET LIGHT
- MAILBOX
- STORM SEWER CLEAN OUT
- STORM SEWER CATCH BASIN
- STORM SEWER AREA DRAIN
- STORM SEWER MANHOLE
- GAS METER
- GAS VALVE
- GUY WIRE ANCHOR
- POWER POLE
- POWER VAULT
- POWER JUNCTION BOX
- POWER PEDESTAL
- COMMUNICATIONS VAULT
- COMMUNICATIONS JUNCTION BOX
- COMMUNICATIONS RISER
- RIGHT-OF-WAY LINE
- BOUNDARY LINE
- PROPERTY LINE
- CENTERLINE
- DITCH
- CURB
- EDGE OF PAVEMENT
- EASEMENT
- FENCE LINE
- GRAVEL EDGE
- POWER LINE
- OVERHEAD WIRE
- COMMUNICATIONS LINE
- FIBER OPTIC LINE
- GAS LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- WATER LINE

NOTES:

1. UTILITIES SHOWN ARE BASED ON UNDERGROUND UTILITY LOCATE MARKINGS AS PROVIDED BY OTHERS, PROVIDED PER UTILITY LOCATE TICKET NUMBER 13220827. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND LOCATES REPRESENT THE ONLY UTILITIES IN THE AREA. CONTRACTORS ARE RESPONSIBLE FOR VERIFYING ALL EXISTING CONDITIONS PRIOR TO BEGINNING CONSTRUCTION.
2. FIELD WORK WAS CONDUCTED OCTOBER 2-17, 2013.
3. VERTICAL DATUM: ELEVATIONS ARE BASED ON WASHINGTON COUNTY BENCHMARK NO. 130, BEING A 2-1/2 INCH BRASS DISK SET IN CONCRETE AT THE INTERSECTION OF OREGON STREET AND TONQUIN ROAD, WITH AN ELEVATION OF 130.722 (NGVD29).
4. THIS MAP DOES NOT CONSTITUTE A PROPERTY BOUNDARY SURVEY. BOUNDARIES ARE PER SURVEYS AND PLATS OF RECORD. TITLE REPORTS WERE RECEIVED FOR ALL PROPERTIES WITH THE EXCEPTION OF TAX LOT 400 – TAX MAP 2S132BA.
5. SURVEY IS ONLY VALID WITH SURVEYOR'S STAMP AND SIGNATURE.
6. BUILDING FOOTPRINTS ARE MEASURED TO SIDING UNLESS NOTED OTHERWISE. CONTACT SURVEYOR WITH QUESTIONS REGARDING BUILDING TIES.
7. CONTOUR INTERVAL IS 1 FOOT.
8. ONLY TREES HAVING A DIAMETER OF 6" AND GREATER, MEASURED AT BREAST HEIGHT, WERE SURVEYED AT THIS TIME.
9. EASEMENT FOR INGRESS, EGRESS AND PUBLIC UTILITIES PER PARTITION PLAT NO. 1997-042 FOR THE BENEFIT OF PARCEL 1 OF SAID PARTITION PLAT.

TREE TABLE		
[illegible]	[illegible]	[illegible]

PRE DEVELOPMENT IMPERVIOUS AREAS (RE-DEVELOPMENT AREA ONLY)

PRE-DEVELOPED IMPERVIOUS AREA: 0.88 ACRES
PRE-DEVELOPED PERVIOUS AREA: 2.34 ACRES

LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

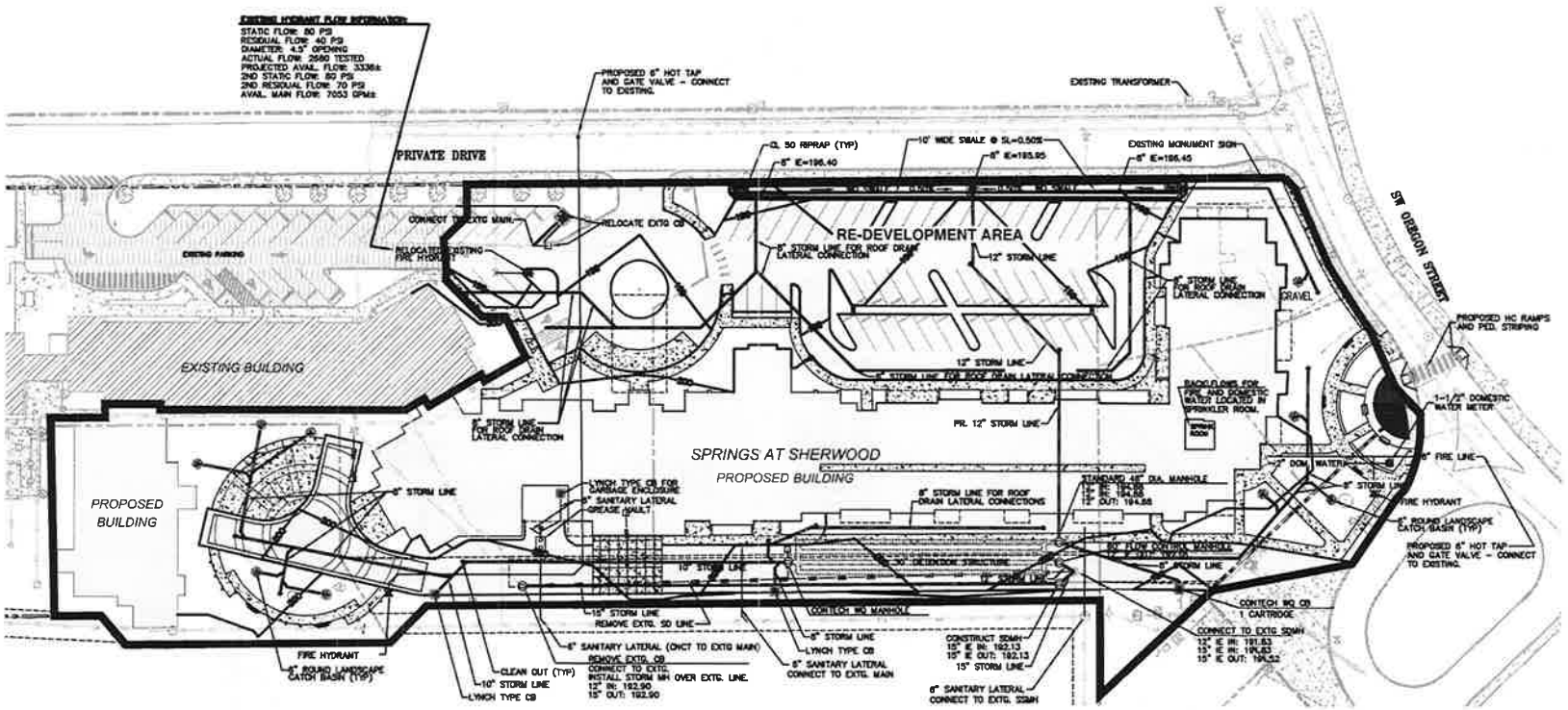
PROJECT NUMBER: 212203

The Springs at Sherwood
Sherwood, Oregon

SHEET TITLE:
EXISTING CONDITIONS / PRE-DEV BASIN

DRAWN BY: CPR
DATE ISSUED: 03.22.2014

SHEET: **C101**



EXISTING LEGEND

DECIDUOUS TREE	STORM SEWER CLEAN OUT	RIGHT-OF-WAY LINE
CONIFEROUS TREE	STORM SEWER CATCH BASIN	BOUNDARY LINE
FIRE HYDRANT	STORM SEWER AREA DRAIN	PROPERTY LINE
WATER BLOWOFF	STORM SEWER MANHOLE	CENTERLINE
WATER METER	GAS METER	DITCH
WATER VALVE	GAS VALVE	CURB
DOUBLE CHECK VALVE	GUY WIRE ANCHOR	EDGE OF PAVEMENT
AIR RELEASE VALVE	POWER POLE	EASEMENT
SANITARY SEWER CLEAN OUT	POWER VAULT	FENCE LINE
SANITARY SEWER MANHOLE	POWER JUNCTION BOX	GRAVEL EDGE
SIGN	POWER PEDESTAL	POWER LINE
STREET LIGHT	COMMUNICATIONS VAULT	OVERHEAD WIRE
MAILBOX	COMMUNICATIONS JUNCTION BOX	COMMUNICATIONS LINE
	COMMUNICATIONS RISER	FIBER OPTIC LINE
		GAS LINE
		STORM SEWER LINE
		SANITARY SEWER LINE
		WATER LINE

PROPOSED LEGEND

- PROPOSED 5FT. CONTOUR INTERVAL
- PROPOSED 1FT. CONTOUR INTERVAL
- PROPOSED STORM DRAIN LINE
- PROPOSED SANITARY LATERAL
- PROPOSED WATER LINE
- PROPOSED 6" ROUND LANDSCAPE CATCH BASIN
- PROPOSED STORM "LYNCH" STYLE CATCH BASIN
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM SEWER CLEAN OUT
- PROPOSED SANITARY SEWER CLEAN OUT
- PROPOSED FIRE HYDRANT
- PROPOSED WATER METER
- KEYSTONE BLOCK OR CONCRETE RETAINING WALL TO BE DETERMINED WITH CONSTRUCTION PLANS

1 inch = 30 ft.

POST DEVELOPMENT IMPERVIOUS AREAS (RE-DEVELOPMENT AREA ONLY)

POST-DEVELOPED IMPERVIOUS AREA: 2.22 ACRES
POST-DEVELOPED PERVIOUS AREA: 0.995 ACRES

LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

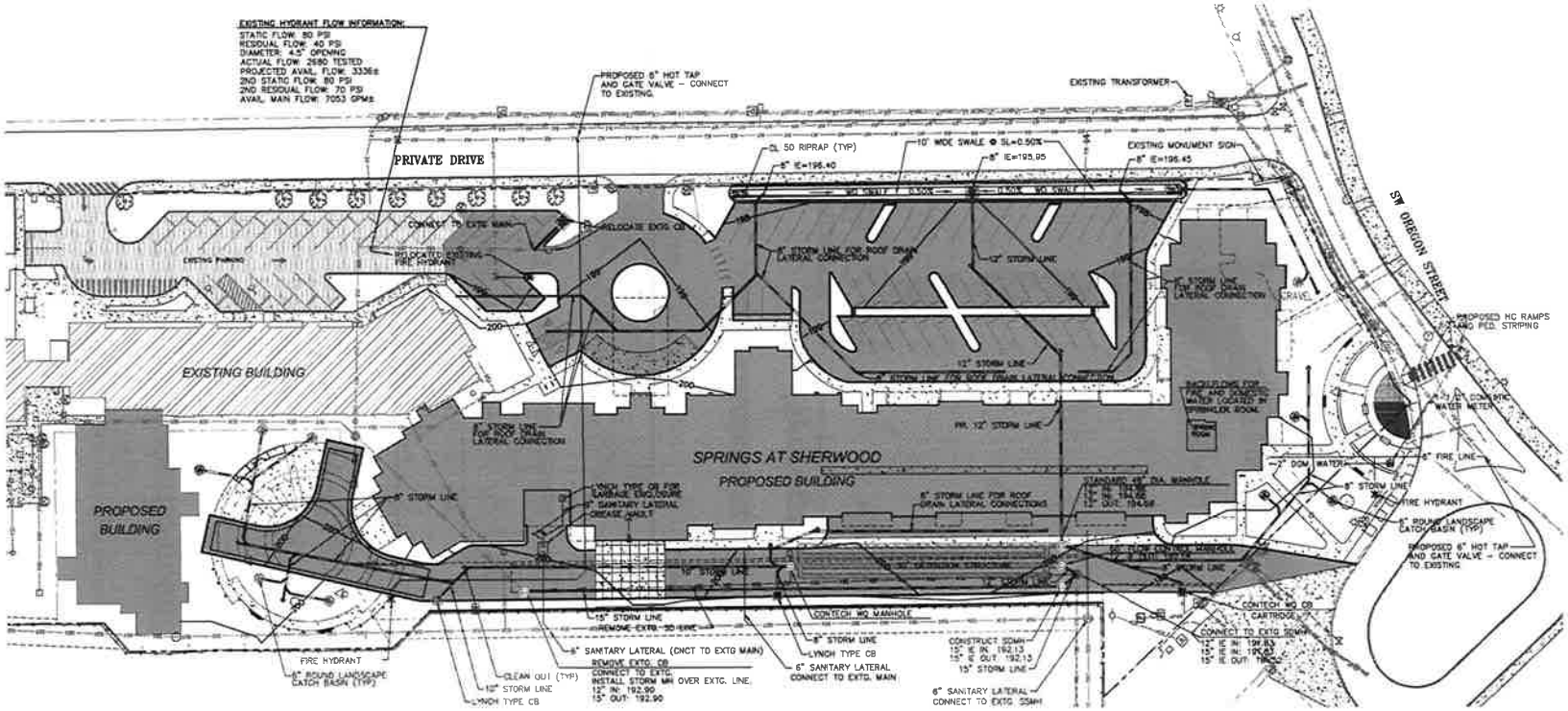
PROJECT NUMBER: 212203

The Springs at Sherwood
Sherwood, Oregon

SHEET TITLE:
PRELIMINARY UTILITY PLAN POST-DEV. AREA

DRAWN BY: CM
DATE ISSUED: 02.22.2021

SHEET: **C103**



EXISTING LEGEND

DECIDUOUS TREE	STORM SEWER CLEAN OUT	RIGHT-OF-WAY LINE
COMIFEROUS TREE	STORM SEWER CATCH BASIN	BOUNDARY LINE
FIRE HYDRANT	STORM SEWER AREA DRAIN	PROPERTY LINE
WATER BLOWOFF	STORM SEWER MANHOLE	CENTERLINE
WATER METER	GAS METER	DITCH
WATER VALVE	GAS VALVE	CURB
DOUBLE CHECK VALVE	GUY WIRE ANCHOR	EDGE OF PAVEMENT
AIR RELEASE VALVE	POWER POLE	EASEMENT
SANITARY SEWER CLEAN OUT	POWER VAULT	FENCE LINE
SANITARY SEWER MANHOLE	POWER JUNCTION BOX	GRAVEL EDGE
SIGN	POWER PEDESTAL	POWER LINE
STREET LIGHT	COMMUNICATIONS VAULT	OVERHEAD WIRE
MAILBOX	COMMUNICATIONS JUNCTION BOX	COMMUNICATIONS LINE
	COMMUNICATIONS RISER	FIBER OPTIC LINE
		GAS LINE
		STORM SEWER LINE
		SANITARY SEWER LINE
		WATER LINE

PROPOSED LEGEND

- 125 – PROPOSED 5FT. CONTOUR INTERVAL
- 124 – PROPOSED 1FT. CONTOUR INTERVAL
- PROPOSED STORM DRAIN LINE
- PROPOSED SANITARY LATERAL
- PROPOSED WATER LINE
- PROPOSED 6" ROUND LANDSCAPE CATCH BASIN
- PROPOSED STORM "LYNCH" STYLE CATCH BASIN
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM SEWER CLEAN OUT
- PROPOSED SANITARY SEWER CLEAN OUT
- PROPOSED FIRE HYDRANT
- PROPOSED WATER METER
- KEYSTONE BLOCK OR CONCRETE RETAINING WALL TO BE DETERMINED WITH CONSTRUCTION PLANS

1 Inch = 30 Ft.

PRE AND POST DEVELOPMENT AREAS
(RE-DEVELOPMENT AREA ONLY)

PRE-DEVELOPED IMPERVIOUS AREA: 0.88 ACRES
PRE-DEVELOPED PERVIOUS AREA: 2.34 ACRES

POST-DEVELOPED IMPERVIOUS AREA: 2.22 ACRES
POST-DEVELOPED PERVIOUS AREA: 0.995 ACRES

LRS ARCHITECTS

PRELIMINARY NOT FOR CONSTRUCTION

CONSULTANT:

PROJECT NUMBER: 21220

The Springs at Sherwood
Sherwood, Oregon

SHEET TITLE:
PRELIMINARY UTILITY PLAN

DRAWN BY: CPK
DATE ISSUED: 03.22.2022

SHEET: **C103**

Summary for Subcatchment 6S: EXTG. CONDITIONS

Runoff = 0.72 cfs @ 12.17 hrs, Volume= 0.390 af, Depth= 1.45"

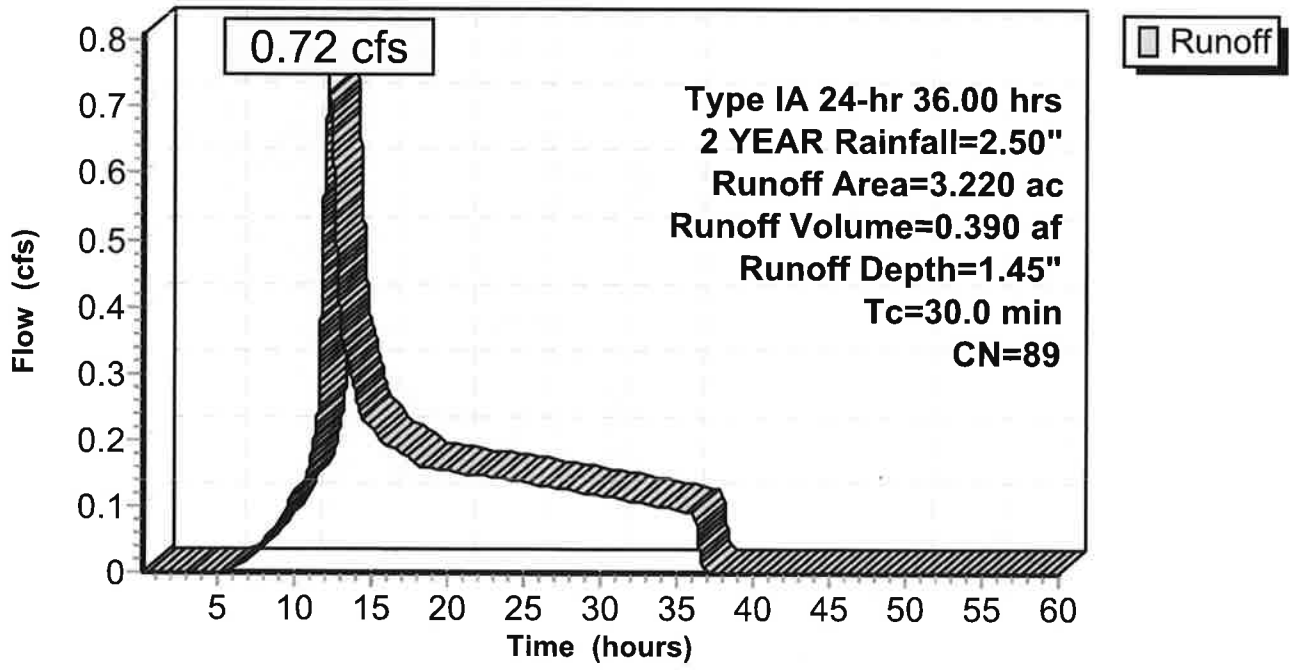
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 2 YEAR Rainfall=2.50"

	Area (ac)	CN	Description
*	2.340	86	PERVIOUS AREA
*	0.880	98	IMPERVIOUS AC
	3.220	89	Weighted Average
	2.340		72.67% Pervious Area
	0.880		27.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry, Calc'd time of Tc**

Subcatchment 6S: EXTG. CONDITIONS

Hydrograph



Summary for Subcatchment 6S: EXTG. CONDITIONS

Runoff = 1.19 cfs @ 12.16 hrs, Volume= 0.620 af, Depth= 2.31"

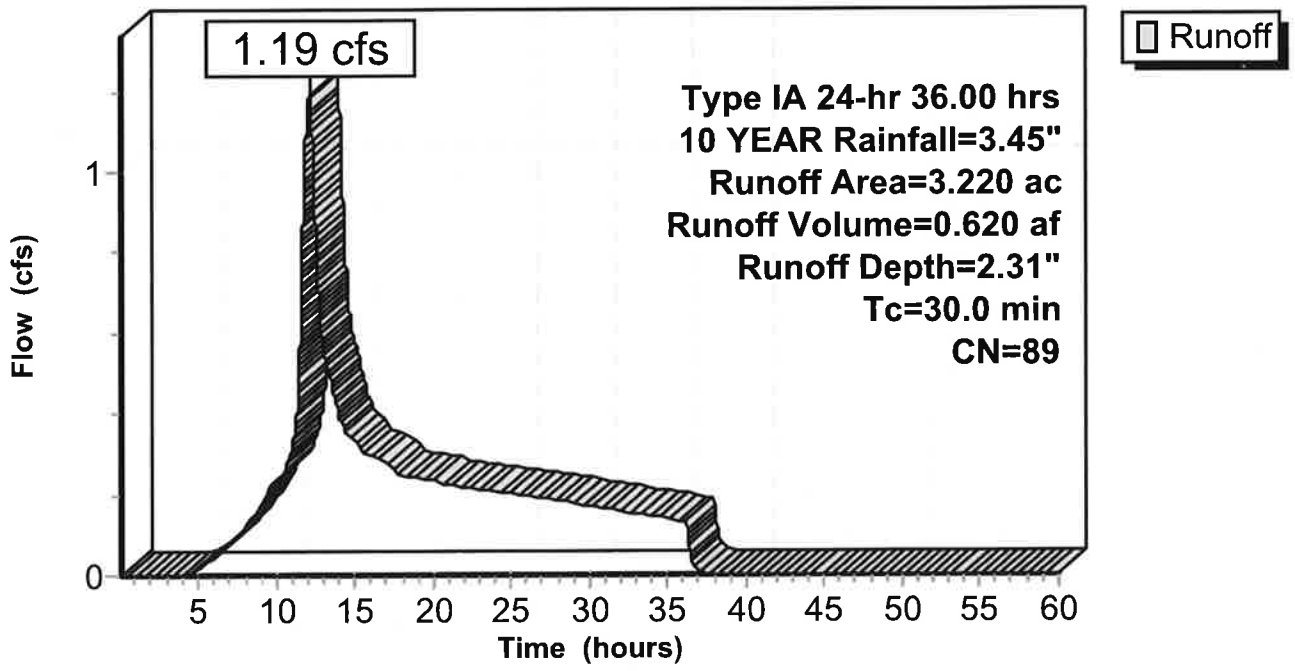
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 10 YEAR Rainfall=3.45"

	Area (ac)	CN	Description
*	2.340	86	PERVIOUS AREA
*	0.880	98	IMPERVIOUS AC
	3.220	89	Weighted Average
	2.340		72.67% Pervious Area
	0.880		27.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry, Calc'd time of Tc**

Subcatchment 6S: EXTG. CONDITIONS

Hydrograph



Summary for Subcatchment 6S: EXTG. CONDITIONS

Runoff = 1.45 cfs @ 12.16 hrs, Volume= 0.745 af, Depth= 2.78"

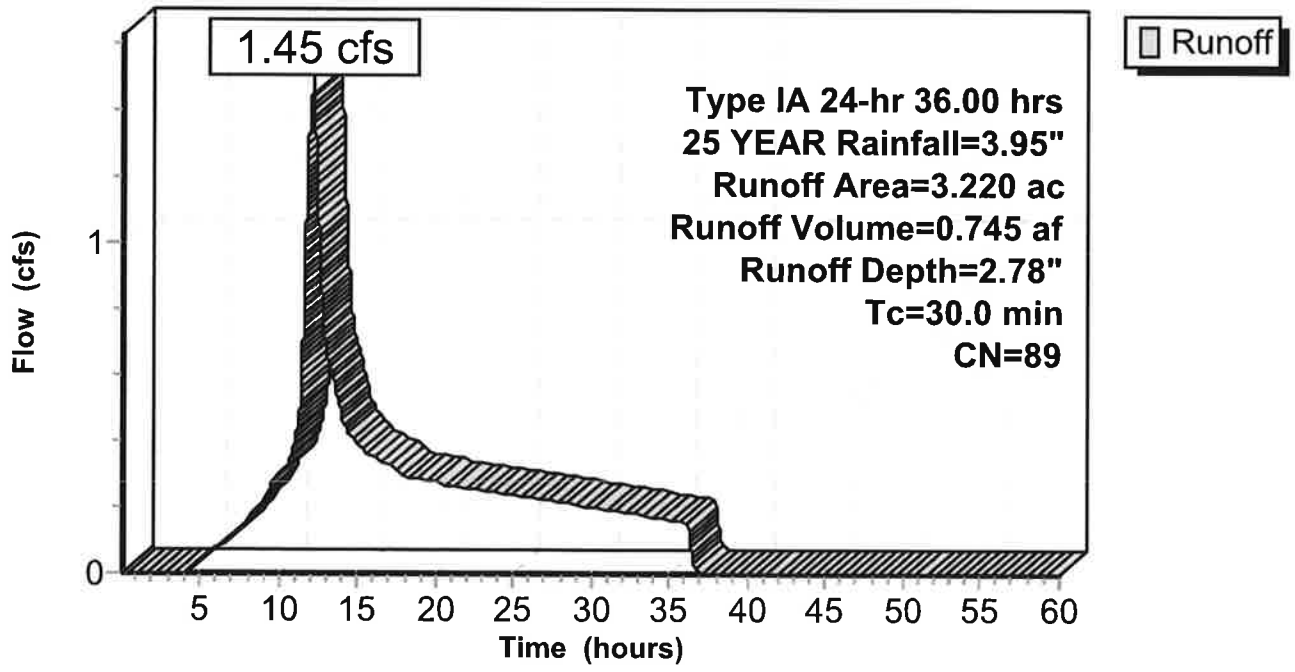
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 25 YEAR Rainfall=3.95"

	Area (ac)	CN	Description
*	2.340	86	PERVIOUS AREA
*	0.880	98	IMPERVIOUS AC
	3.220	89	Weighted Average
	2.340		72.67% Pervious Area
	0.880		27.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry, Calc'd time of Tc**

Subcatchment 6S: EXTG. CONDITIONS

Hydrograph



Summary for Subcatchment 1S: PROPOSED CONDITIONS

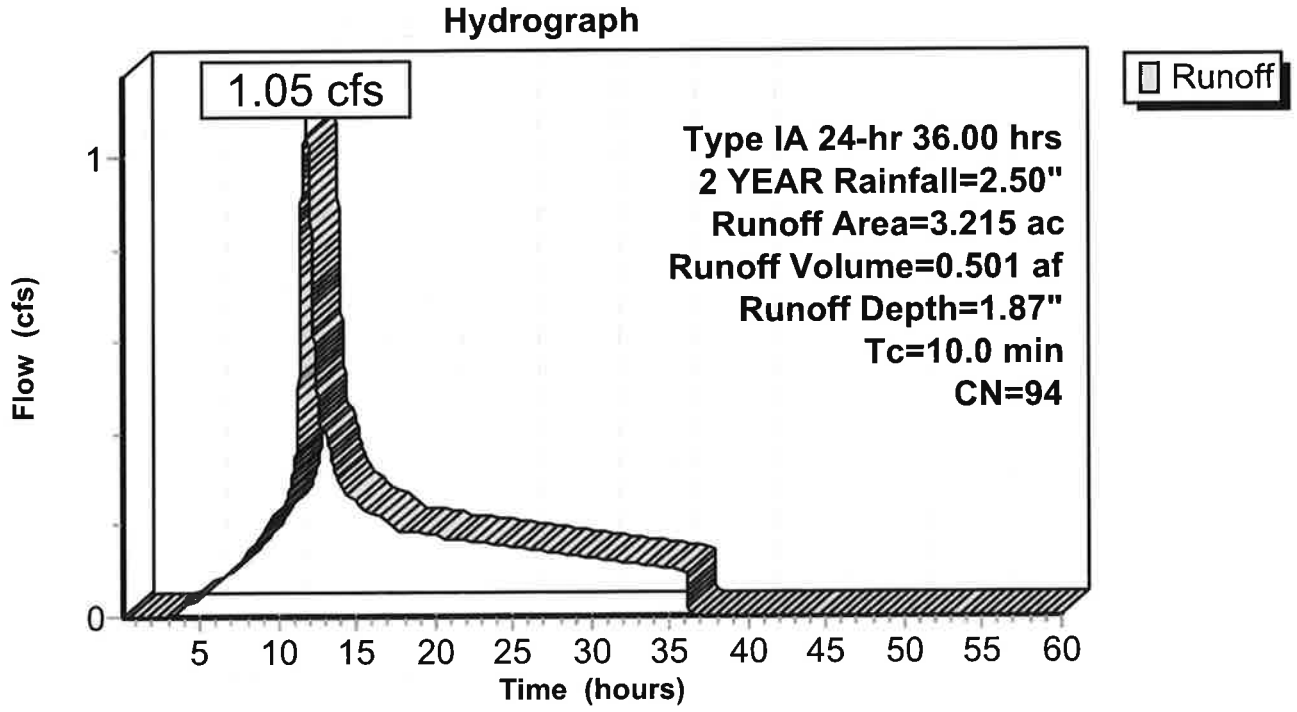
Runoff = 1.05 cfs @ 11.88 hrs, Volume= 0.501 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 2 YEAR Rainfall=2.50"

	Area (ac)	CN	Description
*	0.995	86	PERVIOUS
*	2.220	98	IMPERVIOUS
	3.215	94	Weighted Average
	0.995		30.95% Pervious Area
	2.220		69.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: PROPOSED CONDITIONS



Summary for Subcatchment 1S: PROPOSED CONDITIONS

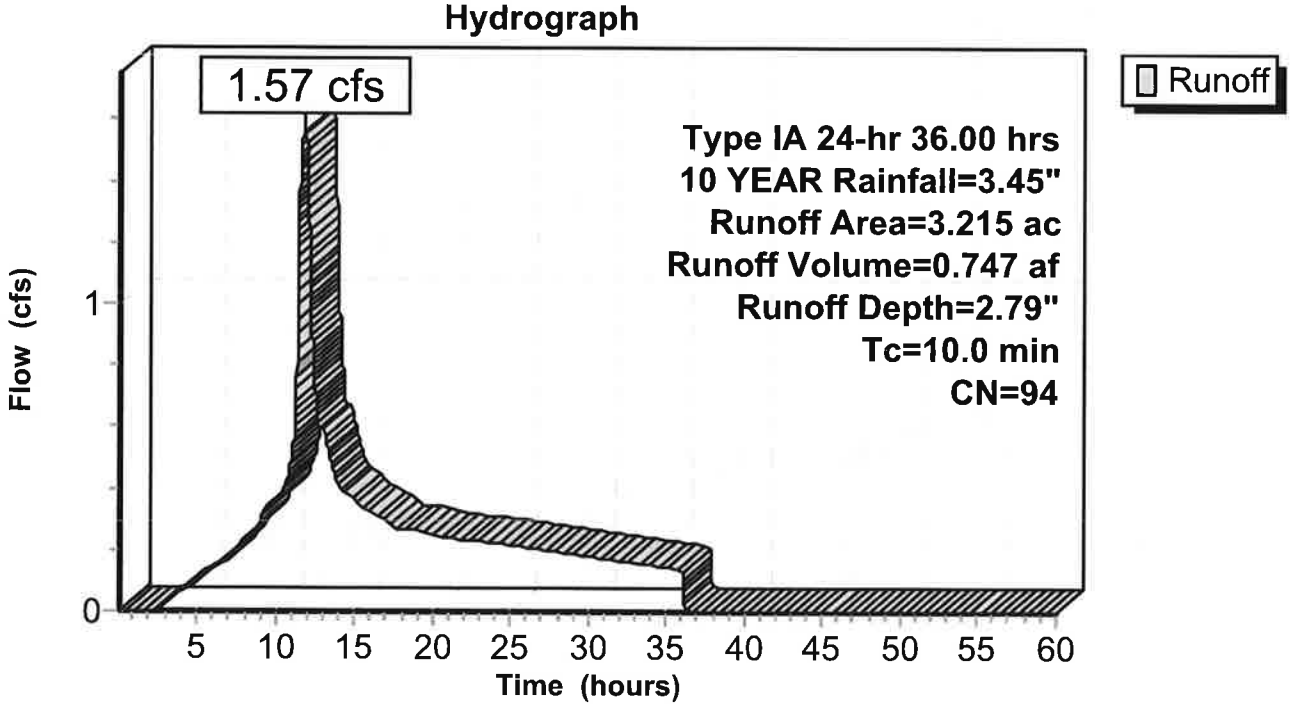
Runoff = 1.57 cfs @ 11.86 hrs, Volume= 0.747 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 10 YEAR Rainfall=3.45"

	Area (ac)	CN	Description
*	0.995	86	PERVIOUS
*	2.220	98	IMPERVIOUS
	3.215	94	Weighted Average
	0.995		30.95% Pervious Area
	2.220		69.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: PROPOSED CONDITIONS



Summary for Subcatchment 1S: PROPOSED CONDITIONS

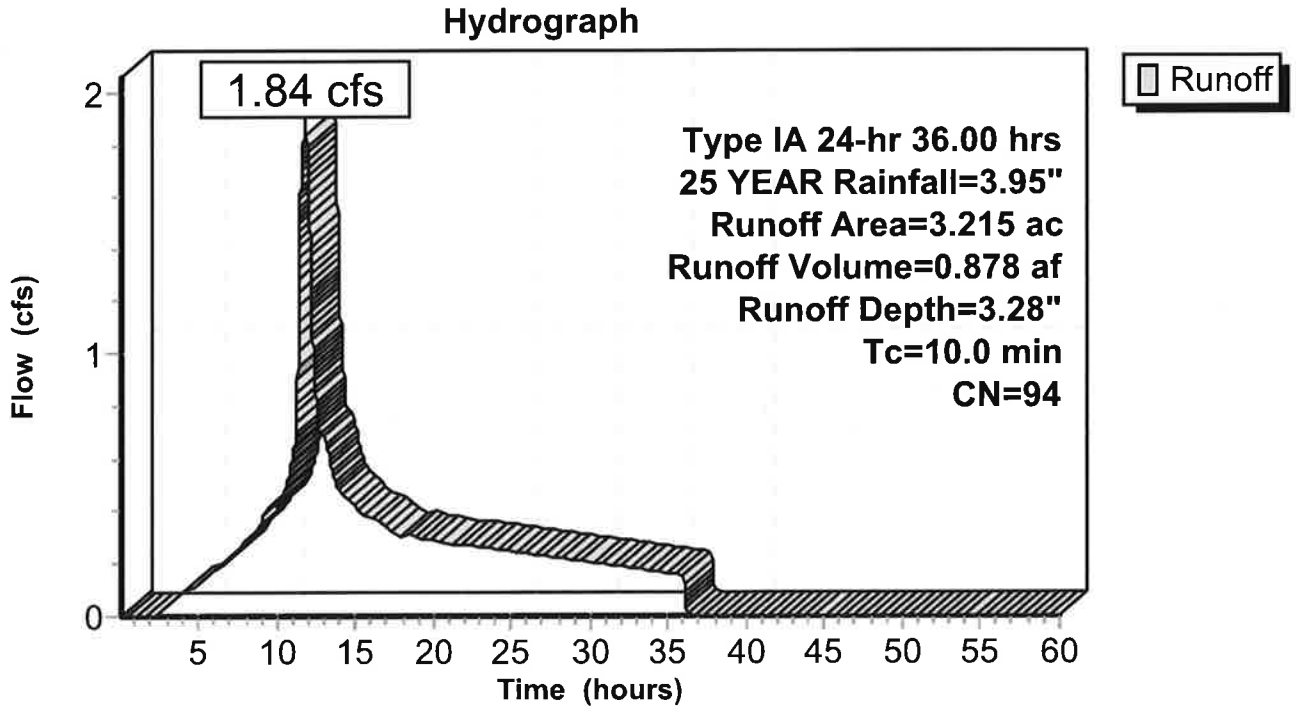
Runoff = 1.84 cfs @ 11.86 hrs, Volume= 0.878 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 36.00 hrs 25 YEAR Rainfall=3.95"

	Area (ac)	CN	Description
*	0.995	86	PERVIOUS
*	2.220	98	IMPERVIOUS
	3.215	94	Weighted Average
	0.995		30.95% Pervious Area
	2.220		69.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: PROPOSED CONDITIONS



Ck *CPK 13:40 19-Apr-14*

Project LRS.010
Springs at Sherwood - Time of Concentration

TIME OF CONCENTRATION
Pre-developed Time of Concentration

2-year, 24-hour rainfall = 2.50"

	flow type	*description*	*coeff.*	*distance*	*fall*	*slope*	*t/c*
1	overland sheet	dense.grasses	n=0.24	240.0'	6.0'	2.50%	29.75'

total Time of Concentration = 29.75'

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	18P	193.00	192.95	10.0	0.0050	0.013	12.0	0.0	0.0

Summary for Pond 18P: working version - 30" pipe 550 LF

Inflow Area = 3.215 ac, 69.05% Impervious, Inflow Depth = 1.87" for 2 YEAR event
Inflow = 1.05 cfs @ 11.88 hrs, Volume= 0.501 af
Outflow = 0.72 cfs @ 12.20 hrs, Volume= 0.501 af, Atten= 31%, Lag= 19.3 min
Primary = 0.72 cfs @ 12.20 hrs, Volume= 0.501 af

Routing by Stor-Ind method, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Peak Elev= 194.21' @ 12.20 hrs Surf.Area= 1,374 sf Storage= 1,292 cf

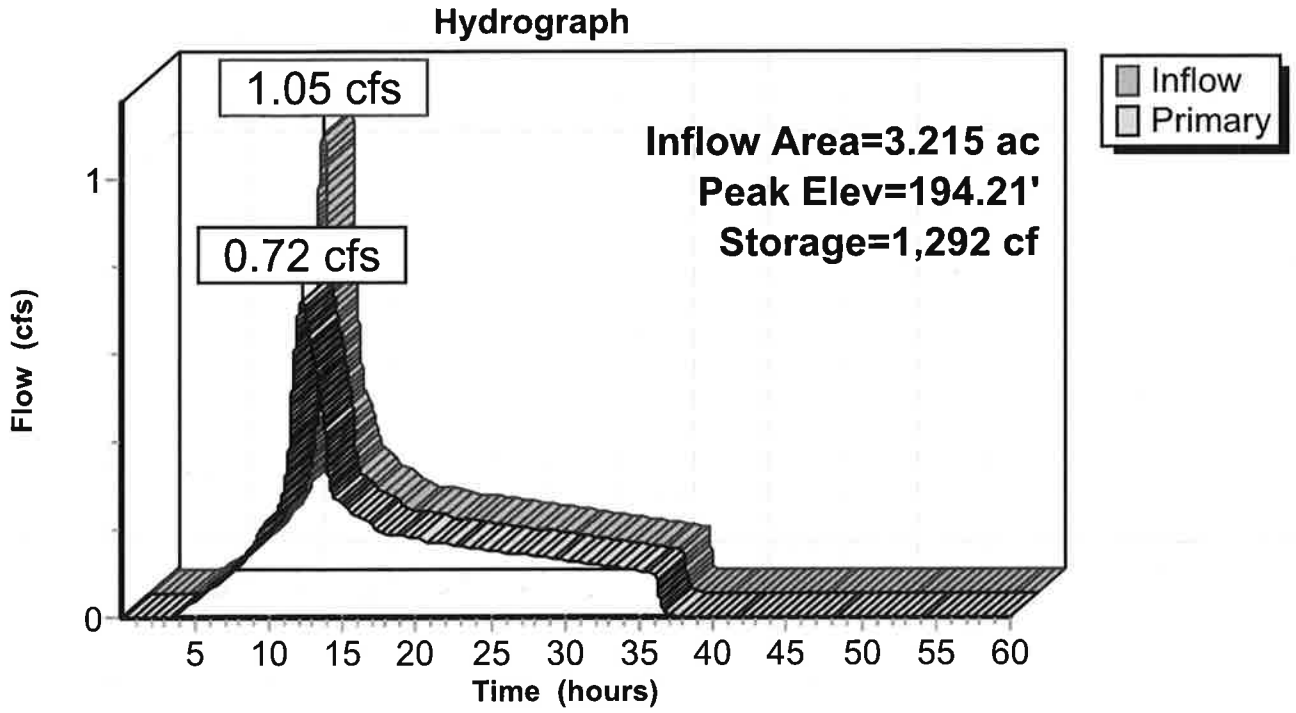
Plug-Flow detention time= 16.3 min calculated for 0.501 af (100% of inflow)
Center-of-Mass det. time= 16.3 min (1,106.7 - 1,090.4)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	2,700 cf	**30.0" D x 550.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Primary	193.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.00' / 192.95' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	191.50'	**5.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	194.60'	**4.6" Vert. Orifice/Grate** C= 0.600
#4	Device 1	195.40'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.72 cfs @ 12.20 hrs HW=194.21' (Free Discharge)
└─**1=Culvert** (Passes 0.72 cfs of 2.43 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.72 cfs @ 5.29 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Pond 18P: working version - 30" pipe 550 LF



Summary for Pond 18P: working version - 30" pipe 550 LF

Inflow Area = 3.215 ac, 69.05% Impervious, Inflow Depth = 2.79" for 10 YEAR event
Inflow = 1.57 cfs @ 11.86 hrs, Volume= 0.747 af
Outflow = 1.15 cfs @ 12.17 hrs, Volume= 0.747 af, Atten= 26%, Lag= 18.6 min
Primary = 1.15 cfs @ 12.17 hrs, Volume= 0.747 af

Routing by Stor-Ind method, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Peak Elev= 194.97' @ 12.17 hrs Surf.Area= 1,127 sf Storage= 2,278 cf

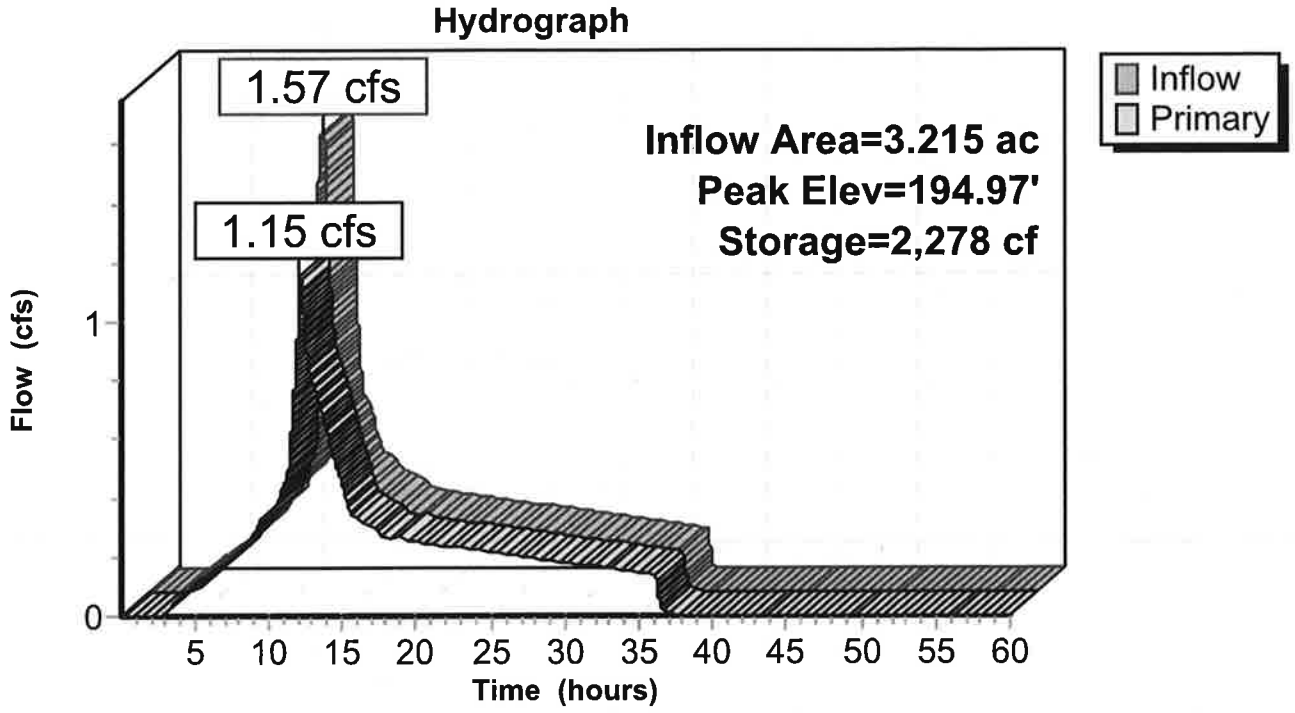
Plug-Flow detention time= 18.2 min calculated for 0.747 af (100% of inflow)
Center-of-Mass det. time= 18.1 min (1,080.3 - 1,062.2)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	2,700 cf	**30.0" D x 550.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Primary	193.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.00' / 192.95' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	191.50'	**5.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	194.60'	**4.6" Vert. Orifice/Grate** C= 0.600
#4	Device 1	195.40'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.15 cfs @ 12.17 hrs HW=194.97' (Free Discharge)
└**1=Culvert** (Passes 1.15 cfs of 3.61 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 0.92 cfs @ 6.75 fps)
├**3=Orifice/Grate** (Orifice Controls 0.23 cfs @ 2.06 fps)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond 18P: working version - 30" pipe 550 LF



Summary for Pond 18P: working version - 30" pipe 550 LF

Inflow Area = 3.215 ac, 69.05% Impervious, Inflow Depth = 3.28" for 25 YEAR event
Inflow = 1.84 cfs @ 11.86 hrs, Volume= 0.878 af
Outflow = 1.44 cfs @ 12.14 hrs, Volume= 0.878 af, Atten= 21%, Lag= 17.2 min
Primary = 1.44 cfs @ 12.14 hrs, Volume= 0.878 af

Routing by Stor-Ind method, Time Span= 0.10-60.00 hrs, dt= 0.01 hrs
Peak Elev= 195.39' @ 12.14 hrs Surf.Area= 566 sf Storage= 2,658 cf

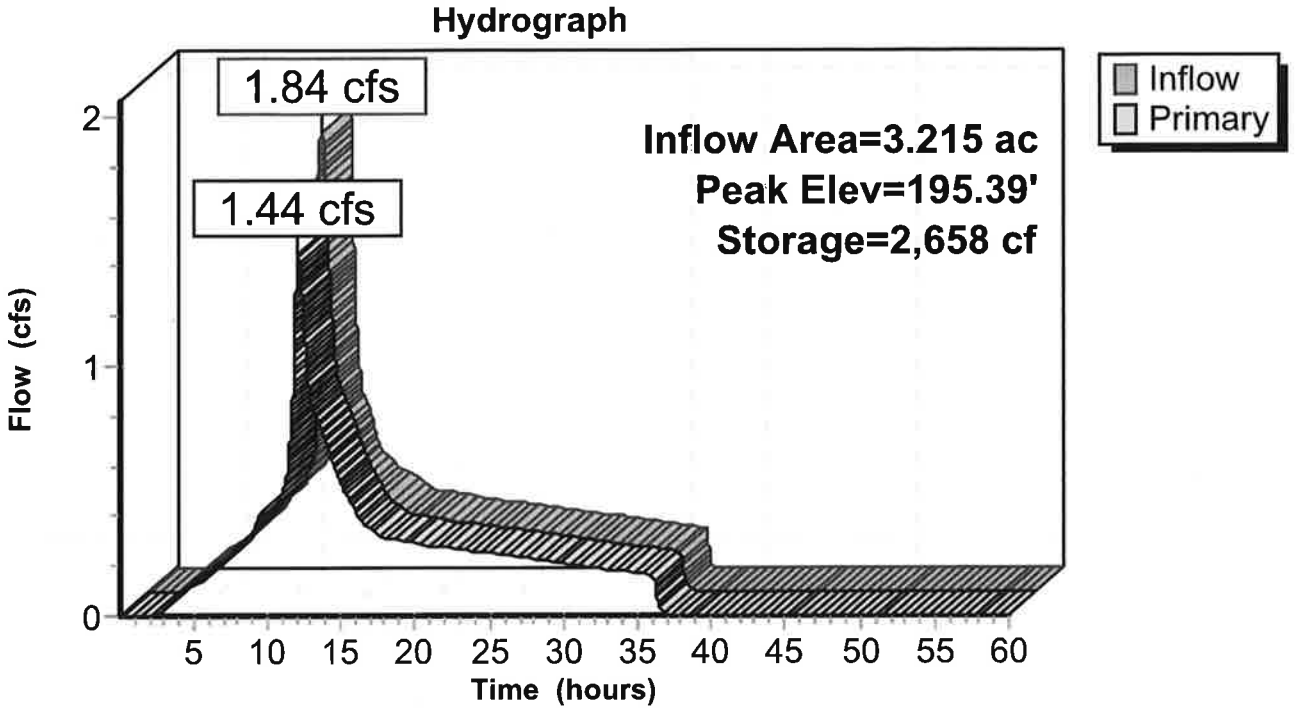
Plug-Flow detention time= 18.5 min calculated for 0.878 af (100% of inflow)
Center-of-Mass det. time= 18.4 min (1,070.2 - 1,051.8)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	2,700 cf	**30.0" D x 550.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Primary	193.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.00' / 192.95' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	191.50'	**5.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	194.60'	**4.6" Vert. Orifice/Grate** C= 0.600
#4	Device 1	195.40'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.44 cfs @ 12.14 hrs HW=195.39' (Free Discharge)
└**1=Culvert** (Passes 1.44 cfs of 4.10 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 1.01 cfs @ 7.44 fps)
├**3=Orifice/Grate** (Orifice Controls 0.43 cfs @ 3.72 fps)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond 18P: working version - 30" pipe 550 LF



Appendix E:

Geotechnical Report

LaVIELLE GEOTECHNICAL P.C.

2313 NE Alameda
Portland, Oregon 97212
(503) 287-0511, Fax 282-7671

December 15, 2013 our ref: 13-2582.046

The Springs Living
15677 NE Oregon St
Sherwood, Oregon 97213

RE: GEOTECHNICAL INVESTIGATION
SOUTH SIDE ADDITION TO THE SPRINGS LIVING
15677 NE OREGON ST.
SHERWOOD, OREGON

Greetings:

In accordance with your request the present herein our recommendations for parameters that may be used in the design of proposed new buildings foundations. The site is a vacant lot in a former agricultural area.

The soil exposed in shallow test pits and hand auger borings was a Medium Stiff, Brown,Clayey Silt. Groundwater was found below a depth of 4 feet. The material encountered in our exploration had sufficient cohesion to roll a thread 1/8" to 1/4" inch diameter. Our interpretation is that this material would not liquefy as a result of seismic shaking. Other materials at greater depth may lack the cohesion that is mentioned here. However based on our experience in the area it is our opinion that the site has a low risk of liquefaction.

Wall foundations should be designed based on the following recommended values.

Maximum Allowable Bearing Pressures:

2,000 psf	Medium Stiff, Brown Clayey Silt
2,000 psf	Compacted Fill (95% of ASTM:D-1557) founded above-mentioned soil.

These values may be increased by 1/3 for short-term wind and seismic loadings.

Estimated Settlement for Foundation in the Silt:

Total Settlement:	3/4 inches
Differential Settlement:	1/2 inches

Foundation Setback from Slope Faces:

All foundations should setback from face of slopes a minimum of 7 feet horizontally.

Foundation Minimum Embedment: 18 inches

Lateral Load Resistance:

Passive Resistance:	250 pcf, Equivalent fluid
Coefficient of Friction:	0.35

Note: The values for lateral load resistance do not include any factor of safety. The top foot of depth should be neglected in design computations of the passive capacity unless the soil is confined beneath a pavement or slab.

Foundations are underlain by at least 6 inches of 1½-inch minus crushed gravel. If the 0.5 value is used in design, the structural drawings must show the crushed gravel layer and must require special inspection of the gravel layer by a geotechnical engineer before constructing forms.

Passive pressure may be used to resist sliding during seismic loading if the ground in front of the foundation is level for at least 7 feet or three times the height of the surface generating passive resistance. The seismic passive resistance may be calculated using an equivalent fluid weight of 250 pcf. This seismic passive equivalent fluid weight was calculated using the Mononobe-Okabe method with $\delta=\frac{1}{2}\varphi'$ and a pseudostatic horizontal acceleration equal to a_{max}.

Only two-thirds of the passive resistance should be used if friction and passive resistance are combined to resist lateral forces.

The minimum recommended factors of safety for seismic design of sliding, overturning, and bearing capacity are taken as 75% of the values recommended for statically loaded structures. Therefore, the minimum static factors of safety for sliding, overturning, and bearing capacity of 1.5, 1.5, and 2.0 are reduced to 1.1, 1.1, and 1.5, respectively, when evaluating seismic stability.

Excavations & Slopes

It is our understanding that excavations as deep as 2.5 feet are expected. These excavations may be completed without shoring if the following measures are taken.

Temporary excavations should be cut at an inclination of 1H:4V (horizontal:vertical), or flatter. Permanent cut slopes should be left at inclinations no steeper than 2H:1V. Stormwater should be controlled and directed well away from the cuts. The up slope area should be covered with plastic sheeting.

The cuts should not be left open for longer than 1.5 weeks. If this limited time cannot be met the contractor shall be prepared to install shoring or to backfill excavation. The contractor should walk the perimeter of the excavations at least daily looking for evidence of instability. If instability is detected the geotechnical engineer should be contacted immediately.

Earthworks

In general the soils onsite appear to be well over their optimum moisture content and highly moisture sensitive and therefore they are not suited for use in structural fills except during warm dry weather.

If fill material is imported to the site we recommend the import material should be a clean sand and gravel that contains less than 5% passing the No. 200 sieve, based on the minus 3/4 inch fraction. This type of material can typically be placed and compacted in wet weather conditions.

Any fill placed beneath building foundations, or pavements should be placed in maximum 8 inch loose lifts and compacted to at least 95% of the ASTM D 1557 laboratory standard. We recommend a large steel wheeled vibratory roller be used to compact the imported granular fills while a sheepsfoot roller is best for compacting the fine grained soils. If density tests taken in the fills indicate compaction is not be being achieved, the fill should be scarified, moisture conditioned and recompacted.

Any fill placed on slopes steeper than 5H:1V should be properly keyed and benched and compacted.

We are available to discuss projects.

Sincerely,
LaVIELLE GEOTECHNICAL PC
Craig C. LaVielle, PE/GE

Expires 12/31/14

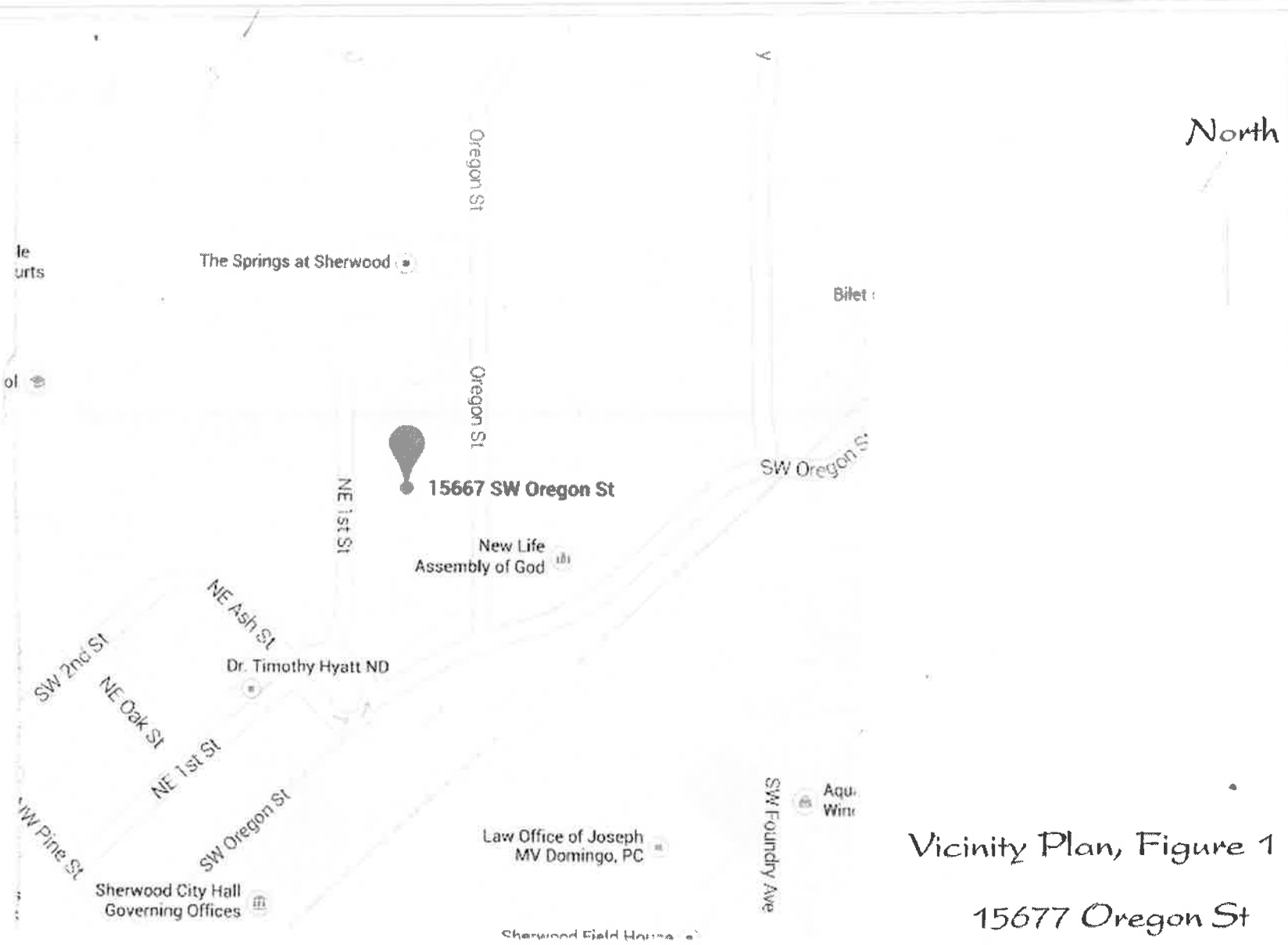
A geotechnical engineer from our office visually classified the soils encountered according to the Unified Soil Classification System (USCS) as follows:

TP-1	Depth (ft.)	USCS	Description
	0 – 0.7	ML-OL	Dark Brown – Black, Clayey Silt. Soft (Topsoil)
	0.7 - 4.5	ML-SM	Brown Clayey Silt, Medium Stiff Slight seepage at 4 feet.

TP-2	Depth (ft.)	USCS	Description
	0 – 0.8	ML-OL	Dark Brown – Black, Clayey Silt, Soft (Topsoil)
	0.8 - 4.75	ML-SM	Brown Clayey Silt, Medium Stiff Slight seepage at 4 feet.

TB-1	Depth (ft.)	USCS	Description
	0 – 6.2	ML-SM	Brown Clayey Silt, Medium Stiff

TB-2	Depth (ft.)	USCS	Description
	0 – 5.75	ML-SM	Brown Clayey Silt, Medium Stiff

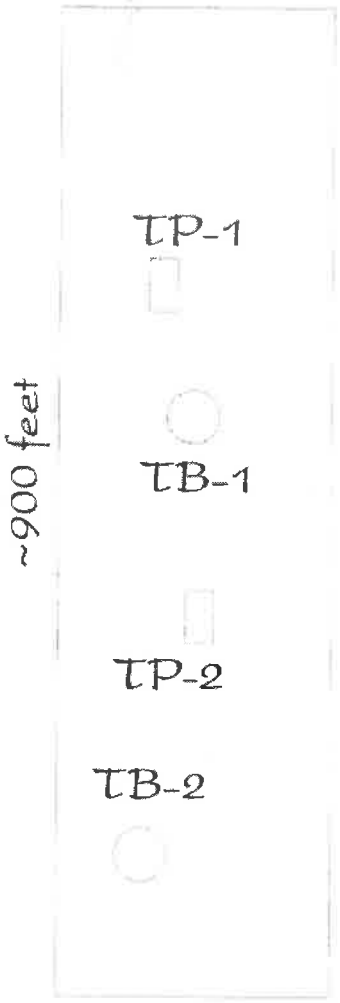


Vicinity Plan, Figure 1

15677 Oregon St

Sherwood, Oregon

LaVielle Geotechnical P.C.



North

Indicates Approximate
Location of Test Pits and Borings

Site Plan, Figure 2

Addition to 15677 Oregon St
Portland, Oregon

LaVielle Geotechnical P.C.