CARPENTER
ENGINEERING, INC.
4114 NW 122ND STREET
VANCOUVER WA 98685
360-574-6088
www.carpentering.net

VALENTINAS VILLAS

Preliminary Stormwater Design Report

PREPARED FOR:

Jonathan Christopher
PO Box 1690
Brush Prairie, WA 98606
joniecrete@aol.com
360-910-2507

To the best of my knowledge and understanding, all information required by the City of Kelso Stormwater Ordinance is included in this report. Also, the proposed stormwater facilities are feasible as submitted.

11/15/2024

REVISION	BY	DATE	COMMENTS

TABLE OF CONTENTS

SECTION A -	**PROJECT OVERVIEW**	**1**
SECTION B -	**EXISTING CONDITIONS and SOILS**	**1-2**
SECTION C -	**MINIMUM REQUIREMENTS**	**2-6**
SECTION D -	**ONSITE STORMWATER MANAGEMENT SELECTION AND SIZING (MR 5)**	**6**
SECTION E -	**RUNOFF TREATMENT ANALYSIS and DESIGN**	**6-8**
SECTION F -	**FLOW CONTROL ANALYSIS and DESIGN**	**8-9**
SECTION G -	**CONVEYANCE SYSTEM ANALYSIS and DESIGN**	**9**
SECTION H -	**SOURCE CONTROL**	**9**
SECTION I -	**ONGOING OPERATIONS and MAINTENANCE**	**10**
SECTION J -	**GROUNDWATER MONITORING PROGRAM**	**10**
SECTION K -	**APPENDICES**	**10**

MAPS

- **Vicinity Map**
- **Soils Map**
- **Environmental Constraints Map**
- **Aerial Photo Map**

TECHNICAL APPENDIX:

I Existing Condition Basin Plan
II Stormwater Basin Plan
III WWHM Calculations
IV Geotechnical Soils Report
V Operation and Maintenance

SECTION A - PROJECT OVERVIEW

The existing 2.70-acre parcel is currently vacant. The site is located at the southeast corner of Corduroy Road and Harris Street. Access to the site is from Corduroy Road thru a shared driveway with the southerly neighboring Assisted Living Facility. The property is zoned RMF – Residential Multi-Family. The proposal is to develop the site into an apartment project consisting of two three story buildings with 50 total apartment units.
The subject parcel is located within an urban area of the City of Kelso, developed with single family residences on large lots and apartment complexes. An assisted living facility and church are located south of the subject parcel. Except for small areas in the north and east associated with an unnamed stream and wetland, the entirety of the subject parcel is impacted by historic grading and fill. The site topography is generally flat with the exception of the stream channel that flanks the flat graded area to the north and east. The central graded area of the parcel has limited vegetation with a few scattered clusters of tree saplings, with Himalayan blackberry dominating the perimeter. Himalayan blackberry generally dominates the narrow vegetated berm west of the stream channel, and reed canary grass dominates the wetland in the north. The onsite critical areas are degraded and will benefit from the proposed mitigation planting.

The proposal will include construction of the two 3-story apartment buildings with new paved access and parking. New sidewalks, utility extensions and stormwater facilities will be constructed. Stormwater impacts from the newly created impervious surfaces will be mitigated with the construction of a combination of bioretention treatment ponds, underground detention pipes, swales and dispersion trenches.

The applicants for the development are seeking Site Plan approval the City of Kelso and SEPA permit approval.

SECTION B – EXISTING CONDITIONS AND SOILS

The subject parcel is located within an urban area of the City of Kelso developed with single family residences on large lots and apartment complexes. An assisted living facility and church are located south of the subject parcel. Except for small areas in the north and east associated with an unnamed stream and wetland, the entirety of the subject parcel is impacted by historic grading and fill.

The property is relatively level (0-5% slope) with a gentle to moderate downward slope along both the north and west sides along the existing roadways. The east side of the site gently slopes downward to an existing creek that runs north to south and remains wet year-round. The total elevation change across the property is about 5-7 feet. The ground surface at the time of our investigation consisted of a soil/gravel turnaround area at the south side and gravel across the

remainder of the property. Mature deciduous and evergreen trees were located at the west and east sides, with juvenile deciduous and understory shrubs scattered across the remainder of the site. A 250' wide BPA easement is also located at the north/northeast corner of the property and runs northwest to southeast. Himalayan blackberry generally dominates the narrow vegetated berm west of the stream channel, and reed canary grass dominates the wetland in the north.
Soils within the subject parcel are mapped by the Natural Resource Conservation Service (NRCS) Soil Survey of Cowlitz County (2006) as (65) Godfrey silt loam, 0 to 3 percent slopes, (95) Kalama gravelly loam, 15-30 percent slopes, and (103) Kelso silt loam, 30 to 50 percent slopes (Figure 2).

A geotechnical site investigation was performed by Soil and Water Technologies, Inc. (SWT) The report dated October 2023, is attached in Appendix IV. Additionally, SWT performed water table monitoring thru an onsite single piezometer between the months of February to June of 2024.

Investigations indicate that the site is suitable for the proposed construction subject to following the geotechnical construction recommendations. Water table fluctuations indicate varying depths to water table to as shallow as 2'-7" below ground surface. Infiltration testing was performed with infiltration rates identified at approximately 2 inches per hour (2 in/hr) at depths between 1 and 3 feet below ground surfaces.

SECTION C – MINIMUM REQUIREMENTS

The method for Stormwater Management has been selected utilizing the LID Performance Standards outlined in the 2024 SMMWW. The proposal creates over 5,000 square feet of new impervious surface triggering the requirements to address MR #1-9. Below is a summary of the proposed surface types.

Total site Area -	2.70 Acres (per survey)
Total New Hard Surface Area	
• Paving -	32,512 sf = 0.74 Acres
• Roofs -	21,124 sf = 0.48 Acres
• Landscape -	64,402 sf = 1.47 Acres
TOTAL	117,612 sf (2.70 acres)
Replaced Hard Surfaces -	0 sf
Total new & replaced hard surfaces -	53,636 sf (1.23 Acres)
Native vegetation converted to pasture -	0 SF
Vegetation converted to landscaping –	64,402 SF
Total area of land disturbing activity -	53,143 SF (1.22 ACRES)

Minimum Requirements #1 through #9 apply to this project.

Minimum Requirement #1 – Preparation of a Stormwater Site Plan
A preliminary Stormwater Plan has been prepared and is attached in Appendix II. Additional erosion control plans will be submitted with final engineering.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention
A Stormwater Pollution Prevention Plan (SWPPP) will be prepared with the final engineering.

Minimum Requirement #3 – Source Control
The SWPPP and the Erosion Control Plans to be supplied with final engineering will provide short term protection of the site and downstream areas during construction. There are no long-term pollution risks associated with this project that would require source control measures.

Minimum Requirement #4 – Preserve Natural Drainage Systems & Outfalls
The proposed improvements associated with this parcel will preserve the existing conveyance. Existing drainage patterns at the site consist of overland sheet flow into the un-named stream channel and road frontage ditch. New facilities are designed to collect, treat, and detain surface runoff prior to discharge to existing drainage features.

Minimum Requirement #5 – On-Site Stormwater management BMP's
The method for Stormwater Management has been selected utilizing the LID Performance Standards outlined in the 2024 SMMWW. The Pollution Generating Impervious Parking Lot Surfaces (PGIS) will be treated thru bioretention cells and swales per BMP's T7.30, T9.10 and T5.10B. The treatment cells also provide a measure of stormwater attenuation as required per MR #7.

The non-PGIS roof surfaces will be discharged to downspout dispersion trenches per BMP T5.10.

Disturbed landscape areas will be landscaped and soils enhanced per MBP T5.13 – Post-Construction Soil Quality and Depth

Minimum Requirement #6 – Runoff Treatment Analysis and Design
The on-site Pollution Generating roadway surface runoff will be treated by passing thru Bioretention Cells and Swales per BMP's T7.30 and T9.10.

There are three separate Bioretention Cells proposed and one Bioretention Swale. Bioretention cells 1, 2 and 3 are located at the north and south ends of Building B and at the south end of Building A. Bioretention Swale #4 is located along the north and west sides of Building A.
Stormwater from the parking areas will flow to low points in the curb and pass under sidewalks into the cells and swale. The bioretention cells have been designed to treat no less than 91% of the water quality flow. Treatment in the

cells is provided thru infiltration thru an 18" depth of Bioretention Soil Mix (BSM). The Bioretention swale treatment is provided thru a minimum travel time of 9 minutes thru the vegetated swale. The following table provides BMP numbering and design data.

Water Quality BMP Design Data Table						
BMP #	Description	Length (ft)	Width (ft)	Bottom Area (sf)	Treatment Media	Water Quality % Filtered
1	Bioretention Cell	47	50	2350	BSM	100
2	Bioretention Cell	60	33	1980	BSM	100
3	Bioretention Swale	140	15	2100	grass swale	> 9min
4	Bioretention Cell	43	43	1866	BSM	99.76

See the attached stormwater basin plan for location and details of proposed treatment facilities. See the WWHM12 calculations and facility cut sheets provided in Appendix III.
See Section E below for details of proposed treatment facilities and cut sheets of design features taken from the WWHM12 Continuous Flow Modeling.

Minimum Requirement #7 – Flow Control
Thresholds:

The following require construction of flow control facilities and/or land use management BMPs that will achieve the standard requirement for western Washington:

- *Projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area, or*

- *Projects that convert ¾ acres or more of native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site, or*

- *Projects that through a combination of effective hard surfaces and converted vegetation areas cause a 0.10 cubic feet per second increase in the 100-year flow frequency from a threshold discharge area as estimated using an approved continuous flow model and one-hour time steps (or a 0.15 cfs increase using 15-minute time steps). The 0.10 cfs (one-hour time steps) or 0.15 cfs (15-minute time steps) increase shall be a comparison of the post-project runoff to the existing condition runoff. For the purpose of applying this threshold, the existing condition is the preproject land cover.*

That portion of any development project in which the above thresholds are not exceeded in a threshold discharge area shall apply Onsite Stormwater Management BMPs in accordance with Minimum Requirement #5.

The onsite portion of this project will create more than 10,000 square feet of effective impervious surfaces and is therefore subject to flow control.
Roof dispersion trenches serving the rear side of the proposed buildings and the underground detention pipe system for the front of the buildings provide onsite flow control to the development.

The proposed detention pipe chambers consist of a buried pipe bed 9.5' wide by 130' in length with gravel fill and a control outlet manhole. The outlet structure and control manhole is designed to attenuate release rates thru design orifice and overflow structures.
The four bioretention cells that provide water quality treatment also provide a measure of flow control due to the overflow riser mechanism and elevation.

There are three criteria by which flow duration values are compared for the Flow Control Standard:

1. If the post-development flow duration values exceed any of the pre-development flow levels between 50% and 100% of the 2-year pre-development peak flow values (100 Percent Threshold) then the Flow Control Standard has not been met.

2. If the post-development flow duration values exceed any of the pre-development flow levels between 100% of the 2-year and 100% of the 50-year pre-development peak flow values more than 10 percent of the time (110 Percent Threshold) then the Flow Control Standard has not been met.

3. If more than 50% of the flow duration levels exceed the 100% threshold then the Flow Control Standard has not been met.

This project will detain surface water runoff to meet the post-development flow durations in conformance with the LID Performance Standards. See the attached WWHM12 model report attached in the Appendix III.
Also see Section F below for pre-vs post developed flow comparisons derived from the WWHM12 model.

Minimum Requirement #8 – Wetland Protection
There are identified wetlands on the north end of the site on the opposite side of the stream. No wetlands are located upon or within the construction area of this project.
Stormwater treatment BMP's will protect ground water.

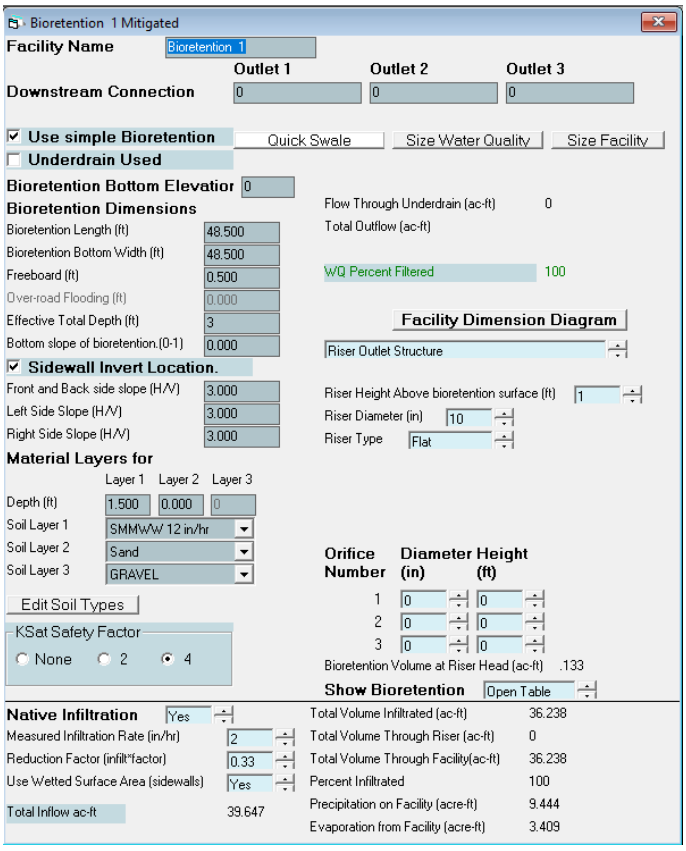
Minimum Requirement #9 – Operations and Maintenance (O&M)
Stormwater management facilities on-site will be privately owned and maintained. O&M Maintenance Standards Per Volume V of the 2024 SMMWW for onsite water quality and quantity BMP's are attached in Appendix V.

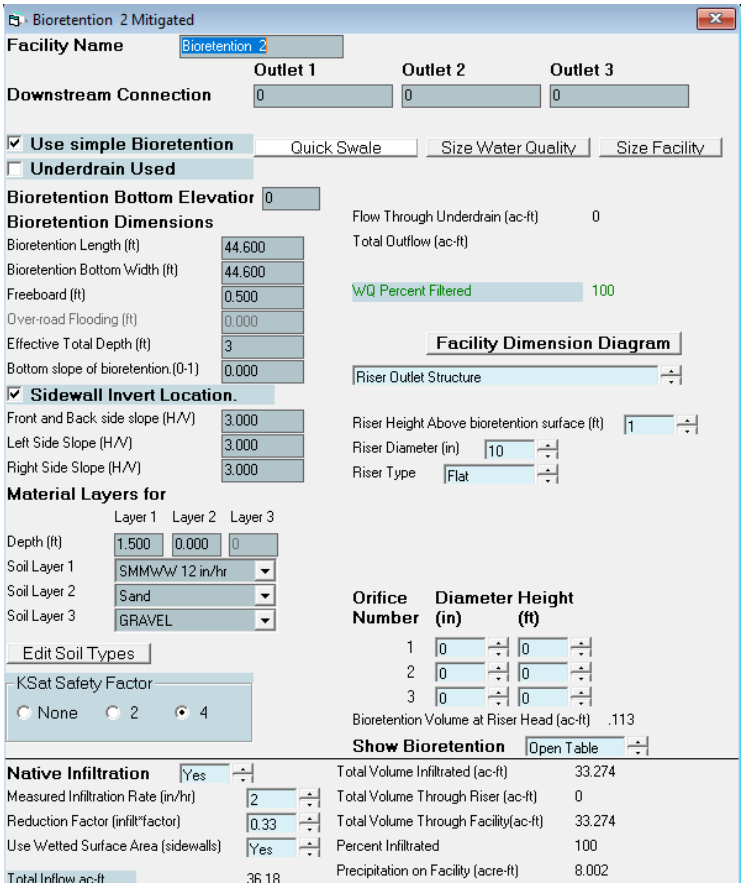
SECTION D - ONSITE STORMWATER MANAGEMENT SELECTION AND SIZING (MR 5)

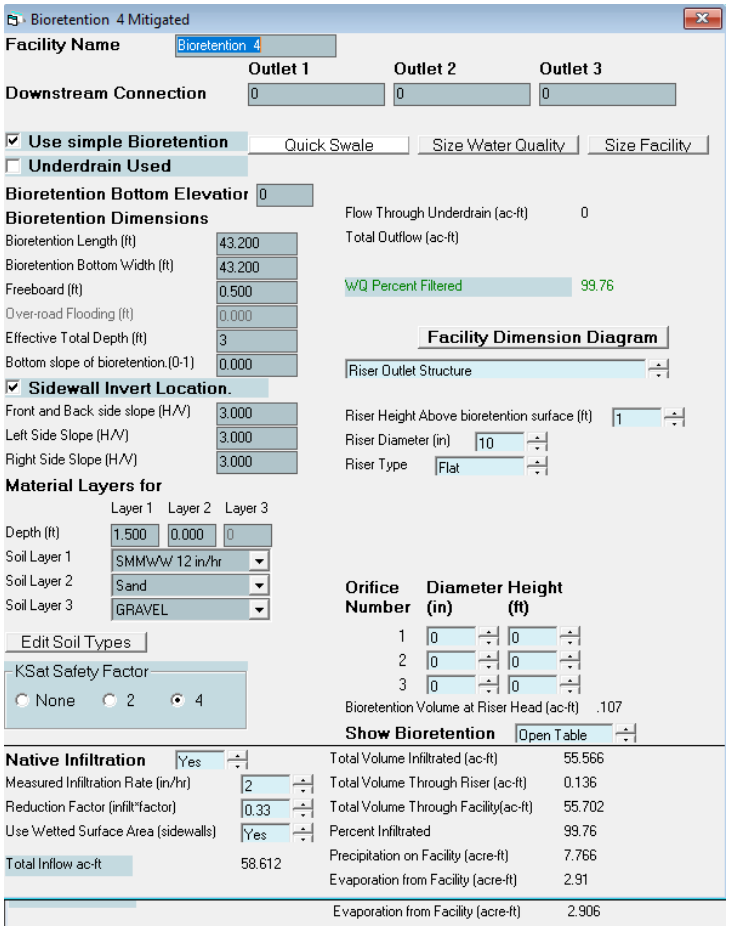
The onsite stormwater management BMP's selected for this project include Bioretention Cells, Swales and underground detention. These BMP's follow the design guidelines of BMP's T5.10B and T9.10, BMP T7.30. Due to the flat nature of the existing site contours and relatively shallow water table these BMP's provide treatment, attenuation and dispersion of stormwater without the need for deep cuts or excessive underground piping.

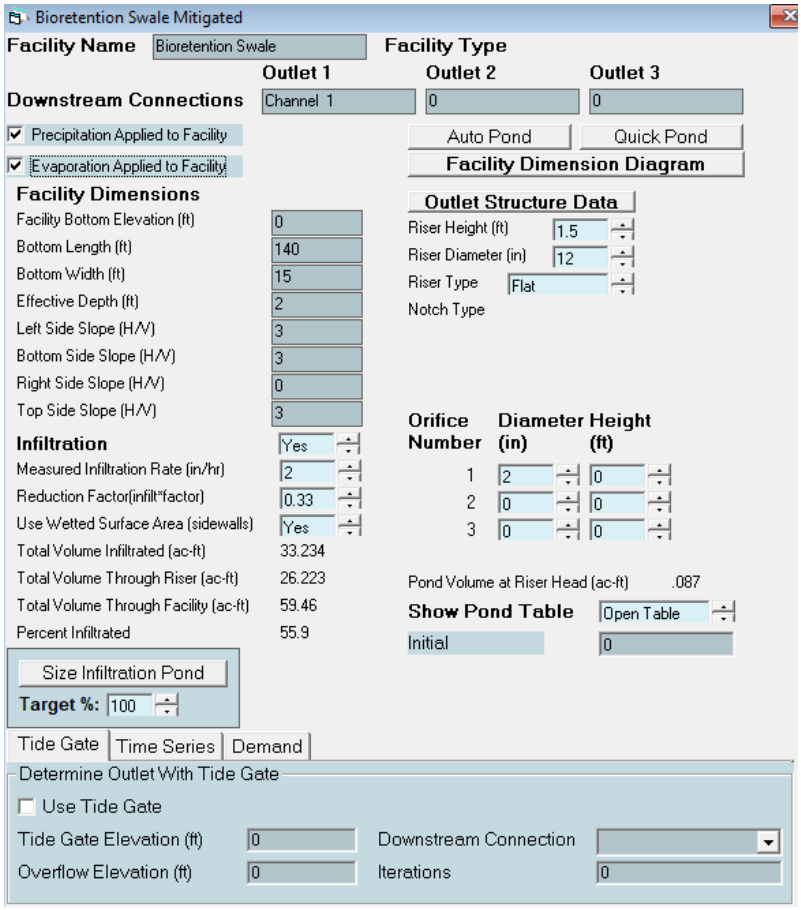
SECTION E - RUNOFF TREATMENT ANALYSIS and DESIGN

See Minimum Requirement # 6 above for a description of the runoff treatment design. The cut sheets below are from the WWHM12 hydrology model and provide details of each BMP facility used in the treatment of surface waters.



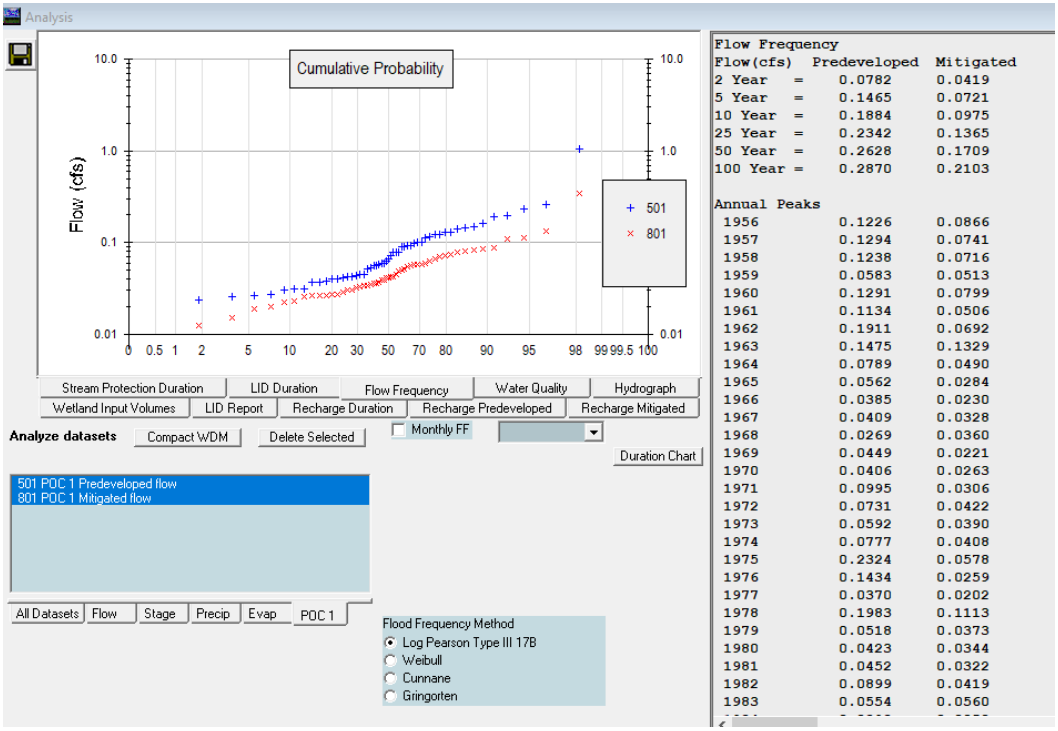

Bioretention 2 Mitigated
Facility Name
Bioretention 2
Outlet 1
Outlet 2
Outlet 3
Downstream Connection
0
0
0
Use simple Bioretention
Quick Swale
Size Water Quality
Size Facility
Underdrain Used
Bioretention Bottom Elevatior
0
Bioretention Dimensions
Bioretention Length (ft)
44.600
Bioretention Bottom Width (ft)
44.600
Freeboard (ft)
0.500
Over-road Flooding (ft)
0.000
Effective Total Depth (ft)
3
Bottom slope of bioretention.(0-1)
0.000
Sidewall Invert Location.
Front and Back side slope (H/V)
3.000
Left Side Slope (H/V)
3.000
Right Side Slope (H/V)
3.000
Material Layers for
Layer 1
Layer 2
Layer 3
Depth (ft)
1.500
0.000
0
Soil Layer 1
SMMWW 12 in/hr
Soil Layer 2
Sand
Soil Layer 3
GRAVEL
Edit Soil Types
KSat Safety Factor
None
2
4
Flow Through Underdrain (ac-ft)
0
Total Outflow (ac-ft)
WQ Percent Filtered
100
Facility Dimension Diagram
Riser Outlet Structure
Riser Height Above bioretention surface (ft)
1
Riser Diameter (in)
10
Riser Type
Flat
Orifice Number
Diameter (in)
Height (ft)
1
0
0
2
0
0
3
0
0
Bioretention Volume at Riser Head (ac-ft)
.113
Show Bioretention
Open Table
Native Infiltration
Yes
Measured Infiltration Rate (in/hr)
2
Reduction Factor (infilt*factor)
0.33
Use Wetted Surface Area (sidewalls)
Yes
Total Inflow ac-ft
36.18
Total Volume Infiltrated (ac-ft)
33.274
Total Volume Through Riser (ac-ft)
0
Total Volume Through Facility(ac-ft)
33.274
Percent Infiltrated
100
Precipitation on Facility (acre-ft)
8.002


Bioretention 4 Mitigated
Facility Name
Bioretention 4
Outlet 1
Outlet 2
Outlet 3
Downstream Connection
0
0
0
Use simple Bioretention
Quick Swale
Size Water Quality
Size Facility
Underdrain Used
Bioretention Bottom Elevatior
0
Bioretention Dimensions
Bioretention Length (ft)
43.200
Bioretention Bottom Width (ft)
43.200
Freeboard (ft)
0.500
Over-road Flooding (ft)
0.000
Effective Total Depth (ft)
3
Bottom slope of bioretention.(0-1)
0.000
Sidewall Invert Location.
Front and Back side slope (H/V)
3.000
Left Side Slope (H/V)
3.000
Right Side Slope (H/V)
3.000
Material Layers for
Layer 1
Layer 2
Layer 3
Depth (ft)
1.500
0.000
0
Soil Layer 1
SMMWW 12 in/hr
Soil Layer 2
Sand
Soil Layer 3
GRAVEL
Edit Soil Types
KSat Safety Factor
None
2
4
Flow Through Underdrain (ac-ft)
0
Total Outflow (ac-ft)
WQ Percent Filtered
99.76
Facility Dimension Diagram
Riser Outlet Structure
Riser Height Above bioretention surface (ft)
1
Riser Diameter (in)
10
Riser Type
Flat
Orifice Number
Diameter (in)
Height (ft)
1
0
0
2
0
0
3
0
0
Bioretention Volume at Riser Head (ac-ft)
.107
Show Bioretention
Open Table
Native Infiltration
Yes
Measured Infiltration Rate (in/hr)
2
Reduction Factor (infilt*factor)
0.33
Use Wetted Surface Area (sidewalls)
Yes
Total Inflow ac-ft
58.612
Total Volume Infiltrated (ac-ft)
55.566
Total Volume Through Riser (ac-ft)
0.136
Total Volume Through Facility(ac-ft)
55.702
Percent Infiltrated
99.76
Precipitation on Facility (acre-ft)
7.766
Evaporation from Facility (acre-ft)
2.91
Evaporation from Facility (acre-ft)
2.906

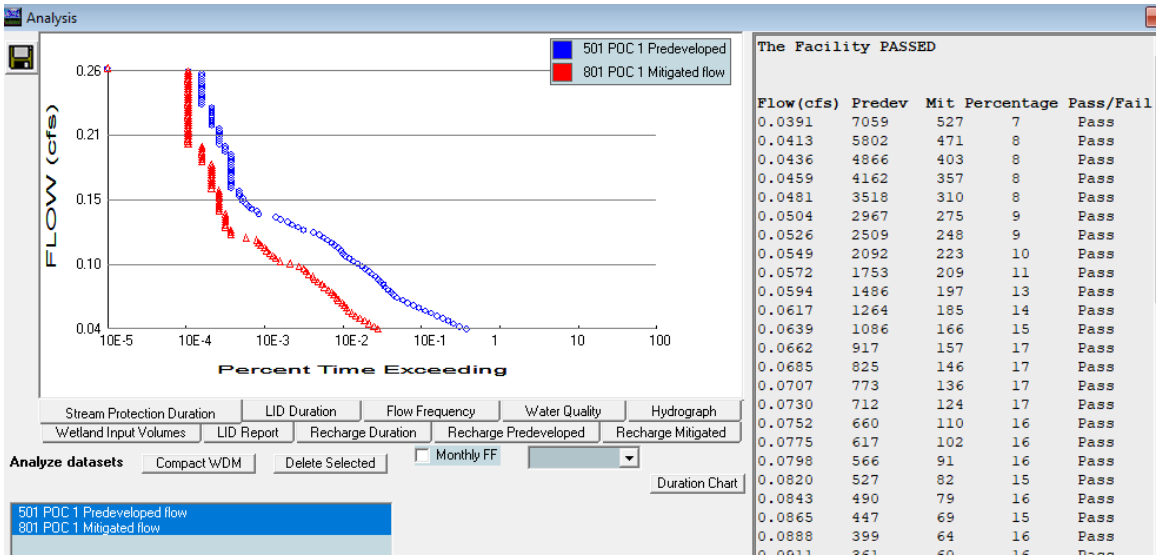


SECTION F - FLOW CONTROL ANALYSIS and DESIGN

See minimum requirement # 7 above for description of flow control design. The below cut sheet from the WWHM12 hydrology model provides graphical and tabulated pre vs post flow frequencies and duration pass charts.

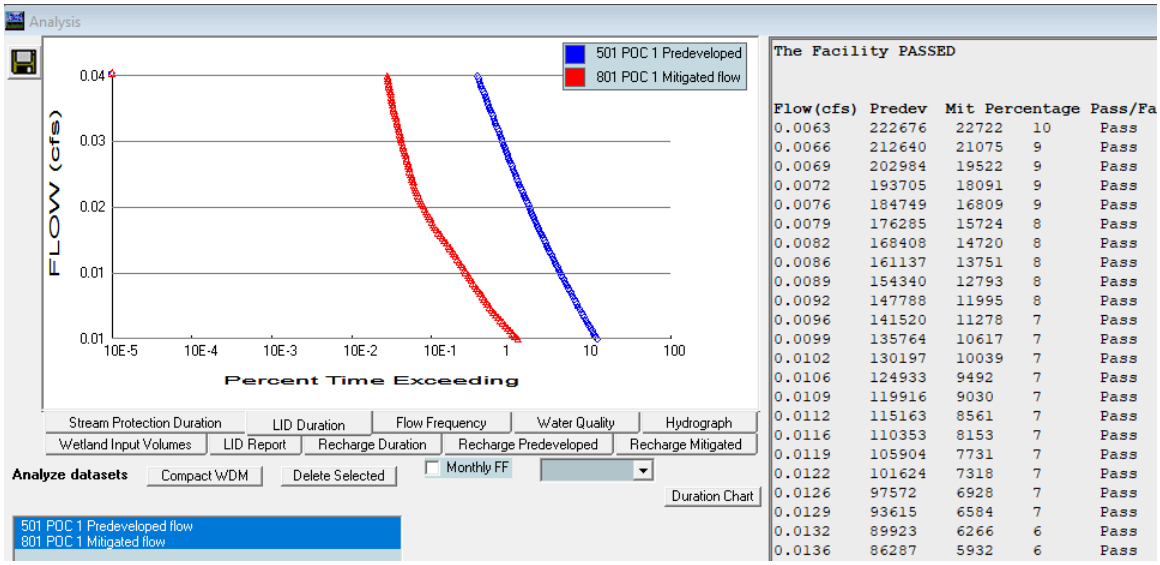


Stream Protection Duration



Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0391	7059	527	7	Pass
0.0413	5802	471	8	Pass
0.0436	4866	403	8	Pass
0.0459	4162	357	8	Pass
0.0481	3518	310	8	Pass
0.0504	2967	275	9	Pass
0.0526	2509	248	9	Pass
0.0549	2092	223	10	Pass
0.0572	1753	209	11	Pass
0.0594	1486	197	13	Pass
0.0617	1264	185	14	Pass
0.0639	1086	166	15	Pass
0.0662	917	157	17	Pass
0.0685	825	146	17	Pass
0.0707	773	136	17	Pass
0.0730	712	124	17	Pass
0.0752	660	110	16	Pass
0.0775	617	102	16	Pass
0.0798	566	91	16	Pass
0.0820	527	82	15	Pass
0.0843	490	79	16	Pass
0.0865	447	69	15	Pass
0.0888	399	64	16	Pass

LID Duration



Flow(cfs)	Predev	Mit	Percentage	Pass/Fa
0.0063	222676	22722	10	Pass
0.0066	212640	21075	9	Pass
0.0069	202984	19522	9	Pass
0.0072	193705	18091	9	Pass
0.0076	184749	16809	9	Pass
0.0079	176285	15724	8	Pass
0.0082	168408	14720	8	Pass
0.0086	161137	13751	8	Pass
0.0089	154340	12793	8	Pass
0.0092	147788	11995	8	Pass
0.0096	141520	11278	7	Pass
0.0099	135764	10617	7	Pass
0.0102	130197	10039	7	Pass
0.0106	124933	9492	7	Pass
0.0109	119916	9030	7	Pass
0.0112	115163	8561	7	Pass
0.0116	110353	8153	7	Pass
0.0119	105904	7731	7	Pass
0.0122	101624	7318	7	Pass
0.0126	97572	6928	7	Pass
0.0129	93615	6584	7	Pass
0.0132	89923	6266	6	Pass
0.0136	86287	5932	6	Pass

SECTION G - CONVEYANCE SYSTEM ANALYSIS and DESIGN

Stormwater conveyance systems have been designed and sized at a minimum to convey the 10-year storm flow. Most all site water is sheet flow thru curb cuts off the parking areas. Surface waters then enter the treatment cells prior to discharge. Roof downspout pipe have been sized to pass a minimum 10-yr storm event.

SECTION H - SOURCE CONTROL

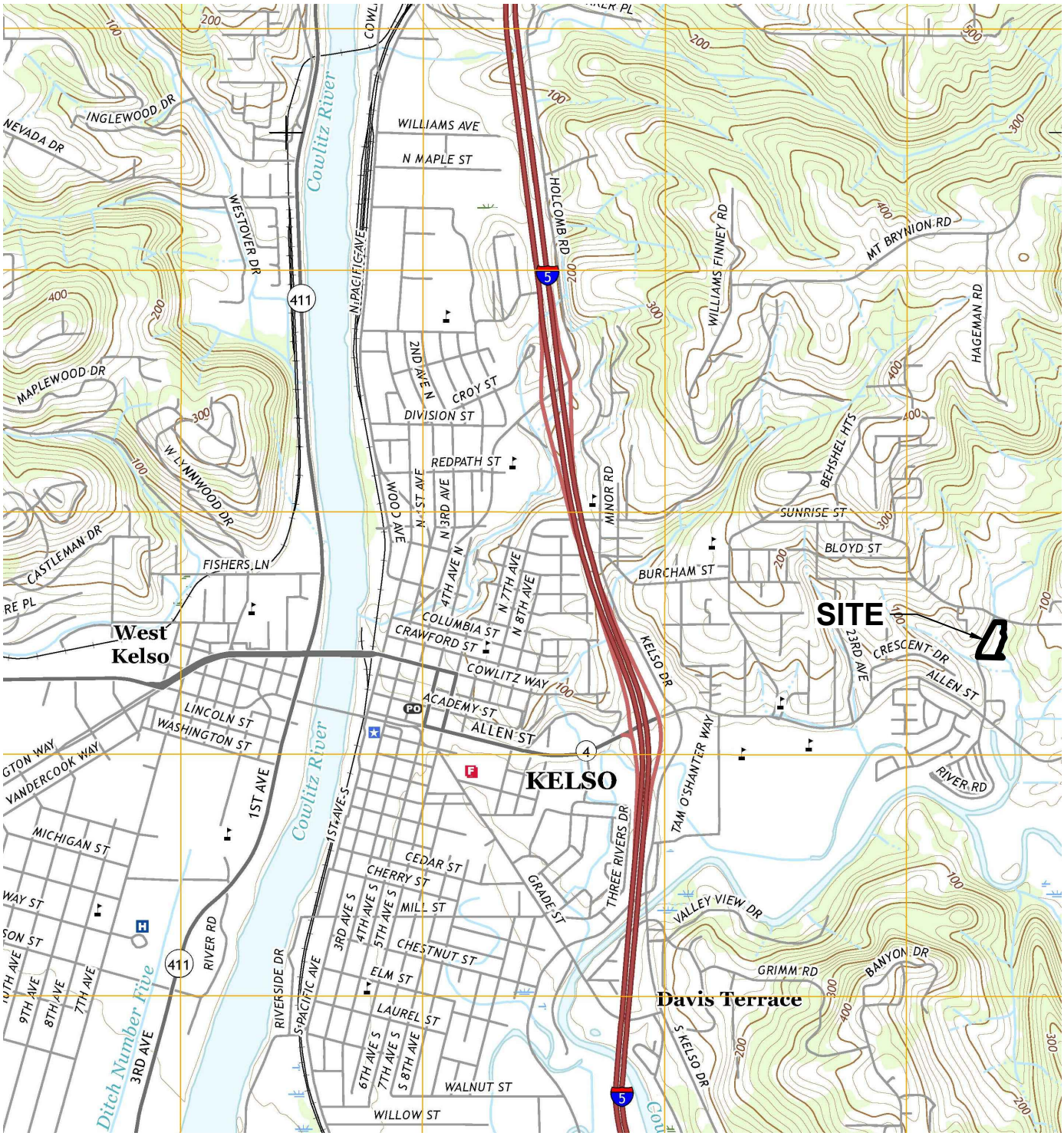
The SWPPP and the Erosion Control Plans to be supplied with final engineering will provide short term protection of the site and downstream areas during construction. There is no long-term pollution risks associated with this project that would require source control measures.

SECTION I - ONGOING OPERATIONS and MAINTENANCE
See Operations and Maintenance Manuals in Appendix V.

SECTION J - GROUNDWATER MONITORING PROGRAM
Water table monitoring thru an onsite single piezometer between the months of February to June of 2024 was conducted.
Investigations indicate that the site is suitable for the proposed construction subject to following the geotechnical construction recommendations. Water table fluctuations indicate varying depths to water table to as shallow as 2'-7" below ground surface. Infiltration testing was performed with infiltration rates identified at approximately 2 inches per hour (2 in/hr) at depths between 1 and 3 feet below ground surfaces.

SECTION K - APPENDICES
Appendices are attached at the back of this report.

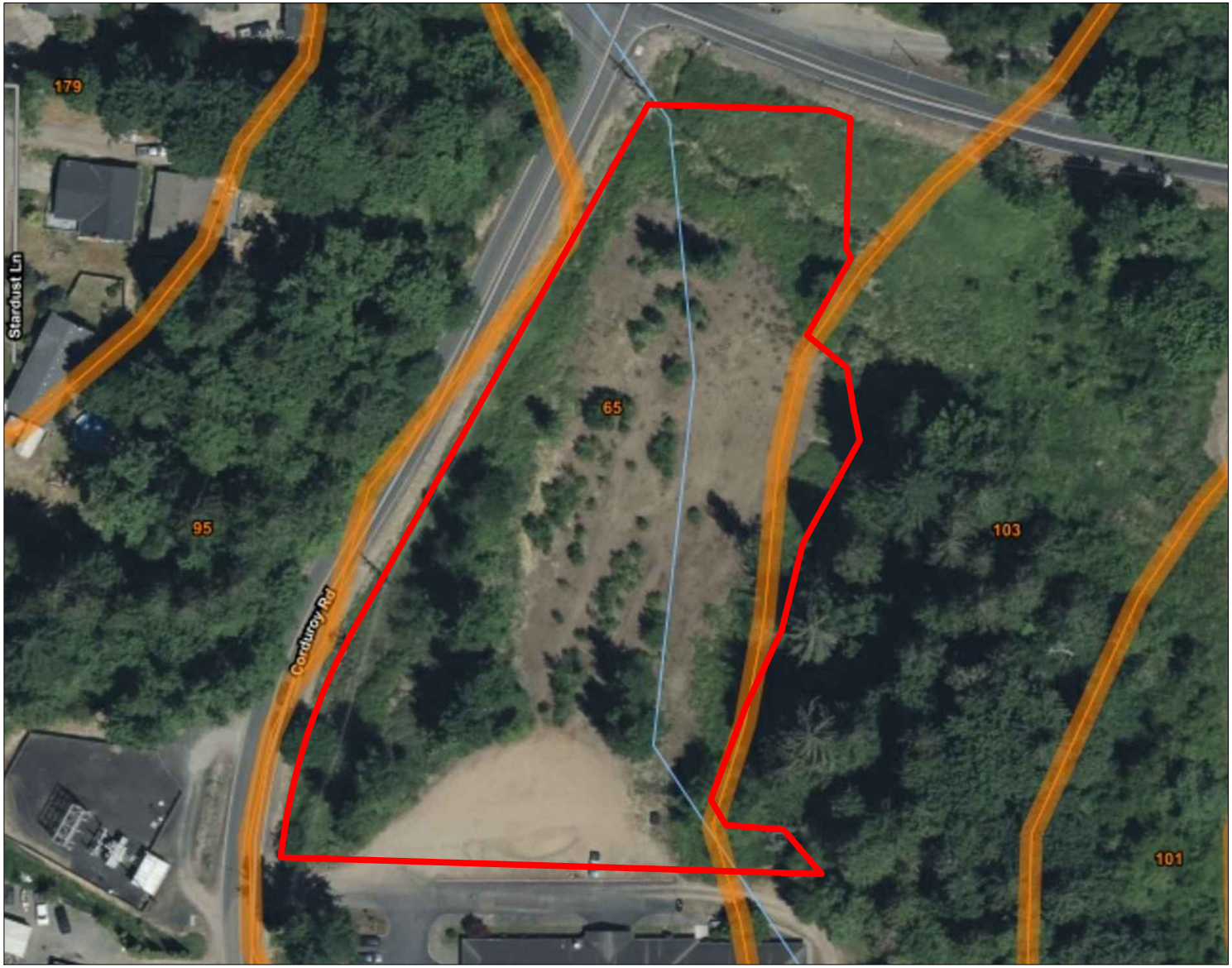
MAPS



NOTE(S):
USGS, KELSO QUADRANGLE
WASHINGTON-OREGON
7.5 MINUTE SERIES (TOPOGRAPHIC)

PURPOSE: XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	VICINITY MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 1 **DATE:** 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg



65 - Godfrey silt loam, 0-3% slopes

95 - Kalama gravelly loam, 15-30% slopes

103 - Kelso silt loam, 30-50% slopes

N

0 100 200

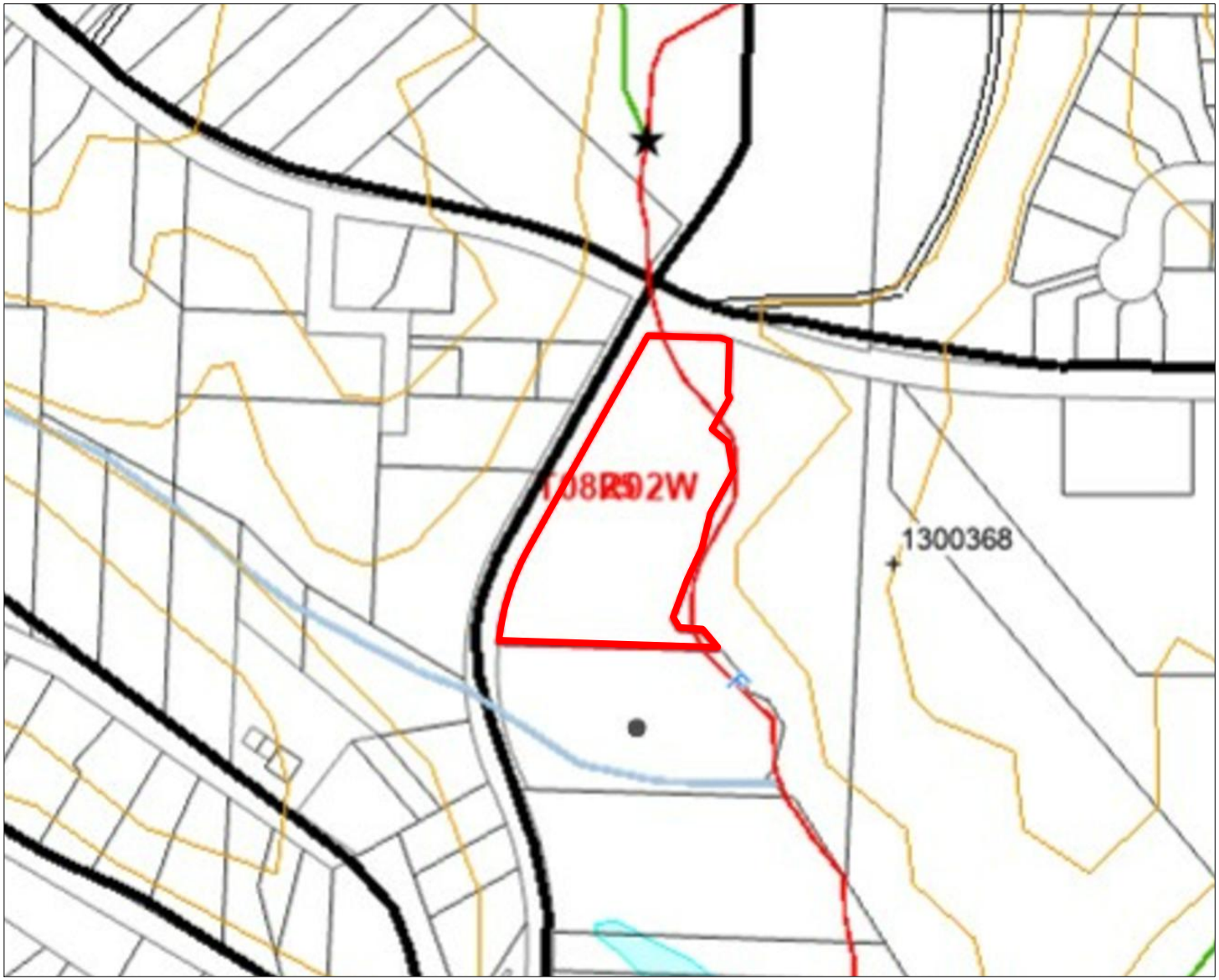
SCALE IN FEET
1" = 100'

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg

AshECO SOLUTIONS, LLC	**PURPOSE:** XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	SOIL SURVEY MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 2 **DATE:** 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg

AshECO SOLUTIONS, LLC	**PURPOSE:** XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	NATIONAL WETLANDS INVENTORY MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 3 **DATE:** 9-13-24



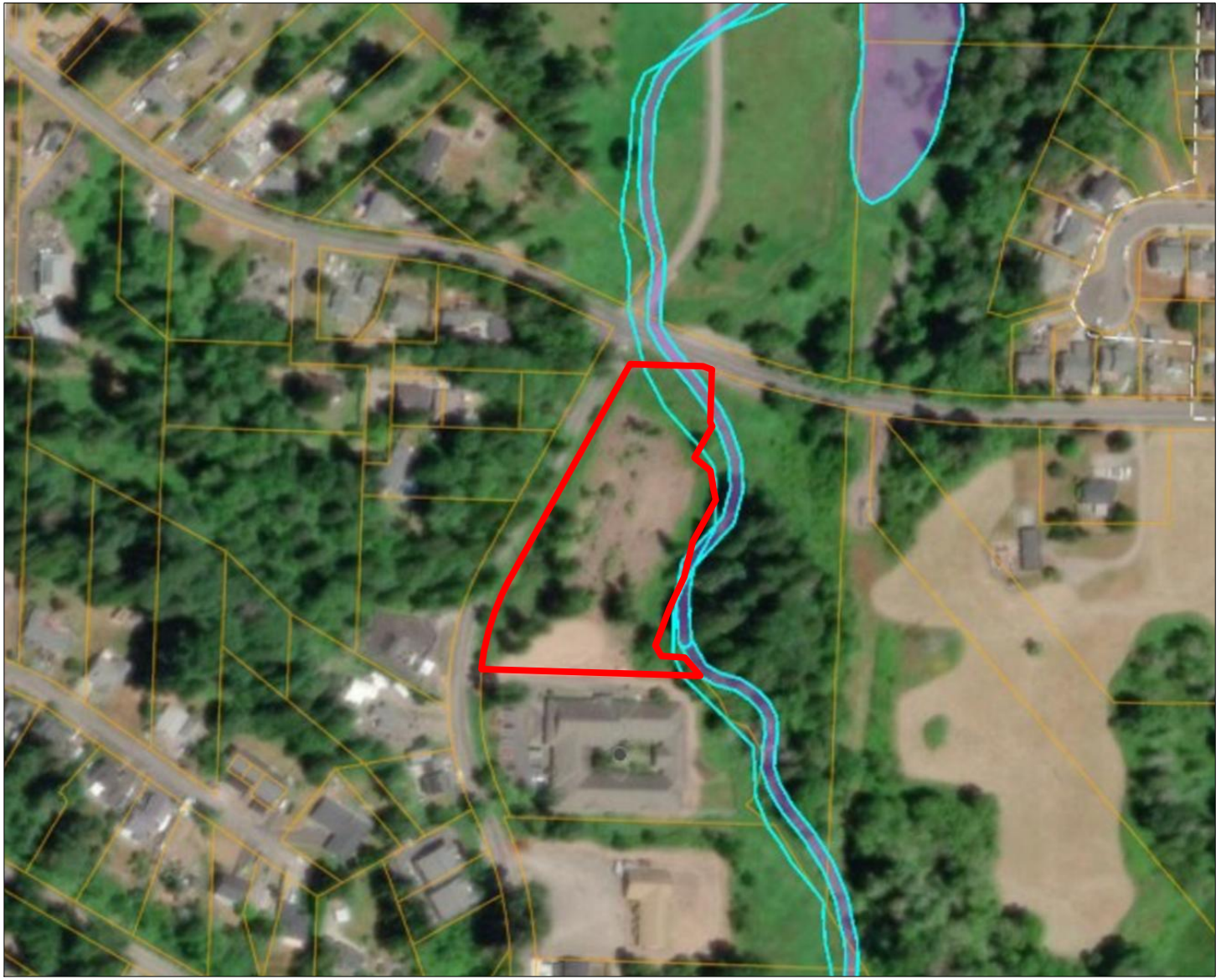
N

0 250 500

SCALE IN FEET
1" = 250'

Ash ECO SOLUTIONS, LLC	**PURPOSE:** XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	DNR FRAMT MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 4 **DATE:** 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg



N

0 250 500

SCALE IN FEET
1" = 250'

	PURPOSE: XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	WDFW PHS MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 5 **DATE:** 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg

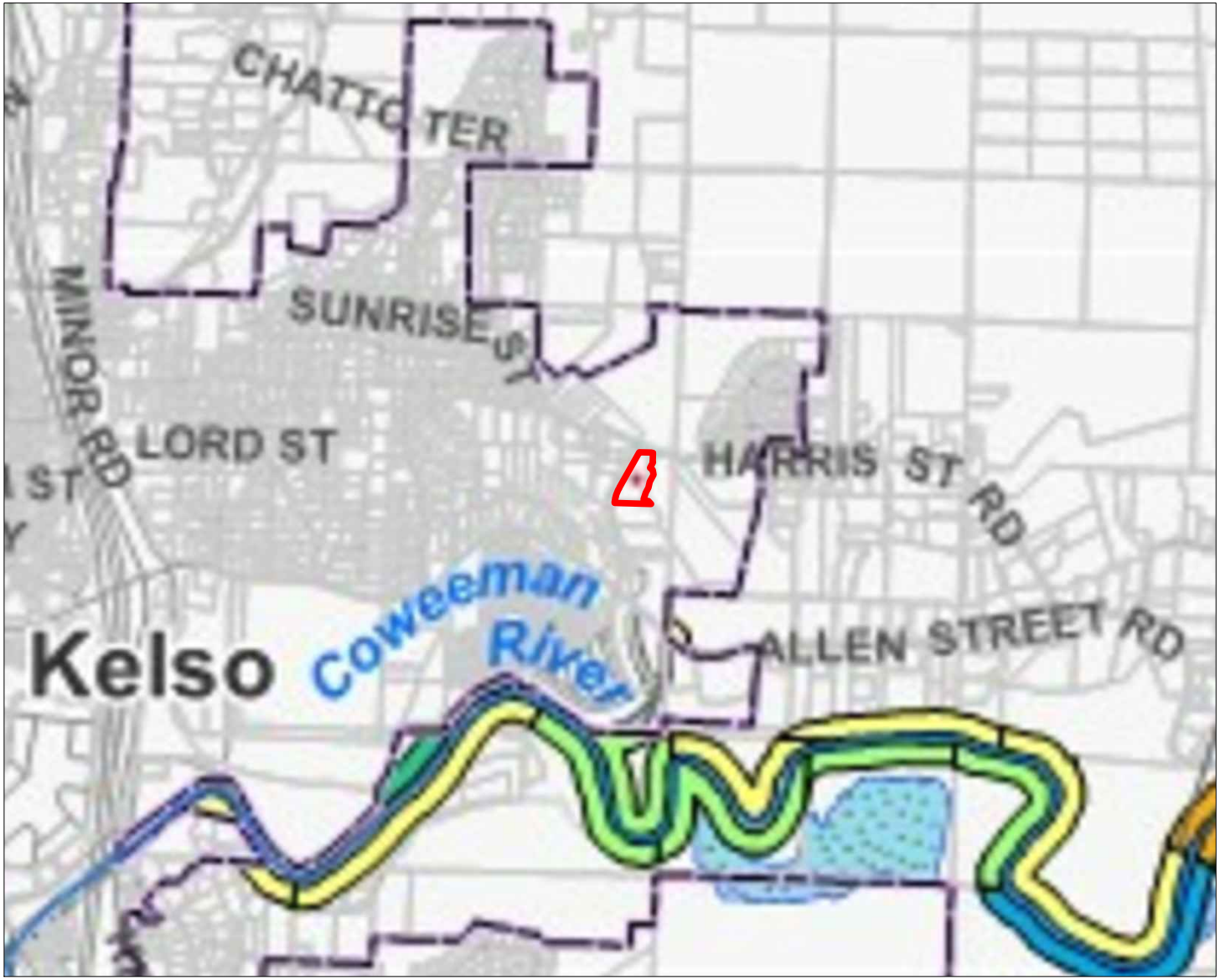
N

0 250 500

SCALE IN FEET
1" = 250'

Ash ECO SOLUTIONS, LLC	**PURPOSE:** XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	FEMA FLOODZONE MAP **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 6 **DATE:** 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg



Cowlitz County Shoreline Environment Designations Map

- City Limits
- UGB
- County Boundary
- Parcel Boundary
- Potential Wetland

Shoreline SEDs

- High Intensity
- Rural Conservancy
- Urban Conservancy
- Residential
- Recreation
- Natural
- Aquatic

N

0 1500 3000

SCALE IN FEET
1" = 1500'

Ash ECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

SHORELINE ENVIRONMENT DESIGNATION MAP
APPLICANT: Jonathan Christopher
PROJECT NAME: Valentina's Villas
PARCEL #: 243570101
SITE LOCATION ADDRESS:
North of 114 Corduroy Rd.

PROPOSED: XX
Add 2
IN: Kelso
NEAR: XX
COUNTY: Cowlitz **STATE:** WA
FIGURE: 7
DATE: 9-13-24

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg

PROPOSED: XX
Add 2
IN: Kelso
NEAR: XX
COUNTY: Cowlitz
STATE: WA
FIGURE: 8
DATE: 9-13-24

EXISTING CONDITIONS MAP

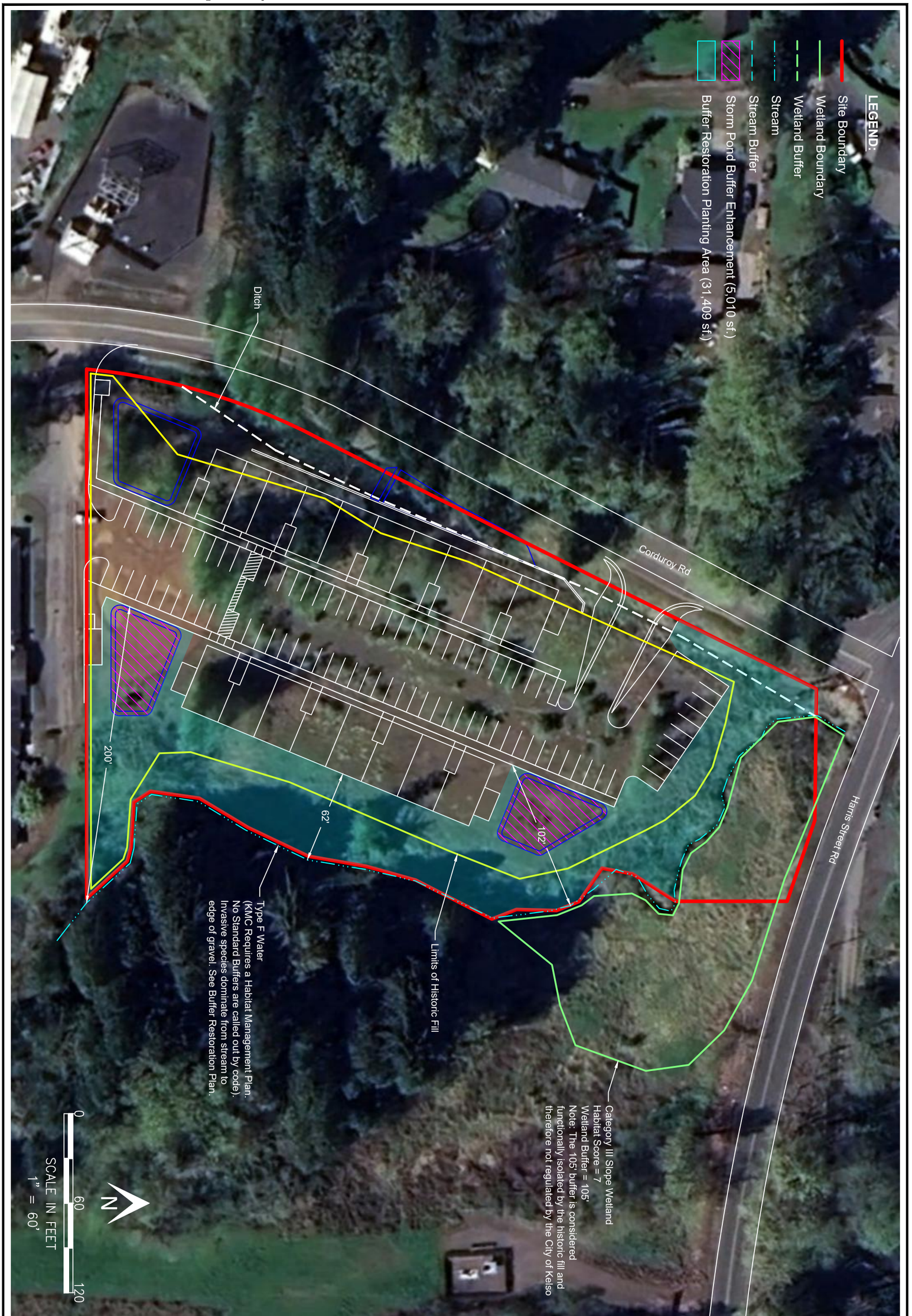
APPLICANT: Jonathan Christopher
PROJECT NAME: Valentina's Villas
PARCEL #: 243570101
SITE LOCATION ADDRESS:
North of 114 Corduroy Rd.

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

Ash ECO SOLUTIONS, LLC

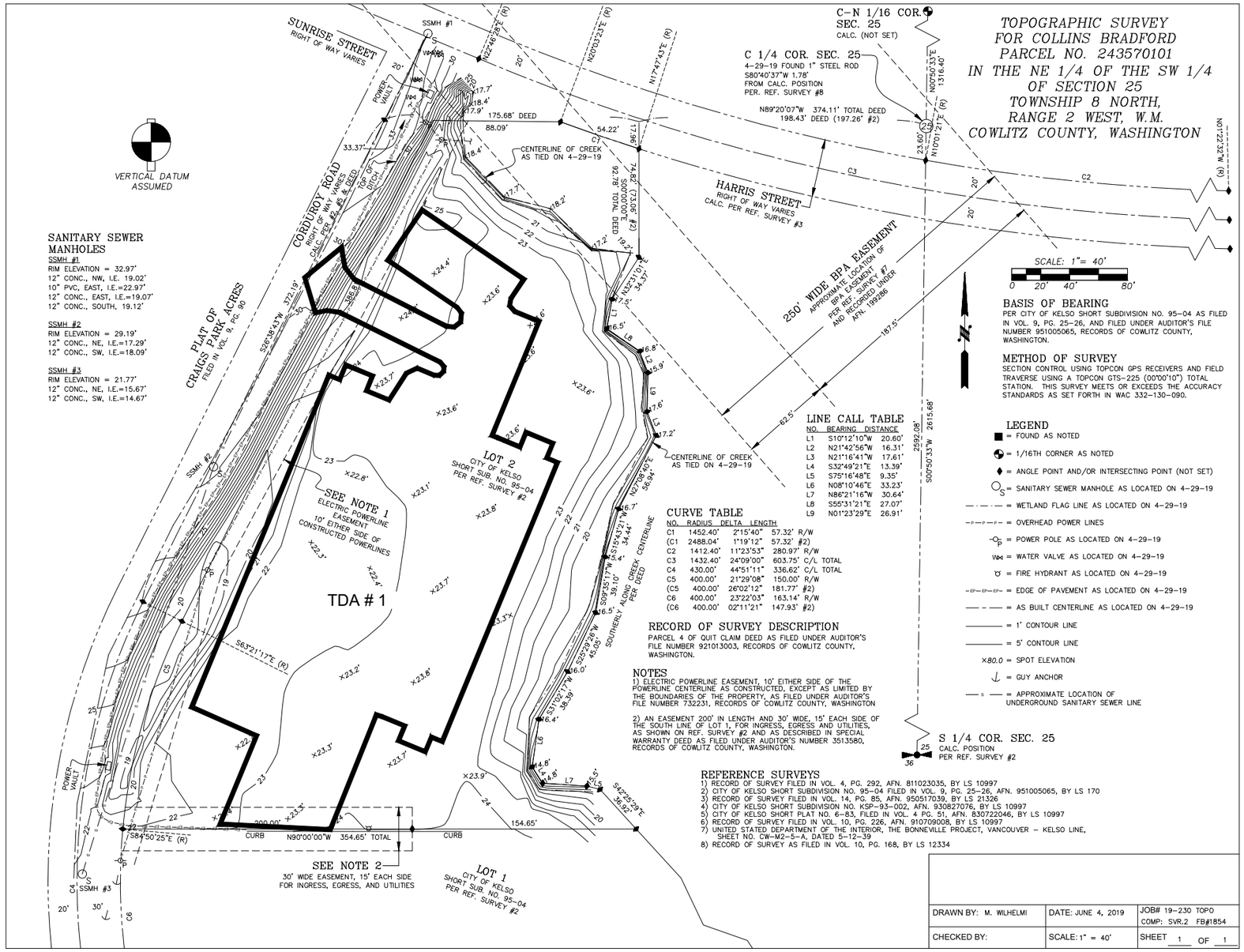
I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg

I:\Autocad Files\AshECO Autocad\Valentinas Villas\2023.29_BM-090324.dwg



AshECO SOLUTIONS, LLC	**PURPOSE:** XX Line 1 Line 2 **DATUM:** NAVD 88 **ADJACENT PROPERTY OWNERS:** Adj 1 Adj 2	PROPOSED SITE PLAN **APPLICANT:** Jonathan Christopher **PROJECT NAME:** Valentina's Villas **PARCEL #:** 243570101 **SITE LOCATION ADDRESS:** North of 114 Corduroy Rd.	**PROPOSED:** XX Add 2 **IN:** Kelso **NEAR:** XX **COUNTY:** Cowlitz **STATE:** WA **FIGURE:** 9 **DATE:** 9-13-24

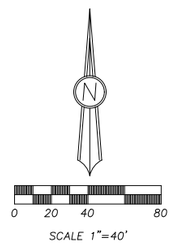
APPENDIX I



DRAWN BY: M. WILHELMI	DATE: JUNE 4, 2019	JOB# 19-230 TOPO COMP: SVR.2 FB#1854
CHECKED BY:	SCALE: 1" = 40'	SHEET 1 OF 1

EXISITING CONDITION TDA

TDA #	Description	Area Impervious (Ac.)	Area Impervious (Ac)	WWHM Soil Group
		(Forested)		
1	Vacant Lot	1.27	0	C



SET DATE: 10/28/2024

REV	DATE	REVISION DESCRIPTION	DESIGNER	REVIEWER

ROBERT E. CARPENTER
STATE OF WASHINGTON
36032
REGISTERED
PROFESSIONAL ENGINEER
10-28-2024

CARPENTER ENGINEERING, INC.
Civil Engineering & Consulting
t. (360) 374-6088 | e. bcarpe@comcast.net

CEI PROJECT NO: 23-003
CONTRACT NO: -----

THIS LINE IS 1" LONG
AT THE CORRECT SCALE

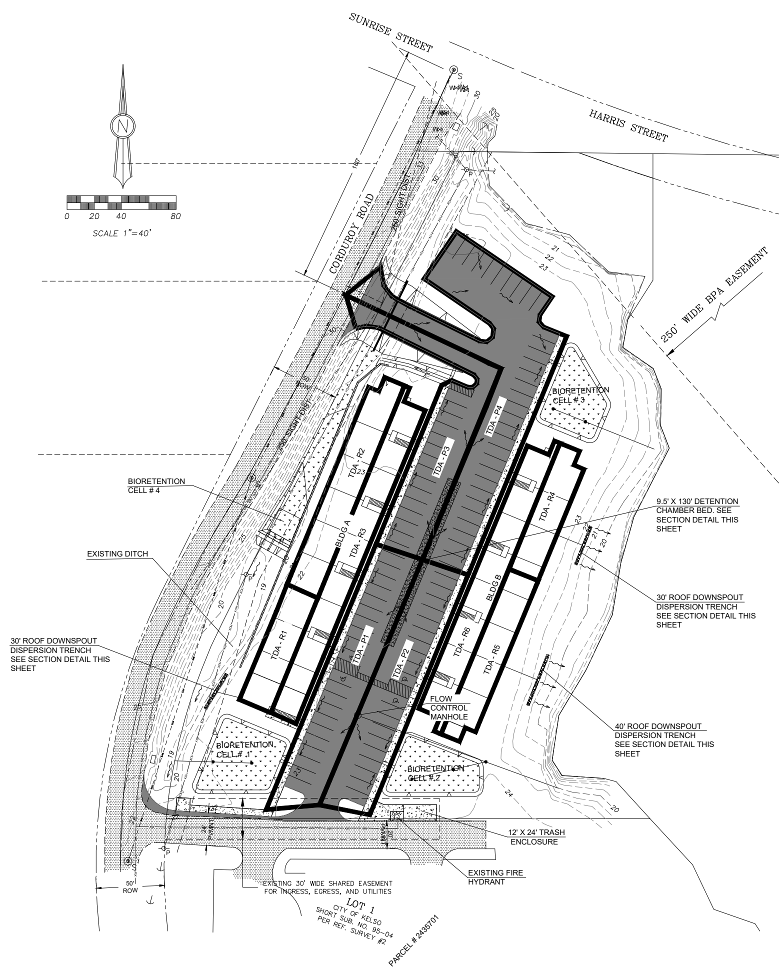
VALENTINA'S VILLAS
EXISTING CONDITIONS BASIN PLAN

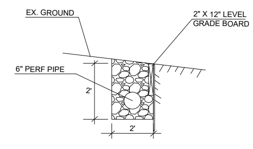
JONATHAN CHRISTOPHER
PO BOX 1690
BRUSH PRARIE, WA 98606

0 REVISION

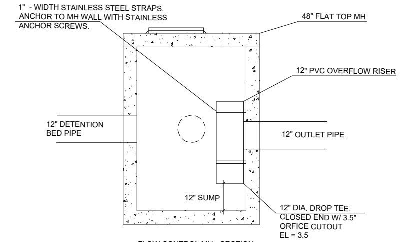
1
1 / 1

APPENDIX II

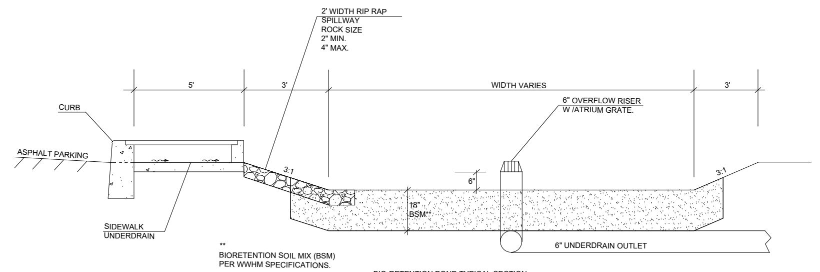




DOWNSPOUT DISPERSION TRENCH SECTION
NTS



FLOW CONTROL MH - SECTION
NTS

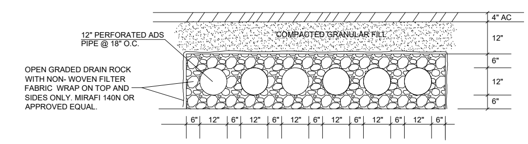


BIO-RETENTION POND TYPICAL SECTION
NTS

LEGEND

TDA# THRESHOLD DRAINAGE AREA

SURFACE WATER FLOW DIRECTION ARROW



DETENTION CHAMBER BED - SECTION
NTS

SITE SURFACES SUMMARY TABLE

Total site Area -	2.70 Acres (per survey)
Total New Hard Surface Area	
• Paving -	32,512 sf = 0.74 Acres
• Roofs -	21,124 sf = 0.48 Acres
• Landscape -	64,402 sf = 1.47 Acres
TOTAL	117,612 sf (2.70 acres)
Replaced Hard Surfaces -	0 sf
Total new & replaced hard surfaces -	53,636 sf (1.23 Acres)
Native vegetation converted to pasture -	0 SF
Vegetation converted to landscaping –	64,402 SF
Total area of land disturbing activity -	53,143 SF (1.22 ACRES)

TDA DATA TABLE

TDA #	Description	Area Impervious (sf) (Non PGIS)	Area Impervious (sf) (PGIS)
R1	Roof	2,251	0
R2	Roof	3,999	0
R3	Roof	5,104	0
R4	Roof	2,215	0
R5	Roof	2,899	0
R6	Roof	4,660	0
P1	Parking	0	7,160
P2	Parking	0	6,944
P3	Parking	0	6,355
P4	Parking	0	12,053

PGIS = Pollution Generating Impervious Surface

SET DATE: 10/28/2024

REV	DATE	REVISION DESCRIPTION	DESIGNER	REVIEWER

30032 REGISTERED PROFESSIONAL ENGINEER
10-28-2024

CARPENTER ENGINEERING, INC.
Civil Engineering & Consulting

CEI PROJECT NO: 23-003
CONTRACT NO: -----

THIS LINE IS 1" LONG AT THE CORRECT SCALE

VALENTINAS VILLAS
STORMWATER BASIN PLAN

JONATHAN CHRISTOPHER
PO BOX 1690
BRUSH PRARIE, WA 98606

REVISION 0

1

1 / 1

APPENDIX III

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Kelso

Site Name:	Valentinas Villas
Site Address:	
City:	
Report Date:	12/18/2024
Gage:	Longview
Data Start:	1955/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.143
Version Date:	2023/01/27
Version:	4.2.19

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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.27
Pervious Total	1.27
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.27

Mitigated Land Use

TDA P1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.164
Impervious Total	0.164
Basin Total	0.164

TDA R1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.081
Impervious Total	0.081
Basin Total	0.081

TDA P2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.153
Impervious Total	0.153
Basin Total	0.153

TDA P3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.146
Impervious Total	0.146
Basin Total	0.146

TDA P4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.276
Impervious Total	0.276
Basin Total	0.276

TDA R2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.062
Impervious Total	0.062
Basin Total	0.062

TDA R3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.117
Impervious Total	0.117
Basin Total	0.117

TDA R4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.05
Impervious Total	0.05
Basin Total	0.05

TDA R5

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.066
Impervious Total	0.066
Basin Total	0.066

TDA R6

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.1
Impervious Total	0.1
Basin Total	0.1

Mitigated Routing

Bioretention 1

Bottom Length: 48.50 ft.
Bottom Width: 48.50 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0
Material type for second layer: Sand
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 0.33
Wetted surface area On
Total Volume Infiltrated (ac-ft.): 36.238
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 36.238
Percent Infiltrated: 100
Total Precip Applied to Facility: 9.444
Total Evap From Facility: 3.409
Underdrain not used
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 10 in.
Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0540	0.0000	0.0000	0.0000
0.0330	0.0540	0.0008	0.0000	0.0000
0.0659	0.0540	0.0016	0.0000	0.0000
0.0989	0.0540	0.0024	0.0000	0.0000
0.1319	0.0540	0.0033	0.0000	0.0000
0.1648	0.0540	0.0041	0.0007	0.0007
0.1978	0.0540	0.0049	0.0011	0.0011
0.2308	0.0540	0.0057	0.0016	0.0016
0.2637	0.0540	0.0065	0.0022	0.0022
0.2967	0.0540	0.0073	0.0029	0.0029
0.3297	0.0540	0.0081	0.0038	0.0038
0.3626	0.0540	0.0090	0.0048	0.0048
0.3956	0.0540	0.0098	0.0060	0.0060
0.4286	0.0540	0.0106	0.0073	0.0073
0.4615	0.0540	0.0114	0.0087	0.0087
0.4945	0.0540	0.0122	0.0104	0.0104
0.5275	0.0540	0.0130	0.0122	0.0122
0.5604	0.0540	0.0138	0.0141	0.0141
0.5934	0.0540	0.0147	0.0163	0.0163
0.6264	0.0540	0.0155	0.0186	0.0186
0.6593	0.0540	0.0163	0.0211	0.0211
0.6923	0.0540	0.0171	0.0238	0.0238
0.7253	0.0540	0.0179	0.0267	0.0267
0.7582	0.0540	0.0187	0.0298	0.0298
0.7912	0.0540	0.0195	0.0331	0.0331

0.8242	0.0540	0.0204	0.0359	0.0359
0.8571	0.0540	0.0212	0.0359	0.0359
0.8901	0.0540	0.0220	0.0359	0.0359
0.9231	0.0540	0.0228	0.0359	0.0359
0.9560	0.0540	0.0236	0.0359	0.0359
0.9890	0.0540	0.0244	0.0359	0.0359
1.0220	0.0540	0.0252	0.0359	0.0359
1.0549	0.0540	0.0261	0.0359	0.0359
1.0879	0.0540	0.0269	0.0359	0.0359
1.1209	0.0540	0.0277	0.0359	0.0359
1.1538	0.0540	0.0285	0.0359	0.0359
1.1868	0.0540	0.0293	0.0359	0.0359
1.2198	0.0540	0.0301	0.0359	0.0359
1.2527	0.0540	0.0309	0.0359	0.0359
1.2857	0.0540	0.0317	0.0359	0.0359
1.3187	0.0540	0.0326	0.0359	0.0359
1.3516	0.0540	0.0334	0.0359	0.0359
1.3846	0.0540	0.0342	0.0359	0.0359
1.4176	0.0540	0.0350	0.0359	0.0359
1.4505	0.0540	0.0358	0.0359	0.0359
1.4835	0.0540	0.0366	0.0359	0.0359
1.5000	0.0540	0.0370	0.0359	0.0359

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.5000	0.0540	0.0370	0.0000	0.0359	0.0003
1.5330	0.0544	0.0388	0.0000	0.0359	0.0006
1.5659	0.0549	0.0406	0.0000	0.0359	0.0009
1.5989	0.0553	0.0424	0.0000	0.0359	0.0012
1.6319	0.0558	0.0443	0.0000	0.0359	0.0015
1.6648	0.0562	0.0461	0.0000	0.0359	0.0018
1.6978	0.0567	0.0480	0.0000	0.0359	0.0021
1.7308	0.0571	0.0499	0.0000	0.0359	0.0024
1.7637	0.0576	0.0518	0.0000	0.0359	0.0027
1.7967	0.0580	0.0537	0.0000	0.0359	0.0030
1.8297	0.0585	0.0556	0.0000	0.0359	0.0033
1.8626	0.0590	0.0575	0.0000	0.0359	0.0036
1.8956	0.0594	0.0595	0.0000	0.0359	0.0039
1.9286	0.0599	0.0614	0.0000	0.0359	0.0042
1.9615	0.0603	0.0634	0.0000	0.0359	0.0045
1.9945	0.0608	0.0654	0.0000	0.0359	0.0048
2.0275	0.0613	0.0674	0.0000	0.0359	0.0052
2.0604	0.0617	0.0695	0.0000	0.0359	0.0055
2.0934	0.0622	0.0715	0.0000	0.0359	0.0058
2.1264	0.0627	0.0736	0.0000	0.0359	0.0061
2.1593	0.0632	0.0756	0.0000	0.0359	0.0064
2.1923	0.0636	0.0777	0.0000	0.0359	0.0067
2.2253	0.0641	0.0798	0.0000	0.0359	0.0071
2.2582	0.0646	0.0819	0.0000	0.0359	0.0074
2.2912	0.0651	0.0841	0.0000	0.0359	0.0077
2.3242	0.0656	0.0862	0.0000	0.0359	0.0080
2.3571	0.0661	0.0884	0.0000	0.0359	0.0084
2.3901	0.0665	0.0906	0.0000	0.0359	0.0087
2.4231	0.0670	0.0928	0.0000	0.0359	0.0090
2.4560	0.0675	0.0950	0.0000	0.0359	0.0093
2.4890	0.0680	0.0972	0.0000	0.0359	0.0097
2.5220	0.0685	0.0995	0.0000	0.0359	0.0100
2.5549	0.0690	0.1018	0.0000	0.0359	0.0103

2.5879	0.0695	0.1041	0.0000	0.0359	0.0107
2.6209	0.0700	0.1064	0.0000	0.0359	0.0110
2.6538	0.0705	0.1087	0.0000	0.0359	0.0113
2.6868	0.0710	0.1110	0.0000	0.0359	0.0117
2.7198	0.0715	0.1133	0.0000	0.0359	0.0120
2.7527	0.0720	0.1157	0.0000	0.0359	0.0123
2.7857	0.0725	0.1181	0.0000	0.0359	0.0127
2.8187	0.0731	0.1205	0.0000	0.0359	0.0130
2.8516	0.0736	0.1229	0.0000	0.0359	0.0134
2.8846	0.0741	0.1253	0.0000	0.0359	0.0137
2.9176	0.0746	0.1278	0.0000	0.0359	0.0141
2.9505	0.0751	0.1303	0.0000	0.0359	0.0144
2.9835	0.0756	0.1328	0.0000	0.0359	0.0146
3.0000	0.0759	0.1340	0.0000	0.0359	0.0096

Surface retention 1

Bioretention 2

Bottom Length:	44.60 ft.
Bottom Width:	44.60 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	0
Material type for second layer:	Sand
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	33.274
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	33.274
Percent Infiltrated:	100
Total Precip Applied to Facility:	8.002
Total Evap From Facility:	2.906
Underdrain not used	
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0457	0.0000	0.0000	0.0000
0.0330	0.0457	0.0007	0.0000	0.0000
0.0659	0.0457	0.0014	0.0000	0.0000
0.0989	0.0457	0.0021	0.0000	0.0000
0.1319	0.0457	0.0028	0.0000	0.0000
0.1648	0.0457	0.0034	0.0006	0.0006
0.1978	0.0457	0.0041	0.0009	0.0009
0.2308	0.0457	0.0048	0.0013	0.0013
0.2637	0.0457	0.0055	0.0019	0.0019
0.2967	0.0457	0.0062	0.0025	0.0025
0.3297	0.0457	0.0069	0.0032	0.0032
0.3626	0.0457	0.0076	0.0041	0.0041
0.3956	0.0457	0.0083	0.0051	0.0051
0.4286	0.0457	0.0089	0.0062	0.0062
0.4615	0.0457	0.0096	0.0074	0.0074
0.4945	0.0457	0.0103	0.0088	0.0088
0.5275	0.0457	0.0110	0.0103	0.0103
0.5604	0.0457	0.0117	0.0119	0.0119
0.5934	0.0457	0.0124	0.0137	0.0137
0.6264	0.0457	0.0131	0.0157	0.0157
0.6593	0.0457	0.0138	0.0178	0.0178
0.6923	0.0457	0.0145	0.0201	0.0201
0.7253	0.0457	0.0151	0.0226	0.0226
0.7582	0.0457	0.0158	0.0252	0.0252
0.7912	0.0457	0.0165	0.0280	0.0280
0.8242	0.0457	0.0172	0.0304	0.0304
0.8571	0.0457	0.0179	0.0304	0.0304

0.8901	0.0457	0.0186	0.0304	0.0304
0.9231	0.0457	0.0193	0.0304	0.0304
0.9560	0.0457	0.0200	0.0304	0.0304
0.9890	0.0457	0.0207	0.0304	0.0304
1.0220	0.0457	0.0213	0.0304	0.0304
1.0549	0.0457	0.0220	0.0304	0.0304
1.0879	0.0457	0.0227	0.0304	0.0304
1.1209	0.0457	0.0234	0.0304	0.0304
1.1538	0.0457	0.0241	0.0304	0.0304
1.1868	0.0457	0.0248	0.0304	0.0304
1.2198	0.0457	0.0255	0.0304	0.0304
1.2527	0.0457	0.0262	0.0304	0.0304
1.2857	0.0457	0.0268	0.0304	0.0304
1.3187	0.0457	0.0275	0.0304	0.0304
1.3516	0.0457	0.0282	0.0304	0.0304
1.3846	0.0457	0.0289	0.0304	0.0304
1.4176	0.0457	0.0296	0.0304	0.0304
1.4505	0.0457	0.0303	0.0304	0.0304
1.4835	0.0457	0.0310	0.0304	0.0304
1.5000	0.0457	0.0313	0.0304	0.0304

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.5000	0.0457	0.0313	0.0000	0.0304	0.0003
1.5330	0.0461	0.0328	0.0000	0.0304	0.0005
1.5659	0.0465	0.0344	0.0000	0.0304	0.0008
1.5989	0.0469	0.0359	0.0000	0.0304	0.0011
1.6319	0.0473	0.0375	0.0000	0.0304	0.0014
1.6648	0.0477	0.0390	0.0000	0.0304	0.0016
1.6978	0.0481	0.0406	0.0000	0.0304	0.0019
1.7308	0.0485	0.0422	0.0000	0.0304	0.0022
1.7637	0.0490	0.0438	0.0000	0.0304	0.0025
1.7967	0.0494	0.0454	0.0000	0.0304	0.0028
1.8297	0.0498	0.0471	0.0000	0.0304	0.0030
1.8626	0.0502	0.0487	0.0000	0.0304	0.0033
1.8956	0.0507	0.0504	0.0000	0.0304	0.0036
1.9286	0.0511	0.0520	0.0000	0.0304	0.0039
1.9615	0.0515	0.0537	0.0000	0.0304	0.0042
1.9945	0.0519	0.0554	0.0000	0.0304	0.0045
2.0275	0.0524	0.0572	0.0000	0.0304	0.0048
2.0604	0.0528	0.0589	0.0000	0.0304	0.0050
2.0934	0.0532	0.0606	0.0000	0.0304	0.0053
2.1264	0.0537	0.0624	0.0000	0.0304	0.0056
2.1593	0.0541	0.0642	0.0000	0.0304	0.0059
2.1923	0.0546	0.0660	0.0000	0.0304	0.0062
2.2253	0.0550	0.0678	0.0000	0.0304	0.0065
2.2582	0.0555	0.0696	0.0000	0.0304	0.0068
2.2912	0.0559	0.0714	0.0000	0.0304	0.0071
2.3242	0.0564	0.0733	0.0000	0.0304	0.0074
2.3571	0.0568	0.0752	0.0000	0.0304	0.0077
2.3901	0.0573	0.0770	0.0000	0.0304	0.0080
2.4231	0.0577	0.0789	0.0000	0.0304	0.0083
2.4560	0.0582	0.0808	0.0000	0.0304	0.0086
2.4890	0.0586	0.0828	0.0000	0.0304	0.0089
2.5220	0.0591	0.0847	0.0000	0.0304	0.0092
2.5549	0.0595	0.0867	0.0000	0.0304	0.0095
2.5879	0.0600	0.0886	0.0000	0.0304	0.0099
2.6209	0.0605	0.0906	0.0000	0.0304	0.0102

2.6538	0.0609	0.0926	0.0000	0.0304	0.0105
2.6868	0.0614	0.0946	0.0000	0.0304	0.0108
2.7198	0.0619	0.0967	0.0000	0.0304	0.0111
2.7527	0.0624	0.0987	0.0000	0.0304	0.0114
2.7857	0.0628	0.1008	0.0000	0.0304	0.0117
2.8187	0.0633	0.1029	0.0000	0.0304	0.0121
2.8516	0.0638	0.1050	0.0000	0.0304	0.0124
2.8846	0.0643	0.1071	0.0000	0.0304	0.0127
2.9176	0.0647	0.1092	0.0000	0.0304	0.0130
2.9505	0.0652	0.1113	0.0000	0.0304	0.0133
2.9835	0.0657	0.1135	0.0000	0.0304	0.0135
3.0000	0.0660	0.1146	0.0000	0.0304	0.0000

Surface retention 2

Bioretention 4

Bottom Length:	43.20 ft.
Bottom Width:	43.20 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	0
Material type for second layer:	Sand
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	55.566
Total Volume Through Riser (ac-ft.):	0.136
Total Volume Through Facility (ac-ft.):	55.702
Percent Infiltrated:	99.76
Total Precip Applied to Facility:	7.766
Total Evap From Facility:	2.91
Underdrain not used	
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0428	0.0000	0.0000	0.0000
0.0330	0.0428	0.0006	0.0000	0.0000
0.0659	0.0428	0.0013	0.0000	0.0000
0.0989	0.0428	0.0019	0.0000	0.0000
0.1319	0.0428	0.0026	0.0000	0.0000
0.1648	0.0428	0.0032	0.0006	0.0006
0.1978	0.0428	0.0039	0.0009	0.0009
0.2308	0.0428	0.0045	0.0013	0.0013
0.2637	0.0428	0.0052	0.0018	0.0018
0.2967	0.0428	0.0058	0.0023	0.0023
0.3297	0.0428	0.0065	0.0030	0.0030
0.3626	0.0428	0.0071	0.0038	0.0038
0.3956	0.0428	0.0078	0.0047	0.0047
0.4286	0.0428	0.0084	0.0058	0.0058
0.4615	0.0428	0.0090	0.0069	0.0069
0.4945	0.0428	0.0097	0.0082	0.0082
0.5275	0.0428	0.0103	0.0096	0.0096
0.5604	0.0428	0.0110	0.0112	0.0112
0.5934	0.0428	0.0116	0.0129	0.0129
0.6264	0.0428	0.0123	0.0147	0.0147
0.6593	0.0428	0.0129	0.0167	0.0167
0.6923	0.0428	0.0136	0.0189	0.0189
0.7253	0.0428	0.0142	0.0212	0.0212
0.7582	0.0428	0.0149	0.0237	0.0237
0.7912	0.0428	0.0155	0.0263	0.0263
0.8242	0.0428	0.0161	0.0285	0.0285
0.8571	0.0428	0.0168	0.0285	0.0285

0.8901	0.0428	0.0174	0.0285	0.0285
0.9231	0.0428	0.0181	0.0285	0.0285
0.9560	0.0428	0.0187	0.0285	0.0285
0.9890	0.0428	0.0194	0.0285	0.0285
1.0220	0.0428	0.0200	0.0285	0.0285
1.0549	0.0428	0.0207	0.0285	0.0285
1.0879	0.0428	0.0213	0.0285	0.0285
1.1209	0.0428	0.0220	0.0285	0.0285
1.1538	0.0428	0.0226	0.0285	0.0285
1.1868	0.0428	0.0233	0.0285	0.0285
1.2198	0.0428	0.0239	0.0285	0.0285
1.2527	0.0428	0.0245	0.0285	0.0285
1.2857	0.0428	0.0252	0.0285	0.0285
1.3187	0.0428	0.0258	0.0285	0.0285
1.3516	0.0428	0.0265	0.0285	0.0285
1.3846	0.0428	0.0271	0.0285	0.0285
1.4176	0.0428	0.0278	0.0285	0.0285
1.4505	0.0428	0.0284	0.0285	0.0285
1.4835	0.0428	0.0291	0.0285	0.0285
1.5000	0.0428	0.0294	0.0285	0.0285

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.5000	0.0428	0.0294	0.0000	0.0285	0.0003
1.5330	0.0432	0.0308	0.0000	0.0285	0.0005
1.5659	0.0436	0.0322	0.0000	0.0285	0.0008
1.5989	0.0440	0.0337	0.0000	0.0285	0.0011
1.6319	0.0444	0.0351	0.0000	0.0285	0.0013
1.6648	0.0448	0.0366	0.0000	0.0285	0.0016
1.6978	0.0452	0.0381	0.0000	0.0285	0.0019
1.7308	0.0456	0.0396	0.0000	0.0285	0.0021
1.7637	0.0460	0.0411	0.0000	0.0285	0.0024
1.7967	0.0464	0.0426	0.0000	0.0285	0.0027
1.8297	0.0469	0.0442	0.0000	0.0285	0.0029
1.8626	0.0473	0.0457	0.0000	0.0285	0.0032
1.8956	0.0477	0.0473	0.0000	0.0285	0.0035
1.9286	0.0481	0.0489	0.0000	0.0285	0.0038
1.9615	0.0485	0.0505	0.0000	0.0285	0.0041
1.9945	0.0489	0.0521	0.0000	0.0285	0.0043
2.0275	0.0494	0.0537	0.0000	0.0285	0.0046
2.0604	0.0498	0.0553	0.0000	0.0285	0.0049
2.0934	0.0502	0.0570	0.0000	0.0285	0.0052
2.1264	0.0506	0.0586	0.0000	0.0285	0.0055
2.1593	0.0510	0.0603	0.0000	0.0285	0.0057
2.1923	0.0515	0.0620	0.0000	0.0285	0.0060
2.2253	0.0519	0.0637	0.0000	0.0285	0.0063
2.2582	0.0523	0.0654	0.0000	0.0285	0.0066
2.2912	0.0528	0.0671	0.0000	0.0285	0.0069
2.3242	0.0532	0.0689	0.0000	0.0285	0.0072
2.3571	0.0537	0.0707	0.0000	0.0285	0.0075
2.3901	0.0541	0.0724	0.0000	0.0285	0.0078
2.4231	0.0545	0.0742	0.0000	0.0285	0.0081
2.4560	0.0550	0.0760	0.0000	0.0285	0.0084
2.4890	0.0554	0.0778	0.0000	0.0285	0.0087
2.5220	0.0559	0.0797	0.0000	0.0285	0.0090
2.5549	0.0563	0.0815	0.0000	0.0285	0.0093
2.5879	0.0568	0.0834	0.0000	0.0285	0.0096
2.6209	0.0572	0.0853	0.0000	0.0285	0.0099

2.6538	0.0577	0.0872	0.0000	0.0285	0.0102
2.6868	0.0581	0.0891	0.0000	0.0285	0.0105
2.7198	0.0586	0.0910	0.0000	0.0285	0.0108
2.7527	0.0590	0.0929	0.0000	0.0285	0.0111
2.7857	0.0595	0.0949	0.0000	0.0285	0.0114
2.8187	0.0600	0.0969	0.0000	0.0285	0.0117
2.8516	0.0604	0.0988	0.0000	0.0285	0.0120
2.8846	0.0609	0.1008	0.0000	0.0285	0.0123
2.9176	0.0614	0.1029	0.0000	0.0285	0.0126
2.9505	0.0618	0.1049	0.0000	0.0285	0.0130
2.9835	0.0623	0.1069	0.0000	0.0285	0.0131
3.0000	0.0626	0.1080	0.0000	0.0285	0.0000

Surface retention 4

Storage Bed

Bottom Length:	130.00 ft.
Bottom Width:	9.50 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	2
Pour Space of material for first layer:	0.65
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	31.326
Total Volume Through Riser (ac-ft.):	8.618
Total Volume Through Facility (ac-ft.):	39.944
Percent Infiltrated:	78.42
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure

Riser Height:	2 ft.
Riser Diameter:	12 in.
Orifice 1 Diameter:	1.000 in. Elevation:0 ft.

Element Flows To:

Outlet 1 Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.028	0.000	0.000	0.000
0.0222	0.028	0.000	0.004	0.018
0.0444	0.028	0.000	0.005	0.018
0.0667	0.028	0.001	0.007	0.018
0.0889	0.028	0.001	0.008	0.018
0.1111	0.028	0.002	0.009	0.018
0.1333	0.028	0.002	0.009	0.018
0.1556	0.028	0.002	0.010	0.018
0.1778	0.028	0.003	0.011	0.018
0.2000	0.028	0.003	0.012	0.018
0.2222	0.028	0.004	0.012	0.018
0.2444	0.028	0.004	0.013	0.018
0.2667	0.028	0.004	0.014	0.018
0.2889	0.028	0.005	0.014	0.018
0.3111	0.028	0.005	0.015	0.018
0.3333	0.028	0.006	0.015	0.018
0.3556	0.028	0.006	0.016	0.018
0.3778	0.028	0.007	0.016	0.018
0.4000	0.028	0.007	0.017	0.018
0.4222	0.028	0.007	0.017	0.018
0.4444	0.028	0.008	0.018	0.018
0.4667	0.028	0.008	0.018	0.018
0.4889	0.028	0.009	0.019	0.018
0.5111	0.028	0.009	0.019	0.018

0.5333	0.028	0.009	0.019	0.018
0.5556	0.028	0.010	0.020	0.018
0.5778	0.028	0.010	0.020	0.018
0.6000	0.028	0.011	0.021	0.018
0.6222	0.028	0.011	0.021	0.018
0.6444	0.028	0.011	0.021	0.018
0.6667	0.028	0.012	0.022	0.018
0.6889	0.028	0.012	0.022	0.018
0.7111	0.028	0.013	0.022	0.018
0.7333	0.028	0.013	0.023	0.018
0.7556	0.028	0.013	0.023	0.018
0.7778	0.028	0.014	0.023	0.018
0.8000	0.028	0.014	0.024	0.018
0.8222	0.028	0.015	0.024	0.018
0.8444	0.028	0.015	0.024	0.018
0.8667	0.028	0.016	0.025	0.018
0.8889	0.028	0.016	0.025	0.018
0.9111	0.028	0.016	0.025	0.018
0.9333	0.028	0.017	0.026	0.018
0.9556	0.028	0.017	0.026	0.018
0.9778	0.028	0.018	0.026	0.018
1.0000	0.028	0.018	0.027	0.018
1.0222	0.028	0.018	0.027	0.018
1.0444	0.028	0.019	0.027	0.018
1.0667	0.028	0.019	0.028	0.018
1.0889	0.028	0.020	0.028	0.018
1.1111	0.028	0.020	0.028	0.018
1.1333	0.028	0.020	0.028	0.018
1.1556	0.028	0.021	0.029	0.018
1.1778	0.028	0.021	0.029	0.018
1.2000	0.028	0.022	0.029	0.018
1.2222	0.028	0.022	0.030	0.018
1.2444	0.028	0.022	0.030	0.018
1.2667	0.028	0.023	0.030	0.018
1.2889	0.028	0.023	0.030	0.018
1.3111	0.028	0.024	0.031	0.018
1.3333	0.028	0.024	0.031	0.018
1.3556	0.028	0.025	0.031	0.018
1.3778	0.028	0.025	0.031	0.018
1.4000	0.028	0.025	0.032	0.018
1.4222	0.028	0.026	0.032	0.018
1.4444	0.028	0.026	0.032	0.018
1.4667	0.028	0.027	0.032	0.018
1.4889	0.028	0.027	0.033	0.018
1.5111	0.028	0.027	0.033	0.018
1.5333	0.028	0.028	0.033	0.018
1.5556	0.028	0.028	0.033	0.018
1.5778	0.028	0.029	0.034	0.018
1.6000	0.028	0.029	0.034	0.018
1.6222	0.028	0.029	0.034	0.018
1.6444	0.028	0.030	0.034	0.018
1.6667	0.028	0.030	0.035	0.018
1.6889	0.028	0.031	0.035	0.018
1.7111	0.028	0.031	0.035	0.018
1.7333	0.028	0.031	0.035	0.018
1.7556	0.028	0.032	0.036	0.018
1.7778	0.028	0.032	0.036	0.018
1.8000	0.028	0.033	0.036	0.018

1.8222	0.028	0.033	0.036	0.018
1.8444	0.028	0.034	0.036	0.018
1.8667	0.028	0.034	0.037	0.018
1.8889	0.028	0.034	0.037	0.018
1.9111	0.028	0.035	0.037	0.018
1.9333	0.028	0.035	0.037	0.018
1.9556	0.028	0.036	0.037	0.018
1.9778	0.028	0.036	0.038	0.018
2.0000	0.028	0.036	0.038	0.018

Dispersion Trench 4

Bottom Length:	40.00 ft.
Bottom Width:	3.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	3
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	8.649
Total Volume Through Riser (ac-ft.):	0.535
Total Volume Through Facility (ac-ft.):	9.184
Percent Infiltrated:	94.17
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	3 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2
Trapezoidal Pond 1	

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.002	0.000	0.000	0.000
0.0333	0.002	0.000	0.000	0.001
0.0667	0.002	0.000	0.000	0.001
0.1000	0.002	0.000	0.000	0.001
0.1333	0.002	0.000	0.000	0.001
0.1667	0.002	0.000	0.000	0.001
0.2000	0.002	0.000	0.000	0.001
0.2333	0.002	0.000	0.000	0.001
0.2667	0.002	0.000	0.000	0.001
0.3000	0.002	0.000	0.000	0.001
0.3333	0.002	0.000	0.000	0.001
0.3667	0.002	0.000	0.000	0.001
0.4000	0.002	0.000	0.000	0.001
0.4333	0.002	0.000	0.000	0.001
0.4667	0.002	0.000	0.000	0.001
0.5000	0.002	0.000	0.000	0.001
0.5333	0.002	0.000	0.000	0.001
0.5667	0.002	0.000	0.000	0.001
0.6000	0.002	0.000	0.000	0.001
0.6333	0.002	0.000	0.000	0.001
0.6667	0.002	0.000	0.000	0.001
0.7000	0.002	0.000	0.000	0.001
0.7333	0.002	0.000	0.000	0.001
0.7667	0.002	0.000	0.000	0.001
0.8000	0.002	0.000	0.000	0.001

0.8333	0.002	0.000	0.000	0.001
0.8667	0.002	0.001	0.000	0.001
0.9000	0.002	0.001	0.000	0.001
0.9333	0.002	0.001	0.000	0.001
0.9667	0.002	0.001	0.000	0.001
1.0000	0.002	0.001	0.000	0.001
1.0333	0.002	0.001	0.000	0.001
1.0667	0.002	0.001	0.000	0.001
1.1000	0.002	0.001	0.000	0.001
1.1333	0.002	0.001	0.000	0.001
1.1667	0.002	0.001	0.000	0.001
1.2000	0.002	0.001	0.000	0.001
1.2333	0.002	0.001	0.000	0.001
1.2667	0.002	0.001	0.000	0.001
1.3000	0.002	0.001	0.000	0.001
1.3333	0.002	0.001	0.000	0.001
1.3667	0.002	0.001	0.000	0.001
1.4000	0.002	0.001	0.000	0.001
1.4333	0.002	0.001	0.000	0.001
1.4667	0.002	0.001	0.000	0.001
1.5000	0.002	0.001	0.000	0.001
1.5333	0.002	0.001	0.000	0.001
1.5667	0.002	0.001	0.000	0.001
1.6000	0.002	0.001	0.000	0.001
1.6333	0.002	0.001	0.000	0.001
1.6667	0.002	0.001	0.000	0.001
1.7000	0.002	0.001	0.000	0.001
1.7333	0.002	0.001	0.000	0.001
1.7667	0.002	0.001	0.000	0.001
1.8000	0.002	0.002	0.000	0.001
1.8333	0.002	0.002	0.000	0.001
1.8667	0.002	0.002	0.000	0.001
1.9000	0.002	0.002	0.000	0.001
1.9333	0.002	0.002	0.000	0.001
1.9667	0.002	0.002	0.000	0.001
2.0000	0.002	0.002	0.000	0.001
2.0333	0.002	0.002	0.000	0.001
2.0667	0.002	0.002	0.000	0.001
2.1000	0.002	0.002	0.000	0.001
2.1333	0.002	0.002	0.000	0.001
2.1667	0.002	0.002	0.000	0.001
2.2000	0.002	0.002	0.000	0.001
2.2333	0.002	0.002	0.000	0.001
2.2667	0.002	0.002	0.000	0.001
2.3000	0.002	0.002	0.000	0.001
2.3333	0.002	0.002	0.000	0.001
2.3667	0.002	0.002	0.000	0.001
2.4000	0.002	0.002	0.000	0.001
2.4333	0.002	0.002	0.000	0.001
2.4667	0.002	0.002	0.000	0.001
2.5000	0.002	0.002	0.000	0.001
2.5333	0.002	0.002	0.000	0.001
2.5667	0.002	0.002	0.000	0.001
2.6000	0.002	0.002	0.000	0.001
2.6333	0.002	0.002	0.000	0.001
2.6667	0.002	0.002	0.000	0.001
2.7000	0.002	0.003	0.000	0.001
2.7333	0.002	0.003	0.000	0.001

2.7667	0.002	0.003	0.000	0.001
2.8000	0.002	0.003	0.000	0.001
2.8333	0.002	0.003	0.000	0.001
2.8667	0.002	0.003	0.000	0.001
2.9000	0.002	0.003	0.000	0.001
2.9333	0.002	0.003	0.000	0.001
2.9667	0.002	0.003	0.000	0.001
3.0000	0.002	0.003	0.000	0.001

Trapezoidal Pond 1

Bottom Length:	30.00 ft.
Bottom Width:	20.00 ft.
Depth:	1 ft.
Volume at riser head:	0.0014 acre-feet.
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	0.516
Total Volume Through Riser (ac-ft.):	0.019
Total Volume Through Facility (ac-ft.):	0.535
Percent Infiltrated:	96.45
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Side slope 1:	0 To 1
Side slope 2:	0 To 1
Side slope 3:	0 To 1
Side slope 4:	0 To 1
Discharge Structure	
Riser Height:	0.1 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

Pond Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.013	0.000	0.000	0.000
0.0111	0.013	0.000	0.000	0.009
0.0222	0.013	0.000	0.000	0.009
0.0333	0.013	0.000	0.000	0.009
0.0444	0.013	0.000	0.000	0.009
0.0556	0.013	0.000	0.000	0.009
0.0667	0.013	0.000	0.000	0.009
0.0778	0.013	0.001	0.000	0.009
0.0889	0.013	0.001	0.000	0.009
0.1000	0.013	0.001	0.000	0.009
0.1111	0.013	0.001	0.010	0.009
0.1222	0.013	0.001	0.029	0.009
0.1333	0.013	0.001	0.053	0.009
0.1444	0.013	0.002	0.082	0.009
0.1556	0.013	0.002	0.115	0.009
0.1667	0.013	0.002	0.151	0.009
0.1778	0.013	0.002	0.190	0.009
0.1889	0.013	0.002	0.232	0.009
0.2000	0.013	0.002	0.276	0.009
0.2111	0.013	0.002	0.323	0.009
0.2222	0.013	0.003	0.371	0.009
0.2333	0.013	0.003	0.420	0.009
0.2444	0.013	0.003	0.471	0.009
0.2556	0.013	0.003	0.523	0.009
0.2667	0.013	0.003	0.575	0.009
0.2778	0.013	0.003	0.628	0.009
0.2889	0.013	0.004	0.680	0.009
0.3000	0.013	0.004	0.733	0.009

0.3111	0.013	0.004	0.784	0.009
0.3222	0.013	0.004	0.835	0.009
0.3333	0.013	0.004	0.885	0.009
0.3444	0.013	0.004	0.933	0.009
0.3556	0.013	0.004	0.980	0.009
0.3667	0.013	0.005	1.024	0.009
0.3778	0.013	0.005	1.067	0.009
0.3889	0.013	0.005	1.107	0.009
0.4000	0.013	0.005	1.145	0.009
0.4111	0.013	0.005	1.180	0.009
0.4222	0.013	0.005	1.212	0.009
0.4333	0.013	0.006	1.242	0.009
0.4444	0.013	0.006	1.269	0.009
0.4556	0.013	0.006	1.294	0.009
0.4667	0.013	0.006	1.316	0.009
0.4778	0.013	0.006	1.337	0.009
0.4889	0.013	0.006	1.355	0.009
0.5000	0.013	0.006	1.372	0.009
0.5111	0.013	0.007	1.388	0.009
0.5222	0.013	0.007	1.421	0.009
0.5333	0.013	0.007	1.439	0.009
0.5444	0.013	0.007	1.458	0.009
0.5556	0.013	0.007	1.476	0.009
0.5667	0.013	0.007	1.494	0.009
0.5778	0.013	0.008	1.511	0.009
0.5889	0.013	0.008	1.529	0.009
0.6000	0.013	0.008	1.546	0.009
0.6111	0.013	0.008	1.563	0.009
0.6222	0.013	0.008	1.580	0.009
0.6333	0.013	0.008	1.597	0.009
0.6444	0.013	0.008	1.613	0.009
0.6556	0.013	0.009	1.630	0.009
0.6667	0.013	0.009	1.646	0.009
0.6778	0.013	0.009	1.662	0.009
0.6889	0.013	0.009	1.678	0.009
0.7000	0.013	0.009	1.694	0.009
0.7111	0.013	0.009	1.709	0.009
0.7222	0.013	0.009	1.725	0.009
0.7333	0.013	0.010	1.740	0.009
0.7444	0.013	0.010	1.755	0.009
0.7556	0.013	0.010	1.770	0.009
0.7667	0.013	0.010	1.785	0.009
0.7778	0.013	0.010	1.800	0.009
0.7889	0.013	0.010	1.815	0.009
0.8000	0.013	0.011	1.830	0.009
0.8111	0.013	0.011	1.844	0.009
0.8222	0.013	0.011	1.858	0.009
0.8333	0.013	0.011	1.873	0.009
0.8444	0.013	0.011	1.887	0.009
0.8556	0.013	0.011	1.901	0.009
0.8667	0.013	0.011	1.915	0.009
0.8778	0.013	0.012	1.929	0.009
0.8889	0.013	0.012	1.942	0.009
0.9000	0.013	0.012	1.956	0.009
0.9111	0.013	0.012	1.969	0.009
0.9222	0.013	0.012	1.983	0.009
0.9333	0.013	0.012	1.996	0.009
0.9444	0.013	0.013	2.009	0.009

0.9556	0.013	0.013	2.023	0.009
0.9667	0.013	0.013	2.036	0.009
0.9778	0.013	0.013	2.049	0.009
0.9889	0.013	0.013	2.062	0.009
1.0000	0.013	0.013	2.075	0.009
1.0111	0.013	0.013	2.087	0.009

Dispersion Trench 5

Bottom Length:	40.00 ft.
Bottom Width:	3.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	3
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	10.81
Total Volume Through Riser (ac-ft.):	1.322
Total Volume Through Facility (ac-ft.):	12.131
Percent Infiltrated:	89.11
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	3 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2
Trapezoidal Pond 1	

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.002	0.000	0.000	0.000
0.0333	0.002	0.000	0.000	0.001
0.0667	0.002	0.000	0.000	0.001
0.1000	0.002	0.000	0.000	0.001
0.1333	0.002	0.000	0.000	0.001
0.1667	0.002	0.000	0.000	0.001
0.2000	0.002	0.000	0.000	0.001
0.2333	0.002	0.000	0.000	0.001
0.2667	0.002	0.000	0.000	0.001
0.3000	0.002	0.000	0.000	0.001
0.3333	0.002	0.000	0.000	0.001
0.3667	0.002	0.000	0.000	0.001
0.4000	0.002	0.000	0.000	0.001
0.4333	0.002	0.000	0.000	0.001
0.4667	0.002	0.000	0.000	0.001
0.5000	0.002	0.000	0.000	0.001
0.5333	0.002	0.000	0.000	0.001
0.5667	0.002	0.000	0.000	0.001
0.6000	0.002	0.000	0.000	0.001
0.6333	0.002	0.000	0.000	0.001
0.6667	0.002	0.000	0.000	0.001
0.7000	0.002	0.000	0.000	0.001
0.7333	0.002	0.000	0.000	0.001
0.7667	0.002	0.000	0.000	0.001
0.8000	0.002	0.000	0.000	0.001

0.8333	0.002	0.000	0.000	0.001
0.8667	0.002	0.001	0.000	0.001
0.9000	0.002	0.001	0.000	0.001
0.9333	0.002	0.001	0.000	0.001
0.9667	0.002	0.001	0.000	0.001
1.0000	0.002	0.001	0.000	0.001
1.0333	0.002	0.001	0.000	0.001
1.0667	0.002	0.001	0.000	0.001
1.1000	0.002	0.001	0.000	0.001
1.1333	0.002	0.001	0.000	0.001
1.1667	0.002	0.001	0.000	0.001
1.2000	0.002	0.001	0.000	0.001
1.2333	0.002	0.001	0.000	0.001
1.2667	0.002	0.001	0.000	0.001
1.3000	0.002	0.001	0.000	0.001
1.3333	0.002	0.001	0.000	0.001
1.3667	0.002	0.001	0.000	0.001
1.4000	0.002	0.001	0.000	0.001
1.4333	0.002	0.001	0.000	0.001
1.4667	0.002	0.001	0.000	0.001
1.5000	0.002	0.001	0.000	0.001
1.5333	0.002	0.001	0.000	0.001
1.5667	0.002	0.001	0.000	0.001
1.6000	0.002	0.001	0.000	0.001
1.6333	0.002	0.001	0.000	0.001
1.6667	0.002	0.001	0.000	0.001
1.7000	0.002	0.001	0.000	0.001
1.7333	0.002	0.001	0.000	0.001
1.7667	0.002	0.001	0.000	0.001
1.8000	0.002	0.002	0.000	0.001
1.8333	0.002	0.002	0.000	0.001
1.8667	0.002	0.002	0.000	0.001
1.9000	0.002	0.002	0.000	0.001
1.9333	0.002	0.002	0.000	0.001
1.9667	0.002	0.002	0.000	0.001
2.0000	0.002	0.002	0.000	0.001
2.0333	0.002	0.002	0.000	0.001
2.0667	0.002	0.002	0.000	0.001
2.1000	0.002	0.002	0.000	0.001
2.1333	0.002	0.002	0.000	0.001
2.1667	0.002	0.002	0.000	0.001
2.2000	0.002	0.002	0.000	0.001
2.2333	0.002	0.002	0.000	0.001
2.2667	0.002	0.002	0.000	0.001
2.3000	0.002	0.002	0.000	0.001
2.3333	0.002	0.002	0.000	0.001
2.3667	0.002	0.002	0.000	0.001
2.4000	0.002	0.002	0.000	0.001
2.4333	0.002	0.002	0.000	0.001
2.4667	0.002	0.002	0.000	0.001
2.5000	0.002	0.002	0.000	0.001
2.5333	0.002	0.002	0.000	0.001
2.5667	0.002	0.002	0.000	0.001
2.6000	0.002	0.002	0.000	0.001
2.6333	0.002	0.002	0.000	0.001
2.6667	0.002	0.002	0.000	0.001
2.7000	0.002	0.003	0.000	0.001
2.7333	0.002	0.003	0.000	0.001

2.7667	0.002	0.003	0.000	0.001
2.8000	0.002	0.003	0.000	0.001
2.8333	0.002	0.003	0.000	0.001
2.8667	0.002	0.003	0.000	0.001
2.9000	0.002	0.003	0.000	0.001
2.9333	0.002	0.003	0.000	0.001
2.9667	0.002	0.003	0.000	0.001
3.0000	0.002	0.003	0.000	0.001

Trapezoidal Pond 1

Bottom Length:	30.00 ft.
Bottom Width:	20.00 ft.
Depth:	1 ft.
Volume at riser head:	0.0014 acre-feet.
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	1.24
Total Volume Through Riser (ac-ft.):	0.081
Total Volume Through Facility (ac-ft.):	1.321
Percent Infiltrated:	93.87
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Side slope 1:	0 To 1
Side slope 2:	0 To 1
Side slope 3:	0 To 1
Side slope 4:	0 To 1
Discharge Structure	
Riser Height:	0.1 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

Pond Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.013	0.000	0.000	0.000
0.0111	0.013	0.000	0.000	0.009
0.0222	0.013	0.000	0.000	0.009
0.0333	0.013	0.000	0.000	0.009
0.0444	0.013	0.000	0.000	0.009
0.0556	0.013	0.000	0.000	0.009
0.0667	0.013	0.000	0.000	0.009
0.0778	0.013	0.001	0.000	0.009
0.0889	0.013	0.001	0.000	0.009
0.1000	0.013	0.001	0.000	0.009
0.1111	0.013	0.001	0.010	0.009
0.1222	0.013	0.001	0.029	0.009
0.1333	0.013	0.001	0.053	0.009
0.1444	0.013	0.002	0.082	0.009
0.1556	0.013	0.002	0.115	0.009
0.1667	0.013	0.002	0.151	0.009
0.1778	0.013	0.002	0.190	0.009
0.1889	0.013	0.002	0.232	0.009
0.2000	0.013	0.002	0.276	0.009
0.2111	0.013	0.002	0.323	0.009
0.2222	0.013	0.003	0.371	0.009
0.2333	0.013	0.003	0.420	0.009
0.2444	0.013	0.003	0.471	0.009
0.2556	0.013	0.003	0.523	0.009
0.2667	0.013	0.003	0.575	0.009
0.2778	0.013	0.003	0.628	0.009
0.2889	0.013	0.004	0.680	0.009
0.3000	0.013	0.004	0.733	0.009

0.3111	0.013	0.004	0.784	0.009
0.3222	0.013	0.004	0.835	0.009
0.3333	0.013	0.004	0.885	0.009
0.3444	0.013	0.004	0.933	0.009
0.3556	0.013	0.004	0.980	0.009
0.3667	0.013	0.005	1.024	0.009
0.3778	0.013	0.005	1.067	0.009
0.3889	0.013	0.005	1.107	0.009
0.4000	0.013	0.005	1.145	0.009
0.4111	0.013	0.005	1.180	0.009
0.4222	0.013	0.005	1.212	0.009
0.4333	0.013	0.006	1.242	0.009
0.4444	0.013	0.006	1.269	0.009
0.4556	0.013	0.006	1.294	0.009
0.4667	0.013	0.006	1.316	0.009
0.4778	0.013	0.006	1.337	0.009
0.4889	0.013	0.006	1.355	0.009
0.5000	0.013	0.006	1.372	0.009
0.5111	0.013	0.007	1.388	0.009
0.5222	0.013	0.007	1.421	0.009
0.5333	0.013	0.007	1.439	0.009
0.5444	0.013	0.007	1.458	0.009
0.5556	0.013	0.007	1.476	0.009
0.5667	0.013	0.007	1.494	0.009
0.5778	0.013	0.008	1.511	0.009
0.5889	0.013	0.008	1.529	0.009
0.6000	0.013	0.008	1.546	0.009
0.6111	0.013	0.008	1.563	0.009
0.6222	0.013	0.008	1.580	0.009
0.6333	0.013	0.008	1.597	0.009
0.6444	0.013	0.008	1.613	0.009
0.6556	0.013	0.009	1.630	0.009
0.6667	0.013	0.009	1.646	0.009
0.6778	0.013	0.009	1.662	0.009
0.6889	0.013	0.009	1.678	0.009
0.7000	0.013	0.009	1.694	0.009
0.7111	0.013	0.009	1.709	0.009
0.7222	0.013	0.009	1.725	0.009
0.7333	0.013	0.010	1.740	0.009
0.7444	0.013	0.010	1.755	0.009
0.7556	0.013	0.010	1.770	0.009
0.7667	0.013	0.010	1.785	0.009
0.7778	0.013	0.010	1.800	0.009
0.7889	0.013	0.010	1.815	0.009
0.8000	0.013	0.011	1.830	0.009
0.8111	0.013	0.011	1.844	0.009
0.8222	0.013	0.011	1.858	0.009
0.8333	0.013	0.011	1.873	0.009
0.8444	0.013	0.011	1.887	0.009
0.8556	0.013	0.011	1.901	0.009
0.8667	0.013	0.011	1.915	0.009
0.8778	0.013	0.012	1.929	0.009
0.8889	0.013	0.012	1.942	0.009
0.9000	0.013	0.012	1.956	0.009
0.9111	0.013	0.012	1.969	0.009
0.9222	0.013	0.012	1.983	0.009
0.9333	0.013	0.012	1.996	0.009
0.9444	0.013	0.013	2.009	0.009

0.9556	0.013	0.013	2.023	0.009
0.9667	0.013	0.013	2.036	0.009
0.9778	0.013	0.013	2.049	0.009
0.9889	0.013	0.013	2.062	0.009
1.0000	0.013	0.013	2.075	0.009
1.0111	0.013	0.013	2.087	0.009

Channel 1

Bottom Length:	170.00 ft.
Bottom Width:	10.00 ft.
Manning's n:	0.25
Channel bottom slope 1:	0.005 To 1
Channel Left side slope 0:	3 To 1
Channel right side slope 2:	4 To 1
Infiltration On	
Infiltration rate:	2
Infiltration safety factor:	0.33
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	16.866
Total Volume Through Riser (ac-ft.):	5.034
Total Volume Through Facility (ac-ft.):	21.9
Percent Infiltrated:	77.01
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

Channel Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.039	0.000	0.000	0.000
0.0222	0.039	0.000	0.007	0.026
0.0444	0.040	0.001	0.023	0.026
0.0667	0.040	0.002	0.046	0.027
0.0889	0.041	0.003	0.075	0.027
0.1111	0.042	0.004	0.109	0.028
0.1333	0.042	0.005	0.148	0.028
0.1556	0.043	0.006	0.192	0.028
0.1778	0.043	0.007	0.241	0.029
0.2000	0.044	0.008	0.294	0.029
0.2222	0.045	0.009	0.352	0.030
0.2444	0.045	0.010	0.414	0.030
0.2667	0.046	0.011	0.480	0.030
0.2889	0.046	0.012	0.550	0.031
0.3111	0.047	0.013	0.624	0.031
0.3333	0.048	0.014	0.702	0.032
0.3556	0.048	0.015	0.784	0.032
0.3778	0.049	0.016	0.870	0.032
0.4000	0.050	0.017	0.960	0.033
0.4222	0.050	0.018	1.053	0.033
0.4444	0.051	0.020	1.151	0.034
0.4667	0.051	0.021	1.252	0.034
0.4889	0.052	0.022	1.357	0.034
0.5111	0.053	0.023	1.466	0.035
0.5333	0.053	0.024	1.579	0.035
0.5556	0.054	0.025	1.696	0.036
0.5778	0.054	0.027	1.816	0.036
0.6000	0.055	0.028	1.940	0.036
0.6222	0.056	0.029	2.068	0.037
0.6444	0.056	0.030	2.200	0.037

0.6667	0.057	0.032	2.335	0.038
0.6889	0.057	0.033	2.475	0.038
0.7111	0.058	0.034	2.618	0.038
0.7333	0.059	0.036	2.764	0.039
0.7556	0.059	0.037	2.915	0.039
0.7778	0.060	0.038	3.069	0.040
0.8000	0.060	0.040	3.228	0.040
0.8222	0.061	0.041	3.390	0.040
0.8444	0.062	0.042	3.556	0.041
0.8667	0.062	0.044	3.725	0.041
0.8889	0.063	0.045	3.899	0.042
0.9111	0.063	0.046	4.076	0.042
0.9333	0.064	0.048	4.257	0.042
0.9556	0.065	0.049	4.443	0.043
0.9778	0.065	0.051	4.632	0.043
1.0000	0.066	0.052	4.825	0.044
1.0222	0.067	0.054	5.021	0.044
1.0444	0.067	0.055	5.222	0.045
1.0667	0.068	0.057	5.427	0.045
1.0889	0.068	0.058	5.636	0.045
1.1111	0.069	0.060	5.848	0.046
1.1333	0.070	0.061	6.065	0.046
1.1556	0.070	0.063	6.286	0.047
1.1778	0.071	0.064	6.510	0.047
1.2000	0.071	0.066	6.739	0.047
1.2222	0.072	0.068	6.972	0.048
1.2444	0.073	0.069	7.209	0.048
1.2667	0.073	0.071	7.450	0.049
1.2889	0.074	0.073	7.694	0.049
1.3111	0.074	0.074	7.944	0.049
1.3333	0.075	0.076	8.197	0.050
1.3556	0.076	0.078	8.454	0.050
1.3778	0.076	0.079	8.716	0.051
1.4000	0.077	0.081	8.981	0.051
1.4222	0.077	0.083	9.251	0.051
1.4444	0.078	0.084	9.525	0.052
1.4667	0.079	0.086	9.803	0.052
1.4889	0.079	0.088	10.08	0.053
1.5111	0.080	0.090	10.37	0.053
1.5333	0.080	0.092	10.66	0.053
1.5556	0.081	0.093	10.96	0.054
1.5778	0.082	0.095	11.25	0.054
1.6000	0.082	0.097	11.56	0.055
1.6222	0.083	0.099	11.87	0.055
1.6444	0.084	0.101	12.18	0.055
1.6667	0.084	0.103	12.50	0.056
1.6889	0.085	0.104	12.82	0.056
1.7111	0.085	0.106	13.14	0.057
1.7333	0.086	0.108	13.47	0.057
1.7556	0.087	0.110	13.81	0.057
1.7778	0.087	0.112	14.15	0.058
1.8000	0.088	0.114	14.49	0.058
1.8222	0.088	0.116	14.84	0.059
1.8444	0.089	0.118	15.19	0.059
1.8667	0.090	0.120	15.55	0.059
1.8889	0.090	0.122	15.91	0.060
1.9111	0.091	0.124	16.28	0.060
1.9333	0.091	0.126	16.65	0.061

1.9556	0.092	0.128	17.02	0.061
1.9778	0.093	0.130	17.40	0.061
2.0000	0.093	0.132	17.79	0.062
2.0222	0.094	0.134	18.18	0.062

Bioretention Swale

Bottom Length: 140.00 ft.
Bottom Width: 15.00 ft.
Depth: 2 ft.
Volume at riser head: 0.0867 acre-feet.
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 0.33
Wetted surface area On
Total Volume Infiltrated (ac-ft.): 40.066
Total Volume Through Riser (ac-ft.): 21.912
Total Volume Through Facility (ac-ft.): 61.978
Percent Infiltrated: 64.65
Total Precip Applied to Facility: 9.619
Total Evap From Facility: 0.876
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 0 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 1.5 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 2.000 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2
Channel 1

Pond Hydraulic Table

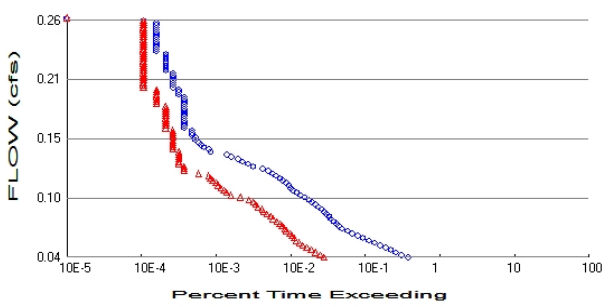
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.048	0.000	0.000	0.000
0.0222	0.048	0.001	0.016	0.032
0.0444	0.048	0.002	0.022	0.032
0.0667	0.049	0.003	0.028	0.032
0.0889	0.049	0.004	0.032	0.032
0.1111	0.049	0.005	0.036	0.033
0.1333	0.049	0.006	0.039	0.033
0.1556	0.050	0.007	0.042	0.033
0.1778	0.050	0.008	0.045	0.033
0.2000	0.050	0.009	0.048	0.033
0.2222	0.050	0.011	0.051	0.033
0.2444	0.051	0.012	0.053	0.034
0.2667	0.051	0.013	0.056	0.034
0.2889	0.051	0.014	0.058	0.034
0.3111	0.051	0.015	0.060	0.034
0.3333	0.052	0.016	0.062	0.034
0.3556	0.052	0.017	0.064	0.034
0.3778	0.052	0.019	0.066	0.035
0.4000	0.053	0.020	0.068	0.035
0.4222	0.053	0.021	0.070	0.035
0.4444	0.053	0.022	0.072	0.035
0.4667	0.053	0.023	0.074	0.035
0.4889	0.054	0.025	0.075	0.036
0.5111	0.054	0.026	0.077	0.036
0.5333	0.054	0.027	0.079	0.036
0.5556	0.054	0.028	0.080	0.036
0.5778	0.055	0.029	0.082	0.036

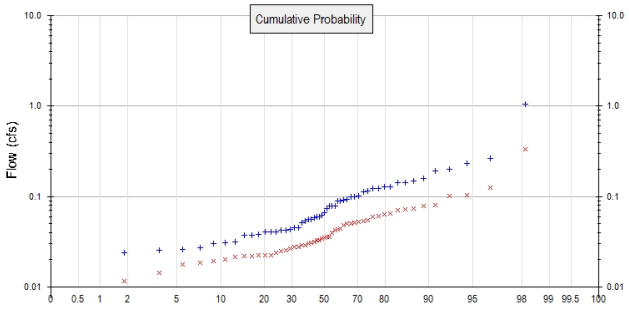
0.6000	0.055	0.031	0.084	0.036
0.6222	0.055	0.032	0.085	0.037
0.6444	0.055	0.033	0.087	0.037
0.6667	0.056	0.034	0.088	0.037
0.6889	0.056	0.036	0.090	0.037
0.7111	0.056	0.037	0.091	0.037
0.7333	0.057	0.038	0.093	0.037
0.7556	0.057	0.039	0.094	0.038
0.7778	0.057	0.041	0.095	0.038
0.8000	0.057	0.042	0.097	0.038
0.8222	0.058	0.043	0.098	0.038
0.8444	0.058	0.045	0.099	0.038
0.8667	0.058	0.046	0.101	0.039
0.8889	0.058	0.047	0.102	0.039
0.9111	0.059	0.048	0.103	0.039
0.9333	0.059	0.050	0.104	0.039
0.9556	0.059	0.051	0.106	0.039
0.9778	0.060	0.052	0.107	0.040
1.0000	0.060	0.054	0.108	0.040
1.0222	0.060	0.055	0.109	0.040
1.0444	0.060	0.056	0.110	0.040
1.0667	0.061	0.058	0.112	0.040
1.0889	0.061	0.059	0.113	0.040
1.1111	0.061	0.061	0.114	0.041
1.1333	0.062	0.062	0.115	0.041
1.1556	0.062	0.063	0.116	0.041
1.1778	0.062	0.065	0.117	0.041
1.2000	0.062	0.066	0.118	0.041
1.2222	0.063	0.067	0.120	0.042
1.2444	0.063	0.069	0.121	0.042
1.2667	0.063	0.070	0.122	0.042
1.2889	0.064	0.072	0.123	0.042
1.3111	0.064	0.073	0.124	0.042
1.3333	0.064	0.075	0.125	0.043
1.3556	0.064	0.076	0.126	0.043
1.3778	0.065	0.077	0.127	0.043
1.4000	0.065	0.079	0.128	0.043
1.4222	0.065	0.080	0.129	0.043
1.4444	0.066	0.082	0.130	0.043
1.4667	0.066	0.083	0.131	0.044
1.4889	0.066	0.085	0.132	0.044
1.5111	0.066	0.086	0.145	0.044
1.5333	0.067	0.088	0.199	0.044
1.5556	0.067	0.089	0.274	0.044
1.5778	0.067	0.091	0.365	0.045
1.6000	0.068	0.092	0.470	0.045
1.6222	0.068	0.094	0.586	0.045
1.6444	0.068	0.095	0.711	0.045
1.6667	0.068	0.097	0.843	0.045
1.6889	0.069	0.098	0.979	0.046
1.7111	0.069	0.100	1.118	0.046
1.7333	0.069	0.101	1.257	0.046
1.7556	0.070	0.103	1.395	0.046
1.7778	0.070	0.105	1.528	0.046
1.8000	0.070	0.106	1.655	0.047
1.8222	0.070	0.108	1.774	0.047
1.8444	0.071	0.109	1.884	0.047
1.8667	0.071	0.111	1.982	0.047

1.8889	0.071	0.112	2.070	0.047
1.9111	0.072	0.114	2.146	0.048
1.9333	0.072	0.116	2.211	0.048
1.9556	0.072	0.117	2.266	0.048
1.9778	0.073	0.119	2.313	0.048
2.0000	0.073	0.120	2.356	0.048
2.0222	0.073	0.122	2.430	0.049

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.27
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 1.215

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.078181
5 year	0.146463
10 year	0.188433
25 year	0.234208
50 year	0.262768
100 year	0.286967

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.036052
5 year	0.063417
10 year	0.087338
25 year	0.125256
50 year	0.159818
100 year	0.200441

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.123	0.078
1957	0.129	0.065
1958	0.124	0.063
1959	0.058	0.044
1960	0.129	0.072
1961	0.113	0.043
1962	0.191	0.061
1963	0.148	0.125
1964	0.079	0.042
1965	0.056	0.024

1966	0.038	0.020
1967	0.041	0.027
1968	0.027	0.030
1969	0.045	0.019
1970	0.041	0.022
1971	0.100	0.025
1972	0.073	0.035
1973	0.059	0.033
1974	0.078	0.035
1975	0.232	0.054
1976	0.143	0.022
1977	0.037	0.019
1978	0.198	0.103
1979	0.052	0.031
1980	0.042	0.029
1981	0.045	0.028
1982	0.090	0.036
1983	0.055	0.050
1984	0.090	0.029
1985	0.026	0.031
1986	0.160	0.101
1987	0.059	0.051
1988	0.043	0.025
1989	0.024	0.014
1990	0.101	0.048
1991	0.062	0.022
1992	0.030	0.022
1993	0.037	0.023
1994	0.031	0.018
1995	0.099	0.040
1996	0.141	0.074
1997	0.054	0.033
1998	0.115	0.081
1999	0.040	0.022
2000	0.042	0.035
2001	0.001	0.008
2002	0.261	0.055
2003	0.026	0.050
2004	0.031	0.012
2005	1.043	0.332
2006	0.067	0.028
2007	0.079	0.060
2008	0.092	0.053
2009	0.094	0.070

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.0427	0.3321
2	0.2615	0.1250
3	0.2324	0.1027
4	0.1983	0.1013
5	0.1911	0.0807
6	0.1600	0.0778
7	0.1475	0.0744
8	0.1434	0.0720
9	0.1412	0.0703
10	0.1294	0.0653

11	0.1291	0.0630
12	0.1238	0.0609
13	0.1226	0.0596
14	0.1147	0.0550
15	0.1134	0.0536
16	0.1010	0.0526
17	0.0995	0.0512
18	0.0985	0.0503
19	0.0936	0.0498
20	0.0916	0.0480
21	0.0899	0.0441
22	0.0898	0.0434
23	0.0790	0.0421
24	0.0789	0.0399
25	0.0777	0.0355
26	0.0731	0.0355
27	0.0665	0.0349
28	0.0619	0.0346
29	0.0595	0.0327
30	0.0592	0.0327
31	0.0583	0.0315
32	0.0562	0.0306
33	0.0554	0.0302
34	0.0535	0.0291
35	0.0518	0.0286
36	0.0452	0.0278
37	0.0449	0.0277
38	0.0434	0.0266
39	0.0425	0.0255
40	0.0423	0.0250
41	0.0409	0.0237
42	0.0406	0.0225
43	0.0404	0.0223
44	0.0385	0.0223
45	0.0374	0.0221
46	0.0370	0.0220
47	0.0311	0.0216
48	0.0309	0.0200
49	0.0303	0.0193
50	0.0269	0.0186
51	0.0261	0.0178
52	0.0257	0.0143
53	0.0239	0.0116
54	0.0011	0.0084

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0391	7059	527	7	Pass
0.0413	5802	471	8	Pass
0.0436	4866	403	8	Pass
0.0459	4162	357	8	Pass
0.0481	3518	310	8	Pass
0.0504	2967	275	9	Pass
0.0526	2509	248	9	Pass
0.0549	2092	223	10	Pass
0.0572	1753	209	11	Pass
0.0594	1486	197	13	Pass
0.0617	1264	185	14	Pass
0.0639	1086	166	15	Pass
0.0662	917	157	17	Pass
0.0685	825	146	17	Pass
0.0707	773	136	17	Pass
0.0730	712	124	17	Pass
0.0752	660	110	16	Pass
0.0775	617	102	16	Pass
0.0798	566	91	16	Pass
0.0820	527	82	15	Pass
0.0843	490	79	16	Pass
0.0865	447	69	15	Pass
0.0888	399	64	16	Pass
0.0911	361	60	16	Pass
0.0933	331	52	15	Pass
0.0956	290	40	13	Pass
0.0978	259	30	11	Pass
0.1001	228	26	11	Pass
0.1024	203	24	11	Pass
0.1046	190	22	11	Pass
0.1069	179	20	11	Pass
0.1091	163	19	11	Pass
0.1114	148	17	11	Pass
0.1136	135	16	11	Pass
0.1159	121	15	12	Pass
0.1182	108	11	10	Pass
0.1204	94	7	7	Pass
0.1227	79	7	8	Pass
0.1249	59	7	11	Pass
0.1272	51	6	11	Pass
0.1295	43	6	13	Pass
0.1317	37	6	16	Pass
0.1340	30	6	20	Pass
0.1362	26	6	23	Pass
0.1385	16	6	37	Pass
0.1408	15	5	33	Pass
0.1430	13	5	38	Pass
0.1453	12	5	41	Pass
0.1475	11	5	45	Pass
0.1498	10	5	50	Pass
0.1521	10	5	50	Pass
0.1543	9	5	55	Pass
0.1566	9	5	55	Pass

0.1588	9	5	55	Pass
0.1611	7	4	57	Pass
0.1634	7	4	57	Pass
0.1656	7	4	57	Pass
0.1679	7	4	57	Pass
0.1701	7	4	57	Pass
0.1724	7	4	57	Pass
0.1747	7	4	57	Pass
0.1769	7	4	57	Pass
0.1792	7	4	57	Pass
0.1814	7	4	57	Pass
0.1837	7	3	42	Pass
0.1859	7	3	42	Pass
0.1882	7	3	42	Pass
0.1905	7	3	42	Pass
0.1927	6	3	50	Pass
0.1950	6	3	50	Pass
0.1972	6	3	50	Pass
0.1995	5	2	40	Pass
0.2018	5	2	40	Pass
0.2040	5	2	40	Pass
0.2063	5	2	40	Pass
0.2085	5	2	40	Pass
0.2108	5	2	40	Pass
0.2131	5	2	40	Pass
0.2153	4	2	50	Pass
0.2176	4	2	50	Pass
0.2198	4	2	50	Pass
0.2221	4	2	50	Pass
0.2244	4	2	50	Pass
0.2266	4	2	50	Pass
0.2289	4	2	50	Pass
0.2311	4	2	50	Pass
0.2334	3	2	66	Pass
0.2357	3	2	66	Pass
0.2379	3	2	66	Pass
0.2402	3	2	66	Pass
0.2424	3	2	66	Pass
0.2447	3	2	66	Pass
0.2470	3	2	66	Pass
0.2492	3	2	66	Pass
0.2515	3	2	66	Pass
0.2537	3	2	66	Pass
0.2560	3	2	66	Pass
0.2582	3	2	66	Pass
0.2605	3	2	66	Pass
0.2628	2	2	100	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
retention 1 POC	☑	32.98	36.24	36.24	☑	100.00	36.24	100.00	Treat. Credit
retention 2	☑	30.28	33.27	33.27	☑	100.00	33.27	100.00	Treat. Credit
retention 4	☑	50.69	55.70	55.57	☑	99.76	55.57	99.76	Treat. Credit
Storage Bed POC	☐	36.35			☐	78.42			
Trapezoidal Pond 1 POC	☐	0.49			☐	96.37			
Dispersion Trench 4	☐	8.36			☐	94.17			
Trapezoidal Pond 1 POC	☐	1.20			☐	93.84			
Dispersion Trench 5	☐	11.04			☐	89.11			
Channel 1 POC	☐	19.93			☐	77.01			
Bioretention Swale	☑	56.40	61.98	40.07	☐	64.65	40.07	64.65	
Total Volume Infiltrated		247.71	187.19	165.15		86.17	165.15	165 / 187 = 88%	Treat. Credit = 88%
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.

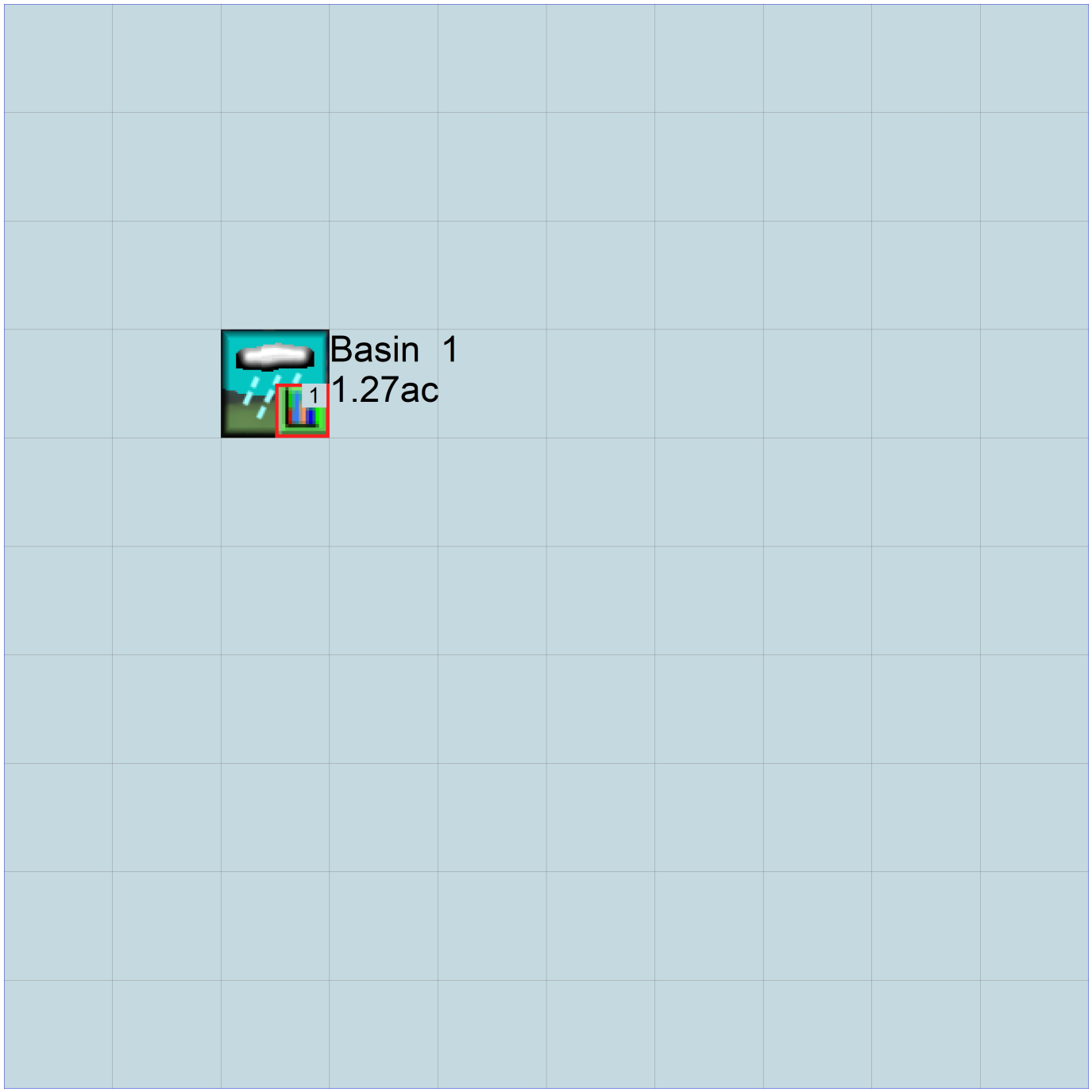
PERLND Changes

No PERLND changes have been made.

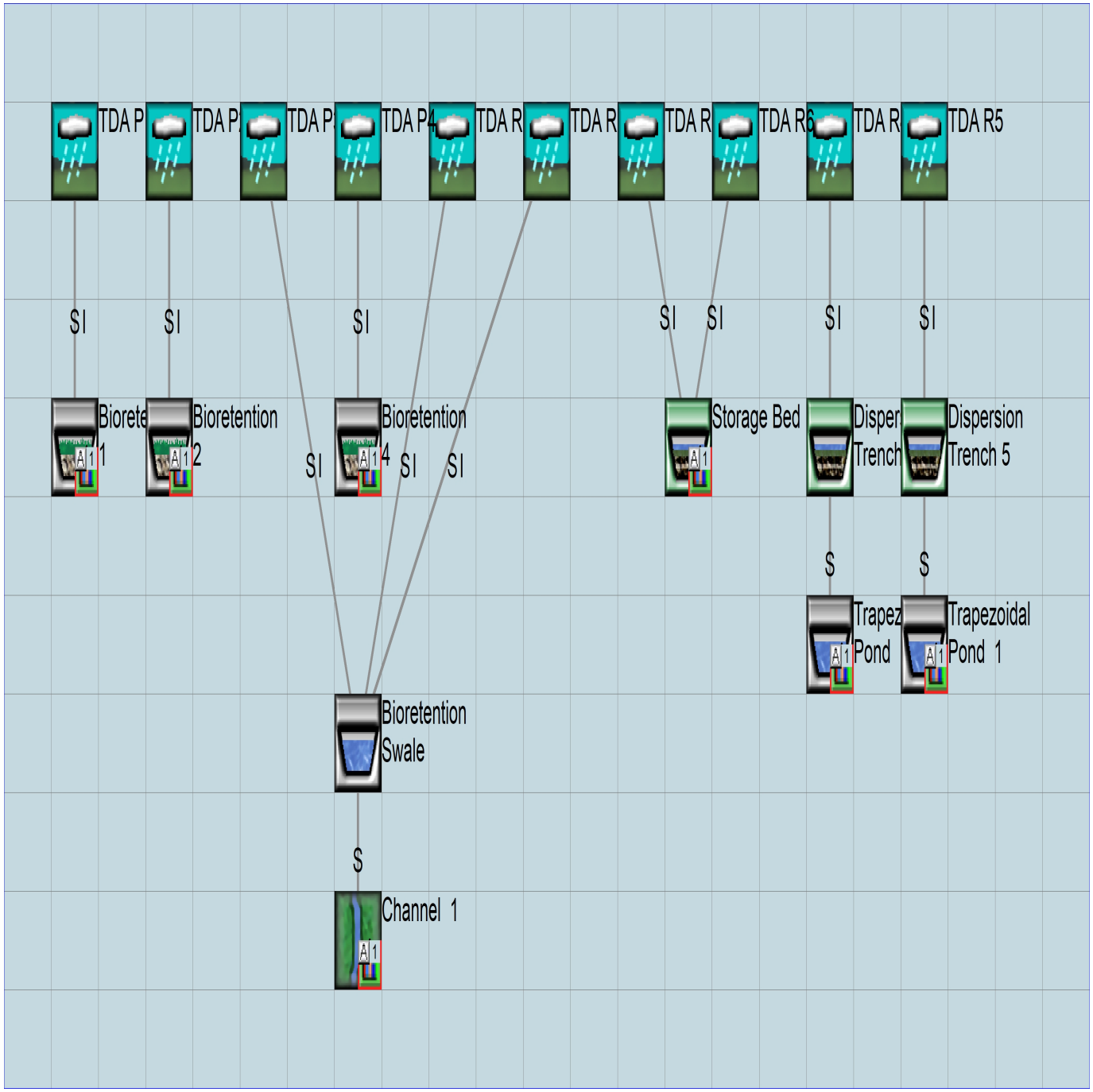
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2009 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   Kelso.wdm
MESSU       25   PreKelso.MES
            27   PreKelso.L61
            28   PreKelso.L62
            30   POCKelso1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   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           ***
   10     C, Forest, 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 ***
   10         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  *********
   10         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 ***
   10         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
   10              0       4.5      0.08       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
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10           0.2       0.5      0.35         6       0.5       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
   10             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           ***
  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#   ***
Basin  1***
PERLND  10                       1.27     COPY   501     12
PERLND  10                       1.27     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    1.143          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.143          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    2009 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   Kelso.wdm
MESSU       25   MitKelso.MES
            27   MitKelso.L61
            28   MitKelso.L62
            30   POCKelso1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       5
      IMPLND       4
      RCHRES       1
      RCHRES       2
      RCHRES       3
      RCHRES       4
      RCHRES       5
      RCHRES       6
      RCHRES       7
      RCHRES       8
      RCHRES       9
      RCHRES      10
      RCHRES      11
      RCHRES      12
      RCHRES      13
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface retention  1        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           ***
  END GEN-INFO
```

```
  *** Section PWATER***

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

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

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    5      DRIVEWAYS/FLAT         1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    5         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    5         0    0    4    0    0    4    1    9
    4         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     ***
    5         0    0    0    0    0
    4         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    5            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    5              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    5              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
TDA P1***
IMPLND   5                       0.164     RCHRES   1      5
TDA R1***
IMPLND   4                       0.081     RCHRES  12      5
TDA P2***
IMPLND   5                       0.153     RCHRES   3      5
TDA P3***
IMPLND   5                       0.146     RCHRES  12      5
TDA P4***
IMPLND   5                       0.276     RCHRES   5      5
TDA R2***
IMPLND   4                       0.062     RCHRES  12      5
TDA R3***
IMPLND   4                       0.117     RCHRES   9      5
TDA R4***
IMPLND   4                        0.05     RCHRES   7      5
TDA R5***
IMPLND   4                       0.066     RCHRES   8      5
TDA R6***
IMPLND   4                         0.1     RCHRES   9      5

******Routing******
IMPLND   5                       0.164     COPY     1     15
RCHRES   1                           1     RCHRES   2      8
RCHRES   3                           1     RCHRES   4      8
RCHRES   3                                 COPY     1     18
RCHRES   5                           1     RCHRES   6      8
RCHRES   5                                 COPY     1     18
IMPLND   4                       0.117     COPY     1     15
RCHRES   7                           1     RCHRES  10      7
RCHRES   7                                 COPY     1     17
RCHRES   8                           1     RCHRES  11      7
RCHRES   8                                 COPY     1     17
IMPLND   4                         0.1     COPY     1     15
RCHRES  12                           1     RCHRES  13      7
RCHRES  12                                 COPY     1     17
RCHRES   2                           1     COPY   501     17
RCHRES   1                           1     COPY   501     17
RCHRES   4                           1     COPY   501     17
RCHRES   6                           1     COPY   501     17
RCHRES   9                           1     COPY   501     17
RCHRES  10                           1     COPY   501     17
RCHRES  11                           1     COPY   501     17
RCHRES  13                           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     Surface retentio-008    3    1    1    1   28    0    1
    2     Bioretention  1         2    1    1    1   28    0    1
    3     Surface retentio-012    3    1    1    1   28    0    1
    4     Bioretention  2         2    1    1    1   28    0    1
    5     Surface retentio-018    3    1    1    1   28    0    1
    6     Bioretention  4         2    1    1    1   28    0    1
    7     Dispersion Trenc-026    2    1    1    1   28    0    1
    8     Dispersion Trenc-029    2    1    1    1   28    0    1
    9     Storage Bed             2    1    1    1   28    0    1
   10     Trapezoidal Pond-027    2    1    1    1   28    0    1
   11     Trapezoidal Pond-030    2    1    1    1   28    0    1
   12     Bioretention Swa-035    2    1    1    1   28    0    1
   13     Channel  1              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
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
    5         1    0    0    0    0    0    0    0    0    0
    6         1    0    0    0    0    0    0    0    0    0
    7         1    0    0    0    0    0    0    0    0    0
    8         1    0    0    0    0    0    0    0    0    0
    9         1    0    0    0    0    0    0    0    0    0
   10         1    0    0    0    0    0    0    0    0    0
   11         1    0    0    0    0    0    0    0    0    0
   12         1    0    0    0    0    0    0    0    0    0
   13         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
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
    4         4    0    0    0    0    0    0    0    0    0    1    9
    5         4    0    0    0    0    0    0    0    0    0    1    9
    6         4    0    0    0    0    0    0    0    0    0    1    9
    7         4    0    0    0    0    0    0    0    0    0    1    9
    8         4    0    0    0    0    0    0    0    0    0    1    9
    9         4    0    0    0    0    0    0    0    0    0    1    9
   10         4    0    0    0    0    0    0    0    0    0    1    9
   11         4    0    0    0    0    0    0    0    0    0    1    9
   12         4    0    0    0    0    0    0    0    0    0    1    9
   13         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  6  0  0       0  0  0  0  0        2  2  2  2  2
    2       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    3       0  1  0  0    4  5  6  0  0       0  0  0  0  0        2  2  2  2  2
    4       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    5       0  1  0  0    4  5  6  0  0       0  0  0  0  0        2  2  2  2  2
    6       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    7       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    8       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    9       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
   10       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
   11       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
   12       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
   13       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       0.0       0.0
    2              2      0.01       0.0       0.0       0.0       0.0
    3              3      0.01       0.0       0.0       0.0       0.0
    4              4      0.01       0.0       0.0       0.0       0.0
    5              5      0.01       0.0       0.0       0.0       0.0
    6              6      0.01       0.0       0.0       0.0       0.0
    7              7      0.01       0.0       0.0       0.5       0.0
    8              8      0.01       0.0       0.0       0.5       0.0
    9              9      0.02       0.0       0.0       0.5       0.0
   10             10      0.01       0.0       0.0       0.5       0.0
   11             11      0.01       0.0       0.0       0.5       0.0
   12             12      0.03       0.0       0.0       0.5       0.0
   13             13      0.03       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  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    5            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    6            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    7            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    8            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    9            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
   10         0            4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
   11         0            4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
   12         0            4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
   13         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      2
   47    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.054000  0.000000  0.000000  0.000000
  0.032967  0.054000  0.000814  0.000000  0.000000
  0.065934  0.054000  0.001628  0.000000  0.000000
  0.098901  0.054000  0.002442  0.000000  0.000000
  0.131868  0.054000  0.003256  0.000000  0.000004
```

```
  0.164835  0.054000  0.004070  0.000000  0.000700
  0.197802  0.054000  0.004885  0.000000  0.001092
  0.230769  0.054000  0.005699  0.000000  0.001591
  0.263736  0.054000  0.006513  0.000000  0.002207
  0.296703  0.054000  0.007327  0.000000  0.002946
  0.329670  0.054000  0.008141  0.000000  0.003817
  0.362637  0.054000  0.008955  0.000000  0.004825
  0.395604  0.054000  0.009769  0.000000  0.005977
  0.428571  0.054000  0.010583  0.000000  0.007280
  0.461538  0.054000  0.011397  0.000000  0.008740
  0.494505  0.054000  0.012211  0.000000  0.010362
  0.527473  0.054000  0.013026  0.000000  0.012152
  0.560440  0.054000  0.013840  0.000000  0.014115
  0.593407  0.054000  0.014654  0.000000  0.016258
  0.626374  0.054000  0.015468  0.000000  0.018584
  0.659341  0.054000  0.016282  0.000000  0.021098
  0.692308  0.054000  0.017096  0.000000  0.023806
  0.725275  0.054000  0.017910  0.000000  0.026713
  0.758242  0.054000  0.018724  0.000000  0.029822
  0.791209  0.054000  0.019538  0.000000  0.033139
  0.824176  0.054000  0.020352  0.000000  0.035937
  0.857143  0.054000  0.021167  0.000000  0.035937
  0.890110  0.054000  0.021981  0.000000  0.035937
  0.923077  0.054000  0.022795  0.000000  0.035937
  0.956044  0.054000  0.023609  0.000000  0.035937
  0.989011  0.054000  0.024423  0.000000  0.035937
  1.021978  0.054000  0.025237  0.000000  0.035937
  1.054945  0.054000  0.026051  0.000000  0.035937
  1.087912  0.054000  0.026865  0.000000  0.035937
  1.120879  0.054000  0.027679  0.000000  0.035937
  1.153846  0.054000  0.028493  0.000000  0.035937
  1.186813  0.054000  0.029308  0.000000  0.035937
  1.219780  0.054000  0.030122  0.000000  0.035937
  1.252747  0.054000  0.030936  0.000000  0.035937
  1.285714  0.054000  0.031750  0.000000  0.035937
  1.318681  0.054000  0.032564  0.000000  0.035937
  1.351648  0.054000  0.033378  0.000000  0.035937
  1.384615  0.054000  0.034192  0.000000  0.035937
  1.417582  0.054000  0.035006  0.000000  0.035937
  1.450549  0.054000  0.035820  0.000000  0.035937
  1.483516  0.054000  0.036634  0.000000  0.035937
  1.500000  0.054000  0.037784  0.000000  0.035937
  END FTABLE  2
  FTABLE      1
   47    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.054000  0.000000  0.000000  0.000000  0.000294
  0.032967  0.054442  0.001788  0.000000  0.035937  0.000294
  0.065934  0.054885  0.003590  0.000000  0.035937  0.000589
  0.098901  0.055330  0.005406  0.000000  0.035937  0.000885
  0.131868  0.055776  0.007238  0.000000  0.035937  0.001182
  0.164835  0.056225  0.009084  0.000000  0.035937  0.001481
  0.197802  0.056675  0.010945  0.000000  0.035937  0.001780
  0.230769  0.057128  0.012821  0.000000  0.035937  0.002081
  0.263736  0.057581  0.014712  0.000000  0.035937  0.002383
  0.296703  0.058037  0.016617  0.000000  0.035937  0.002687
  0.329670  0.058495  0.018538  0.000000  0.035937  0.002991
  0.362637  0.058954  0.020474  0.000000  0.035937  0.003297
  0.395604  0.059415  0.022425  0.000000  0.035937  0.003604
  0.428571  0.059878  0.024392  0.000000  0.035937  0.003912
  0.461538  0.060343  0.026373  0.000000  0.035937  0.004221
  0.494505  0.060809  0.028370  0.000000  0.035937  0.004531
  0.527473  0.061278  0.030383  0.000000  0.035937  0.004843
  0.560440  0.061748  0.032411  0.000000  0.035937  0.005156
  0.593407  0.062220  0.034454  0.000000  0.035937  0.005470
  0.626374  0.062693  0.036513  0.000000  0.035937  0.005785
  0.659341  0.063169  0.038588  0.000000  0.035937  0.006102
```

```
0.692308  0.063646  0.040678  0.000000  0.035937  0.006419
0.725275  0.064125  0.042784  0.000000  0.035937  0.006738
0.758242  0.064606  0.044906  0.000000  0.035937  0.007058
0.791209  0.065089  0.047044  0.000000  0.035937  0.007379
0.824176  0.065573  0.049198  0.000000  0.035937  0.007702
0.857143  0.066060  0.051368  0.000000  0.035937  0.008026
0.890110  0.066548  0.053553  0.000000  0.035937  0.008350
0.923077  0.067038  0.055755  0.000000  0.035937  0.008676
0.956044  0.067529  0.057974  0.000000  0.035937  0.009004
0.989011  0.068023  0.060208  0.000000  0.035937  0.009332
1.021978  0.068518  0.062459  0.028803  0.035937  0.009662
1.054945  0.069015  0.064726  0.113632  0.035937  0.009992
1.087912  0.069514  0.067009  0.228879  0.035937  0.010324
1.120879  0.070014  0.069309  0.365247  0.035937  0.010657
1.153846  0.070517  0.071625  0.515121  0.035937  0.010992
1.186813  0.071021  0.073958  0.670824  0.035937  0.011327
1.219780  0.071527  0.076308  0.824493  0.035937  0.011664
1.252747  0.072035  0.078675  0.968497  0.035937  0.012002
1.285714  0.072545  0.081058  1.096154  0.035937  0.012341
1.318681  0.073056  0.083458  1.202640  0.035937  0.012682
1.351648  0.073569  0.085875  1.286061  0.035937  0.013023
1.384615  0.074084  0.088309  1.348651  0.035937  0.013366
1.417582  0.074601  0.090759  1.413410  0.035937  0.013710
1.450549  0.075120  0.093227  1.468143  0.035937  0.014055
1.483516  0.075640  0.095712  1.520907  0.035937  0.014401
1.500000  0.075901  0.096961  1.571901  0.035937  0.014575
END FTABLE  1
FTABLE      4
 47    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.045665  0.000000  0.000000  0.000000
0.032967  0.045665  0.000688  0.000000  0.000000
0.065934  0.045665  0.001377  0.000000  0.000000
0.098901  0.045665  0.002065  0.000000  0.000000
0.131868  0.045665  0.002754  0.000000  0.000003
0.164835  0.045665  0.003442  0.000000  0.000592
0.197802  0.045665  0.004131  0.000000  0.000923
0.230769  0.045665  0.004819  0.000000  0.001346
0.263736  0.045665  0.005507  0.000000  0.001866
0.296703  0.045665  0.006196  0.000000  0.002492
0.329670  0.045665  0.006884  0.000000  0.003228
0.362637  0.045665  0.007573  0.000000  0.004080
0.395604  0.045665  0.008261  0.000000  0.005055
0.428571  0.045665  0.008950  0.000000  0.006157
0.461538  0.045665  0.009638  0.000000  0.007391
0.494505  0.045665  0.010327  0.000000  0.008763
0.527473  0.045665  0.011015  0.000000  0.010276
0.560440  0.045665  0.011703  0.000000  0.011937
0.593407  0.045665  0.012392  0.000000  0.013748
0.626374  0.045665  0.013080  0.000000  0.015715
0.659341  0.045665  0.013769  0.000000  0.017841
0.692308  0.045665  0.014457  0.000000  0.020132
0.725275  0.045665  0.015146  0.000000  0.022589
0.758242  0.045665  0.015834  0.000000  0.025219
0.791209  0.045665  0.016522  0.000000  0.028024
0.824176  0.045665  0.017211  0.000000  0.030390
0.857143  0.045665  0.017899  0.000000  0.030390
0.890110  0.045665  0.018588  0.000000  0.030390
0.923077  0.045665  0.019276  0.000000  0.030390
0.956044  0.045665  0.019965  0.000000  0.030390
0.989011  0.045665  0.020653  0.000000  0.030390
1.021978  0.045665  0.021341  0.000000  0.030390
1.054945  0.045665  0.022030  0.000000  0.030390
1.087912  0.045665  0.022718  0.000000  0.030390
1.120879  0.045665  0.023407  0.000000  0.030390
1.153846  0.045665  0.024095  0.000000  0.030390
1.186813  0.045665  0.024784  0.000000  0.030390
1.219780  0.045665  0.025472  0.000000  0.030390
1.252747  0.045665  0.026161  0.000000  0.030390
```

```
  1.285714  0.045665  0.026849  0.000000  0.030390
  1.318681  0.045665  0.027537  0.000000  0.030390
  1.351648  0.045665  0.028226  0.000000  0.030390
  1.384615  0.045665  0.028914  0.000000  0.030390
  1.417582  0.045665  0.029603  0.000000  0.030390
  1.450549  0.045665  0.030291  0.000000  0.030390
  1.483516  0.045665  0.030980  0.000000  0.030390
  1.500000  0.045665  0.031952  0.000000  0.030390
  END FTABLE  4
  FTABLE      3
   47    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.045665  0.000000  0.000000  0.000000  0.000270
  0.032967  0.046071  0.001512  0.000000  0.030390  0.000270
  0.065934  0.046479  0.003038  0.000000  0.030390  0.000542
  0.098901  0.046888  0.004577  0.000000  0.030390  0.000814
  0.131868  0.047299  0.006129  0.000000  0.030390  0.001088
  0.164835  0.047713  0.007695  0.000000  0.030390  0.001363
  0.197802  0.048127  0.009275  0.000000  0.030390  0.001639
  0.230769  0.048544  0.010869  0.000000  0.030390  0.001916
  0.263736  0.048963  0.012476  0.000000  0.030390  0.002195
  0.296703  0.049383  0.014097  0.000000  0.030390  0.002474
  0.329670  0.049805  0.015732  0.000000  0.030390  0.002755
  0.362637  0.050229  0.017381  0.000000  0.030390  0.003037
  0.395604  0.050655  0.019044  0.000000  0.030390  0.003321
  0.428571  0.051082  0.020721  0.000000  0.030390  0.003605
  0.461538  0.051512  0.022412  0.000000  0.030390  0.003891
  0.494505  0.051943  0.024117  0.000000  0.030390  0.004178
  0.527473  0.052376  0.025837  0.000000  0.030390  0.004466
  0.560440  0.052810  0.027571  0.000000  0.030390  0.004755
  0.593407  0.053247  0.029319  0.000000  0.030390  0.005046
  0.626374  0.053685  0.031081  0.000000  0.030390  0.005337
  0.659341  0.054125  0.032858  0.000000  0.030390  0.005630
  0.692308  0.054567  0.034650  0.000000  0.030390  0.005924
  0.725275  0.055011  0.036456  0.000000  0.030390  0.006220
  0.758242  0.055456  0.038277  0.000000  0.030390  0.006516
  0.791209  0.055903  0.040113  0.000000  0.030390  0.006814
  0.824176  0.056352  0.041963  0.000000  0.030390  0.007113
  0.857143  0.056803  0.043828  0.000000  0.030390  0.007413
  0.890110  0.057256  0.045708  0.000000  0.030390  0.007714
  0.923077  0.057710  0.047603  0.000000  0.030390  0.008016
  0.956044  0.058167  0.049514  0.000000  0.030390  0.008320
  0.989011  0.058625  0.051439  0.000000  0.030390  0.008625
  1.021978  0.059085  0.053379  0.028803  0.030390  0.008931
  1.054945  0.059546  0.055334  0.113632  0.030390  0.009238
  1.087912  0.060010  0.057305  0.228879  0.030390  0.009546
  1.120879  0.060475  0.059291  0.365247  0.030390  0.009856
  1.153846  0.060942  0.061292  0.515121  0.030390  0.010167
  1.186813  0.061411  0.063309  0.670824  0.030390  0.010479
  1.219780  0.061881  0.065342  0.824493  0.030390  0.010792
  1.252747  0.062354  0.067389  0.968497  0.030390  0.011106
  1.285714  0.062828  0.069453  1.096154  0.030390  0.011422
  1.318681  0.063304  0.071532  1.202640  0.030390  0.011739
  1.351648  0.063782  0.073627  1.286061  0.030390  0.012057
  1.384615  0.064261  0.075737  1.348651  0.030390  0.012376
  1.417582  0.064743  0.077864  1.413410  0.030390  0.012696
  1.450549  0.065226  0.080006  1.468143  0.030390  0.013018
  1.483516  0.065711  0.082164  1.520907  0.030390  0.013341
  1.500000  0.065954  0.083250  1.571901  0.030390  0.013503
  END FTABLE  3
  FTABLE      6
   47    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.042843  0.000000  0.000000  0.000000
  0.032967  0.042843  0.000646  0.000000  0.000000
  0.065934  0.042843  0.001292  0.000000  0.000000
```

```
  0.098901  0.042843  0.001938  0.000000  0.000000
  0.131868  0.042843  0.002584  0.000000  0.000003
  0.164835  0.042843  0.003229  0.000000  0.000555
  0.197802  0.042843  0.003875  0.000000  0.000866
  0.230769  0.042843  0.004521  0.000000  0.001263
  0.263736  0.042843  0.005167  0.000000  0.001751
  0.296703  0.042843  0.005813  0.000000  0.002338
  0.329670  0.042843  0.006459  0.000000  0.003028
  0.362637  0.042843  0.007105  0.000000  0.003828
  0.395604  0.042843  0.007751  0.000000  0.004742
  0.428571  0.042843  0.008397  0.000000  0.005776
  0.461538  0.042843  0.009043  0.000000  0.006934
  0.494505  0.042843  0.009688  0.000000  0.008221
  0.527473  0.042843  0.010334  0.000000  0.009641
  0.560440  0.042843  0.010980  0.000000  0.011199
  0.593407  0.042843  0.011626  0.000000  0.012899
  0.626374  0.042843  0.012272  0.000000  0.014744
  0.659341  0.042843  0.012918  0.000000  0.016739
  0.692308  0.042843  0.013564  0.000000  0.018888
  0.725275  0.042843  0.014210  0.000000  0.021194
  0.758242  0.042843  0.014856  0.000000  0.023660
  0.791209  0.042843  0.015501  0.000000  0.026292
  0.824176  0.042843  0.016147  0.000000  0.028512
  0.857143  0.042843  0.016793  0.000000  0.028512
  0.890110  0.042843  0.017439  0.000000  0.028512
  0.923077  0.042843  0.018085  0.000000  0.028512
  0.956044  0.042843  0.018731  0.000000  0.028512
  0.989011  0.042843  0.019377  0.000000  0.028512
  1.021978  0.042843  0.020023  0.000000  0.028512
  1.054945  0.042843  0.020669  0.000000  0.028512
  1.087912  0.042843  0.021314  0.000000  0.028512
  1.120879  0.042843  0.021960  0.000000  0.028512
  1.153846  0.042843  0.022606  0.000000  0.028512
  1.186813  0.042843  0.023252  0.000000  0.028512
  1.219780  0.042843  0.023898  0.000000  0.028512
  1.252747  0.042843  0.024544  0.000000  0.028512
  1.285714  0.042843  0.025190  0.000000  0.028512
  1.318681  0.042843  0.025836  0.000000  0.028512
  1.351648  0.042843  0.026482  0.000000  0.028512
  1.384615  0.042843  0.027128  0.000000  0.028512
  1.417582  0.042843  0.027773  0.000000  0.028512
  1.450549  0.042843  0.028419  0.000000  0.028512
  1.483516  0.042843  0.029065  0.000000  0.028512
  1.500000  0.042843  0.029977  0.000000  0.028512
  END FTABLE  6
  FTABLE      5
   47    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.042843  0.000000  0.000000  0.000000  0.000262
  0.032967  0.043236  0.001419  0.000000  0.028512  0.000262
  0.065934  0.043631  0.002851  0.000000  0.028512  0.000525
  0.098901  0.044028  0.004296  0.000000  0.028512  0.000789
  0.131868  0.044427  0.005754  0.000000  0.028512  0.001054
  0.164835  0.044827  0.007225  0.000000  0.028512  0.001320
  0.197802  0.045229  0.008709  0.000000  0.028512  0.001588
  0.230769  0.045633  0.010207  0.000000  0.028512  0.001857
  0.263736  0.046039  0.011718  0.000000  0.028512  0.002127
  0.296703  0.046447  0.013243  0.000000  0.028512  0.002398
  0.329670  0.046856  0.014781  0.000000  0.028512  0.002671
  0.362637  0.047267  0.016332  0.000000  0.028512  0.002944
  0.395604  0.047680  0.017897  0.000000  0.028512  0.003219
  0.428571  0.048095  0.019476  0.000000  0.028512  0.003495
  0.461538  0.048512  0.021068  0.000000  0.028512  0.003773
  0.494505  0.048930  0.022675  0.000000  0.028512  0.004051
  0.527473  0.049350  0.024295  0.000000  0.028512  0.004331
  0.560440  0.049772  0.025928  0.000000  0.028512  0.004611
  0.593407  0.050196  0.027576  0.000000  0.028512  0.004893
```

```
0.626374  0.050622  0.029238  0.000000  0.028512  0.005177
0.659341  0.051049  0.030914  0.000000  0.028512  0.005461
0.692308  0.051478  0.032604  0.000000  0.028512  0.005747
0.725275  0.051909  0.034308  0.000000  0.028512  0.006033
0.758242  0.052342  0.036027  0.000000  0.028512  0.006321
0.791209  0.052776  0.037759  0.000000  0.028512  0.006611
0.824176  0.053213  0.039506  0.000000  0.028512  0.006901
0.857143  0.053651  0.041268  0.000000  0.028512  0.007193
0.890110  0.054091  0.043044  0.000000  0.028512  0.007485
0.923077  0.054533  0.044834  0.000000  0.028512  0.007779
0.956044  0.054976  0.046639  0.000000  0.028512  0.008075
0.989011  0.055421  0.048459  0.000000  0.028512  0.008371
1.021978  0.055869  0.050294  0.028803  0.028512  0.008669
1.054945  0.056317  0.052143  0.113632  0.028512  0.008967
1.087912  0.056768  0.054007  0.228879  0.028512  0.009267
1.120879  0.057221  0.055886  0.365247  0.028512  0.009568
1.153846  0.057675  0.057780  0.515121  0.028512  0.009871
1.186813  0.058131  0.059689  0.670824  0.028512  0.010174
1.219780  0.058589  0.061613  0.824493  0.028512  0.010479
1.252747  0.059049  0.063552  0.968497  0.028512  0.010785
1.285714  0.059510  0.065506  1.096154  0.028512  0.011092
1.318681  0.059973  0.067475  1.202640  0.028512  0.011400
1.351648  0.060439  0.069460  1.286061  0.028512  0.011710
1.384615  0.060905  0.071460  1.348651  0.028512  0.012021
1.417582  0.061374  0.073476  1.413410  0.028512  0.012332
1.450549  0.061845  0.075507  1.468143  0.028512  0.012646
1.483516  0.062317  0.077554  1.520907  0.028512  0.012960
1.500000  0.062554  0.078583  1.571901  0.028512  0.013118
END FTABLE  5
FTABLE      9
 92    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.028352  0.000000  0.000000  0.000000
0.022222  0.028352  0.000410  0.004045  0.018868
0.044444  0.028352  0.000819  0.005721  0.018868
0.066667  0.028352  0.001229  0.007007  0.018868
0.088889  0.028352  0.001638  0.008091  0.018868
0.111111  0.028352  0.002048  0.009046  0.018868
0.133333  0.028352  0.002457  0.009909  0.018868
0.155556  0.028352  0.002867  0.010703  0.018868
0.177778  0.028352  0.003276  0.011442  0.018868
0.200000  0.028352  0.003686  0.012136  0.018868
0.222222  0.028352  0.004095  0.012792  0.018868
0.244444  0.028352  0.004505  0.013417  0.018868
0.266667  0.028352  0.004914  0.014013  0.018868
0.288889  0.028352  0.005324  0.014586  0.018868
0.311111  0.028352  0.005733  0.015136  0.018868
0.333333  0.028352  0.006143  0.015667  0.018868
0.355556  0.028352  0.006552  0.016181  0.018868
0.377778  0.028352  0.006962  0.016679  0.018868
0.400000  0.028352  0.007371  0.017163  0.018868
0.422222  0.028352  0.007781  0.017633  0.018868
0.444444  0.028352  0.008190  0.018091  0.018868
0.466667  0.028352  0.008600  0.018538  0.018868
0.488889  0.028352  0.009010  0.018974  0.018868
0.511111  0.028352  0.009419  0.019401  0.018868
0.533333  0.028352  0.009829  0.019818  0.018868
0.555556  0.028352  0.010238  0.020227  0.018868
0.577778  0.028352  0.010648  0.020627  0.018868
0.600000  0.028352  0.011057  0.021020  0.018868
0.622222  0.028352  0.011467  0.021406  0.018868
0.644444  0.028352  0.011876  0.021785  0.018868
0.666667  0.028352  0.012286  0.022157  0.018868
0.688889  0.028352  0.012695  0.022523  0.018868
0.711111  0.028352  0.013105  0.022884  0.018868
0.733333  0.028352  0.013514  0.023239  0.018868
0.755556  0.028352  0.013924  0.023588  0.018868
0.777778  0.028352  0.014333  0.023932  0.018868
0.800000  0.028352  0.014743  0.024272  0.018868
```

```
0.822222  0.028352  0.015152  0.024607  0.018868
0.844444  0.028352  0.015562  0.024937  0.018868
0.866667  0.028352  0.015971  0.025263  0.018868
0.888889  0.028352  0.016381  0.025585  0.018868
0.911111  0.028352  0.016791  0.025903  0.018868
0.933333  0.028352  0.017200  0.026217  0.018868
0.955556  0.028352  0.017610  0.026527  0.018868
0.977778  0.028352  0.018019  0.026834  0.018868
1.000000  0.028352  0.018429  0.027137  0.018868
1.022222  0.028352  0.018838  0.027437  0.018868
1.044444  0.028352  0.019248  0.027733  0.018868
1.066667  0.028352  0.019657  0.028027  0.018868
1.088889  0.028352  0.020067  0.028317  0.018868
1.111111  0.028352  0.020476  0.028605  0.018868
1.133333  0.028352  0.020886  0.028889  0.018868
1.155556  0.028352  0.021295  0.029171  0.018868
1.177778  0.028352  0.021705  0.029450  0.018868
1.200000  0.028352  0.022114  0.029727  0.018868
1.222222  0.028352  0.022524  0.030001  0.018868
1.244444  0.028352  0.022933  0.030272  0.018868
1.266667  0.028352  0.023343  0.030541  0.018868
1.288889  0.028352  0.023752  0.030808  0.018868
1.311111  0.028352  0.024162  0.031073  0.018868
1.333333  0.028352  0.024571  0.031335  0.018868
1.355556  0.028352  0.024981  0.031595  0.018868
1.377778  0.028352  0.025391  0.031853  0.018868
1.400000  0.028352  0.025800  0.032109  0.018868
1.422222  0.028352  0.026210  0.032363  0.018868
1.444444  0.028352  0.026619  0.032614  0.018868
1.466667  0.028352  0.027029  0.032864  0.018868
1.488889  0.028352  0.027438  0.033112  0.018868
1.511111  0.028352  0.027848  0.033359  0.018868
1.533333  0.028352  0.028257  0.033603  0.018868
1.555556  0.028352  0.028667  0.033846  0.018868
1.577778  0.028352  0.029076  0.034086  0.018868
1.600000  0.028352  0.029486  0.034326  0.018868
1.622222  0.028352  0.029895  0.034563  0.018868
1.644444  0.028352  0.030305  0.034799  0.018868
1.666667  0.028352  0.030714  0.035033  0.018868
1.688889  0.028352  0.031124  0.035266  0.018868
1.711111  0.028352  0.031533  0.035498  0.018868
1.733333  0.028352  0.031943  0.035727  0.018868
1.755556  0.028352  0.032352  0.035956  0.018868
1.777778  0.028352  0.032762  0.036182  0.018868
1.800000  0.028352  0.033171  0.036408  0.018868
1.822222  0.028352  0.033581  0.036632  0.018868
1.844444  0.028352  0.033991  0.036855  0.018868
1.866667  0.028352  0.034400  0.037076  0.018868
1.888889  0.028352  0.034810  0.037296  0.018868
1.911111  0.028352  0.035219  0.037515  0.018868
1.933333  0.028352  0.035629  0.037732  0.018868
1.955556  0.028352  0.036038  0.037948  0.018868
1.977778  0.028352  0.036448  0.038163  0.018868
2.000000  0.028352  0.036857  0.038377  0.018868
2.022222  0.028352  0.037487  0.073736  0.018868
END FTABLE  9
FTABLE      7
 92    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.002755  0.000000  0.000000  0.000000
0.033333  0.002755  0.000037  0.000000  0.001833
0.066667  0.002755  0.000073  0.000000  0.001833
0.100000  0.002755  0.000110  0.000000  0.001833
0.133333  0.002755  0.000147  0.000000  0.001833
0.166667  0.002755  0.000184  0.000000  0.001833
0.200000  0.002755  0.000220  0.000000  0.001833
0.233333  0.002755  0.000257  0.000000  0.001833
0.266667  0.002755  0.000294  0.000000  0.001833
0.300000  0.002755  0.000331  0.000000  0.001833
```

0.333333	0.002755	0.000367	0.000000	0.001833
0.366667	0.002755	0.000404	0.000000	0.001833
0.400000	0.002755	0.000441	0.000000	0.001833
0.433333	0.002755	0.000478	0.000000	0.001833
0.466667	0.002755	0.000514	0.000000	0.001833
0.500000	0.002755	0.000551	0.000000	0.001833
0.533333	0.002755	0.000588	0.000000	0.001833
0.566667	0.002755	0.000624	0.000000	0.001833
0.600000	0.002755	0.000661	0.000000	0.001833
0.633333	0.002755	0.000698	0.000000	0.001833
0.666667	0.002755	0.000735	0.000000	0.001833
0.700000	0.002755	0.000771	0.000000	0.001833
0.733333	0.002755	0.000808	0.000000	0.001833
0.766667	0.002755	0.000845	0.000000	0.001833
0.800000	0.002755	0.000882	0.000000	0.001833
0.833333	0.002755	0.000918	0.000000	0.001833
0.866667	0.002755	0.000955	0.000000	0.001833
0.900000	0.002755	0.000992	0.000000	0.001833
0.933333	0.002755	0.001028	0.000000	0.001833
0.966667	0.002755	0.001065	0.000000	0.001833
1.000000	0.002755	0.001102	0.000000	0.001833
1.033333	0.002755	0.001139	0.000000	0.001833
1.066667	0.002755	0.001175	0.000000	0.001833
1.100000	0.002755	0.001212	0.000000	0.001833
1.133333	0.002755	0.001249	0.000000	0.001833
1.166667	0.002755	0.001286	0.000000	0.001833
1.200000	0.002755	0.001322	0.000000	0.001833
1.233333	0.002755	0.001359	0.000000	0.001833
1.266667	0.002755	0.001396	0.000000	0.001833
1.300000	0.002755	0.001433	0.000000	0.001833
1.333333	0.002755	0.001469	0.000000	0.001833
1.366667	0.002755	0.001506	0.000000	0.001833
1.400000	0.002755	0.001543	0.000000	0.001833
1.433333	0.002755	0.001579	0.000000	0.001833
1.466667	0.002755	0.001616	0.000000	0.001833
1.500000	0.002755	0.001653	0.000000	0.001833
1.533333	0.002755	0.001690	0.000000	0.001833
1.566667	0.002755	0.001726	0.000000	0.001833
1.600000	0.002755	0.001763	0.000000	0.001833
1.633333	0.002755	0.001800	0.000000	0.001833
1.666667	0.002755	0.001837	0.000000	0.001833
1.700000	0.002755	0.001873	0.000000	0.001833
1.733333	0.002755	0.001910	0.000000	0.001833
1.766667	0.002755	0.001947	0.000000	0.001833
1.800000	0.002755	0.001983	0.000000	0.001833
1.833333	0.002755	0.002020	0.000000	0.001833
1.866667	0.002755	0.002057	0.000000	0.001833
1.900000	0.002755	0.002094	0.000000	0.001833
1.933333	0.002755	0.002130	0.000000	0.001833
1.966667	0.002755	0.002167	0.000000	0.001833
2.000000	0.002755	0.002204	0.000000	0.001833
2.033333	0.002755	0.002241	0.000000	0.001833
2.066667	0.002755	0.002277	0.000000	0.001833
2.100000	0.002755	0.002314	0.000000	0.001833
2.133333	0.002755	0.002351	0.000000	0.001833
2.166667	0.002755	0.002388	0.000000	0.001833
2.200000	0.002755	0.002424	0.000000	0.001833
2.233333	0.002755	0.002461	0.000000	0.001833
2.266667	0.002755	0.002498	0.000000	0.001833
2.300000	0.002755	0.002534	0.000000	0.001833
2.333333	0.002755	0.002571	0.000000	0.001833
2.366667	0.002755	0.002608	0.000000	0.001833
2.400000	0.002755	0.002645	0.000000	0.001833
2.433333	0.002755	0.002681	0.000000	0.001833
2.466667	0.002755	0.002718	0.000000	0.001833
2.500000	0.002755	0.002755	0.000000	0.001833
2.533333	0.002755	0.002792	0.000000	0.001833
2.566667	0.002755	0.002828	0.000000	0.001833
2.600000	0.002755	0.002865	0.000000	0.001833
2.633333	0.002755	0.002902	0.000000	0.001833

```
2.666667  0.002755  0.002938  0.000000  0.001833
2.700000  0.002755  0.002975  0.000000  0.001833
2.733333  0.002755  0.003012  0.000000  0.001833
2.766667  0.002755  0.003049  0.000000  0.001833
2.800000  0.002755  0.003085  0.000000  0.001833
2.833333  0.002755  0.003122  0.000000  0.001833
2.866667  0.002755  0.003159  0.000000  0.001833
2.900000  0.002755  0.003196  0.000000  0.001833
2.933333  0.002755  0.003232  0.000000  0.001833
2.966667  0.002755  0.003269  0.000000  0.001833
3.000000  0.002755  0.003306  0.000000  0.001833
3.033333  0.002755  0.003398  0.064540  0.001833
END FTABLE  7
FTABLE     10
 91    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.013774  0.000000  0.000000  0.000000
0.011111  0.013774  0.000153  0.000000  0.009167
0.022222  0.013774  0.000306  0.000000  0.009167
0.033333  0.013774  0.000459  0.000000  0.009167
0.044444  0.013774  0.000612  0.000000  0.009167
0.055556  0.013774  0.000765  0.000000  0.009167
0.066667  0.013774  0.000918  0.000000  0.009167
0.077778  0.013774  0.001071  0.000000  0.009167
0.088889  0.013774  0.001224  0.000000  0.009167
0.100000  0.013774  0.001377  0.000000  0.009167
0.111111  0.013774  0.001530  0.010359  0.009167
0.122222  0.013774  0.001684  0.029284  0.009167
0.133333  0.013774  0.001837  0.053769  0.009167
0.144444  0.013774  0.001990  0.082732  0.009167
0.155556  0.013774  0.002143  0.115525  0.009167
0.166667  0.013774  0.002296  0.151685  0.009167
0.177778  0.013774  0.002449  0.190836  0.009167
0.188889  0.013774  0.002602  0.232654  0.009167
0.200000  0.013774  0.002755  0.276837  0.009167
0.211111  0.013774  0.002908  0.323094  0.009167
0.222222  0.013774  0.003061  0.371140  0.009167
0.233333  0.013774  0.003214  0.420687  0.009167
0.244444  0.013774  0.003367  0.471444  0.009167
0.255556  0.013774  0.003520  0.523118  0.009167
0.266667  0.013774  0.003673  0.575411  0.009167
0.277778  0.013774  0.003826  0.628019  0.009167
0.288889  0.013774  0.003979  0.680642  0.009167
0.300000  0.013774  0.004132  0.732975  0.009167
0.311111  0.013774  0.004285  0.784719  0.009167
0.322222  0.013774  0.004438  0.835581  0.009167
0.333333  0.013774  0.004591  0.885276  0.009167
0.344444  0.013774  0.004744  0.933531  0.009167
0.355556  0.013774  0.004897  0.980092  0.009167
0.366667  0.013774  0.005051  1.024723  0.009167
0.377778  0.013774  0.005204  1.067215  0.009167
0.388889  0.013774  0.005357  1.107385  0.009167
0.400000  0.013774  0.005510  1.145088  0.009167
0.411111  0.013774  0.005663  1.180216  0.009167
0.422222  0.013774  0.005816  1.212705  0.009167
0.433333  0.013774  0.005969  1.242541  0.009167
0.444444  0.013774  0.006122  1.269763  0.009167
0.455556  0.013774  0.006275  1.294473  0.009167
0.466667  0.013774  0.006428  1.316838  0.009167
0.477778  0.013774  0.006581  1.337097  0.009167
0.488889  0.013774  0.006734  1.355566  0.009167
0.500000  0.013774  0.006887  1.372649  0.009167
0.511111  0.013774  0.007040  1.388838  0.009167
0.522222  0.013774  0.007193  1.421241  0.009167
0.533333  0.013774  0.007346  1.439820  0.009167
0.544444  0.013774  0.007499  1.458162  0.009167
0.555556  0.013774  0.007652  1.476277  0.009167
0.566667  0.013774  0.007805  1.494171  0.009167
0.577778  0.013774  0.007958  1.511855  0.009167
```

```
0.588889  0.013774  0.008111  1.529333  0.009167
0.600000  0.013774  0.008264  1.546614  0.009167
0.611111  0.013774  0.008418  1.563705  0.009167
0.622222  0.013774  0.008571  1.580610  0.009167
0.633333  0.013774  0.008724  1.597336  0.009167
0.644444  0.013774  0.008877  1.613890  0.009167
0.655556  0.013774  0.009030  1.630275  0.009167
0.666667  0.013774  0.009183  1.646497  0.009167
0.677778  0.013774  0.009336  1.662561  0.009167
0.688889  0.013774  0.009489  1.678471  0.009167
0.700000  0.013774  0.009642  1.694231  0.009167
0.711111  0.013774  0.009795  1.709847  0.009167
0.722222  0.013774  0.009948  1.725321  0.009167
0.733333  0.013774  0.010101  1.740657  0.009167
0.744444  0.013774  0.010254  1.755860  0.009167
0.755556  0.013774  0.010407  1.770932  0.009167
0.766667  0.013774  0.010560  1.785876  0.009167
0.777778  0.013774  0.010713  1.800697  0.009167
0.788889  0.013774  0.010866  1.815397  0.009167
0.800000  0.013774  0.011019  1.829979  0.009167
0.811111  0.013774  0.011172  1.844445  0.009167
0.822222  0.013774  0.011325  1.858799  0.009167
0.833333  0.013774  0.011478  1.873043  0.009167
0.844444  0.013774  0.011631  1.887179  0.009167
0.855556  0.013774  0.011785  1.901211  0.009167
0.866667  0.013774  0.011938  1.915139  0.009167
0.877778  0.013774  0.012091  1.928967  0.009167
0.888889  0.013774  0.012244  1.942697  0.009167
0.900000  0.013774  0.012397  1.956330  0.009167
0.911111  0.013774  0.012550  1.969868  0.009167
0.922222  0.013774  0.012703  1.983315  0.009167
0.933333  0.013774  0.012856  1.996671  0.009167
0.944444  0.013774  0.013009  2.009938  0.009167
0.955556  0.013774  0.013162  2.023118  0.009167
0.966667  0.013774  0.013315  2.036212  0.009167
0.977778  0.013774  0.013468  2.049224  0.009167
0.988889  0.013774  0.013621  2.062153  0.009167
1.000000  0.013774  0.013774  2.075001  0.009167
END FTABLE 10
FTABLE      8
 92    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.002755  0.000000  0.000000  0.000000
0.033333  0.002755  0.000037  0.000000  0.001833
0.066667  0.002755  0.000073  0.000000  0.001833
0.100000  0.002755  0.000110  0.000000  0.001833
0.133333  0.002755  0.000147  0.000000  0.001833
0.166667  0.002755  0.000184  0.000000  0.001833
0.200000  0.002755  0.000220  0.000000  0.001833
0.233333  0.002755  0.000257  0.000000  0.001833
0.266667  0.002755  0.000294  0.000000  0.001833
0.300000  0.002755  0.000331  0.000000  0.001833
0.333333  0.002755  0.000367  0.000000  0.001833
0.366667  0.002755  0.000404  0.000000  0.001833
0.400000  0.002755  0.000441  0.000000  0.001833
0.433333  0.002755  0.000478  0.000000  0.001833
0.466667  0.002755  0.000514  0.000000  0.001833
0.500000  0.002755  0.000551  0.000000  0.001833
0.533333  0.002755  0.000588  0.000000  0.001833
0.566667  0.002755  0.000624  0.000000  0.001833
0.600000  0.002755  0.000661  0.000000  0.001833
0.633333  0.002755  0.000698  0.000000  0.001833
0.666667  0.002755  0.000735  0.000000  0.001833
0.700000  0.002755  0.000771  0.000000  0.001833
0.733333  0.002755  0.000808  0.000000  0.001833
0.766667  0.002755  0.000845  0.000000  0.001833
0.800000  0.002755  0.000882  0.000000  0.001833
0.833333  0.002755  0.000918  0.000000  0.001833
0.866667  0.002755  0.000955  0.000000  0.001833
```

```
0.900000  0.002755  0.000992  0.000000  0.001833
0.933333  0.002755  0.001028  0.000000  0.001833
0.966667  0.002755  0.001065  0.000000  0.001833
1.000000  0.002755  0.001102  0.000000  0.001833
1.033333  0.002755  0.001139  0.000000  0.001833
1.066667  0.002755  0.001175  0.000000  0.001833
1.100000  0.002755  0.001212  0.000000  0.001833
1.133333  0.002755  0.001249  0.000000  0.001833
1.166667  0.002755  0.001286  0.000000  0.001833
1.200000  0.002755  0.001322  0.000000  0.001833
1.233333  0.002755  0.001359  0.000000  0.001833
1.266667  0.002755  0.001396  0.000000  0.001833
1.300000  0.002755  0.001433  0.000000  0.001833
1.333333  0.002755  0.001469  0.000000  0.001833
1.366667  0.002755  0.001506  0.000000  0.001833
1.400000  0.002755  0.001543  0.000000  0.001833
1.433333  0.002755  0.001579  0.000000  0.001833
1.466667  0.002755  0.001616  0.000000  0.001833
1.500000  0.002755  0.001653  0.000000  0.001833
1.533333  0.002755  0.001690  0.000000  0.001833
1.566667  0.002755  0.001726  0.000000  0.001833
1.600000  0.002755  0.001763  0.000000  0.001833
1.633333  0.002755  0.001800  0.000000  0.001833
1.666667  0.002755  0.001837  0.000000  0.001833
1.700000  0.002755  0.001873  0.000000  0.001833
1.733333  0.002755  0.001910  0.000000  0.001833
1.766667  0.002755  0.001947  0.000000  0.001833
1.800000  0.002755  0.001983  0.000000  0.001833
1.833333  0.002755  0.002020  0.000000  0.001833
1.866667  0.002755  0.002057  0.000000  0.001833
1.900000  0.002755  0.002094  0.000000  0.001833
1.933333  0.002755  0.002130  0.000000  0.001833
1.966667  0.002755  0.002167  0.000000  0.001833
2.000000  0.002755  0.002204  0.000000  0.001833
2.033333  0.002755  0.002241  0.000000  0.001833
2.066667  0.002755  0.002277  0.000000  0.001833
2.100000  0.002755  0.002314  0.000000  0.001833
2.133333  0.002755  0.002351  0.000000  0.001833
2.166667  0.002755  0.002388  0.000000  0.001833
2.200000  0.002755  0.002424  0.000000  0.001833
2.233333  0.002755  0.002461  0.000000  0.001833
2.266667  0.002755  0.002498  0.000000  0.001833
2.300000  0.002755  0.002534  0.000000  0.001833
2.333333  0.002755  0.002571  0.000000  0.001833
2.366667  0.002755  0.002608  0.000000  0.001833
2.400000  0.002755  0.002645  0.000000  0.001833
2.433333  0.002755  0.002681  0.000000  0.001833
2.466667  0.002755  0.002718  0.000000  0.001833
2.500000  0.002755  0.002755  0.000000  0.001833
2.533333  0.002755  0.002792  0.000000  0.001833
2.566667  0.002755  0.002828  0.000000  0.001833
2.600000  0.002755  0.002865  0.000000  0.001833
2.633333  0.002755  0.002902  0.000000  0.001833
2.666667  0.002755  0.002938  0.000000  0.001833
2.700000  0.002755  0.002975  0.000000  0.001833
2.733333  0.002755  0.003012  0.000000  0.001833
2.766667  0.002755  0.003049  0.000000  0.001833
2.800000  0.002755  0.003085  0.000000  0.001833
2.833333  0.002755  0.003122  0.000000  0.001833
2.866667  0.002755  0.003159  0.000000  0.001833
2.900000  0.002755  0.003196  0.000000  0.001833
2.933333  0.002755  0.003232  0.000000  0.001833
2.966667  0.002755  0.003269  0.000000  0.001833
3.000000  0.002755  0.003306  0.000000  0.001833
3.033333  0.002755  0.003398  0.064540  0.001833
END FTABLE  8
FTABLE     11
 91    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
```

0.000000	0.013774	0.000000	0.000000	0.000000
0.011111	0.013774	0.000153	0.000000	0.009167
0.022222	0.013774	0.000306	0.000000	0.009167
0.033333	0.013774	0.000459	0.000000	0.009167
0.044444	0.013774	0.000612	0.000000	0.009167
0.055556	0.013774	0.000765	0.000000	0.009167
0.066667	0.013774	0.000918	0.000000	0.009167
0.077778	0.013774	0.001071	0.000000	0.009167
0.088889	0.013774	0.001224	0.000000	0.009167
0.100000	0.013774	0.001377	0.000000	0.009167
0.111111	0.013774	0.001530	0.010359	0.009167
0.122222	0.013774	0.001684	0.029284	0.009167
0.133333	0.013774	0.001837	0.053769	0.009167
0.144444	0.013774	0.001990	0.082732	0.009167
0.155556	0.013774	0.002143	0.115525	0.009167
0.166667	0.013774	0.002296	0.151685	0.009167
0.177778	0.013774	0.002449	0.190836	0.009167
0.188889	0.013774	0.002602	0.232654	0.009167
0.200000	0.013774	0.002755	0.276837	0.009167
0.211111	0.013774	0.002908	0.323094	0.009167
0.222222	0.013774	0.003061	0.371140	0.009167
0.233333	0.013774	0.003214	0.420687	0.009167
0.244444	0.013774	0.003367	0.471444	0.009167
0.255556	0.013774	0.003520	0.523118	0.009167
0.266667	0.013774	0.003673	0.575411	0.009167
0.277778	0.013774	0.003826	0.628019	0.009167
0.288889	0.013774	0.003979	0.680642	0.009167
0.300000	0.013774	0.004132	0.732975	0.009167
0.311111	0.013774	0.004285	0.784719	0.009167
0.322222	0.013774	0.004438	0.835581	0.009167
0.333333	0.013774	0.004591	0.885276	0.009167
0.344444	0.013774	0.004744	0.933531	0.009167
0.355556	0.013774	0.004897	0.980092	0.009167
0.366667	0.013774	0.005051	1.024723	0.009167
0.377778	0.013774	0.005204	1.067215	0.009167
0.388889	0.013774	0.005357	1.107385	0.009167
0.400000	0.013774	0.005510	1.145088	0.009167
0.411111	0.013774	0.005663	1.180216	0.009167
0.422222	0.013774	0.005816	1.212705	0.009167
0.433333	0.013774	0.005969	1.242541	0.009167
0.444444	0.013774	0.006122	1.269763	0.009167
0.455556	0.013774	0.006275	1.294473	0.009167
0.466667	0.013774	0.006428	1.316838	0.009167
0.477778	0.013774	0.006581	1.337097	0.009167
0.488889	0.013774	0.006734	1.355566	0.009167
0.500000	0.013774	0.006887	1.372649	0.009167
0.511111	0.013774	0.007040	1.388838	0.009167
0.522222	0.013774	0.007193	1.421241	0.009167
0.533333	0.013774	0.007346	1.439820	0.009167
0.544444	0.013774	0.007499	1.458162	0.009167
0.555556	0.013774	0.007652	1.476277	0.009167
0.566667	0.013774	0.007805	1.494171	0.009167
0.577778	0.013774	0.007958	1.511855	0.009167
0.588889	0.013774	0.008111	1.529333	0.009167
0.600000	0.013774	0.008264	1.546614	0.009167
0.611111	0.013774	0.008418	1.563705	0.009167
0.622222	0.013774	0.008571	1.580610	0.009167
0.633333	0.013774	0.008724	1.597336	0.009167
0.644444	0.013774	0.008877	1.613890	0.009167
0.655556	0.013774	0.009030	1.630275	0.009167
0.666667	0.013774	0.009183	1.646497	0.009167
0.677778	0.013774	0.009336	1.662561	0.009167
0.688889	0.013774	0.009489	1.678471	0.009167
0.700000	0.013774	0.009642	1.694231	0.009167
0.711111	0.013774	0.009795	1.709847	0.009167
0.722222	0.013774	0.009948	1.725321	0.009167
0.733333	0.013774	0.010101	1.740657	0.009167
0.744444	0.013774	0.010254	1.755860	0.009167
0.755556	0.013774	0.010407	1.770932	0.009167
0.766667	0.013774	0.010560	1.785876	0.009167

```
0.777778  0.013774  0.010713  1.800697  0.009167
0.788889  0.013774  0.010866  1.815397  0.009167
0.800000  0.013774  0.011019  1.829979  0.009167
0.811111  0.013774  0.011172  1.844445  0.009167
0.822222  0.013774  0.011325  1.858799  0.009167
0.833333  0.013774  0.011478  1.873043  0.009167
0.844444  0.013774  0.011631  1.887179  0.009167
0.855556  0.013774  0.011785  1.901211  0.009167
0.866667  0.013774  0.011938  1.915139  0.009167
0.877778  0.013774  0.012091  1.928967  0.009167
0.888889  0.013774  0.012244  1.942697  0.009167
0.900000  0.013774  0.012397  1.956330  0.009167
0.911111  0.013774  0.012550  1.969868  0.009167
0.922222  0.013774  0.012703  1.983315  0.009167
0.933333  0.013774  0.012856  1.996671  0.009167
0.944444  0.013774  0.013009  2.009938  0.009167
0.955556  0.013774  0.013162  2.023118  0.009167
0.966667  0.013774  0.013315  2.036212  0.009167
0.977778  0.013774  0.013468  2.049224  0.009167
0.988889  0.013774  0.013621  2.062153  0.009167
1.000000  0.013774  0.013774  2.075001  0.009167
END FTABLE 11
FTABLE     13
 91    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.039027  0.000000  0.000000  0.000000
0.022222  0.039634  0.000874  0.007419  0.026376
0.044444  0.040241  0.001762  0.023607  0.026780
0.066667  0.040848  0.002662  0.046510  0.027184
0.088889  0.041455  0.003577  0.075304  0.027588
0.111111  0.042062  0.004505  0.109498  0.027992
0.133333  0.042669  0.005446  0.148754  0.028397
0.155556  0.043277  0.006401  0.192826  0.028801
0.177778  0.043884  0.007370  0.241522  0.029205
0.200000  0.044491  0.008352  0.294694  0.029609
0.222222  0.045098  0.009347  0.352220  0.030013
0.244444  0.045705  0.010356  0.414000  0.030417
0.266667  0.046312  0.011379  0.479951  0.030821
0.288889  0.046919  0.012414  0.550004  0.031225
0.311111  0.047527  0.013464  0.624102  0.031629
0.333333  0.048134  0.014527  0.702194  0.032033
0.355556  0.048741  0.015603  0.784239  0.032437
0.377778  0.049348  0.016693  0.870202  0.032841
0.400000  0.049955  0.017796  0.960053  0.033245
0.422222  0.050562  0.018913  1.053768  0.033649
0.444444  0.051170  0.020044  1.151325  0.034053
0.466667  0.051777  0.021187  1.252707  0.034457
0.488889  0.052384  0.022345  1.357901  0.034861
0.511111  0.052991  0.023516  1.466894  0.035266
0.533333  0.053598  0.024700  1.579678  0.035670
0.555556  0.054205  0.025898  1.696247  0.036074
0.577778  0.054813  0.027109  1.816595  0.036478
0.600000  0.055420  0.028334  1.940721  0.036882
0.622222  0.056027  0.029572  2.068622  0.037286
0.644444  0.056634  0.030824  2.200300  0.037690
0.666667  0.057241  0.032089  2.335755  0.038094
0.688889  0.057848  0.033368  2.474992  0.038498
0.711111  0.058456  0.034660  2.618013  0.038902
0.733333  0.059063  0.035966  2.764824  0.039306
0.755556  0.059670  0.037285  2.915431  0.039710
0.777778  0.060277  0.038618  3.069840  0.040114
0.800000  0.060884  0.039964  3.228060  0.040519
0.822222  0.061492  0.041324  3.390097  0.040923
0.844444  0.062099  0.042697  3.555962  0.041327
0.866667  0.062706  0.044084  3.725664  0.041731
0.888889  0.063313  0.045484  3.899212  0.042135
0.911111  0.063920  0.046898  4.076618  0.042539
0.933333  0.064528  0.048325  4.257893  0.042943
0.955556  0.065135  0.049766  4.443048  0.043347
```

```
0.977778  0.065742  0.051220  4.632095  0.043751
1.000000  0.066349  0.052688  4.825047  0.044155
1.022222  0.066956  0.054169  5.021916  0.044559
1.044444  0.067564  0.055663  5.222716  0.044964
1.066667  0.068171  0.057172  5.427460  0.045368
1.088889  0.068778  0.058693  5.636161  0.045772
1.111111  0.069385  0.060228  5.848834  0.046176
1.133333  0.069992  0.061777  6.065492  0.046580
1.155556  0.070600  0.063339  6.286151  0.046984
1.177778  0.071207  0.064915  6.510825  0.047388
1.200000  0.071814  0.066504  6.739529  0.047792
1.222222  0.072421  0.068107  6.972277  0.048196
1.244444  0.073029  0.069723  7.209086  0.048600
1.266667  0.073636  0.071352  7.449970  0.049005
1.288889  0.074243  0.072995  7.694946  0.049409
1.311111  0.074850  0.074652  7.944028  0.049813
1.333333  0.075457  0.076322  8.197234  0.050217
1.355556  0.076065  0.078006  8.454578  0.050621
1.377778  0.076672  0.079703  8.716077  0.051025
1.400000  0.077279  0.081413  8.981747  0.051429
1.422222  0.077886  0.083137  9.251605  0.051833
1.444444  0.078494  0.084875  9.525667  0.052237
1.466667  0.079101  0.086626  9.803950  0.052642
1.488889  0.079708  0.088390  10.08647  0.053046
1.511111  0.080315  0.090169  10.37324  0.053450
1.533333  0.080923  0.091960  10.66429  0.053854
1.555556  0.081530  0.093765  10.95962  0.054258
1.577778  0.082137  0.095584  11.25926  0.054662
1.600000  0.082744  0.097416  11.56321  0.055066
1.622222  0.083351  0.099261  11.87151  0.055470
1.644444  0.083959  0.101120  12.18416  0.055875
1.666667  0.084566  0.102993  12.50119  0.056279
1.688889  0.085173  0.104879  12.82260  0.056683
1.711111  0.085780  0.106778  13.14842  0.057087
1.733333  0.086388  0.108691  13.47867  0.057491
1.755556  0.086995  0.110618  13.81336  0.057895
1.777778  0.087602  0.112558  14.15250  0.058299
1.800000  0.088210  0.114511  14.49612  0.058703
1.822222  0.088817  0.116478  14.84424  0.059108
1.844444  0.089424  0.118458  15.19687  0.059512
1.866667  0.090031  0.120452  15.55403  0.059916
1.888889  0.090639  0.122460  15.91573  0.060320
1.911111  0.091246  0.124481  16.28200  0.060724
1.933333  0.091853  0.126515  16.65284  0.061128
1.955556  0.092460  0.128563  17.02829  0.061532
1.977778  0.093068  0.130625  17.40835  0.061937
2.000000  0.093675  0.132699  17.79305  0.062341
END FTABLE 13
FTABLE     12
 91    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.048209  0.000000  0.000000  0.000000
0.022222  0.048470  0.001074  0.016181  0.032257
0.044444  0.048731  0.002154  0.022884  0.032430
0.066667  0.048992  0.003240  0.028027  0.032604
0.088889  0.049253  0.004332  0.032363  0.032778
0.111111  0.049515  0.005429  0.036182  0.032952
0.133333  0.049778  0.006532  0.039636  0.033127
0.155556  0.050041  0.007641  0.042812  0.033302
0.177778  0.050304  0.008756  0.045768  0.033477
0.200000  0.050567  0.009877  0.048544  0.033653
0.222222  0.050832  0.011004  0.051170  0.033828
0.244444  0.051096  0.012136  0.053667  0.034004
0.266667  0.051361  0.013275  0.056054  0.034181
0.288889  0.051626  0.014419  0.058342  0.034357
0.311111  0.051892  0.015569  0.060545  0.034534
0.333333  0.052158  0.016725  0.062670  0.034711
0.355556  0.052424  0.017887  0.064725  0.034888
0.377778  0.052691  0.019055  0.066717  0.035066
```

0.400000	0.052959	0.020229	0.068651	0.035244
0.422222	0.053226	0.021409	0.070532	0.035422
0.444444	0.053495	0.022595	0.072365	0.035601
0.466667	0.053763	0.023787	0.074152	0.035779
0.488889	0.054032	0.024984	0.075897	0.035958
0.511111	0.054301	0.026188	0.077603	0.036138
0.533333	0.054571	0.027398	0.079272	0.036317
0.555556	0.054841	0.028613	0.080906	0.036497
0.577778	0.055112	0.029835	0.082509	0.036677
0.600000	0.055383	0.031063	0.084080	0.036857
0.622222	0.055654	0.032297	0.085623	0.037038
0.644444	0.055926	0.033536	0.087139	0.037219
0.666667	0.056198	0.034782	0.088628	0.037400
0.688889	0.056471	0.036034	0.090093	0.037581
0.711111	0.056744	0.037292	0.091535	0.037763
0.733333	0.057017	0.038556	0.092954	0.037945
0.755556	0.057291	0.039826	0.094352	0.038127
0.777778	0.057566	0.041102	0.095730	0.038310
0.800000	0.057840	0.042385	0.097088	0.038493
0.822222	0.058115	0.043673	0.098427	0.038676
0.844444	0.058391	0.044968	0.099748	0.038859
0.866667	0.058667	0.046268	0.101052	0.039043
0.888889	0.058943	0.047575	0.102339	0.039227
0.911111	0.059220	0.048888	0.103611	0.039411
0.933333	0.059497	0.050207	0.104867	0.039595
0.955556	0.059774	0.051532	0.106108	0.039780
0.977778	0.060052	0.052864	0.107334	0.039965
1.000000	0.060331	0.054201	0.108547	0.040150
1.022222	0.060609	0.055545	0.109747	0.040336
1.044444	0.060888	0.056895	0.110933	0.040521
1.066667	0.061168	0.058251	0.112107	0.040707
1.088889	0.061448	0.059613	0.113269	0.040894
1.111111	0.061728	0.060982	0.114419	0.041080
1.133333	0.062009	0.062357	0.115557	0.041267
1.155556	0.062290	0.063738	0.116685	0.041454
1.177778	0.062572	0.065125	0.117801	0.041642
1.200000	0.062854	0.066519	0.118908	0.041829
1.222222	0.063136	0.067919	0.120003	0.042017
1.244444	0.063419	0.069325	0.121089	0.042206
1.266667	0.063702	0.070738	0.122166	0.042394
1.288889	0.063986	0.072156	0.123233	0.042583
1.311111	0.064270	0.073581	0.124291	0.042772
1.333333	0.064555	0.075013	0.125340	0.042961
1.355556	0.064840	0.076451	0.126380	0.043151
1.377778	0.065125	0.077895	0.127411	0.043341
1.400000	0.065410	0.079345	0.128435	0.043531
1.422222	0.065697	0.080802	0.129450	0.043721
1.444444	0.065983	0.082265	0.130458	0.043912
1.466667	0.066270	0.083734	0.131457	0.044103
1.488889	0.066557	0.085210	0.132449	0.044294
1.511111	0.066845	0.086692	0.145867	0.044485
1.533333	0.067133	0.088181	0.198952	0.044677
1.555556	0.067422	0.089676	0.274111	0.044869
1.577778	0.067711	0.091178	0.365770	0.045061
1.600000	0.068000	0.092685	0.470823	0.045254
1.622222	0.068290	0.094200	0.586893	0.045447
1.644444	0.068580	0.095721	0.711839	0.045640
1.666667	0.068871	0.097248	0.843566	0.045833
1.688889	0.069162	0.098781	0.979946	0.046027
1.711111	0.069453	0.100322	1.118808	0.046221
1.733333	0.069745	0.101868	1.257944	0.046415
1.755556	0.070037	0.103421	1.395152	0.046610
1.777778	0.070330	0.104981	1.528281	0.046804
1.800000	0.070623	0.106547	1.655303	0.046999
1.822222	0.070916	0.108120	1.774382	0.047195
1.844444	0.071210	0.109699	1.883957	0.047390
1.866667	0.071504	0.111285	1.982835	0.047586
1.888889	0.071799	0.112877	2.070289	0.047782
1.911111	0.072094	0.114476	2.146159	0.047978
1.933333	0.072389	0.116081	2.210965	0.048175

```
  1.955556  0.072685  0.117693  2.266021  0.048372
  1.977778  0.072982  0.119312  2.313557  0.048569
  2.000000  0.073278  0.120937  2.356844  0.048767
  END FTABLE 12
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    1.143          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.143          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
WDM      2 PREC     ENGL    1.143          RCHRES   1     EXTNL  PREC
WDM      2 PREC     ENGL    1.143          RCHRES   3     EXTNL  PREC
WDM      2 PREC     ENGL    1.143          RCHRES   5     EXTNL  PREC
WDM      2 PREC     ENGL    1.143          RCHRES  12     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   2     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   3     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   4     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   5     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   6     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES  12     EXTNL  POTEV

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   2 HYDR   RO     1 1         1     WDM   1000 FLOW     ENGL       REPL
RCHRES   2 HYDR   O      1 1         1     WDM   1001 FLOW     ENGL       REPL
RCHRES   2 HYDR   O      2 1         1     WDM   1002 FLOW     ENGL       REPL
RCHRES   2 HYDR   STAGE  1 1         1     WDM   1003 STAG     ENGL       REPL
RCHRES   1 HYDR   STAGE  1 1         1     WDM   1004 STAG     ENGL       REPL
RCHRES   1 HYDR   O      1 1         1     WDM   1005 FLOW     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
RCHRES   4 HYDR   RO     1 1         1     WDM   1010 FLOW     ENGL       REPL
RCHRES   4 HYDR   O      1 1         1     WDM   1011 FLOW     ENGL       REPL
RCHRES   4 HYDR   O      2 1         1     WDM   1012 FLOW     ENGL       REPL
RCHRES   4 HYDR   STAGE  1 1         1     WDM   1013 STAG     ENGL       REPL
RCHRES   3 HYDR   STAGE  1 1         1     WDM   1014 STAG     ENGL       REPL
RCHRES   3 HYDR   O      1 1         1     WDM   1015 FLOW     ENGL       REPL
RCHRES   6 HYDR   RO     1 1         1     WDM   1022 FLOW     ENGL       REPL
RCHRES   6 HYDR   O      1 1         1     WDM   1023 FLOW     ENGL       REPL
RCHRES   6 HYDR   O      2 1         1     WDM   1024 FLOW     ENGL       REPL
RCHRES   6 HYDR   STAGE  1 1         1     WDM   1025 STAG     ENGL       REPL
RCHRES   5 HYDR   STAGE  1 1         1     WDM   1026 STAG     ENGL       REPL
RCHRES   5 HYDR   O      1 1         1     WDM   1027 FLOW     ENGL       REPL
RCHRES   9 HYDR   RO     1 1         1     WDM   1032 FLOW     ENGL       REPL
RCHRES   9 HYDR   O      1 1         1     WDM   1033 FLOW     ENGL       REPL
RCHRES   9 HYDR   O      2 1         1     WDM   1034 FLOW     ENGL       REPL
RCHRES   9 HYDR   STAGE  1 1         1     WDM   1035 STAG     ENGL       REPL
RCHRES  10 HYDR   RO     1 1         1     WDM   1036 FLOW     ENGL       REPL
RCHRES  10 HYDR   O      1 1         1     WDM   1037 FLOW     ENGL       REPL
RCHRES  10 HYDR   O      2 1         1     WDM   1038 FLOW     ENGL       REPL
RCHRES  10 HYDR   STAGE  1 1         1     WDM   1039 STAG     ENGL       REPL
RCHRES  11 HYDR   RO     1 1         1     WDM   1040 FLOW     ENGL       REPL
RCHRES  11 HYDR   O      1 1         1     WDM   1041 FLOW     ENGL       REPL
RCHRES  11 HYDR   O      2 1         1     WDM   1042 FLOW     ENGL       REPL
RCHRES  11 HYDR   STAGE  1 1         1     WDM   1043 STAG     ENGL       REPL
RCHRES  13 HYDR   RO     1 1         1     WDM   1048 FLOW     ENGL       REPL
RCHRES  13 HYDR   O      1 1         1     WDM   1049 FLOW     ENGL       REPL
RCHRES  13 HYDR   O      2 1         1     WDM   1050 FLOW     ENGL       REPL
RCHRES  13 HYDR   STAGE  1 1         1     WDM   1051 STAG     ENGL       REPL
END EXT TARGETS

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

```
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

  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

  MASS-LINK       18
RCHRES     OFLOW  OVOL   2                 COPY           INPUT  MEAN
  END MASS-LINK   18


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1974/12/26 21:30

RCHRES:     8

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2        VOL
92  144.01     148.02     149.01
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1974/12/26 21:30

RCHRES:     8

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00  240.02    -299.68       1.2486  1.2486E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1997/10/30 10:45

RCHRES:     8

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2        VOL
92 1.4401E+02  148.02     148.09
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1997/10/30 10:45

RCHRES:     8

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00  240.02    -244.17       1.0173  1.0173E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 2005/ 4/29  9:45

RCHRES:     7
```

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1.4401E+02	148.02	155.91

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 9:45

RCHRES: 7

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	240.02	-712.64	2.9691	2.9691	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 10: 0

RCHRES: 7

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	144.01	148.02	148.50

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 10: 0

RCHRES: 7

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	240.02	-268.92	1.1205	1.1204E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 9:30

RCHRES: 8

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1.4401E+02	148.02	151.88

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 9:30

RCHRES: 8

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	240.02	-471.52	1.9645	1.9645E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 9:45

RCHRES: 8

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1.4401E+02	148.02	155.43

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 9:45

RCHRES: 8

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	240.02	-683.75	2.8488	2.8488E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 10: 0

RCHRES: 8

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1.4401E+02	148.02	153.25

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 10: 0

RCHRES: 8

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).

Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	240.02	-553.43	2.3058	2.3058E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 10:15

RCHRES: 9

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1.6055E+03	1632.9	1640.0

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 10:15

RCHRES: 9

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	2470.0	-3.103E+03	1.2561	1.2561	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2005/ 4/29 10:30

RCHRES: 9

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
92	1605.5	1632.9	1647.8

ERROR/WARNING ID: 341   5

DATE/TIME: 2005/ 4/29 10:30

RCHRES: 9

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	2470.0	-3.808E+03	1.5417	1.5417E+00	2

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

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

APPENDIX IV

Soil and Water Technologies, Inc.
Geotechnical | Monitoring | Materials Testing | Erosion Compliance Services

Van Hanson
PO Box 1690
Brush Prairie | WA 98607
Attn: Jonathan Christopher

June 18th, 2024
G0242400

Subject: **Final Groundwater Monitoring Letter Report**
Proposed Hanson Property
Adjacent to 114 Corduroy Road | Kelso, WA 98626
(Parcel No. 243570101)

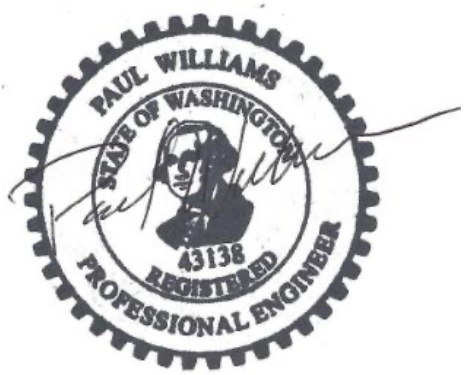
References: **Geotechnical Engineering Study w/Infiltration**
Proposed Hanson Property
Provided by: SWT / Job No. G1172300; dated October 2023

Hello Jonathan,

As requested, from February 6th, 2024, through June 14th, 2024, SWT provided groundwater installation and monitoring located at the north-central side of the site. A single piezometer was installed on 2/6/2024 in order to help determine the static groundwater elevation at the site and continue monthly monitoring throughout the wet season. Based on our field observations and groundwater readings, the nearest seasonal groundwater depth was 2'-7" below the existing ground surface. We have attached our site plan with groundwater chart, *Figure 1.* We suggest that surveying be performed by a licensed professional surveyor for more accurate elevations.

If you have any questions, or if we can be of further assistance, please contact us at 360-200-8693.

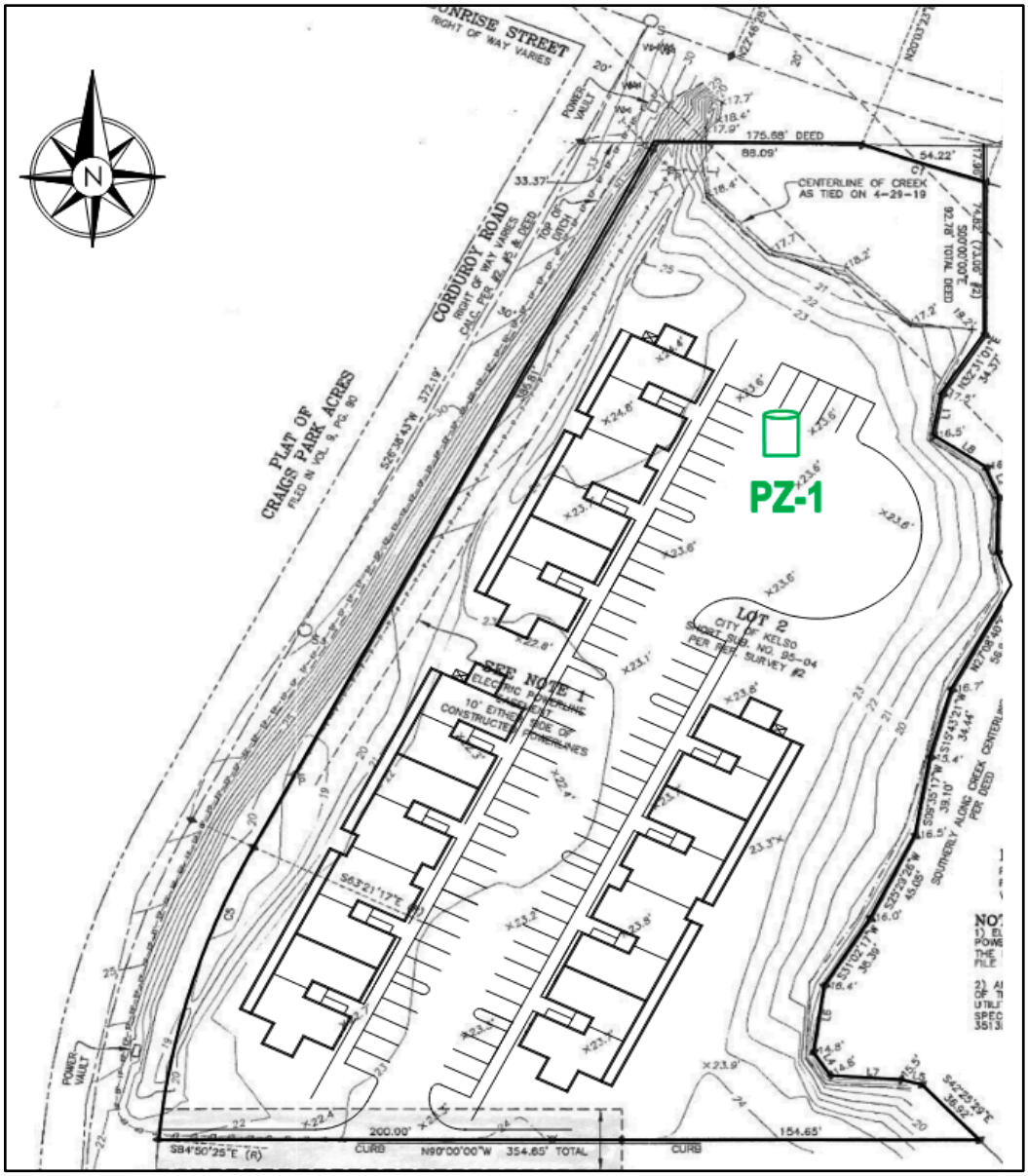
Respectfully Submitted,
Soil and Water Technologies, Inc



Seth Chandlee
President

Paul Williams, PE
Project Engineer

6/18/2024



PZ-1

Approx. Elevation (ft) = ~22

Date	Depth to GW (ft.)
2/29/2024	4’-6”
3/6/2024	4’-1.5”
4/5/2024	3’-9”
5/22/2024	2’-7”
6/14/2024	4’-2”

GEOTECHNICAL ENGINEERING STUDY
W/INFILTRATION

Proposed Hanson Property
Adjacent to 114 Corduroy Road
Kelso, WA 98626
(Parcel No. 243570101)

Prepared for:

Jonathan Christopher
PO Box 1690
Brush Prairie, WA

Prepared By:

Seth A. Chandlee
President

Paul Williams, PE
Project Engineer

Project No. G1172300
{October 2023}

Soil and Water Technologies, Inc.
1101 Broadway | Suite 216 | Vancouver, Washington 98660
(360) 200-8693 / www.swt.ski

Soil and Water Technologies, Inc.

Geotechnical | Monitoring | Materials Testing | Erosion Compliance Services

Jonathan Christopher
PO Box 1690
Brush Prairie, WA

October 2nd, 2023
G1172300

Hello Jonathan,

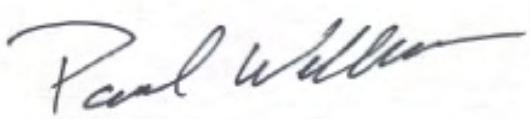
We are pleased to submit our report titled "Geotechnical Engineering Study with Infiltration Testing" for the proposed Hanson Property located north of 114 Corduroy Road in Kelso, Washington. This report presents the results of our field exploration, laboratory testing, and engineering analyses.

Based on the results of this study, it is our opinion that construction of the proposed residential townhome buildings (3 total) is feasible from a geotechnical standpoint, provided recommendations presented in this report are included in the project design.

We appreciate the opportunity to have been of service to you and look forward to working with you in the future. Should you have any questions about the content of this report, or if we can be of further assistance, please call (360) 200-8693.

Respectfully Submitted,
Soil and Water Technologies, Inc.

Seth A. Chandlee
President



Paul Williams, PE
Project Engineer

TABLE OF CONTENTS

INTRODUCTION **1**
General 1
Project Description 1
SITE CONDITIONS **1**
General Regional/Local Geology 1
Surface 2
Subsurface 2
Infiltration Testing 3
Groundwater 3
GEOLOGIC HAZARDS **3**
Seismic Hazards 4
Ground Motion Amplification 4
Liquefaction 4
Seismic Design Criteria: 4
GEOTECHNICAL DESIGN RECOMMENDATIONS **5**
General 5
Foundations 5
Slab on Grade 6
Site Drainage 6
Pavement Areas 6
CONSTRUCTION RECOMMENDATIONS **7**
Site Earthwork and Grading 7
Wet Weather Construction & Moisture Sensitive Soils: 8
Erosion Control 9
Utility Support and Backfill 9
Temporary Excavations 9

GRAPHICS

Figure 1	**Vicinity Map**
Figure 2	**Site Plan (Locations)**
Figure 3	**Footing and Drainage Detail**
Figure 4	**Utility Trench Backfill Detail**
Appendix A	**Field Exploration**
Plate A1	**Unified Soil Classification – Legend**
Plates A2 to A5	**Logs of Exploratory Test Pits**
Appendix B	**Laboratory Testing**
PSD-1 to PSD-2	**Particle Size Distribution**
LPL-1	**Atterberg**
Appendix C	**ASCE7-22 Seismic Summary**

INTRODUCTION

General

This report presents the results of the geotechnical engineering study completed by Soil and Water Technologies, Inc. (SWT) for the proposed Hanson Property located in Kelso, Washington. The general location of the site is shown on the *Vicinity Map, Figure 1.* Our approximate exploratory test pit locations are shown in relation to the site on the *Site Plan, Figure 2.*

The purpose of this study is to explore and evaluate subsurface conditions at the site and provide geotechnical recommendations for the proposed construction based on the conditions encountered. These recommendations include site specific geotechnical parameters for foundation support, earthwork grading, stormwater infiltration, site drainage, erosion control, and seismic hazard evaluation.

Project Description

Based on our review of the preliminary development site plan by Carpenter Engineering, Inc., it is our understanding that the 2.52-acre parcel will be developed into a total of 3 separate townhome buildings, consisting of 22 single-family units. Site construction will also include associated underground utilities (sanitary sewer, stormwater, domestic water), with an asphalt paved roadway and associated parking stalls (70 total). Based on the existing site topography, we anticipate earthwork grading to consist of minimal cuts/fills ranging from approximately 1 to 2 feet in thickness, where necessary, to achieve the desired grade.

Specific structural design loads were also not available, however, based on our experience with similar projects, we anticipate that wall loads will be approximately 700 to 1,500 pounds per lineal foot (plf). Slab-on-grade floor loads will most likely range from one hundred to one hundred and fifty pounds per square foot (100-150 psf).

If any of the above information is incorrect or changes, we should be consulted to review the recommendations contained in this report. In any case, it is recommended that Soil and Water Technologies perform a general review of the final design.

SITE CONDITIONS

General Regional/Local Geology

General information about geologic conditions and soil in the vicinity of the site was obtained by reviewing the USGS Geologic Map of Washington-Southwest Quadrant, WA. State Department of Natural Resources, (Geologic Map GM-34, 1987) and the Geologic Map of the Vancouver Quadrangle, Washington & Oregon, (DLNR), Open File Report 87-10 and the USDA web soil survey.

Regionally, the site is located within Portland-Vancouver Basin/ Willamette Valley/Puget Sound lowland. This area is defined by the coastal range mountains located to the west and the Cascade volcanic mountains to the east.

Locally, the site is located within the Late Pleistocene (17 -13 kya) Cayaclysmic-flood deposit zone. These deposits were created by a series of floods caused by the failure of the ice dam at Glacial Lake Missoula in western Montana. This dam failure caused the deposition of suspended sediments after the floodwaters became hydraulically dammed north of the confluence of the Columbia and Lewis Rivers. Fine-grained sediments were deposited when the flood waters slowed down and created a series of distinct layers described as unconsolidated Gravels, Sands, Silts, and Clays.

Surface

As shown on our *Site Plan, figure 2,* the subject site is located at the southeast corner of the intersection of Harris/Sunrise Street and Corduroy Road in Kelso, Washington. The subject property is bordered to the north, by Harris/Sunrise Street, to the west by Corduroy Road, to the south by a retirement facility, and to the east by heavily forested vacant land/BPA easement.

The property is relatively level (0-5% slope) with a gentle to moderate downward slope along both the north and west sides along the existing roadways. The east side of the site gently slopes downward to an existing creek that runs north to south and remains wet year-round. The total elevation change across the property is about 5-7 feet. The ground surface at the time of our investigation consisted of a soil/gravel turnaround area at the south side and gravel across the remainder of the property. Mature deciduous and evergreen trees were located at the west and east sides, with juvenile deciduous and understory shrubs scattered across the remainder of the site. A 250' wide BPA easement is also located at the north/northeast corner of the property and runs northwest to southeast.

Subsurface

On July 20th, 2023, we excavated a total of 5 exploratory test pits, designated I-1, I-2, and TP-3 through TP-5 to the maximum explored depth of 9.0 feet below the existing ground surface (bgs). Test pit TP-4 was only excavated to a depth of ~1.5 feet due to hard undocumented fill. All exploration locations were selected by the SWT to determine subsurface conditions across the site and for the proposed stormwater treatment/control locations. The approximate locations are shown on the *Site Plan, Figure 2.*

All soil was classified in general accordance with the *Unified Soil Classification System (USCS).* Soil samples obtained from the test pits were returned to our office for additional evaluation and laboratory testing. Descriptions of field and laboratory procedures are included in Appendices A and B, respectively.

The following is a generalized description of the subsurface units encountered.

SURFACE MATERIALS:	Surface materials encountered at the test pits consisted of approximately 4 inches of organic topsoil/root zone.
SILTY GRAVEL W/SAND (FILL)	Undocumented fill, consisting of silty Gravel (GM) with sand, was encountered below the surface materials at all test pits within the upper 2.5 to 4.5 feet bgs. The silty Gravel (GM) with sand was dense to very dense, brown/gray, and in a slightly moist to moist condition. The fines content of the fill was 17.8% with 2-man boulders at a maximum diameter of ~8 inches.
SANDY SILT	Native sandy Silt (ML) was encountered below the silty Gravel (GM) with sand (fill) layer at I-1, I-2, and TP-5 to depth ranging from 4.5/6.5 to the maximum explored depths ranging from 6.5 to 9.0 feet bgs. The sandy Silt (ML) was firm to stiff, gray/blue, and in a very moist to wet/saturated condition. The moisture content of this layer ranged from 38.0% to 39.6%, with a fines content of ranging from 57.8% to 67.2%.
SILTY SAND	Native silty Sand (SM) and silty Sand (SM) with gravels was encountered below silty Gravel (GM) with sand (fill) layer at I-2, TP-3, and TP-5 to depths ranging from 2.5/3.0 to 5.0 feet bgs. These soil layers were dense, gray/brown/black, and in a slightly moist condition. The moisture content of

the of this layer ranged from 9.2% to 12.6%, with a fines content ranging from 10.4% to 19.4%.

SILTY GRAVEL WITH SAND

Native silty Gravel (GM) with sand was encountered below the silty Sand (SM) at I-2 from 5.0 to 6.5 feet bgs. The silty Gravel (GM) with sand was brown, dense, and in a moist condition. The moisture content of this layer was 23.7% with a fines content of 31.0%.

Infiltration Testing

Infiltration testing was performed at test pits I-1 and I-2 at depths of 1.0 and 3.5 feet bgs. The approximate locations of the infiltration test pits are shown on the *Site Plan, Figure 2.* The purpose of performing these tests was to determine if site subgrade soils are suitable for infiltration of stormwater and provide stormwater treatment and control for all onsite impervious surfaces after construction. Infiltration testing methods were performed in general accordance with the Single-Ring Falling Head Infiltration Test. Each test pit was excavated to the desired depths and a 6-inch diameter PVC pipe was embedded into the exposed soil ~ 6 inches in depth. Following a minimum 4-hour pre-saturation period, the pipe was filled with water and timed as the head dropped. The test results were averaged and recorded in inches per hour (iph).

All soil was classified following the *Unified Soil Classification System* (USCS) and the *AASHTO Soil Classification System (M145).* The following table provides the field infiltration test results and associated laboratory testing:

Location	USCS Soil Type	WWHM	Approx. depth to groundwater	Depth (ft.)	% Passing #200 sieve	% Moisture content	Field Coefficient of Permeability (Inches per hour)
I-1	**GM (fill)**	**SG-4**	**Not encountered to 9.0 ft. bgs**	**1.0**	**17.8**	**-**	**2.5 iph**
I-2	**SM**	**SG-4**	**Light seepage encountered at 8.0 ft. bgs**	**3.0**	**57.8**	**32.0**	**1.8 iph**

(USCS) Unified Soil Classification System / (SM) silty Sand
(WWHM) Western Washington Hydrology Model / SG-4 (poorly drained)

Groundwater

Light groundwater was encountered at I-2 at a depth of 8.0 feet bgs. Our review of historical well log data from the Department of Ecology indicates a groundwater level around 47 feet bgs, however, current data is not available within the vicinity of the site.

It is important to note that groundwater conditions are not static; fluctuations may be expected in the level and seepage of flow depending on the season, amount of rainfall, surface water runoff, and other factors. Generally, the groundwater level is higher and seepage rate is greater in the wetter winter months (typically October through May).

GEOLOGIC HAZARDS

The following provides a geologic hazard review for the subject site. The purpose of this investigation was to determine if geologic hazards are present on the site, and if so, to provide recommendations to

mitigate their impacts on development. The geologic hazard review as based on our site reconnaissance and subsurface explorations, as well as a review of publicly available published literature and maps.

Seismic Hazards

The following seismic hazards have been considered as part of our geologic hazards review for the project site. Seismic hazards pertain to areas that are subject to risk of earthquake-induced damage. These hazards include ground shaking/motion amplification and soil liquefaction.

Ground Motion Amplification

According to the NEHRP Seismic Site Class layer of the Washington Geologic Information Portal, the site is designated as a seismic Site Class "E", which indicates soft Clay soil. However, based on our subsurface explorations and laboratory test results, it is our opinion that a Site Class "C/D" is more appropriate for the predominantly dense to very dense soils encountered across the site in the upper 4.5 to 6.5 feet. This designation indicates that some amplification of seismic activity may occur during a seismic event based on the subsurface soil conditions encountered.

Liquefaction

Structures are subject to damage from earthquakes due to direct and indirect action. Shaking represents direct action. Indirect action is represented by foundation failures and is typified by liquefaction. Liquefaction occurs when soil loses all shear strength for short periods of time during an earthquake. Ground shaking of sufficient duration then results in the loss of grain-to-grain contact as well as a rapid increase in pore water pressure. This causes the soil to assume the physical properties of a fluid.

To have potential for liquefaction a soil must be loose, cohesion-less (generally sands and silts), below the groundwater table, and must be subjected to sufficient magnitude and duration of ground shaking.

According to the "Liquefaction Susceptibility" layer of the Washington Geologic Information Portal, the site is mapped as having a "moderate to high" liquefaction susceptibility. Due to the dense to very dense subsurface soils encountered in our test pits to depths ranging from 4.5 to 6.5 feet in depth, and the absence of near surface groundwater, it is our professional opinion that soil liquefaction and induced differential settlement will not occur at the subject site during a moderate to strong seismic event and that a "low to moderate" susceptibility is adequate for the site.

Seismic Design Criteria:

As stated above, Clark County Maps Online indicated the supportive foundation soils encountered at the site are classified as a type "E". However, based on our test pit explorations and laboratory testing, a type "C/D" soil is more appropriate for the site. For more detail regarding soil conditions refer to the soil logs in Appendix A of this report.

The seismic design criteria for this project found herein is based on the American Society of Civil Engineers (ASCE7-22), and ASCE7Hazardtool.online. A summary of ASCE7-22 seismic design criterion is below.

ASCE7-22 Seismic Design Parameters		
Location (46.126849, -122.878714)	**Short Period**	**1-Second**
Maximum Credible Earthquake Spectral Acceleration	S_s = 1.01	S_1 = 0.4
Soil Site Class / Risk Category	C/D / II	
Adjusted Spectral Acceleration	S_{MS} = 1.21	S_{M1} = 0.67
Design Spectral Response Acceleration Parameters	S_{DS} = 0.8	S_{D1} = 0.45

g – acceleration due to gravity

Using the information provided, the structural engineer can select/calculate the appropriate site coefficient values (F_a and F_v) from Tables 1613.5.3(1) and 16135.3(2) of the IBC for determining an earthquake spectral response acceleration for the reference site. Please *Appendix C* for ASCE7-22 Seismic Summary for the site.

Due to the Site Class "C/D" designation and the long period MCES (S_1) value exceeding 0.2g, the structural engineer must apply the site -specific ground motion increases outline in Section 11.4.8 of ASCE 7-22, including an increase of 50 percent to the seismic base shear coefficient, C_s. As an alternative to applying these conservative increases to the ground motions, a site-specific ground motion hazard analysis may be performed, however such an analysis was not included in the scope of this study.

GEOTECHNICAL DESIGN RECOMMENDATIONS

General

Based on the results of our study, it is our opinion the proposed residential townhome buildings (3 total) can be constructed as planned, provided the geotechnical recommendations contained in this report are incorporated into the final design. The following sections present detailed recommendations and parameters pertaining to the geotechnical engineering design for this project.

Foundations

Based on the encountered subsurface soil conditions, preliminary building design criteria, and assuming compliance with the preceding *Site Earthwork and Grading* section, the proposed residential building foundations may be supported on conventional shallow spread footings bearing on over-excavated and re-compacted silty Gravel (GM) with sand (fill) once the upper 2.5 feet has been removed and recompacted in 10-inch lifts across all building areas. SWT should provide subgrade verification during footing excavation prior to the placement and compaction of footing base aggregate, forms, and rebar.

Individual spread footings or continuous wall footings providing support for the proposed buildings may be designed for a maximum allowable bearing value of **2,000 pounds per square foot (psf).** Footings for one level structures should be at least 12 inches in width. Footings for two level structures should be at least 15 inches in width. Footings for three level structures should be at least 18 inches in width. All footings should extend to a depth of at least 12 inches below the lowest adjacent finished subgrade.

These basic allowable bearing values are for dead plus live loads and may be increased one-third for combined dead, live, wind, and seismic forces. Lateral loads can be resisted by friction between the foundation and the supporting sub grade or by passive earth pressure acting on the buried portions of the foundation. For the latter, the foundations must be poured "neat" against the existing soil or back filled with a compacted fill meeting the requirements of structural fill.

- Passive Pressure = 300 pcf (equivalent fluid weight)
- Coefficient of Friction = 0.40

It is estimated that total and differential footing settlements for the relatively light townhome buildings will be approximately 1-1/2 inches, respectively. Therefore, it is recommended that an SWT representative be contacted to reevaluate removal limits during building construction and observe the condition of footing soils prior to the installation of forms/rebar.

Slab on Grade

If concrete floor slabs are desired, then any disturbed soils must be re-compacted prior to pouring concrete. Satisfactory subgrade support for lightly loaded building floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. However, we recommend a 6-inch-thick layer of compacted crushed rock beneath the slab to provide a homogeneous support surface for the slab. A subgrade modulus of 125 pounds per cubic inch (pcf) may be used to design floor slabs.

A minimum 6-inch-thick layer of free draining fill should be placed and compacted over the prepared subgrade to assist as a capillary break and blanket drain. It is also suggested that nominal reinforcement such as "6x6-10/10" welded wire mesh be employed, near midpoint, in new concrete slabs. In areas where slab moisture is undesirable, a vapor barrier such as a 6-mil plastic membrane should be placed beneath the slab.

Exterior concrete slabs that are subject to vehicle traffic loads should be at least 4 inches in thickness. It is also suggested that nominal reinforcement such as "6x6-10/10" welded wire mesh be installed, near midpoint, in new exterior concrete slabs and paving. Fiber mesh concrete may be used in lieu of welded wire mesh.

Site Drainage

The site should be graded so that surface water is directed off the site. Water should not be allowed to stand in any area where buildings or foundations are to be constructed. Loose surfaces should be sealed at the end of each workday by compacting the surface to reduce the potential of moisture infiltrating into the soils. Final site grades should allow for positive drainage away from the building foundations.

The ground should be sloped at a gradient of 3% for a distance of at least 10 feet away from the buildings. We suggest that a foundation footing drain be installed around the perimeter of the buildings. The drain should consist of a 4-inch diameter perforated pipe with holes facing down and installed in an envelope of clean drain rock or pea gravel wrapped with free draining filter fabric. The drain should be a minimum of one-foot-wide and one-foot-deep with sufficient gradient to initiate flow. The drain should be routed to a suitable discharge area. Details for the footing drain have been included as *Figure 3, Typical Footing Subdrain Detail.*

Under no circumstances should the roof down spouts be connected to the perimeter building drain. We suggest that clean outs be installed at several accessible locations to allow for the periodic maintenance of the drain system.

Pavement Areas

Asphaltic Cement (AC) and Crushed Rock Base (CRB) materials should conform to WSDOT specifications. All pavement area subgrades should be compacted to at least 95% of the ASTM D1557 modified proctor laboratory test standard. Based on our visual observations, and laboratory testing, the

subgrade soils is an AASHTO A-1. Therefore, we recommend that a minimum of 3 inches of AC underlain by 6 inches of compacted CRB be applied at all public right-of-way road improvement areas.

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements have the potential to saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be scarified 12 inches in depth, re-compacted to 95% percent (modified proctor ASTM D1557) and graded to provide positive drainage within the granular base section.

The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

CONSTRUCTION RECOMMENDATIONS

Site Earthwork and Grading

Clearing and Grubbing:

Prior to grading, the project area should be cleared of all rubble, trash, debris, etc. Any buried organic debris, undocumented fill or other unsuitable material encountered (soft soils) during subsequent excavation and grading work should also be removed. This also includes existing building foundations, slabs, walls, utility lines, tanks, and any other subterranean structures. Once adequately removed to a competent subgrade, areas proposed for compacted fill and backfilling of subsurface structures should be prepared in the following manner:

- Once the organic topsoil/root zone has been adequately removed (~ 4 inches), a proof roll, if possible, with a fully loaded haul truck shall be administered on the exposed subgrade prior the placement of fill to identify soft areas that may still be present.
- If yielding areas are observed and identified, the soft soils shall be removed to a competent subgrade and re-compacted with suitable structural fill in lifts not exceeding ~8 inches in loose thickness
- As mentioned above, the upper 2.5 to 4.5 feet consists of undocumented fill consisting of silty Gravel (GW) with sand. This layer shall be removed and re-compacted across all building areas prior to excavating footings.

  Structural fill shall be placed in loose lifts not exceeding ~ 8-10 inches in thickness and compacted with adequate equipment (e.g., Segmented pad roller) to a minimum 95% of the Modified Proctor (ASTM D1557) laboratory test standard.

  Compaction testing should be verified by use of a nuclear density gauge during the placement and compaction of the fill material. Each vertical foot of compacted structural fill shall be observed, tested, and compaction of additional lifts.

- Any large trees should be removed from any fill areas. Any remaining root balls, possibly reaching 3+ feet in depth, should be adequately removed and backfilled with approved structural fill. We recommend an SWT representative observe the removal and provide monitoring and density testing of compacted structural fill/backfill at all removal areas.

It is also critical that any surficial subgrade materials disturbed during initial demolition and clearing work be removed and/or re-compacted during subsequent site preparation earthwork operations.

It is important to note that all soft undocumented fill, if present, is to be over-excavated to a competent subgrade and replaced with suitable structural fill. Supporting the proposed buildings on homogeneous material will significantly decrease the potential for differential settlement across the foundation area. In order to create uniform subgrade support conditions, in the vicinity of undocumented fill areas if encountered, the following earthwork operations are recommended:

- Over-excavate existing soils to a competent native subgrade below the bottom of the proposed foundations. The excavations should extend at least one-half width laterally beyond the foundation footprint, or as constrained by existing structures. In addition, native soil removal shall extend to a minimum depth so that a maximum 2:1 ratio of differential structural fill thickness is maintained below all building spread foundation systems.
- The fill soils placed shall consist of clean soils with an expansion index (EI) less than twenty (20), and be free of organic material, debris, and rocks greater than 3 inches in maximum diameter. Based on the field observations and laboratory testing, the existing native soil is suitable for use as structural fill so long as the material does not exceed 3 inches in diameter and is within two percent (2%) of its optimum moisture content prior to compaction.
- The replacement fill shall consist of minimum 95% of a Modified Proctor (ASTM D1557). In addition to the relative compaction requirements, all fills shall be compacted to a firm non-yielding condition.
- Import soils should be sampled, tested, and approved by SWT prior to arrival on site. Imported soils shall consist of clean soils (EI of 20 or less) free from vegetation, debris, or rocks larger than three inches in maximum dimension.

Subgrade Verification and Proof Rolling

After clearing and grading the site, it is possible that some localized areas of soft, wet or unstable subgrade conditions may still exist. Before placement of any roadway base rock, the subgrade should be scarified 12 inches in depth and compacted with suitable compaction equipment. Yielding areas that are identified should be excavated to a competent subgrade and replaced with compacted 2 inch-minus clean crushed rock or equivalent. All building and pavement areas should be compacted to a dense non-yielding condition with suitable compaction equipment.

Wet Weather Construction & Moisture Sensitive Soils:

Field observations and laboratory testing indicates that the subsurface soil to a depth of ~ 2.5 to 4.5 feet consists of undocumented fill consisting of silty Gravel (GM) with sand and can be considered a moisture sensitive material. As such, in an exposed condition, moisture sensitive soil can become disturbed during normal construction activity, especially when in a wet or in a saturated condition. Once disturbed, in a wet condition, these soils will be unsuitable for support of foundations, floor slabs and roadways.

Therefore, where soil is exposed and will support new construction, care must be taken not to disturb its condition. If disturbed soil conditions develop, the affected soil must be removed and replaced with suitable structural fill. The depth of removal will be dependent on the depth of disturbance developed during construction. Covering the excavated area with plastic and refraining from excavation activities during rainfall will minimize the disturbance and decrease the potential degradation of supportive soils.

Erosion Control

If construction extends into the winter "rainy" season, earthwork activities are feasible if proper erosion control measures are implemented to minimize degradation to exposed surfaces. All surface storm water should be captured and directed away from such slopes by means of erosion control measures including straw wattles, sediment fences, temporary sediment ponds etc. Once final grading has been achieved, all exposed surfaces shall be covered with appropriate erosion control such as straw or vegetated as soon as possible.

Utility Support and Backfill

Based on the conditions encountered, the soil to be exposed by utility trenches should provide adequate support for utilities. Utility trench backfill is a concern in reducing the potential for settlement along utility alignments, particularly in pavement areas. It is also important that each section of utility line be adequately supported in the bedding material. The backfill material should be hand tamped to ensure support is provided around the pipe haunches.

Fill should be carefully placed and hand tamped to about 12 inches above the crown of the pipe before any compaction equipment is used. The remainder of the trench back fill should be placed in lifts having a loose thickness of eight inches.

A typical trench backfill section and compaction requirements for load supporting and non-load supporting areas is presented on *Figure 4, Utility Trench Backfill Detail*.

Temporary Excavations

The following information is provided solely as a service to our client. Under no circumstances should this information be interpreted to mean that SWT is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred. In no case should excavation slopes be greater than the limits specified in local, state and federal safety regulations.

Based on the information obtained from our field exploration and laboratory testing, the onsite soils expected to be encountered in excavations will consist of silty Gravel (GM) with sand, sandy Silt (ML), silty Sand (SM) and silty Sand (SM) with gravels. According to Occupational Safety and Health Administration (OSHA) Sloping and Shoring, these soils would be classified as a type "B and C" soils. Therefore, temporary excavations and cuts greater than 4 feet in height, should be sloped at an inclination no steeper than 1H:1V or 1-1/2H:1V (horizontal to vertical) depending on the exposed soils.

If slopes of this inclination, or flatter, cannot be constructed, or if excavations greater than four feet in depth are required, temporary shoring may be necessary. This shoring would help protect against slope or excavation collapse and would provide protection to workmen in the excavation. If temporary shoring is required, we will be available to provide shoring design criteria, if requested.

LIMITATIONS

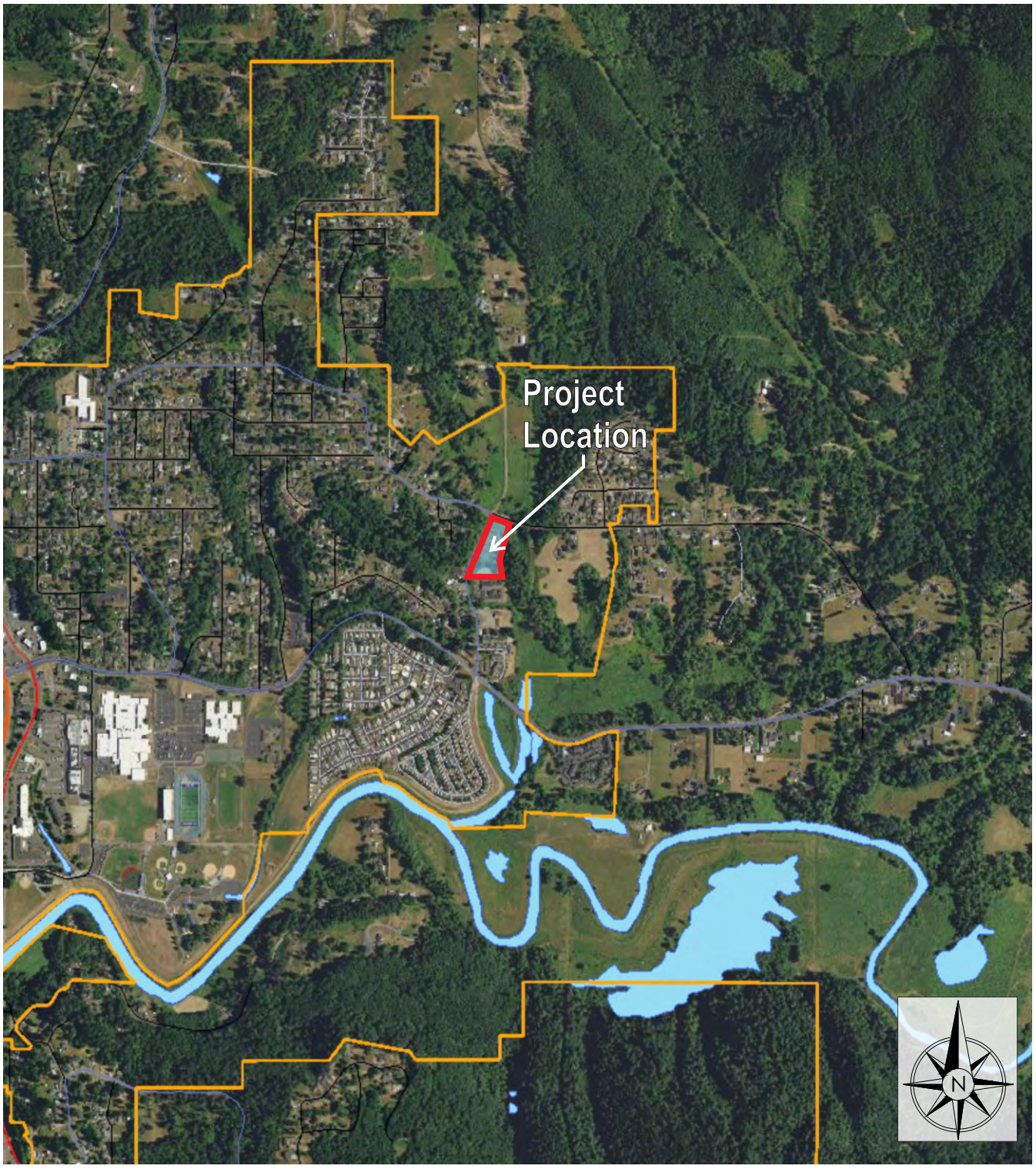
Our recommendations and conclusions are based on the site materials observed, selective laboratory testing, engineering analyses and other design information provided to Soil and Water Technologies as well as our experience and engineering judgment. The conclusions and recommendations are professional opinions derived in a manner consistent with that level of care and skill ordinarily exercised by other

members of the profession currently practicing under similar conditions in this area. No warranty is expressed or implied.

The recommendations submitted in this report are based upon the data obtained from the test pits. Soil and groundwater conditions between the test pits may vary from those encountered. The nature and extent of variations may not become evident until construction. If variations do appear, Soil and Water Technologies should be requested to reevaluate the recommendations contained in this report and to modify or verify them in writing prior to proceeding with the proposed construction.

Temporary construction excavation and site safety are the sole responsibility of the construction contractor who also is solely responsible for the means, methods, and sequencing of construction operations. We are providing the following information only as a service to our client for planning purposes by their design team. Under no circumstances should the information provided herein be interpreted to mean that SWT is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

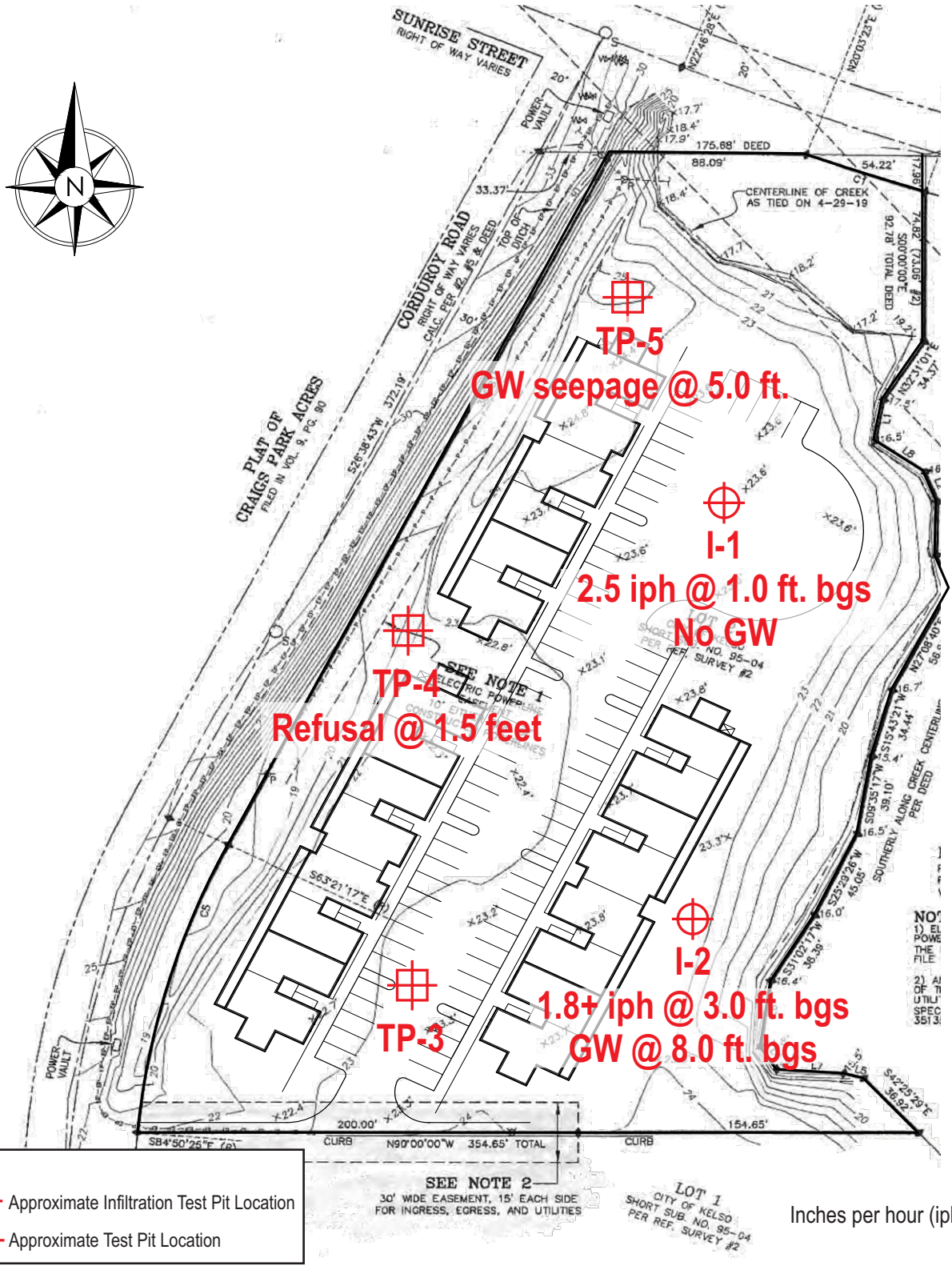
VICINITY MAP



Soil and Water Technologies, Inc
1101 Broadway | Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	*DRAWN:*	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	*DATE:*	8/12/2023
		FIGURE:	1
		PRO. #:	G1172300

SITE MAP



Legend

I-1 ⊕ Approximate Infiltration Test Pit Location

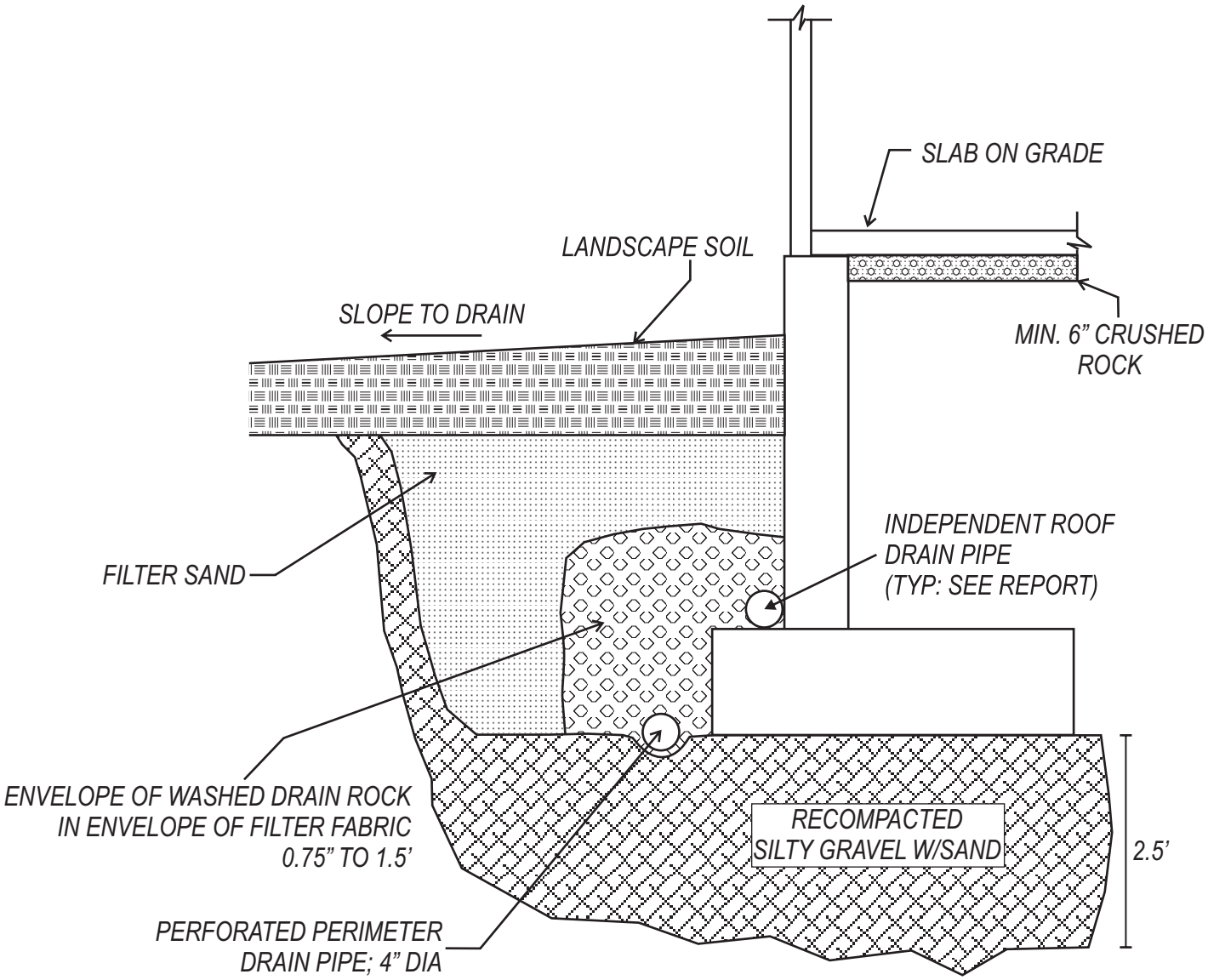
TP-3 ⊞ Approximate Test Pit Location

Inches per hour (iph)

Soil and Water Technologies, Inc
1101 Broadway | Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

swt

CLIENT:	Van Hanson	*DRAWN:*	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	*DATE:*	8/8/2023
		FIGURE:	2
		PRO. #:	G1172300



NOTES:

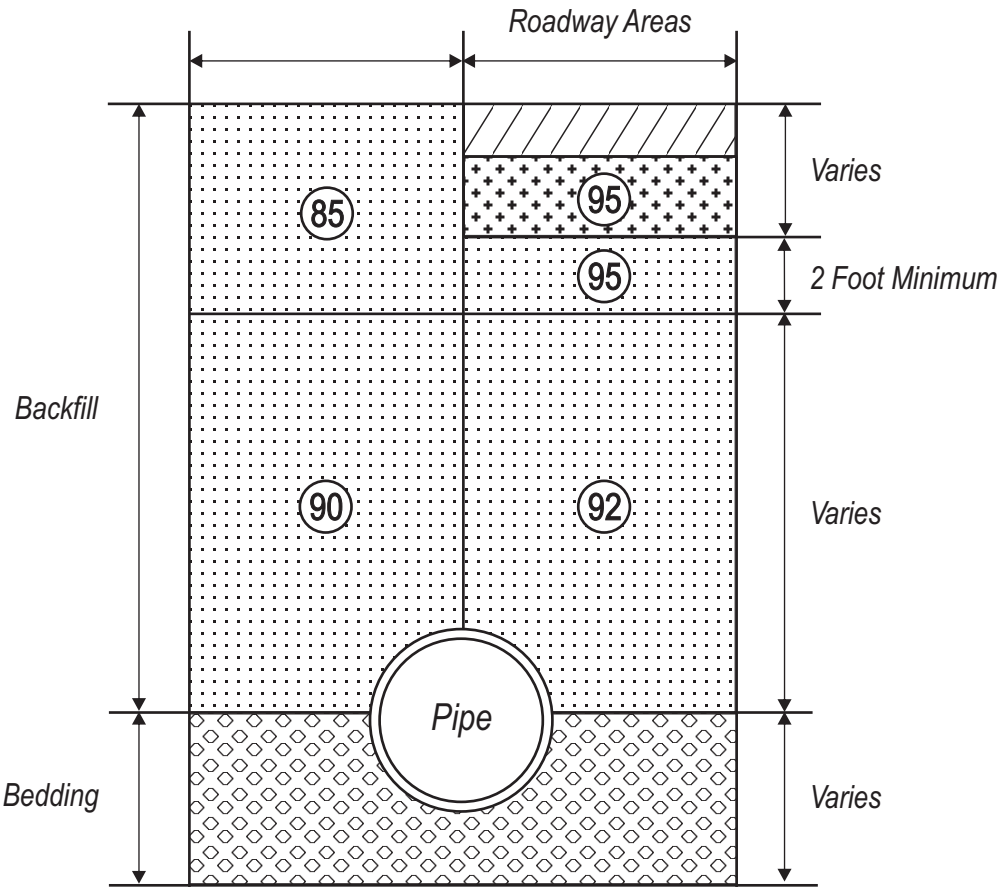
1. FILTER SAND - FINE AGGREGATE FOR PORTLAND CEMENT; SECTION 9=03.1(2)
2. 4" DIAM PERFORATED OR SLOTTED RIGID PVC PIPE WITH A POSITIVE DRAINAGE GRADIENT
3. FOOTINGS BEARING ON RE-COMPACTED SUBGRADE (EX. SILTY GRAVEL WITH SAND)
   *SEE REPORT FOR FOOTING SUBGRADE RECOMMENDATIONS

TYPICAL SLAB ON GRADE DETAIL

Not to Scale

Soil and Water Technologies, Inc
1101 Broadway | Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/12/2023
		FIGURE:	3
		PRO. #:	G1172300



LEGEND

Asphalt or Concrete Pavement

Roadway Base Material or Base Rock

Backfill: Compacted on-site soil or imported select fill material as described in the site preparation of the general Earthwork Section of the attached report text.

95 — Minimum percentage of maximum Laboratory Dry Density as determined by ASTM Test method D1557 (Modified Proctor),unless otherwise specified in the attached report text.

Bedding Material: Material type depends on type of pipe and laying conditions. Bedding should conform to the manufacturer's recommendations for the type of pipe selected.

UTILITY TRENCH BACKFILL DETAIL

Not to Scale

Soil and Water Technologies, Inc
1101 Broadway, Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/12/2023
		FIGURE:	4
		PRO. #:	G1172300

`

APPENDIX A

(FIELD EXPLORATION)

FIELD EXPLORATION

Our field exploration was performed on July 20th, 2023. Subsurface conditions at the site were explored by excavating a total of 5 test pits to the maximum explored depth of 9.0 feet below the existing ground surface.

The approximate test pit locations were determined by Soil and Water Technologies, Inc. (SWT) by pacing from existing site features. These approximate locations are shown on the *Site Plan, Figure 2.*

The field exploration was monitored by SWT, who classified the soil encountered and maintained a log of each test pit, obtained representative samples, and observed pertinent site features. Representative soil samples were placed in sealed plastic bags and returned to the laboratory for further examination and testing.

All samples were visually classified in accordance with the Unified Soil Classification System (USCS), which is presented on *Plate A1*. Logs of each test pit is presented in *Appendix A*. The final logs represent our interpretations of the field logs and the results of the laboratory tests on field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In fact, the transitions may be more gradual.

UNIFIED SOIL CLASSIFICATION SYSTEM
LEGEND

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTION
Coarse Grained Soils	Gravel and Gravelly Soils More Than 50% Coarse Fraction Retained on No 4 Sieve	Clean Gravels (little or no fines)		GW gw	Well-Graded Gravels, Gravel-Sand Mixtures Little or no Fines
				GP gp	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
		Gravels with Fines (appreciable amount of fines)		GM gm	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC gc	Clayey Gravels, Gravel-Sand-Clay Mixtures
More Than 50% Material Larger Than No 200 Sieve Size	Sand and Sandy Soils More Than 50% Coarse Fraction Passing No 4 Sieve	Clean Sand (little or no fines)		SW sw	Well-graded Sands, Gravelly Sands Little or no Fines
				SP sp	Poorly-Graded Sands, Gravelly Sands Little or no Fines
		Sands with Fines (appreciable amount of fines)		SM sm	Silty Sands, Sand-Silt Mixtures
				SC sc	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils	Silts and Clays	Liquid Limit Less than 50		ML ml	Inorganic Silts and Very Fine Sands, Rock Flour, Silty-Clayey Fine Sands; Clayey Silts w/ slight Plasticity
				CL cl	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean
				OL ol	Organic Silts and Organic Silty Clays of Low Plasticity
More Than 50% Material Smaller Than No 200 Sieve Size	Silts and Clays	Liquid Limit Greater than 50		MH mh	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils
				CH ch	Inorganic Clays of High Plasticity, Fat Clays
				OH oh	Organic Clays of Medium to High Plasticity, Organic Silts
Highly Organic Soils				PT pt	Peat, Humus, Swamp Soils with High Organic Contents

Topsoil		Humus and Duff Layer
Fill		Highly Variable Constituents

SAMPLING DESCRIPTIONS

- Grab Sample
- SPT Drive Sampler (ASTM D1586)
- Shelby Tube Push Sampler (ASTM D1587)
- Dames and Moore Drive Sampler (ASTM D3550)

Soil and Water Technologies, Inc
1101 Broadway, Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/15/2023
		PLATE:	A1
		PRO. #:	G1172300

LOG OF TEST PIT **I-1**

ELEVATION: ***23 +/- feet***
EXPLORATORY EQUIPMENT: ***Track-hoe***
DATE: ***7/20/2023***

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200	NOTES
1–4		*brown/gray, dense to very dense imported silty **Gravel (GM)** with sand moist* *{fill}*				*4" organic topsoil* *Field coefficient of permeability 2.5 iph @ 1.0 ft. bgs* *{cobbles & boulders @ 2' bgs}*
5–8	●	*gray/blue, firm to stiff sandy **Silt (ML)** very moist* *{native}*		*39.6*	*67.2*	*{LL-45; PL-28: PI-17}*

Bottom of test pit at 8.0 feet below existing ground surface (bgs).
No groundwater or groundwater seepage encountered.

Soil and Water Technologies, Inc
1101 Broadway |Suite 216
Vancouver, WA | 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	*DRAWN:*	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	*DATE:*	2/6/2023
		PLATE:	A2
		PRO. #:	G0082300

LOG OF TEST PIT — I-2

ELEVATION: **23 +/- feet**
EXPLORATORY EQUIPMENT: **Track-hoe**
DATE: **7/20/2023**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200	NOTES
1–2		brown/orange, dense to very dense imported silty **Gravel (GM)** with sand slightly moist {fill}				4" organic topsoil {cobbles/boulders max 8" diam}
3–4	•	brown, dense silty **Sand (SM)** slightly moist {native}		10.9	19.4	{3.0-3.5 tsf on penetrometer} Field coefficient of permeability 1.8 iph @ 3.0 ft. bgs
5–6	•	brown, dense, moist silty **Gravel (GM)** with sand		23.7	31.0	
7–8	• ▼	gray/blue, firm sandy **Silt (ML)** wet/saturated		38.0	57.8	{light groundwater encountered @ 8.0 feet bgs}
9						

Bottom of test pit at 9.0 feet below existing ground surface (bgs).
No groundwater or groundwater seepage encountered.

Soil and Water Technologies, Inc
1101 Broadway |Suite 216
Vancouver, WA | 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/15/2023
		PLATE:	A3
		PRO. #:	G1172300

LOG OF TEST PIT — TP-3

ELEVATION: **23 +/- feet**
EXPLORATORY EQUIPMENT: **Track-hoe**
DATE: **7/20/2023**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200	NOTES
1–2		brown/orange, dense to very dense imported silty **Gravel (GM)** with sand slightly moist {fill}				4" organic topsoil
3–4	●	brown/gray/black, dense silty **Sand (SM)** with gravels slightly moist {native}		9.2	10.4	{thin 2-3" layer of clean Sand}
5						

Bottom of test pit at 5.0 feet below existing ground surface (bgs).
No groundwater or groundwater seepage encountered.

Soil and Water Technologies, Inc
1101 Broadway |Suite 216
Vancouver, WA | 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/15/2023
		PLATE:	A4
		PRO. #:	G1172300

LOG OF TEST PIT — TP-5

ELEVATION: **25 +/- feet**
EXPLORATORY EQUIPMENT: **Track-hoe**
DATE: **7/20/2023**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200	NOTES
1–3		brown/orange, dense to very dense imported silty **Gravel (GM)** with sand slightly moist {fill}				4" organic topsoil {2-man boulders @ 1' bgs}
3–4	●	brown, dense silty **Sand (SM)** with gravels slightly moist {native} ▼		12.6	11.7	{perched seepage above sandy Silt}
4–6		gray/blue, firm, wet/saturated sandy **Silt (ML)**				

Bottom of test pit at 5.0 feet below existing ground surface (bgs).
No groundwater or groundwater seepage encountered.

Soil and Water Technologies, Inc
1101 Broadway |Suite 216
Vancouver, WA | 98660
PH: (360) 200-8693
www.swt.ski

CLIENT:	Van Hanson	DRAWN:	RN
PROJECT:	Hanson Property North of 114 Courduroy Road Kelso, WA 98626	DATE:	8/15/2023
		PLATE:	A5
		PRO. #:	G1172300

APPENDIX B

(LABORATORY TESTING)

LABORATORY TESTING

Laboratory tests were conducted on representative soil samples to verify or modify field soil classifications, and to evaluate the general physical properties and engineering characteristics of the soils encountered.

The following provides information about the testing procedures performed on representative soil samples:

- ***Moisture Content Tests (ASTM D2216)*** were performed on representative samples encountered in each soil horizon.
- ***Sieve Analysis – >2" sieve w/no. 200 wash*** (ASTM C117/C136) was performed on a representative sample encountered at test pit I-2 and the undocumented structural fill encountered at each test pit.
- ***Atterberg Limits (ASTM D4318)*** was performed on a representative sample collected in test pit I-1 at a depth of 5.5 feet bgs.

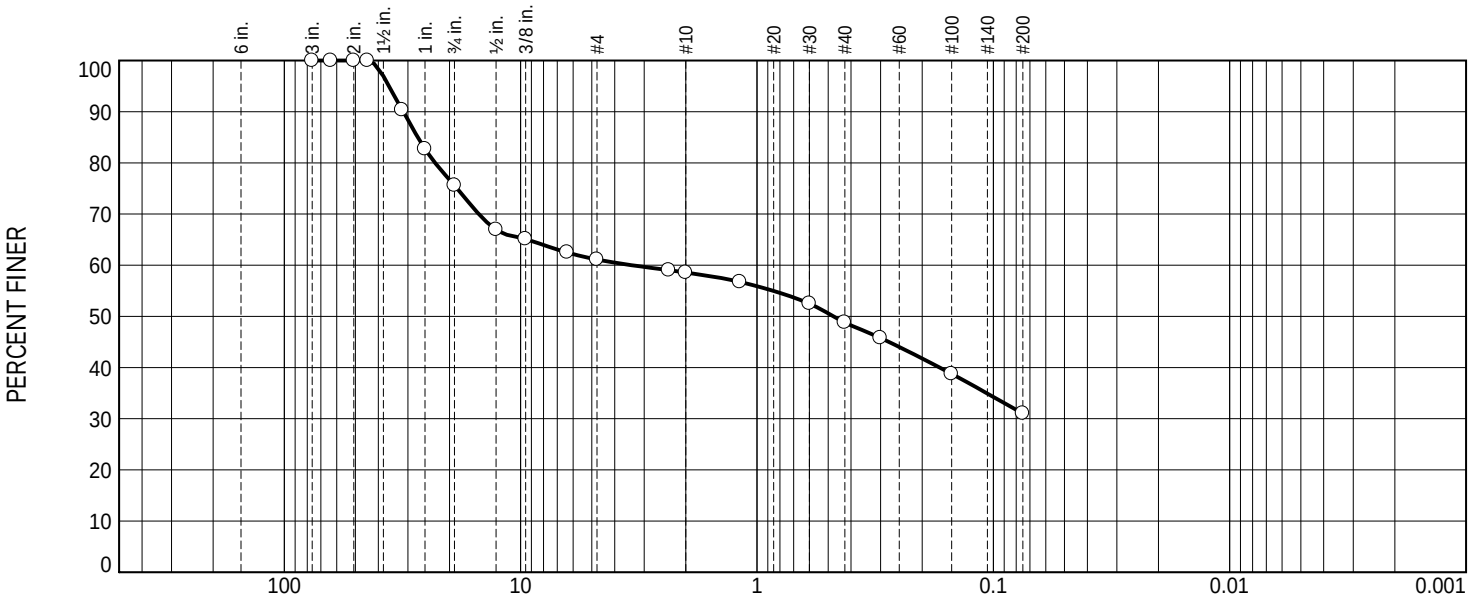
The results of laboratory tests performed on specific samples are provided at the appropriate sample depth on the individual test pit logs. However, it is important to note that some variation of subsurface conditions may exist. Our geotechnical recommendations are based on our interpretation of these test results.

Particle Size Distribution Report

Project: Hanson Property Project No.: G1172300

Client: Van Hanson

Location: I-2 @ 6.0'
Sample Number: 689 Sample Date: 7/20/23



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	41.4	9.8	17.8	31.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2 1/2"	100.0		
2"	100.0		
1 3/4"	100.0		
1 1/4"	90.4		
1"	82.7		
3/4"	75.6		
1/2"	66.9		
3/8"	65.1		
1/4"	62.5		
#4	61.1		
#8	59.0		
#10	58.6		
#16	56.7		
#30	52.5		
#40	48.8		
#50	45.8		
#100	38.8		
#200	31.0		

* (no specification provided)

Material Description

silty Gravel with sand

Atterberg Limits

PL= 0 LL= 0 PI=

Coefficients

D_{85}= 27.2514 D_{60}= 3.3823 D_{50}= 0.4751
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO= A-2-4(0)

Remarks

Figure PSD-1

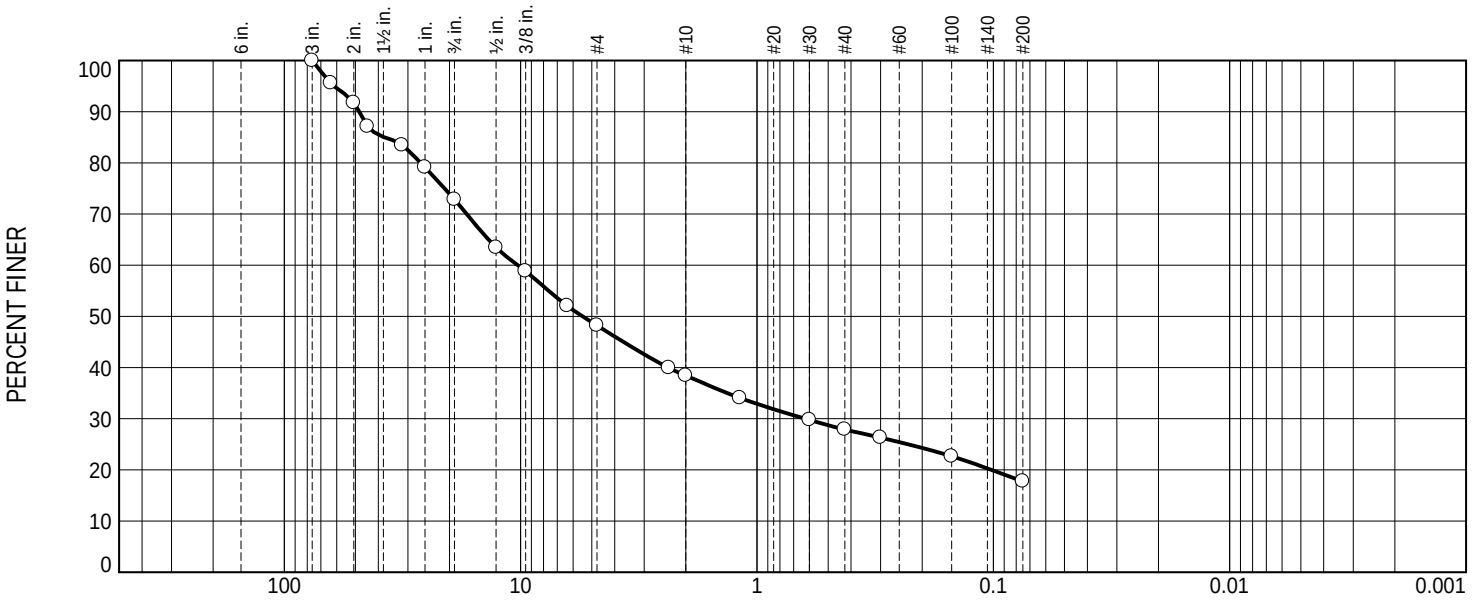
Tested By: KH

Particle Size Distribution Report

Project: Hanson Property Project No.: G1172300

Client: Van Hanson

Location: Undocumented fill (0-4.5')
Sample Number: 689 Sample Date: 7/20/2023



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	61.6	10.5	10.1	17.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2 1/2"	95.6		
2"	91.8		
1 3/4"	87.1		
1 1/4"	83.5		
1"	79.1		
3/4"	72.8		
1/2"	63.5		
3/8"	58.8		
1/4"	52.1		
#4	48.2		
#8	39.9		
#10	38.4		
#16	34.1		
#30	29.8		
#40	27.9		
#50	26.3		
#100	22.7		
#200	17.8		

* (no specification provided)

Material Description
silty Gravel with sand

Atterberg Limits
PL= 0 LL= 0 PI=

Coefficients
D_{85}= 37.6787 D_{60}= 10.2682 D_{50}= 5.4707
D_{30}= 0.6240 D_{15}= D_{10}=
C_u= C_c=

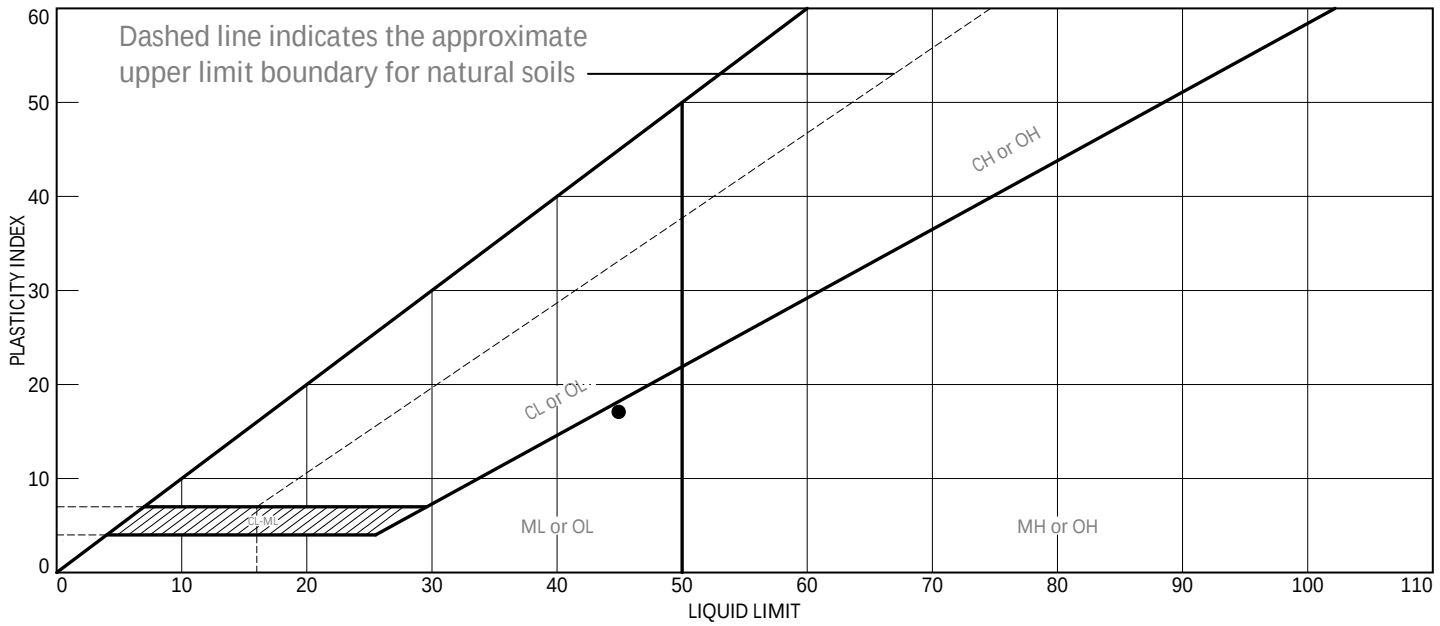
Classification
USCS= GM AASHTO= A-1-b

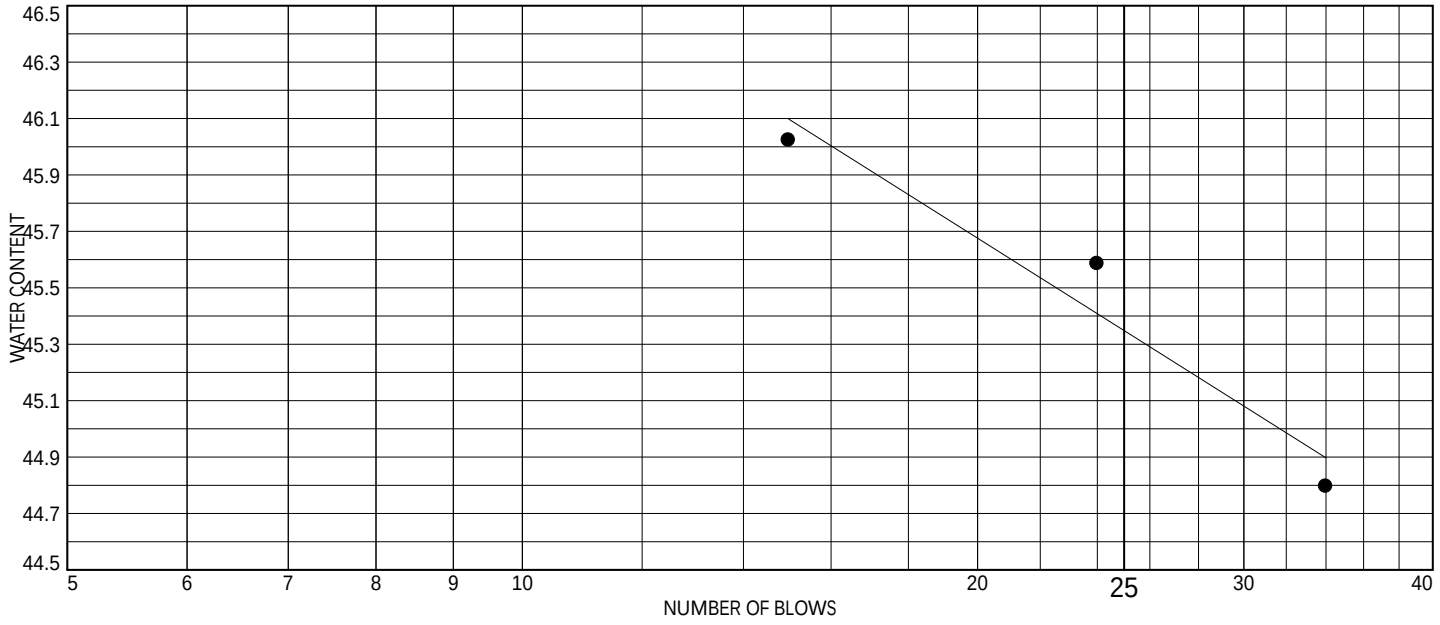
Remarks

Figure PSD-2

Tested By: KH

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	sandy silt	45	28	17	98	67.19	ML

Project No. G1172300 Client: Van Hanson

Project: Hanson Property

Location: I-1 @ 5.5'
Sample Number: 689

Soil and Water Technologies, Inc.
1101 Broadway, Suite 216
Vancouver, WA 98660
PH: (360) 200-8693
www.swt.ski

Remarks:

Figure LPL-1

Tested By: KH

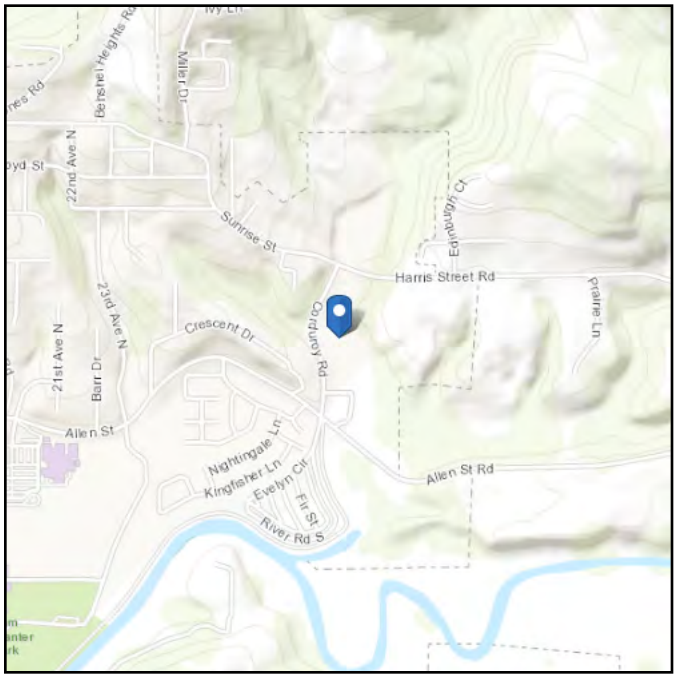
APPENDIX C

(ASCE7-22 SEISMIC SUMMARY)

ASCE 7 Hazards Report

Address:
114 Corduroy Rd
Kelso, Washington
98626

Standard:	ASCE/SEI 7-22	**Latitude:**	46.146849
Risk Category:	II	**Longitude:**	-122.878714
Soil Class:	CD	**Elevation:**	28.02169006007988 ft (NAVD 88)



Seismic

CD

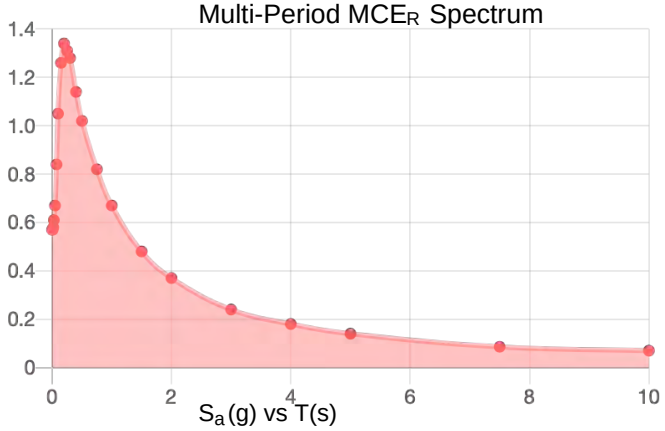
Site Soil Class:

Results:

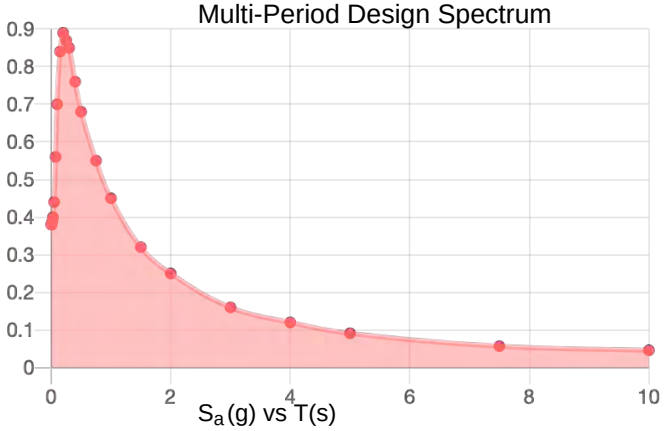
PGA_M :	0.54	T_L :	16
S_{MS} :	1.21	S_S :	1.01
S_{M1} :	0.67	S_1 :	0.4
S_{DS} :	0.8	V_{S30} :	365
S_{D1} :	0.45		

Seismic Design Category: D

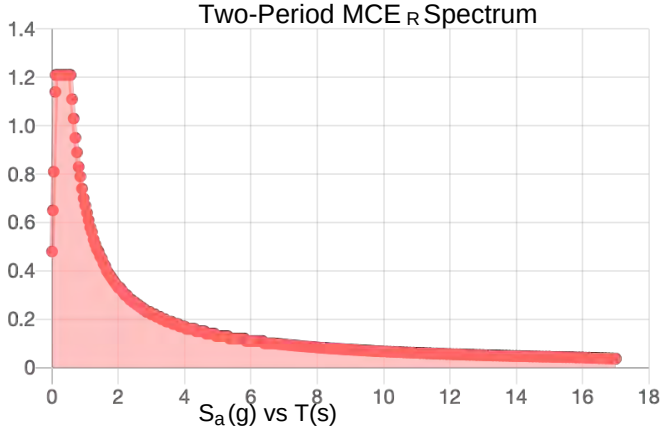
Multi-Period MCE_R Spectrum



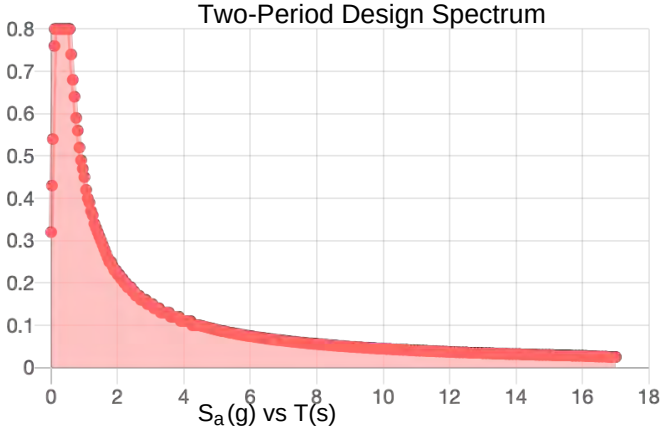
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Thu Aug 24 2023

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

APPENDIX V

Stormwater Conveyance Pipe

Storm sewer pipes convey stormwater. Inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

Key Operations and Maintenance Considerations

- The most common tool for cleaning stormwater conveyance pipes is a truck with a tank, vacuum hose, and a jet hose (Vactor® truck) to flush sediment and debris from the pipes.

Stormwater Conveyance Pipe			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source, AND • Report to Clark County Clean Water Program.	No contaminants or pollutants present.
	Drainage Slow	Decreased capacity that indicates slow drainage. Does not meet facility design infiltration rate. The Water Quality Design Storm Volume does not infiltrate within 48 hours (if perforated pipe). Water remains in the pipe for greater than 24 hours after the end of most moderate rainfall events.	Perforated drain pipe has been cleaned and drainage rates are per design specifications. (Do not allow removed sediment and water to discharge back into the storm sewer.)
	Obstructions, Including Roots	Root enters or deforms pipe, reducing flow.	Roots have been removed from pipe (using mechanical methods; do not put root-dissolving chemicals in storm sewer pipes). If necessary, vegetation over the line removed.
	Pipe Dented or Broken	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced per design standards.
	Pipe Rusted or Deteriorated	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired and/or replaced per design standards.
	Sediment and Debris	Sediment depth is greater than 20% of pipe diameter.	Pipe has been cleaned and is free of sediment/ debris. (Upstream debris traps installed where applicable.)
	Debris Barrier or Trash Rack Missing	Stormwater pipes > than 18 inches need debris barrier.	Debris barrier present on all stormwater pipes 18 inches and greater.

Stormwater Facility Discharge Points / Pipe Outlets

Stormwater facility discharge points may convey stormwater from the stormwater facility into open channels, ditches, ponds, streams, and wetlands. Stormwater facility discharge points need to be assessed to make sure stormwater is not causing any negative impacts to these drainage areas.

Key Operations and Maintenance Considerations

- The most common tools are hand tools to remove debris or to redistribute outfall protection rock.

(Source: USDA - Natural Resources Conservation Service - Illinois)

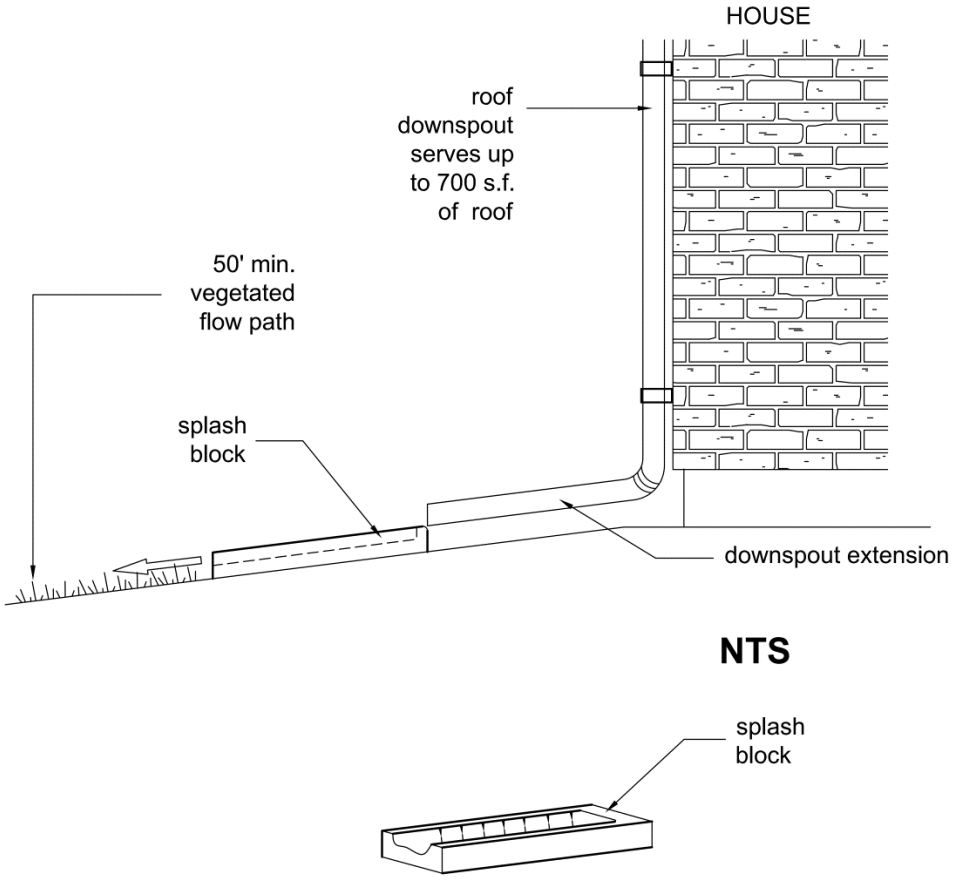
Facility Discharge Point			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Monitoring	Contaminants in Discharge Water	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source, AND • Report to Clark County Clean Water Program.	Effluent discharge from facility is clear.
	Receiving Area Saturated	Water in receiving area is causing substrate to become saturated and unstable. • Report to Clark County Clean Water Program for Engineer Evaluation.	Receiving area is sound and not saturated.
	Ditch or Stream Banks Eroding (via Off Site Assessment)	Erosion, scouring, or headcuts in ditch or stream banks downstream of facility discharge point due to flow channelization or higher flows. • Report to Clark County Clean Water Program for Engineer Evaluation.	Ditch or stream banks are stable.
General	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design function.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design function.
	Obstructions, Including Roots	Roots or debris enters pipe or deforms pipe, reducing flow.	Roots have been removed from pipe (using mechanical methods; do not put root-dissolving chemicals in storm sewer pipes). If necessary, vegetation over the line removed.
	Pipe Rusted or Deteriorated	Any part of the pipe that is broken, crushed, or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced to design standards.
Internal (If Applicable)			
Energy Dissipater	**See "Energy Dissipater"**		

Downspout Dispersion

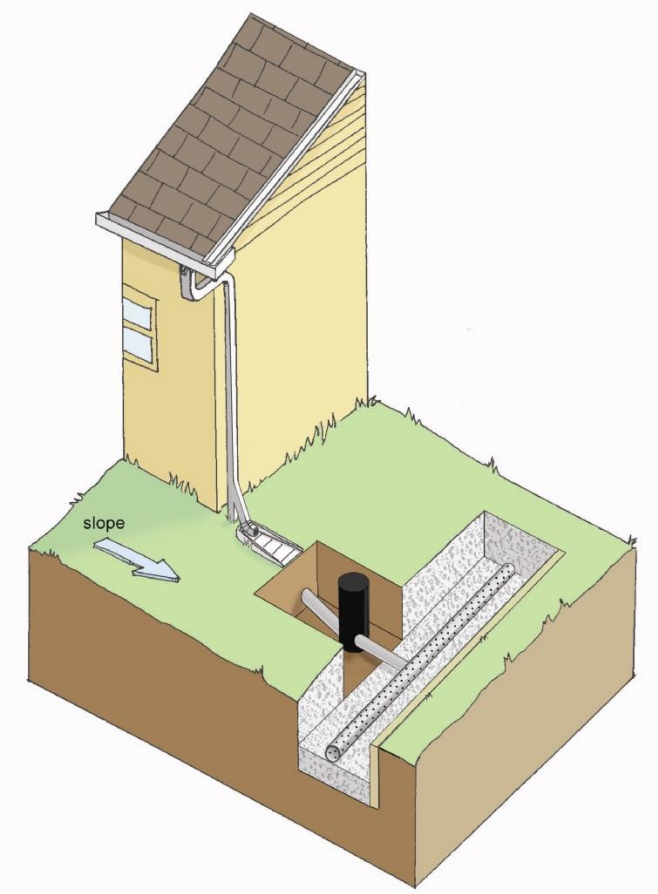
Downspout dispersion systems consist of splash blocks or gravel-filled trenches, which serve to spread roof runoff over vegetated pervious areas.

Facility objects that are typically associated with downspout dispersion include:

- Splash block
- Downspout extension
- Dispersion trench: Gravel-filled trenches used to spread stormwater runoff from a downspout drain over a vegetated pervious area. Downspout drains are routed to a trench via a perforated or slotted pipe. The trench typically includes a notched grade board or other device to distribute flow equally along the length of the trench.
- Dispersal area: Stormwater is dispersed to an area vegetated with well-established lawn or pasture, landscaping with well-established groundcover, or native vegetation with natural groundcover. The required vegetated flow path is 50 feet for splash blocks and concentrated dispersion, 25 feet when using a dispersion trench and varies for sheet flow dispersion.



Downspout Dispersion using Splash Blocks



Schematic Downspout Dispersion using Dispersion Trench

Key Operations and Maintenance Considerations

- For dispersion practices to be effective, the dispersion area must remain covered with dense, well-established vegetation. Site uses should protect vegetation and avoid compaction.
- A notched grade board at a dispersion trench must be maintained at a level grade to prevent concentrated flow. Downspout drains are directed to the trench via a storage sump that must be maintained to remove accumulated sediment.
- The groundcover for the extent of the flow in any dispersal area must be maintained to be dense enough to help disperse and infiltrate flows and to prevent erosion.
- The most common tools for cleaning these systems are hand tools to redistribute material disturbed by concentrated flows and a hose to flush downspouts.

Downspout Dispersion			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Pests	Signs of pest infestations (IPM protocol threshold(s) are exceeded), including rodent holes or mounds that disturb dispersion flow paths.	Pests are not present or engaged in activities that present a significant public health risk or compromise to the intended design function of the facility. Pests that have exceeded acceptable thresholds have been addressed using appropriate IPM measures.
Splash Block	Water Directed Towards Building	Water is being directed towards building structure.	Water is directed away from foundations and other building structures.
	Erosion	Water disrupts soil media.	Water is dispersed into soil/mulch/plantings in a manner that does not create erosion or other issues due to concentrated flows.
Dispersion Trench	Concentrated Discharge	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” from edge of trench; intent is to prevent erosion damage).	Water is discharging as a sheet flow and any disruptive material (e.g. trash, debris, sediment accumulation) has been removed from trench surface.
	Surface of Trench	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow from facility. Vegetation/moss present on drain rock surface impedes sheet flow from facility.	Surface of drain rock is free of trash, debris, and sediment accumulation. Rock surface is open, free of vegetation buildup, and drains freely.
	Damage to or Trash/Sediment Accumulation Around Pipes	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc. Pipe from sump to trench or drywell has accumulated sediment or is plugged. Cracked, collapsed, broken, or misaligned drain pipes.	Trash, debris, and sediment is cleared from dispersion trench components (gutters, pipes, etc.). Pipes are free of damage or defects that hinder system from functioning according to design.
Storage Sump	Sediment in Sump	Sediment in the sump.	Sediment not present in sump. Sediment has also been removed from adjacent components (inlet/outlet pipes, etc.) to prevent immediate re-accumulation.
	Access Lid Not Working	Cannot be easily opened; buried; or cover missing.	Access lid present and functioning per design standards.
	Erosion	Erosion of the pond’s side slopes and/or scouring of the pond bottom, which exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
Rock Pad	General	Only one layer of rock exists above native soil in area 6 square feet or larger, or any exposure of native soil. Soil erosion in or adjacent to rock pad.	Rock pad has been repaired or replaced to meet design standards.

Downspout Dispersion			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
Dispersal Area	Erosion or Sediment Accumulation	Erosion (gullies/ rills) greater than 2 inches deep in dispersal area. Accumulated sediment or debris to extent that blocks or channelizes flow path.	Cause of erosion has been eliminated and the damaged area has been repaired and stabilized.
	Standing Water After Storm Event	Standing surface water in dispersion area remains for more than 3 days after the end of a storm event.	Standing water drains within 72 hours of a storm event.
	Transition Zone Erosion and Sizing	Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than two feet of width.	Transition zone meets design criteria and does not exhibit erosion or other evidence of concentrated flows.
	Poor Vegetation Cover	Poor vegetation cover such that erosion is occurring.	Vegetation has been properly watered and established to meet facility design specifications.
	Excessive Vegetation Cover	Vegetation inhibits dispersed flow along flow path.	Vegetation has been weeded, trimmed, pruned, or thinned to meet facility design criteria.

Modular Detention Systems

Modular detention systems are passive, flow-through, stormwater detention systems that detain (store) stormwater underground. These detention systems function similarly to a detention pond with the temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. The structure is typically constructed of modular units that provide void space for stormwater detention surrounded by a structural aggregate, filter fabric, and/or membrane to isolate the detention from surrounding material and support various above-ground uses (such as parking, roadways, etc.). These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites. The modular nature allows them to be installed with various sizes to accommodate site-specific detention volumes and used for sites with irregularly-shaped spaces available for stormwater detention.

Example Proprietary Modular Detention System Installation

(Source: Contech Engineered Solutions)

Key Operations and Maintenance Considerations

- The most common tool for cleaning manufactured modular detention systems is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris.
- Underground detention systems are enclosed spaces where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual trained and certified to work in hazardous confined spaces.
- Periodic inspections of the inlet and outlet areas to ascertain correct operation of the system.
- Access and maintenance requirements and methods vary by type of system; some maintenance activities may be accomplished without human entry into the system. Check the manufacturer's publications and the site's maintenance plan for details.

Modular Detention Systems			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the depth of the storage area for 1/2 length of storage area or any point depth exceeds 15% of depth. (Example: 72-inch deep storage area would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of storage area.)	Storage area free of sediment and debris.
	Leaks in Joints Between Storage/ Vault/ Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability.)	All joints between tank/pipe sections are sealed.
	Tears, Cracks, or Leaks in Storage Area Structure	Cracks wider than 1/2 inch and any evidence of soil particles entering the storage area through cracks or tears in top, bottom or walls, or maintenance/inspection personnel determines that the storage area is not structurally sound.	Storage area replaced or repaired to design specifications and is structurally sound. No further evidence of soil particles entering through cracks/tears in enclosure.
	Poor Water Quality	Inspection of discharge water for obvious signs of poor water quality (i.e. obvious oil or other contaminants present).	Effluent discharge from vault clear, without thick visible sheen.
	Other Defects Listed in Manufacturer Specifications or Maintenance Literature	Other damage or defects that prevent the system from functioning to design specifications.	Defects repaired/ corrected per manufacturer's documentation and/ or design specifications.
	Vegetation Encroachment	Root encroachment of tree or shrub have impacted function or integrity of wetvault.	Roots are found in vault to be removed and repair vault.
Manhole (if present)		**See "Manhole"**	

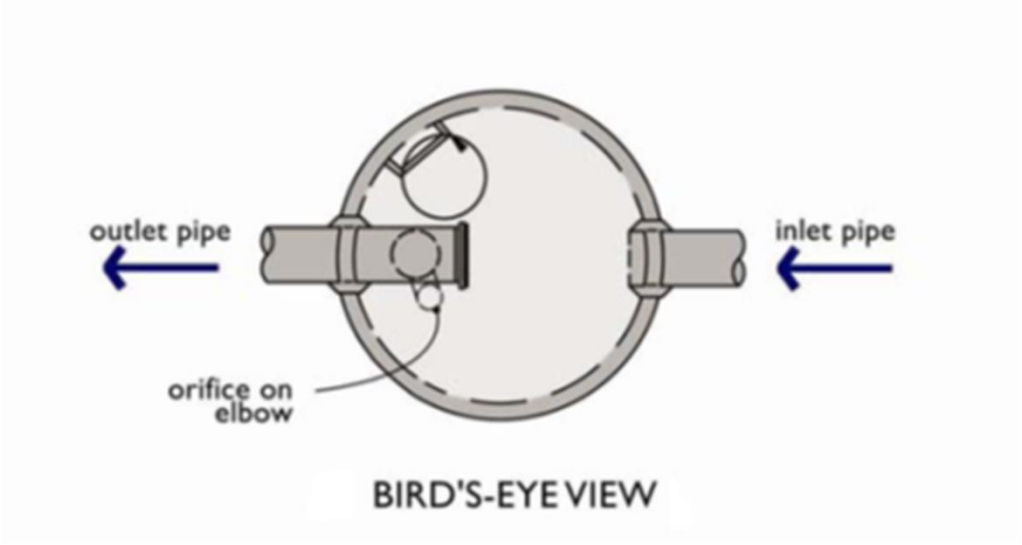
Control Structure/Flow Restrictor

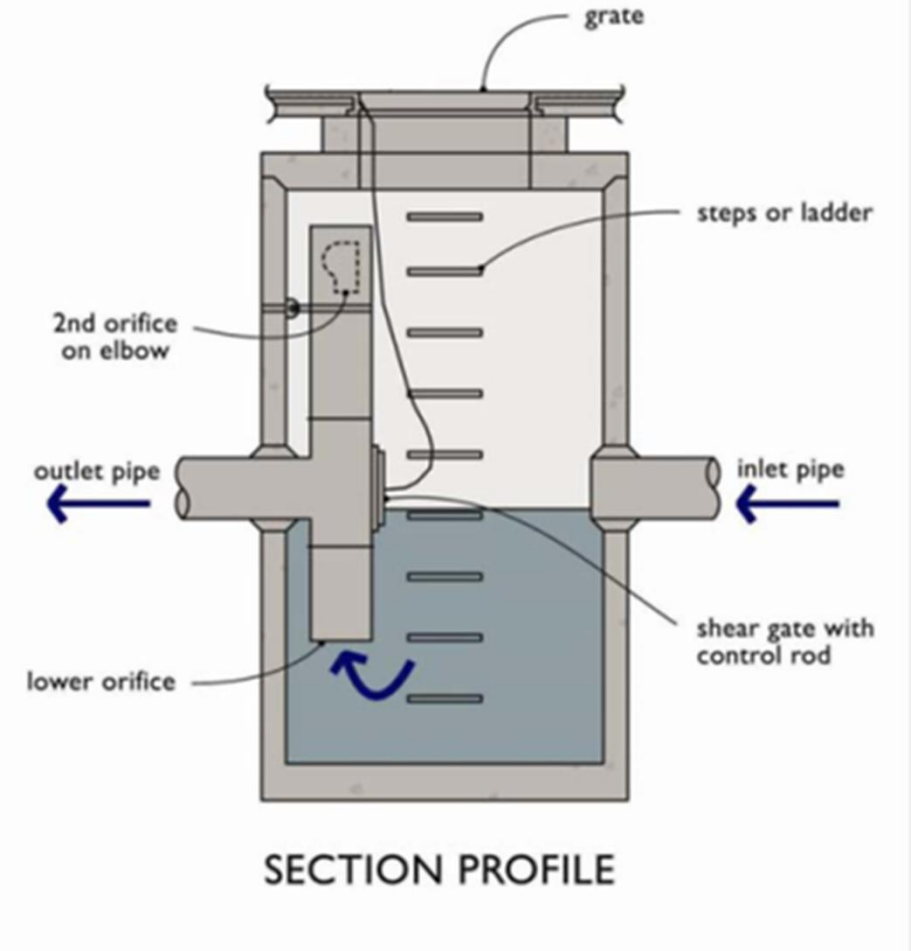
Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or "V" shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. If these flow controls are damaged, plugged, bypassed, or not working properly, the facility could overtop or release water too quickly.

Control structures have a history of maintenance-related problems and it is imperative to establish a good maintenance program for them to function properly. Sediment typically builds up inside the structure, which blocks or restricts flow to the outlet. To prevent this problem, routinely clean out these structures and conduct regular inspections to detect the need for non-routine cleanout.

Facility objects that are typically associated with a control structure/flow restrictor include:

- detention ponds
- media cartridge filters
- closed detention system
- conveyance stormwater pipe





Key Operations and Maintenance Considerations

- Conduct regular inspections of control structures to detect the need for non-routine cleanout, especially if construction or land-disturbing activities occur in the contributing drainage area.
- The most common tool for cleaning control structures/flow restrictors is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A control structure is an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a control structure, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

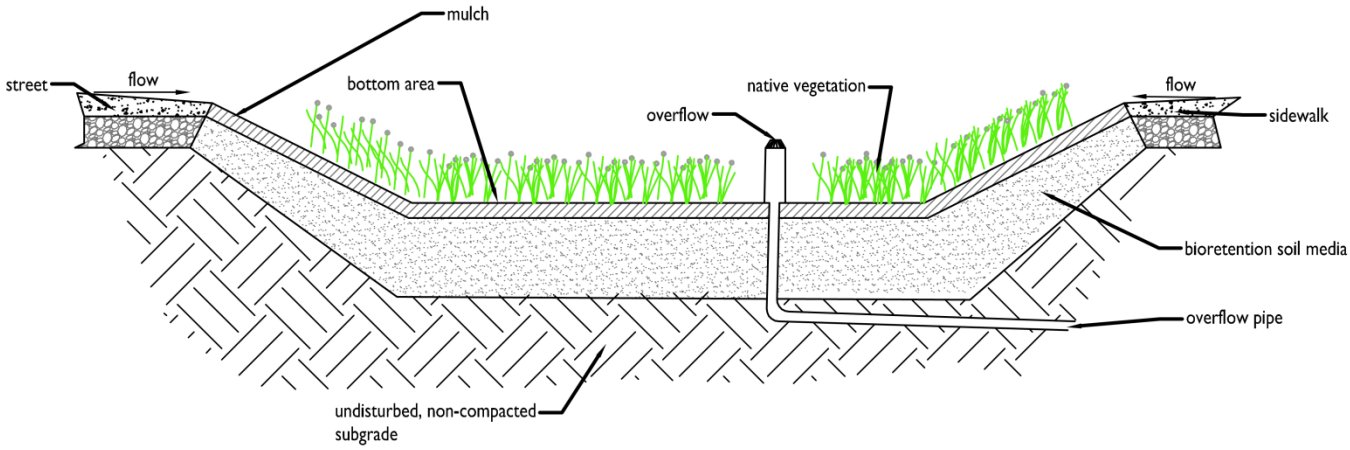
Control Structure/Flow Restrictor			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris has been removed.
	Structural Damage	Structure is not securely attached to manhole wall.	Structure securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design specifications. Allows maintenance person safe access.
Catch Basins	**See "Catch Basins"**		

Bioretention System

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlying bioretention soil. Stormwater that exceeds the surface storage capacity overflows to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket.

Facility objects that are often associated with a bioretention unit include:

- Inlet
- Overflow
- Underdrains (optional)



- Signage

Key Operations and Maintenance Considerations

- Protect the facility from external loads (e.g. trucks, riding mowers, other heavy equipment) to preserve the proper function of bioretention soils. Because the risk of compaction is higher when soils are saturated, any type of loading in the bioretention facility (including foot traffic) should be avoided during wet conditions. All maintenance activities must be performed in a manner to prevent compaction of the bioretention soil.
- Erosion control measures must be maintained in areas of concentrated flows (e.g., pipes inlets or narrow curb cuts). Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly

designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur, the following should be reassessed:

- (1) flow volumes from contributing areas and bioretention cell sizing; (2) flow velocities and gradients within the cell; and (3) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.
- Establish and follow a maintenance schedule for visual inspection and remove sediment if the volume of the ponding area has been compromised.
- Corrective maintenance for excessive drawdown times may include clearing underdrain obstructions or tilling the bioretention soil media. Partial or complete replacement of bioretention soil media may be necessary.
- Regular maintenance of vegetation includes weeding and pruning. Plants require irrigation during the first 2 to 3 years of establishment and during extended dry periods. Replace all dead plants and, if specific plants have a high mortality rate, assess the cause and replace with appropriate species.
- The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. If in question, have soil analyzed for fertility.
- Replace mulch annually in bioretention facilities where heavy metal deposition is high (e.g., contributing areas that include gas stations, ports and roads with high traffic loads). In residential settings or other areas where metals or other pollutant loads are not anticipated to be high, replace or add mulch as needed (likely 3 to 5 years) to maintain a 2 to 3-inch depth.
- Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems, but this will vary according to pollutant load. Replacing mulch media in bioretention facilities where heavy metal deposition is likely provides an additional level of protection for prolonged performance. If in question, have soil analyzed for fertility and pollutant levels.
- Presence of pests such as geese or rodents can generally be corrected by ensuring that drawdown time matches facility design function and plants are spaced at proper densities.
- If an underdrain is present, remove trash, debris, and sediment from the inlet orifice biannually.
- The plants listed in Table 7 are species adapted to seasonal inundation and drought. Light requirements are provided to assist with selecting plants suitable for the site conditions. At a minimum, the size of herbaceous, shrub, groundcover, and accent plants shall be 1-gallon container and tree sizes shall be 1-inch caliper, 5-foot height, 10-gallon container. Installing plants with larger root masses will provide the plants an advantage when establishing.

- Irrigate or hand-water vegetation as needed to help plants establish in the first few years after installation and as needed after plants are established. The following schedule is recommended:
    - Provide watering weekly for two summers. On average, plants require 1-inch of water weekly to establish. Additional water may be necessary during excessive heat.
    - Provide summer watering every two to four weeks during the summer or as needed during prolonged dry periods.
    - Provided summer watering as needed after plants are established.

Plant Material

Table 7: Plant List for Bioretention System*

Moist to Wet Soil Conditions (Facility Bottom to Bottom of Overflow) **Table continues next page.**					
Type	**Botanical Name**	**Common Name**	**O.C. Spacing**	**Allowed ROW****	**Light Requirements**
Herbaceous	*Carex obnupta*	Slough Sedge	18”	N	Full Sun/Part Shade
Herbaceous	*Deschampsia cespitosa*	Tufted Hair Grass	18”	N	Full Sun
Herbaceous	*Juncus patens*	Spreading Rush	18”	Y	Full Sun
Shrub	*Cornus sericea ‘Kelseyii’*	Kelsey Dogwood	24”	Y	Full Sun/Part Shade
Shrub	*Spiraea betulifolia*	Birch-leaf Spiraea	24”	N	Full Sun/Part Shade
Shrub	*Spiraea densiflora*	Sub-alpine Spiraea	24”	Y	Full Sun/Part Shade
Shrub	*Spiraea japonica*	Japanese spirea cultivars	24”	Y	Full Sun
Groundcover	*Rubus calcynoides & pentalobus*	Creeping Bramble	12”	N	Full Sun/Part Shade
Accent	*Camassia leichtinii*	Great Camas	12”	N	Full Sun/Part Shade
Accent	*Camassia quamash*	Common Camas	12”	N	Full Sun/Part Shade
Tree	*Celtis occidentalis*	Hackberry	50’	N	Full Sun
Tree	*Frangula purshiana*	Cascara	30’	N	Full Sun
Tree	*Nyssa sylvatica*	Black tupelo	50’	Y	Full Sun
Tree	*Quercus bicolor*	Swamp White Oak	45’	Y	Full Sun
Tree	*Quercus shumardii*	Shumard Oak	70’	Y	Full Sun

Dry Soil Conditions (Overflow and Above)					
Type	**Botanical Name**	**Common Name**	**O.C. Spacing**	**Allowed ROW****	**Light Requirements**
Herbaceous	*Deschampsia cespitosa*	Tufted Hair Grass	18"	N	Full Sun
Herbaceous	*Helictotrichon sempervirens*	Blue Oat Grass	18"	N	Full Sun
Shrub	*Euonymous japonicas 'Microphyllus'*	Box Euonymus	24"	N	Full Sun
Shrub	*Mahonia aquifolium 'Compacta'*	Compact Oregon Grape	24"	Y	Part Shade/ Shade
Shrub	*Spiraea betulifolia*	Birch-leaf Spirea	24"	N	Full Sun/ Part Shade
Shrub	*Spiraea densiflora*	Sub-alpine Spirea	24"	Y	Full Sun/ Part Shade
Shrub	*Spiraea japonica*	Japanese spirea cultivars	24"	Y	Full Sun
Groundcover	*Arctostapylos uva-ursi*	Kinnikinnick	12"	Y	Full Sun
Groundcover	*Fragaria chiloensis*	Coastal Strawberry	12"	Y	Full Sun
Groundcover	*Mahonia repens*	Creeping Oregon Grape	12"	N	Part Shade/ Shade
Tree	*Celtis occidentalis*	Hackberry	50'	N	Full Sun
Tree	*Frangula purshiana*	Cascara	30'	N	Full Sun
Tree	*Quercus bicolor*	Swamp White Oak	45'	Y	Full Sun
Tree	*Quercus shumardii*	Shumard Oak	70'	Y	Full Sun

Selected plants shall not include any plants from the State of Washington Noxious Weed Board: https://www.nwcb.wa.gov/ and local Clark County Noxious Weed List: https://www.clark.wa.gov/public-works/vegetation-management.

Also please refer to the State of Washington quarantine list for plants prohibited for sale: https://www.nwcb.wa.gov/noxious-weed-quarantine-list.

*Adapted from Portland Bureau of Environmental Services *2014 Stormwater Management Manual*, Appendix F.4., Planting Templates and Plant Lists

** Plant species allowed in Clark County street Rights of Way

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Pests	Signs of pest infestations (IPM protocol threshold(s) are exceeded), including rodent holes or mounds that disturb dispersion flow paths.	Pests are not present or engaged in activities that present a significant public health risk or compromise to the intended design function of the facility. Pests that have exceeded acceptable thresholds have been addressed using appropriate IPM measures. Standing water that may allow mosquito breeding has been removed and cause of standing water has been addressed (see "Ponded Water"). Pest-damaged vegetation has been removed.
Facility Area	Trash and Debris	Trash and debris present in facility area.	Facility area is free of trash and debris.
	Pet Waste	Large volumes of feces from domestic pets are present.	Pet waste removed. Pet waste station or additional signage installed, if appropriate.
	Mulch	Mulch depth is less than 2 inches or the facility has bare spots without mulch cover.	Mulch has been restored to a depth of 2 to 3 inches and is appropriate to the location within the facility (e.g. compost mulch in the bottom and wood chips on side slopes).
Facility Bottom Area	Sediment	Sediment accumulated to extent that infiltration rate is reduced, water can be seen to be ponding, or surface storage capacity is significantly impacted.	Source of sediment has been identified and controlled. Excess sediment has been removed, and damaged vegetation and mulch has been replaced.
	Leaves	After fall leaf drop, leaves have accumulated in the facility in a manner to pose a risk of impeding water flow or clogging the outlet.	Leaves have been removed.
	Ponded Water	Water overflows during storms smaller than the design event, or ponded water remains in the basin more than 48 hours after the end of a storm.	Cause of excessive ponding has been identified by investigating: 1) potential that debris build-up is impeding infiltration; 2) condition of underdrain (if present); 3) potential that other water inputs are present (e.g. groundwater, illicit connections); 4) facility size is appropriate to contributing area; and 5) condition of bioretention soil media.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
			Cause of excessive ponding has been corrected. Engineer has been consulted where necessary.
Earthen Side Slopes and Berms	Erosion at Inlets/ Outlets	Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes.	For channels or cuts over 3 inches deep, temporary erosion control measures have been put into place until permanent repairs are made. Source of erosion has been addressed/ eliminated and eroded areas repaired per design specifications, with additional stabilizing material (cobbles, vegetation, etc.) added as necessary.
	Erosion of Side Slopes	Erosion of sides causes slope to become a hazard.	Source of erosion has been addressed and side slopes repaired to design specifications. Slopes have stabilizing material where necessary.
	Settlement	Settlement greater than 3 inches (relative to undisturbed sections of berm).	Slopes and berm have been restored to design elevations/ heights.
	Berm Leaking	Downstream face of berm wet; seeps or leaks evident.	Any seeps or leaks have been plugged and berm material and compaction are per design specifications. Engineer has been consulted where necessary.
	Rodents in Berm	Any evidence of rodent holes or water piping in berm.	Rodents have been eradicated (see "Pests in Facility"). Holes have been filled and berm compacted (see "Berm Leaking").
Concrete Sidewalls	Damage to Concrete	Cracks or failure of concrete sidewalls.	Concrete sidewalls have been repaired, or replaced if repair is insufficient.
Rockery Sidewalls	Rockery Sidewalls Insecure	Rockery sidewalls are insecure.	Rockery sidewalls have been repaired to design standard, with consultation/ inspection by a professional engineer as necessary (walls over 4 foot height).
Low Permeability Check Dams and Weirs	Sediment or Other Debris Blocking	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice.	No blockage present of check dam, flow control weir, or orifice. Any likely immediate sources of additional debris or sediment (e.g. additional dead plant material, erosion issue, etc. upstream) addressed or removed.
	Erosion or Undercutting	Erosion and/or undercutting present.	Eroded and/or undercut areas have been repaired and sources of issue addressed to prevent further erosion/undercutting at weir.
	Grade Board Not Level	Grade board or top of weir damaged or not level.	Grade board is undamaged (repaired or replaced) and level.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
Inlet	Erosion at Inlet	Concentrated flows are causing erosion at inlet.	A cover of rock or cobbles or other erosion protection measure (e.g., matting) is in place to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale).
Splash Block Inlet	Water Misdirected from Inlet	Water is not being directed properly to the facility and away from the inlet structure.	Splash block(s) reconfigured/ repaired to direct water to facility and away from structure.
Curb Inlet/Outlet	Leaf Accumulation at Curb Cut	Accumulated leaves or other debris at curb cuts (inlets and outlets) can block water flow and proper function of the facility. Maintenance is particularly important in the fall.	Curb cuts and adjacent gutters are free of leaves and debris, and water can flow freely into (and out of) the facility.
Pipe Inlet/Outlet	Pipe is Damaged	Pipe is damaged.	Pipe repaired or replaced to design specifications.
	Pipe is Clogged	Pipe is clogged, completely or partially. Problem material may include leaves, debris, trash, roots, sediment, or other material.	Pipe is unclogged and free of any obstructions. Pipe functioning at design capacity.
	Access is Blocked	Vegetation is blocking access for inspection.	Area within 1 foot of inlets/outlets is clear of vegetation, and access pathways are clear and maintained where necessary.
Trash Rack	Trash and Debris	Trash or other debris is present on trash rack. Capacity may be reduced by buildup of trash or debris.	Trash rack is free of trash, leaves, debris, or other foreign material.
	Bar Screen Damage	Bar screen on trash rack is damaged or missing.	Bar screen has been repaired/ replaced to design specifications.
Overflow	Overflow Blocked	Overflow capacity is reduced by sediment or debris.	Overflow area is free of sediment and debris and capacity functions per design standards.
Underdrain Pipe	Reduced Capacity	Plant roots, sediment, or debris may reduce the capacity of the underdrain. Symptoms may include ponded water in facility bottom area.	Underdrain pipe is free or plant roots, sediment, and debris. Infiltration and pipe capacity functioning per design function.
Vegetation (continues on next page)	Poor Vegetation Health	Less than 75% of planted vegetation is healthy with a generally good appearance (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	At least 75% of planted vegetation is healthy with generally good appearance. Any conditions found that were deleterious to plant health have been corrected where possible. Routine maintenance schedule, including watering, has been updated as necessary to ensure continued plant health and satisfactory appearance.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
	Diseased Plant Material	Diseased plants or plant material is present in the facility.	Diseased plants and plant parts have been removed and disposed of in an approved location (off-site). Potential sources of and conditions exacerbating disease have been addressed (see Pacific Northwest Plant Disease Management Handbook). Vegetated areas replanted as necessary to maintain vegetative coverage per design.
	Vegetation Needs Pruning	Trees and shrubs need regular maintenance and/or corrective pruning.	Trees and shrubs pruned per routine maintenance schedule, appropriate to individual species and age of plants. All pruning of mature trees done under direct supervision of ISA certified arborist.
	Large Trees and Shrubs Interfering	Large trees and shrubs interfere with operation of the facility or access for maintenance.	Trees and shrubs have been pruned using most current ANSI A300 standards and ISA BMPs. Trees and shrubs removed if necessary for operation of facility per design function.
	Dead Vegetation	Standing dead vegetation is present (particularly in fall and spring).	Standing dead vegetation has been removed from site; gaps in vegetation have been replaced with new plantings where necessary, or appropriate erosion control measures put in place until vegetation replacement is feasible.
	Maintenance Needed Around Mature Trees	If conditions warrant maintenance work or planting of new vegetation around mature trees (within the dripline), appropriate care must be taken to avoid adverse impacts to the mature tree(s).	The most current ANSI A300 standards and ISA BMPs have been followed to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil) when working around and under mature trees. New plantings under mature trees include mainly plants that come as bulbs, bare root or in 4-inch pots; new plants in no larger than 1-gallon containers.
	Stakes or Guys Present	Stakes or guys present in plantings installed for over 1 year.	Stakes or guys have been removed from new vegetation after 1 year since installation. Holes have been backfilled where necessary.
	Vehicular Sight Lines Impaired by Vegetation	Vegetation causes some visibility (line of sight) or driver safety issues.	Vegetation has been pruned to appropriate height and spread to maintain sight clearances. If continued (regular) pruning of a given plant have been necessary, plant(s) have been relocated to a more appropriate location and replaced with plant(s) of appropriate mature size.
	Emergent Vegetation Compromises Conveyance	Emergent vegetation compromises conveyance (may become too dense).	Emergent vegetation has been thinned and does not impede conveyance.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
	Noxious Weeds Present	Noxious weeds are present among the site vegetation. Remove, bag, and dispose of Class A & B noxious weeds immediately per WA law. Make reasonable attempts to remove and dispose of Class C noxious weeds. See http://www.nwcb.wa.gov/. Follow Integrated Pest Management (IPM) protocols.	Noxious weeds are not present on site above thresholds established by WA law.