CARPENTER ROAD SHORT PLAT
Agency # 21-168
Drainage Control Plan

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Report Date: June 07, 2022

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Project No: 21-045
Project Name: CARPENTER ROAD SHORT PLAT
H:\Office\JOBS\2021\21-045 Carpenter Rd Short Plat\LAND USE\Storm Analysis

I hereby state that this Preliminary Drainage Control Plan for, Carpenter Road Short Plat located at 3019 Carpenter Road SE, Leacey 98503, Thurston County, WA, has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the CITY OF LACEY does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

____

Signature

6/8/22

Date

____

Seal

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DRAINAGE CONTROL PLAN

Section 1 – Project Description

The Carpenter Road Short Plat project is located southerly of the intersection of Carpenter Road SE and Stanfield Road SE in the City of Lacey, Thurston County. The site is located in Section 27, Township 18, Range 1W on tax parcel number 11827131206. See Site Plan on page 3.

This project is a new development on a 2.64 acres parcel which proposes to develop 7 single-family residential lots. Zoning for the property is LD 0-4 (Low Density Residential). Construction will include approximately 21,000 square feet of roof areas, 5,200 square feet of driveway & patio, 4,400 square feet of sidewalks, and 15,000 square feet of public asphalt road. Construction will also include approximately 80 feet frontage improvement along Carpenter Road SE located to the northeast property line. 5,765 square feet will be designated for tree tract which is required at 5% of the total area. Once complete the plat will create impervious surfaces covering approximately 43% of the site. A summary of pre-developed and proposed pervious and impervious areas are included in Table 1.1.

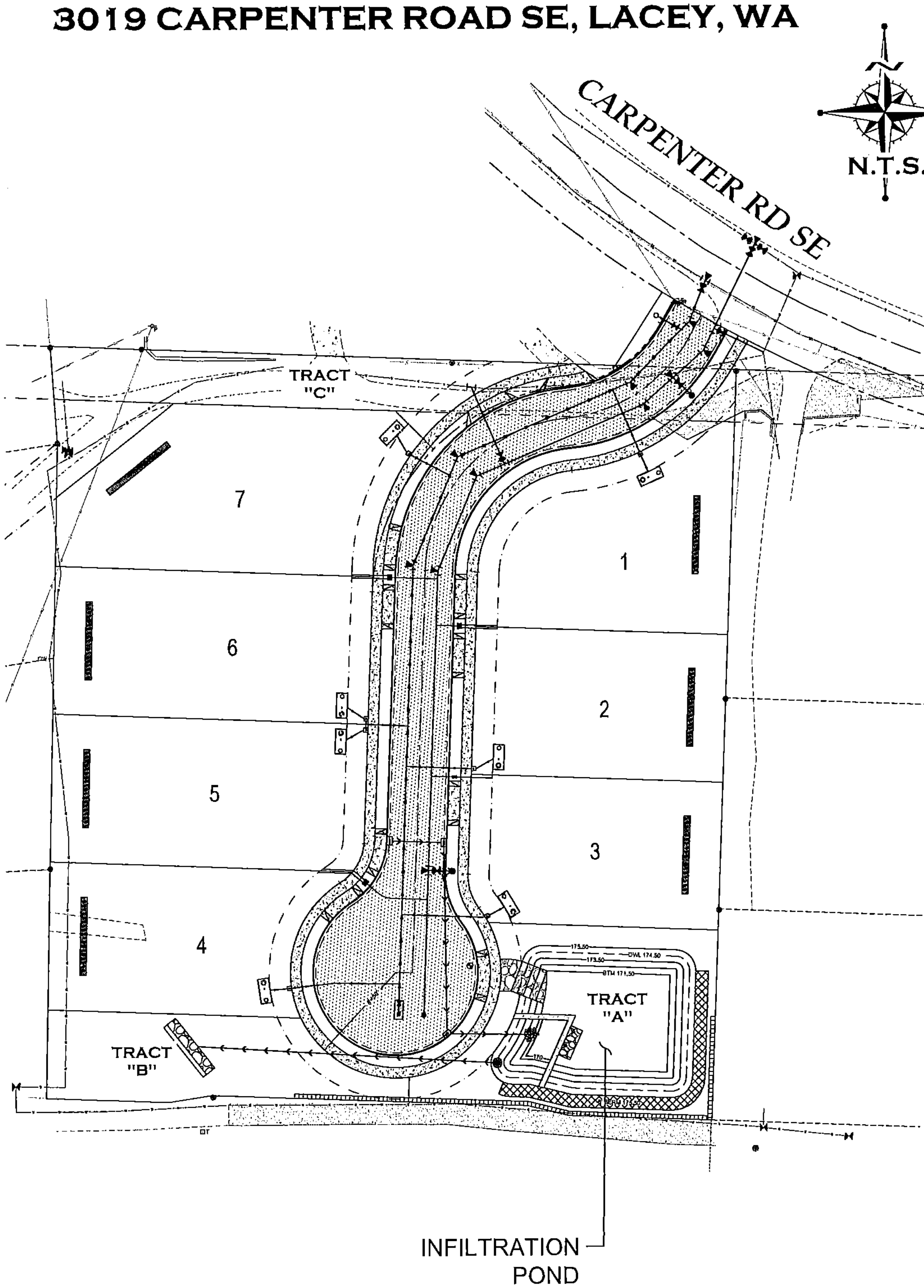
The proposed project will require grading, encroachment, and utility permits. Installation of utilities includes street lighting, dry utilities, water, and sewer. Water and sewer will be provided via connection to the City of Lacey utilities. Utilities will be stubbed to each future single-family lots of the plat.

This project proposes to infiltrate 100% of 100-year return runoff generated from the proposed development. Stormwater design was completed following guidelines in the 2016 City of Lacey Stormwater Design Manual (SDM). The site consists of one (1) basin for stormwater modeling, the Site Basin. Stormwater runoff generated within developed roads, sidewalks, driveways, and landscaping areas will be conveyed via catch basins and piping to an onsite pre-settling cell for pretreatment followed by infiltration pond for 100% infiltration. The pond is located in the southeast corner of the plat and utilizes treatment soil. Roof runoff does not require treatment as they are non-pollution generating surface and will be connected to individual drywell trenches at the time of home construction. See further explanation of stormwater facility sizing in section 4 of this report. See Basin Map on page 4.

Table 1.1 - Area Summary All areas measured in acres		
Pre-Developed	**Site Basin**	**Total Site**
Forest (A/B Moderate)	2.64	2.64
100-Year Pre-Developed Flow Rate	0.181 cfs	0.181 cfs
Developed	**Site Basin**	**Total Site**
Roof	0.48	0.48
Roads (Flat)	0.15	0.15
Roads (Mod)	0.19	0.19
Sidewalk (Flat)	0.05	0.05
Sidewalk (Mod)	0.05	0.05
Driveway	0.12	0.12
Pond	0.14	0.14
Lawn/Landscape (A/B)	1.32	1.32
Forest (A/B Mod)	0.13	0.13
Total	2.64	2.64
100-Year Developed Flow Rate	0 cfs	0 cfs

CARPENTER ROAD SHORT PLAT

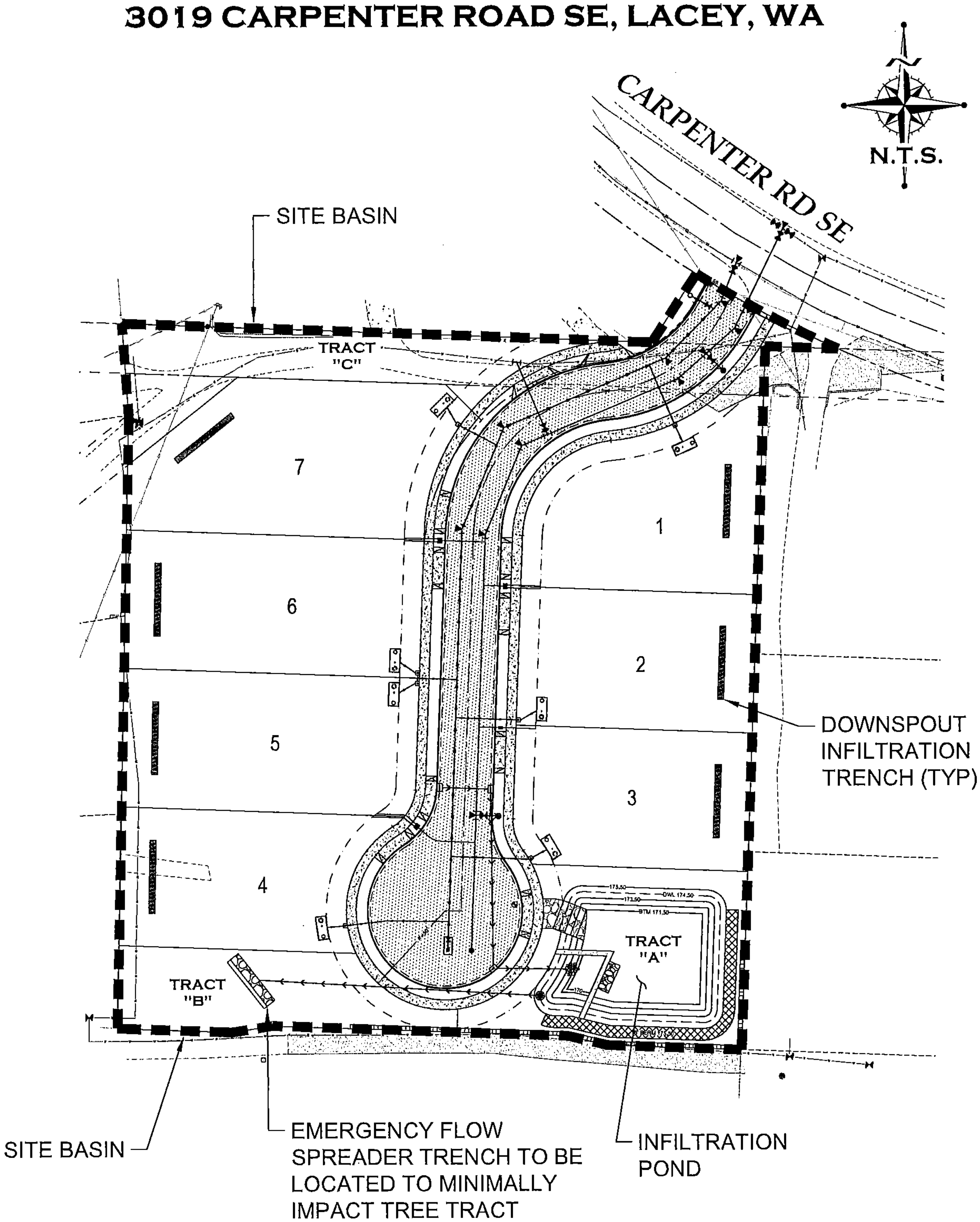
3019 CARPENTER ROAD SE, LACEY, WA



SITE PLAN

CARPENTER ROAD SHORT PLAT

3019 CARPENTER ROAD SE, LACEY, WA



BASIN MAP

Table 1.2 – Schedule of Structures				
Catch Basin / Manhole Number	**Stationing *or* Northing / Easting**	**Street Name**	**Catch Basin / Manhole Type and Size**	**Connected Pipes Invert Elevation & Diameter**
CB-1	10+65.19	A ROAD	TYPE 2-48	OUT: 177.54 (8" E)
CB-2	10+65.19	A ROAD	TYPE 2-48	IN: 174.41(8" W) OUT: 174.41 (8" S)
CB-3	9+71.71	A ROAD	TYPE 2-48	IN: 172.50 (8" N) OUT: 172.50 (12" E)

The City of Lacey 2016 Stormwater Design Manual (SDM) summarizes the thresholds which determine the applicability of the core requirements for each project. All new development projects are required to comply with Core Requirement #2; Construction Stormwater Pollution Prevention. Table 1.3 summarizes the thresholds which trigger compliance with the remaining core requirements.

Table 1.3 – Thresholds for Core Requirement Applicability		
	Required to comply with Core Requirements #1 through #5	**Required to comply with Core Requirements #1 through #9**
≥ 2,000 ft^2 of new, replaced, or new + replaced hard surface area	X	
≥ 7,000 ft^2 land disturbing activity	X	
≥ 5,000 ft^2 new + replaced hard surface area		X
Converts ≥ 0.75 acre of vegetation to lawn or landscape		X
Coverts ≥ 2.5 acres of native vegetation to pasture		X

This project adds 45,500 square feet of impervious area; therefore, core requirements #1 - #9 apply.

The applicable core requirements are:

- Core Requirement #1: Preparation of Stormwater Site Plans
- Core Requirement #2: Construction Stormwater Pollution Prevention
- Core Requirement #3: Source Control of Pollution
- Core Requirement #4: Preservation of Natural Drainage Systems and Outfalls
- Core Requirement #5: On-Site Stormwater Management
- Core Requirement #6: Runoff Treatment
- Core Requirement #7: Flow Control

- Core Requirement #8: Wetlands Protection
- Core Requirement #9: Operation and Maintenance

Addressing these applicable core requirements, it is anticipated that the proposed project will have no significant adverse effect on downstream or surrounding hydrology. Each of the applicable core requirements is discussed below.

Core Requirement #1: Preparation of Stormwater Site Plans

The main components of Stormwater Site Planning are Construction Stormwater Pollution Prevention Planning and Permanent Stormwater Control Planning. This Drainage Report, a Construction Stormwater Pollution Prevention Plan, Soils Report, Maintenance and Source Control Manual, and copy of the proposed Maintenance Covenant for stormwater facilities are submitted as part of the Carpenter Road Short Plat Drainage Control Plan to meet this requirement.

Core Requirement #2: Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (C-SWPPP) has been developed to address erosion and sediment control anticipated during construction. A Construction NPDES permit will be obtained prior to construction. The C-SWPPP will address all thirteen elements as required by the Department of Ecology.

Core Requirement #3: Source Control of Pollution

Source control BMPs are used to prevent stormwater from coming in contact with pollutants and are used as a cost-effective means of reducing pollutants in stormwater. The selection of permanent source control BMPs is based on the activities likely to occur on the site and the pollutants associated with those activities.

The Stormwater Pollution Source Control Checklist and Worksheet found in Appendix 9A of Chapter 9 of 2016 SDM has been completed to determine the applicable post-construction activities with required Source Control BMPs on this site. Methods to address source control of pollution from these activities are provided in the Maintenance and Source Control Manual submitted as part of the Drainage Control Plan for this project. Construction source control BMPs are addressed in the C-SWPPP. A copy of the Stormwater Pollution Source Control Checklist and Worksheet can be found in Appendix C of the Maintenance and Source Control Manual.

Core Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Infiltration BMPs will be used to reduce developed site runoff to the maximum extent feasible. In the current condition, stormwater runoff from the site sheet flows from north to south and west, infiltrates onsite through native soils.

In the developed condition, stormwater runoff generated from roads, sidewalks, driveways, and landscaping areas will be conveyed via catch basins and stormwater pipes to an onsite infiltration pond located at southeast side of the project for 100% treatment and infiltration. Roof runoff from all 7 lots will be connected to downspouts infiltration trenches at the time of home construction. See section 4 of this report for further explanation of stormwater facility sizing. Proposed stormwater mitigation BMPs reduce stormwater runoff from the site and mimic pre-developed natural drainage patterns.

Core Requirement #5: On-Site Stormwater Management

The 2016 SDM summarizes the requirements for employing on-site stormwater management BMPs, providing treatment, and flow control in decision charts. This project proposes to satisfy Core Requirement #5 meeting the LID Performance Standard as defined in the 2016 SDM.

This project proposes to implement Postconstruction Soil Quality and Depth (Ecology BMP T5.13) in all new and disturbed lawn/landscape areas to retain greater stormwater functions, including increased infiltration potential and treatment of pollutants and sediments resulting from development. Downspout infiltration system (Ecology BMP T5.10A) will be employed to infiltrate 100% tributary stormwater runoff from proposed roof areas. Also, Native vegetation will be restored in accordance with Preserving Native Vegetation (Ecology BMP T5.40) in tree tract B. Stormwater runoff from the remainder of the site will be routed to an onsite infiltration pond for 100% treatment and infiltration. The combination of stormwater BMPs used for this project results in the site meeting the Low Impact Development standard as shown on page 15 of Site Analysis WWHM report which indicates that LID Performance Standard is met. See the attached WWHM report in Appendix 1.

Core Requirement #6: Runoff Treatment

Table 1.4 – Thresholds for Core Requirement #6: Runoff Treatment	
	Required to Comply
< 5,000 sf of total effective pollution-generating hard surface (PGHS)	
≥ 5,000 sf of total effective pollution-generating hard surface (PGHS)	X
< ¾ acres of pollution-generating pervious surface (PGPS) from which there will be a surface discharge in a natural or artificial conveyance system from the site	
≥ ¾ acres of pollution-generating pervious surface (PGPS) from which there will be a surface discharge in a natural or artificial conveyance system from the site	X

Table 1.4 above summarizes the thresholds for construction of stormwater treatment facilities. This project will add approximately **25,000** sf of PGHS; therefore, treatment is required.

This project proposes to provide phosphorus and enhanced treatment, by utilizing presettling cell and infiltration pond lined with 18 inch of amended treatment soil. See further explanation of runoff treatment in Section 4 of this Drainage Report.

Core Requirement #7: Flow Control

Table 1.5 – Thresholds for Core Requirement #7: Flow Control	
	Required to Comply
< ¾ acres of native vegetation converted to lawn/landscape or < 2.5 acres converted to pasture from which there is a surface discharge in a natural or artificial conveyance system from the site	
≥ ¾ acres of native vegetation converted to lawn/landscape or ≥ 2.5 acres converted to pasture from which there is a surface discharge in a natural or artificial conveyance system from the site	X
< 10,000 sf of effective impervious area	
≥ 10,000 sf of effective impervious area	X
≥ 0.10 cfs increase in the 100-year storm flow frequency using 1-hour time steps or ≥ 0.15 cfs increase in the 100-year storm flow frequency using 15-minute time steps	X

Table 1.5 above summarizes the thresholds for achievement of the standard flow control requirement for Western Washington. This project will add **45,500** sf of effective impervious surface. Flow control is required.

This project proposes to provide flow control by infiltrating 100% of tributary runoff in an onsite infiltration pond and LID performance standard such as Postconstruction Soil Quality and Depth (Ecology BMP T5.13), Downspout infiltration system (Ecology BMP T5.10A). See further explanation of flow control in Section 4 of this Drainage Report.

Core Requirement #8: Wetlands Protection

This project does not have wetlands or discharge to a wetland; therefore, wetland protection is not required.

Core Requirement #9: Operation and Maintenance

Proper operation and maintenance of proposed stormwater facilities is a vital component to the success of stormwater mitigation. A Maintenance and Source Control Manual and Operation and Maintenance Agreement will be prepared and included as part of the Drainage Control Plan for the Carpenter Road Short Plat project during final design.

Section 2 – Existing Conditions Description

Section 2.1 Topography

Elevations onsite range from high point of 196 feet in the north to a low point of 167 feet in the west and 170 feet at south side of the project. The site has a moderate slope of 5%-15% down toward the west and south. See the Existing Condition map on page 11.

Section 2.2 Ground Cover

The site is currently undeveloped, it is primarily forested with Fir trees, native grass, and brush.

Section 2.3 Drainage

In the current condition, stormwater runoff from the site sheet flows from north to west and south sides of the project and infiltrate onsite through native soils. See the Existing Condition map on page 11.

Section 2.4 Soils

The soil survey of Thurston County mapped by the Natural Resources Conservation Service (NRCS) indicates that 100% onsite soils is Everett very gravelly sandy loam, this type of soils are characterized as Hydrologic Soil Group A.

South Sound Geotechnical Consulting (SSGC) conducted a geotechnical and stormwater evaluation with findings summarized in a report dated July 26,2021. The study consisted of seven (7) test pits excavated across the site to evaluate soil conditions and obtain samples for preliminary infiltration rate calculations. Test pits were excavated to approximately depths of 5.5 feet to 9 feet below existing ground surface, no groundwater or indications of seasonal high ground water was observed in the test pits at time of excavation. SSGC recommend a design infiltration rate of 32 in/hr (or maximum allowed by the City of Lacey). Test pit 4 located at the southeast side of the site excavated at depth of 7.5 feet indicate CEC results equal to 9.1 milliequivalents and Organic Content Results of 3.72% which are greater than the minimum design criteria. For proposed infiltration pond a design infiltration rate of 3 in/hr, lined with 18 inch of water quality treatment soils meeting the criteria specified in Section 8.6.3 of the 2016 City of Lacey SDM has been used.

Two groundwater monitoring wells were installed onsite from 11/30/2021 to 3/31/2022. Peak groundwater was encountered at 158.7 in Piezometer 1 and 159.7 in Piezometer 2. The groundwater encountered were approximately 13 ft below the bottom of pond. No adjustment to infiltration rate is required. A copy of the SSGC Geotechnical Repot and NRSC soils map are in Appendix 3.

Section 2.5 Critical Areas

The site is located within a Category I Critical Aquifer Recharge Area and located in City of Lacey Wellhead Protection.

Section 2.6 Adjacent Areas

The project site is bounded by Carpenter Road SE to the northeast and bounded by single family residential houses in all other directions.

Section 2.8 Reports and Studies

A Geotechnical and Stormwater report of the site was prepared by South Sound Geotechnical Consulting (SSGC) on July 26, 2021, as attached in Appendix 3. The basin analysis details the catch basin and conveyance pipe sizing to convey the 25-year flow in accordance with the City of Lacey SDM. WWHM continuous simulation hydrologic modeling software was used to size and analyze proposed BMPs and is included in Appendix 1.

Section 2.9 – Wells and Septic Systems

Records at Thurston County and the Department of Ecology were searched in order to locate the presence of wells and septic systems that may be located within the setback distances from the stormwater pond. In addition, the Project Engineer, or someone under his/her direct supervision, has visited the site to verify the presence or absence of wells and septic systems as best can be done visually without trespassing onto other properties. All wells and septic systems found to be located within the setback distances from the stormwater facility have been shown on the plans.

Section 2.10 – Fuel Tanks

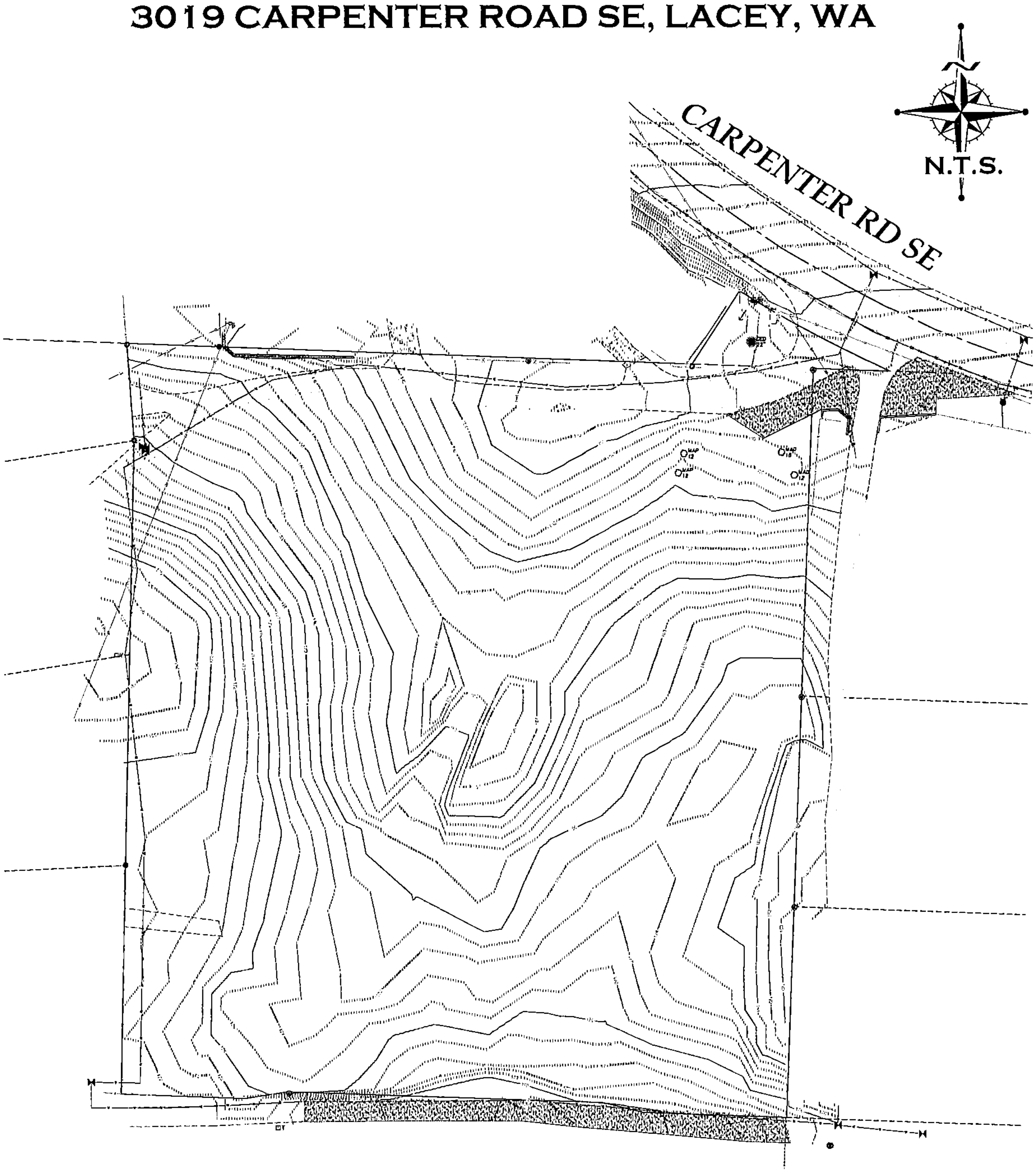
Records at Thurston County and the Department of Ecology were searched in order to locate the presence of above and below ground fuel storage tanks that may be located within the setback distances from the infiltration pond and infiltration trenches. In addition, the Project Engineer, or someone under his/her direct supervision, has visited the site to verify the presence or absence of fuel tanks as best can be done visually without trespassing onto other properties. All fuel tanks found to be located within the setback distances from the stormwater facility have been shown on the plans.

Section 2.11 – Analysis of 100-Year Flood

The Federal Emergency Management Agency prepares maps for all areas within Thurston County, including the incorporated cities therein. Panel #0193 depicts the areas, if any, subjected to flooding in the vicinity of this proposal. By inspection of this map, this proposal appears to be located in Zone **X**, an area of minimal flooding. This area, therefore, is not located within the 100-year flood plain.

CARPENTER ROAD SHORT PLAT

3019 CARPENTER ROAD SE, LACEY, WA



EXISTING CONDITIONS

Section 3 – Vicinity Analysis and Sub-Basin Description

The project site consists of one (1) basin for stormwater modeling, the Site Basin. The Site Basin includes 0.13-acre forest, 1.32-acres lawn, 0.48-acre roof areas, 0.15-acre roads, 0.1-acre sidewalks,0.12-acre driveways, and 0.14-acre infiltration pond.

This project is proposing to implement LID techniques and infiltration BMPs to reduce stormwater runoff. There is no apparent offsite drainage tributary to the project basin. This project will reduce overall runoff from the site, improving any existing flooding issues that may exist. No adverse downstream impacts are expected due to the development of this site.

Section 4 – Flow Control and Water Quality Facility Sizing

Water Quality Treatment Facility Sizing

This project generates more than 5,000 square feet of pollution-generating hard surfaces and is therefore required to provide stormwater runoff treatment.

This project is not a "high use site"; therefore, oil control is not required.

Section 8.2.1 of the City of Lacey SDM identifies any projects that infiltrate within ¼ mile of freshwater bodies requires phosphorus treatment. Due to the proximity to Hicks Lake and the site location in Category I Critical Aquifer Recharge Area, phosphorus treatment is required.

This project infiltrates within ¼ mile of the Hicks Lake (a fish-bearing waterbody). Enhanced treatment is required.

Runoff treatment from pollution-generating surfaces will be provided by combined uses of presettling cell and infiltration pond lined with 18 inch amended treatment soil. The presettling cell was sized to hold a minimum of 30% of the water quality volume form tributary stormwater runoff as defined by Presettling Basin (Ecology BMP T6.10) and WWHM. Onsite treatment infiltration pond was sized in accordance with the 2016 City of Lacy SDM. The infiltration pond will be constructed with 18 inch amended treatment liner to meet the site suitability criteria for infiltration treatment. Stormwater runoff from roofs will be directed to individual downspout infiltration system per (Ecology BMP T5.10A). See Appendix 1 for WWHM report, downspout infiltration sizing, and presettling basin calculations.

Flow Control Facility Sizing

This project generates more than 10,000 square feet of effective hard surfaces and is therefore required to provide flow control.

The project pollution-generating pervious surfaces (PGPS) areas calculated per the City of Lacey construction details and the 2016 City of Lacey SDM requirements. The average lot size of the project is approximately 9,600 sf, the roof area has been assumed 3,000 sf as well as an additional 650 sf of driveway and driveway ramp for each lot.

Flow control for the project will be provided via infiltration pond and drywell trench. The infiltration pond is sized using the WWHM continues model to infiltrate 100% of 100-year return runoff generated from developed site. See the attached WWHM report in Appendix 1.

The combined facility has a design top elevation of 175.5 ft, with design water surface on the infiltration basin is set to 174.5 ft and a bottom of 171.5 ft. The irregular bottom surface area of the pond is 2,478 sf. To model the pond bottom in WWHM a 55 ft x 45 ft bottom dimension was used. (55' x 45') = 2,475 sf. The area was modeled in WWHM at a 3.0 in/hr infiltration rate, 100% infiltration was reach.

Section 5 – Aesthetic Considerations for Facilities

All above ground stormwater facilities will be hydroseeded upon completion. Additional landscaping shall also be provided throughout the project in conformance with the approved landscaping and tree restoration plan, as applicable, and as otherwise required by the approving authority.

Section 6 – Conveyance System Analysis and Design

Onsite stormwater conveyance and piping will be sized to convey the 25-year flow in accordance with City of Lacey SDM requirements. See conveyance system calculations in Appendix I.

Section 7 – Covenants, Dedications and Easement

All stormwater facilities located on private property shall be owned, operated and maintained by the property owners, their heirs, successors and assigns. The property owners shall enter into an agreement with the governing body, a copy of which agreement is included in the Maintenance and Source Control Manual of the Drainage Control Plan. The agreement requires maintenance of the stormwater facilities in accordance with the maintenance plan provided and shall grant easement for access to the governing body to inspect the stormwater facilities. The agreement also makes provisions for the governing body to make repairs, after due notice is given to the owners, if repairs are necessary to ensure proper performance of the stormwater system and if the owners fail to make the necessary repairs. The cost of said repairs shall be borne by the property owners, their heirs, successors and assigns.

Section 8 – Agreements and Guarantees

The property owner is required to enter into a Stormwater Maintenance Agreement to maintain stormwater facilities and implement a Pollution Source Control Plan. A copy of the maintenance agreement is included in the Maintenance and Source Control Manual.

The owner is required to provide a Performance Guarantee to the City of Lacey in the amount of 150% of the estimated cost of onsite drainage systems and public utilities (sidewalk, planter strip, sewer, and watermain) construction. A Stormwater Maintenance Guarantee in the amount of 20% of the estimated cost of stormwater improvements for two years is required for maintenance and repair of drainage facilities. An article of Incorporation will be prepared for the Property Owner Association (HOA) and will be submitted to the governing body with Final Plat Approval.

Section 9 – Other Permits or Conditions Place on the Project

Agency Permit/Approval

Thurston County	ROW Permits
City of Lacey	Plan Review

APPENDIX 1 – Design Calculations

Area Summary (Acre)

	Pre-Developed	Developed	
	Total Site	Site Basin	Total Site
Forest (A/Mod)	2.64	0.13	0.13
Lawn (A/Mod)		1.32	1.32
Roof		0.48	0.48
Road (Flat)		0.15	0.15
Road (Mod)		0.19	0.19
Driveway (Flat)		0.12	0.12
Sidewalk (Flat)		0.05	0.05
Sidewalk (Mod)		0.05	0.05
Infiltration Pond		0.14	0.14
Total	2.64	2.64	2.64
WQV (ac-ft)	-	0.1659	-
WQV (cf)	-	7227	-

Impervious	
Site Basin	Total Site
1.05	1.05
40%	40%

Pervious	
Site Basin	Total Site
1.59	1.59
60%	60%

Presettling Basin Volume Summary							
Basin	WQV (cf)	Required Volume (30% WQV) (cf)	Provided Volume				
			Bottom Elevation	Bottom Area (sf)	Top Elevation	Top Area (sf)	Volume (cf)
Site	7227	2168	170	240	173.5	1000	2170

DOWNSPOUT INFILTRATION SIZING						
Lot	Soil Type	Approximate Roof	Required Area (sf)	Length (ft)	Width (ft)	Depth (ft)
1 - 7	Medium Sand	3000	111	37	3	4

Conveyance Pipe Sizing

	Road
Q_{25} (cfs) from WWHM	0.090697
Pipe Diameter (in)	8
Manning's n	0.012
Minimum Pipe Slope (ft/ft)	0.005
Velocity	2.659025635
$Q_{capacity}$ (cfs)	0.928175045
Capacity Check	OK

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Site Analysis
Site Name:	
Site Address:	
City:	
Report Date:	6/8/2022
Gage:	Woodland Creek
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	0.889
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Site Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	2.64
Pervious Total	2.64
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.64

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	0.13
A B, Pasture, Mod	1.32
A B IMP INF MOD	0.48
Pervious Total	1.93
Impervious Land Use	acre
ROADS FLAT	0.15
ROADS MOD	0.19
DRIVEWAYS FLAT	0.12
SIDEWALKS FLAT	0.05
SIDEWALKS MOD	0.05
POND	0.14
Impervious Total	0.7
Basin Total	2.63

Element Flows To:

Surface	Interflow	Groundwater
Infiltration Pond	Infiltration Pond	

Routing Elements
Predeveloped Routing

Mitigated Routing

Infiltration Pond

Bottom Length: 55.00 ft.
Bottom Width: 44.00 ft.
Depth: 4 ft.
Volume at riser head: 0.2378 acre-feet.
Infiltration On
Infiltration rate: 3
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 135.588
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 135.588
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 3 ft.
Riser Diameter: 12 in.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

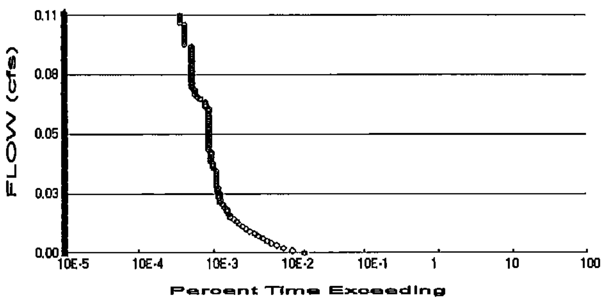
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.055	0.000	0.000	0.000
0.0444	0.056	0.002	0.000	0.168
0.0889	0.056	0.005	0.000	0.168
0.1333	0.057	0.007	0.000	0.168
0.1778	0.058	0.010	0.000	0.168
0.2222	0.058	0.012	0.000	0.168
0.2667	0.059	0.015	0.000	0.168
0.3111	0.059	0.018	0.000	0.168
0.3556	0.060	0.020	0.000	0.168
0.4000	0.061	0.023	0.000	0.168
0.4444	0.061	0.026	0.000	0.168
0.4889	0.062	0.028	0.000	0.168
0.5333	0.063	0.031	0.000	0.168
0.5778	0.063	0.034	0.000	0.168
0.6222	0.064	0.037	0.000	0.168
0.6667	0.065	0.040	0.000	0.168
0.7111	0.065	0.043	0.000	0.168
0.7556	0.066	0.046	0.000	0.168
0.8000	0.067	0.048	0.000	0.168
0.8444	0.067	0.051	0.000	0.168
0.8889	0.068	0.055	0.000	0.168
0.9333	0.069	0.058	0.000	0.168
0.9778	0.069	0.061	0.000	0.168
1.0222	0.070	0.064	0.000	0.168
1.0667	0.071	0.067	0.000	0.168
1.1111	0.071	0.070	0.000	0.168
1.1556	0.072	0.073	0.000	0.168

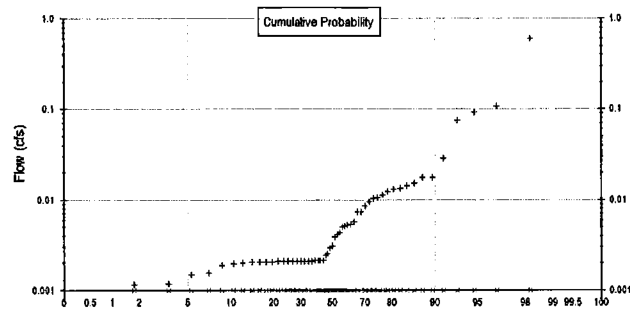
1.2000	0.073	0.077	0.000	0.168
1.2444	0.073	0.080	0.000	0.168
1.2889	0.074	0.083	0.000	0.168
1.3333	0.075	0.086	0.000	0.168
1.3778	0.075	0.090	0.000	0.168
1.4222	0.076	0.093	0.000	0.168
1.4667	0.077	0.097	0.000	0.168
1.5111	0.078	0.100	0.000	0.168
1.5556	0.078	0.104	0.000	0.168
1.6000	0.079	0.107	0.000	0.168
1.6444	0.080	0.111	0.000	0.168
1.6889	0.080	0.114	0.000	0.168
1.7333	0.081	0.118	0.000	0.168
1.7778	0.082	0.121	0.000	0.168
1.8222	0.083	0.125	0.000	0.168
1.8667	0.083	0.129	0.000	0.168
1.9111	0.084	0.133	0.000	0.168
1.9556	0.085	0.136	0.000	0.168
2.0000	0.086	0.140	0.000	0.168
2.0444	0.086	0.144	0.000	0.168
2.0889	0.087	0.148	0.000	0.168
2.1333	0.088	0.152	0.000	0.168
2.1778	0.089	0.156	0.000	0.168
2.2222	0.089	0.160	0.000	0.168
2.2667	0.090	0.164	0.000	0.168
2.3111	0.091	0.168	0.000	0.168
2.3556	0.092	0.172	0.000	0.168
2.4000	0.093	0.176	0.000	0.168
2.4444	0.093	0.180	0.000	0.168
2.4889	0.094	0.184	0.000	0.168
2.5333	0.095	0.189	0.000	0.168
2.5778	0.096	0.193	0.000	0.168
2.6222	0.097	0.197	0.000	0.168
2.6667	0.097	0.201	0.000	0.168
2.7111	0.098	0.206	0.000	0.168
2.7556	0.099	0.210	0.000	0.168
2.8000	0.100	0.215	0.000	0.168
2.8444	0.101	0.219	0.000	0.168
2.8889	0.101	0.224	0.000	0.168
2.9333	0.102	0.228	0.000	0.168
2.9778	0.103	0.233	0.000	0.168
3.0222	0.104	0.237	0.035	0.168
3.0667	0.105	0.242	0.182	0.168
3.1111	0.106	0.247	0.389	0.168
3.1556	0.106	0.251	0.637	0.168
3.2000	0.107	0.256	0.907	0.168
3.2444	0.108	0.261	1.183	0.168
3.2889	0.109	0.266	1.447	0.168
3.3333	0.110	0.271	1.683	0.168
3.3778	0.111	0.276	1.879	0.168
3.4222	0.111	0.281	2.029	0.168
3.4667	0.112	0.286	2.138	0.168
3.5111	0.113	0.291	2.251	0.168
3.5556	0.114	0.296	2.347	0.168
3.6000	0.115	0.301	2.439	0.168
3.6444	0.116	0.306	2.528	0.168
3.6889	0.117	0.311	2.614	0.168
3.7333	0.118	0.316	2.697	0.168

3.7778	0.118	0.322	2.777	0.168
3.8222	0.119	0.327	2.856	0.168
3.8667	0.120	0.332	2.932	0.168
3.9111	0.121	0.338	3.006	0.168
3.9556	0.122	0.343	3.078	0.168
4.0000	0.123	0.348	3.149	0.168
4.0444	0.124	0.354	3.218	0.168

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.64
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.93
Total Impervious Area: 0.7

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.004303
5 year	0.013609
10 year	0.027137
25 year	0.060728
50 year	0.106257
100 year	0.180514

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.011	0.000
1957	0.005	0.000
1958	0.002	0.000
1959	0.003	0.000
1960	0.005	0.000
1961	0.007	0.000
1962	0.002	0.000
1963	0.012	0.000
1964	0.013	0.000
1965	0.003	0.000

1966	0.002	0.000
1967	0.013	0.000
1968	0.002	0.000
1969	0.002	0.000
1970	0.002	0.000
1971	0.093	0.000
1972	0.029	0.000
1973	0.002	0.000
1974	0.009	0.000
1975	0.004	0.000
1976	0.015	0.000
1977	0.002	0.000
1978	0.018	0.000
1979	0.002	0.000
1980	0.004	0.000
1981	0.007	0.000
1982	0.011	0.000
1983	0.005	0.000
1984	0.003	0.000
1985	0.002	0.000
1986	0.010	0.000
1987	0.018	0.000
1988	0.002	0.000
1989	0.002	0.000
1990	0.002	0.000
1991	0.108	0.000
1992	0.607	0.000
1993	0.074	0.000
1994	0.002	0.000
1995	0.005	0.000
1996	0.014	0.000
1997	0.008	0.000
1998	0.002	0.000
1999	0.002	0.000
2000	0.001	0.000
2001	0.001	0.000
2002	0.002	0.000
2003	0.001	0.000
2004	0.002	0.000
2005	0.002	0.000
2006	0.002	0.000
2007	0.002	0.000
2008	0.001	0.000
2009	0.004	0.000
2010	0.002	0.000
2011	0.006	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.6070	0.0000
2	0.1077	0.0000
3	0.0931	0.0000
4	0.0742	0.0000
5	0.0287	0.0000
6	0.0177	0.0000
7	0.0176	0.0000
8	0.0153	0.0000

9	0.0141	0.0000
10	0.0133	0.0000
11	0.0130	0.0000
12	0.0124	0.0000
13	0.0112	0.0000
14	0.0106	0.0000
15	0.0103	0.0000
16	0.0095	0.0000
17	0.0085	0.0000
18	0.0074	0.0000
19	0.0074	0.0000
20	0.0057	0.0000
21	0.0054	0.0000
22	0.0052	0.0000
23	0.0052	0.0000
24	0.0050	0.0000
25	0.0043	0.0000
26	0.0042	0.0000
27	0.0039	0.0000
28	0.0031	0.0000
29	0.0029	0.0000
30	0.0025	0.0000
31	0.0024	0.0000
32	0.0021	0.0000
33	0.0021	0.0000
34	0.0021	0.0000
35	0.0021	0.0000
36	0.0021	0.0000
37	0.0021	0.0000
38	0.0021	0.0000
39	0.0021	0.0000
40	0.0021	0.0000
41	0.0021	0.0000
42	0.0021	0.0000
43	0.0021	0.0000
44	0.0021	0.0000
45	0.0021	0.0000
46	0.0020	0.0000
47	0.0020	0.0000
48	0.0020	0.0000
49	0.0020	0.0000
50	0.0020	0.0000
51	0.0019	0.0000
52	0.0015	0.0000
53	0.0015	0.0000
54	0.0012	0.0000
55	0.0011	0.0000
56	0.0011	0.0000

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0022	310	0	0	Pass
0.0032	216	0	0	Pass
0.0043	163	0	0	Pass
0.0053	134	0	0	Pass
0.0064	113	0	0	Pass
0.0074	100	0	0	Pass
0.0085	89	0	0	Pass
0.0095	76	0	0	Pass
0.0106	68	0	0	Pass
0.0116	58	0	0	Pass
0.0127	53	0	0	Pass
0.0137	47	0	0	Pass
0.0148	43	0	0	Pass
0.0158	39	0	0	Pass
0.0169	36	0	0	Pass
0.0179	32	0	0	Pass
0.0190	31	0	0	Pass
0.0200	29	0	0	Pass
0.0211	29	0	0	Pass
0.0221	27	0	0	Pass
0.0232	26	0	0	Pass
0.0242	24	0	0	Pass
0.0253	24	0	0	Pass
0.0263	23	0	0	Pass
0.0274	23	0	0	Pass
0.0284	23	0	0	Pass
0.0295	22	0	0	Pass
0.0305	22	0	0	Pass
0.0316	21	0	0	Pass
0.0326	21	0	0	Pass
0.0337	21	0	0	Pass
0.0348	21	0	0	Pass
0.0358	21	0	0	Pass
0.0369	21	0	0	Pass
0.0379	21	0	0	Pass
0.0390	20	0	0	Pass
0.0400	19	0	0	Pass
0.0411	19	0	0	Pass
0.0421	18	0	0	Pass
0.0432	18	0	0	Pass
0.0442	18	0	0	Pass
0.0453	18	0	0	Pass
0.0463	18	0	0	Pass
0.0474	17	0	0	Pass
0.0484	17	0	0	Pass
0.0495	17	0	0	Pass
0.0505	17	0	0	Pass
0.0516	17	0	0	Pass
0.0526	17	0	0	Pass
0.0537	17	0	0	Pass
0.0547	17	0	0	Pass
0.0558	17	0	0	Pass
0.0568	17	0	0	Pass

0.0579	17	0	0	Pass
0.0589	17	0	0	Pass
0.0600	17	0	0	Pass
0.0610	17	0	0	Pass
0.0621	17	0	0	Pass
0.0631	17	0	0	Pass
0.0642	17	0	0	Pass
0.0652	17	0	0	Pass
0.0663	15	0	0	Pass
0.0673	15	0	0	Pass
0.0684	15	0	0	Pass
0.0695	13	0	0	Pass
0.0705	12	0	0	Pass
0.0716	11	0	0	Pass
0.0726	11	0	0	Pass
0.0737	11	0	0	Pass
0.0747	10	0	0	Pass
0.0758	10	0	0	Pass
0.0768	10	0	0	Pass
0.0779	10	0	0	Pass
0.0789	10	0	0	Pass
0.0800	10	0	0	Pass
0.0810	10	0	0	Pass
0.0821	10	0	0	Pass
0.0831	10	0	0	Pass
0.0842	10	0	0	Pass
0.0852	10	0	0	Pass
0.0863	10	0	0	Pass
0.0873	10	0	0	Pass
0.0884	10	0	0	Pass
0.0894	10	0	0	Pass
0.0905	10	0	0	Pass
0.0915	10	0	0	Pass
0.0926	10	0	0	Pass
0.0936	8	0	0	Pass
0.0947	8	0	0	Pass
0.0957	8	0	0	Pass
0.0968	8	0	0	Pass
0.0978	8	0	0	Pass
0.0989	8	0	0	Pass
0.0999	8	0	0	Pass
0.1010	8	0	0	Pass
0.1021	8	0	0	Pass
0.1031	7	0	0	Pass
0.1042	7	0	0	Pass
0.1052	7	0	0	Pass
0.1063	7	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

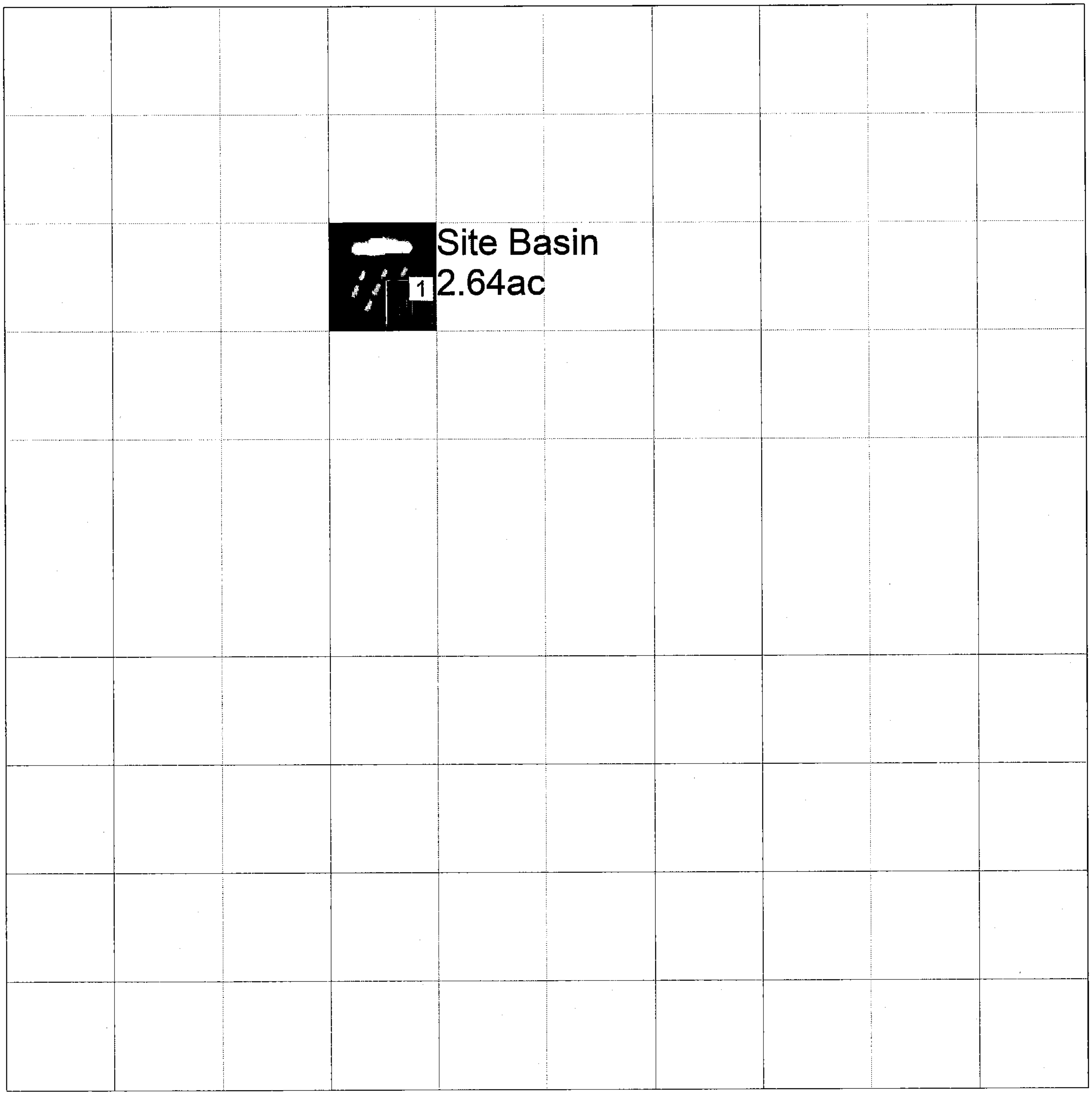
Total of 0 changes have been made.

PERLND Changes
No PERLND changes have been made.

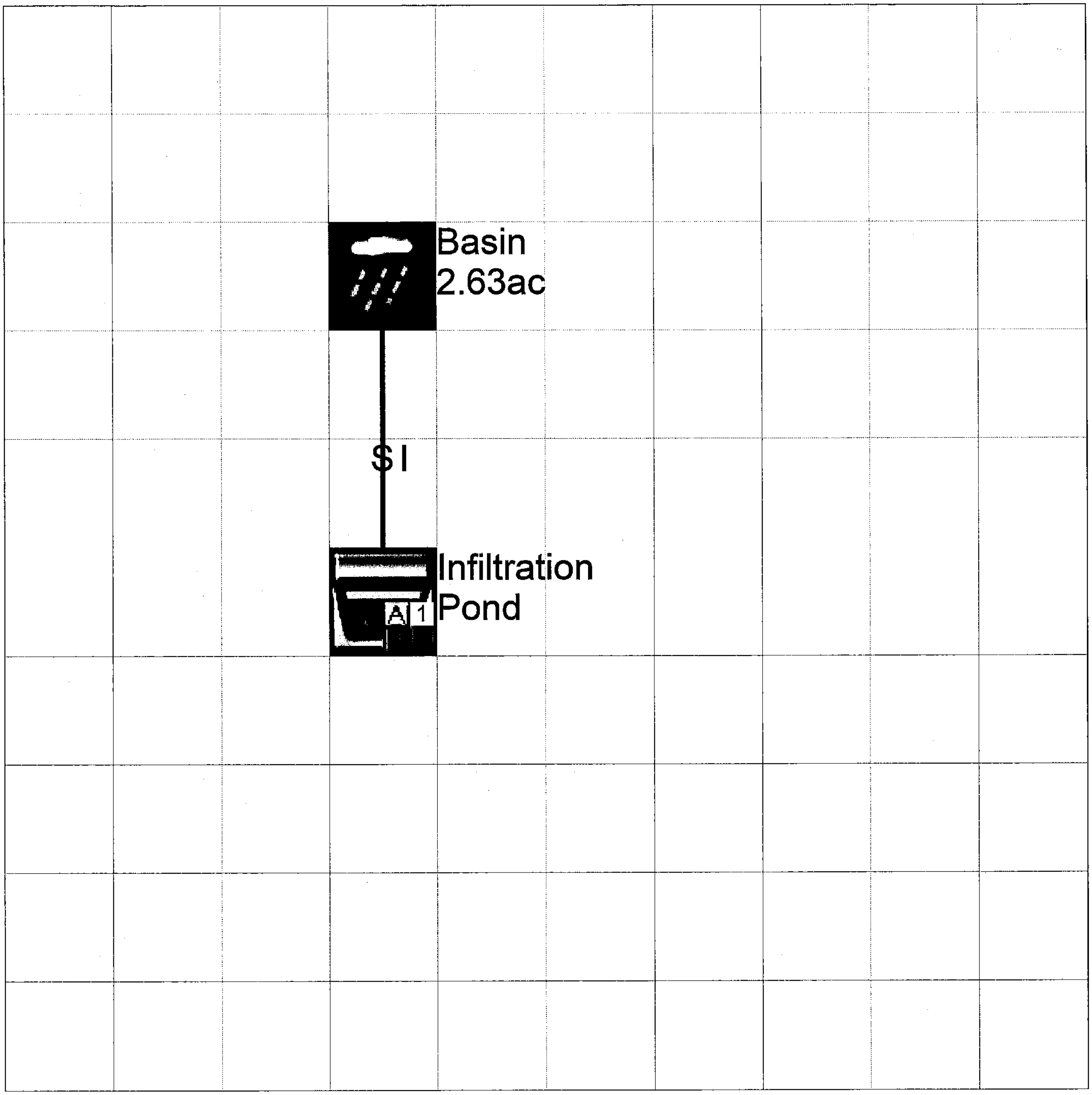
IMPLND Changes
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Site Analysis.wdm
MESSU      25   MitSite Analysis.MES
           27   MitSite Analysis.L61
           28   MitSite Analysis.L62
           30   POCSite Analysis1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       1
      PERLND       5
      PERLND      32
      IMPLND       1
      IMPLND       2
      IMPLND       5
      IMPLND       8
      IMPLND       9
      IMPLND      14
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Infiltratio Pond             MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
    1      A/B, Forest, Flat       1    1    1    1   27    0
    5      A/B, Pasture, Mod       1    1    1    1   27    0
   32        A/B/IMP INF/MOD       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***
```

```
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1         0    0    1    0    0    0    0    0    0    0    0    0
    5         0    0    1    0    0    0    0    0    0    0    0    0
   32         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    5         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   32         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1         0    0    0    0    0    0    0    0    0    0    0
    5         0    0    0    0    0    0    0    0    0    0    0
   32         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    1              0         5         2       400      0.05       0.3     0.996
    5              0         5       1.5       400       0.1       0.3     0.996
   32              0         5       0.8       400       0.1       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1              0         0         2         2         0         0         0
    5              0         0         2         2         0         0         0
   32              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1            0.2       0.5      0.35         0       0.7       0.7
    5           0.15       0.5       0.3         0       0.7       0.4
   32            0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    1              0         0         0         0         3         1         0
    5              0         0         0         0         3         1         0
   32              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems  Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out          ***
    1       ROADS/FLAT            1     1    1   27    0
    2       ROADS/MOD             1     1    1   27    0
    5       DRIVEWAYS/FLAT        1     1    1   27    0
    8       SIDEWALKS/FLAT        1     1    1   27    0
    9       SIDEWALKS/MOD         1     1    1   27    0
   14       POND                  1     1    1   27    0
  END GEN-INFO
```

```
*** Section IWATER***

ACTIVITY
  <PLS > ************* Active Sections *****************************
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  1         0    0    1    0    0    0
  2         0    0    1    0    0    0
  5         0    0    1    0    0    0
  8         0    0    1    0    0    0
  9         0    0    1    0    0    0
 14         0    0    1    0    0    0
END ACTIVITY

PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  1         0    0    4    0    0    0    1    9
  2         0    0    4    0    0    0    1    9
  5         0    0    4    0    0    0    1    9
  8         0    0    4    0    0    0    1    9
  9         0    0    4    0    0    0    1    9
 14         0    0    4    0    0    0    1    9
END PRINT-INFO

IWAT-PARM1
  <PLS >  IWATER variable monthly parameter value flags  ***
  # -  # CSNO RTOP  VRS  VNN RTLI     ***
  1         0    0    0    0    0
  2         0    0    0    0    0
  5         0    0    0    0    0
  8         0    0    0    0    0
  9         0    0    0    0    0
 14         0    0    0    0    0
END IWAT-PARM1

IWAT-PARM2
  <PLS >      IWATER input info: Part 2         ***
  # -  # ***  LSUR     SLSUR      NSUR     RETSC
  1           400      0.01       0.1       0.1
  2           400      0.05       0.1      0.08
  5           400      0.01       0.1       0.1
  8           400      0.01       0.1       0.1
  9           400      0.05       0.1      0.08
 14           400      0.01       0.1       0.1
END IWAT-PARM2

IWAT-PARM3
  <PLS >      IWATER input info: Part 3         ***
  # -  # ***PETMAX    PETMIN
  1             0         0
  2             0         0
  5             0         0
  8             0         0
  9             0         0
 14             0         0
END IWAT-PARM3

IWAT-STATE1
  <PLS > *** Initial conditions at start of simulation
  # -  # ***  RETS      SURS
  1             0         0
  2             0         0
  5             0         0
  8             0         0
  9             0         0
 14             0         0
END IWAT-STATE1

END IMPLND
```

```
SCHEMATIC
<-Source->                      <--Area-->      <-Target->   MBLK     ***
<Name>   #                      <-factor->      <Name>   #   Tbl#     ***
Basin  ***
PERLND   1                            0.13      RCHRES   1      2
PERLND   1                            0.13      RCHRES   1      3
PERLND   5                            1.32      RCHRES   1      2
PERLND   5                            1.32      RCHRES   1      3
IMPLND   1                            0.15      RCHRES   1      5
IMPLND   2                            0.19      RCHRES   1      5
IMPLND   5                            0.12      RCHRES   1      5
IMPLND   8                            0.05      RCHRES   1      5
IMPLND   9                            0.05      RCHRES   1      5
IMPLND  14                            0.14      RCHRES   1      5

******Routing******
PERLND   1                            0.13      COPY     1     12
PERLND   5                            1.32      COPY     1     12
PERLND  32                            0.48      COPY     1     12
IMPLND   1                            0.15      COPY     1     15
IMPLND   2                            0.19      COPY     1     15
IMPLND   5                            0.12      COPY     1     15
IMPLND   8                            0.05      COPY     1     15
IMPLND   9                            0.05      COPY     1     15
IMPLND  14                            0.14      COPY     1     15
PERLND   1                            0.13      COPY     1     13
PERLND   5                            1.32      COPY     1     13
PERLND  32                            0.48      COPY     1     13
RCHRES   1                               1      COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                         in  out                             ***
    1     Infiltratio Pond-005    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
  END HYDR-PARM1
```

```
  HYDR-PARM2
    # -  #     FTABNO       LEN     DELTH     STCOR        KS      DB50         ***
  <------><--------><--------><--------><--------><--------><-------->         ***
    1              1      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                           ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)      (cfs)  (ft/sec)    (Minutes)***
  0.000000  0.055556  0.000000  0.000000  0.000000
  0.044444  0.056163  0.002483  0.000000  0.168056
  0.088889  0.056774  0.004992  0.000000  0.168056
  0.133333  0.057388  0.007529  0.000000  0.168056
  0.177778  0.058006  0.010094  0.000000  0.168056
  0.222222  0.058627  0.012685  0.000000  0.168056
  0.266667  0.059251  0.015305  0.000000  0.168056
  0.311111  0.059878  0.017952  0.000000  0.168056
  0.355556  0.060509  0.020628  0.000000  0.168056
  0.400000  0.061142  0.023331  0.000000  0.168056
  0.444444  0.061779  0.026062  0.000000  0.168056
  0.488889  0.062420  0.028822  0.000000  0.168056
  0.533333  0.063063  0.031611  0.000000  0.168056
  0.577778  0.063710  0.034428  0.000000  0.168056
  0.622222  0.064360  0.037274  0.000000  0.168056
  0.666667  0.065014  0.040149  0.000000  0.168056
  0.711111  0.065670  0.043053  0.000000  0.168056
  0.755556  0.066330  0.045987  0.000000  0.168056
  0.800000  0.066994  0.048949  0.000000  0.168056
  0.844444  0.067660  0.051942  0.000000  0.168056
  0.888889  0.068330  0.054964  0.000000  0.168056
  0.933333  0.069003  0.058015  0.000000  0.168056
  0.977778  0.069679  0.061097  0.000000  0.168056
  1.022222  0.070359  0.064209  0.000000  0.168056
  1.066667  0.071041  0.067351  0.000000  0.168056
  1.111111  0.071727  0.070524  0.000000  0.168056
  1.155556  0.072417  0.073727  0.000000  0.168056
  1.200000  0.073109  0.076961  0.000000  0.168056
  1.244444  0.073805  0.080226  0.000000  0.168056
  1.288889  0.074504  0.083522  0.000000  0.168056
  1.333333  0.075207  0.086849  0.000000  0.168056
  1.377778  0.075912  0.090207  0.000000  0.168056
  1.422222  0.076621  0.093596  0.000000  0.168056
  1.466667  0.077333  0.097018  0.000000  0.168056
  1.511111  0.078049  0.100471  0.000000  0.168056
  1.555556  0.078767  0.103955  0.000000  0.168056
  1.600000  0.079489  0.107472  0.000000  0.168056
  1.644444  0.080215  0.111021  0.000000  0.168056
  1.688889  0.080943  0.114603  0.000000  0.168056
  1.733333  0.081675  0.118216  0.000000  0.168056
  1.777778  0.082410  0.121863  0.000000  0.168056
  1.822222  0.083148  0.125542  0.000000  0.168056
  1.866667  0.083890  0.129254  0.000000  0.168056
  1.911111  0.084635  0.132999  0.000000  0.168056
  1.955556  0.085383  0.136777  0.000000  0.168056
  2.000000  0.086134  0.140588  0.000000  0.168056
  2.044444  0.086889  0.144433  0.000000  0.168056
  2.088889  0.087647  0.148312  0.000000  0.168056
```

```
  2.133333  0.088408  0.152224  0.000000  0.168056
  2.177778  0.089172  0.156170  0.000000  0.168056
  2.222222  0.089940  0.160151  0.000000  0.168056
  2.266667  0.090711  0.164165  0.000000  0.168056
  2.311111  0.091485  0.168214  0.000000  0.168056
  2.355556  0.092262  0.172297  0.000000  0.168056
  2.400000  0.093043  0.176415  0.000000  0.168056
  2.444444  0.093827  0.180568  0.000000  0.168056
  2.488889  0.094614  0.184755  0.000000  0.168056
  2.533333  0.095405  0.188978  0.000000  0.168056
  2.577778  0.096199  0.193236  0.000000  0.168056
  2.622222  0.096996  0.197529  0.000000  0.168056
  2.666667  0.097796  0.201858  0.000000  0.168056
  2.711111  0.098600  0.206222  0.000000  0.168056
  2.755556  0.099407  0.210622  0.000000  0.168056
  2.800000  0.100217  0.215058  0.000000  0.168056
  2.844444  0.101030  0.219530  0.000000  0.168056
  2.888889  0.101847  0.224039  0.000000  0.168056
  2.933333  0.102667  0.228584  0.000000  0.168056
  2.977778  0.103490  0.233165  0.000000  0.168056
  3.022222  0.104316  0.237783  0.035147  0.168056
  3.066667  0.105146  0.242437  0.182234  0.168056
  3.111111  0.105979  0.247129  0.389839  0.168056
  3.155556  0.106815  0.251858  0.637321  0.168056
  3.200000  0.107655  0.256624  0.907676  0.168056
  3.244444  0.108498  0.261427  1.183559  0.168056
  3.288889  0.109344  0.266268  1.447495  0.168056
  3.333333  0.110193  0.271147  1.683468  0.168056
  3.377778  0.111045  0.276063  1.879270  0.168056
  3.422222  0.111901  0.281017  2.029388  0.168056
  3.466667  0.112760  0.286010  2.138326  0.168056
  3.511111  0.113623  0.291041  2.251735  0.168056
  3.555556  0.114488  0.296110  2.347596  0.168056
  3.600000  0.115357  0.301218  2.439693  0.168056
  3.644444  0.116229  0.306364  2.528438  0.168056
  3.688889  0.117105  0.311549  2.614172  0.168056
  3.733333  0.117983  0.316773  2.697182  0.168056
  3.777778  0.118865  0.322037  2.777713  0.168056
  3.822222  0.119751  0.327339  2.855973  0.168056
  3.866667  0.120639  0.332681  2.932146  0.168056
  3.911111  0.121531  0.338063  3.006389  0.168056
  3.955556  0.122426  0.343484  3.078843  0.168056
  4.000000  0.123324  0.348945  3.149630  0.168056
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.889          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.889          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1         1     WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1         1     WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1         1     WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1         1     WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1      48.4     WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      48.4     WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
```

```
  MASS-LINK         2
PERLND      PWATER SURO        0.083333       RCHRES          INFLOW IVOL
  END MASS-LINK     2

  MASS-LINK         3
PERLND      PWATER IFWO        0.083333       RCHRES          INFLOW IVOL
  END MASS-LINK     3

  MASS-LINK         5
IMPLND      IWATER SURO        0.083333       RCHRES          INFLOW IVOL
  END MASS-LINK     5

  MASS-LINK        12
PERLND      PWATER SURO        0.083333       COPY            INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        13
PERLND      PWATER IFWO        0.083333       COPY            INPUT  MEAN
  END MASS-LINK    13

  MASS-LINK        15
IMPLND      IWATER SURO        0.083333       COPY            INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        17
RCHRES     OFLOW  OVOL   1                    COPY            INPUT  MEAN
  END MASS-LINK    17

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

Site Treatment

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	default[26]
Site Name:	
Site Address:	
City:	
Report Date:	6/8/2022
Gage:	Woodland Creek
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	0.889
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Site Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Mod	2.64
Pervious Total	2.64
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.64

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B IMP INF FLAT	0.48
A B, Forest, Mod	0.13
C, Pasture, Flat	1.32
Pervious Total	1.93
Impervious Land Use	acre
ROADS FLAT	0.15
ROADS MOD	0.19
DRIVEWAYS FLAT	0.12
SIDEWALKS FLAT	0.05
SIDEWALKS MOD	0.05
POND	0.14
Impervious Total	0.7
Basin Total	2.63

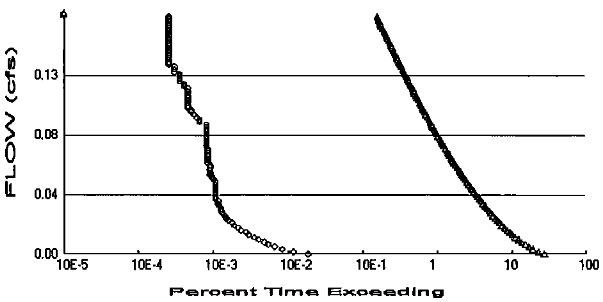
Element Flows To:

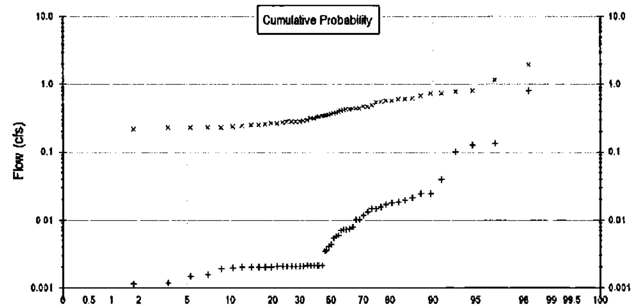
Surface	Interflow	Groundwater

Mitigated Routing

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.64
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.93
Total Impervious Area: 0.7

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.005084
5 year	0.017804
10 year	0.037739
25 year	0.090697 ← Used for Conveyance Sizing
50 year	0.166751
100 year	0.296892

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.371819
5 year	0.560348
10 year	0.716513
25 year	0.954629
50 year	1.165148
100 year	1.407224

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.016	0.345
1957	0.007	0.606
1958	0.002	0.269
1959	0.004	0.433
1960	0.007	0.441
1961	0.010	0.242
1962	0.002	0.273
1963	0.017	0.734
1964	0.018	0.576
1965	0.004	0.352

1966	0.002	0.251
1967	0.018	0.318
1968	0.003	0.284
1969	0.002	0.238
1970	0.002	0.234
1971	0.128	0.470
1972	0.040	0.374
1973	0.002	0.286
1974	0.013	0.499
1975	0.006	0.672
1976	0.021	0.362
1977	0.002	0.621
1978	0.024	0.475
1979	0.002	0.545
1980	0.005	0.330
1981	0.010	0.572
1982	0.015	0.441
1983	0.008	0.779
1984	0.004	0.316
1985	0.002	0.444
1986	0.015	0.609
1987	0.025	0.383
1988	0.002	0.217
1989	0.002	0.233
1990	0.002	0.418
1991	0.133	0.800
1992	0.810	1.967
1993	0.102	0.398
1994	0.002	0.256
1995	0.007	0.431
1996	0.020	0.404
1997	0.012	1.177
1998	0.002	0.743
1999	0.002	0.328
2000	0.001	0.283
2001	0.001	0.230
2002	0.002	0.296
2003	0.001	0.231
2004	0.002	0.288
2005	0.002	0.216
2006	0.002	0.339
2007	0.002	0.281
2008	0.001	0.253
2009	0.006	0.352
2010	0.002	0.552
2011	0.008	0.268

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.8103	1.9665
2	0.1333	1.1767
3	0.1279	0.7997
4	0.1021	0.7790
5	0.0397	0.7426
6	0.0245	0.7335
7	0.0244	0.6723
8	0.0213	0.6206

9	0.0197	0.6085
10	0.0184	0.6060
11	0.0181	0.5762
12	0.0172	0.5723
13	0.0156	0.5525
14	0.0148	0.5451
15	0.0148	0.4986
16	0.0132	0.4750
17	0.0118	0.4699
18	0.0103	0.4436
19	0.0103	0.4411
20	0.0079	0.4408
21	0.0075	0.4328
22	0.0073	0.4309
23	0.0072	0.4178
24	0.0070	0.4043
25	0.0060	0.3984
26	0.0057	0.3833
27	0.0054	0.3740
28	0.0043	0.3622
29	0.0041	0.3524
30	0.0036	0.3523
31	0.0034	0.3447
32	0.0021	0.3392
33	0.0021	0.3300
34	0.0021	0.3279
35	0.0021	0.3179
36	0.0021	0.3161
37	0.0021	0.2959
38	0.0021	0.2877
39	0.0021	0.2857
40	0.0021	0.2836
41	0.0021	0.2834
42	0.0021	0.2814
43	0.0021	0.2734
44	0.0021	0.2686
45	0.0020	0.2676
46	0.0020	0.2560
47	0.0020	0.2532
48	0.0020	0.2505
49	0.0020	0.2424
50	0.0020	0.2379
51	0.0019	0.2344
52	0.0015	0.2330
53	0.0015	0.2309
54	0.0012	0.2304
55	0.0011	0.2173
56	0.0011	0.2159

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0025	361	537826	148982	Fail
0.0042	232	447697	192972	Fail
0.0059	166	384470	231608	Fail
0.0075	129	337147	261354	Fail
0.0092	107	299447	279857	Fail
0.0108	94	268618	285763	Fail
0.0125	80	242895	303618	Fail
0.0142	70	220707	315295	Fail
0.0158	58	201856	348027	Fail
0.0175	54	185303	343153	Fail
0.0191	46	170812	371330	Fail
0.0208	42	157911	375978	Fail
0.0224	37	146346	395529	Fail
0.0241	35	136057	388734	Fail
0.0258	31	126710	408741	Fail
0.0274	29	118365	408155	Fail
0.0291	28	110746	395521	Fail
0.0307	26	103638	398607	Fail
0.0324	25	97256	389024	Fail
0.0341	25	91208	364832	Fail
0.0357	24	85789	357454	Fail
0.0374	23	80821	351395	Fail
0.0390	23	76167	331160	Fail
0.0407	21	71808	341942	Fail
0.0424	21	67783	322776	Fail
0.0440	21	64052	305009	Fail
0.0457	21	60694	289019	Fail
0.0473	21	57474	273685	Fail
0.0490	21	54470	259380	Fail
0.0506	21	51583	245633	Fail
0.0523	21	48952	233104	Fail
0.0540	20	46439	232195	Fail
0.0556	19	44122	232221	Fail
0.0573	18	41981	233227	Fail
0.0589	18	39880	221555	Fail
0.0606	18	38074	211522	Fail
0.0623	18	36326	201811	Fail
0.0639	18	34657	192538	Fail
0.0656	17	33086	194623	Fail
0.0672	17	31574	185729	Fail
0.0689	17	30200	177647	Fail
0.0705	17	28865	169794	Fail
0.0722	17	27608	162400	Fail
0.0739	17	26410	155352	Fail
0.0755	17	25291	148770	Fail
0.0772	16	24250	151562	Fail
0.0788	16	23190	144937	Fail
0.0805	16	22247	139043	Fail
0.0822	16	21305	133156	Fail
0.0838	16	20382	127387	Fail
0.0855	16	19500	121875	Fail
0.0871	16	18668	116675	Fail
0.0888	16	17875	111718	Fail
0.0905	16	17156	107225	Fail

0.0921	16	16467	102918	Fail
0.0938	13	15789	121453	Fail
0.0954	13	15157	116592	Fail
0.0971	12	14550	121250	Fail
0.0987	11	13971	127009	Fail
0.1004	10	13390	133900	Fail
0.1021	10	12887	128869	Fail
0.1037	9	12371	137455	Fail
0.1054	9	11933	132588	Fail
0.1070	9	11479	127544	Fail
0.1087	9	11063	122922	Fail
0.1104	9	10599	117766	Fail
0.1120	9	10211	113455	Fail
0.1137	9	9863	109588	Fail
0.1153	9	9498	105533	Fail
0.1170	9	9140	101555	Fail
0.1186	8	8773	109662	Fail
0.1203	8	8439	105487	Fail
0.1220	7	8174	116771	Fail
0.1236	7	7882	112600	Fail
0.1253	7	7583	108328	Fail
0.1269	7	7301	104300	Fail
0.1286	6	7020	117000	Fail
0.1303	6	6794	113233	Fail
0.1319	6	6511	108516	Fail
0.1336	5	6303	126060	Fail
0.1352	5	6079	121580	Fail
0.1369	5	5855	117100	Fail
0.1386	5	5655	113100	Fail
0.1402	5	5433	108660	Fail
0.1419	5	5247	104940	Fail
0.1435	5	5060	101200	Fail
0.1452	5	4911	98220	Fail
0.1468	5	4717	94340	Fail
0.1485	5	4546	90920	Fail
0.1502	5	4391	87820	Fail
0.1518	5	4210	84200	Fail
0.1535	5	4069	81380	Fail
0.1551	5	3913	78260	Fail
0.1568	5	3776	75520	Fail
0.1585	5	3627	72540	Fail
0.1601	5	3503	70060	Fail
0.1618	5	3379	67580	Fail
0.1634	5	3271	65420	Fail
0.1651	5	3175	63500	Fail
0.1668	5	3067	61340	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.1659 acre-feet
On-line facility target flow:	0.1409 cfs.
Adjusted for 15 min:	0.1409 cfs.
Off-line facility target flow:	0.0781 cfs.
Adjusted for 15 min:	0.0781 cfs.

Used for Presettling Sizing

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

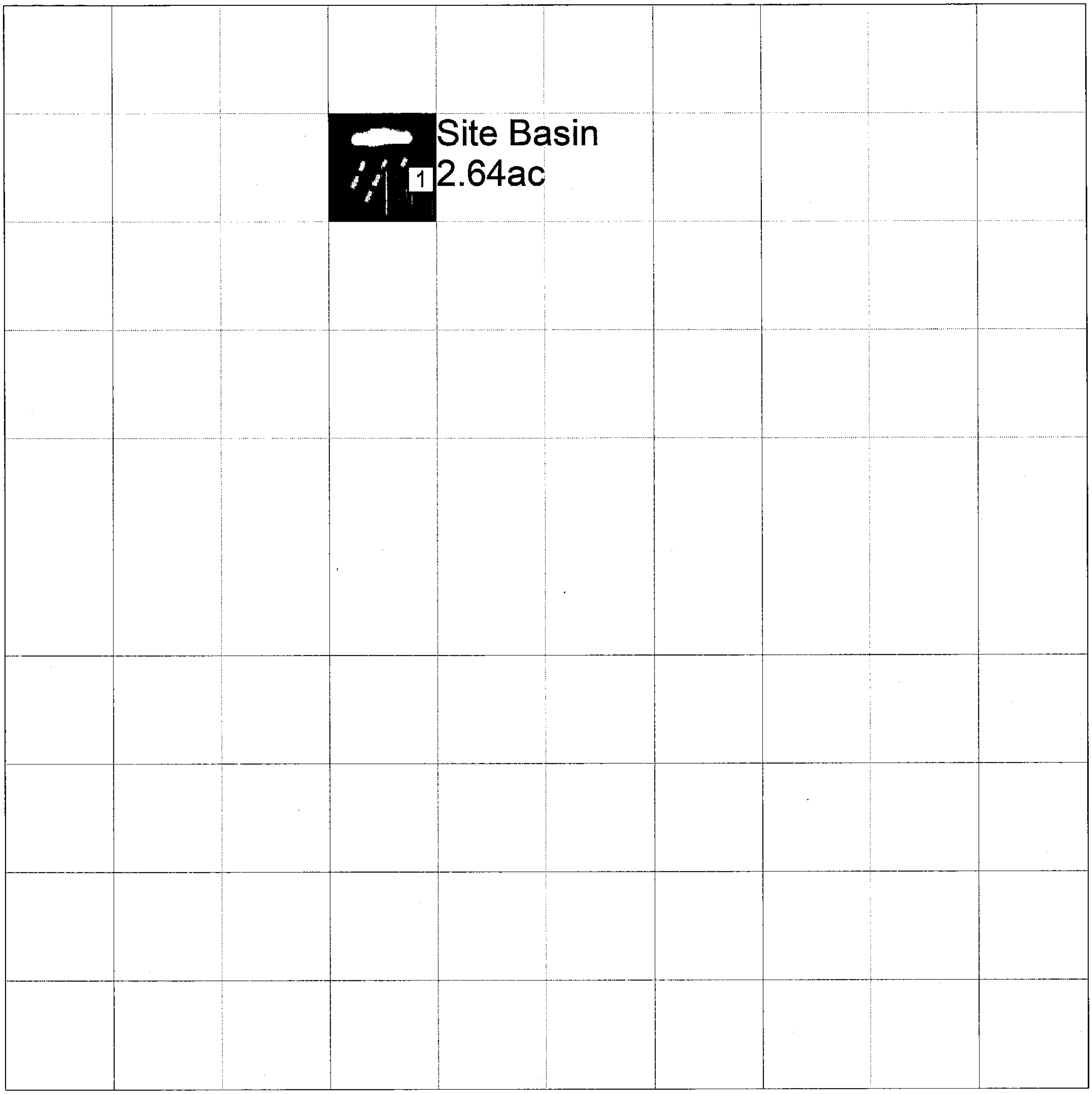
Model Default Modifications

Total of 0 changes have been made.

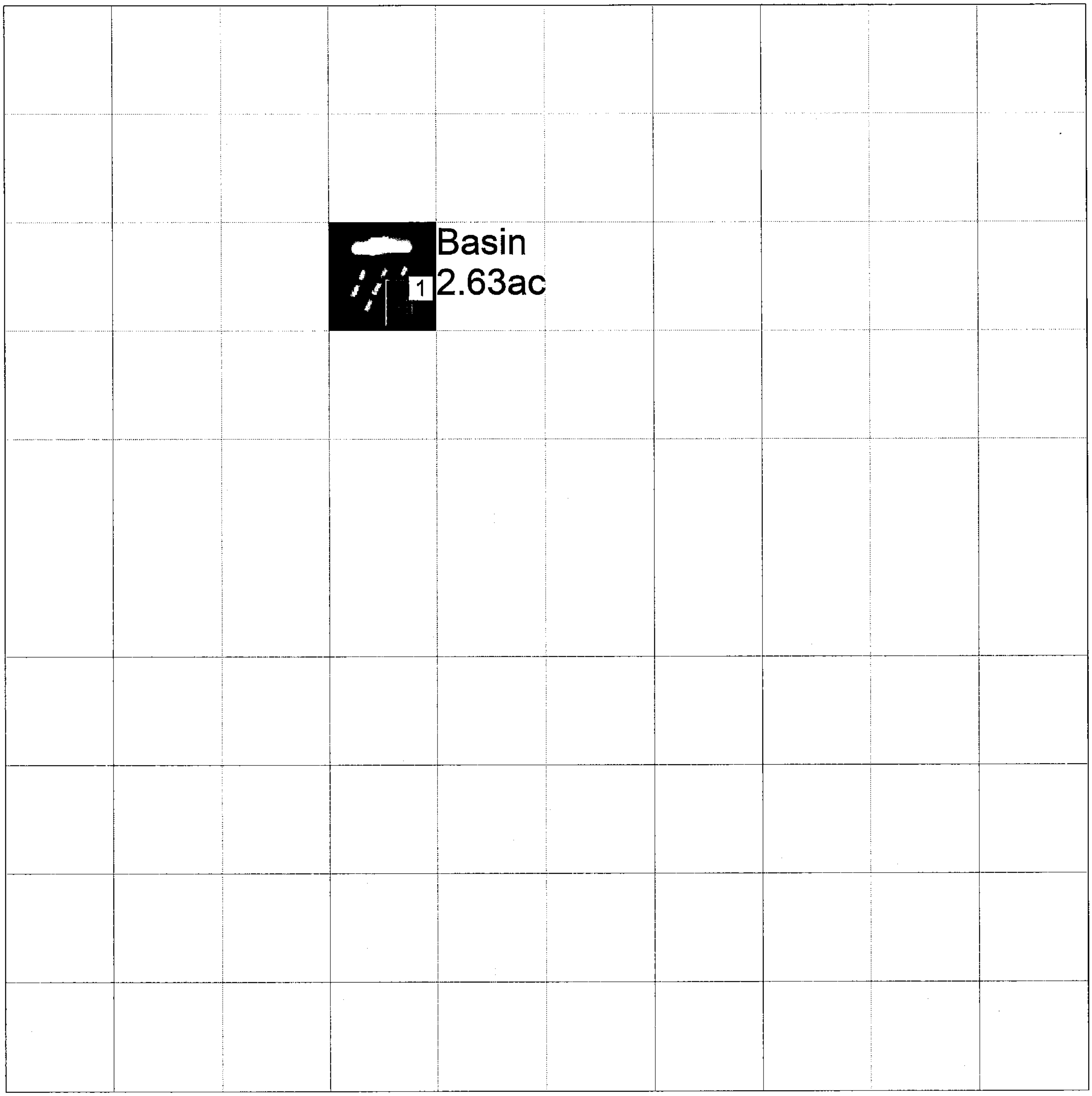
PERLND Changes
No PERLND changes have been made.

IMPLND Changes
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME      0 RUN      1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   default[26].wdm
MESSU      25   Predefault[26].MES
           27   Predefault[26].L61
           28   Predefault[26].L62
           30   POCdefault[26]1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       2
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Site Basin                 MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
    2     A/B, Forest, Mod        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    2         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    2         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    2         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    2              0         5         2       400       0.1       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    2              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    2            0.2       0.5      0.35         0       0.7       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    2              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI    ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
Site Basin  ***
PERLND   2                        2.64     COPY   501      12
PERLND   2                        2.64     COPY   501      13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                             ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR       KS      DB50        ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.889          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.889          IMPLND   1 999 EXTNL  PREC
```

```
WDM        1 EVAP     ENGL     0.76               PERLND    1 999 EXTNL  PETINP
WDM        1 EVAP     ENGL     0.76               IMPLND    1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>      <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>               <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY          INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY          INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   default[26].wdm
MESSU      25   Mitdefault[26].MES
           27   Mitdefault[26].L61
           28   Mitdefault[26].L62
           30   POCdefault[26]1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      31
      PERLND       2
      PERLND      13
      IMPLND       1
      IMPLND       2
      IMPLND       5
      IMPLND       8
      IMPLND       9
      IMPLND      14
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin                       MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   31      A/B/IMP INF/FLAT       1    1    1    1   27    0
    2     A/B, Forest, Mod        1    1    1    1   27    0
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
```

```
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   31         0    0    1    0    0    0    0    0    0    0    0    0
    2         0    0    1    0    0    0    0    0    0    0    0    0
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > **************** Print-flags ***************************** PIVL  PYR
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   31         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    2         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   31         0    0    0    0    0    0    0    0    0    0    0
    2         0    0    0    0    0    0    0    0    0    0    0
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -   # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   31              0         5       0.8       400      0.05       0.3     0.996
    2              0         5         2       400       0.1       0.3     0.996
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   31              0         0         2         2         0         0         0
    2              0         0         2         2         0         0         0
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   31             0.1       0.5      0.25         0       0.7      0.25
    2             0.2       0.5      0.35         0       0.7       0.7
   13            0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -   # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   31              0         0         0         0         3         1         0
    2              0         0         0         0         3         1         0
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -   #                    User  t-series Engl Metr ***
                                       in  out           ***
    1       ROADS/FLAT            1     1    1   27    0
    2       ROADS/MOD             1     1    1   27    0
    5       DRIVEWAYS/FLAT        1     1    1   27    0
    8       SIDEWALKS/FLAT        1     1    1   27    0
    9       SIDEWALKS/MOD         1     1    1   27    0
   14       POND                  1     1    1   27    0
  END GEN-INFO
  *** Section IWATER***
```

```
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    2         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
    9         0    0    1    0    0    0
   14         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    2         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
    9         0    0    4    0    0    0    1    9
   14         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags   ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    2         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
    9         0    0    0    0    0
   14         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR      SLSUR      NSUR     RETSC
    1            400       0.01       0.1       0.1
    2            400       0.05       0.1      0.08
    5            400       0.01       0.1       0.1
    8            400       0.01       0.1       0.1
    9            400       0.05       0.1      0.08
   14            400       0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    2              0         0
    5              0         0
    8              0         0
    9              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    2              0         0
    5              0         0
    8              0         0
    9              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
```

```
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  ***
PERLND   2                    0.13      COPY   501     12
PERLND   2                    0.13      COPY   501     13
PERLND  13                    1.32      COPY   501     12
PERLND  13                    1.32      COPY   501     13
IMPLND   1                    0.15      COPY   501     15
IMPLND   2                    0.19      COPY   501     15
IMPLND   5                    0.12      COPY   501     15
IMPLND   8                    0.05      COPY   501     15
IMPLND   9                    0.05      COPY   501     15
IMPLND  14                    0.14      COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
```

```
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.889          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.889          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1      48.4     WDM    701 FLOW     ENGL       REPL
COPY   501 OUTPUT MEAN   1 1      48.4     WDM    801 FLOW     ENGL       REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Disclaimer

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APPENDIX 2 – Soil Management Plan

To be Completed with the final permit submittal.

Soil Management Site Plan

Create a SMP Site Plan which delineates the areas to be fenced and left undisturbed during construction, and the areas that will be amended per the SMP worksheet on the next page.

Soil Management Plan Worksheet

Fill out and include the Soil Management Plan Worksheet here.

APPENDIX 3 – Supplemental Reports and Information

United States Department of Agriculture

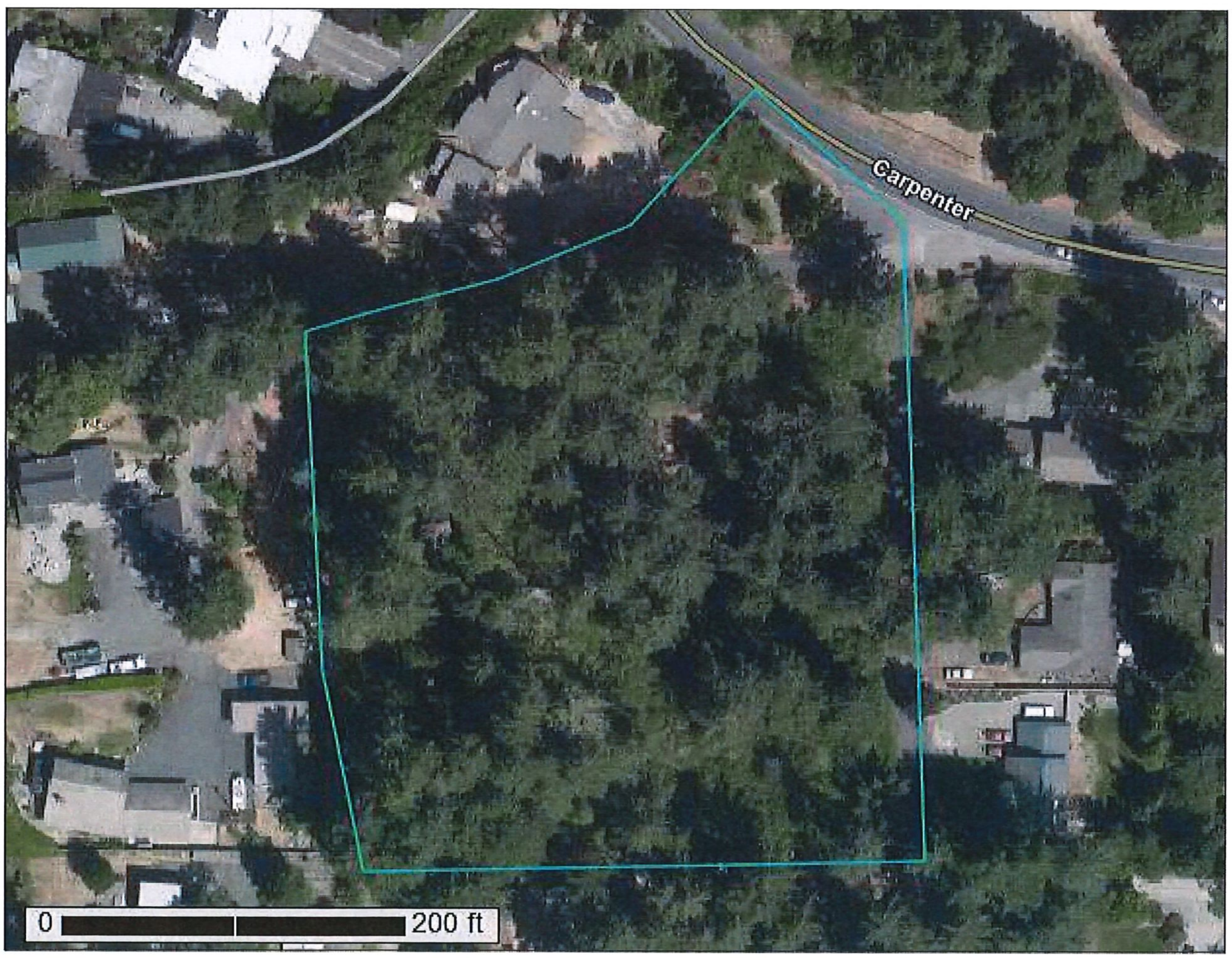
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Thurston County Area, Washington



November 9, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:850 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

Please rely on the bar scale on each map sheet for map measurements.

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

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

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

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 15, Aug 31, 2021

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

Date(s) aerial images were photographed: Jul 22, 2018—Jul 27, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
33	Everett very gravelly sandy loam, 8 to 15 percent slopes	2.9	100.0%
Totals for Area of Interest		**2.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Thurston County Area, Washington

33—Everett very gravelly sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t62b
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Moraines, eskers, kames
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA)
Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 10 percent
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

July 26, 2021

Bar Holdings, LLC
P.O. Box 14996
Tumwater, WA 98511

Attention: Mr. Mike Brewer

Subject: Geotechnical Engineering Report – Infiltration Assessment
Carpenter Road Short Plat
Lacey, Washington
SSGC Project No. 21047

Mr. Brewer,

South Sound Geotechnical Consulting (SSGC) has completed a geotechnical assessment for the planned Carpenter Road short plat in Lacey, Washington. Our services have been completed in general conformance with our proposal P21064 (dated June 2, 2021) and authorized per signature of our agreement for services. Our scope of services included the completion of seven test pits on the property, laboratory testing, engineering analyses, and preparation of this report.

PROJECT INFORMATION

The project property is located at 3019 Carpenter Road SE. It is on the south side of the road and encompasses approximately 2.6 acres. Development plans include up to seven individual residential lots. Infiltration facilities are proposed to assist in stormwater control.

SITE CONDITIONS

The property is on a gentle southerly to westerly facing slope. It is currently undeveloped and covered with mixed forest growth. Based on topographic information on the Thurston County GIS system and Google maps, slope inclinations on the site are on the order of 15 percent, or less.

SUBSURFACE CONDITIONS

Subsurface conditions were characterized by completing seven test pits on June 14, 2021. Test pits were advanced to final depths between 5.5 and 9 feet below existing ground surface. Approximate locations of the explorations are shown on Figure 1, Exploration Plan. A summary description of observed subgrade conditions is provided below. Logs of the test pits are provided in Appendix A.

Soil Conditions

Topsoil and/or fill were below the surface in the test pits. Fill consisted of loose sand and silt with variable organics. Fill/topsoil extended between 1 to 2 feet at the test pit locations. In most of the test pits soils below the fill/topsoil consisted of an upper layer of native silty sand with gravel. This soil was in a loose condition and extended to depths between 2 and 6 feet. In the southern portion of the property where stormwater facilities are planned, sandy gravel to gravelly sand was below the upper soil/topsoil layers. This soil was in a loose to medium dense condition and extended to the termination of the test pits. This soil is considered to be glacial outwash.

Groundwater Conditions

Groundwater was not observed in the test pits at the time of excavation. Mottling or other indicators of shallow groundwater was not observed to the base of the tests pits. The permanent groundwater table is expected at depth and should not impact the planned development.

Geologic Setting

Native soils on the property are mapped as "Everett very gravelly sandy loam" per the USDA Soil Conservation Service survey of Thurston County. Native soil in the test pits in the proposed stormwater facility in the southern portion of the site appear to conform to the mapped outwash soil.

GEOTECHNICAL DESIGN CONSIDERATIONS

The planned development is considered feasible based on observed soil conditions in the test holes. Native soils can be used for support of conventional spread footing foundations, slab-on-grade floors, and pavements. Existing topsoil and any fill encountered should be removed from planned building or pavement areas. Native outwash soils have good infiltration potential based on the tests completed and are considered suitable to support infiltration systems.

Site slopes are on the order of 15 percent or shallower. No evidence of past instability was observed on site slopes. This site is not considered a landslide or erosion hazard area.

Recommendations presented in the following sections should be considered general and may require modifications when earthwork and grading occur. They are based upon the subsurface conditions observed in the test holes and the assumption that finish site grades will be similar to existing grades. It should be noted that subsurface conditions across the site may vary from those depicted on the exploration logs and can change with time. Therefore, proper site preparation will depend upon the weather and soil conditions encountered at the time of construction. We recommend that SSGC review final plans and further assess subgrade conditions at the time of construction, as warranted.

General Site Preparation

Site grading and earthwork should include procedures to control surface water runoff. Grading the site without adequate drainage control measures may negatively impact site soils, resulting in increased export of impacted soil and import of fill materials, potentially increasing the cost of the earthwork and subgrade preparation phases of the project.

Site grading should include removal (stripping) of topsoil (and any fill encountered) in building and pavement areas. Subgrades should consist of firm native soils following stripping. Stripping depth will be on the order of 1 foot based on observed soil conditions in the test holes, but may vary across the site. Final stripping depths can only be determined at the time of construction.

General Subgrade Preparation

Subgrades in building and pavement areas should consist of firm native soil. We recommend exposed subgrades in building and conventional pavement areas are proofrolled using a large roller, loaded dump truck, or other mechanical equipment to assess subgrade conditions following stripping. Proofrolling efforts should result in the upper 1 foot of subgrade soils achieving a firm and unyielding condition and a compaction level of at least 92 percent of the maximum dry density (MDD) per the ASTM D1557 test method. Wet, loose, or soft subgrades that cannot achieve a firm and unyielding condition should be removed (over-excavated) and replaced with structural fill. The depth of over-excavation should be based on soil conditions at the time of construction. A representative of SSGC should be present to assess subgrade conditions during proofrolling.

Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Allowing surface water into cut or fill areas, utility trenches, and building footprints should be prevented.

Structural Fill Materials

The suitability of soil for use as structural fill will depend on the gradation and moisture content of the soil when it is placed. Soils with higher fines content (soil fraction passing the U.S. No. 200 sieve) will become sensitive with higher moisture content. It is often difficult to achieve adequate compaction if soil moisture is outside of optimum ranges for soils that contain more than about 5 percent fines.

<u>Site Soils:</u> Topsoil and the silty soils in the northern portion of the site are not considered suitable for structural fill. Native outwash soils are considered suitable for use as structural fill provided they can be moisture conditioned to within optimal ranges. Optimum moisture is considered within about +/- 2 percent of the moisture content required to achieve the maximum density per the ASTM D-1557 test method. If moisture content is higher or lower than optimum, soils would need to be dried or wetted prior to placement as structural fill.

Outwash contains variable cobbles and occasional boulders. Particles larger than about 4 inches should be screened from outwash soils prior to their use as structural fill. Larger particles tend to cluster during earthwork and can form voids and non-uniform compaction if not screened.

Import Fill Materials: We recommend import structural fill placed during dry weather periods consist of material which meets the specifications for *Gravel Borrow* as described in Section 9-03.14(1) of the 2018 Washington State Department of Transportation (WSDOT) Specifications for Road, Bridge, and Municipal Construction (Publication M 41-10). Gravel Borrow should be protected from disturbance if exposed to wet conditions after placement.

During wet weather, or for backfill on wet subgrades, import soil suitable for compaction in wetter conditions should be provided. Imported fill for use in wet conditions should generally conform to specifications for *Select Borrow* as described in Section 9-03.14(2), or *Crushed Surfacing* per Section 9-03.9(3) of the 2018 WSDOT M-41 manual, with the modification that a maximum of 5 percent by weight shall pass the U.S. No. 200 sieve.

It should be noted that structural fill placement and compaction is weather-dependent. Delays due to inclement weather are common, even when using select granular fill. We recommend site grading and earthwork be scheduled for the drier months of the year. Structural fill should not consist of frozen material.

Structural Fill Placement

We recommend structural fill is placed in lifts not exceeding about 10 inches in loose measure. It may be necessary to adjust lift thickness based on site and fill conditions during placement and compaction. Finer grained soil used as structural fill and/or lighter weight compaction equipment may require significantly thinner lifts to attain required compaction levels. Granular soil with lower fines contents could potentially be placed in thicker lifts if they can be adequately compacted. Structural fill should be compacted to attain the recommended levels presented in Table 1, Compaction Criteria.

Table 1. Compaction Criteria

Fill Application	Compaction Criteria*
Footing areas (below structures and retaining walls)	95 %
Upper 2 feet in pavement areas, slabs and sidewalks, and utility trenches	95 %
Below 2 feet in pavement areas, slabs and sidewalks, and utility trenches	92 %
Utility trenches or general fill in non-paved or -building areas	90 %

*Per the ASTM D 1557 test method.

Trench backfill within about 2 feet of utility lines should not be over-compacted to reduce the risk of damage to the line. In some instances, the top of the utility line may be within 2 feet of the surface. Backfill in these circumstances should be compacted to a firm and unyielding condition.

We recommend fill procedures include maintaining grades that promote drainage and do not allow ponding of water within the fill area. The contractor should protect compacted fill subgrades from disturbance during wet weather. In the event of rain during structural fill placement, the exposed fill surface should be allowed to dry prior to placement of additional fill. Alternatively, the wet soil can be removed. We recommend consideration be given to protecting haul routes and other high traffic areas with free-draining granular fill material (i.e. sand and gravel containing less than 5 percent fines) or quarry spalls to reduce the potential for disturbance to the subgrade during inclement weather.

Earthwork Procedures

Conventional earthmoving equipment should be suitable for earthwork at this site. Earthwork may be difficult during periods of wet weather or if elevated soil moisture is present. Excavated site soils may not be suitable as structural fill depending on the soil moisture content and weather conditions at the time of earthwork. If soils are stockpiled and wet weather is anticipated, the stockpile should be protected with securely anchored plastic sheeting. If stockpiled soils become unusable, it may become necessary to import clean, granular soils to complete wet weather site work.

Wet or disturbed subgrade soils should be over-excavated to expose firm, non-yielding, non-organic soils and backfilled with compacted structural fill. We recommend the earthwork portion of this project be completed during extended periods of dry weather. If earthwork is completed during the wet season (typically late October through May) it may be necessary to take extra measures to protect subgrade soils.

If earthwork takes place during freezing conditions, we recommend exposed subgrades are allowed to thaw and re-compacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen soil can be removed to unfrozen soil and replaced with structural fill.

The contractor is responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of excavation sides and bottoms. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. Temporary excavation cuts should be sloped at inclinations of 1H:1.5V (Horizontal:Vertical) or flatter, unless the contractor can demonstrate the safety of steeper inclinations. Shoring may be required in deeper excavations (below 4 feet) as glacial outwash soils tend to cave into open excavations.

A geotechnical engineer and accredited testing material laboratory should be retained during the construction phase of the project to observe earthwork operations and perform necessary tests and observations during subgrade preparation, placement and compaction of structural fill, and backfilling of excavations.

Infiltration Characteristics

Infiltration facilities will be used to assist in control of stormwater. An assessment of infiltration potential was completed per Volume 3, Appendix III-A, Method 3 of the 2016 Thurston County Drainage Design and Erosion Control Manual. Gradation correlations based on Massmann's equation were completed on samples of the native outwash from two of the test pits in the proposed stormwater facility in the southern portion of the site. Results of the correlations are presented in Table 2.

Table 2. Infiltration Rates

Sample ID and Depth (ft)	Soil Type	Calculated Infiltration Rate (in/hr)	Corrected Infiltration Rate (in/hr)	Correction Factors* (Fg/Ft/Fp)
TP-4, S-1, 4 ft	Outwash	>100	32	(1/0.4/0.8)
TP-5, S-2, 9 ft	Outwash	>100	32	(1/0.4/0.8)

*Correction Factors from the 2016 Thurston County Drainage Design and Erosion Control Manual.

Calculated and corrected infiltration rates are considered appropriate for the soil tested and are similar to infiltration tests completed at other sites with similar soil throughout Thurston County. We recommend a long-term design rate of 32 inches per hour (in/hr) for design of infiltration facilities located in outwash soils (or as limited by County codes). Modifications to the above correction factors should be applied to the above recommended long-term rate, as required by the County manual for the type of infiltration system used.

Groundwater was not observed in the test pits to a maximum depth of 9 feet. Mottling or other indicators of elevated groundwater were not observed. Infiltration facilities should not be adversely influenced by groundwater or other impervious soil layers.

Cation Exchange Capacity (CEC) and organic content tests were completed on select samples. Test results are summarized in the table below.

Table 3. CEC and Organic Content Results

Test Site, Sample Number, Depth	CEC Results (milliequivalents)	CEC Required* (milliequivalents)	Organic Content Results (%)	Organic Content Required* (%)
TP-4, S-1, 4 ft	9.1	≥ 5	3.72	≥1.0

* Values from the 2016 Thurston County Drainage Design and Erosion Control Manual.

Organic content and CEC results of the tested sample satisfy County requirements.

Conventional Pavement Sections

Subgrades for conventional pavements should be prepared as described in the "*Subgrade Preparation*" and "*Structural Fill*" sections of this report. Subgrades below pavement sections should be graded or crowned to promote drainage and not allow for ponding of water beneath the section. If drainage is not provided and ponding occurs, subgrade soils could become saturated, lose strength, and result in premature distress or failure of the section. In addition, the pavement surfacing should also be graded to promote drainage and reduce the potential for ponding of water on the pavement surface. Minimum recommended pavement sections for conventional asphalt or concrete pavements are presented in Table 5.

Table 4. Pavement Sections

Traffic Area	Minimum Recommended Pavement Section Thickness (inches)			
	Asphalt Concrete Surface[1]	Portland Cement Concrete[2]	Aggregate Base Course[3,4]	Subbase Aggregate[5]
Access Drive	2	6	4	12
Driveways	2	5	6	12

[1] 1/2 –inch nominal aggregate hot-mix asphalt (HMA) per WSDOT 9-03.8(1)

[2] A 28 day minimum compressive strength of 4,000 psi and an allowable flexural strength of at least 250 psi

[3] Crushed Surfacing Base Course per WSDOT 9-03.9(3)

[4] Although not required for structural support under concrete pavements, a minimum four-inch thick base course layer is recommended to help reduce potentials for slab curl, shrinkage cracking, and subgrade "pumping" through joints

[5] Native granular soils compacted to 95% of the ASTM D1557 test method, or Gravel Borrow per WSDOT 9-03.14(1) or Crushed Surfacing Base Course WSDOT 9-03.9(3)[1] 1/2 –inch nominal aggregate hot-mix asphalt (HMA) per WSDOT 9-03.8(1)

Conventional Pavement Maintenance

The performance and lifespan of pavements can be significantly impacted by future maintenance. The above pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be completed. Proper maintenance will slow the rate of pavement deterioration, and will improve pavement performance and life. Preventive maintenance consists of both localized maintenance (crack and joint sealing and patching) and global maintenance (surface sealing). Added maintenance measures and reduced pavement life should be anticipated over the lifetime of pavements if any existing fill or topsoil is left in-place beneath pavement sections.

Porous Pavements

Porous pavements to support stormwater control are considered feasible at this site. We are available to provided additional recommendations relative to the design of porous pavements, as requested.

REPORT CONDITIONS

This report has been prepared for the exclusive use of Barr Holdings, LLC for specific application to the project discussed, and has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No warranties, either express or implied, are intended or made. The analysis and recommendations presented in this report are based on observed soil conditions and test results at the indicated locations, and from other geologic information discussed. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction, or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

This report was prepared for the planned type of development of the site as discussed herein. It is not valid for third party entities or alternate types of development on the site without the express written consent of SSGC. If development plans change we should be notified to review those changes and modify our recommendations as necessary.

The scope of services for this project does not include any environmental or biological assessment of the site including identification or prevention of pollutants, hazardous materials, or conditions. Other studies should be completed if the owner is concerned about the potential for contamination or pollution.

We appreciate the opportunity to work with you on this project. Please contact us if additional information is required or we can be of further assistance.

Respectfully,

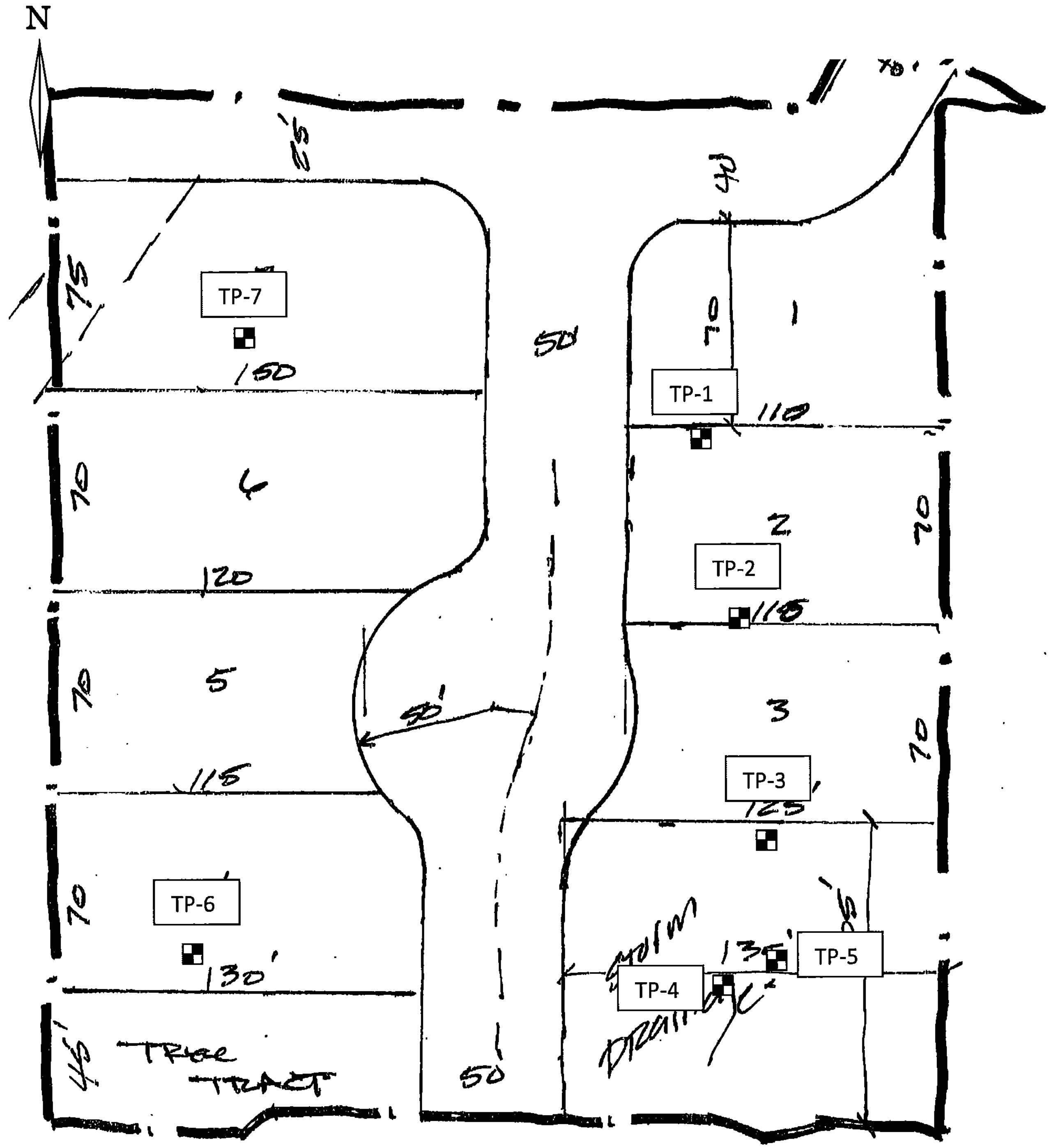
South Sound Geotechnical Consulting

TIMOTHY H. ROBERTS
STATE OF WASHINGTON
43126
REGISTERED PROFESSIONAL ENGINEER
7-26-21

Timothy H. Roberts, P.E.
Member/Geotechnical Engineer

Attachments: Figure 1 – Exploration Plan
Appendix A – Field Exploration Procedures and Test Pit Logs
Appendix B – Laboratory Testing and Results
Unified Soil Classification System

cc: Hatton Godat Pantier, Inc. – Chloe McIntyre, P.E.



Legend

TP - 1

■ **Approximate Test Pit Location**

Base map from client provided sketch.

Scale: NTS

South Sound Geotechnical Consulting
P.O. Box 39500
Lakewood, WA 98496
(253) 973-0515

Figure 1 – Exploration Plan

Carpenter Road Short Plat
Lacey, WA

SSGC Project #21047

Appendix A

Field Exploration Procedures and Test Pit Logs

Field Exploration Procedures

Our field exploration for this project included seven test pits completed on June 14, 2019. The approximate locations of the explorations are shown on Figure 1, Exploration Plan. Test pit locations were determined by pacing from site features. Ground surface elevations referenced on the logs were inferred from Google Earth satellite imagery. Test pit locations and elevations should be considered accurate only to the degree implied by the means and methods used.

A client provided excavator dug the test pits. Soil samples were collected and stored in moisture tight containers for further assessment and laboratory testing. Explorations were backfilled with excavated soils and tamped when completed. Please note that backfill in the explorations may settle with time. Backfill material located in roads or building areas should be re-excavated and recompacted, or replaced with structural fill.

The following logs indicate the observed lithology of soils and other materials observed in the explorations at the time of excavation. Where a soil contact was observed to be gradational, our log indicates the average contact depth. Our logs also indicate the approximate depth to groundwater (where observed at the time of excavation), along with sample numbers and approximate sample depths. Soil descriptions on the logs are based on the Unified Soil Classification System.

Test Pit TP-1

Depth (feet)	Material Description
0 – 2	**Fill/Topsoil:** Silt, sand, organics (limbs) with minor debris: Loose, moist, dark brown.
2 – 6	Silty SAND with gravel: Loose to medium dense, moist, brown. (SM)

Test pit completed at approximately 6 feet on 6/14/21.
Groundwater not observed at time of excavation.
Approximate surface elevation: 188 feet

Test Pit TP-2

Depth (feet)	Material Description
0 – 2	**Fill/Topsoil:** Silt, sand, organics (limbs): Loose, moist, dark brown.
2 – 5.5	Silty SAND with gravel: Loose to medium dense, moist, brown grading gray. (SM)

Test pit completed at approximately 5.5 feet on 6/14/21.
Groundwater not observed at time of excavation.
Approximate surface elevation: 183 feet

Test Pit TP-3

Depth (feet)	Material Description
0 – 1.5	**Topsoil**
1.5 – 5.5	Silty SAND with gravel: Loose to medium dense, moist, brown grading gray. (SM)

Test pit completed at approximately 8 feet on 6/14/21.
Groundwater not observed at time of excavation.
Approximate surface elevation: 178 feet

Test Pit TP-4

Depth (feet)	Material Description
0 – 1.5	**Topsoil**
1.5 – 7.5	Sandy GRAVEL with trace silt: Loose to medium dense, moist, brownish gray. (GW)(Outwash) (Sample S-1 @ 4 feet)

Test pit completed at approximately 7.5 feet on 6/14/21 due to caving.
Groundwater not observed at time of excavation.
Piezometer set in test pit.
Approximate surface elevation: 174 feet

Test Pit TP-5

Depth (feet)	Material Description
0 – 1	**Topsoil**
1 – 2	Silty SAND with gravel: Loose to medium dense, moist, brown grading gray. (SM)
2 – 4	Sandy GRAVEL with trace silt: Loose to medium dense, moist, brownish gray. (GW)(Outwash)
4 – 9	Gravelly SAND with trace silt: Loose to medium dense, moist, gray. (SW)(Outwash) (Sample S-1 @ 6 feet; Sample S-2 @ 9 feet)

Test pit completed at approximately 9 feet on 6/14/21.
Groundwater not observed at time of excavation.
Piezometer set in test pit.
Approximate surface elevation: 176 feet

Depth (feet)	Test Pit TP-6 Material Description
0 – 1.5	**Fill/Topsoil:** Silt, sand, organics (limbs): Loose, moist, dark brown.
1.5 – 3	Silty SAND with gravel: Loose to medium dense, moist, brown grading gray. (SM)
3 – 6.5	Sandy GRAVEL with trace silt: Loose to medium dense, moist, brownish gray. (GW)(Outwash)

Test pit completed at approximately 6.5 feet on 6/14/21.
Groundwater not observed at time of excavation.
Approximate surface elevation: 172 feet

Depth (feet)	Test Pit TP-7 Material Description
0 – 1	**Topsoil**
1 – 3	Silty SAND with gravel: Loose to medium dense, moist, brown grading gray. (SM)
3 – 6	Sandy GRAVEL with trace silt: Loose to medium dense, moist, brown. (GW)(Outwash)

Test pit completed at approximately 6 feet on 6/14/21.
Groundwater not observed at time of excavation.
Approximate surface elevation: 190 feet

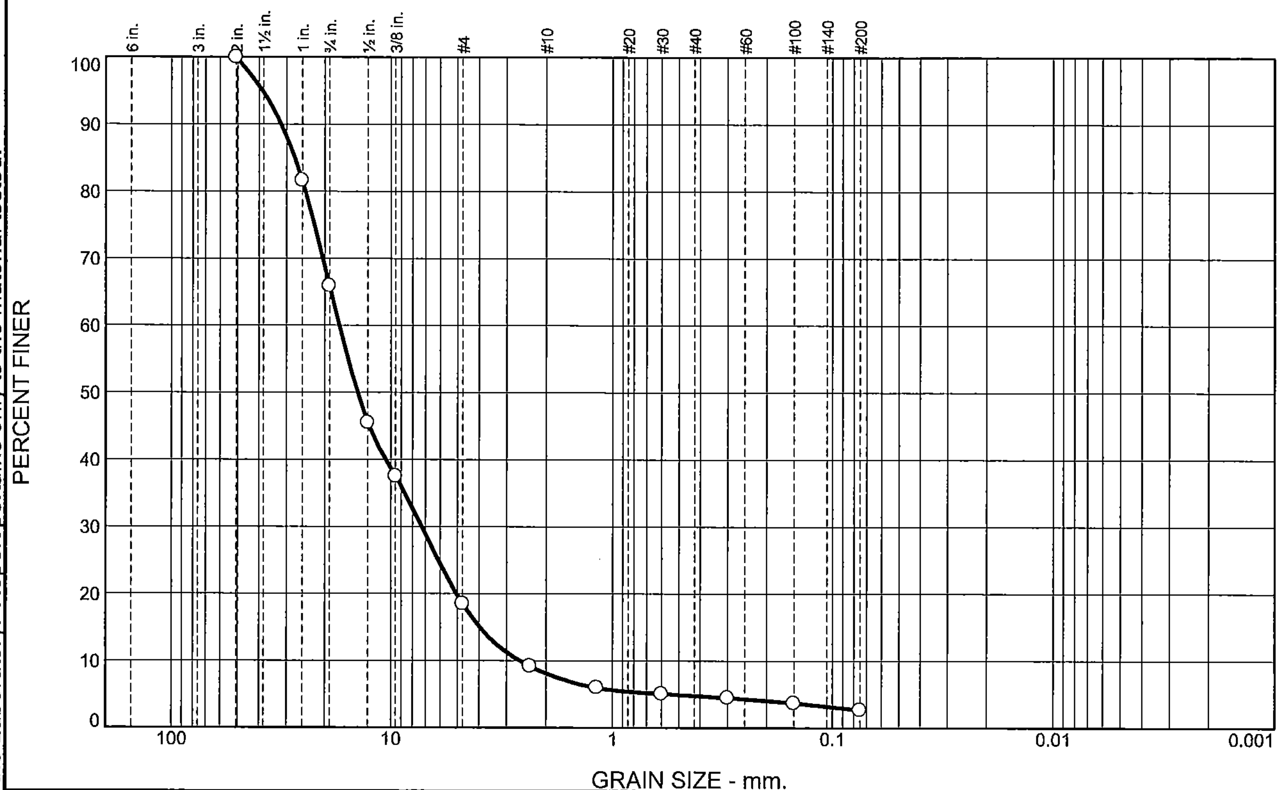
Appendix B

Laboratory Testing and Results

Laboratory Testing

Select soil samples were tested for organic content and cation exchange capacity (CEC) by Northwest Agricultural Consultants of Kennewick, Washington. Grain size (gradation) tests were completed by Construction Testing Laboratories (CTL) of Puyallup, Washington. Results of the laboratory testing are included in this appendix.

Particle Size Distribution Report ASTM C-117,C136



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0.0	0.0	34.1	47.4	10.4	2.4	0.7	0.7	1.2		3.1		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1"	81.6		
3/4"	65.9		
1/2"	45.5		
3/8"	37.5		
#4	18.5		
#8	9.2		
#16	6.0		
#30	5.1		
#50	4.5		
#100	3.7		
#200	2.7		

* (no specification provided)

Material Description

Grab Sample, S-1
Sampled at 4'

Atterberg Limits

PL= LL= PI=

Classification

USCS= GW AASHTO=

Remarks

Report: #002

Sampled by: Client

Source of Sample: TP-4
Sample Number: 21-724

Date: 06-14-21

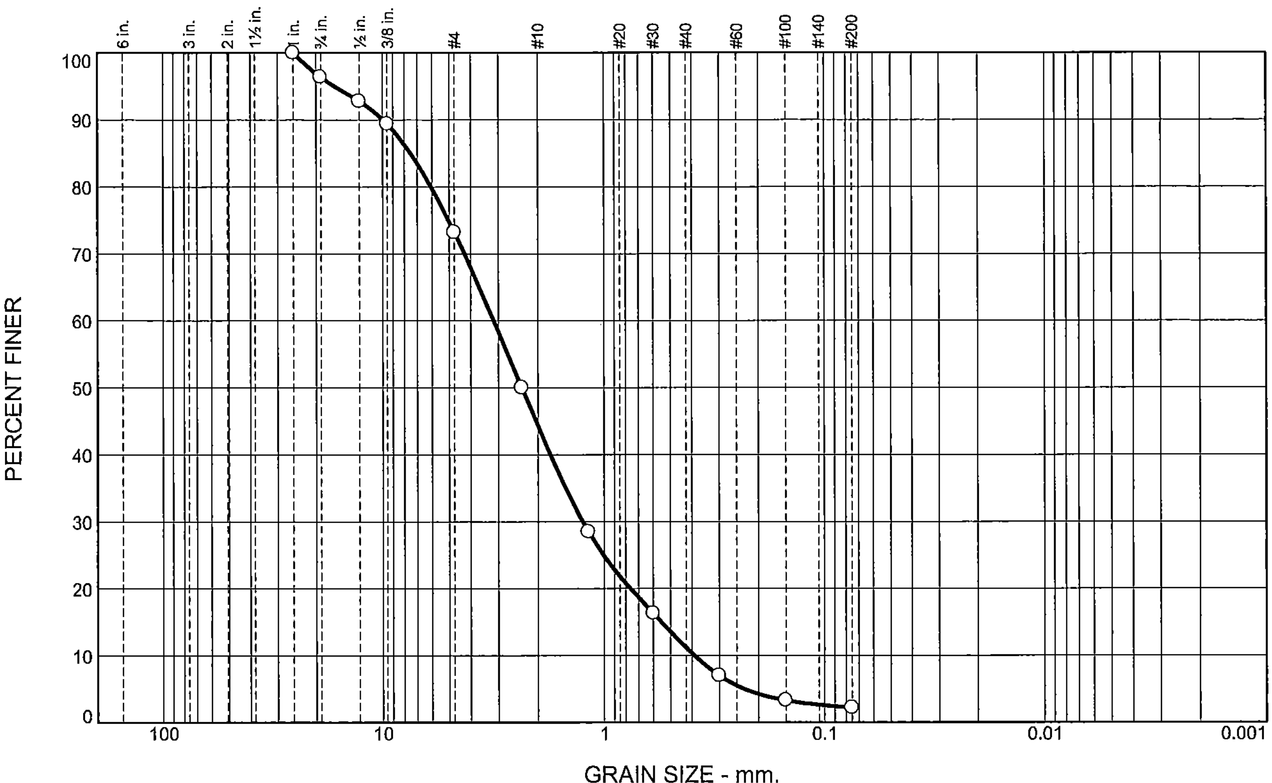
Construction Testing Laboratories
400 Valley Ave. NE, Suite #102
Puyallup WA, 98372 Tel. (253) 383-8778

Client: South Sound Geotechnical
Project: Carpenter Road (Jo #21047)

Project No: 9213 **Figure**

Tested By: R Rowden **Checked By:** C Pedersen

Particle Size Distribution Report ASTM C-117,C136



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0.0	0.0	3.6	23.2	28.9	19.5	11.2	8.1	3.0		2.5		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.4		
1/2"	92.8		
3/8"	89.4		
#4	73.2		
#8	50.0		
#16	28.5		
#30	16.3		
#50	7.0		
#100	3.3		
#200	2.2		

* (no specification provided)

Material Description

Grab Sample, S-2
Sampled at 9'

Atterberg Limits

PL= LL= PI=

Classification

USCS= SW AASHTO=

Remarks

Report: #001

Sampled by: Client

Source of Sample: TP-5
Sample Number: 21-723

Date: 06-14-21

Construction Testing Laboratories
400 Valley Ave. NE, Suite #102
Puyallup WA, 98372 Tel. (253) 383-8778

Client: South Sound Geotechnical
Project: Carpenter Road (Jo #21047)

Project No: 9213 **Figure**

Tested By: R Rowden **Checked By:** C Pedersen

Northwest Agricultural Consultants

2545 W Falls Avenue
Kennewick, WA 99336
509.783.7450
www.nwag.com
lab@nwag.com

PAP-Accredited
NAPT

South Sound Geotechnical Consulting
PO Box 39500
Lakewood, WA 98496

Report: 55440-1-1
Date: June 17, 2021
Project No: 21047
Project Name: Carpenter Road

Sample ID	Organic Matter	Cation Exchange Capacity
TP-4, S-1	3.72%	9.1 meq/100g
Method	**ASTM D2974**	**EPA 9081**

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D]Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥ 15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L]If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

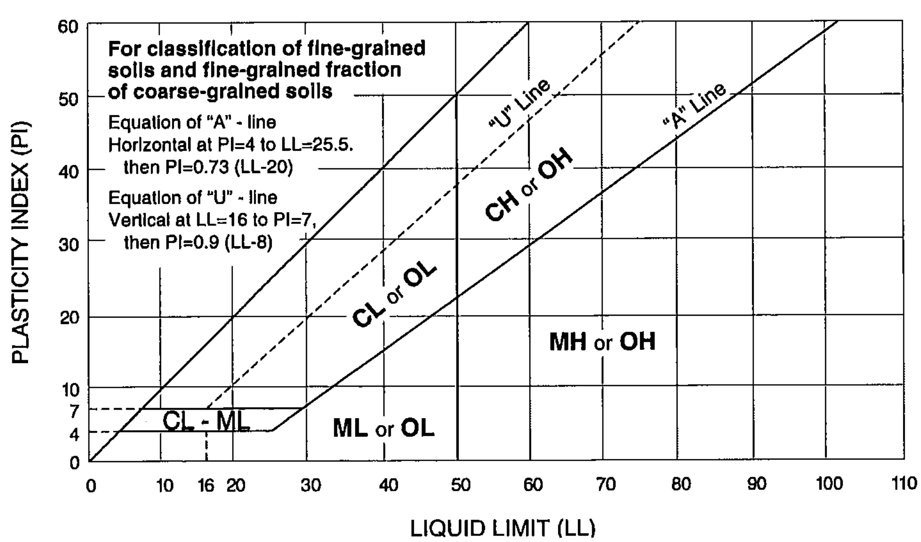
[M]If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

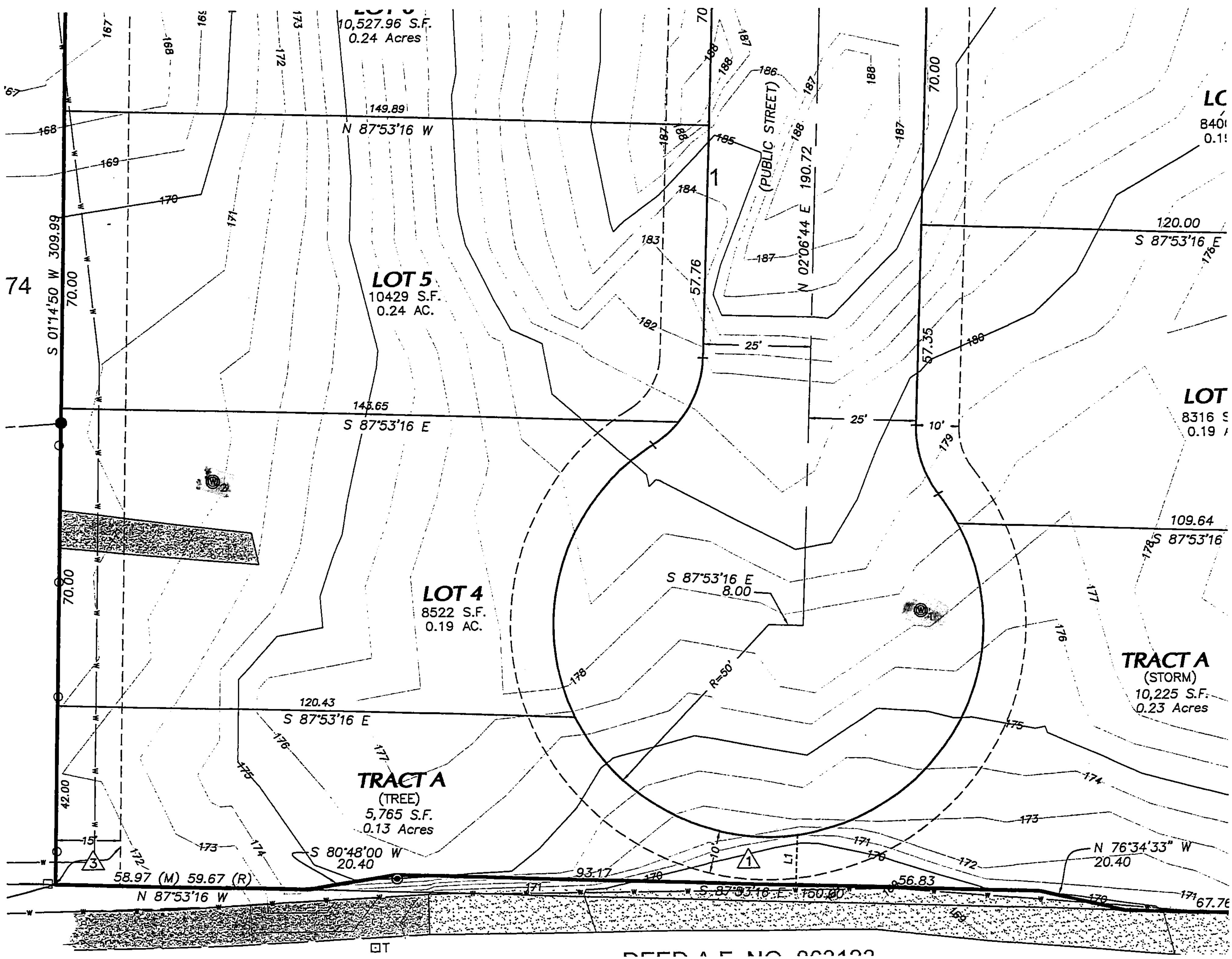
[N]PI ≥ 4 and plots on or above "A" line.

[O]PI < 4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.





LOT 5
10429 S.F.
0.24 AC.
LOT 4
8522 S.F.
0.19 AC.
TRACT A
(TREE)
5,765 S.F.
0.13 Acres
TRACT A
(STORM)
10,225 S.F.
0.23 Acres
10,527.96 S.F.
0.24 Acres
LOT
8316
0.19
(PUBLIC STREET)
N 02°06'44 E 190.72
S 01°14'50 W 309.99
74
70.00
42.00
149.89
N 87°53'16 W
143.65
S 87°53'16 E
120.43
S 87°53'16 E
120.00
S 87°53'16 E
109.64
S 87°53'16
57.76
57.35
25'
10'
15'
R=50'
S 87°53'16 E
8.00
S 80°48'00 W
20.40
58.97 (M) 59.67 (R)
N 87°53'16 W
93.17
S 87°53'16 E 160.00
56.83
N 76°34'33" W
20.40
67.76
L1

PIZO 1 Top of Casing Elev 177.37

Date/time	Water head[ft]	Water below TOC [ft]	Static Elevation
11/30/2021 17:30	13.80	21.20	156.17
12/1/2021 17:30	13.82	21.18	156.19
12/2/2021 17:30	13.81	21.19	156.18
12/3/2021 17:30	13.83	21.17	156.20
12/4/2021 17:30	13.83	21.17	156.20
12/5/2021 17:30	13.87	21.13	156.24
12/6/2021 17:30	13.91	21.09	156.28
12/7/2021 17:30	13.93	21.08	156.30
12/8/2021 17:30	13.89	21.11	156.26
12/9/2021 17:30	13.90	21.10	156.27
12/10/2021 17:30	13.93	21.07	156.30
12/11/2021 17:30	14.10	20.90	156.47
12/12/2021 17:30	14.17	20.83	156.54
12/13/2021 17:30	14.24	20.76	156.61
12/14/2021 17:30	14.25	20.75	156.62
12/15/2021 17:30	14.26	20.74	156.63
12/16/2021 17:30	14.28	20.72	156.65
12/17/2021 17:30	14.30	20.70	156.67
12/18/2021 17:30	14.36	20.64	156.73
12/19/2021 17:30	14.40	20.60	156.77
12/20/2021 17:30	14.45	20.55	156.82
12/21/2021 17:30	14.44	20.56	156.81
12/22/2021 17:30	14.54	20.46	156.91
12/24/2021 17:30	14.67	20.33	157.04
12/25/2021 17:30	14.73	20.27	157.10
12/26/2021 17:30	14.76	20.24	157.13
12/27/2021 17:30	14.80	20.20	157.17
12/28/2021 17:30	14.80	20.20	157.17
12/29/2021 17:30	14.80	20.20	157.17
12/30/2021 17:30	14.83	20.17	157.20
12/31/2021 17:30	14.80	20.20	157.17
1/1/2022 17:30	14.83	20.17	157.20
1/2/2022 17:30	14.83	20.17	157.20
1/3/2022 17:30	15.03	19.97	157.40
1/4/2022 17:30	15.10	19.90	157.47
1/5/2022 17:30	15.14	19.86	157.51
1/6/2022 17:30	15.54	19.46	157.91
1/7/2022 17:30	15.94	19.06	158.31
1/8/2022 17:30	15.94	19.06	158.31
1/9/2022 17:30	15.93	19.07	158.30
1/10/2022 17:30	15.98	19.02	158.35
1/11/2022 17:30	15.99	19.01	158.36
1/12/2022 17:30	16.09	18.91	158.46
1/13/2022 17:30	16.14	18.86	158.51
1/14/2022 17:30	16.15	18.85	158.52

1/15/2022 17:30	16.14	18.86	158.51
1/16/2022 17:30	16.14	18.86	158.51
1/17/2022 17:30	16.15	18.85	158.52
1/18/2022 17:30	16.10	18.90	158.47
1/19/2022 17:30	16.09	18.91	158.46
1/20/2022 17:30	16.09	18.91	158.46
1/21/2022 17:30	16.01	18.99	158.38
1/22/2022 17:30	16.03	18.97	158.40
1/23/2022 17:30	16.02	18.98	158.39
1/24/2022 17:30	15.98	19.02	158.35
1/25/2022 17:30	15.95	19.05	158.32
1/26/2022 17:30	15.91	19.09	158.28
1/27/2022 17:30	15.87	19.13	158.24
1/28/2022 17:30	15.84	19.16	158.21
1/29/2022 17:30	15.83	19.17	158.20
1/30/2022 17:30	15.80	19.20	158.17
1/31/2022 17:30	15.79	19.21	158.16
2/1/2022 17:30	15.75	19.25	158.12
2/2/2022 17:30	15.71	19.29	158.08
2/3/2022 17:30	15.68	19.32	158.05
2/4/2022 17:30	15.64	19.36	158.01
2/5/2022 17:30	15.58	19.42	157.95
2/6/2022 17:30	15.55	19.45	157.92
2/7/2022 17:30	15.52	19.48	157.89
2/8/2022 17:30	15.50	19.50	157.87
2/9/2022 17:30	15.48	19.52	157.85
2/10/2022 17:30	15.46	19.54	157.83
2/11/2022 17:30	15.46	19.54	157.83
2/12/2022 17:30	15.41	19.59	157.78
2/13/2022 17:30	15.41	19.59	157.78
2/14/2022 17:30	15.36	19.64	157.73
2/15/2022 17:30	15.34	19.66	157.71
2/16/2022 17:30	15.34	19.66	157.71
2/17/2022 17:30	15.32	19.68	157.69
2/18/2022 17:30	15.29	19.71	157.66
2/19/2022 17:30	15.30	19.70	157.67
2/20/2022 17:30	15.27	19.73	157.64
2/21/2022 17:30	15.28	19.72	157.65
2/22/2022 17:30	15.22	19.78	157.59
2/23/2022 17:30	15.20	19.80	157.57
2/24/2022 17:30	15.19	19.81	157.56
2/25/2022 17:30	15.15	19.85	157.52
2/26/2022 17:30	15.16	19.84	157.53
2/27/2022 17:30	15.20	19.80	157.57
2/28/2022 17:30	15.58	19.42	157.95
3/1/2022 17:30	15.78	19.22	158.15
3/2/2022 17:30	15.74	19.26	158.11

3/3/2022 17:30	15.76	19.24	158.13
3/4/2022 17:30	15.71	19.29	158.08
3/5/2022 17:30	15.70	19.30	158.07
3/6/2022 17:30	15.65	19.35	158.02
3/7/2022 17:30	15.66	19.34	158.03
3/8/2022 17:30	15.67	19.33	158.04
3/9/2022 17:30	15.62	19.38	157.99
3/10/2022 17:30	15.55	19.45	157.92
3/11/2022 17:30	15.61	19.39	157.98
3/12/2022 17:30	15.58	19.42	157.95
3/13/2022 17:30	15.52	19.48	157.89
3/14/2022 17:30	15.52	19.48	157.89
3/15/2022 17:30	15.60	19.40	157.97
3/16/2022 17:30	15.58	19.42	157.95
3/17/2022 17:30	15.52	19.48	157.89
3/18/2022 17:30	15.57	19.43	157.94
3/19/2022 17:30	15.55	19.45	157.92
3/20/2022 17:30	15.50	19.50	157.87
3/21/2022 17:30	15.50	19.50	157.87
3/22/2022 17:30	15.48	19.52	157.85
3/23/2022 17:30	15.49	19.51	157.86
3/24/2022 17:30	15.49	19.51	157.86
3/25/2022 17:30	15.48	19.52	157.85
3/26/2022 17:30	15.42	19.59	157.79
3/27/2022 17:30	15.41	19.59	157.78
3/28/2022 17:30	15.35	19.65	157.72
3/29/2022 17:30	15.35	19.65	157.72
3/30/2022 17:30	15.35	19.65	157.72
3/31/2022 17:30	15.32	19.68	157.69

PIZO 2 Top of Casing Elev 171.77

Water head[ft]	Water below TOC [ft]	Static Elevation
10.58	14.42	157.35
10.60	14.40	157.37
10.59	14.41	157.36
10.61	14.39	157.38
10.61	14.39	157.38
10.62	14.38	157.39
10.68	14.32	157.45
10.70	14.30	157.47
10.67	14.33	157.44
10.68	14.32	157.45
10.71	14.29	157.48
10.88	14.12	157.65
10.95	14.05	157.72
11.03	13.97	157.80
11.02	13.98	157.79
11.05	13.95	157.82
11.06	13.94	157.83
11.08	13.92	157.85
11.14	13.86	157.91
11.18	13.82	157.95
11.23	13.77	158.00
11.22	13.78	157.99
11.32	13.68	158.09
11.46	13.54	158.23
11.52	13.48	158.29
11.53	13.47	158.30
11.58	13.42	158.35
11.58	13.42	158.35
11.59	13.41	158.36
11.61	13.39	158.38
11.58	13.42	158.35
11.59	13.41	158.36
11.61	13.39	158.38
11.81	13.19	158.58
11.88	13.12	158.65
11.93	13.07	158.70
12.32	12.68	159.09
12.71	12.29	159.48
12.72	12.28	159.49
12.71	12.29	159.48
12.76	12.24	159.53
12.77	12.23	159.54
12.87	12.13	159.64
12.92	12.08	159.69
12.93	12.07	159.70

12.94	12.06	159.71
12.92	12.08	159.69
12.93	12.07	159.70
12.88	12.12	159.65
12.87	12.13	159.64
12.87	12.13	159.64
12.79	12.21	159.56
12.82	12.18	159.59
12.80	12.20	159.57
12.74	12.26	159.51
12.73	12.27	159.50
12.69	12.31	159.46
12.66	12.34	159.43
12.62	12.38	159.39
12.61	12.39	159.38
12.58	12.42	159.35
12.57	12.43	159.34
12.53	12.47	159.30
12.50	12.50	159.27
12.46	12.54	159.23
12.42	12.58	159.19
12.36	12.64	159.13
12.33	12.67	159.10
12.30	12.70	159.07
12.28	12.72	159.05
12.26	12.74	159.03
12.25	12.75	159.02
12.24	12.76	159.01
12.19	12.81	158.96
12.19	12.81	158.96
12.14	12.86	158.91
12.12	12.88	158.89
12.12	12.88	158.89
12.12	12.88	158.89
12.07	12.93	158.84
12.07	12.93	158.84
12.05	12.95	158.82
12.06	12.94	158.83
12.00	13.00	158.77
11.98	13.02	158.75
11.97	13.03	158.74
11.94	13.06	158.71
11.94	13.06	158.71
11.98	13.02	158.75
12.36	12.64	159.13
12.56	12.44	159.33
12.52	12.48	159.29

12.54	12.46	159.31
12.49	12.51	159.26
12.48	12.52	159.25
12.43	12.57	159.20
12.43	12.57	159.20
12.45	12.55	159.22
12.40	12.60	159.17
12.33	12.67	159.10
12.39	12.61	159.16
12.36	12.64	159.13
12.30	12.70	159.07
12.31	12.69	159.08
12.38	12.62	159.15
12.36	12.64	159.13
12.31	12.69	159.08
12.35	12.65	159.12
12.33	12.67	159.10
12.28	12.72	159.05
12.28	12.72	159.05
12.27	12.73	159.04
12.27	12.73	159.04
12.27	12.73	159.04
12.26	12.74	159.03
12.20	12.81	158.97
12.19	12.81	158.96
12.13	12.87	158.90
12.12	12.88	158.89
12.13	12.87	158.90
12.10	12.90	158.87