
Stormwater Plan

320 Todd Road Development

320 Todd Rd NE
Puyallup, WA 98371

Prepared by
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July 09, 2024



PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Stormwater Plan for the 320 Todd Road Development in Puyallup has been prepared by me or under my supervision and meets minimum standards of Washington State Department of Ecology, The City of Puyallup, and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.



Justin Jones, PE



07-09-24

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PROJECT OVERVIEW AND MAPS

The 320 Todd Road Development is located in Puyallup, WA along the southern side of Todd Rd NE. The proposed project is on a 65,123 SF residential multi-family lot, RM-20, with a proposed project area of 27,110 SF. The surrounding area is comprised of residential and commercial buildings.



The project is a new development project and includes the renovation of an existing two-story residential building with a roof overhang/deck area of 2,745 SF, 500 SF of pervious concrete pavement, 12,216 SF of asphalt pavement, and 12,600 SF of landscaping. Additionally, the development will include the construction of a driveway approach and garbage enclosure. The stormwater approach is to fully infiltrate all stormwater onsite using permeable pavement, bioswales, and an underground infiltration gallery.



EXISTING CONDITIONS SUMMARY

The Todd Rd Development is a 65,123 SF (1.50 acres) parcel, with a proposed project area of 27,110 SF. The site consists of an existing two-story residential 2,195 SF building, one-story garage, concrete, landscaping, septic drainfield, and wood fence along the perimeter of the property.

The project site is generally flat sloping from east to west; Stormwater that falls within the existing site infiltrates into native soils. There is no existing stormwater conveyance system to the site. The existing project site is approximately 14.3% impervious.

PROPOSED CONDITIONS SUMMARY

The Todd Rd Development proposes the conversion of an existing residential building to a 2,745 SF office building (including roof overhangs and decks) with site improvements.

The proposed development will result in 17,736 SF of impervious surface be 72.8% pervious.

Site improvements include the construction of 12,216 SF of new asphalt pavement, 500 SF of new permeable concrete pavement, and 12,600 SF of landscaping. The building will also have utility service connections for sewer, water, power, gas, and communications.

Stormwater from the Todd Rd building will be collected with roof downspouts and conveyed to a proposed infiltration gallery, which will infiltrate 100% of stormwater up to the 100-year storm. Infiltration testing was performed on site to obtain a design infiltration rate for on-site soils in the vicinity of stormwater infiltration systems, see Appendix A.

Runoff from the proposed pervious aconcrete surfaces within the site will infiltrate into native soils below the pavements. The pervious pavements are designed to infiltrate 100% of stormwater up to the 100-year storm event.

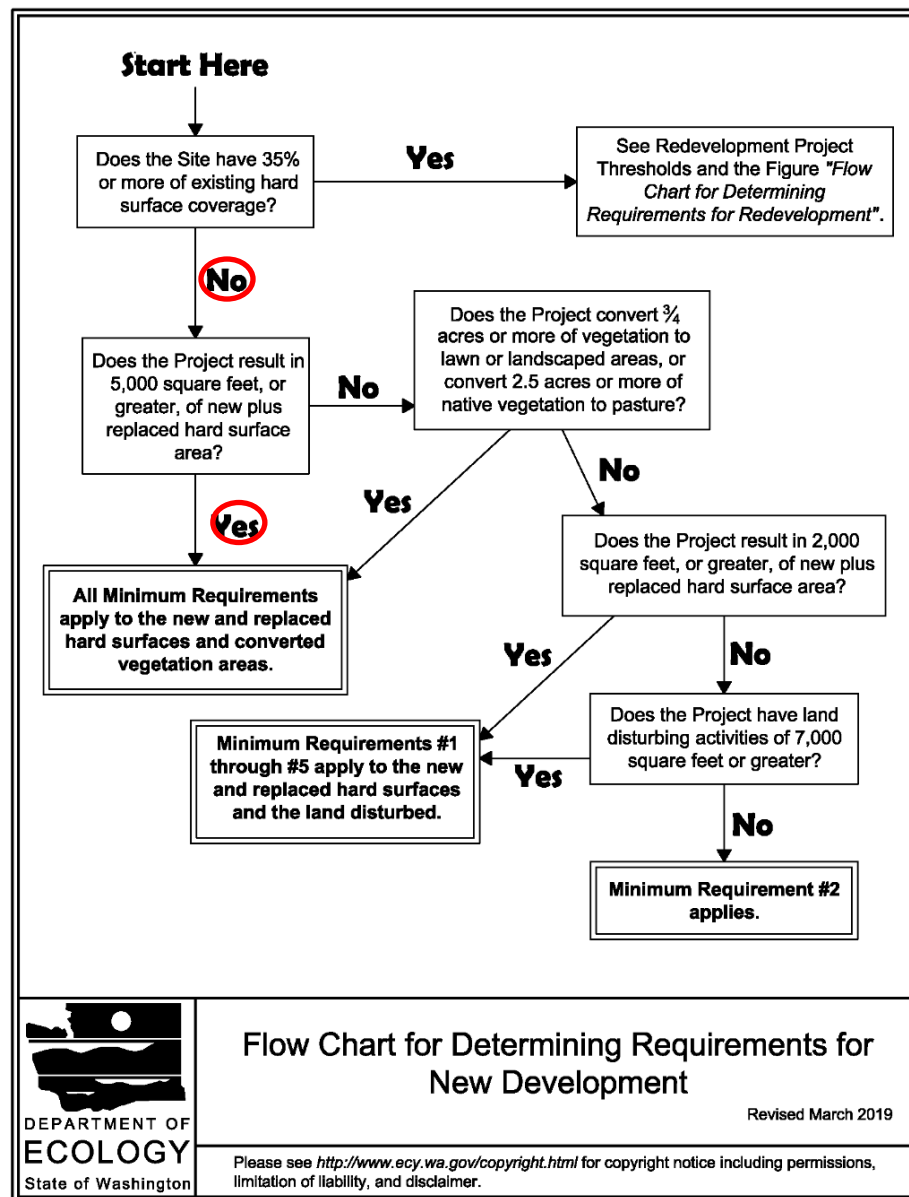
Bioswales will collect and treat the asphalt stormwater runoff; subsequently the runoff in the bioswales will be conveyed to the same underground infiltration gallery.

The Todd Rd Development will have 17,736 SF of new and replaced hard surfaces upon project completion, and a total of 27,110 SF of land disturbing activity. The fully developed site will be 27.2% impervious in the final condition. Since the project exceeds 5,000 SF of new plus replaced hard surfaces, the project is subject to all minimum requirements.

SUMMARY OF MINIMUM REQUIREMENTS

The City of Puyallup utilizes the 2019 Department of Ecology Stormwater Manual for Western Washington (manual) for stormwater design. Volume 1 of this manual describes the Minimum Requirements for stormwater management for a New Development site. Using the flow chart below, all minimum requirements apply to the Todd Rd project site.

Figure I-3.1: Flow Chart for Determining Requirements for New Development



MINIMUM REQUIREMENT 1: PREPARATION OF STORMWATER SITE PLANS

Stormwater Site Plan drawings have been prepared per the City of Puyallup development codes and the 2019 DOE Manual, see Appendix B.

MINIMUM REQUIREMENT 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION

Temporary Erosion and Sediment Control Plans and a Construction Stormwater Pollution Prevention Plan have been prepared per the City of Puyallup development codes and the 2019 DOE Manual. Construction Stormwater Pollution Prevention measures may include: construction entrance; silt. See Appendix C for CSWPPP.

MINIMUM REQUIREMENT 3: SOURCE CONTROL OF POLLUTION

Source control BMPs will be implemented to minimize stormwater contamination and help comply with the Department of Ecology Stormwater Management Manual for Western Washington. BMP's for the project may include:

- *Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O & M Improvements.*
- *Clean catch basins when the depth of deposits reaches 60-percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin.*
- *Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.*

MINIMUM REQUIREMENT 4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The existing site is comprised of an existing two-story residential building, garage, landscaping, concrete, and a wood fence along the perimeter of the property and is 14.3% impervious. Stormwater currently infiltrates into native soils, and surface flows to the west side of the property. The proposed stormwater runoff will maintain existing drainage patterns and infiltrate onsite.

MINIMUM REQUIREMENT 5: ONSITE STORMWATER MANAGEMENT

Minimum Requirement #5 states projects shall utilize either On-Site Stormwater Management BMP's from List #2 or demonstrate compliance with the LID Performance Standard. The LID performance standard requires the site to match predeveloped flows through flow control systems for 8% of the 2-year and 50-year storm events. The Todd Rd project is increasing the amount of impervious surface coverage on-site, and thus would be increasing stormwater flow frequency volumes. List #2 requires the evaluation of BMP's in the order listed to determine the most appropriate stormwater management system for landscaped areas, roofs, and hard surfaces. The stormwater approach is to infiltrate all stormwater runoff onsite, therefore the Todd Rd project will meet the LID performance standard.

Each BMP requires varying separation between the bottom of the BMP and the seasonal high groundwater level. Therefore, testing of the stormwater infiltration rate and seasonal high groundwater level was conducted. Excavation was conducted to a depth of 5.0-feet. No mottling or groundwater was observed in the test locations. A Pilot Infiltration Test (PIT) was conducted in the west and east sides of the site. The tests recorded infiltration rates of 0.87 and 0.85 inches per hour, and after applying factors of safety design infiltration rates are 0.39 and 0.38 inches per hour, see Appendix A for Infiltration Report. Groundwater was not encountered during soil inspections.

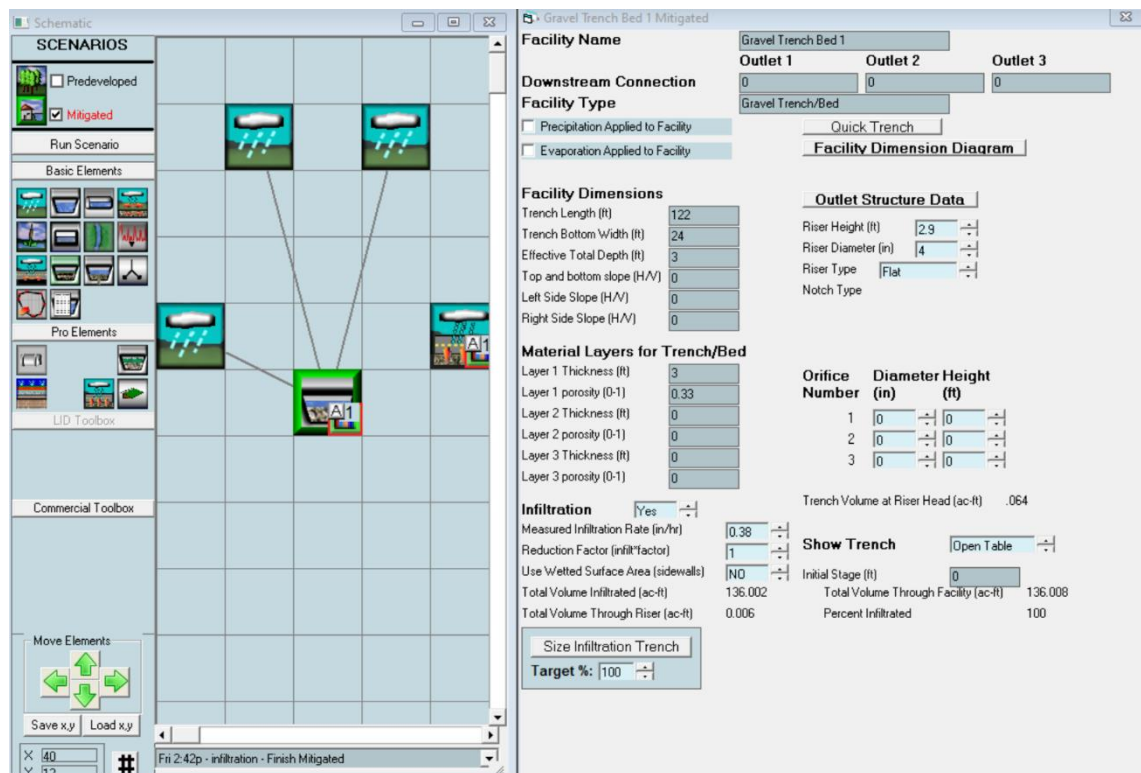
Three drive-point piezometers (DPPs) were installed by GeoResources to conduct groundwater monitoring for the 320 Todd Rd project site during the wet season. Groundwater levels were manually measured bi-monthly from January 6, 2023 to March 31, 2023, see Appendix E in Appendix A for Soils Report.

The measured seasonal high groundwater level is at elevation 43.0', approximately 7 to 8 feet below existing grade. All BMP's will have sufficient separation between the bottom of the BMP and seasonal high groundwater level.

The following Stormwater BMP's were evaluated for feasibility with regards to the Todd Rd Development project:

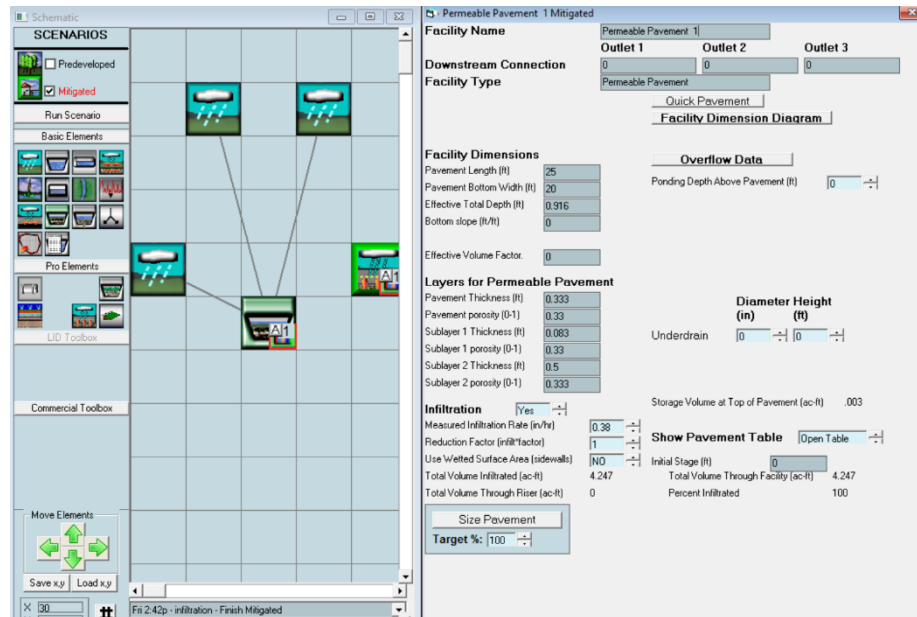
- Lawn & Landscaped Areas:
 - Post Construction Soil Quality: Post Construction soil quality and depth will be utilized for the Todd Rd project in accordance with BMP T5.13.
- Roofs:
 - Full Dispersion: Full dispersion is feasible if a site maintains 65% of its area in a native vegetated condition. The Todd Rd Development project does not maintain 65% of the site in a native condition and thus full dispersion was deemed infeasible for roof stormwater management.
 - Downspout Infiltration: Downspout infiltration was evaluated for feasibility for the site, and infiltration was deemed feasible for the site. Proposed roof areas will be routed to the infiltration trench and infiltrate at 100% on site into native soils based on WWHM modeling, see Appendix D. The infiltration trench has been sized utilizing the WWHM Model for a gravel trench bed based on the following criteria:
 - Infiltration rate of 0.38 in/hr
 - Field measured rates for infiltration are higher than the design infiltration rate, however the rate 0.38 in/hr has been used as a conservative design rate.
 - Drain Rock Basin with a porosity of 0.33
 - 3.0' Drainage/Storage Layer thickness
 - Minimum 1-foot of separation between the bottom of the infiltration trench and the seasonal high groundwater level

See screenshot below for infiltration trench WWHM Modelling:



- Other Hard Surfaces:
 - Full Dispersion: Full dispersion is feasible if a site maintains 65% of its area in a native vegetated condition. The Todd Rd Development project does not maintain 65% of the site in a native condition and thus full dispersion was deemed infeasible for hard surface stormwater management.
 - Permeable Pavement: Permeable Pavements were evaluated for the Todd Rd Development site and were determined to be feasible for the project. Proposed permeable pavement areas will infiltrate at 100% on site into native soils based on WWHM modeling, see Appendix D for WWHM report. Permeable Pavements have been sized utilizing the WWHM Model for permeable pavement based on the following criteria:
 - Infiltration rate of 0.48 in/hr
 - Field measured rates for infiltration are higher than the design infiltration rate, however the rate 0.48 in/hr has been used as a conservative design rate.
 - Drain Rock Basin with a porosity of 0.33
 - 4" Drainage/Storage Layer thickness
 - Minimum 1-foot of separation between the bottom of the permeable pavement and the seasonal high groundwater level
 - Permeable Pavements will include the following:
 - 6" minimum ASTM #8 Stone
 - Impermeable geotextile along building walls

See screenshot below for permeable pavement WWHM Modelling:



Based upon the evaluation of the above BMP's, runoff from building roof will be collected from the downspout locations and routed through stormwater pipes along the perimeter of the building and connect into the proposed infiltration gallery. Stormwater entering the infiltration trench will infiltrate 100% up to the 100-year storm event. The top of the infiltration gallery will be located at the bottom of the storage course of the proposed permeable pavement.

The asphalt parking lot stormwater runoff will be managed with bioswales and the same underground infiltration gallery as the roof. Runoff in the asphalt parking lot will sheet flow to one of two bioswales where the stormwater will be treated and then conveyed to the underground infiltration gallery.

Permeable pavements located within the Todd Rd Development project area have been sized to infiltrate 100% of stormwater runoff up to the 100-year storm event. Stormwater runoff in these areas will infiltrate through the pavement surface, through the storage layer into native soils below.

Proposed landscaping will adhere to BMP T5.13 and infiltrate 100% of the stormwater runoff onsite into the native soils below.

MINIMUM REQUIREMENT 6: WATER QUALITY

The Department of Ecology Stormwater Management Manual states that any project with a pollution generating threshold discharge area greater than 5,000 SF shall be required to utilize runoff treatment BMPs. The project proposes 12,216 SF of asphalt driveways and is therefore subject to runoff treatment for pollution generating areas.

Stormwater runoff from the asphalt parking lot will sheet flow to one of two bioswales and be treated before entering the stormwater conveyance system to the underground infiltration gallery, see Appendix E for WWHM modeling.

The bioswales have been designed per the 2019 DOE manual and sized using WWHM and the following criteria:

- Treat 91% of runoff
- DOE bioretention soil mix (BSM)
- 3.0-inches per hour infiltration rate for basins less than 8,000 SF
 - Per 2019 DOE manual when using default soil media mix
- 0.5-foot of ponding with 24-hour drawdown
- 6-inches freeboard
- 1.5-foot depth BSM
- 2.0-feet x 5.0-feet and 2.0-feet x 12.0-feet bottom areas will be used for the two bioswales
- 3:1 side slopes

Subbasin Name: West Drive Aisle

Flows To: Surface retention 1, Interflow, Groundwater

Area in Basin:

Available Pervious	Acres	Available Impervious	Acres
A/B, Forest, Flat	0	ROADS/FLAT	0
A/B, Forest, Mod	0	ROADS/MOD	0
A/B, Forest, Steep	0	ROADS/STEEP	0
A/B, Pasture, Flat	0	ROOF TOPS/FLAT	0
A/B, Pasture, Mod	0	DRIVEWAYS/FLAT	0.184
A/B, Pasture, Steep	0	DRIVEWAYS/MOD	0
A/B, Lawn, Flat	0	DRIVEWAYS/STEEP	0
A/B, Lawn, Mod	0	SIDEWALKS/FLAT	0
A/B, Lawn, Steep	0	SIDEWALKS/MOD	0
C, Forest, Flat	0	SIDEWALKS/STEEP	0
C, Forest, Mod	0	PARKING/FLAT	0
C, Forest, Steep	0	PARKING/MOD	0
C, Pasture, Flat	0	PARKING/STEEP	0
C, Pasture, Mod	0	POND	0
C, Pasture, Steep	0	Porous Pavement	0
C, Lawn, Flat	0	Porous Pavement	0
C, Lawn, Mod	0		
C, Lawn, Steep	0		
SAT, Forest, Flat	0		
SAT, Forest, Mod	0		
SAT, Forest, Steep	0		

Previous Total: 0 Acres
Impervious Total: 0.184 Acres
Basin Total: 0.184 Acres

Facility Name: Bioretention 1

Outlet 1: 0, **Outlet 2:** 0, **Outlet 3:** 0

Downstream Connection: 0, 0, 0

Use simple Bioretention: Quick Swale, Size Water Quality, Size Facility

Underdrain Used: Underdrain Diameter (ft): 0.5, Offset (in): 0

Bioretention Bottom Elevation: 0

Bioretention Dimensions: Bioretention Length (ft): 12,000, Bioretention Bottom Width (ft): 2,000, Freeboard (ft): 0.500, Over-road Flooding (ft): 0.000, Effective Total Depth (ft): 4.75, Bottom slope of bioretention (ft): 0.000

Facility Dimension Diagram: Riser Outlet Structure

Material Layers for: Layer 1: 0.250, Layer 2: 1.500, Layer 3: 2.000
Soil Layer 1: SMWVW 12 in/hr, Soil Layer 2: SMWVW 12 in/hr, Soil Layer 3: GRAVEL

Native Infiltration: NO

91.52% filtered based on a 8,000 SF basin

Total Inflow ac-ft: 81.65, Precipitation on Facility (ac-ft): 7.583, Evaporation from Facility (ac-ft): 2.231

Subbasin Name: East Drive Aisle

Flows To: Surface retention 2, Interflow, Groundwater

Area in Basin:

Available Pervious	Acres	Available Impervious	Acres
A/B, Forest, Flat	0	ROADS/FLAT	0
A/B, Forest, Mod	0	ROADS/MOD	0
A/B, Forest, Steep	0	ROADS/STEEP	0
A/B, Pasture, Flat	0	ROOF TOPS/FLAT	0
A/B, Pasture, Mod	0	DRIVEWAYS/FLAT	0.091
A/B, Pasture, Steep	0	DRIVEWAYS/MOD	0
A/B, Lawn, Flat	0	DRIVEWAYS/STEEP	0
A/B, Lawn, Mod	0	SIDEWALKS/FLAT	0
A/B, Lawn, Steep	0	SIDEWALKS/MOD	0
C, Forest, Flat	0	SIDEWALKS/STEEP	0
C, Forest, Mod	0	PARKING/FLAT	0
C, Forest, Steep	0	PARKING/MOD	0
C, Pasture, Flat	0	PARKING/STEEP	0
C, Pasture, Mod	0	POND	0
C, Pasture, Steep	0	Porous Pavement	0
C, Lawn, Flat	0	Porous Pavement	0
C, Lawn, Mod	0		
C, Lawn, Steep	0		
SAT, Forest, Flat	0		
SAT, Forest, Mod	0		
SAT, Forest, Steep	0		

Previous Total: 0 Acres
Impervious Total: 0.091 Acres
Basin Total: 0.091 Acres

Facility Name: Bioretention 2

Outlet 1: 0, **Outlet 2:** 0, **Outlet 3:** 0

Downstream Connection: 0, 0, 0

Use simple Bioretention: Quick Swale, Size Water Quality, Size Facility

Underdrain Used: Underdrain Diameter (ft): 0.5, Offset (in): 0

Bioretention Bottom Elevation: 0

Bioretention Dimensions: Bioretention Length (ft): 5,000, Bioretention Bottom Width (ft): 2,000, Freeboard (ft): 0.500, Over-road Flooding (ft): 0.000, Effective Total Depth (ft): 4.75, Bottom slope of bioretention (ft): 0.000

Facility Dimension Diagram: Riser Outlet Structure

Material Layers for: Layer 1: 0.250, Layer 2: 1.500, Layer 3: 2.000
Soil Layer 1: SMWVW 12 in/hr, Soil Layer 2: SMWVW 12 in/hr, Soil Layer 3: GRAVEL

Native Infiltration: NO

92.97% filtered based on a 3,968 SF basin

Total Inflow ac-ft: 42.852, Precipitation on Facility (ac-ft): 6.221, Evaporation from Facility (ac-ft): 1.719

Bioretention soil mix to meet 2019 DOE manual “Default Soil Media (BSM)”, below:

Default Bioretention Soil Media (BSM)

Projects which use the following requirements for the bioretention soil media do not have to test the media for its saturated hydraulic conductivity (aka. Infiltration rate). They may assume the rates specified in the subsection titled “Determining Bioretention Soil Mix Infiltration Rate.”

Mineral Aggregate

Percent Fines: A range of 2 to 4 percent passing the #200 sieve is ideal and fines should not be above 5 percent for a proper functioning specification according to ASTM D422.

Aggregate Gradation

The aggregate portion of the BSM should be well-graded. According to ASTM D 2487-98 (Classification of Soils for Engineering Purposes (Unified Soil Classification System)), well-graded sand should have the following gradation coefficients:

- Coefficient of Uniformity ($C_u = D_{60}/D_{10}$) equal to or greater than 4, And
- Coefficient of Curve ($C_c = (D_{30})^2/D_{60} \times D_{10}$) greater than or equal to 1 and less than or equal to 3.

Table 7.4.1 provides a gradation guideline for the aggregate component of a Bioretention Soil Mix specification in western Washington (Hinman, Robertson, 2007). The sand gradation below is often supplied as a well graded utility or screened. With compost this blend provides enough fines

for adequate water retention, hydraulic conductivity within recommended range (see below), pollutant removal capability, and plant growth characteristics for meeting design guidelines and objectives.

Table 7.4.1

General Guideline for Mineral Aggregate Gradation

Sieve Size	Percent Passing
3/8"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

Where existing soils meet the above aggregate gradation, those soils may be amended rather than importing mineral aggregate.

Compost to Aggregate Ratio, Organic Matter Content, Cation Exchange Capacity:

- Compost to aggregate ratio: 60-65 percent mineral aggregate, 35 – 40 percent compost by volume.
- Organic matter content: 5 – 8 percent by weight.
- Cation Exchange Capacity (CEC) must be > 5 milliequivalents/100 g dry soil Note: Soil mixes meeting the above specifications do not have to be tested for CEC. They will readily meet the minimum CEC.

Compost

To ensure that the BSM will support healthy plant growth and root development, contribute to biofiltration of pollutants, and not restrict infiltration when used in the proportions cited herein, the following compost standards are required.

- Meets the definition of “composted material” in WAC 173-350-100 and complies with testing parameters and other standards in WAC 173-350-220.
- Produced at a composting facility that is permitted by the jurisdictional health authority. Permitted compost facilities in Washington are included on a list available at <http://www.ecy.wa.gov/programs/swfa/organics/soil.html>. The compost product must originate a minimum of 65 percent by volume from recycled plant waste comprised of “yard debris,” “crop residues,” and “bulking agents” as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of “postconsumer food waste” as defined in WAC 173-350-100, but not including biosolids, may be substituted for recycled plant waste.
- Stable (low oxygen use and CO₂ generation) and mature (capable of supporting plant growth) by tests shown below. This is critical to plant success in a bioretention soil mixes.
- Moisture content range: no visible free water or dust produced when handling the material.
- Tested in accordance with the U.S. Composting Council “Test Method for the Examination of Compost and Composting” (TMECC), as established in the Composting Council’s “Seal of Testing Assurance” (STA) program. Most Washington compost facilities now use these tests.

- Screened to the following size gradations for Fine Compost when tested in accordance with TMECC test method 02.02-B, Sample Sieving for Aggregate Size Classification.”

Fine Compost shall meet the following gradation by dry weight

Minimum percent passing	2”	100%
Minimum percent passing	1”	99%
Minimum percent passing	5/8”	90%
Minimum percent passing	¼”	75%

- pH between 6.0 and 8.5 (TMECC 04.11-A). “Physical contaminants” (as defined in WAC 173-350-100) content less than 1% by weight (TMECC 03.08-A) total, not to exceed 0.25 percent film plastic by dry weight.
- Minimum organic matter content of 40% (TMECC 05.07-A “Loss on Ignition)
- Soluble salt content less than 4.0 dS/m (mmhos/cm) (TMECC 04.10-A “Electrical Conductivity, 1:5 Slurry Method, Mass Basis”)
- Maturity indicators from a cucumber bioassay (TMECC 05.05-A “Seedling Emergence and Relative Growth) must be greater than 80% for both emergence and vigor”)
- Stability of 7 mg CO₂-C/g OM/day or below (TMECC 05.08-B “Carbon Dioxide Evolution Rate”)
- Carbon to nitrogen ratio (TMECC 05.02A “ Carbon to Nitrogen Ratio” which uses 04.01 “Organic Carbon” and 04.02D “Total Nitrogen by Oxidation”) of less than 25:1. The C:N ratio may be up to 35:1 for plantings composed

entirely of Puget Sound Lowland native species and up to 40:1 for coarse compost to be used as a surface mulch (not in a soil mix).

MINIMUM REQUIREMENT 7: FLOW CONTROL

The Todd Rd Development project site uses infiltration to meet the requirement of Minimum Requirement 7 Flow Control.

The Department of Ecology Stormwater Management Manual code requires the infiltration trench to be sized using WWHM and to achieve 100 percent infiltration. Stormwater will have an opportunity to infiltrate into native soils, permeable pavements and the infiltration trench were modeled to infiltrate 100% of the flows that they receive.

Per the department of Ecology Stormwater Management Manual, developed discharge durations shall match the predeveloped rates from 50% of the 2-year peak flow up to the full 50-year peak flow. This project is choosing to meet the LID performance standard, therefore 8% of the 2-year peak flow up to the full 50-year peak flow discharge must be met. WWHM modeling was conducted to confirm that the infiltration trench and permeable pavements infiltrated 100% of the stormwater runoff up to the 100-year storm event, see Appendix D for WWHM report. Both the infiltration gallery and permeable pavements infiltrate 100% of the stormwater runoff up to the 100-year storm event therefore, the proposed stormwater runoff flows are less than 8% of the 2-year peak flow discharge and the full 5-year peak flow discharge.

MINIMUM REQUIREMENT 8: WETLANDS PROTECTION

Any threshold discharge area that discharges stormwater through a conveyance system into a wetland is required to meet the Ecology Manual standards for protecting the wetland. The Todd Rd Development project will not discharge stormwater into a wetland, and thus is not subject to the wetlands protection standards outlined in Minimum Requirement #8.

MINIMUM REQUIREMENT 9: OPERATION AND MAINTENANCE

See Appendix F for Operations & Maintenance Manual for all new stormwater BMP's installed with the project.

APPENDIX A

Infiltration Testing Report

320 Todd Rd NE

Puyallup, WA

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May 23, 2024

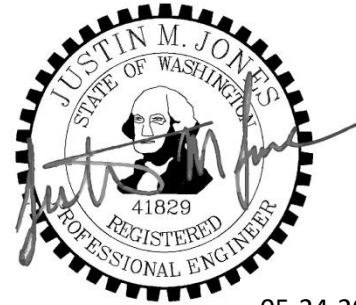


PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Infiltration Testing Report for Todd RD Development has been prepared by me or under my supervision and meets minimum standards of the Department of Ecology Stormwater Management Manual for Western Washington.



Justin Jones, PE



05-24-2024

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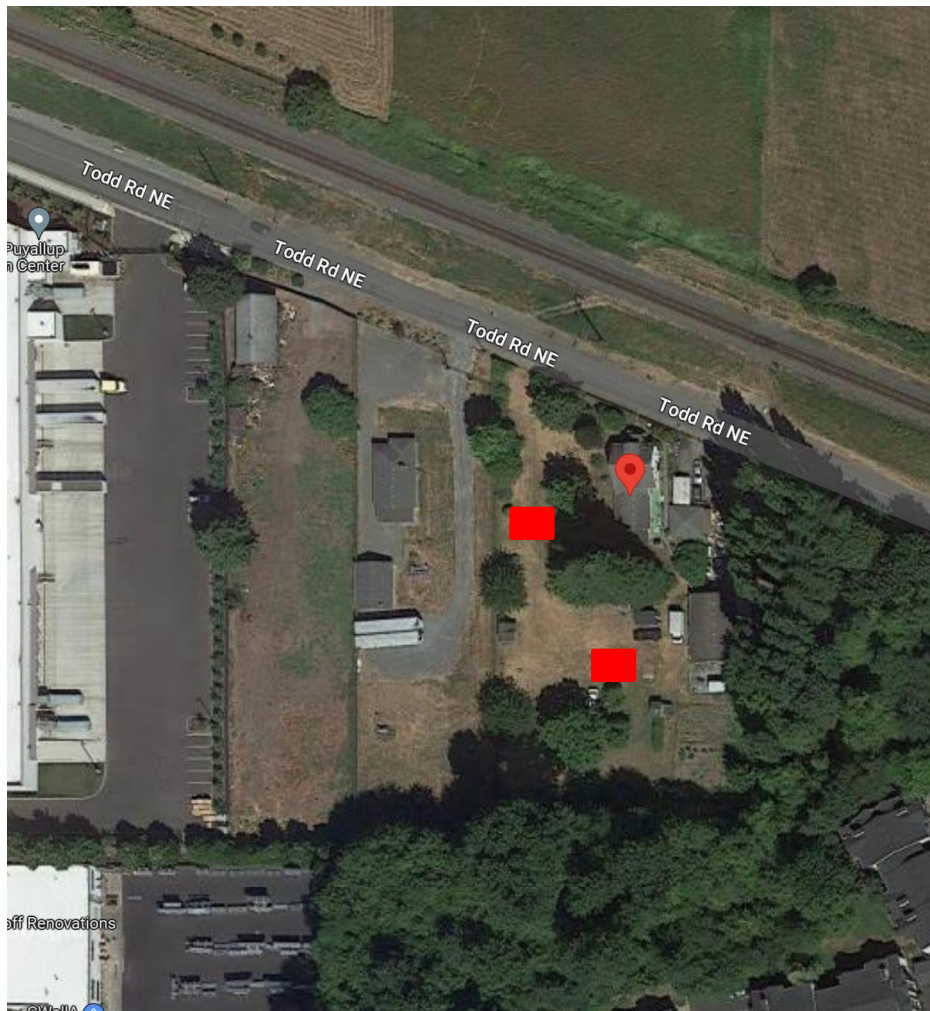
SUMMARY

This report details the results of infiltration testing for use in the stormwater system design of Todd Road Development located within Puyallup, WA. Two Pilot Infiltration Test (PIT) was conducted on site to determine the onsite stormwater infiltration rate. The test hole was excavated and backfilled by a licensed contractor and the PIT was completed in accordance with the Department of Ecology (ECY) Stormwater Management Manual for Western Washington (Stormwater Manual).

The PIT process evaluates the infiltration within a 12 SF area by first measuring the rate of water required to maintain a constant water elevation of approximately 12-inches in the test pit, and second by measuring the drawdown rate of the water within the test pit. The drawdown is done using a data logger. The test pit is excavated to a depth of 5.0-feet below existing grade and observed for groundwater.

The field data is then analyzed, and a factor of safety applied to determine the stormwater design infiltration rate. Below is a summary of the results.

Test Pit Location



Summary of Results

Per the PIT, the site soils are suitable for stormwater infiltration. A soil sample was taken from each PIT, the soil sample has been submitted and is pending results.

Testing	Test PIT	Results	ECY Threshold
Ground Water	Pit Depth	4.0-feet	N/A
	Test Hole 1 Groundwater Level	Ground Water not Observed	N/A
	Test Hole 2 Groundwater Level	Ground Water not Observed	N/A
Infiltration Rate	Infiltration Rate Factor of Safety	0.45	N/A
	Test Hole 1 Infiltration Rates	Uncorrected: 0.87 inches per hour	≥ 0.3 inches per hour
		Design: 0.39 Inches per hour	
	Test Hole 2 Infiltration Rates	Uncorrected: 0.85 inches per hour	≥ 0.3 inches per hour
		Design: 0.38 inches per hour	
Water Quality	Test Hole 1 Lab Analysis	Pending Results	≥ 5.0 milliequivalents CEC/100g
		Pending Results	≥ 1.0%
	Test Hole 2 Lab Analysis	Pending Results	≥ 5.0 milliequivalents CEC/100g
		Pending Results	≥ 1.0%

INFILTRATION TEST PROCEDURES

Below is the process taken for the PIT:

- ❑ Identify PIT locations based on the site survey of existing buildings and utilities as well as the potential locations of infiltration facilities based on the preliminary site plan.
- ❑ Obtain public and private utility locates. Prior to the PIT utility locates will be called to ensure there are no utilities present in the PIT locations.
- ❑ Excavation of PIT holes (approximately 3-feet x 4-feet 4-feet deep). A 3-feet x 4-feet x2-feet tall wood box is inserted into the test hole to ensure that the bottom surface area is exactly 12 SF. The box is backfilled to the top edge to ensure stability and infiltration only through the bottom of the test hole for the duration of the PIT.
- ❑ A soil sample is collected from the bottom of the hole to test treatment capability. A lab tests the cation exchange rate and organic matter content of soils. Lab results confirm if the soil is suitable for treatment based on Stormwater Manual criteria.
- ❑ A float system with a water hose connection is set into the center of the test hole. The float system is equipped with a leveling plate, a measuring ruler for visual inspection of water levels and a perforated pipe housing for the data collector.
- ❑ Using water transfer tanks or hose spigot as available, the test hole is filled to a 12-inch water depth that is maintained. The presoak period ensures that the soils have been fully saturated before conducting the PIT. A 1-hour stabilization test is performed after the presoak period to confirm soil stabilization. If the test yields 4 constant gallon per minute (GPM) readings that are conducted every 15-minutes, the stabilization of the soil is confirmed.
- ❑ A 1-hour GPM test is conducted per the Stormwater Manual. Using a water meter accurate to the nearest tenth of a gallon, a GPM flow rate is recorded every 15-minutes while the water level is maintained at a 12-inch depth. An infiltration rate (in/hr) can be determined using the GPM flow rate and the 12 SF bottom surface area of the hole.
- ❑ A drawdown test is performed per Stormwater Manual to determine the drawdown infiltration capability of the soil. A CRS451V (Pressure Transducer) is placed into the test hole and set to take pressure (PSI) readings every 10-minutes. The water source is shutoff, and the pressure transducer will measure water drawdown for a 2-hour period. At the end of the period the sensors are removed from the test hole, the data is collected using a PC interface module and the HydroSci program to communicate with the sensor to retrieve the data.
- ❑ The wood box and the float system are removed from the test hole.
- ❑ Over excavate test hole to confirm there is no ground water mounding.
- ❑ The test pit is then backfilled and restored to prior state of excavation.

FINDINGS AND RECOMMENDATIONS

Groundwater Conditions

The Stormwater Manual specifies minimum separations between the seasonal high groundwater elevation and the bottom of the infiltration facility based on different best management practices (BMP):

- **Downspout Infiltration:** 1-foot
- **Permeable Pavement:** 1-foot
- **Infiltration Facility:** 3-foot

With known groundwater conditions for each test hole, there is adequate spacing between groundwater and BMPs. An overflow should be installed with BMP in case of large storm events.

Three drive-point piezometers (DPPs) were installed by GeoResources to conduct groundwater monitoring for the 320 Todd Rd project site during the wet season. Groundwater levels were manually measured bi-monthly from January 6, 2023 to March 31, 2023, see Appendix E for Soils Report.

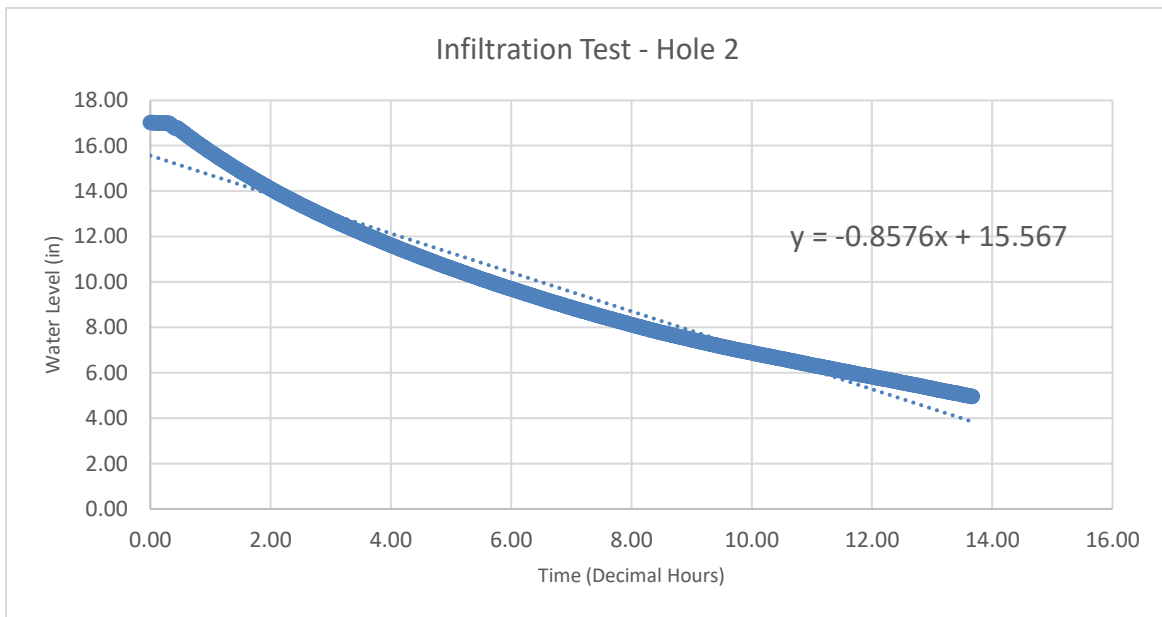
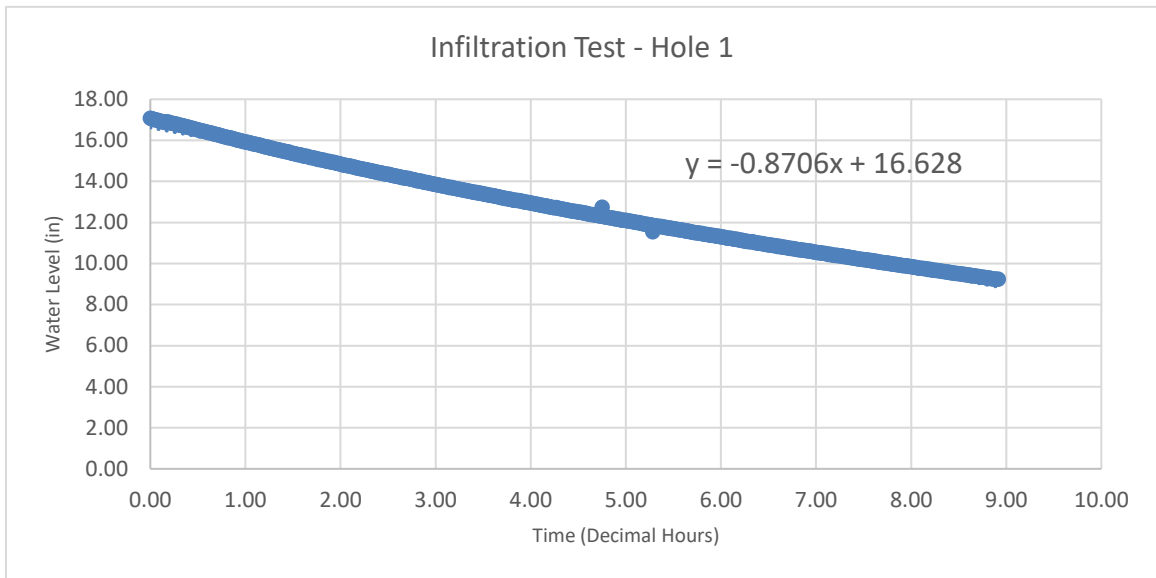
The measured seasonal high groundwater level is at elevation 43.0', approximately 7 to 8 feet below existing grade. All BMP's will have sufficient separation between the bottom of the BMP and seasonal high groundwater level.

Field Measured Infiltration Rate

The infiltration rate was collected using two methods in during the PIT. The first method is to measure the gallons per minute flowrate required to maintain a constant water level in the test pit. The average of the flowrate measurements taken over an hour timeframe.

The second method is to measure the drawdown rate of the test pit. Measurements were taken both visually and with a data logger. The average of the drawdown measurements resulted in an infiltration rate of resulted in the following infiltration rates:

- Test Hole 1: 0.87 inches per hour
- Test Hole 2: 0.85 inches per hour



Design Infiltration Rate

Per the Stormwater Manual a minimum design infiltration rate of 0.3 inches per hour is required for onsite infiltration. The design infiltration rate takes the field measured infiltration rate and applies a factor of safety based on three correction factors. The three corrections are based on site variability, test method, and degree of influent control (See Appendix D).

Issue	Partial Correction Factor
Site variability and number of locations tested	$CF_v = 0.33 \text{ to } 1.0$
Test Method	
• Large-scale PIT • Small-scale PIT • Other small-scale (e.g. Double ring, falling head) • Grain Size Method	▣ $CF_t = 0.75$ ▣ $= 0.50$ ▣ $= 0.40$ ▣ $= 0.40$
Degree of influent control to prevent siltation and bio-buildup	$CF_m = 0.9$

$$\text{Total Correction Factor, } CF_T = CF_v \times CF_t \times CF_m$$

Based on multiple geotechnical reports from nearby projects, soils are known to be consistent in this area. Per the Stormwater Manual, a site variability correction of 1 is used. A correction of 0.5 for the small-scale PIT

and 0.9 for the degree of influent are also used. A total correction factor of 0.45 is applied to the measured infiltration rate yielding a recommended design infiltration rates as follows:

- Test Hole 1: 0.39 inches per hour
- Test Hole 2: 0.38 inches per hour

Treatment Suitability

Per the Stormwater Manual the soils that stormwater is infiltrated into may be used for treatment of pollution generating surfaces if the soil meets specific requirements. Otherwise, a treatment layer is required to treat pollution generating surfaces. The treatment threshold of the infiltrated soil per the Stormwater Manual is a Cation Exchange Capacity greater than or equal to 5 milliequivalents CEC/100g and a minimum of 1.0% organic content.

A soil sample was taken from the PIT, soils samples are still in testing and are pending results.

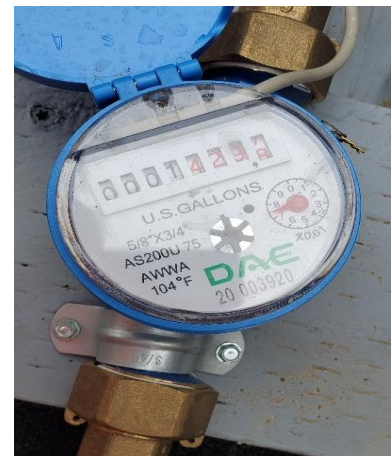
TEST PIT PHOTO DOCUMENTATION – TEST HOLE 1



3-feet x 4-feet x 18-inches



Test Pit Pre-soak at 12-inches



1-hour GPM Test



Pressure Transducer Drawdown
Test



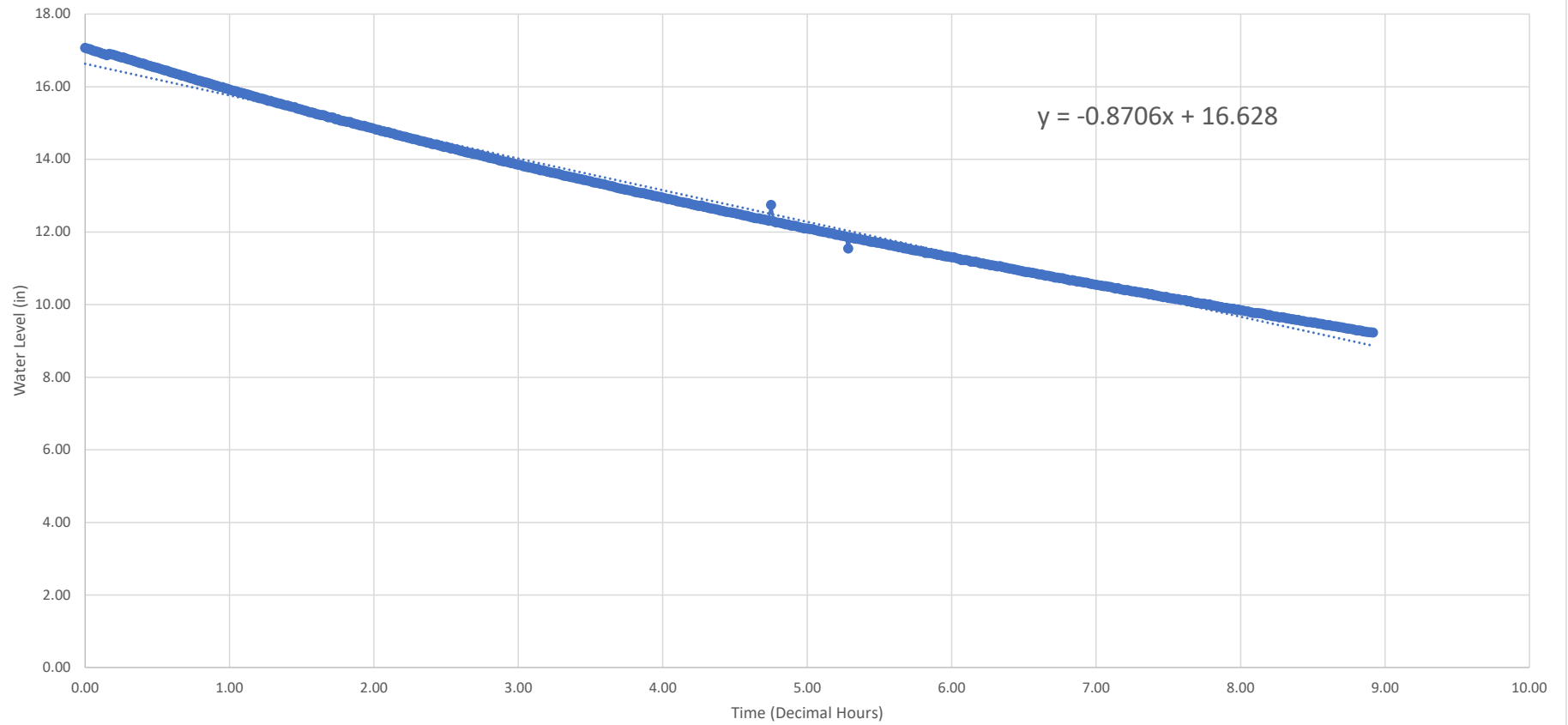
Over Excavation to observe if
Groundwater is Mounding



Backfill Test Hole

APPENDIX A

Infiltration Test - Hole 1



JMJ 02 03/15/23								
Project Location:		Todd Rd Development						
Date of Test:		3/15/2023						
Test Pit Dimensions:		Length (Feet)	4'	Width (Feet):	3'	Depth (feet):	4'	
Presoak:		9:55 - AM at 12-inch water column						
Infiltration Test:		Water Column Maintained (inches): 12						
		Gallons Per Inch:	7.48					
		Time(Minutes)	Volume (gallons)	Flow Rate (GPM)			Flow (Gallons)	Infiltration Rate (in/hr)
				Meter Start	Meter End	Flow (Gallons)		
		0						
		15						
		30						
		45						
		60						0.0
		Water Column Maintained (inches)		12				
Weather Conditions:		Cloudy						
Drawdown Test (Sensor):								
Sensor Name:		JMJ 02 (CRS451V Sensors from Campbell Scientific)						
Time (decimal Hours)		Time Stamp	Record #	Reading (PSI)	Level (in)			
0.00	0.0	3:05:00 PM	0	0.6156866	17.07			
0.02	1.0	3:06:00 PM	1	0.6148627	17.04			
0.03	2.0	3:07:00 PM	2	0.6143792	17.03			
0.05	3.0	3:08:00 PM	3	0.6133576	17.00			
0.07	4.0	3:09:00 PM	4	0.6126429	16.98			
0.08	5.0	3:10:00 PM	5	0.6119932	16.96			
0.10	6.0	3:11:00 PM	6	0.6110991	16.94			
0.12	7.0	3:12:00 PM	7	0.6101094	16.91			
0.13	8.0	3:13:00 PM	8	0.6094368	16.89			
0.15	9.0	3:14:00 PM	9	0.6084362	16.87			
0.17	10.0	3:15:00 PM	10	0.6098647	16.91			
0.18	11.0	3:16:00 PM	11	0.6093236	16.89			
0.20	12.0	3:17:00 PM	12	0.6087492	16.87			
0.22	13.0	3:18:00 PM	13	0.6077613	16.85			
0.23	14.0	3:19:00 PM	14	0.6070306	16.83			
0.25	15.0	3:20:00 PM	15	0.6062381	16.80			
0.27	16.0	3:21:00 PM	16	0.6060572	16.80			
0.28	17.0	3:22:00 PM	17	0.6051728	16.78			
0.30	18.0	3:23:00 PM	18	0.6042444	16.75			
0.32	19.0	3:24:00 PM	19	0.6038356	16.74			
0.33	20.0	3:25:00 PM	20	0.603064	16.72			
0.35	21.0	3:26:00 PM	21	0.602203	16.69			
0.37	22.0	3:27:00 PM	22	0.6014171	16.67			
0.38	23.0	3:28:00 PM	23	0.6006184	16.65			
0.40	24.0	3:29:00 PM	24	0.6002951	16.64			
0.42	25.0	3:30:00 PM	25	0.5992771	16.61			
0.43	26.0	3:31:00 PM	26	0.5982766	16.58			
0.45	27.0	3:32:00 PM	27	0.5977812	16.57			

0.47	28.0	3:33:00 PM	28	0.5970181	16.55			
0.48	29.0	3:34:00 PM	29	0.5963655	16.53			
0.50	30.0	3:35:00 PM	30	0.5959253	16.52			
0.52	31.0	3:36:00 PM	31	0.5948336	16.49			
0.53	32.0	3:37:00 PM	32	0.5941705	16.47			
0.55	33.0	3:38:00 PM	33	0.5933849	16.45			
0.57	34.0	3:39:00 PM	34	0.5930045	16.44			
0.58	35.0	3:40:00 PM	35	0.5921196	16.41			
0.60	36.0	3:41:00 PM	36	0.5912513	16.39			
0.62	37.0	3:42:00 PM	37	0.5906174	16.37			
0.63	38.0	3:43:00 PM	38	0.589988	16.35			
0.65	39.0	3:44:00 PM	39	0.5894052	16.34			
0.67	40.0	3:45:00 PM	40	0.588398	16.31			
0.68	41.0	3:46:00 PM	41	0.5878983	16.30			
0.70	42.0	3:47:00 PM	42	0.5870169	16.27			
0.72	43.0	3:48:00 PM	43	0.5864626	16.26			
0.73	44.0	3:49:00 PM	44	0.5854719	16.23			
0.75	45.0	3:50:00 PM	45	0.584968	16.22			
0.77	46.0	3:51:00 PM	46	0.5838918	16.19			
0.78	47.0	3:52:00 PM	47	0.5833375	16.17			
0.80	48.0	3:53:00 PM	48	0.5826278	16.15			
0.82	49.0	3:54:00 PM	49	0.5819051	16.13			
0.83	50.0	3:55:00 PM	50	0.5815238	16.12			
0.85	51.0	3:56:00 PM	51	0.5808325	16.10			
0.87	52.0	3:57:00 PM	52	0.5799282	16.08			
0.88	53.0	3:58:00 PM	53	0.5792771	16.06			
0.90	54.0	3:59:00 PM	54	0.578376	16.03			
0.92	55.0	4:00:00 PM	55	0.5778934	16.02			
0.93	56.0	4:01:00 PM	56	0.5769713	15.99			
0.95	57.0	4:02:00 PM	57	0.5766121	15.98			
0.97	58.0	4:03:00 PM	58	0.5757054	15.96			
0.98	59.0	4:04:00 PM	59	0.5750806	15.94			
1.00	60.0	4:05:00 PM	60	0.5741982	15.92			
1.02	61.0	4:06:00 PM	61	0.5735646	15.90			
1.03	62.0	4:07:00 PM	62	0.5729434	15.88			
1.05	63.0	4:08:00 PM	63	0.5726172	15.87			
1.07	64.0	4:09:00 PM	64	0.5713918	15.84			
1.08	65.0	4:10:00 PM	65	0.5710028	15.83			
1.10	66.0	4:11:00 PM	66	0.5705318	15.82			
1.12	67.0	4:12:00 PM	67	0.569611	15.79			
1.13	68.0	4:13:00 PM	68	0.5690674	15.77			
1.15	69.0	4:14:00 PM	69	0.5684627	15.76			
1.17	70.0	4:15:00 PM	70	0.5675685	15.73			
1.18	71.0	4:16:00 PM	71	0.5669469	15.72			
1.20	72.0	4:17:00 PM	72	0.5660034	15.69			
1.22	73.0	4:18:00 PM	73	0.5655891	15.68			
1.23	74.0	4:19:00 PM	74	0.5650941	15.66			
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1.27	76.0	4:21:00 PM	76	0.5630262	15.61			
1.28	77.0	4:22:00 PM	77	0.5631915	15.61			
1.30	78.0	4:23:00 PM	78	0.5621863	15.58			
1.32	79.0	4:24:00 PM	79	0.5614846	15.56			
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1.35	81.0	4:26:00 PM	81	0.5605492	15.54			
1.37	82.0	4:27:00 PM	82	0.5595577	15.51			
1.38	83.0	4:28:00 PM	83	0.5588057	15.49			
1.40	84.0	4:29:00 PM	84	0.5584829	15.48			
1.42	85.0	4:30:00 PM	85	0.5576767	15.46			
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1.75	105.0	4:50:00 PM	105	0.5448695	15.10			
1.77	106.0	4:51:00 PM	106	0.5435811	15.07			
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1.82	109.0	4:54:00 PM	109	0.5420786	15.03			
1.83	110.0	4:55:00 PM	110	0.5419946	15.02			
1.85	111.0	4:56:00 PM	111	0.5407454	14.99			
1.87	112.0	4:57:00 PM	112	0.5401692	14.97			
1.88	113.0	4:58:00 PM	113	0.5397636	14.96			
1.90	114.0	4:59:00 PM	114	0.5387734	14.93			
1.92	115.0	5:00:00 PM	115	0.5382738	14.92			
1.93	116.0	5:01:00 PM	116	0.5384395	14.93			
1.95	117.0	5:02:00 PM	117	0.5372641	14.89			
1.97	118.0	5:03:00 PM	118	0.536586	14.87			
1.98	119.0	5:04:00 PM	119	0.5359896	14.86			
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2.47	148.0	5:33:00 PM	148	0.5180068	14.36			
2.48	149.0	5:34:00 PM	149	0.5175015	14.35			
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2.55	153.0	5:38:00 PM	153	0.5155004	14.29			
2.57	154.0	5:39:00 PM	154	0.5146531	14.27			
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2.63	158.0	5:43:00 PM	158	0.5122814	14.20			
2.65	159.0	5:44:00 PM	159	0.5115144	14.18			
2.67	160.0	5:45:00 PM	160	0.5113738	14.18			
2.68	161.0	5:46:00 PM	161	0.5105324	14.15			
2.70	162.0	5:47:00 PM	162	0.5101804	14.14			
2.72	163.0	5:48:00 PM	163	0.5099925	14.14			
2.73	164.0	5:49:00 PM	164	0.5092018	14.12			
2.75	165.0	5:50:00 PM	165	0.5085192	14.10			
2.77	166.0	5:51:00 PM	166	0.5079156	14.08			
2.78	167.0	5:52:00 PM	167	0.5074483	14.07			
2.80	168.0	5:53:00 PM	168	0.5064862	14.04			
2.82	169.0	5:54:00 PM	169	0.5059146	14.02			
2.83	170.0	5:55:00 PM	170	0.5055254	14.01			
2.85	171.0	5:56:00 PM	171	0.5049577	14.00			
2.87	172.0	5:57:00 PM	172	0.5039244	13.97			
2.88	173.0	5:58:00 PM	173	0.5034221	13.95			
2.90	174.0	5:59:00 PM	174	0.502814	13.94			
2.92	175.0	6:00:00 PM	175	0.5027304	13.94			
2.93	176.0	6:01:00 PM	176	0.5020565	13.92			
2.95	177.0	6:02:00 PM	177	0.5013036	13.90			
2.97	178.0	6:03:00 PM	178	0.5007532	13.88			
2.98	179.0	6:04:00 PM	179	0.500052	13.86			
3.00	180.0	6:05:00 PM	180	0.4996347	13.85			
3.02	181.0	6:06:00 PM	181	0.499271	13.84			
3.03	182.0	6:07:00 PM	182	0.4984125	13.82			
3.05	183.0	6:08:00 PM	183	0.4976832	13.80			
3.07	184.0	6:09:00 PM	184	0.4970511	13.78			
3.08	185.0	6:10:00 PM	185	0.4967992	13.77			
3.10	186.0	6:11:00 PM	186	0.496339	13.76			
3.12	187.0	6:12:00 PM	187	0.4953722	13.73			
3.13	188.0	6:13:00 PM	188	0.4953351	13.73			
3.15	189.0	6:14:00 PM	189	0.494025	13.69			
3.17	190.0	6:15:00 PM	190	0.4942182	13.70			
3.18	191.0	6:16:00 PM	191	0.4934728	13.68			
3.20	192.0	6:17:00 PM	192	0.4927351	13.66			
3.22	193.0	6:18:00 PM	193	0.4921242	13.64			
3.23	194.0	6:19:00 PM	194	0.4917595	13.63			
3.25	195.0	6:20:00 PM	195	0.491395	13.62			
3.27	196.0	6:21:00 PM	196	0.4907802	13.60			
3.28	197.0	6:22:00 PM	197	0.4902606	13.59			
3.30	198.0	6:23:00 PM	198	0.4893938	13.57			
3.32	199.0	6:24:00 PM	199	0.4886401	13.55			
3.33	200.0	6:25:00 PM	200	0.4883151	13.54			
3.35	201.0	6:26:00 PM	201	0.4877641	13.52			
3.37	202.0	6:27:00 PM	202	0.4873322	13.51			
3.38	203.0	6:28:00 PM	203	0.486859	13.50			
3.40	204.0	6:29:00 PM	204	0.4862999	13.48			
3.42	205.0	6:30:00 PM	205	0.4857687	13.47			
3.43	206.0	6:31:00 PM	206	0.4852299	13.45			
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3.55	213.0	6:38:00 PM	213	0.4814751	13.35			
3.57	214.0	6:39:00 PM	214	0.4806702	13.32			
3.58	215.0	6:40:00 PM	215	0.4804766	13.32			
3.60	216.0	6:41:00 PM	216	0.4799258	13.30			
3.62	217.0	6:42:00 PM	217	0.4792077	13.28			
3.63	218.0	6:43:00 PM	218	0.4785481	13.27			
3.65	219.0	6:44:00 PM	219	0.4782073	13.26			
3.67	220.0	6:45:00 PM	220	0.4774906	13.24			
3.68	221.0	6:46:00 PM	221	0.4766157	13.21			
3.70	222.0	6:47:00 PM	222	0.4762415	13.20			

3.72	223.0	6:48:00 PM	223	0.4756183	13.18			
3.73	224.0	6:49:00 PM	224	0.4750919	13.17			
3.75	225.0	6:50:00 PM	225	0.474655	13.16			
3.77	226.0	6:51:00 PM	226	0.4740577	13.14			
3.78	227.0	6:52:00 PM	227	0.4739504	13.14			
3.80	228.0	6:53:00 PM	228	0.4729107	13.11			
3.82	229.0	6:54:00 PM	229	0.4721898	13.09			
3.83	230.0	6:55:00 PM	230	0.4720053	13.08			
3.85	231.0	6:56:00 PM	231	0.4713734	13.07			
3.87	232.0	6:57:00 PM	232	0.4713112	13.06			
3.88	233.0	6:58:00 PM	233	0.4707035	13.05			
3.90	234.0	6:59:00 PM	234	0.4702266	13.03			
3.92	235.0	7:00:00 PM	235	0.4697167	13.02			
3.93	236.0	7:01:00 PM	236	0.4687088	12.99			
3.95	237.0	7:02:00 PM	237	0.4685055	12.99			
3.97	238.0	7:03:00 PM	238	0.4678922	12.97			
3.98	239.0	7:04:00 PM	239	0.4676406	12.96			
4.00	240.0	7:05:00 PM	240	0.4667491	12.94			
4.02	241.0	7:06:00 PM	241	0.4661983	12.92			
4.03	242.0	7:07:00 PM	242	0.4655441	12.90			
4.05	243.0	7:08:00 PM	243	0.4653235	12.90			
4.07	244.0	7:09:00 PM	244	0.4645744	12.88			
4.08	245.0	7:10:00 PM	245	0.4644127	12.87			
4.10	246.0	7:11:00 PM	246	0.463375	12.84			
4.12	247.0	7:12:00 PM	247	0.4629279	12.83			
4.13	248.0	7:13:00 PM	248	0.4624807	12.82			
4.15	249.0	7:14:00 PM	249	0.4619249	12.80			
4.17	250.0	7:15:00 PM	250	0.4616999	12.80			
4.18	251.0	7:16:00 PM	251	0.4609861	12.78			
4.20	252.0	7:17:00 PM	252	0.4604497	12.76			
4.22	253.0	7:18:00 PM	253	0.4598548	12.75			
4.23	254.0	7:19:00 PM	254	0.459208	12.73			
4.25	255.0	7:20:00 PM	255	0.4587872	12.72			
4.27	256.0	7:21:00 PM	256	0.4590833	12.73			
4.28	257.0	7:22:00 PM	257	0.4579127	12.69			
4.30	258.0	7:23:00 PM	258	0.4574784	12.68			
4.32	259.0	7:24:00 PM	259	0.4568346	12.66			
4.33	260.0	7:25:00 PM	260	0.4562342	12.65			
4.35	261.0	7:26:00 PM	261	0.4558793	12.64			
4.37	262.0	7:27:00 PM	262	0.4553724	12.62			
4.38	263.0	7:28:00 PM	263	0.4548495	12.61			
4.40	264.0	7:29:00 PM	264	0.454033	12.59			
4.42	265.0	7:30:00 PM	265	0.4537116	12.58			
4.43	266.0	7:31:00 PM	266	0.4529433	12.56			
4.45	267.0	7:32:00 PM	267	0.4524295	12.54			
4.47	268.0	7:33:00 PM	268	0.4522238	12.54			
4.48	269.0	7:34:00 PM	269	0.4518773	12.53			
4.50	270.0	7:35:00 PM	270	0.4513924	12.51			
4.52	271.0	7:36:00 PM	271	0.4505684	12.49			
4.53	272.0	7:37:00 PM	272	0.4504066	12.49			
4.55	273.0	7:38:00 PM	273	0.4496302	12.46			
4.57	274.0	7:39:00 PM	274	0.4492884	12.45			
4.58	275.0	7:40:00 PM	275	0.4488221	12.44			
4.60	276.0	7:41:00 PM	276	0.4480051	12.42			
4.62	277.0	7:42:00 PM	277	0.4474825	12.40			
4.63	278.0	7:43:00 PM	278	0.4467733	12.38			
4.65	279.0	7:44:00 PM	279	0.4464708	12.38			
4.67	280.0	7:45:00 PM	280	0.4463106	12.37			
4.68	281.0	7:46:00 PM	281	0.4454604	12.35			
4.70	282.0	7:47:00 PM	282	0.4453031	12.34			
4.72	283.0	7:48:00 PM	283	0.4445886	12.32			
4.73	284.0	7:49:00 PM	284	0.4440461	12.31			
4.75	285.0	7:50:00 PM	285	0.4598133	12.75			
4.77	286.0	7:51:00 PM	286	0.4433854	12.29			
4.78	287.0	7:52:00 PM	287	0.4422977	12.26			

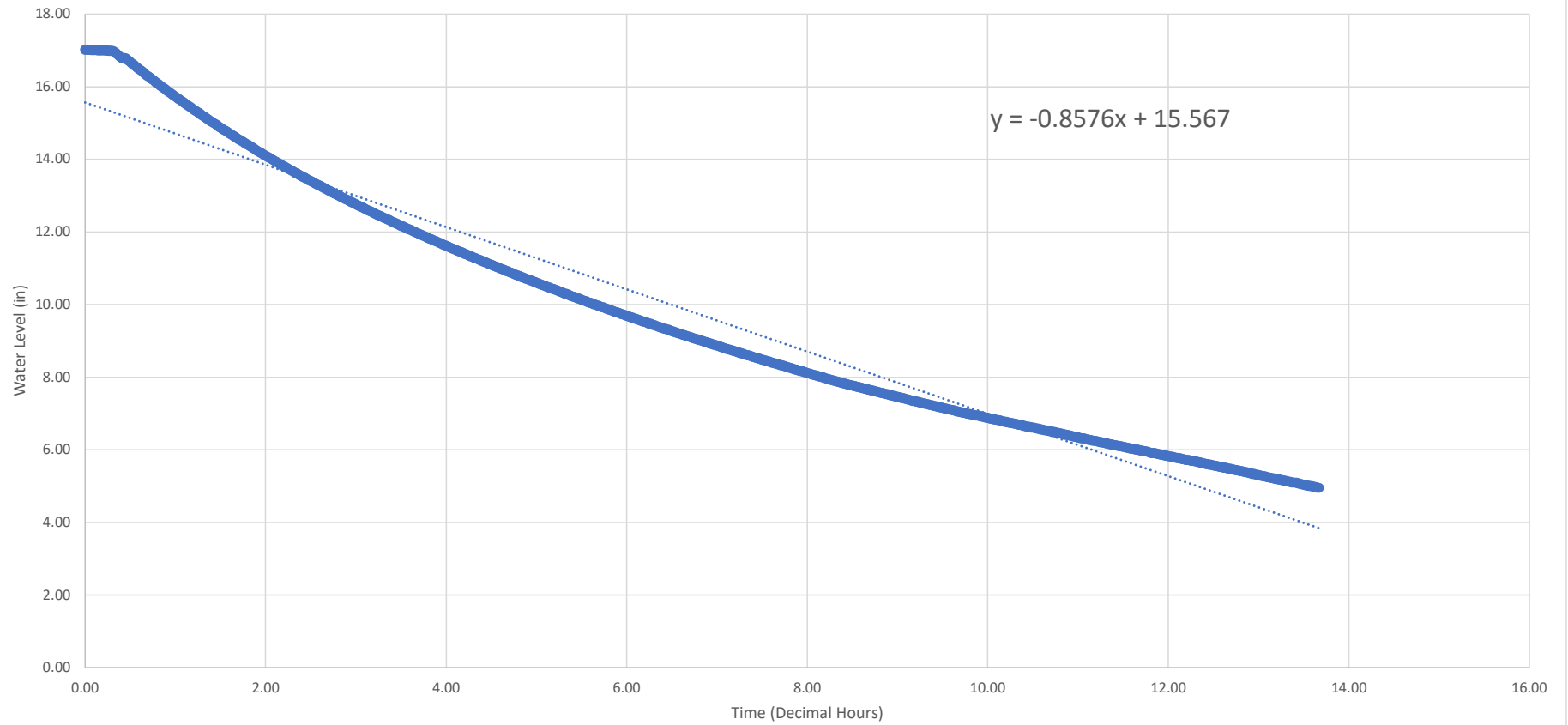
4.80	288.0	7:53:00 PM	288	0.4420955	12.25			
4.82	289.0	7:54:00 PM	289	0.4417258	12.24			
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4.85	291.0	7:56:00 PM	291	0.4404738	12.21			
4.87	292.0	7:57:00 PM	292	0.4402833	12.20			
4.88	293.0	7:58:00 PM	293	0.4392645	12.18			
4.90	294.0	7:59:00 PM	294	0.4390843	12.17			
4.92	295.0	8:00:00 PM	295	0.4390247	12.17			
4.93	296.0	8:01:00 PM	296	0.4381262	12.14			
4.95	297.0	8:02:00 PM	297	0.4374221	12.13			
4.97	298.0	8:03:00 PM	298	0.4368554	12.11			
4.98	299.0	8:04:00 PM	299	0.4364111	12.10			
5.00	300.0	8:05:00 PM	300	0.4363991	12.10			
5.02	301.0	8:06:00 PM	301	0.4357242	12.08			
5.03	302.0	8:07:00 PM	302	0.4356918	12.08			
5.05	303.0	8:08:00 PM	303	0.4348011	12.05			
5.07	304.0	8:09:00 PM	304	0.4342441	12.04			
5.08	305.0	8:10:00 PM	305	0.4337437	12.02			
5.10	306.0	8:11:00 PM	306	0.4331467	12.01			
5.12	307.0	8:12:00 PM	307	0.4325188	11.99			
5.13	308.0	8:13:00 PM	308	0.4326446	11.99			
5.15	309.0	8:14:00 PM	309	0.4316702	11.97			
5.17	310.0	8:15:00 PM	310	0.4315181	11.96			
5.18	311.0	8:16:00 PM	311	0.4306561	11.94			
5.20	312.0	8:17:00 PM	312	0.4300736	11.92			
5.22	313.0	8:18:00 PM	313	0.4299336	11.92			
5.23	314.0	8:19:00 PM	314	0.4292848	11.90			
5.25	315.0	8:20:00 PM	315	0.4289575	11.89			
5.27	316.0	8:21:00 PM	316	0.4285058	11.88			
5.28	317.0	8:22:00 PM	317	0.4163842	11.54			
5.30	318.0	8:23:00 PM	318	0.4272409	11.84			
5.32	319.0	8:24:00 PM	319	0.4268593	11.83			
5.33	320.0	8:25:00 PM	320	0.4261787	11.81			
5.35	321.0	8:26:00 PM	321	0.4260441	11.81			
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5.38	323.0	8:28:00 PM	323	0.4249824	11.78			
5.40	324.0	8:29:00 PM	324	0.4245381	11.77			
5.42	325.0	8:30:00 PM	325	0.4241344	11.76			
5.43	326.0	8:31:00 PM	326	0.4233149	11.73			
5.45	327.0	8:32:00 PM	327	0.4228588	11.72			
5.47	328.0	8:33:00 PM	328	0.4228771	11.72			
5.48	329.0	8:34:00 PM	329	0.4221428	11.70			
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5.52	331.0	8:36:00 PM	331	0.4211294	11.67			
5.53	332.0	8:37:00 PM	332	0.4209543	11.67			
5.55	333.0	8:38:00 PM	333	0.4203614	11.65			
5.57	334.0	8:39:00 PM	334	0.4196712	11.63			
5.58	335.0	8:40:00 PM	335	0.4195567	11.63			
5.60	336.0	8:41:00 PM	336	0.4188875	11.61			
5.62	337.0	8:42:00 PM	337	0.4185083	11.60			
5.63	338.0	8:43:00 PM	338	0.4176286	11.58			
5.65	339.0	8:44:00 PM	339	0.4179963	11.59			
5.67	340.0	8:45:00 PM	340	0.4166287	11.55			
5.68	341.0	8:46:00 PM	341	0.4162635	11.54			
5.70	342.0	8:47:00 PM	342	0.4159639	11.53			
5.72	343.0	8:48:00 PM	343	0.4152418	11.51			
5.73	344.0	8:49:00 PM	344	0.4148639	11.50			
5.75	345.0	8:50:00 PM	345	0.4145225	11.49			
5.77	346.0	8:51:00 PM	346	0.4142239	11.48			
5.78	347.0	8:52:00 PM	347	0.4137594	11.47			
5.80	348.0	8:53:00 PM	348	0.4135064	11.46			
5.82	349.0	8:54:00 PM	349	0.4121646	11.43			
5.83	350.0	8:55:00 PM	350	0.4120906	11.42			
5.85	351.0	8:56:00 PM	351	0.4118601	11.42			
5.87	352.0	8:57:00 PM	352	0.4114033	11.40			

5.88	353.0	8:58:00 PM	353	0.4109527	11.39			
5.90	354.0	8:59:00 PM	354	0.4103119	11.37			
5.92	355.0	9:00:00 PM	355	0.4100701	11.37			
5.93	356.0	9:01:00 PM	356	0.4093683	11.35			
5.95	357.0	9:02:00 PM	357	0.4088797	11.33			
5.97	358.0	9:03:00 PM	358	0.4086282	11.33			
5.98	359.0	9:04:00 PM	359	0.4082363	11.32			
6.00	360.0	9:05:00 PM	360	0.4075574	11.30			
6.02	361.0	9:06:00 PM	361	0.4074436	11.29			
6.03	362.0	9:07:00 PM	362	0.4066026	11.27			
6.05	363.0	9:08:00 PM	363	0.4060326	11.26			
6.07	364.0	9:09:00 PM	364	0.4049584	11.23			
6.08	365.0	9:10:00 PM	365	0.4050892	11.23			
6.10	366.0	9:11:00 PM	366	0.4050245	11.23			
6.12	367.0	9:12:00 PM	367	0.4043415	11.21			
6.13	368.0	9:13:00 PM	368	0.4034517	11.18			
6.15	369.0	9:14:00 PM	369	0.4033616	11.18			
6.17	370.0	9:15:00 PM	370	0.403163	11.18			
6.18	371.0	9:16:00 PM	371	0.4025511	11.16			
6.20	372.0	9:17:00 PM	372	0.4015446	11.13			
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6.25	375.0	9:20:00 PM	375	0.4007378	11.11			
6.27	376.0	9:21:00 PM	376	0.3997173	11.08			
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6.30	378.0	9:23:00 PM	378	0.3991556	11.06			
6.32	379.0	9:24:00 PM	379	0.3986912	11.05			
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6.38	383.0	9:28:00 PM	383	0.396899	11.00			
6.40	384.0	9:29:00 PM	384	0.3963188	10.99			
6.42	385.0	9:30:00 PM	385	0.3961894	10.98			
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6.45	387.0	9:32:00 PM	387	0.3950145	10.95			
6.47	388.0	9:33:00 PM	388	0.3946161	10.94			
6.48	389.0	9:34:00 PM	389	0.3940708	10.92			
6.50	390.0	9:35:00 PM	390	0.3934942	10.91			
6.52	391.0	9:36:00 PM	391	0.3931231	10.90			
6.53	392.0	9:37:00 PM	392	0.3928045	10.89			
6.55	393.0	9:38:00 PM	393	0.3923118	10.87			
6.57	394.0	9:39:00 PM	394	0.3922051	10.87			
6.58	395.0	9:40:00 PM	395	0.3915047	10.85			
6.60	396.0	9:41:00 PM	396	0.3907251	10.83			
6.62	397.0	9:42:00 PM	397	0.3908065	10.83			
6.63	398.0	9:43:00 PM	398	0.3900802	10.81			
6.65	399.0	9:44:00 PM	399	0.3891978	10.79			
6.67	400.0	9:45:00 PM	400	0.3894995	10.80			
6.68	401.0	9:46:00 PM	401	0.3887725	10.78			
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6.73	404.0	9:49:00 PM	404	0.3873371	10.74			
6.75	405.0	9:50:00 PM	405	0.3869162	10.73			
6.77	406.0	9:51:00 PM	406	0.3867165	10.72			
6.78	407.0	9:52:00 PM	407	0.3861673	10.70			
6.80	408.0	9:53:00 PM	408	0.3855217	10.69			
6.82	409.0	9:54:00 PM	409	0.38482	10.67			
6.83	410.0	9:55:00 PM	410	0.3849325	10.67			
6.85	411.0	9:56:00 PM	411	0.3844962	10.66			
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6.93	416.0	10:01:00 PM	416	0.3825421	10.60			
6.95	417.0	10:02:00 PM	417	0.3818117	10.58			

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7.02	421.0	10:06:00 PM	421	0.37999	10.53			
7.03	422.0	10:07:00 PM	422	0.379525	10.52			
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7.32	439.0	10:24:00 PM	439	0.3725324	10.33			
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7.40	444.0	10:29:00 PM	444	0.3700362	10.26			
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7.43	446.0	10:31:00 PM	446	0.3692849	10.24			
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7.57	454.0	10:39:00 PM	454	0.3661635	10.15			
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7.60	456.0	10:41:00 PM	456	0.3653121	10.13			
7.62	457.0	10:42:00 PM	457	0.3650196	10.12			
7.63	458.0	10:43:00 PM	458	0.3641022	10.09			
7.65	459.0	10:44:00 PM	459	0.364122	10.09			
7.67	460.0	10:45:00 PM	460	0.3630724	10.06			
7.68	461.0	10:46:00 PM	461	0.3626614	10.05			
7.70	462.0	10:47:00 PM	462	0.3623884	10.05			
7.72	463.0	10:48:00 PM	463	0.3618577	10.03			
7.73	464.0	10:49:00 PM	464	0.3616126	10.02			
7.75	465.0	10:50:00 PM	465	0.3615493	10.02			
7.77	466.0	10:51:00 PM	466	0.3606695	10.00			
7.78	467.0	10:52:00 PM	467	0.3609027	10.00			
7.80	468.0	10:53:00 PM	468	0.3596428	9.97			
7.82	469.0	10:54:00 PM	469	0.3597279	9.97			
7.83	470.0	10:55:00 PM	470	0.3592831	9.96			
7.85	471.0	10:56:00 PM	471	0.3586352	9.94			
7.87	472.0	10:57:00 PM	472	0.3583514	9.93			
7.88	473.0	10:58:00 PM	473	0.3576606	9.91			
7.90	474.0	10:59:00 PM	474	0.3573305	9.91			
7.92	475.0	11:00:00 PM	475	0.3569244	9.89			
7.93	476.0	11:01:00 PM	476	0.3567483	9.89			
7.95	477.0	11:02:00 PM	477	0.3565202	9.88			
7.97	478.0	11:03:00 PM	478	0.3554768	9.85			
7.98	479.0	11:04:00 PM	479	0.3556866	9.86			
8.00	480.0	11:05:00 PM	480	0.3551398	9.84			
8.02	481.0	11:06:00 PM	481	0.3547916	9.83			
8.03	482.0	11:07:00 PM	482	0.3541431	9.82			

8.05	483.0	11:08:00 PM	483	0.3541102	9.82			
8.07	484.0	11:09:00 PM	484	0.3532099	9.79			
8.08	485.0	11:10:00 PM	485	0.3525001	9.77			
8.10	486.0	11:11:00 PM	486	0.3524059	9.77			
8.12	487.0	11:12:00 PM	487	0.3522007	9.76			
8.13	488.0	11:13:00 PM	488	0.3519594	9.76			
8.15	489.0	11:14:00 PM	489	0.3517121	9.75			
8.17	490.0	11:15:00 PM	490	0.3511513	9.73			
8.18	491.0	11:16:00 PM	491	0.3500417	9.70			
8.20	492.0	11:17:00 PM	492	0.3502798	9.71			
8.22	493.0	11:18:00 PM	493	0.3493306	9.68			
8.23	494.0	11:19:00 PM	494	0.3490596	9.68			
8.25	495.0	11:20:00 PM	495	0.3489193	9.67			
8.27	496.0	11:21:00 PM	496	0.348048	9.65			
8.28	497.0	11:22:00 PM	497	0.3481885	9.65			
8.30	498.0	11:23:00 PM	498	0.3479398	9.64			
8.32	499.0	11:24:00 PM	499	0.3470287	9.62			
8.33	500.0	11:25:00 PM	500	0.346844	9.61			
8.35	501.0	11:26:00 PM	501	0.3463698	9.60			
8.37	502.0	11:27:00 PM	502	0.3459623	9.59			
8.38	503.0	11:28:00 PM	503	0.3456394	9.58			
8.40	504.0	11:29:00 PM	504	0.3453229	9.57			
8.42	505.0	11:30:00 PM	505	0.3444213	9.55			
8.43	506.0	11:31:00 PM	506	0.3445507	9.55			
8.45	507.0	11:32:00 PM	507	0.34374	9.53			
8.47	508.0	11:33:00 PM	508	0.3433304	9.52			
8.48	509.0	11:34:00 PM	509	0.3433363	9.52			
8.50	510.0	11:35:00 PM	510	0.3426367	9.50			
8.52	511.0	11:36:00 PM	511	0.3427011	9.50			
8.53	512.0	11:37:00 PM	512	0.3419479	9.48			
8.55	513.0	11:38:00 PM	513	0.3417095	9.47			
8.57	514.0	11:39:00 PM	514	0.3413677	9.46			
8.58	515.0	11:40:00 PM	515	0.3405904	9.44			
8.60	516.0	11:41:00 PM	516	0.3403109	9.43			
8.62	517.0	11:42:00 PM	517	0.3402545	9.43			
8.63	518.0	11:43:00 PM	518	0.3394211	9.41			
8.65	519.0	11:44:00 PM	519	0.3393098	9.41			
8.67	520.0	11:45:00 PM	520	0.3388627	9.39			
8.68	521.0	11:46:00 PM	521	0.3383609	9.38			
8.70	522.0	11:47:00 PM	522	0.3379867	9.37			
8.72	523.0	11:48:00 PM	523	0.3376943	9.36			
8.73	524.0	11:49:00 PM	524	0.3371136	9.34			
8.75	525.0	11:50:00 PM	525	0.3366016	9.33			
8.77	526.0	11:51:00 PM	526	0.336421	9.33			
8.78	527.0	11:52:00 PM	527	0.3361159	9.32			
8.80	528.0	11:53:00 PM	528	0.3350894	9.29			
8.82	529.0	11:54:00 PM	529	0.3352662	9.29			
8.83	530.0	11:55:00 PM	530	0.334726	9.28			
8.85	531.0	11:56:00 PM	531	0.3338711	9.25			
8.87	532.0	11:57:00 PM	532	0.3336633	9.25			
8.88	533.0	11:58:00 PM	533	0.333342	9.24			
8.90	534.0	11:59:00 PM	534	0.3331816	9.24			
8.92	535.0	12:00:00 AM	535	0.3328936	9.23			
							</	

Infiltration Test - Hole 2



JMJ 01 03/15/23							
Project Location:		Todd Rd Development					
Date of Test:		3/15/2023					
Test Pit Dimensions:		Length (Feet)	4'	Width (Feet):	3'	Depth (feet):	4'
Presoak:		9:45 - AM at 12-inch water column					
Infiltration Test:							
		Water Column Maintained (inches):		12			
		Gallons Per Inch:	7.48				
		Time(Minutes)	Volume (gallons)	Flow Rate (GPM)		Flow (Gallons)	Infiltration Rate (in/hr)
				Meter Start	Meter End	Flow (Gallons)	
		0					
		15					
		30					
		45					
		60					0.0
		Water Column Maintained (inches)		12			
Weather Conditions:		Cloudy					
Drawdown Test (Sensor):							
Sensor Name:		JMJ 01 (CRS451V Sensors from Campbell Scientific)					
Time (decimal Hours)	Readings (min)	Time Stamp	Record #	Reading (PSI)	Level (in)		
0.00	0.0	2:47:00 PM	47	0.6138949	17.02		
0.02	1.0	2:48:00 PM	48	0.6139137	17.02		
0.03	2.0	2:49:00 PM	49	0.6138233	17.02		
0.05	3.0	2:50:00 PM	50	0.6137089	17.01		
0.07	4.0	2:51:00 PM	51	0.6136847	17.01		
0.08	5.0	2:52:00 PM	52	0.6136202	17.01		
0.10	6.0	2:53:00 PM	53	0.6136599	17.01		
0.12	7.0	2:54:00 PM	54	0.6137359	17.01		
0.13	8.0	2:55:00 PM	55	0.6134056	17.00		
0.15	9.0	2:56:00 PM	56	0.6132602	17.00		
0.17	10.0	2:57:00 PM	57	0.6132336	17.00		
0.18	11.0	2:58:00 PM	58	0.6132448	17.00		
0.20	12.0	2:59:00 PM	59	0.6132962	17.00		
0.22	13.0	3:00:00 PM	60	0.6131705	17.00		
0.23	14.0	3:01:00 PM	61	0.6130547	16.99		
0.25	15.0	3:02:00 PM	62	0.6129683	16.99		
0.27	16.0	3:03:00 PM	63	0.6127514	16.99		
0.28	17.0	3:04:00 PM	64	0.612825	16.99		
0.30	18.0	3:05:00 PM	65	0.6128131	16.99		
0.32	19.0	3:06:00 PM	66	0.6122638	16.97		
0.33	20.0	3:07:00 PM	67	0.6110082	16.94		
0.35	21.0	3:08:00 PM	68	0.6099396	16.91		
0.37	22.0	3:09:00 PM	69	0.6085999	16.87		
0.38	23.0	3:10:00 PM	70	0.6072317	16.83		
0.40	24.0	3:11:00 PM	71	0.6059656	16.80		
0.42	25.0	3:12:00 PM	72	0.6049975	16.77		
0.43	26.0	3:13:00 PM	73	0.6056166	16.79		
0.45	27.0	3:14:00 PM	74	0.6052875	16.78		
0.47	28.0	3:15:00 PM	75	0.6040337	16.74		

0.48	29.0	3:16:00 PM	76	0.6028686	16.71			
0.50	30.0	3:17:00 PM	77	0.6016765	16.68			
0.52	31.0	3:18:00 PM	78	0.6003692	16.64			
0.53	32.0	3:19:00 PM	79	0.5993606	16.61			
0.55	33.0	3:20:00 PM	80	0.5979576	16.58			
0.57	34.0	3:21:00 PM	81	0.5968477	16.54			
0.58	35.0	3:22:00 PM	82	0.5956032	16.51			
0.60	36.0	3:23:00 PM	83	0.5944473	16.48			
0.62	37.0	3:24:00 PM	84	0.5934092	16.45			
0.63	38.0	3:25:00 PM	85	0.5921558	16.41			
0.65	39.0	3:26:00 PM	86	0.5909004	16.38			
0.67	40.0	3:27:00 PM	87	0.5895347	16.34			
0.68	41.0	3:28:00 PM	88	0.5882849	16.31			
0.70	42.0	3:29:00 PM	89	0.587389	16.28			
0.72	43.0	3:30:00 PM	90	0.5861614	16.25			
0.73	44.0	3:31:00 PM	91	0.5849614	16.22			
0.75	45.0	3:32:00 PM	92	0.5840887	16.19			
0.77	46.0	3:33:00 PM	93	0.5826423	16.15			
0.78	47.0	3:34:00 PM	94	0.5815355	16.12			
0.80	48.0	3:35:00 PM	95	0.5805561	16.09			
0.82	49.0	3:36:00 PM	96	0.5794017	16.06			
0.83	50.0	3:37:00 PM	97	0.5781374	16.03			
0.85	51.0	3:38:00 PM	98	0.5771498	16.00			
0.87	52.0	3:39:00 PM	99	0.576111	15.97			
0.88	53.0	3:40:00 PM	100	0.5752172	15.95			
0.90	54.0	3:41:00 PM	101	0.5738214	15.91			
0.92	55.0	3:42:00 PM	102	0.5727864	15.88			
0.93	56.0	3:43:00 PM	103	0.5715603	15.84			
0.95	57.0	3:44:00 PM	104	0.5704766	15.81			
0.97	58.0	3:45:00 PM	105	0.5694889	15.79			
0.98	59.0	3:46:00 PM	106	0.5683067	15.75			
1.00	60.0	3:47:00 PM	107	0.567291	15.73			
1.02	61.0	3:48:00 PM	108	0.5661273	15.69			
1.03	62.0	3:49:00 PM	109	0.5651829	15.67			
1.05	63.0	3:50:00 PM	110	0.5641884	15.64			
1.07	64.0	3:51:00 PM	111	0.5629238	15.60			
1.08	65.0	3:52:00 PM	112	0.5619357	15.58			
1.10	66.0	3:53:00 PM	113	0.5608607	15.55			
1.12	67.0	3:54:00 PM	114	0.5598859	15.52			
1.13	68.0	3:55:00 PM	115	0.5587642	15.49			
1.15	69.0	3:56:00 PM	116	0.5578076	15.46			
1.17	70.0	3:57:00 PM	117	0.5567368	15.43			
1.18	71.0	3:58:00 PM	118	0.5557813	15.41			
1.20	72.0	3:59:00 PM	119	0.5545589	15.37			
1.22	73.0	4:00:00 PM	120	0.5537387	15.35			
1.23	74.0	4:01:00 PM	121	0.5527689	15.32			
1.25	75.0	4:02:00 PM	122	0.5515224	15.29			
1.27	76.0	4:03:00 PM	123	0.5506927	15.27			
1.28	77.0	4:04:00 PM	124	0.5495603	15.23			
1.30	78.0	4:05:00 PM	125	0.5484399	15.20			
1.32	79.0	4:06:00 PM	126	0.5475421	15.18			
1.33	80.0	4:07:00 PM	127	0.5464627	15.15			
1.35	81.0	4:08:00 PM	128	0.5453817	15.12			
1.37	82.0	4:09:00 PM	129	0.5445515	15.09			
1.38	83.0	4:10:00 PM	130	0.5433772	15.06			
1.40	84.0	4:11:00 PM	131	0.5425327	15.04			
1.42	85.0	4:12:00 PM	132	0.5415183	15.01			
1.43	86.0	4:13:00 PM	133	0.5405626	14.98			
1.45	87.0	4:14:00 PM	134	0.5395008	14.95			
1.47	88.0	4:15:00 PM	135	0.5386769	14.93			
1.48	89.0	4:16:00 PM	136	0.5373784	14.90			
1.50	90.0	4:17:00 PM	137	0.5364618	14.87			
1.52	91.0	4:18:00 PM	138	0.5354849	14.84			
1.53	92.0	4:19:00 PM	139	0.5344545	14.82			
1.55	93.0	4:20:00 PM	140	0.5336919	14.79			

1.57	94.0	4:21:00 PM	141	0.532706	14.77			
1.58	95.0	4:22:00 PM	142	0.5317665	14.74			
1.60	96.0	4:23:00 PM	143	0.5307212	14.71			
1.62	97.0	4:24:00 PM	144	0.5298718	14.69			
1.63	98.0	4:25:00 PM	145	0.528906	14.66			
1.65	99.0	4:26:00 PM	146	0.5279417	14.63			
1.67	100.0	4:27:00 PM	147	0.5270448	14.61			
1.68	101.0	4:28:00 PM	148	0.5259753	14.58			
1.70	102.0	4:29:00 PM	149	0.5248329	14.55			
1.72	103.0	4:30:00 PM	150	0.5242014	14.53			
1.73	104.0	4:31:00 PM	151	0.523153	14.50			
1.75	105.0	4:32:00 PM	152	0.5223269	14.48			
1.77	106.0	4:33:00 PM	153	0.5213259	14.45			
1.78	107.0	4:34:00 PM	154	0.5203286	14.42			
1.80	108.0	4:35:00 PM	155	0.5196723	14.41			
1.82	109.0	4:36:00 PM	156	0.5185503	14.37			
1.83	110.0	4:37:00 PM	157	0.5179019	14.36			
1.85	111.0	4:38:00 PM	158	0.5169567	14.33			
1.87	112.0	4:39:00 PM	159	0.5159566	14.30			
1.88	113.0	4:40:00 PM	160	0.5149618	14.27			
1.90	114.0	4:41:00 PM	161	0.5139663	14.25			
1.92	115.0	4:42:00 PM	162	0.5131132	14.22			
1.93	116.0	4:43:00 PM	163	0.5121055	14.20			
1.95	117.0	4:44:00 PM	164	0.5111621	14.17			
1.97	118.0	4:45:00 PM	165	0.5103054	14.15			
1.98	119.0	4:46:00 PM	166	0.509398	14.12			
2.00	120.0	4:47:00 PM	167	0.5086018	14.10			
2.02	121.0	4:48:00 PM	168	0.5076022	14.07			
2.03	122.0	4:49:00 PM	169	0.5069062	14.05			
2.05	123.0	4:50:00 PM	170	0.5059137	14.02			
2.07	124.0	4:51:00 PM	171	0.505071	14.00			
2.08	125.0	4:52:00 PM	172	0.5042806	13.98			
2.10	126.0	4:53:00 PM	173	0.5034274	13.96			
2.12	127.0	4:54:00 PM	174	0.5024111	13.93			
2.13	128.0	4:55:00 PM	175	0.5017368	13.91			
2.15	129.0	4:56:00 PM	176	0.5007994	13.88			
2.17	130.0	4:57:00 PM	177	0.4998519	13.86			
2.18	131.0	4:58:00 PM	178	0.4990126	13.83			
2.20	132.0	4:59:00 PM	179	0.4982367	13.81			
2.22	133.0	5:00:00 PM	180	0.4973976	13.79			
2.23	134.0	5:01:00 PM	181	0.4965979	13.77			
2.25	135.0	5:02:00 PM	182	0.4956314	13.74			
2.27	136.0	5:03:00 PM	183	0.49486	13.72			
2.28	137.0	5:04:00 PM	184	0.4941613	13.70			
2.30	138.0	5:05:00 PM	185	0.4932607	13.67			
2.32	139.0	5:06:00 PM	186	0.4924128	13.65			
2.33	140.0	5:07:00 PM	187	0.4913437	13.62			
2.35	141.0	5:08:00 PM	188	0.4908319	13.61			
2.37	142.0	5:09:00 PM	189	0.4898734	13.58			
2.38	143.0	5:10:00 PM	190	0.4890663	13.56			
2.40	144.0	5:11:00 PM	191	0.4880845	13.53			
2.42	145.0	5:12:00 PM	192	0.4873962	13.51			
2.43	146.0	5:13:00 PM	193	0.4867199	13.49			
2.45	147.0	5:14:00 PM	194	0.4856474	13.46			
2.47	148.0	5:15:00 PM	195	0.4848653	13.44			
2.48	149.0	5:16:00 PM	196	0.4840568	13.42			
2.50	150.0	5:17:00 PM	197	0.4834069	13.40			
2.52	151.0	5:18:00 PM	198	0.4825554	13.38			
2.53	152.0	5:19:00 PM	199	0.4816568	13.35			
2.55	153.0	5:20:00 PM	200	0.4809865	13.33			
2.57	154.0	5:21:00 PM	201	0.480343	13.32			
2.58	155.0	5:22:00 PM	202	0.4793691	13.29			
2.60	156.0	5:23:00 PM	203	0.4787618	13.27			
2.62	157.0	5:24:00 PM	204	0.4779957	13.25			
2.63	158.0	5:25:00 PM	205	0.4771469	13.23			

2.65	159.0	5:26:00 PM	206	0.476334	13.20			
2.67	160.0	5:27:00 PM	207	0.4755825	13.18			
2.68	161.0	5:28:00 PM	208	0.4746859	13.16			
2.70	162.0	5:29:00 PM	209	0.4739624	13.14			
2.72	163.0	5:30:00 PM	210	0.4732182	13.12			
2.73	164.0	5:31:00 PM	211	0.4723836	13.09			
2.75	165.0	5:32:00 PM	212	0.4713183	13.06			
2.77	166.0	5:33:00 PM	213	0.4709212	13.05			
2.78	167.0	5:34:00 PM	214	0.4701534	13.03			
2.80	168.0	5:35:00 PM	215	0.4692768	13.01			
2.82	169.0	5:36:00 PM	216	0.4686942	12.99			
2.83	170.0	5:37:00 PM	217	0.46774	12.97			
2.85	171.0	5:38:00 PM	218	0.4669708	12.94			
2.87	172.0	5:39:00 PM	219	0.4663706	12.93			
2.88	173.0	5:40:00 PM	220	0.4655534	12.91			
2.90	174.0	5:41:00 PM	221	0.4649832	12.89			
2.92	175.0	5:42:00 PM	222	0.4640834	12.86			
2.93	176.0	5:43:00 PM	223	0.4633295	12.84			
2.95	177.0	5:44:00 PM	224	0.4625263	12.82			
2.97	178.0	5:45:00 PM	225	0.462071	12.81			
2.98	179.0	5:46:00 PM	226	0.4611074	12.78			
3.00	180.0	5:47:00 PM	227	0.4603954	12.76			
3.02	181.0	5:48:00 PM	228	0.4596648	12.74			
3.03	182.0	5:49:00 PM	229	0.4590178	12.72			
3.05	183.0	5:50:00 PM	230	0.4579962	12.70			
3.07	184.0	5:51:00 PM	231	0.4574017	12.68			
3.08	185.0	5:52:00 PM	232	0.4567198	12.66			
3.10	186.0	5:53:00 PM	233	0.4559443	12.64			
3.12	187.0	5:54:00 PM	234	0.4552072	12.62			
3.13	188.0	5:55:00 PM	235	0.4543852	12.60			
3.15	189.0	5:56:00 PM	236	0.4536676	12.58			
3.17	190.0	5:57:00 PM	237	0.4530433	12.56			
3.18	191.0	5:58:00 PM	238	0.4523938	12.54			
3.20	192.0	5:59:00 PM	239	0.4516217	12.52			
3.22	193.0	6:00:00 PM	240	0.4509042	12.50			
3.23	194.0	6:01:00 PM	241	0.4501046	12.48			
3.25	195.0	6:02:00 PM	242	0.4493408	12.46			
3.27	196.0	6:03:00 PM	243	0.4487663	12.44			
3.28	197.0	6:04:00 PM	244	0.4481133	12.42			
3.30	198.0	6:05:00 PM	245	0.4472297	12.40			
3.32	199.0	6:06:00 PM	246	0.4466785	12.38			
3.33	200.0	6:07:00 PM	247	0.446042	12.36			
3.35	201.0	6:08:00 PM	248	0.4452429	12.34			
3.37	202.0	6:09:00 PM	249	0.4446959	12.33			
3.38	203.0	6:10:00 PM	250	0.4437504	12.30			
3.40	204.0	6:11:00 PM	251	0.4430337	12.28			
3.42	205.0	6:12:00 PM	252	0.4425249	12.27			
3.43	206.0	6:13:00 PM	253	0.4417984	12.25			
3.45	207.0	6:14:00 PM	254	0.4410664	12.23			
3.47	208.0	6:15:00 PM	255	0.4404542	12.21			
3.48	209.0	6:16:00 PM	256	0.4397186	12.19			
3.50	210.0	6:17:00 PM	257	0.4389174	12.17			
3.52	211.0	6:18:00 PM	258	0.4384156	12.15			
3.53	212.0	6:19:00 PM	259	0.4376729	12.13			
3.55	213.0	6:20:00 PM	260	0.4370528	12.12			
3.57	214.0	6:21:00 PM	261	0.4363786	12.10			
3.58	215.0	6:22:00 PM	262	0.435578	12.07			
3.60	216.0	6:23:00 PM	263	0.4350446	12.06			
3.62	217.0	6:24:00 PM	264	0.4341744	12.04			
3.63	218.0	6:25:00 PM	265	0.4336565	12.02			
3.65	219.0	6:26:00 PM	266	0.4329698	12.00			
3.67	220.0	6:27:00 PM	267	0.4322543	11.98			
3.68	221.0	6:28:00 PM	268	0.4315143	11.96			
3.70	222.0	6:29:00 PM	269	0.4309178	11.95			
3.72	223.0	6:30:00 PM	270	0.4303094	11.93			

3.73	224.0	6:31:00 PM	271	0.4296393	11.91			
3.75	225.0	6:32:00 PM	272	0.4289357	11.89			
3.77	226.0	6:33:00 PM	273	0.4281855	11.87			
3.78	227.0	6:34:00 PM	274	0.4277325	11.86			
3.80	228.0	6:35:00 PM	275	0.4268539	11.83			
3.82	229.0	6:36:00 PM	276	0.4262902	11.82			
3.83	230.0	6:37:00 PM	277	0.4256231	11.80			
3.85	231.0	6:38:00 PM	278	0.4249681	11.78			
3.87	232.0	6:39:00 PM	279	0.4243424	11.76			
3.88	233.0	6:40:00 PM	280	0.4237059	11.75			
3.90	234.0	6:41:00 PM	281	0.4230243	11.73			
3.92	235.0	6:42:00 PM	282	0.4222762	11.71			
3.93	236.0	6:43:00 PM	283	0.4217376	11.69			
3.95	237.0	6:44:00 PM	284	0.420995	11.67			
3.97	238.0	6:45:00 PM	285	0.4202533	11.65			
3.98	239.0	6:46:00 PM	286	0.4195064	11.63			
4.00	240.0	6:47:00 PM	287	0.4190864	11.62			
4.02	241.0	6:48:00 PM	288	0.41845	11.60			
4.03	242.0	6:49:00 PM	289	0.4177613	11.58			
4.05	243.0	6:50:00 PM	290	0.4170712	11.56			
4.07	244.0	6:51:00 PM	291	0.4164875	11.55			
4.08	245.0	6:52:00 PM	292	0.415774	11.53			
4.10	246.0	6:53:00 PM	293	0.4152345	11.51			
4.12	247.0	6:54:00 PM	294	0.4146182	11.49			
4.13	248.0	6:55:00 PM	295	0.4139433	11.47			
4.15	249.0	6:56:00 PM	296	0.4134012	11.46			
4.17	250.0	6:57:00 PM	297	0.4127483	11.44			
4.18	251.0	6:58:00 PM	298	0.412238	11.43			
4.20	252.0	6:59:00 PM	299	0.4113494	11.40			
4.22	253.0	7:00:00 PM	300	0.4107655	11.39			
4.23	254.0	7:01:00 PM	301	0.4100648	11.37			
4.25	255.0	7:02:00 PM	302	0.4095483	11.35			
4.27	256.0	7:03:00 PM	303	0.4088717	11.33			
4.28	257.0	7:04:00 PM	304	0.40831	11.32			
4.30	258.0	7:05:00 PM	305	0.4076103	11.30			
4.32	259.0	7:06:00 PM	306	0.4069979	11.28			
4.33	260.0	7:07:00 PM	307	0.4064675	11.27			
4.35	261.0	7:08:00 PM	308	0.4058159	11.25			
4.37	262.0	7:09:00 PM	309	0.4052145	11.23			
4.38	263.0	7:10:00 PM	310	0.4046304	11.22			
4.40	264.0	7:11:00 PM	311	0.4038675	11.20			
4.42	265.0	7:12:00 PM	312	0.4030887	11.17			
4.43	266.0	7:13:00 PM	313	0.4027538	11.16			
4.45	267.0	7:14:00 PM	314	0.4021398	11.15			
4.47	268.0	7:15:00 PM	315	0.4013925	11.13			
4.48	269.0	7:16:00 PM	316	0.4007931	11.11			
4.50	270.0	7:17:00 PM	317	0.4002134	11.09			
4.52	271.0	7:18:00 PM	318	0.3996933	11.08			
4.53	272.0	7:19:00 PM	319	0.3988602	11.06			
4.55	273.0	7:20:00 PM	320	0.39836	11.04			
4.57	274.0	7:21:00 PM	321	0.3977389	11.03			
4.58	275.0	7:22:00 PM	322	0.3972622	11.01			
4.60	276.0	7:23:00 PM	323	0.3965082	10.99			
4.62	277.0	7:24:00 PM	324	0.3958451	10.97			
4.63	278.0	7:25:00 PM	325	0.3954873	10.96			
4.65	279.0	7:26:00 PM	326	0.3948646	10.95			
4.67	280.0	7:27:00 PM	327	0.3941381	10.93			
4.68	281.0	7:28:00 PM	328	0.3936048	10.91			
4.70	282.0	7:29:00 PM	329	0.3930239	10.89			
4.72	283.0	7:30:00 PM	330	0.3924027	10.88			
4.73	284.0	7:31:00 PM	331	0.3917203	10.86			
4.75	285.0	7:32:00 PM	332	0.3911826	10.84			
4.77	286.0	7:33:00 PM	333	0.3904842	10.82			
4.78	287.0	7:34:00 PM	334	0.3899572	10.81			
4.80	288.0	7:35:00 PM	335	0.3893761	10.79			

4.82	289.0	7:36:00 PM	336	0.3888079	10.78			
4.83	290.0	7:37:00 PM	337	0.3880244	10.76			
4.85	291.0	7:38:00 PM	338	0.3876562	10.75			
4.87	292.0	7:39:00 PM	339	0.3869135	10.73			
4.88	293.0	7:40:00 PM	340	0.386407	10.71			
4.90	294.0	7:41:00 PM	341	0.385884	10.70			
4.92	295.0	7:42:00 PM	342	0.3853933	10.68			
4.93	296.0	7:43:00 PM	343	0.3847068	10.66			
4.95	297.0	7:44:00 PM	344	0.3841428	10.65			
4.97	298.0	7:45:00 PM	345	0.3836304	10.63			
4.98	299.0	7:46:00 PM	346	0.3830567	10.62			
5.00	300.0	7:47:00 PM	347	0.3823491	10.60			
5.02	301.0	7:48:00 PM	348	0.3819116	10.59			
5.03	302.0	7:49:00 PM	349	0.3812596	10.57			
5.05	303.0	7:50:00 PM	350	0.3806176	10.55			
5.07	304.0	7:51:00 PM	351	0.3800986	10.54			
5.08	305.0	7:52:00 PM	352	0.3794895	10.52			
5.10	306.0	7:53:00 PM	353	0.378943	10.50			
5.12	307.0	7:54:00 PM	354	0.3783875	10.49			
5.13	308.0	7:55:00 PM	355	0.3779738	10.48			
5.15	309.0	7:56:00 PM	356	0.3773686	10.46			
5.17	310.0	7:57:00 PM	357	0.3766908	10.44			
5.18	311.0	7:58:00 PM	358	0.3761404	10.43			
5.20	312.0	7:59:00 PM	359	0.3757232	10.42			
5.22	313.0	8:00:00 PM	360	0.3750913	10.40			
5.23	314.0	8:01:00 PM	361	0.3745391	10.38			
5.25	315.0	8:02:00 PM	362	0.3739198	10.37			
5.27	316.0	8:03:00 PM	363	0.3734775	10.35			
5.28	317.0	8:04:00 PM	364	0.3726285	10.33			
5.30	318.0	8:05:00 PM	365	0.3721547	10.32			
5.32	319.0	8:06:00 PM	366	0.3714828	10.30			
5.33	320.0	8:07:00 PM	367	0.3712516	10.29			
5.35	321.0	8:08:00 PM	368	0.3705567	10.27			
5.37	322.0	8:09:00 PM	369	0.3699436	10.25			
5.38	323.0	8:10:00 PM	370	0.3692336	10.24			
5.40	324.0	8:11:00 PM	371	0.3688316	10.22			
5.42	325.0	8:12:00 PM	372	0.3683915	10.21			
5.43	326.0	8:13:00 PM	373	0.3678633	10.20			
5.45	327.0	8:14:00 PM	374	0.3672081	10.18			
5.47	328.0	8:15:00 PM	375	0.3666074	10.16			
5.48	329.0	8:16:00 PM	376	0.3661046	10.15			
5.50	330.0	8:17:00 PM	377	0.3654379	10.13			
5.52	331.0	8:18:00 PM	378	0.3648874	10.11			
5.53	332.0	8:19:00 PM	379	0.3644522	10.10			
5.55	333.0	8:20:00 PM	380	0.3638973	10.09			
5.57	334.0	8:21:00 PM	381	0.3632666	10.07			
5.58	335.0	8:22:00 PM	382	0.3628179	10.06			
5.60	336.0	8:23:00 PM	383	0.3622772	10.04			
5.62	337.0	8:24:00 PM	384	0.3617661	10.03			
5.63	338.0	8:25:00 PM	385	0.3611802	10.01			
5.65	339.0	8:26:00 PM	386	0.3606049	10.00			
5.67	340.0	8:27:00 PM	387	0.3600149	9.98			
5.68	341.0	8:28:00 PM	388	0.359555	9.97			
5.70	342.0	8:29:00 PM	389	0.359046	9.95			
5.72	343.0	8:30:00 PM	390	0.3583884	9.93			
5.73	344.0	8:31:00 PM	391	0.3579948	9.92			
5.75	345.0	8:32:00 PM	392	0.357685	9.92			
5.77	346.0	8:33:00 PM	393	0.3569876	9.90			
5.78	347.0	8:34:00 PM	394	0.3563657	9.88			
5.80	348.0	8:35:00 PM	395	0.3557646	9.86			
5.82	349.0	8:36:00 PM	396	0.3553344	9.85			
5.83	350.0	8:37:00 PM	397	0.3548241	9.84			
5.85	351.0	8:38:00 PM	398	0.3542756	9.82			
5.87	352.0	8:39:00 PM	399	0.3536789	9.80			
5.88	353.0	8:40:00 PM	400	0.3529287	9.78			

5.90	354.0	8:41:00 PM	401	0.3527308	9.78			
5.92	355.0	8:42:00 PM	402	0.3522555	9.76			
5.93	356.0	8:43:00 PM	403	0.3515829	9.75			
5.95	357.0	8:44:00 PM	404	0.3511348	9.73			
5.97	358.0	8:45:00 PM	405	0.3505864	9.72			
5.98	359.0	8:46:00 PM	406	0.3501766	9.71			
6.00	360.0	8:47:00 PM	407	0.3495872	9.69			
6.02	361.0	8:48:00 PM	408	0.3489751	9.67			
6.03	362.0	8:49:00 PM	409	0.3485341	9.66			
6.05	363.0	8:50:00 PM	410	0.348086	9.65			
6.07	364.0	8:51:00 PM	411	0.3476068	9.64			
6.08	365.0	8:52:00 PM	412	0.3468601	9.61			
6.10	366.0	8:53:00 PM	413	0.346528	9.61			
6.12	367.0	8:54:00 PM	414	0.3459253	9.59			
6.13	368.0	8:55:00 PM	415	0.3455652	9.58			
6.15	369.0	8:56:00 PM	416	0.3450215	9.56			
6.17	370.0	8:57:00 PM	417	0.3444068	9.55			
6.18	371.0	8:58:00 PM	418	0.343888	9.53			
6.20	372.0	8:59:00 PM	419	0.3435142	9.52			
6.22	373.0	9:00:00 PM	420	0.3429617	9.51			
6.23	374.0	9:01:00 PM	421	0.3424506	9.49			
6.25	375.0	9:02:00 PM	422	0.3417067	9.47			
6.27	376.0	9:03:00 PM	423	0.3415975	9.47			
6.28	377.0	9:04:00 PM	424	0.3407967	9.45			
6.30	378.0	9:05:00 PM	425	0.3404202	9.44			
6.32	379.0	9:06:00 PM	426	0.3398587	9.42			
6.33	380.0	9:07:00 PM	427	0.3393693	9.41			
6.35	381.0	9:08:00 PM	428	0.3387113	9.39			
6.37	382.0	9:09:00 PM	429	0.3385239	9.38			
6.38	383.0	9:10:00 PM	430	0.3377045	9.36			
6.40	384.0	9:11:00 PM	431	0.337216	9.35			
6.42	385.0	9:12:00 PM	432	0.3368336	9.34			
6.43	386.0	9:13:00 PM	433	0.3365165	9.33			
6.45	387.0	9:14:00 PM	434	0.3357499	9.31			
6.47	388.0	9:15:00 PM	435	0.3355028	9.30			
6.48	389.0	9:16:00 PM	436	0.3347953	9.28			
6.50	390.0	9:17:00 PM	437	0.33433	9.27			
6.52	391.0	9:18:00 PM	438	0.3339249	9.26			
6.53	392.0	9:19:00 PM	439	0.3331754	9.24			
6.55	393.0	9:20:00 PM	440	0.3328319	9.23			
6.57	394.0	9:21:00 PM	441	0.3323514	9.21			
6.58	395.0	9:22:00 PM	442	0.331957	9.20			
6.60	396.0	9:23:00 PM	443	0.3313985	9.19			
6.62	397.0	9:24:00 PM	444	0.3308695	9.17			
6.63	398.0	9:25:00 PM	445	0.3304327	9.16			
6.65	399.0	9:26:00 PM	446	0.32994	9.15			
6.67	400.0	9:27:00 PM	447	0.3293374	9.13			
6.68	401.0	9:28:00 PM	448	0.3290542	9.12			
6.70	402.0	9:29:00 PM	449	0.3284717	9.11			
6.72	403.0	9:30:00 PM	450	0.3279082	9.09			
6.73	404.0	9:31:00 PM	451	0.3275704	9.08			
6.75	405.0	9:32:00 PM	452	0.3269824	9.06			
6.77	406.0	9:33:00 PM	453	0.3265906	9.05			
6.78	407.0	9:34:00 PM	454	0.3261551	9.04			
6.80	408.0	9:35:00 PM	455	0.325501	9.02			
6.82	409.0	9:36:00 PM	456	0.3251712	9.01			
6.83	410.0	9:37:00 PM	457	0.3246202	9.00			
6.85	411.0	9:38:00 PM	458	0.3241235	8.98			
6.87	412.0	9:39:00 PM	459	0.3236007	8.97			
6.88	413.0	9:40:00 PM	460	0.3233609	8.96			
6.90	414.0	9:41:00 PM	461	0.3226585	8.94			
6.92	415.0	9:42:00 PM	462	0.3220744	8.93			
6.93	416.0	9:43:00 PM	463	0.3218187	8.92			
6.95	417.0	9:44:00 PM	464	0.321153	8.90			
6.97	418.0	9:45:00 PM	465	0.3209304	8.90			

6.98	419.0	9:46:00 PM	466	0.3201574	8.87			
7.00	420.0	9:47:00 PM	467	0.3199719	8.87			
7.02	421.0	9:48:00 PM	468	0.3193471	8.85			
7.03	422.0	9:49:00 PM	469	0.3189234	8.84			
7.05	423.0	9:50:00 PM	470	0.3183325	8.82			
7.07	424.0	9:51:00 PM	471	0.3179225	8.81			
7.08	425.0	9:52:00 PM	472	0.3172668	8.79			
7.10	426.0	9:53:00 PM	473	0.3169887	8.79			
7.12	427.0	9:54:00 PM	474	0.3166049	8.78			
7.13	428.0	9:55:00 PM	475	0.3160063	8.76			
7.15	429.0	9:56:00 PM	476	0.3156134	8.75			
7.17	430.0	9:57:00 PM	477	0.3150926	8.73			
7.18	431.0	9:58:00 PM	478	0.3145929	8.72			
7.20	432.0	9:59:00 PM	479	0.3142574	8.71			
7.22	433.0	10:00:00 PM	480	0.3137705	8.70			
7.23	434.0	10:01:00 PM	481	0.3132855	8.68			
7.25	435.0	10:02:00 PM	482	0.3127896	8.67			
7.27	436.0	10:03:00 PM	483	0.3123173	8.66			
7.28	437.0	10:04:00 PM	484	0.3118723	8.65			
7.30	438.0	10:05:00 PM	485	0.3113218	8.63			
7.32	439.0	10:06:00 PM	486	0.3109029	8.62			
7.33	440.0	10:07:00 PM	487	0.310556	8.61			
7.35	441.0	10:08:00 PM	488	0.3102688	8.60			
7.37	442.0	10:09:00 PM	489	0.3097191	8.59			
7.38	443.0	10:10:00 PM	490	0.3091728	8.57			
7.40	444.0	10:11:00 PM	491	0.3086664	8.56			
7.42	445.0	10:12:00 PM	492	0.3082929	8.55			
7.43	446.0	10:13:00 PM	493	0.3078355	8.53			
7.45	447.0	10:14:00 PM	494	0.3072872	8.52			
7.47	448.0	10:15:00 PM	495	0.306905	8.51			
7.48	449.0	10:16:00 PM	496	0.306535	8.50			
7.50	450.0	10:17:00 PM	497	0.3059694	8.48			
7.52	451.0	10:18:00 PM	498	0.3055866	8.47			
7.53	452.0	10:19:00 PM	499	0.3050818	8.46			
7.55	453.0	10:20:00 PM	500	0.3047073	8.45			
7.57	454.0	10:21:00 PM	501	0.3043042	8.44			
7.58	455.0	10:22:00 PM	502	0.3038845	8.42			
7.60	456.0	10:23:00 PM	503	0.3033504	8.41			
7.62	457.0	10:24:00 PM	504	0.3028854	8.40			
7.63	458.0	10:25:00 PM	505	0.302429	8.38			
7.65	459.0	10:26:00 PM	506	0.3021383	8.38			
7.67	460.0	10:27:00 PM	507	0.3016852	8.36			
7.68	461.0	10:28:00 PM	508	0.3011046	8.35			
7.70	462.0	10:29:00 PM	509	0.3006677	8.33			
7.72	463.0	10:30:00 PM	510	0.3002995	8.32			
7.73	464.0	10:31:00 PM	511	0.2999159	8.31			
7.75	465.0	10:32:00 PM	512	0.2994536	8.30			
7.77	466.0	10:33:00 PM	513	0.2988558	8.28			
7.78	467.0	10:34:00 PM	514	0.2985285	8.28			
7.80	468.0	10:35:00 PM	515	0.2980798	8.26			
7.82	469.0	10:36:00 PM	516	0.2977571	8.25			
7.83	470.0	10:37:00 PM	517	0.2971527	8.24			
7.85	471.0	10:38:00 PM	518	0.2966553	8.22			
7.87	472.0	10:39:00 PM	519	0.2962384	8.21			
7.88	473.0	10:40:00 PM	520	0.295904	8.20			
7.90	474.0	10:41:00 PM	521	0.2954712	8.19			
7.92	475.0	10:42:00 PM	522	0.2949799	8.18			
7.93	476.0	10:43:00 PM	523	0.2945293	8.16			
7.95	477.0	10:44:00 PM	524	0.2942546	8.16			
7.97	478.0	10:45:00 PM	525	0.2936298	8.14			
7.98	479.0	10:46:00 PM	526	0.2932622	8.13			
8.00	480.0	10:47:00 PM	527	0.2927607	8.12			
8.02	481.0	10:48:00 PM	528	0.2923438	8.10			
8.03	482.0	10:49:00 PM	529	0.2919472	8.09			
8.05	483.0	10:50:00 PM	530	0.2914852	8.08			

8.07	484.0	10:51:00 PM	531	0.2910667	8.07			
8.08	485.0	10:52:00 PM	532	0.2905825	8.05			
8.10	486.0	10:53:00 PM	533	0.290187	8.04			
8.12	487.0	10:54:00 PM	534	0.2898004	8.03			
8.13	488.0	10:55:00 PM	535	0.2893795	8.02			
8.15	489.0	10:56:00 PM	536	0.288977	8.01			
8.17	490.0	10:57:00 PM	537	0.2884958	8.00			
8.18	491.0	10:58:00 PM	538	0.2880446	7.98			
8.20	492.0	10:59:00 PM	539	0.2876054	7.97			
8.22	493.0	11:00:00 PM	540	0.2871532	7.96			
8.23	494.0	11:01:00 PM	541	0.2865692	7.94			
8.25	495.0	11:02:00 PM	542	0.2863439	7.94			
8.27	496.0	11:03:00 PM	543	0.285934	7.93			
8.28	497.0	11:04:00 PM	544	0.2853926	7.91			
8.30	498.0	11:05:00 PM	545	0.2850575	7.90			
8.32	499.0	11:06:00 PM	546	0.2845982	7.89			
8.33	500.0	11:07:00 PM	547	0.2841134	7.88			
8.35	501.0	11:08:00 PM	548	0.2838154	7.87			
8.37	502.0	11:09:00 PM	549	0.2833345	7.85			
8.38	503.0	11:10:00 PM	550	0.2829339	7.84			
8.40	504.0	11:11:00 PM	551	0.2823529	7.83			
8.42	505.0	11:12:00 PM	552	0.2820951	7.82			
8.43	506.0	11:13:00 PM	553	0.2817876	7.81			
8.45	507.0	11:14:00 PM	554	0.2812302	7.80			
8.47	508.0	11:15:00 PM	555	0.2809139	7.79			
8.48	509.0	11:16:00 PM	556	0.2804275	7.77			
8.50	510.0	11:17:00 PM	557	0.2801899	7.77			
8.52	511.0	11:18:00 PM	558	0.2798247	7.76			
8.53	512.0	11:19:00 PM	559	0.2795561	7.75			
8.55	513.0	11:20:00 PM	560	0.2791081	7.74			
8.57	514.0	11:21:00 PM	561	0.2787391	7.73			
8.58	515.0	11:22:00 PM	562	0.2783832	7.72			
8.60	516.0	11:23:00 PM	563	0.2780272	7.71			
8.62	517.0	11:24:00 PM	564	0.2776232	7.70			
8.63	518.0	11:25:00 PM	565	0.2771862	7.68			
8.65	519.0	11:26:00 PM	566	0.2767598	7.67			
8.67	520.0	11:27:00 PM	567	0.2764525	7.66			
8.68	521.0	11:28:00 PM	568	0.2760223	7.65			
8.70	522.0	11:29:00 PM	569	0.2757339	7.64			
8.72	523.0	11:30:00 PM	570	0.2753151	7.63			
8.73	524.0	11:31:00 PM	571	0.2749712	7.62			
8.75	525.0	11:32:00 PM	572	0.2745787	7.61			
8.77	526.0	11:33:00 PM	573	0.2741412	7.60			
8.78	527.0	11:34:00 PM	574	0.2739182	7.59			
8.80	528.0	11:35:00 PM	575	0.2733957	7.58			
8.82	529.0	11:36:00 PM	576	0.273063	7.57			
8.83	530.0	11:37:00 PM	577	0.2727462	7.56			
8.85	531.0	11:38:00 PM	578	0.2724059	7.55			
8.87	532.0	11:39:00 PM	579	0.2718234	7.53			
8.88	533.0	11:40:00 PM	580	0.2716563	7.53			
8.90	534.0	11:41:00 PM	581	0.2713009	7.52			
8.92	535.0	11:42:00 PM	582	0.2707418	7.50			
8.93	536.0	11:43:00 PM	583	0.2705838	7.50			
8.95	537.0	11:44:00 PM	584	0.2701097	7.49			
8.97	538.0	11:45:00 PM	585	0.2696346	7.47			
8.98	539.0	11:46:00 PM	586	0.2694211	7.47			
9.00	540.0	11:47:00 PM	587	0.2689682	7.46			
9.02	541.0	11:48:00 PM	588	0.2684885	7.44			
9.03	542.0	11:49:00 PM	589	0.2682942	7.44			
9.05	543.0	11:50:00 PM	590	0.267786	7.42			
9.07	544.0	11:51:00 PM	591	0.2675043	7.42			
9.08	545.0	11:52:00 PM	592	0.2671519	7.41			
9.10	546.0	11:53:00 PM	593	0.266704	7.39			
9.12	547.0	11:54:00 PM	594	0.266351	7.38			
9.13	548.0	11:55:00 PM	595	0.2659157	7.37			

9.15	549.0	11:56:00 PM	596	0.2654819	7.36			
9.17	550.0	11:57:00 PM	597	0.2651992	7.35			
9.18	551.0	11:58:00 PM	598	0.2648574	7.34			
9.20	552.0	11:59:00 PM	599	0.2645844	7.33			
9.22	553.0	12:00:00 AM	600	0.2641949	7.32			
9.23	554.0	12:01:00 AM	601	0.2637908	7.31			
9.25	555.0	12:02:00 AM	602	0.2635445	7.31			
9.27	556.0	12:03:00 AM	603	0.2629656	7.29			
9.28	557.0	12:04:00 AM	604	0.2626902	7.28			
9.30	558.0	12:05:00 AM	605	0.2622282	7.27			
9.32	559.0	12:06:00 AM	606	0.2620318	7.26			
9.33	560.0	12:07:00 AM	607	0.2617341	7.26			
9.35	561.0	12:08:00 AM	608	0.2611405	7.24			
9.37	562.0	12:09:00 AM	609	0.2610267	7.24			
9.38	563.0	12:10:00 AM	610	0.2606808	7.23			
9.40	564.0	12:11:00 AM	611	0.260137	7.21			
9.42	565.0	12:12:00 AM	612	0.2597816	7.20			
9.43	566.0	12:13:00 AM	613	0.2594336	7.19			
9.45	567.0	12:14:00 AM	614	0.2591499	7.18			
9.47	568.0	12:15:00 AM	615	0.2587742	7.17			
9.48	569.0	12:16:00 AM	616	0.258481	7.17			
9.50	570.0	12:17:00 AM	617	0.2581647	7.16			
9.52	571.0	12:18:00 AM	618	0.2577306	7.14			
9.53	572.0	12:19:00 AM	619	0.2572978	7.13			
9.55	573.0	12:20:00 AM	620	0.2569368	7.12			
9.57	574.0	12:21:00 AM	621	0.2565182	7.11			
9.58	575.0	12:22:00 AM	622	0.2563441	7.11			
9.60	576.0	12:23:00 AM	623	0.2559004	7.09			
9.62	577.0	12:24:00 AM	624	0.255772	7.09			
9.63	578.0	12:25:00 AM	625	0.2553347	7.08			
9.65	579.0	12:26:00 AM	626	0.2548116	7.06			
9.67	580.0	12:27:00 AM	627	0.2545063	7.05			
9.68	581.0	12:28:00 AM	628	0.2541268	7.04			
9.70	582.0	12:29:00 AM	629	0.2538816	7.04			
9.72	583.0	12:30:00 AM	630	0.2534199	7.02			
9.73	584.0	12:31:00 AM	631	0.2532003	7.02			
9.75	585.0	12:32:00 AM	632	0.2530795	7.02			
9.77	586.0	12:33:00 AM	633	0.2525171	7.00			
9.78	587.0	12:34:00 AM	634	0.2522613	6.99			
9.80	588.0	12:35:00 AM	635	0.2519194	6.98			
9.82	589.0	12:36:00 AM	636	0.251673	6.98			
9.83	590.0	12:37:00 AM	637	0.2513539	6.97			
9.85	591.0	12:38:00 AM	638	0.2508717	6.95			
9.87	592.0	12:39:00 AM	639	0.2506553	6.95			
9.88	593.0	12:40:00 AM	640	0.2502955	6.94			
9.90	594.0	12:41:00 AM	641	0.2501408	6.93			
9.92	595.0	12:42:00 AM	642	0.249725	6.92			
9.93	596.0	12:43:00 AM	643	0.2493508	6.91			
9.95	597.0	12:44:00 AM	644	0.2491928	6.91			
9.97	598.0	12:45:00 AM	645	0.2488329	6.90			
9.98	599.0	12:46:00 AM	646	0.2483446	6.88			
10.00	600.0	12:47:00 AM	647	0.2481155	6.88			
10.02	601.0	12:48:00 AM	648	0.2477672	6.87			
10.03	602.0	12:49:00 AM	649	0.2473367	6.86			
10.05	603.0	12:50:00 AM	650	0.2469757	6.85			
10.07	604.0	12:51:00 AM	651	0.2466465	6.84			
10.08	605.0	12:52:00 AM	652	0.2464564	6.83			
10.10	606.0	12:53:00 AM	653	0.2460556	6.82			
10.12	607.0	12:54:00 AM	654	0.2457658	6.81			
10.13	608.0	12:55:00 AM	655	0.2455626	6.81			
10.15	609.0	12:56:00 AM	656	0.2450209	6.79			
10.17	610.0	12:57:00 AM	657	0.244832	6.79			
10.18	611.0	12:58:00 AM	658	0.2443352	6.77			
10.20	612.0	12:59:00 AM	659	0.2441674	6.77			
10.22	613.0	1:00:00 AM	660	0.2438309	6.76			

10.23	614.0	1:01:00 AM	661	0.2433557	6.75			
10.25	615.0	1:02:00 AM	662	0.2432244	6.74			
10.27	616.0	1:03:00 AM	663	0.2428895	6.73			
10.28	617.0	1:04:00 AM	664	0.2424634	6.72			
10.30	618.0	1:05:00 AM	665	0.242226	6.71			
10.32	619.0	1:06:00 AM	666	0.24213	6.71			
10.33	620.0	1:07:00 AM	667	0.2415085	6.69			
10.35	621.0	1:08:00 AM	668	0.2413204	6.69			
10.37	622.0	1:09:00 AM	669	0.2411366	6.68			
10.38	623.0	1:10:00 AM	670	0.2406868	6.67			
10.40	624.0	1:11:00 AM	671	0.2403203	6.66			
10.42	625.0	1:12:00 AM	672	0.2399281	6.65			
10.43	626.0	1:13:00 AM	673	0.2394554	6.64			
10.45	627.0	1:14:00 AM	674	0.2394218	6.64			
10.47	628.0	1:15:00 AM	675	0.2391005	6.63			
10.48	629.0	1:16:00 AM	676	0.2386801	6.62			
10.50	630.0	1:17:00 AM	677	0.2385307	6.61			
10.52	631.0	1:18:00 AM	678	0.238242	6.60			
10.53	632.0	1:19:00 AM	679	0.2378317	6.59			
10.55	633.0	1:20:00 AM	680	0.23752	6.58			
10.57	634.0	1:21:00 AM	681	0.2372568	6.58			
10.58	635.0	1:22:00 AM	682	0.2367324	6.56			
10.60	636.0	1:23:00 AM	683	0.2365582	6.56			
10.62	637.0	1:24:00 AM	684	0.2361709	6.55			
10.63	638.0	1:25:00 AM	685	0.2359665	6.54			
10.65	639.0	1:26:00 AM	686	0.2357119	6.53			
10.67	640.0	1:27:00 AM	687	0.2353159	6.52			
10.68	641.0	1:28:00 AM	688	0.2349618	6.51			
10.70	642.0	1:29:00 AM	689	0.2347174	6.51			
10.72	643.0	1:30:00 AM	690	0.2342418	6.49			
10.73	644.0	1:31:00 AM	691	0.2341276	6.49			
10.75	645.0	1:32:00 AM	692	0.233656	6.48			
10.77	646.0	1:33:00 AM	693	0.2334084	6.47			
10.78	647.0	1:34:00 AM	694	0.2330576	6.46			
10.80	648.0	1:35:00 AM	695	0.2327521	6.45			
10.82	649.0	1:36:00 AM	696	0.2322982	6.44			
10.83	650.0	1:37:00 AM	697	0.2321964	6.44			
10.85	651.0	1:38:00 AM	698	0.2315463	6.42			
10.87	652.0	1:39:00 AM	699	0.2312906	6.41			
10.88	653.0	1:40:00 AM	700	0.2311036	6.41			
10.90	654.0	1:41:00 AM	701	0.2308283	6.40			
10.92	655.0	1:42:00 AM	702	0.2303913	6.39			
10.93	656.0	1:43:00 AM	703	0.2300765	6.38			
10.95	657.0	1:44:00 AM	704	0.2296918	6.37			
10.97	658.0	1:45:00 AM	705	0.2291716	6.35			
10.98	659.0	1:46:00 AM	706	0.2291427	6.35			
11.00	660.0	1:47:00 AM	707	0.2287972	6.34			
11.02	661.0	1:48:00 AM	708	0.2283093	6.33			
11.03	662.0	1:49:00 AM	709	0.2281099	6.32			
11.05	663.0	1:50:00 AM	710	0.2277659	6.31			
11.07	664.0	1:51:00 AM	711	0.2275424	6.31			
11.08	665.0	1:52:00 AM	712	0.2271643	6.30			
11.10	666.0	1:53:00 AM	713	0.226747	6.29			
11.12	667.0	1:54:00 AM	714	0.2263805	6.28			
11.13	668.0	1:55:00 AM	715	0.2263152	6.27			
11.15	669.0	1:56:00 AM	716	0.2257873	6.26			
11.17	670.0	1:57:00 AM	717	0.225451	6.25			
11.18	671.0	1:58:00 AM	718	0.2253162	6.25			
11.20	672.0	1:59:00 AM	719	0.2250071	6.24			
11.22	673.0	2:00:00 AM	720	0.2245898	6.23			
11.23	674.0	2:01:00 AM	721	0.2243778	6.22			
11.25	675.0	2:02:00 AM	722	0.2239155	6.21			
11.27	676.0	2:03:00 AM	723	0.2238094	6.20			
11.28	677.0	2:04:00 AM	724	0.2233901	6.19			
11.30	678.0	2:05:00 AM	725	0.2231255	6.19			

11.32	679.0	2:06:00 AM	726	0.2228536	6.18			
11.33	680.0	2:07:00 AM	727	0.2224415	6.17			
11.35	681.0	2:08:00 AM	728	0.2218914	6.15			
11.37	682.0	2:09:00 AM	729	0.2218229	6.15			
11.38	683.0	2:10:00 AM	730	0.2212987	6.13			
11.40	684.0	2:11:00 AM	731	0.2211595	6.13			
11.42	685.0	2:12:00 AM	732	0.220771	6.12			
11.43	686.0	2:13:00 AM	733	0.2205335	6.11			
11.45	687.0	2:14:00 AM	734	0.2202411	6.11			
11.47	688.0	2:15:00 AM	735	0.2199863	6.10			
11.48	689.0	2:16:00 AM	736	0.2196768	6.09			
11.50	690.0	2:17:00 AM	737	0.2192997	6.08			
11.52	691.0	2:18:00 AM	738	0.2191253	6.07			
11.53	692.0	2:19:00 AM	739	0.21875	6.06			
11.55	693.0	2:20:00 AM	740	0.2184979	6.06			
11.57	694.0	2:21:00 AM	741	0.2181474	6.05			
11.58	695.0	2:22:00 AM	742	0.2177172	6.04			
11.60	696.0	2:23:00 AM	743	0.2175665	6.03			
11.62	697.0	2:24:00 AM	744	0.217322	6.02			
11.63	698.0	2:25:00 AM	745	0.2168784	6.01			
11.65	699.0	2:26:00 AM	746	0.2165503	6.00			
11.67	700.0	2:27:00 AM	747	0.2163334	6.00			
11.68	701.0	2:28:00 AM	748	0.2160437	5.99			
11.70	702.0	2:29:00 AM	749	0.2155117	5.97			
11.72	703.0	2:30:00 AM	750	0.2153101	5.97			
11.73	704.0	2:31:00 AM	751	0.2151149	5.96			
11.75	705.0	2:32:00 AM	752	0.2147408	5.95			
11.77	706.0	2:33:00 AM	753	0.2144705	5.95			
11.78	707.0	2:34:00 AM	754	0.2140915	5.93			
11.80	708.0	2:35:00 AM	755	0.213584	5.92			
11.82	709.0	2:36:00 AM	756	0.213325	5.91			
11.83	710.0	2:37:00 AM	757	0.2131992	5.91			
11.85	711.0	2:38:00 AM	758	0.2129974	5.90			
11.87	712.0	2:39:00 AM	759	0.2126255	5.89			
11.88	713.0	2:40:00 AM	760	0.2123617	5.89			
11.90	714.0	2:41:00 AM	761	0.2120121	5.88			
11.92	715.0	2:42:00 AM	762	0.2116331	5.87			
11.93	716.0	2:43:00 AM	763	0.211447	5.86			
11.95	717.0	2:44:00 AM	764	0.2110848	5.85			
11.97	718.0	2:45:00 AM	765	0.2107854	5.84			
11.98	719.0	2:46:00 AM	766	0.2104446	5.83			
12.00	720.0	2:47:00 AM	767	0.2101597	5.83			
12.02	721.0	2:48:00 AM	768	0.2097838	5.82			
12.03	722.0	2:49:00 AM	769	0.2094871	5.81			
12.05	723.0	2:50:00 AM	770	0.2093	5.80			
12.07	724.0	2:51:00 AM	771	0.2088682	5.79			
12.08	725.0	2:52:00 AM	772	0.2084447	5.78			
12.10	726.0	2:53:00 AM	773	0.2083865	5.78			
12.12	727.0	2:54:00 AM	774	0.2079379	5.76			
12.13	728.0	2:55:00 AM	775	0.2078394	5.76			
12.15	729.0	2:56:00 AM	776	0.2073376	5.75			
12.17	730.0	2:57:00 AM	777	0.2073809	5.75			
12.18	731.0	2:58:00 AM	778	0.2067196	5.73			
12.20	732.0	2:59:00 AM	779	0.2064185	5.72			
12.22	733.0	3:00:00 AM	780	0.2061854	5.72			
12.23	734.0	3:01:00 AM	781	0.2059976	5.71			
12.25	735.0	3:02:00 AM	782	0.205719	5.70			
12.27	736.0	3:03:00 AM	783	0.2053176	5.69			
12.28	737.0	3:04:00 AM	784	0.2051308	5.69			
12.30	738.0	3:05:00 AM	785	0.2049534	5.68			
12.32	739.0	3:06:00 AM	786	0.2045095	5.67			
12.33	740.0	3:07:00 AM	787	0.2042739	5.66			
12.35	741.0	3:08:00 AM	788	0.2038753	5.65			
12.37	742.0	3:09:00 AM	789	0.2034201	5.64			
12.38	743.0	3:10:00 AM	790	0.2031928	5.63			

12.40	744.0	3:11:00 AM	791	0.2029659	5.63			
12.42	745.0	3:12:00 AM	792	0.2024055	5.61			
12.43	746.0	3:13:00 AM	793	0.2023484	5.61			
12.45	747.0	3:14:00 AM	794	0.2017809	5.59			
12.47	748.0	3:15:00 AM	795	0.201733	5.59			
12.48	749.0	3:16:00 AM	796	0.2011694	5.58			
12.50	750.0	3:17:00 AM	797	0.2008379	5.57			
12.52	751.0	3:18:00 AM	798	0.2005912	5.56			
12.53	752.0	3:19:00 AM	799	0.2002134	5.55			
12.55	753.0	3:20:00 AM	800	0.199972	5.54			
12.57	754.0	3:21:00 AM	801	0.1996798	5.54			
12.58	755.0	3:22:00 AM	802	0.1993177	5.53			
12.60	756.0	3:23:00 AM	803	0.1990687	5.52			
12.62	757.0	3:24:00 AM	804	0.1987474	5.51			
12.63	758.0	3:25:00 AM	805	0.198751	5.51			
12.65	759.0	3:26:00 AM	806	0.1981454	5.49			
12.67	760.0	3:27:00 AM	807	0.1978096	5.48			
12.68	761.0	3:28:00 AM	808	0.1976218	5.48			
12.70	762.0	3:29:00 AM	809	0.1972546	5.47			
12.72	763.0	3:30:00 AM	810	0.1969735	5.46			
12.73	764.0	3:31:00 AM	811	0.1965597	5.45			
12.75	765.0	3:32:00 AM	812	0.1963765	5.44			
12.77	766.0	3:33:00 AM	813	0.1960853	5.44			
12.78	767.0	3:34:00 AM	814	0.1957227	5.43			
12.80	768.0	3:35:00 AM	815	0.195296	5.41			
12.82	769.0	3:36:00 AM	816	0.1952702	5.41			
12.83	770.0	3:37:00 AM	817	0.1946333	5.40			
12.85	771.0	3:38:00 AM	818	0.1944285	5.39			
12.87	772.0	3:39:00 AM	819	0.1939748	5.38			
12.88	773.0	3:40:00 AM	820	0.1937036	5.37			
12.90	774.0	3:41:00 AM	821	0.193235	5.36			
12.92	775.0	3:42:00 AM	822	0.193021	5.35			
12.93	776.0	3:43:00 AM	823	0.192614	5.34			
12.95	777.0	3:44:00 AM	824	0.1923282	5.33			
12.97	778.0	3:45:00 AM	825	0.1920118	5.32			
12.98	779.0	3:46:00 AM	826	0.1916044	5.31			
13.00	780.0	3:47:00 AM	827	0.1913645	5.30			
13.02	781.0	3:48:00 AM	828	0.1909942	5.29			
13.03	782.0	3:49:00 AM	829	0.1904634	5.28			
13.05	783.0	3:50:00 AM	830	0.1902112	5.27			
13.07	784.0	3:51:00 AM	831	0.1899803	5.27			
13.08	785.0	3:52:00 AM	832	0.1896005	5.26			
13.10	786.0	3:53:00 AM	833	0.1890518	5.24			
13.12	787.0	3:54:00 AM	834	0.1890419	5.24			
13.13	788.0	3:55:00 AM	835	0.1885242	5.23			
13.15	789.0	3:56:00 AM	836	0.1882483	5.22			
13.17	790.0	3:57:00 AM	837	0.1880348	5.21			
13.18	791.0	3:58:00 AM	838	0.1876725	5.20			
13.20	792.0	3:59:00 AM	839	0.1872986	5.19			
13.22	793.0	4:00:00 AM	840	0.1871082	5.19			
13.23	794.0	4:01:00 AM	841	0.1867086	5.18			
13.25	795.0	4:02:00 AM	842	0.1863241	5.16			
13.27	796.0	4:03:00 AM	843	0.1861088	5.16			
13.28	797.0	4:04:00 AM	844	0.1857601	5.15			
13.30	798.0	4:05:00 AM	845	0.185582	5.14			
13.32	799.0	4:06:00 AM	846	0.1851991	5.13			
13.33	800.0	4:07:00 AM	847	0.1848724	5.12			
13.35	801.0	4:08:00 AM	848	0.1845708	5.12			
13.37	802.0	4:09:00 AM	849	0.184144	5.10			
13.38	803.0	4:10:00 AM	850	0.1839373	5.10			
13.40	804.0	4:11:00 AM	851	0.1837896	5.09			
13.42	805.0	4:12:00 AM	852	0.1836488	5.09			
13.43	806.0	4:13:00 AM	853	0.1832347	5.08			
13.45	807.0	4:14:00 AM	854	0.1827551	5.07			
13.47	808.0	4:15:00 AM	855	0.1823733	5.06			

13.48	809.0	4:16:00 AM	856	0.1821455	5.05			
13.50	810.0	4:17:00 AM	857	0.1818089	5.04			
13.52	811.0	4:18:00 AM	858	0.1812184	5.02			
13.53	812.0	4:19:00 AM	859	0.180979	5.02			
13.55	813.0	4:20:00 AM	860	0.1807313	5.01			
13.57	814.0	4:21:00 AM	861	0.1804284	5.00			
13.58	815.0	4:22:00 AM	862	0.1803585	5.00			
13.60	816.0	4:23:00 AM	863	0.1799616	4.99			
13.62	817.0	4:24:00 AM	864	0.179759	4.98			
13.63	818.0	4:25:00 AM	865	0.179339	4.97			
13.65	819.0	4:26:00 AM	866	0.1789101	4.96			
13.67	820.0	4:27:00 AM	867	0.1786771	4.95			
			Average Infiltration Rate:		0.85			
				Factor of Safety:	0.45			
					Infiltration Rate of 0.38 in/hr Used for Sizing of System			

APPENDIX B

PRODUCT



CRS451V

Stainless-Steel Vented Stand-Alone Pressure Transducer



Pressure Transducer Combined with a Recorder

High resolution and accuracy

Overview

The CRS451V consists of a submersible water-level and water-temperature sensor with its own time clock and memory to store the collected data—in a compact stainless-steel case. This data logging capability frees users to place the sensor in remote sites and let it collect data for long periods. HydroSci software is included and elegantly supports test setup, data

retrieval, and data display. Long battery life and rugged construction mean you can trust the CRS451V to collect important data. Low cost and ease of use make it a good choice in a variety of applications. The CRS456V is the same as this, but with a titanium case.

Benefits and Features

- › Sensors and data-collection features in one instrument case
- › Rugged stainless-steel case protects piezoresistive sensor
- › Quality construction ensures product reliability
- › Fully temperature-compensated
- › Fast scan rate
- › Large data-storage capacity
- › Long battery life
- › Easy-to-use software

Detailed Description

The CRS451V has several pressure range options.

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configure the CRS451V to monitor surface water, ground water, or a standard pump test.

HydroSci software will display the data in tabular or graphical formats.

Specifications

Venting

Vented

Measurement Time

< 1.0 s

APPENDIX C

INFILTRATION TEST

The Washington State Department of Ecology Stormwater Manual provides testing procedures and best practices, which are described below.

- Testing should occur between December 1 and April 1.
- The horizontal and vertical locations of the PIT shall be surveyed by a licensed land surveyor and accurately shown on the design drawings.
- Excavate the test pit to the estimated elevation of the proposed infiltration into the native soil. Note that for some proposed BMPs, such as and [BMP T5.15: Per-meable Pavements](#), this will be below the proposed finished grade. If the native soils will have to meet a minimum subgrade compaction requirement (for example, the road subgrade if using [BMP T5.15: Permeable Pavements](#)), compact the native soil to that requirement prior to testing. Lay back the slopes sufficiently to avoid caving and erosion during the test. Altern- atively, consider shoring the sides of the test pit.
- The horizontal surface area of the bottom of the test pit should be approximately 100 square feet. Document the size and geometry of the test pit.
- Install a vertical measuring rod (long enough to measure the ponded water depth, minimum 5- ft. long) marked in half-inch increments in the center of the pit bottom.
- Use a rigid 6-inch diameter pipe with a splash plate on the bottom to convey water to the test pit and reduce side-wall erosion or excessive disturbance of the test pit bottom. Excessive erosion and bottom disturbance will result in clogging of the infiltration receptor and yield lower than actual infiltration rates.
- Add water to the pit at a rate that will maintain a water level between 6 and 12 inches above the bottom of the pit. A rotameter can be used to measure the flow rate into the pit.

The depth should not exceed the proposed maximum depth of water expected in the completed BMP. For infiltration BMPs serving large drainage areas, designs with multiple feet of standing water can have infiltration tests with greater than 1 foot of standing water.

- Every 15-30 min, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point on the measuring rod.
- Keep adding water to the pit until one hour after the flow rate into the pit has stabilized (constant flow rate; a goal of 5% or less variation in the total flow) while maintaining the same pond water level. The total of the pre-soak time plus one hour after the flow rate has stabilized should be no less than 6 hours.
- After the flow rate has stabilized for at least one hour, turn off the water and record the rate of infiltration (the drop rate of the standing water) in inches per hour from the measuring rod data, until the pit is empty. Consider running this falling head phase of the test several times to estimate the

dependency of the infiltration rate with head.

- At the conclusion of testing, over-excavate the pit to see if the test water is mounded on shallow restrictive layers or if it has continued to flow deep into the subsurface. The depth of excavation varies depending on soil type and depth to the hydraulic restricting layer, and is determined by the engineer or certified soils professional. Mounding is an indication that a mounding analysis is necessary.

DATA ANALYSIS

Calculate and record the initial K_{sat} rate in inches per hour in 30 minutes or one-hour increments until one hour after the flow has stabilized.

Use statistical/trend analysis to obtain the hourly flow rate when the flow stabilizes. This would be the lowest hourly flow rate. *Example:*

The area of the bottom of the test pit is 8.5-ft. by 11.5-ft. (97.75 sq. ft.).

Water flow rate was measured and recorded at intervals ranging from 15 to 30 minutes throughout the test. Between 400 minutes and 1,000 minutes the flow rate stabilized between 10 and 12.5 gal- lons per minute or 600 to 750 gallons per hour, or 80.2 to 100 ft³ per hour. Dividing this rate by the surface area gives an initial K_{sat} of 9.8 to 12.3 inches per hour.

K_{sat} **Determination Option 2: Small Scale Pilot Infiltration Test (PIT)**

A small-scale PIT can be substituted for [Ksat Determination Option 1: Large Scale Pilot Infiltration Test \(PIT\)](#) in any of the following instances:

- The drainage area to the infiltration BMP is less than 1 acre.
- The testing is for [BMP T7.30: Bioretention](#) or [BMP T5.15: Permeable Pavements](#) that either serve small drainage areas and/or are widely dispersed throughout a project site.
- The site has a high infiltration rate (>4 in/hr), making a large scale PIT difficult, and the site geo- technical investigation suggests uniform subsurface characteristics.

INFILTRATION TEST

Use the same procedures described above in [Ksat Determination Option 1: Large Scale Pilot Infiltration Test \(PIT\)](#), with the following changes:

- The horizontal surface area of the bottom of the test pit should be 12 to 32 square feet. It may be circular or rectangular. Document the size and geometry of the test pit.
- The rigid pipe with a splash plate used to convey water to the pit may be a 3-inch diameter pipe for

pits on the smaller end of the recommended surface area, or a 4-inch pipe for pits on the larger end of the recommended surface area.

- Pre-soak period: Add water to the pit so that there is standing water for at least 6 hours. Maintain the pre-soak water level at least 12 inches above the bottom of the pit.
- At the end of the pre-soak period, add water to the pit at a rate that will maintain a 6-12 inch water level above the bottom of the pit over a full hour. The depth should not exceed the proposed maximum depth of water expected in the completed facility.
- Every 15 minutes, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point (between 6 inches and 1 foot) on the measuring rod. The specific depth should be the same as the maximum designed ponding depth (usually 6 – 12 inches).

After one hour, turn off the water and record the rate of infiltration (the drop rate of the standing water) in inches per hour from the measuring rod data, until the pit is empty.

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APPENDIX D

CALCULATED DESIGN INFILTRATION RATE:

Site variability and number of locations tested (CF_v) - The number of locations tested must be capable of producing a picture of the subsurface conditions that fully represents the conditions throughout the proposed location of the infiltration BMP. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low - for example, conditions are known to be uniform through previous exploration and site geological factors

- one pilot infiltration test (or grain size analysis location) may be adequate to justify a partial correction factor at the high end of the range.

If the level of uncertainty is high, a partial correction factor near the low end of the range may be appropriate. This might be the case where the site conditions are highly variable due to conditions such as a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests (or several grain size test locations), the level of uncertainty may still be high.

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- **Degree of influent control to prevent siltation and bio-buildup (CF_m)** Even with a pre-settling basin or a basic treatment BMP for pre-treatment, the soil's initial infiltration rate will gradually decline as more and more stormwater, with some amount of suspended material, passes through the soil profile. The maintenance schedule calls for removing sediment when the BMP is infiltrating at only 90% of its design capacity. Therefore, a correction factor, CF_m , of 0.9 is called for.

Table V-5.1: Correction Factors to be Used With In-Situ Saturated Hydraulic Conductivity Measurements to Estimate Design Rates

Issue	Partial Correction Factor
Site variability and number of locations tested	$CF_V = 0.33$ to 1.0
Test Method	
• Large-scale PIT • Small-scale PIT • Other small-scale (e.g. Double ring, falling head) • Grain Size Method	▣ $CF_t = 0.75$ ▣ 0.50 ▣ = 0.40 ▣ = 0.40
Degree of influent control to prevent siltation and bio-buildup	CF_m = 0.9

Total Correction Factor, $CF_T = CF_V \times CF_t \times CF_m$

Total Correction Factor, $CF_T = 1.0 \times 0.5 \times 0.9$

$CF_T = 0.45$

APPENDIX B

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Pressure Transducer Combined with a Recorder

High resolution and accuracy

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Total Correction Factor, $CF_T = CF_V \times CF_t \times CF_m$

Total Correction Factor, $CF_T = 1.0 \times 0.5 \times 0.9$

$CF_T = 0.45$

APPENDIX E



GEORESOURCES

earth science & geotechnical engineering

4809 Pacific Hwy. E. | Fife, Washington 98424 | 253.896.1011 | www.georesources.rocks

April 6, 2023

Advanced Underground Utilities
PO Box 309
Sumner, Washington 98390

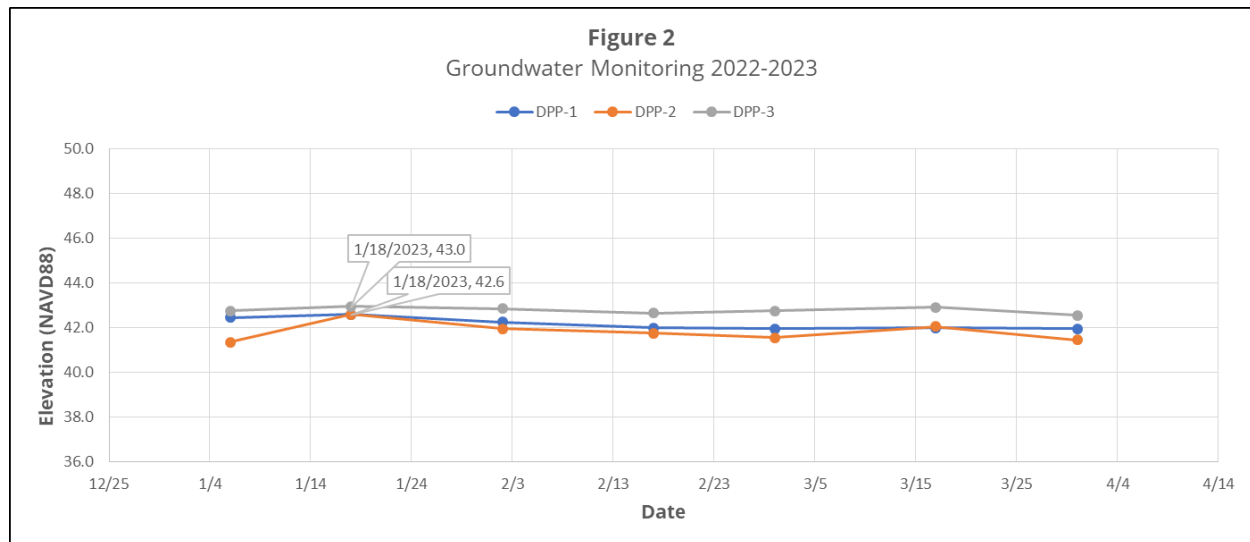
Attn: E.J. Fernandez
(253) 988-2449
ej@auuinc.com

Soils Report Addendum: Groundwater Monitoring
Proposed Contractor's Yard
320 Todd Road NE
Puyallup, Washington
PN: 0420222005
Doc ID: AdvancedUndergroundUtilities.ToddRdNE.SRa

This *Soils Report Addendum* summarizes our seasonal groundwater monitoring for the proposed contractor's yard to be constructed at 320 Todd Road NE in Puyallup, Washington. We prepared a *Soils Report* for the site dated January 4, 2023. To satisfy the groundwater monitoring requirements of the *2019 Stormwater Management Manual for Western Washington* (SWMMWW), we recorded groundwater levels periodically during the 2022-2023 winter wet season.

Three drive-point piezometers (DPPs) were installed by GeoResources at select locations across the site on December 13, 2022 to depths of approximately 10 feet below the existing ground surface. The locations of the DPPs are shown on the Site & Exploration Map, Figure 1. At the time of installation, no groundwater seepage was observed. Groundwater readings for the DPPs were manually measured on a bi-monthly basis from January 6, 2023 to March 31, 2023.

Based on our wet season monitoring, it appears that seasonal high groundwater occurs at about Elevation 42.6 to 43.0 feet (NAVD 88) at the locations monitored. These levels were recorded on January 18, 2023. Based on our measurements, it appears that seasonal high groundwater occurs within about 7 to 8 feet of the ground surface across the site. Figure 2, below, summarizes the groundwater levels recorded as part of our groundwater monitoring program during our monitoring period.



LIMITATIONS

We have prepared this report for use by Advanced Underground Utilities and other members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our subsurface explorations, data from others and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

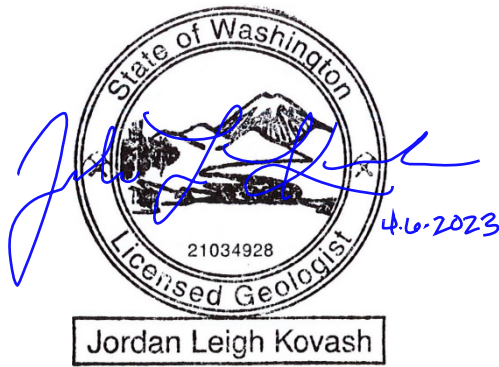
Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.



We have appreciated working for you on this project. Please do not hesitate to call at your earliest convenience if you have any questions or comments.

Respectfully submitted,
GeoResources, LLC



Jordan L. Kovash, LG
Project Geologist



Eric W. Heller, PE, LG
Senior Geotechnical Engineer

JLK:EWJ/jlk

Doc ID: AdvancedUndergroundUtilities.ToddRdNE.SRa

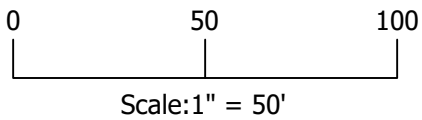
Attachments: Figure 1 – Site & Exploration Plan



Notes:
Map created using Pierce County Public GIS
(<https://matterhornwab.co.pierce.wa.us/publicgis/>)

-  HA/DPP Hand auger/Drive Point Piezometer number and approximate location
-  TP Test pit number and approximate location

This is not a survey.



Site & Exploration Map
Proposed Contractor's Yard
320 Todd Road NE
Puyallup, Washington
PN: 0420222005

APPENDIX B

JMJ TEAM
905 MAIN STREET
SUITE 200
SUMNER, WA 98390
(206) 596-2020
CONTACT: JUSTIN JONES, PE

MSGs ARCHITECTS
510 CAPITOL WAY SOUTH
OLYMPIA, WA 98501
(360) 943-6774, EXT. 112
CONTACT: GARNER MILLER

JMJ TEAM
905 MAIN STREET
SUITE 200
SUMNER, WA 98390
(206) 596-2020
CONTACT: JUSTIN JONES, PE

CONTOUR ENGINEERING LLC
4706 97TH STREET NW, SUITE 100
GIG HARBOR, WA 98335

SITE ADDRESS	320 Todd Rd NE, PUYALLUP, WA 98371
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TAX PARCEL NUMBER(S): 0420222005

ZONING: RM-20

TOTAL PROJECT AREA: 1.50 AC

CONDITIONAL USE PERMIT

Project Location

Todd Rd NE

Spencer St

McKesson Puyallup Distribution Center

CWalls Building materials store

HomeTowne Studios Tacoma - Puyallup 3.3★ 2-star hotel

Larson Chrysler Jeep Dodge Ram Dodge dealer

US. GRADE

Todd Trailer court

Simons Creek

107th Ave C/E

108th Ave C/E

Townhomes at MountainView Valley

320 Todd Rd NE, Puyallup, WA 98371

320 Todd Road Development		
Page #	Sheet #	Sheet Name
1	C1-001	Cover Sheet
2	C1-101	Vicinity Map
3	C1-201	Existing Site Plan
4	C1-301	TESC Plan
5	C1-501	Turning Movement - Firetruck
6	C2-101	Zone Transition Buffer Plan
7	C3-101	Site Plan
8	C3-301	Grading Plan
9	C3-501	Utility Plan
10	C6-101	Landscape Site Plan

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



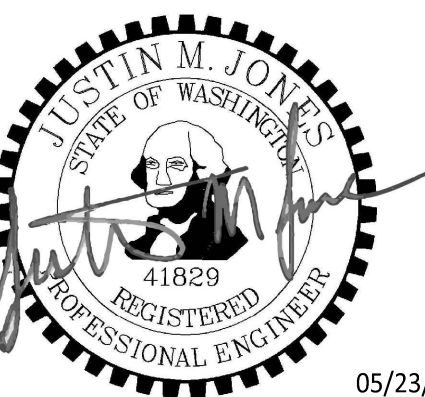
Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

ONE INCH AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY

CONDITIONAL USE PERMIT

[illegible]

SHEET TITLE.

Cover Sheet

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY:
D. Manaka

SHEET NUMBER

C1-001

ONG.

01 OF 10

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1-800-424-5555
UTILITIES UNDERGROUND LOCATION CE



Files: 1611001C-VIC.dwg
Path: \\1611-Fernandez\\320 Todd Road Development\\CAD\\
Plotted by: JMJ Date: 23-May-24 12:51:07pm

LEGEND

Project Area

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSGs Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

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IF NOT, SCALE ACCORDINGLY

CONDITIONAL USE PERMIT



05/23/2024

REV	DATE	DESCRIPTION

SHEET TITLE:

Vicinity Map

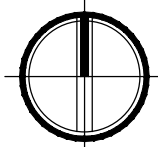
PROJ. NO:	1611-001
DATE:	May 23, 2024
DRAWN BY:	D. Manaka
DESIGN BY:	J. Jones

SHEET NUMBER:

C1-101

DWG.

02 OF 10



0 200 400 Feet

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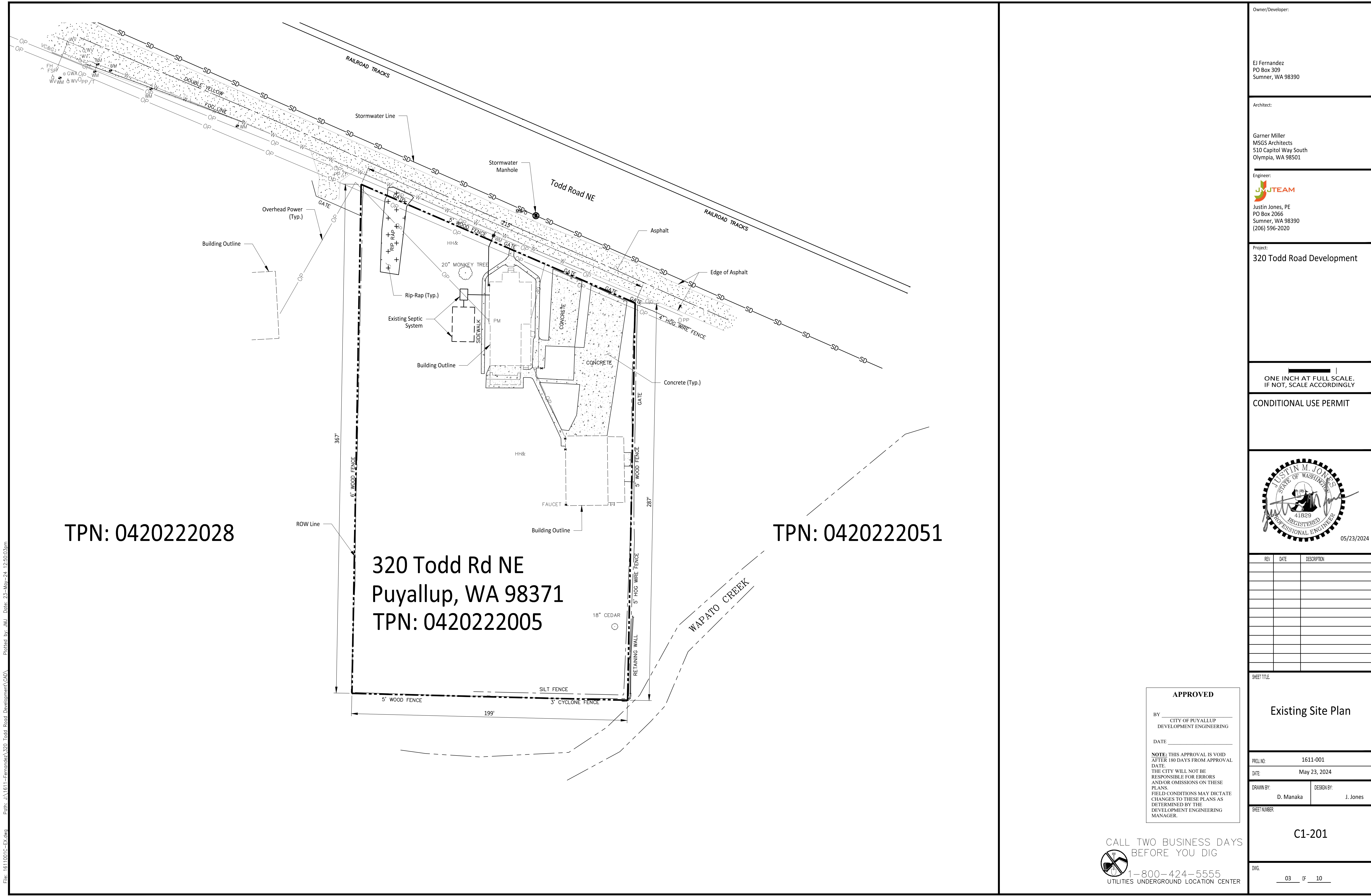
DATE

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UTILITIES UNDERGROUND LOCATION CENTER



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Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development


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CONDITIONAL USE PERMIT


05/23/2024

REV	DATE	DESCRIPTION

SHEET TITLE:

Existing Site Plan

PROJ. NO:

1611-001

DATE:

May 23, 2024

DRAWN BY:

D. Manaka

DESIGN BY:

J. Jones

SHEET NUMBER:

C1-201

DWG.

03 OF 10

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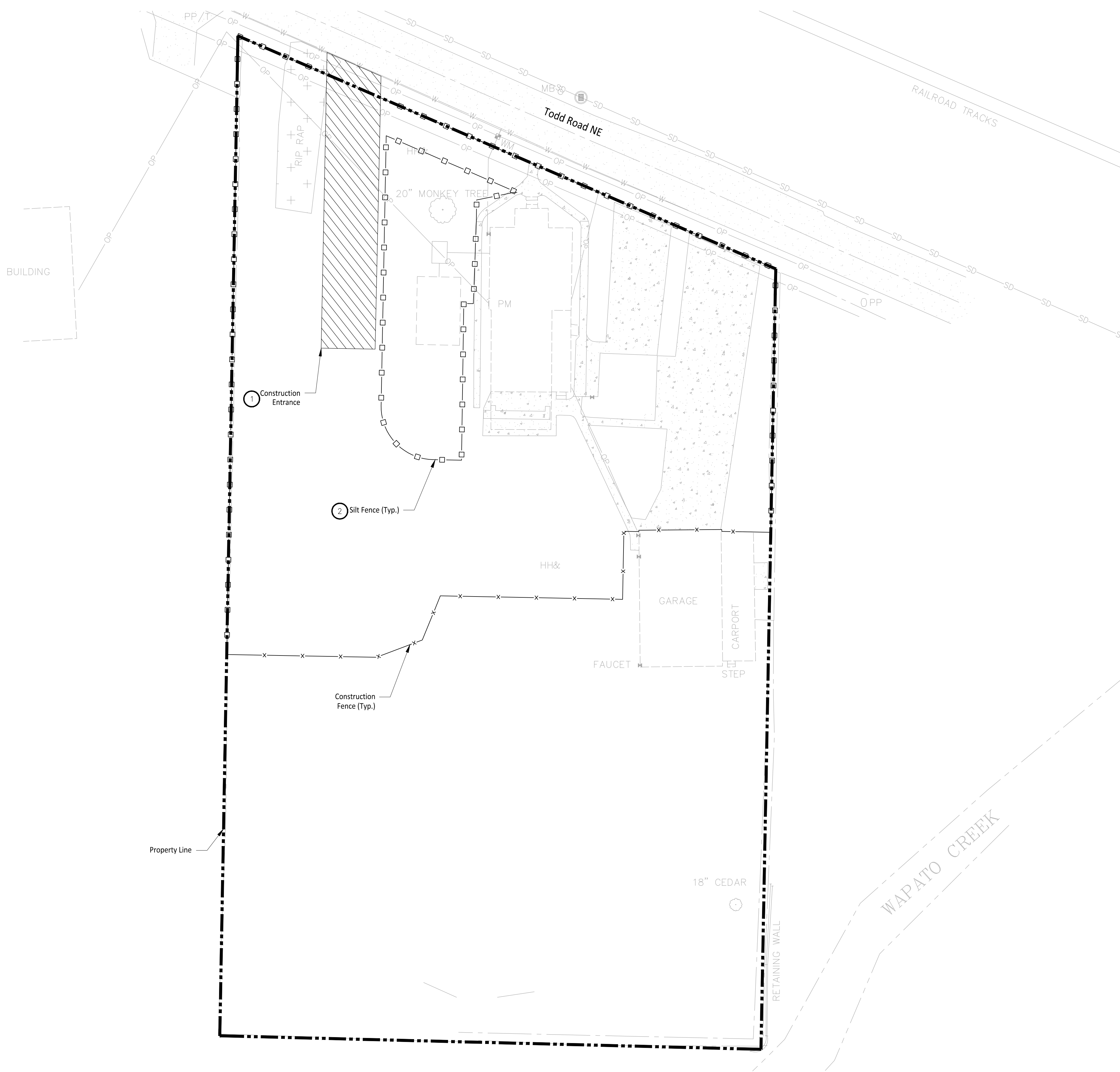
DATE _____

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Path: J:\1611-Fernandez\320 Todd Road Development\CAD\ Plotted by: JMJ Date: 23-May-24 12:53:23pm
File: 1611001C- TESC.dwg



LEGEND

- Silt Fence
- Construction Fence
- Property Line
- Asphalt (Typ.)

CONSTRUCTION NOTES

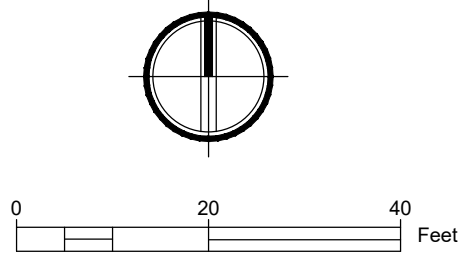
- Maintain construction entrance per City of Puyallup Standard Detail 05.01.01 and install wheel wash as needed per Washington DOE BMP C106.
- Install silt fence per City of Puyallup Standard Detail 02.03.02. Silt Fence to mark clearing limits in the field.
- If necessary, alternative sediment control methods shall be submitted by the contractor for review and approval prior to construction.

GENERAL NOTES

- Construct Pipe trench bedding and backfill as necessary per City of Puyallup Standard Detail 06.01.01.
- Install straw bale barriers, wattles, and other necessary TESC measures as required.
- Exposed soils shall be watered as necessary to prevent dust from leaving the site.
- All concrete handling and equipment washing shall be in accordance with Washington DOE BMP C151.
- Install high visibility construction fence where silt fence is not required as shown per DOE BMP C103.
- A CESCL shall be available on-site or on-call for the duration of construction operations.
- From April 1 to October 31 all disturbed areas at final grade & all exposed areas that are scheduled to remain unworked for 30+ days shall be stabilized within 10 days. From November 1 to March 31 all exposed soils at final grade shall be stabilized immediately using permanent or temporary measures. Exposed soils with an area +5,000 sqft that are scheduled to remain unworked for more than 24 hrs and exposed areas of less than 5,000 sqft that will remain unworked for more than 7 days shall be stabilized immediately. All disturbed areas which are not planned to be constructed on within 90 days from time of clearing & grading shall be revegetated with the native vegetation.
- All BMP's per City of Puyallup standards and protection CSWPPP.
- Contractor to instill protection devices for trees proposed for retention
- Protect Low Impact Development BMPs
 - Protect all Permeable Pavement and Infiltration Areas from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that utilize infiltration BMPs. Leave infiltration areas high and/or place silt fence around the areas to ensure runoff will not accumulate silt within the subgrade. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden Bioretention/rain garden soils, and replacing the removed soils with soils meeting the design specification.
 - Prevent compacting Permeable Pavement and Infiltration BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
 - Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.
 - Pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer's procedures.
 - Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

CONSTRUCTION SEQUENCE

- Hold a preconstruction meeting with the City and obtain required permits.
- Establish clearing and grading limits.
- Construct temporary construction entrance.
- Construct perimeter ditches, silt fences, and other erosion control devices as shown.
- Construct protection devices for critical areas and significant trees proposed for retention.
- Schedule an erosion control inspection with the City.
- Clearly state at what point grading activities can begin, usually only after all drainage and erosion control measures are in place.
- Identify erosion control measures which require regular maintenance.



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1-800-424-5555

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSGs Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

ONE INCH AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY

CONDITIONAL USE PERMIT



REV	DATE	DESCRIPTION

SHEET TITLE

TESC Plan

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY: D. Manaka

DESIGN BY: J. Jones

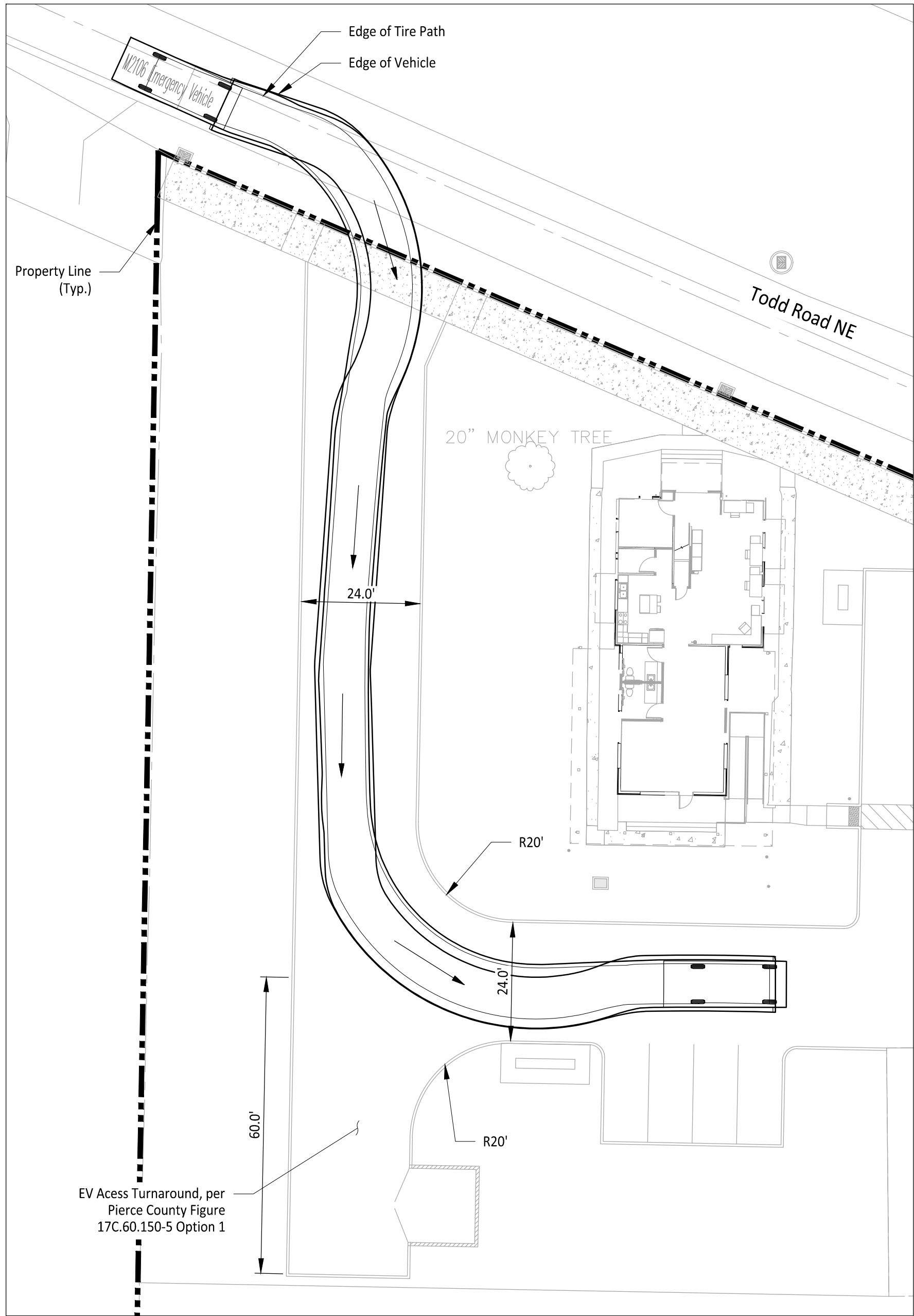
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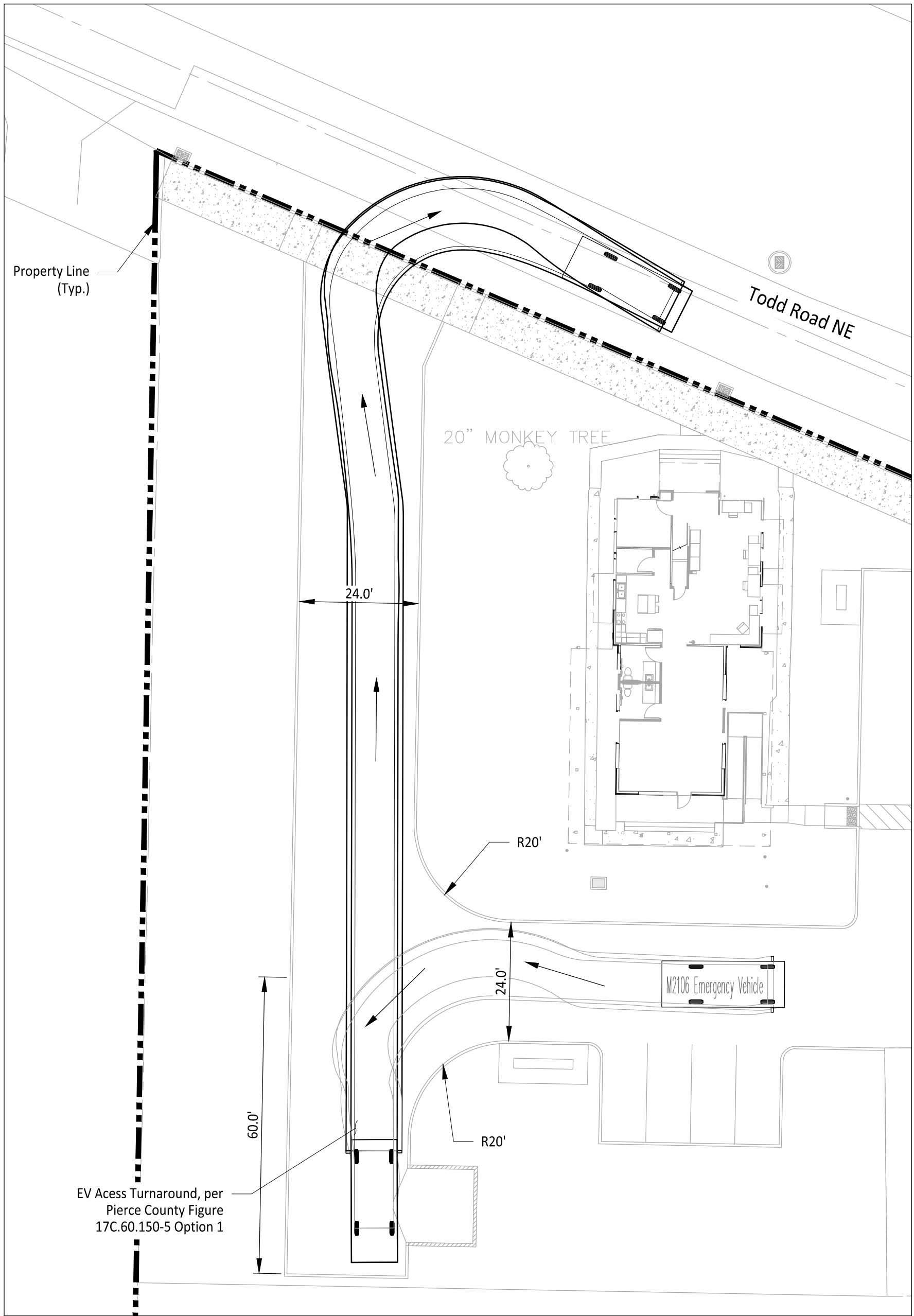
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04 OF 10

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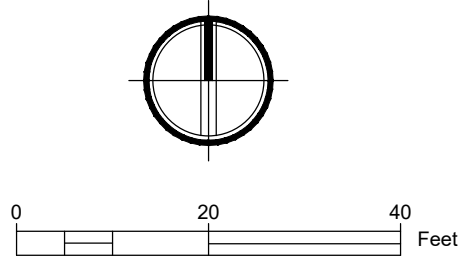
EV - Entry



EV - Exit

TURNING MOVEMENT NOTES:

1. Turning movements based upon M2106 Emergency Vehicle and information provided by Central Pierce Fire Department.



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UTILITIES UNDERGROUND LOCATION CENTER

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSGs Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

ONE INCH AT FULL SCALE.
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REV	DATE	DESCRIPTION

SHEET TITLE:

Turning Movement -
Firetruck

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY: D. Manaka

DESIGN BY: J. Jones

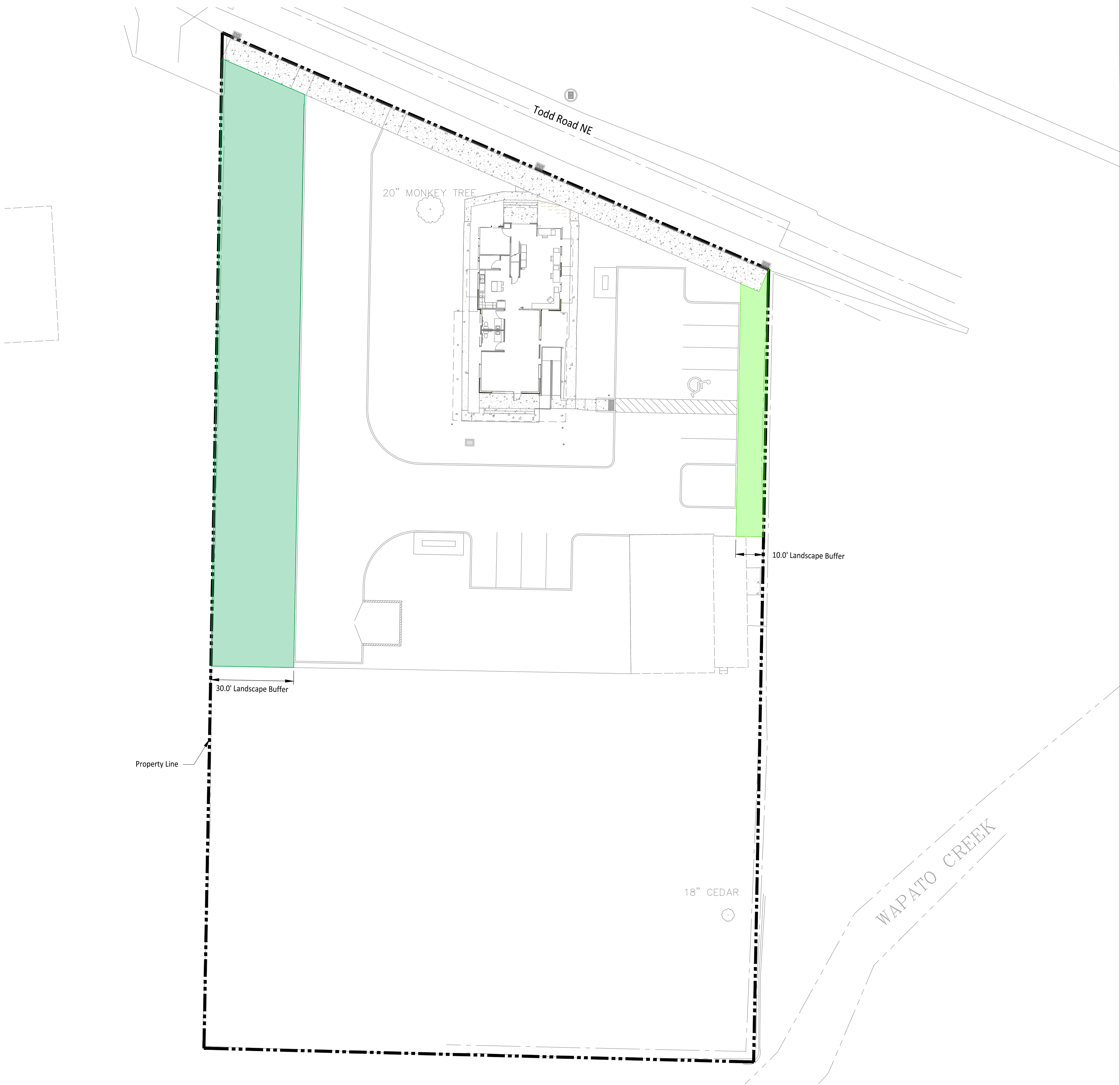
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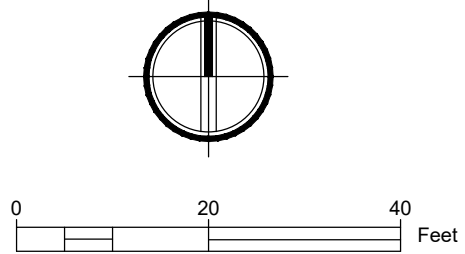
05 OF 10

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LEGEND

- 30-Foot Landscape Buffer
- 10-Foot Landscape Buffer



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UTILITIES UNDERGROUND LOCATION CENTER

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EJ Fernandez
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Sumner, WA 98390

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MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

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REV	DATE	DESCRIPTION

SHEET TITLE:

Zone Transition Buffer
Plan

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY: D. Manaka

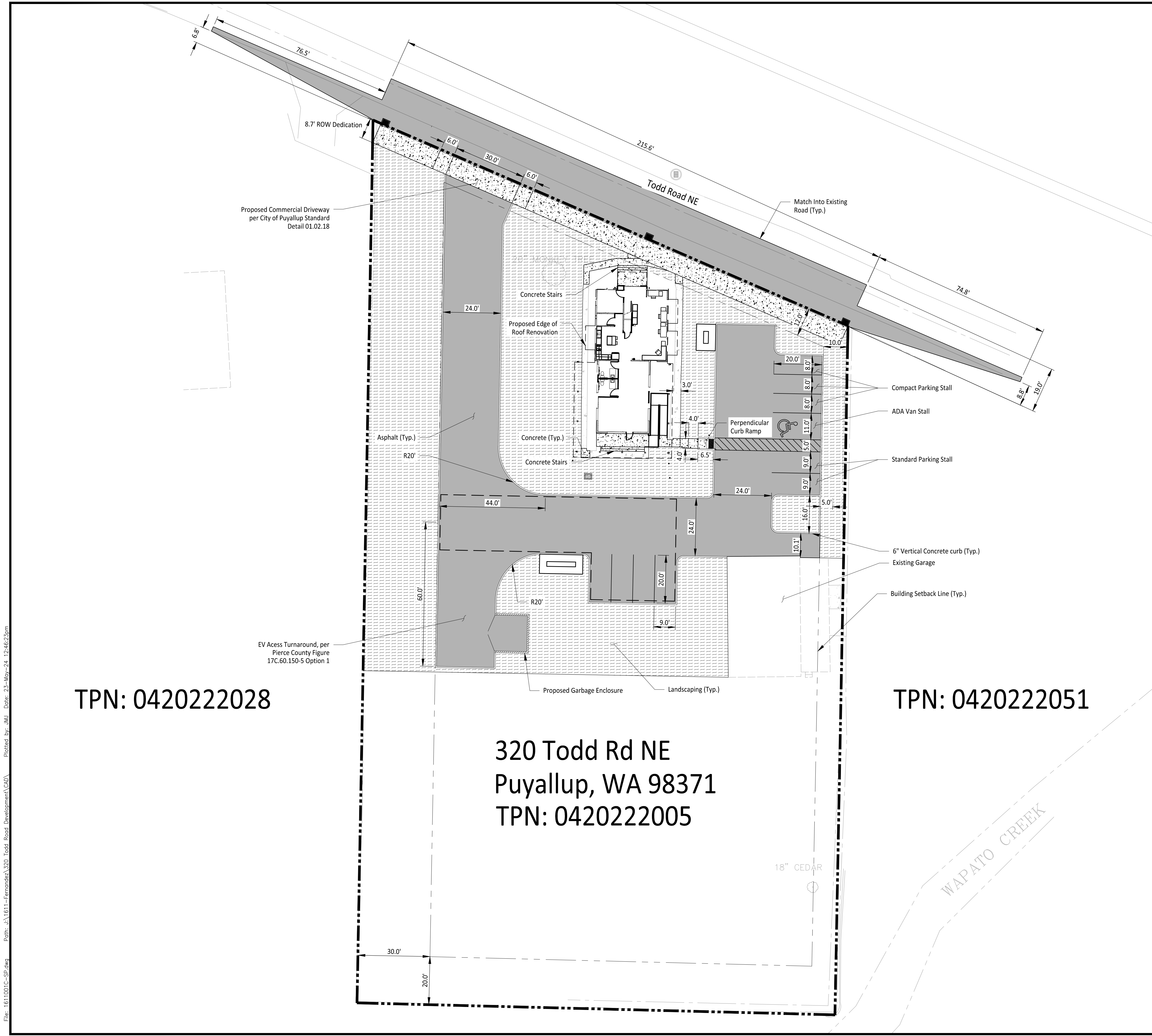
DESIGN BY: J. Jones

SHEET NUMBER:

C2-101

DWG.

06 OF 10



LEGEND

- Property Line
- Concrete (Typ.)
- Asphalt (Typ.)
- Landscaping (Typ.)

General Notes

- Total Gross Floor Area = 3,060 SF
- Land Use: Non Medical, Clinical, or Dental Professional and Business Office
 - (1) Parking Space for each 300 SF of Gross Floor Area
 - 3,060 SF/(200 SF/Parking Space) = 10 Stalls
- Compact Parking Stalls:
 - (10 Stalls)*(0.3) = 3 Stalls
- Total Parking Count:
 - Standard = 6
 - Compact = 3
 - ADA Van = 1

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



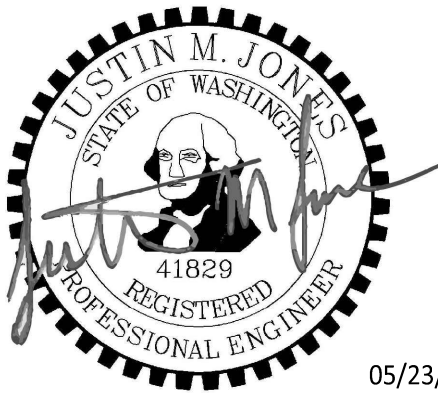
Justin Jones, PE
PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

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REV	DATE	DESCRIPTION

SHEET TITLE:

Site Plan

PROJ. NO:

1611-001

DATE:

May 23, 2024

DRAWN BY:

D. Manaka

DESIGN BY:

J. Jones

SHEET NUMBER:

C3-101

DWG.

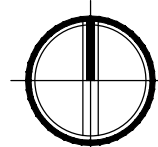
07 OF 10

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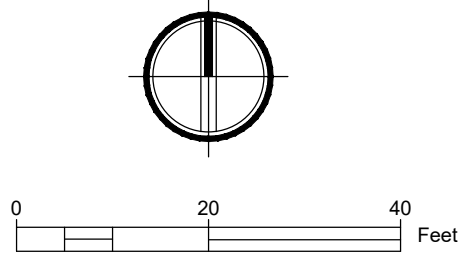
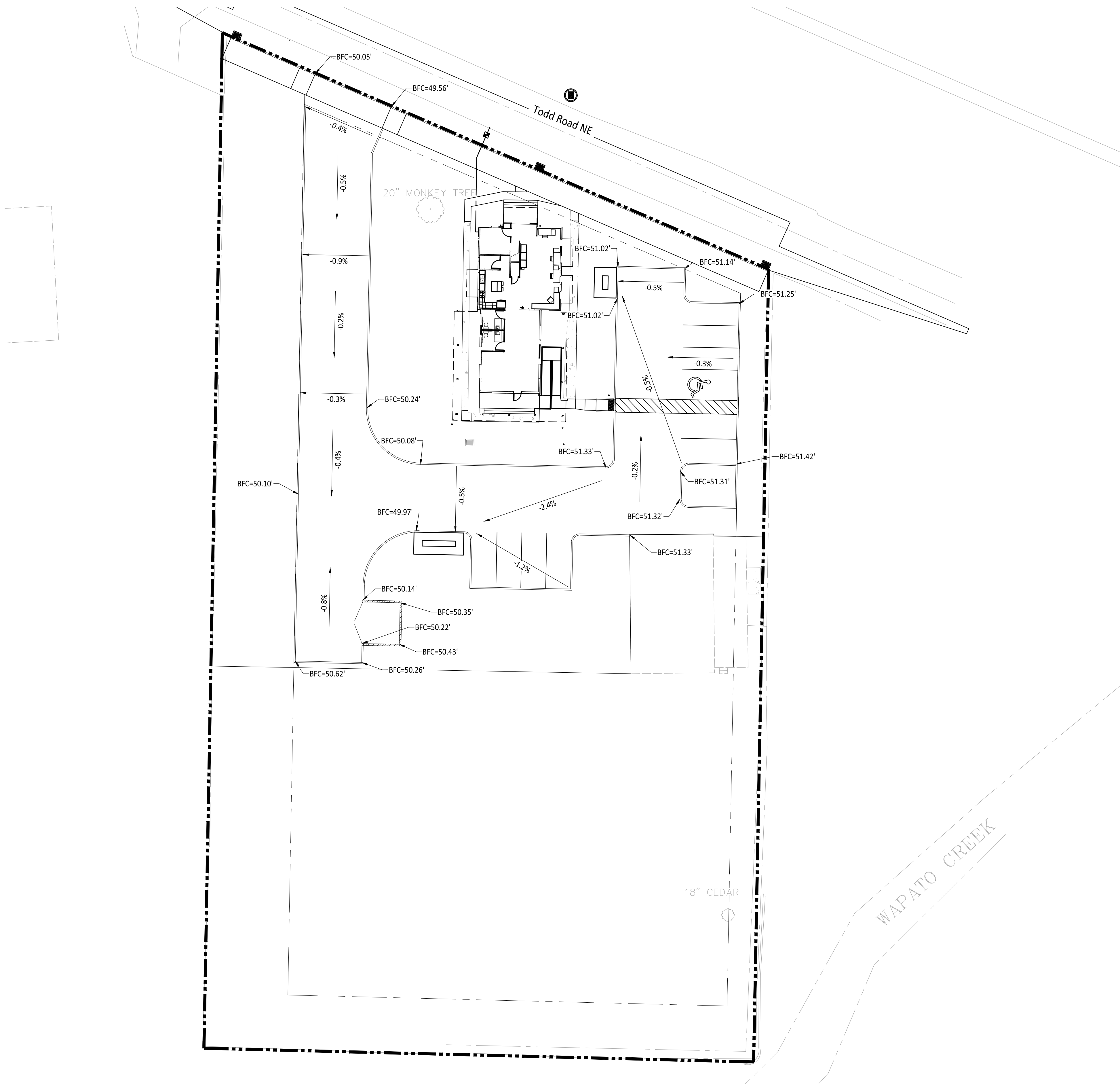
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0 20 40 Feet

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Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



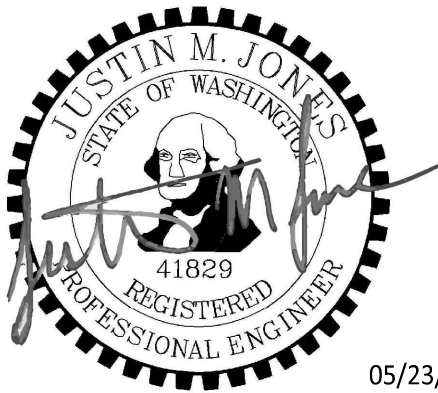
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Project:

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REV	DATE	DESCRIPTION

SHEET TITLE

Grading Plan

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY: D. Manaka

DESIGN BY: J. Jones

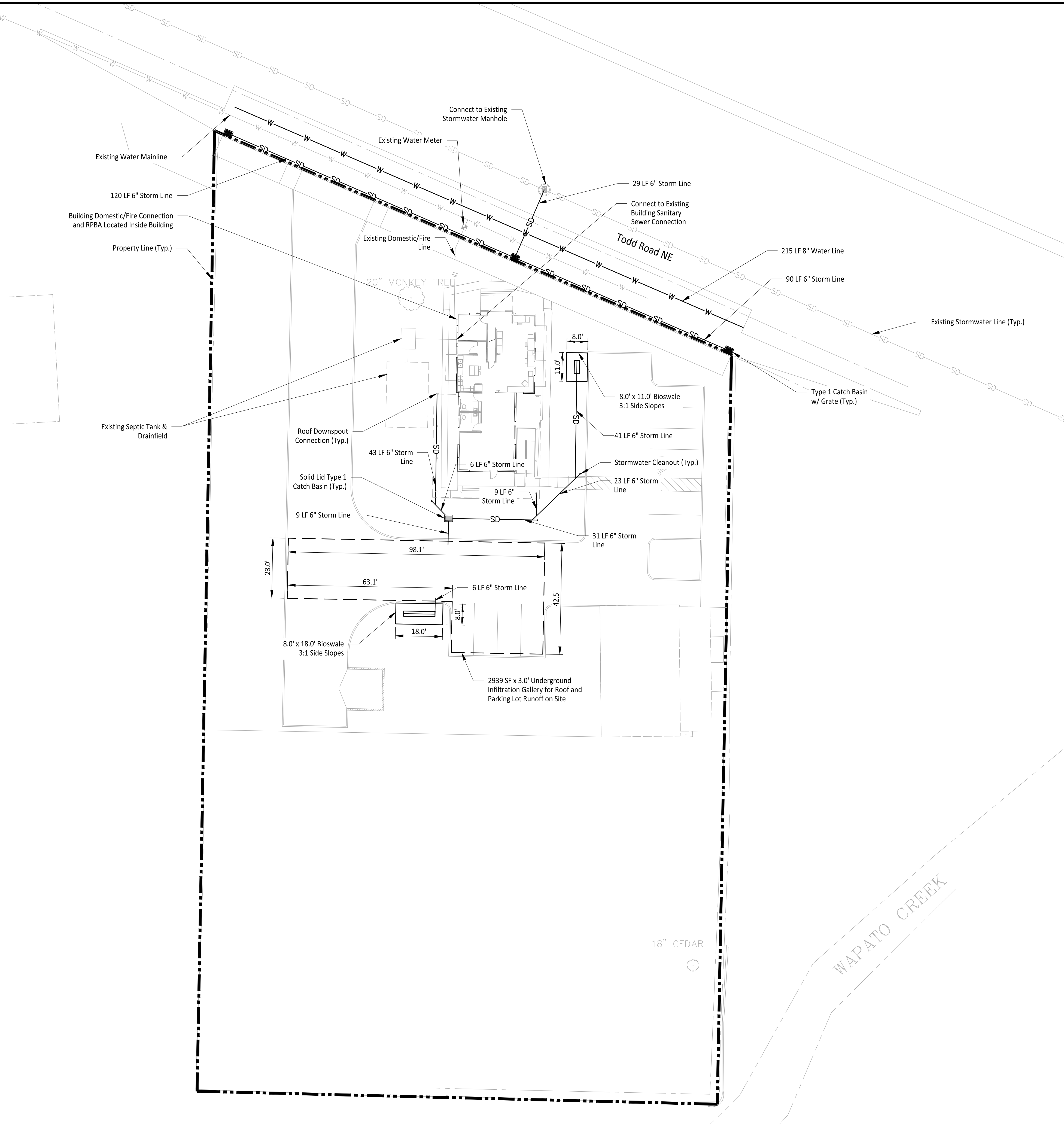
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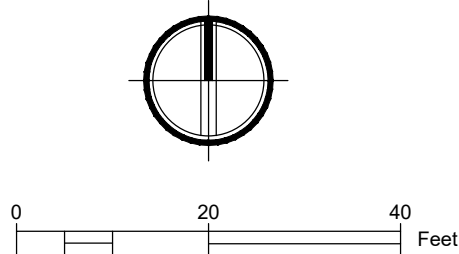
08 OF 10

Files: 1611001C-UT.dwg Path: J:\1611-Fernandez\320 Todd Road Development\CAO\ Plotted By: JMJ Date: 23-May-24 1:54:15pm



LEGEND

- Property Line
- SD Storm Line
- Infiltration Gallery



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UTILITIES UNDERGROUND LOCATION CENTER

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSG Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



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PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

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05/23/2024

REV	DATE	DESCRIPTION

SHEET TITLE:

Utility Plan

PROJ. NO:

1611-001

DATE:

May 23, 2024

DRAWN BY:

D. Manaka

DESIGN BY:

J. Jones

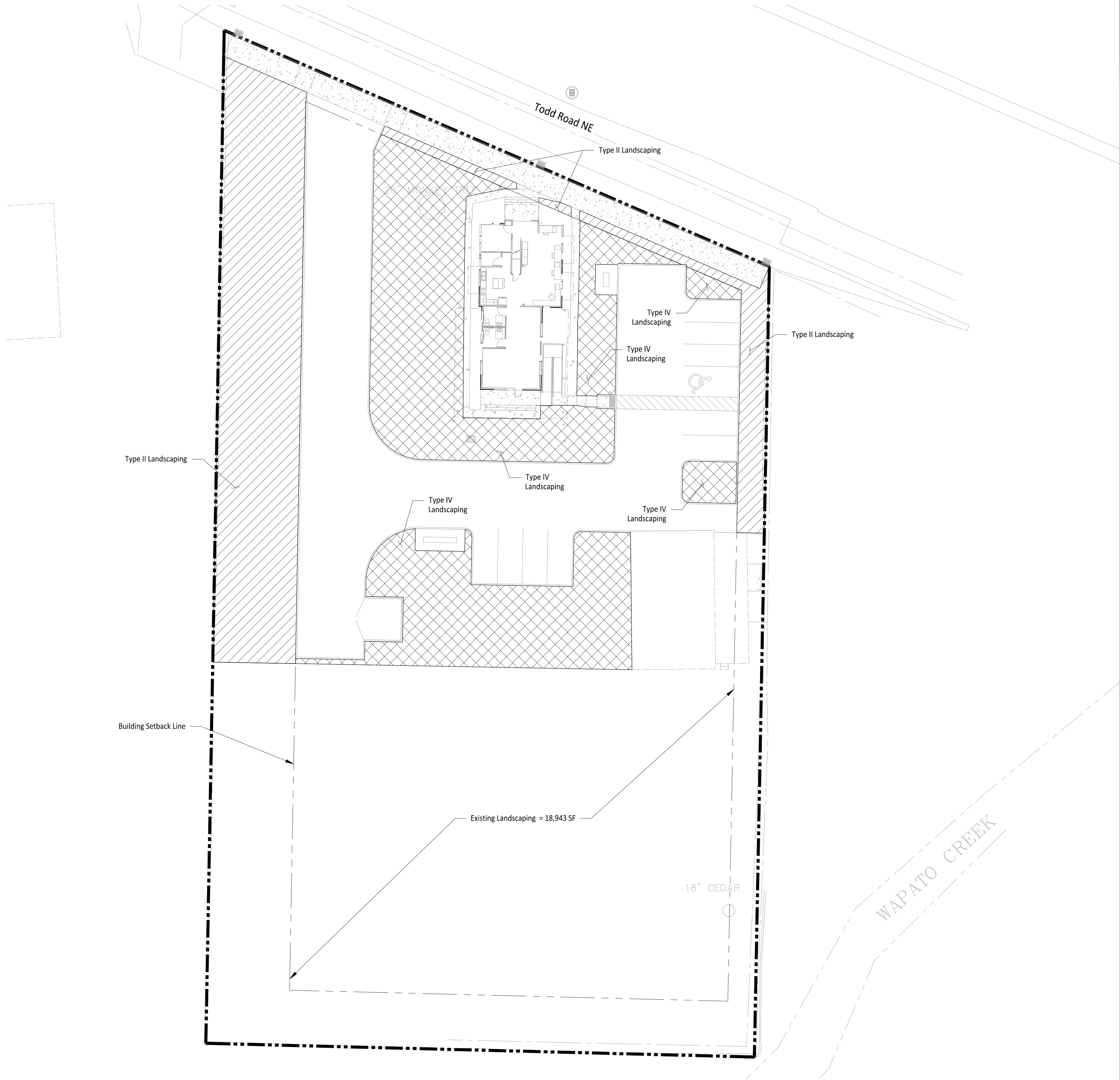
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C3-501

DWG.

09 OF 10

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File: 161101C-LDSCP.dwg



LEGEND

	Planting Area - Type II	QTY: 7,731 SF
	Planting Area - Type IV	QTY: 9,684 SF

General Notes

- Lot Size: 65,123 SF
- Total Required Site Landscaping (20%): 13,025 SF
- Proposed Pavement: 11,968 SF
- Minimum Parking Landscaping (5%): 598 SF

Owner/Developer:

EJ Fernandez
PO Box 309
Sumner, WA 98390

Architect:

Garner Miller
MSGs Architects
510 Capitol Way South
Olympia, WA 98501

Engineer:



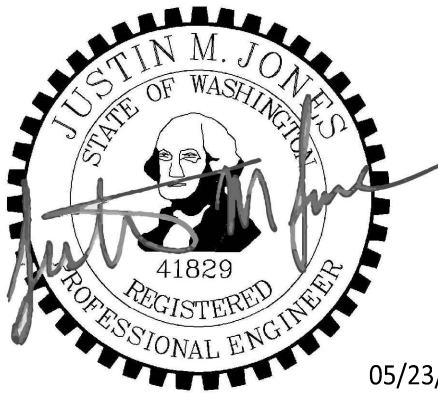
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PO Box 2066
Sumner, WA 98390
(206) 596-2020

Project:

320 Todd Road Development

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REV	DATE	DESCRIPTION

SHEET TITLE

Landscape Site Plan

PROJ. NO: 1611-001

DATE: May 23, 2024

DRAWN BY: D. Manaka

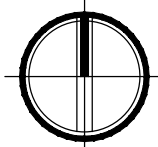
DESIGN BY: J. Jones

SHEET NUMBER

C6-101

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0 20 40 Feet

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UTILITIES UNDERGROUND LOCATION CENTER

APPENDIX C

Construction Stormwater General Permit (CSWGP)

Stormwater Pollution Prevention Plan (SWPPP)

for
320 Todd Rd Development

Prepared for:
Department of Ecology
City of Puyallup

Permittee / Owner	Developer	Operator / Contractor
EJ Fernandez		TBD

320 Todd Rd NE, Puyallup, WA 98371

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number

SWPPP Prepared By

Name	Organization	Contact Phone Number
Derek Manaka	JMJ Team	(206) 596-2020

SWPPP Preparation Date

01 / 05 / 2023

Project Construction Dates

Activity / Phase	Start Date	End Date
Begin Construction		

GENERAL INSTRUCTIONS AND CAVEATS

This template presents the recommended structure and content for preparation of a Construction Stormwater General Permit (CSWGP) Stormwater Pollution Prevention Plan (SWPPP).

The Department of Ecology's (Ecology) CSWGP requirements inform the structure and content of this SWPPP template; however, **you must customize this template to reflect the conditions of your site.**

A Construction Stormwater Site Inspection Form can be found on Ecology's website.
<https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

Using the SWPPP Template

Each section will include instructions and space for information specific to your project. Please read the instructions for each section and provide the necessary information when prompted. This Word template can be modified electronically. You may add/delete text, copy and paste, edit tables, etc. Some sections may be completed with brief answers while others may require several pages of explanation.

Follow this link to a copy of the Construction Stormwater General Permit:
<https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

Table of Contents

List of Tables

List of Appendices

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO ₂	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

Project Information (1.0)

Project/Site Name: 320 Todd Rd Development
Street/Location: 320 Todd Rd NE
City: Puyallup State: WA Zip code: 98371
Subdivision:
Receiving waterbody: N/A

Existing Conditions (1.1)

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 0.62 Acres

Disturbed acreage: 0.62 Acres

Existing structures: None

Landscape topography: Flat

Drainage patterns: Overland Flow to existing landscaping

Existing Vegetation: Trees

Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes):
None

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: None

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
None	N/A	N/A	N/A

Proposed Construction Activities (1.2)

Description of site development (example: subdivision):

The project proposes the renovation of an existing two-story residential building and removal of an existing concrete driveway. The existing concrete will be replaced with an asphalt parking lot and driveway. Additionally, permeable concrete walkways will be added to the site.

Description of construction activities (example: site preparation, demolition, excavation):

Construction activities include: Clearing and Grubbing, Sawcutting, Fence Installation, Utility Installation, Asphalt Paving, and Installation of New Gravel.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

The project proposes the construction of a new infiltration gallery, pervious concrete pavement, and bioswales to allow for infiltration of stormwater into native soils below. An infiltration gallery will infiltrate 100% of the runoff from the proposed roof and asphalt parking lot and driveway. Runoff from the asphalt parking lot and driveway will first sheetflow to one of two bioswales to treat the PGIS before entering the underground infiltration gallery. The permeable concrete will infiltrate onsite.

Description of final stabilization (example: extent of revegetation, paving, landscaping):

Final stabilization of the site includes the following: On-site paving.

Contaminated Site Information:

Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

Construction activities are not anticipated to disturb contaminated soils or groundwater on-site, as none are known to exist in the vicinity of the project.

Construction Stormwater Best Management Practices (BMPs) (2.0)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

The 12 Elements (2.1)

Element 1: Preserve Vegetation / Mark Clearing Limits (2.1.1)

List and describe BMPs: BMP C102 – Buffer Zones
 BMP C103 – High Visibility Plastic or Metal Fence
 Lath & Flagging:

Prior to beginning land disturbing activities, including clearing and grading, all clearing limits and trees that are to be preserved within the construction area shall be clearly marked, both in the field and on the plans, to prevent damage and off-site impacts. Barrier fences shall be constructed as shown on the Temporary Erosion & Sediment Control Plans and in accordance with BMP C103.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 2: Establish Construction Access (2.1.2)

List and describe BMPs: BMP C105 – Stabilized Construction Entrance: The Proposed driveway entrance will be used as a construction entrance. Contractor will maintain the existing driveway approach and road to be free of sediment and debris.

BMP C107 – Construction Road/Parking Area Stabilization:

Adjacent roads and paved areas shall be cleaned thoroughly as needed. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 3: Control Flow Rates (2.1.3)

Will you construct stormwater retention and/or detention facilities?

Yes

☒ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

☒ Yes

No

List and describe BMPs:

Properties downstream from the development site shall be protected from erosion due to any increases in the volume, velocity, and peak flow rate stormwater runoff from the project site. If off-site discharges do occur, temporary basins shall be installed prior to the points of discharge.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 4: Install Sediment Controls (2.1.4)

List and describe BMPs: BMP C230 – Straw Bale Barrier: Straw bale barriers shall be installed as necessary to prevent sediment in construction stormwater from entering existing storm systems.

 BMP C233 – Silt Fence: A silt fence will be installed as noted on the TESC plan along existing vegetation to prevent stormwater runoff from leaving the site.

 BMP C235 – Straw Wattles: Straw wattle barriers shall be installed as necessary to prevent sediment in construction stormwater from entering existing storm systems.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 5: Stabilize Soils (2.1.5)

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Anticipated project dates:

Start date:

End date:

Will you construct during the wet season?

☒ Yes

☐ No

List and describe BMPs: BMP C122 – Nets & Blankets: Nets and Blankets shall be installed to stabilize exposed soils/piles/slopes on site.
BMP C123 – Plastic Covering: Plastic Covering shall be installed to stabilize exposed soils/piles/slopes on site.

All exposed and unworked soils shall be stabilized by application of effective BMPs, which protect the soil from the erosive forces of raindrop impact, flowing water, and wind erosion. From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This condition applies to all soils on site, whether at final grade or not. Additionally, except where approved chemical treatment, full dispersion, or infiltration is practiced, clearing, grading, and other soil disturbing activities are prohibited between November 1 and February 28.

In areas where the soils will remain unworked for more than 30 days or have reached final grade, the areas shall be graveled to stabilize exposed soils. If the slope is 2H:1V or greater with at least 10 feet of vertical relief, nets or blankets shall be used according to BMP C122. Sod shall be used in accordance with BMP C124 for disturbed areas that require immediate vegetative cover. Dust control shall be used as needed to prevent wind transport of dust from disturbed soil surfaces and in accordance with BMP C140.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 6: Protect Slopes (2.1.6)

Will steep slopes be present at the site during construction?

Yes

No

List and describe BMPs:

Slopes will be stabilized as indicated in Element No. 5 above. In addition, the following BMPs may be implemented where appropriate:

BMP C130 – Surface Roughening
BMP C200 – Interceptor Dike and Swale
BMP C205 – Subsurface Drains
BMP C207 – Check Dams

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 7: Protect Drain Inlets (2.1.7)

List and describe BMPs: N/A, no existing drainage structures onsite or downstream.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 8: Stabilize Channels and Outlets (2.1.8)

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

List and describe BMPs: BMP C209 – Outlet Protection:

Stabilizing channel and outlets is not applicable as the project will continue to discharge stormwater to the existing stormwater conveyance system on-site.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 9: Control Pollutants (2.1.9)

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (and source, if applicable)
N/A

List and describe BMPs: BMP C152 - Sawcutting and Surface Pollution Prevention
 BMP C153 – Material Delivery, Storage Containment

All pollutants, including waste materials and demolition debris, that occur on site during construction shall be handled and disposed of in a manner that does not cause contamination of stormwater.

Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173 304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment.

Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities that may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Spills should be reported to 911. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle. Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations shall be followed for application rates and procedures.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

☒ Yes

☐ No

List and describe BMPs: BMP C152 - Sawcutting and Surface Pollution Prevention
BMP C153 – Material Delivery, Storage Containment

All pollutants, including waste materials and demolition debris, that occur on site during construction shall be handled and disposed of in a manner that does not cause contamination of stormwater.

Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173 304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment.

Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities that may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Spills should be reported to 911. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle. Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations shall be followed for application rates and procedures.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Will wheel wash or tire bath system BMPs be used during construction?

Yes

☒ No

List and describe BMPs:

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Will pH-modifying sources be present on-site?

☒ Yes No If yes, check the source(s).

Table 3 – pH-Modifying Sources

	None
	Bulk cement
	Cement kiln dust
	Fly ash
	Other cementitious materials
X	New concrete washing or curing waters
X	Waste streams generated from concrete grinding and sawing
	Exposed aggregate processes
	Dewatering concrete vaults
X	Concrete pumping and mixer washout waters
	Recycled concrete
	Other (i.e. calcium lignosulfate) [please describe]

List and describe BMPs: BMP C152 - Sawcutting and Surface Pollution Prevention
BMP C153 – Material Delivery, Storage Containment

All pollutants, including waste materials and demolition debris, that occur on site during construction shall be handled and disposed of in a manner that does not cause contamination of stormwater.

Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173 304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment.

Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities that may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Spills should be reported to 911. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle. Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations shall be followed for application rates and procedures.

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

Element 10: Control Dewatering (2.1.10)

Table 4 – Dewatering BMPs

	Infiltration
	Transport off-site in a vehicle (vacuum truck for legal disposal)
X	Ecology-approved on-site chemical treatment or other suitable treatment technologies
	Sanitary or combined sewer discharge with local sewer district approval (last resort)
	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs:

Installation Schedules:

Inspection and Maintenance plan:

Responsible Staff:

Element 11: Maintain BMPs (2.1.11)

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW* or *Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

Element 12: Manage the Project (2.1.12)

Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions, shall be delineated on the site plans and the development site.

Turbidity: For storms up to the water quality design event, turbidity downstream of a construction site may not increase more than 5 NTU, if upstream turbidity is 50 NTU or less, and may not increase more than 10 percent, if upstream turbidity is over 50 NTU. To the extent practicable, samples should be taken far enough downstream so that the construction site discharge has been well-mixed with the surface water. Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

pH: shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within a range of less than 0.2 units. For Class A and lower water classifications, the permissible induced increase is 0.5 units (Stormwater Management Manual for Western Washington, Department of Ecology, February 2005 Edition).

A Certified Erosion and Sediment Control Specialist be identified by the contractor at a later date. This information will be added to this CSWPPP.

Table 5 – Management

X	Design the project to fit the existing topography, soils, and drainage patterns
X	Emphasize erosion control rather than sediment control
X	Minimize the extent and duration of the area exposed
X	Keep runoff velocities low
X	Retain sediment on-site
X	Thoroughly monitor site and maintain all ESC measures
X	Schedule major earthwork during the dry season
	Other (please describe)

Table 6 – BMP Implementation Schedule

[illegible]

[illegible]

Element 13: Protect Low Impact Development (LID) BMPs (2.1.13)

Protect all permeable pavement BMPs from sedimentation through installation and maintenance of erosion

and sediment control BMPs on portions of the site that drain into the permeable pavement BMPs. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden permeable pavement soils, and replacing the removed soils with soils meeting the design specification.

Prevent compacting of soils in areas of new permeable pavement BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.

Pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer's procedures.

Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

Pollution Prevention Team (3.0)

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)		
Resident Engineer		
Emergency Ecology Contact		
Emergency Permittee/ Owner Contact		
Non-Emergency Owner Contact		
Monitoring Personnel		
Ecology Regional Office	[Insert Regional Office]	[Insert General Number]

Monitoring and Sampling Requirements (4.0)

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

File a blank form under Appendix D.

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

Complete the following paragraph for sites that discharge to impaired waterbodies for fine sediment, turbidity, phosphorus, or pH:

The receiving waterbody, insert waterbody name, is impaired for: insert impairment. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

Site Inspection (4.1)

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

Stormwater Quality Sampling (4.2)

Turbidity Sampling (4.2.1)

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
X	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU or the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU or the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
<https://www.ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue>
 - Central Region (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490
 - Eastern Region (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
 - Northwest Region (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000
 - Southwest Region (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
 - Turbidity is 25 NTU (or lower).
 - Transparency is 33 cm (or greater).
 - Compliance with the water quality limit for turbidity is achieved.
 - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
 - 1% - 10% over background turbidity, if background is 50 NTU or greater
 - The discharge stops or is eliminated.

pH Sampling (4.2.2)

pH monitoring is required for “Significant concrete work” (i.e. greater than 1000 cubic yards poured concrete or recycled concrete over the life of the project). The use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO₂) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO₂ sparging or dry ice.

Method for sampling pH:

Table 8 – pH Sampling Method

	pH meter
	pH test kit
	Wide range pH indicator paper

Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies (5.0)

303(d) Listed Waterbodies (5.1)

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

Yes No

List the impairment(s):

[Insert text here]

The receiving waterbody, insert waterbody name, is impaired for: insert impairment. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

List and describe BMPs:

[Insert text here]

TMDL Waterbodies (5.2)

Waste Load Allocation for CWSGP discharges:

[Insert text here]

List and describe BMPs:

[Insert text here]

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

Reporting and Record Keeping (6.0)

Record Keeping (6.1)

Site Log Book (6.1.1)

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

Records Retention (6.1.2)

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

Updating the SWPPP (6.1.3)

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

Reporting (6.2)

Discharge Monitoring Reports (6.2.1)

Cumulative soil disturbance is less than one (1) acre; therefore, Discharge Monitoring Reports (DMRs) will not be submitted to Ecology because water quality sampling is not being conducted at the site.

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting “No Discharge”. The DMR due date is fifteen (15) days following the end of each calendar month.

DMRs will be reported online through Ecology’s WQWebDMR System.

<https://www.ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance>

Notification of Noncompliance (6.2.2)

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- Central Region at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County

- Eastern Region at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- Southwest Region at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO₂ sparging is planned for adjustment of high pH water.

Appendix/Glossary

- A. Site Map**
- B. BMP Detail**
- C. Correspondence**
- D. Site Inspection Form**
- E. Construction Stormwater General Permit (CSWGP)**
- F. 303(d) List Waterbodies / TMDL Waterbodies Information**
- G. Contaminated Site Information**
- H. Engineering Calculations**

APPENDIX D

WWHM2012
PROJECT REPORT

General Model Information

WWHM2012 Project Name: infiltration

Site Name:

Site Address:

City:

Report Date: 1/5/2024

Gage: 38 IN CENTRAL

Data Start: 10/01/1901

Data End: 09/30/2059

Timestep: 15 Minute

Precip Scale: 1.000

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

Mitigated Land Use

East Drive Aisle

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.091
Impervious Total	0.091
Basin Total	0.091

West Drive Aisle

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.184
Impervious Total	0.184
Basin Total	0.184

Roof Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.063
Impervious Total	0.063
Basin Total	0.063

Routing Elements

Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length: 122.00 ft.
 Bottom Width: 24.00 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: 0.33
 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: 0.38
 Infiltration safety factor: 1
 Total Volume Infiltrated (ac-ft.): 136.002
 Total Volume Through Riser (ac-ft.): 0.006
 Total Volume Through Facility (ac-ft.): 136.008
 Percent Infiltrated: 100
 Total Precip Applied to Facility: 0
 Total Evap From Facility: 0
 Discharge Structure
 Riser Height: 2.9 ft.
 Riser Diameter: 4 in.
 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	0.067	0.000	0.000	0.000
0.0333	0.067	0.000	0.000	0.025
0.0667	0.067	0.001	0.000	0.025
0.1000	0.067	0.002	0.000	0.025
0.1333	0.067	0.003	0.000	0.025
0.1667	0.067	0.003	0.000	0.025
0.2000	0.067	0.004	0.000	0.025
0.2333	0.067	0.005	0.000	0.025
0.2667	0.067	0.005	0.000	0.025
0.3000	0.067	0.006	0.000	0.025
0.3333	0.067	0.007	0.000	0.025
0.3667	0.067	0.008	0.000	0.025
0.4000	0.067	0.008	0.000	0.025
0.4333	0.067	0.009	0.000	0.025
0.4667	0.067	0.010	0.000	0.025
0.5000	0.067	0.011	0.000	0.025
0.5333	0.067	0.011	0.000	0.025
0.5667	0.067	0.012	0.000	0.025
0.6000	0.067	0.013	0.000	0.025
0.6333	0.067	0.014	0.000	0.025
0.6667	0.067	0.014	0.000	0.025
0.7000	0.067	0.015	0.000	0.025
0.7333	0.067	0.016	0.000	0.025
0.7667	0.067	0.017	0.000	0.025

0.8000	0.067	0.017	0.000	0.025
0.8333	0.067	0.018	0.000	0.025
0.8667	0.067	0.019	0.000	0.025
0.9000	0.067	0.020	0.000	0.025
0.9333	0.067	0.020	0.000	0.025
0.9667	0.067	0.021	0.000	0.025
1.0000	0.067	0.022	0.000	0.025
1.0333	0.067	0.022	0.000	0.025
1.0667	0.067	0.023	0.000	0.025
1.1000	0.067	0.024	0.000	0.025
1.1333	0.067	0.025	0.000	0.025
1.1667	0.067	0.025	0.000	0.025
1.2000	0.067	0.026	0.000	0.025
1.2333	0.067	0.027	0.000	0.025
1.2667	0.067	0.028	0.000	0.025
1.3000	0.067	0.028	0.000	0.025
1.3333	0.067	0.029	0.000	0.025
1.3667	0.067	0.030	0.000	0.025
1.4000	0.067	0.031	0.000	0.025
1.4333	0.067	0.031	0.000	0.025
1.4667	0.067	0.032	0.000	0.025
1.5000	0.067	0.033	0.000	0.025
1.5333	0.067	0.034	0.000	0.025
1.5667	0.067	0.034	0.000	0.025
1.6000	0.067	0.035	0.000	0.025
1.6333	0.067	0.036	0.000	0.025
1.6667	0.067	0.037	0.000	0.025
1.7000	0.067	0.037	0.000	0.025
1.7333	0.067	0.038	0.000	0.025
1.7667	0.067	0.039	0.000	0.025
1.8000	0.067	0.039	0.000	0.025
1.8333	0.067	0.040	0.000	0.025
1.8667	0.067	0.041	0.000	0.025
1.9000	0.067	0.042	0.000	0.025
1.9333	0.067	0.042	0.000	0.025
1.9667	0.067	0.043	0.000	0.025
2.0000	0.067	0.044	0.000	0.025
2.0333	0.067	0.045	0.000	0.025
2.0667	0.067	0.045	0.000	0.025
2.1000	0.067	0.046	0.000	0.025
2.1333	0.067	0.047	0.000	0.025
2.1667	0.067	0.048	0.000	0.025
2.2000	0.067	0.048	0.000	0.025
2.2333	0.067	0.049	0.000	0.025
2.2667	0.067	0.050	0.000	0.025
2.3000	0.067	0.051	0.000	0.025
2.3333	0.067	0.051	0.000	0.025
2.3667	0.067	0.052	0.000	0.025
2.4000	0.067	0.053	0.000	0.025
2.4333	0.067	0.054	0.000	0.025
2.4667	0.067	0.054	0.000	0.025
2.5000	0.067	0.055	0.000	0.025
2.5333	0.067	0.056	0.000	0.025
2.5667	0.067	0.056	0.000	0.025
2.6000	0.067	0.057	0.000	0.025
2.6333	0.067	0.058	0.000	0.025
2.6667	0.067	0.059	0.000	0.025
2.7000	0.067	0.059	0.000	0.025

2.7333	0.067	0.060	0.000	0.025
2.7667	0.067	0.061	0.000	0.025
2.8000	0.067	0.062	0.000	0.025
2.8333	0.067	0.062	0.000	0.025
2.8667	0.067	0.063	0.000	0.025
2.9000	0.067	0.064	0.000	0.025
2.9333	0.067	0.065	0.021	0.025
2.9667	0.067	0.065	0.058	0.025
3.0000	0.067	0.066	0.096	0.025

Permeable Pavement 1

Pavement Area:	0.0115 acre.	Pavement Length:	25.00 ft.
Pavement Width:	20.00 ft.	Pavement slope	1:0 To 1
Pavement thickness:	0.333		
Pour Space of Pavement:	0.33		
Material thickness of second layer:	0.083		
Pour Space of material for second layer:	0.33		
Material thickness of third layer:	0.5		
Pour Space of material for third layer:	0.333		
Infiltration On			
Infiltration rate:	0.38		
Infiltration safety factor:	1		
Total Volume Infiltrated (ac-ft.):	4.247		
Total Volume Through Riser (ac-ft.):	0		
Total Volume Through Facility (ac-ft.):	4.247		
Percent Infiltrated:	100		
Total Precip Applied to Facility:	0		
Total Evap From Facility:	0.308		

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

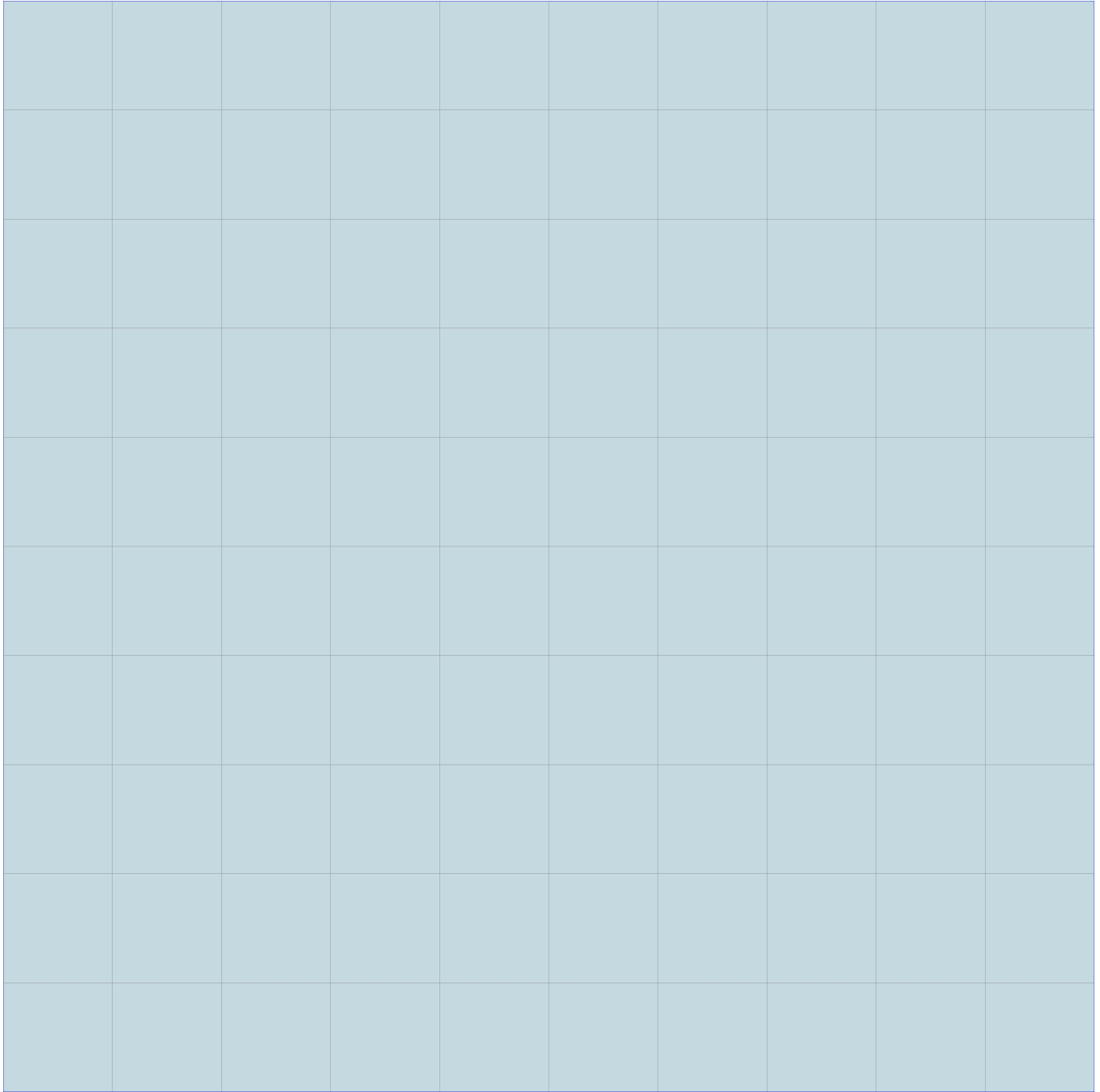
No PERLND changes have been made.

IMPLND Changes

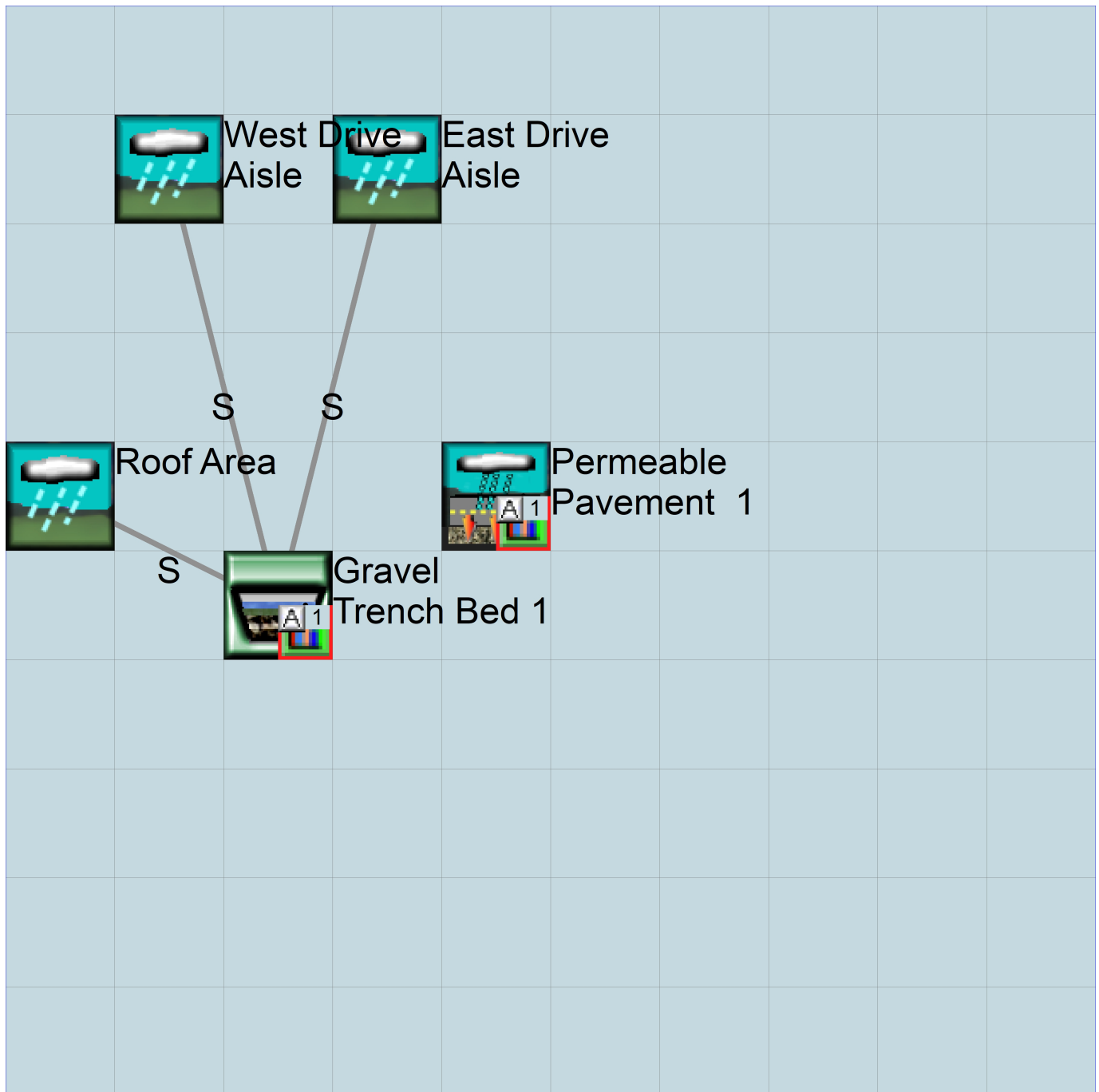
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Mitigated UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1901 10 01      END      2059 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      infiltration.wdm
MESSU    25      Mitinfiltration.MES
          27      Mitinfiltration.L61
          28      Mitinfiltration.L62
          30      POCinfiltration1.dat
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

```
IMPLND      5
IMPLND      4
IMPLND     16
RCHRES      1
RCHRES      2
COPY        1
COPY     501
DISPLY      1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1      Permeable Pavement  1      MAX      1      2      30      9
```

END DISPLY-INF01

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
16 Porous Pavement 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
16 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
16 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
16 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
16 400 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
16         0          0
END IWAT-PARM3

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # *** RETS      SURS
5          0          0
4          0          0
16         0          0
END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->          <--Area-->          <-Target->          MBLK          ***
<Name> #          <-factor->          <Name> #          Tbl#          ***
East Drive Aisle***
IMPLND 5          0.091          RCHRES 2          5
West Drive Aisle***
IMPLND 5          0.184          RCHRES 2          5
Roof Area***
IMPLND 4          0.063          RCHRES 2          5
IMPLND 16         0.0115         RCHRES 1          5

*****Routing*****
IMPLND 5          0.091          COPY 1          15
IMPLND 5          0.184          COPY 1          15
IMPLND 4          0.063          COPY 1          15
RCHRES 2          1          COPY 501          17
RCHRES 1          1          COPY 501          17
END SCHEMATIC

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

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

RCHRES
GEN-INFO
RCHRES          Name          Nexits          Unit Systems          Printer          ***
# - #<-----><----> User T-series          Engl Metr LKFG          ***
1          Permeable Paveme-025          2          1          1          1          28          0          1
2          Gravel Trench Be-012          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
2          1          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
END PRINT-INFO

```

HYDR-PARM1

```

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

```

END HYDR-PARM1

HYDR-PARM2

```

# - #   FTABNO      LEN      DELTH      STCOR      KS      DB50      ***
<-----><-----><-----><-----><-----><-----><----->      ***
1      1      0.01      0.0      0.0      0.5      0.0
2      2      0.02      0.0      0.0      0.5      0.0

```

END HYDR-PARM2

HYDR-INIT

```

RCHRES  Initial conditions for each HYDR section      ***
# - #   *** VOL      Initial value of COLIND      Initial value of OUTDGT
      *** ac-ft      for each possible exit      for each possible exit
<-----><----->      <-----><-----><-----><----->      *** <-----><-----><-----><-----><----->
1      0      4.0 5.0 0.0 0.0 0.0      0.0 0.0 0.0 0.0 0.0
2      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

```

92      5
Depth      Area      Volume      Outflow1      Outflow2      Velocity      Travel Time***
(ft)      (acres)      (acre-ft)      (cfs)      (cfs)      (ft/sec)      (Minutes)***
0.000000  0.067218  0.000000  0.000000  0.000000
0.033333  0.067218  0.000739  0.000000  0.025756
0.066667  0.067218  0.001479  0.000000  0.025756
0.100000  0.067218  0.002218  0.000000  0.025756
0.133333  0.067218  0.002958  0.000000  0.025756
0.166667  0.067218  0.003697  0.000000  0.025756
0.200000  0.067218  0.004436  0.000000  0.025756
0.233333  0.067218  0.005176  0.000000  0.025756
0.266667  0.067218  0.005915  0.000000  0.025756
0.300000  0.067218  0.006655  0.000000  0.025756
0.333333  0.067218  0.007394  0.000000  0.025756
0.366667  0.067218  0.008133  0.000000  0.025756
0.400000  0.067218  0.008873  0.000000  0.025756
0.433333  0.067218  0.009612  0.000000  0.025756
0.466667  0.067218  0.010352  0.000000  0.025756
0.500000  0.067218  0.011091  0.000000  0.025756
0.533333  0.067218  0.011830  0.000000  0.025756
0.566667  0.067218  0.012570  0.000000  0.025756
0.600000  0.067218  0.013309  0.000000  0.025756
0.633333  0.067218  0.014048  0.000000  0.025756
0.666667  0.067218  0.014788  0.000000  0.025756
0.700000  0.067218  0.015527  0.000000  0.025756
0.733333  0.067218  0.016267  0.000000  0.025756
0.766667  0.067218  0.017006  0.000000  0.025756
0.800000  0.067218  0.017745  0.000000  0.025756
0.833333  0.067218  0.018485  0.000000  0.025756
0.866667  0.067218  0.019224  0.000000  0.025756
0.900000  0.067218  0.019964  0.000000  0.025756
0.933333  0.067218  0.020703  0.000000  0.025756
0.966667  0.067218  0.021442  0.000000  0.025756
1.000000  0.067218  0.022182  0.000000  0.025756
1.033333  0.067218  0.022921  0.000000  0.025756
1.066667  0.067218  0.023661  0.000000  0.025756
1.100000  0.067218  0.024400  0.000000  0.025756

```

1.133333	0.067218	0.025139	0.000000	0.025756
1.166667	0.067218	0.025879	0.000000	0.025756
1.200000	0.067218	0.026618	0.000000	0.025756
1.233333	0.067218	0.027358	0.000000	0.025756
1.266667	0.067218	0.028097	0.000000	0.025756
1.300000	0.067218	0.028836	0.000000	0.025756
1.333333	0.067218	0.029576	0.000000	0.025756
1.366667	0.067218	0.030315	0.000000	0.025756
1.400000	0.067218	0.031055	0.000000	0.025756
1.433333	0.067218	0.031794	0.000000	0.025756
1.466667	0.067218	0.032533	0.000000	0.025756
1.500000	0.067218	0.033273	0.000000	0.025756
1.533333	0.067218	0.034012	0.000000	0.025756
1.566667	0.067218	0.034752	0.000000	0.025756
1.600000	0.067218	0.035491	0.000000	0.025756
1.633333	0.067218	0.036230	0.000000	0.025756
1.666667	0.067218	0.036970	0.000000	0.025756
1.700000	0.067218	0.037709	0.000000	0.025756
1.733333	0.067218	0.038448	0.000000	0.025756
1.766667	0.067218	0.039188	0.000000	0.025756
1.800000	0.067218	0.039927	0.000000	0.025756
1.833333	0.067218	0.040667	0.000000	0.025756
1.866667	0.067218	0.041406	0.000000	0.025756
1.900000	0.067218	0.042145	0.000000	0.025756
1.933333	0.067218	0.042885	0.000000	0.025756
1.966667	0.067218	0.043624	0.000000	0.025756
2.000000	0.067218	0.044364	0.000000	0.025756
2.033333	0.067218	0.045103	0.000000	0.025756
2.066667	0.067218	0.045842	0.000000	0.025756
2.100000	0.067218	0.046582	0.000000	0.025756
2.133333	0.067218	0.047321	0.000000	0.025756
2.166667	0.067218	0.048061	0.000000	0.025756
2.200000	0.067218	0.048800	0.000000	0.025756
2.233333	0.067218	0.049539	0.000000	0.025756
2.266667	0.067218	0.050279	0.000000	0.025756
2.300000	0.067218	0.051018	0.000000	0.025756
2.333333	0.067218	0.051758	0.000000	0.025756
2.366667	0.067218	0.052497	0.000000	0.025756
2.400000	0.067218	0.053236	0.000000	0.025756
2.433333	0.067218	0.053976	0.000000	0.025756
2.466667	0.067218	0.054715	0.000000	0.025756
2.500000	0.067218	0.055455	0.000000	0.025756
2.533333	0.067218	0.056194	0.000000	0.025756
2.566667	0.067218	0.056933	0.000000	0.025756
2.600000	0.067218	0.057673	0.000000	0.025756
2.633333	0.067218	0.058412	0.000000	0.025756
2.666667	0.067218	0.059152	0.000000	0.025756
2.700000	0.067218	0.059891	0.000000	0.025756
2.733333	0.067218	0.060630	0.000000	0.025756
2.766667	0.067218	0.061370	0.000000	0.025756
2.800000	0.067218	0.062109	0.000000	0.025756
2.833333	0.067218	0.062848	0.000000	0.025756
2.866667	0.067218	0.063588	0.000000	0.025756
2.900000	0.067218	0.064327	0.000000	0.025756
2.933333	0.067218	0.065067	0.021395	0.025756
2.966667	0.067218	0.065806	0.058227	0.025756
3.000000	0.067218	0.066545	0.096846	0.025756
3.033333	0.067218	0.068786	0.125736	0.025756

END FTABLE 2

FTABLE 1

91 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.011478	0.000000	0.000000	0.000000		
0.010178	0.011478	0.000039	0.000000	0.004398		
0.020356	0.011478	0.000078	0.000000	0.004398		
0.030533	0.011478	0.000117	0.000000	0.004398		
0.040711	0.011478	0.000156	0.000000	0.004398		
0.050889	0.011478	0.000195	0.000000	0.004398		
0.061067	0.011478	0.000233	0.000000	0.004398		

0.071244	0.011478	0.000272	0.000000	0.004398
0.081422	0.011478	0.000311	0.000000	0.004398
0.091600	0.011478	0.000350	0.000000	0.004398
0.101778	0.011478	0.000389	0.000000	0.004398
0.111956	0.011478	0.000428	0.000000	0.004398
0.122133	0.011478	0.000467	0.000000	0.004398
0.132311	0.011478	0.000506	0.000000	0.004398
0.142489	0.011478	0.000545	0.000000	0.004398
0.152667	0.011478	0.000584	0.000000	0.004398
0.162844	0.011478	0.000622	0.000000	0.004398
0.173022	0.011478	0.000661	0.000000	0.004398
0.183200	0.011478	0.000700	0.000000	0.004398
0.193378	0.011478	0.000739	0.000000	0.004398
0.203556	0.011478	0.000778	0.000000	0.004398
0.213733	0.011478	0.000817	0.000000	0.004398
0.223911	0.011478	0.000856	0.000000	0.004398
0.234089	0.011478	0.000895	0.000000	0.004398
0.244267	0.011478	0.000934	0.000000	0.004398
0.254444	0.011478	0.000973	0.000000	0.004398
0.264622	0.011478	0.001011	0.000000	0.004398
0.274800	0.011478	0.001050	0.000000	0.004398
0.284978	0.011478	0.001089	0.000000	0.004398
0.295156	0.011478	0.001128	0.000000	0.004398
0.305333	0.011478	0.001167	0.000000	0.004398
0.315511	0.011478	0.001206	0.000000	0.004398
0.325689	0.011478	0.001245	0.000000	0.004398
0.335867	0.011478	0.001284	0.000000	0.004398
0.346044	0.011478	0.001323	0.000000	0.004398
0.356222	0.011478	0.001362	0.000000	0.004398
0.366400	0.011478	0.001400	0.000000	0.004398
0.376578	0.011478	0.001439	0.000000	0.004398
0.386756	0.011478	0.001478	0.000000	0.004398
0.396933	0.011478	0.001517	0.000000	0.004398
0.407111	0.011478	0.001556	0.000000	0.004398
0.417289	0.011478	0.001595	0.000000	0.004398
0.427467	0.011478	0.001634	0.000000	0.004398
0.437644	0.011478	0.001673	0.000000	0.004398
0.447822	0.011478	0.001712	0.000000	0.004398
0.458000	0.011478	0.001751	0.000000	0.004398
0.468178	0.011478	0.001790	0.000000	0.004398
0.478356	0.011478	0.001828	0.000000	0.004398
0.488533	0.011478	0.001867	0.000000	0.004398
0.498711	0.011478	0.001906	0.000000	0.004398
0.508889	0.011478	0.001945	0.000000	0.004398
0.519067	0.011478	0.001983	0.000000	0.004398
0.529244	0.011478	0.002022	0.000000	0.004398
0.539422	0.011478	0.002060	0.000000	0.004398
0.549600	0.011478	0.002099	0.000000	0.004398
0.559778	0.011478	0.002138	0.000000	0.004398
0.569956	0.011478	0.002176	0.000000	0.004398
0.580133	0.011478	0.002215	0.000000	0.004398
0.590311	0.011478	0.002253	0.000000	0.004398
0.600489	0.011478	0.002292	0.000000	0.004398
0.610667	0.011478	0.002330	0.000000	0.004398
0.620844	0.011478	0.002369	0.000000	0.004398
0.631022	0.011478	0.002407	0.000000	0.004398
0.641200	0.011478	0.002446	0.000000	0.004398
0.651378	0.011478	0.002485	0.000000	0.004398
0.661556	0.011478	0.002523	0.000000	0.004398
0.671733	0.011478	0.002562	0.000000	0.004398
0.681911	0.011478	0.002600	0.000000	0.004398
0.692089	0.011478	0.002639	0.000000	0.004398
0.702267	0.011478	0.002677	0.000000	0.004398
0.712444	0.011478	0.002716	0.000000	0.004398
0.722622	0.011478	0.002754	0.000000	0.004398
0.732800	0.011478	0.002793	0.000000	0.004398
0.742978	0.011478	0.002831	0.000000	0.004398
0.753156	0.011478	0.002870	0.000000	0.004398
0.763333	0.011478	0.002909	0.000000	0.004398
0.773511	0.011478	0.002947	0.000000	0.004398

0.783689	0.011478	0.002986	0.000000	0.004398
0.793867	0.011478	0.003024	0.000000	0.004398
0.804044	0.011478	0.003063	0.000000	0.004398
0.814222	0.011478	0.003101	0.000000	0.004398
0.824400	0.011478	0.003140	0.000000	0.004398
0.834578	0.011478	0.003178	0.000000	0.004398
0.844756	0.011478	0.003217	0.000000	0.004398
0.854933	0.011478	0.003256	0.000000	0.004398
0.865111	0.011478	0.003294	0.000000	0.004398
0.875289	0.011478	0.003333	0.000000	0.004398
0.885467	0.011478	0.003371	0.000000	0.004398
0.895644	0.011478	0.003410	0.000000	0.004398
0.905822	0.011478	0.003448	0.000000	0.004398
0.916000	0.011478	0.003487	0.000000	0.004398

END FTABLE 1
END FTABLES

EXT SOURCES

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

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***
<Name>	#	<Name>	#	tem strg<-factor->	strg	<Name>	#	<Name>	tem strg	strg
RCHRES	2	HYDR	RO	1 1	1	WDM	1000	FLOW	ENGL	REPL
RCHRES	2	HYDR	0	1 1	1	WDM	1001	FLOW	ENGL	REPL
RCHRES	2	HYDR	0	2 1	1	WDM	1002	FLOW	ENGL	REPL
RCHRES	2	HYDR	STAGE	1 1	1	WDM	1003	STAG	ENGL	REPL
COPY	1	OUTPUT	MEAN	1 1	48.4	WDM	701	FLOW	ENGL	REPL
COPY	501	OUTPUT	MEAN	1 1	48.4	WDM	801	FLOW	ENGL	REPL
RCHRES	1	HYDR	RO	1 1	1	WDM	1004	FLOW	ENGL	REPL
RCHRES	1	HYDR	0	1 1	1	WDM	1005	FLOW	ENGL	REPL
RCHRES	1	HYDR	0	2 1	1	WDM	1006	FLOW	ENGL	REPL
RCHRES	1	HYDR	STAGE	1 1	1	WDM	1007	STAG	ENGL	REPL

END EXT TARGETS

MASS-LINK

<Volume>	<-Grp>	<-Member->	<--Mult-->	<Target>	<-Grp>	<-Member->	***
<Name>	#	<Name>	#	<Name>	#	<Name>	#
MASS-LINK		5					
IMPLND	IWATER	SURO	0.083333	RCHRES	INFLOW	IVOL	
END MASS-LINK		5					
MASS-LINK		15					
IMPLND	IWATER	SURO	0.083333	COPY	INPUT	MEAN	
END MASS-LINK		15					
MASS-LINK		17					
RCHRES	OFLOW	OVOL	1	COPY	INPUT	MEAN	
END MASS-LINK		17					

END MASS-LINK

END RUN

Disclaimer

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APPENDIX E

WWHM2012
PROJECT REPORT

General Model Information

WWHM2012 Project Name: treatment

Site Name:

Site Address:

City:

Report Date: 1/5/2024

Gage: 38 IN CENTRAL

Data Start: 10/01/1901

Data End: 09/30/2059

Timestep: 15 Minute

Precip Scale: 1.000

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

Mitigated Land Use

East Drive Aisle

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.091
Impervious Total	0.091
Basin Total	0.091

West Drive Aisle

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.184
Impervious Total	0.184
Basin Total	0.184

Routing Elements

Predeveloped Routing

Mitigated Routing

Bioretention 1

Bottom Length: 12.00 ft.
 Bottom Width: 2.00 ft.
 Material thickness of first layer: 0.25
 Material type for first layer: SMMWW 12 in/hr
 Material thickness of second layer: 1.5
 Material type for second layer: SMMWW 12 in/hr
 Material thickness of third layer: 2
 Material type for third layer: GRAVEL
 Underdrain used
 Underdrain Diameter (feet): 0.5
 Orifice Diameter (in.): 6
 Offset (in.): 0
 Flow Through Underdrain (ac-ft.): 72.688
 Total Outflow (ac-ft.): 79.419
 Percent Through Underdrain: 91.52
 Discharge Structure
 Riser Height: 0.5 ft.
 Riser Diameter: 8 in.
 Element Flows To:
 Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0194	0.0000	0.0000	0.0000
0.0522	0.0190	0.0000	0.0000	0.0000
0.1044	0.0186	0.0000	0.0000	0.0000
0.1566	0.0182	0.0001	0.0000	0.0000
0.2088	0.0178	0.0001	0.0000	0.0000
0.2610	0.0174	0.0001	0.0000	0.0000
0.3132	0.0170	0.0001	0.0000	0.0000
0.3654	0.0166	0.0002	0.0000	0.0000
0.4176	0.0162	0.0002	0.0000	0.0000
0.4698	0.0158	0.0002	0.0001	0.0000
0.5220	0.0154	0.0003	0.0001	0.0000
0.5742	0.0151	0.0003	0.0001	0.0000
0.6264	0.0147	0.0004	0.0001	0.0000
0.6786	0.0143	0.0004	0.0002	0.0000
0.7308	0.0140	0.0005	0.0002	0.0000
0.7830	0.0136	0.0005	0.0003	0.0000
0.8352	0.0132	0.0006	0.0003	0.0000
0.8874	0.0129	0.0007	0.0003	0.0000
0.9396	0.0126	0.0007	0.0004	0.0000
0.9918	0.0122	0.0008	0.0005	0.0000
1.0440	0.0119	0.0009	0.0006	0.0000
1.0962	0.0115	0.0010	0.0006	0.0000
1.1484	0.0112	0.0011	0.0006	0.0000
1.2005	0.0109	0.0012	0.0007	0.0000
1.2527	0.0106	0.0013	0.0008	0.0000
1.3049	0.0103	0.0014	0.0009	0.0000
1.3571	0.0099	0.0015	0.0010	0.0000
1.4093	0.0096	0.0016	0.0011	0.0000
1.4615	0.0093	0.0017	0.0012	0.0000

1.5137	0.0090	0.0018	0.0013	0.0000
1.5659	0.0088	0.0020	0.0014	0.0000
1.6181	0.0085	0.0021	0.0015	0.0000
1.6703	0.0082	0.0022	0.0016	0.0000
1.7225	0.0079	0.0024	0.0017	0.0000
1.7747	0.0076	0.0025	0.0019	0.0000
1.8269	0.0074	0.0027	0.0022	0.0000
1.8791	0.0071	0.0028	0.0022	0.0000
1.9313	0.0068	0.0030	0.0023	0.0000
1.9835	0.0066	0.0031	0.0023	0.0000
2.0357	0.0063	0.0033	0.0032	0.0000
2.0879	0.0061	0.0035	0.0033	0.0000
2.1401	0.0058	0.0037	0.0040	0.0000
2.1923	0.0056	0.0039	0.0042	0.0000
2.2445	0.0054	0.0040	0.0046	0.0000
2.2967	0.0051	0.0042	0.0050	0.0000
2.3489	0.0049	0.0044	0.0050	0.0000
2.4011	0.0047	0.0047	0.0050	0.0000
2.4533	0.0045	0.0049	0.0050	0.0000
2.5055	0.0043	0.0051	0.0050	0.0000
2.5577	0.0041	0.0053	0.0050	0.0000
2.6099	0.0039	0.0056	0.0050	0.0000
2.6621	0.0037	0.0058	0.0050	0.0000
2.7143	0.0035	0.0061	0.0050	0.0000
2.7665	0.0033	0.0063	0.0050	0.0000
2.8187	0.0031	0.0066	0.0050	0.0000
2.8709	0.0029	0.0069	0.0050	0.0000
2.9231	0.0027	0.0072	0.0050	0.0000
2.9753	0.0026	0.0075	0.0050	0.0000
3.0275	0.0024	0.0078	0.0050	0.0000
3.0797	0.0022	0.0081	0.0050	0.0000
3.1319	0.0021	0.0084	0.0050	0.0000
3.1841	0.0019	0.0087	0.0050	0.0000
3.2363	0.0018	0.0090	0.0050	0.0000
3.2885	0.0016	0.0094	0.0050	0.0000
3.3407	0.0015	0.0097	0.0050	0.0000
3.3929	0.0014	0.0101	0.0050	0.0000
3.4451	0.0012	0.0104	0.0050	0.0000
3.4973	0.0011	0.0108	0.0050	0.0000
3.5495	0.0010	0.0112	0.0050	0.0000
3.6016	0.0009	0.0116	0.0050	0.0000
3.6538	0.0008	0.0120	0.0050	0.0000
3.7060	0.0007	0.0124	0.0050	0.0000
3.7500	0.0006	0.0127	0.0050	0.0000

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infiltr(cfs)
3.7500	0.019404	0.012735	0.0000	0.0033	0.0000
3.8022	0.019831	0.013759	0.0000	0.0033	0.0000
3.8544	0.020262	0.014805	0.0000	0.0041	0.0000
3.9066	0.020697	0.015874	0.0000	0.0042	0.0000
3.9588	0.021137	0.016966	0.0000	0.0044	0.0000
4.0110	0.021582	0.018081	0.0000	0.0045	0.0000
4.0632	0.022031	0.019219	0.0000	0.0046	0.0000
4.1154	0.022484	0.020381	0.0000	0.0047	0.0000
4.1676	0.022942	0.021566	0.0000	0.0048	0.0000
4.2198	0.023404	0.022776	0.0000	0.0049	0.0000
4.2720	0.023871	0.024010	0.0230	0.0050	0.0000

4.3242	0.0243430.025268	0.1418	0.0052	0.0000
4.3764	0.0248190.026551	0.3059	0.0053	0.0000
4.4286	0.0252990.027859	0.4809	0.0054	0.0000
4.4808	0.0257840.029192	0.6330	0.0055	0.0000
4.5330	0.0262740.030551	0.7387	0.0056	0.0000
4.5852	0.0267680.031935	0.8104	0.0057	0.0000
4.6374	0.0272660.033346	0.8712	0.0059	0.0000
4.6896	0.0277690.034782	0.9281	0.0060	0.0000
4.7418	0.0282770.036245	0.9816	0.0061	0.0000
4.7500	0.0283570.036478	1.0324	0.0061	0.0000

Surface retention 1

Bioretention 2

Bottom Length: 5.00 ft.
 Bottom Width: 2.00 ft.
 Material thickness of first layer: 0.25
 Material type for first layer: SMMWW 12 in/hr
 Material thickness of second layer: 1.5
 Material type for second layer: SMMWW 12 in/hr
 Material thickness of third layer: 2
 Material type for third layer: GRAVEL
 Underdrain used
 Underdrain Diameter (feet): 0.5
 Orifice Diameter (in.): 6
 Offset (in.): 0
 Flow Through Underdrain (ac-ft.): 38.242
 Total Outflow (ac-ft.): 41.133
 Percent Through Underdrain: 92.97
 Discharge Structure
 Riser Height: 0.5 ft.
 Riser Diameter: 8 in.
 Element Flows To:
 Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0155	0.0000	0.0000	0.0000
0.0522	0.0152	0.0000	0.0000	0.0000
0.1044	0.0148	0.0000	0.0000	0.0000
0.1566	0.0144	0.0000	0.0000	0.0000
0.2088	0.0141	0.0000	0.0000	0.0000
0.2610	0.0137	0.0000	0.0000	0.0000
0.3132	0.0134	0.0001	0.0000	0.0000
0.3654	0.0130	0.0001	0.0000	0.0000
0.4176	0.0127	0.0001	0.0000	0.0000
0.4698	0.0123	0.0001	0.0000	0.0000
0.5220	0.0120	0.0001	0.0000	0.0000
0.5742	0.0117	0.0002	0.0000	0.0000
0.6264	0.0114	0.0002	0.0001	0.0000
0.6786	0.0110	0.0002	0.0001	0.0000
0.7308	0.0107	0.0002	0.0001	0.0000
0.7830	0.0104	0.0003	0.0001	0.0000
0.8352	0.0101	0.0003	0.0001	0.0000
0.8874	0.0098	0.0004	0.0001	0.0000
0.9396	0.0095	0.0004	0.0002	0.0000
0.9918	0.0092	0.0004	0.0002	0.0000
1.0440	0.0089	0.0005	0.0002	0.0000
1.0962	0.0087	0.0005	0.0002	0.0000
1.1484	0.0084	0.0006	0.0002	0.0000
1.2005	0.0081	0.0007	0.0003	0.0000
1.2527	0.0078	0.0007	0.0003	0.0000
1.3049	0.0076	0.0008	0.0004	0.0000
1.3571	0.0073	0.0009	0.0004	0.0000
1.4093	0.0071	0.0009	0.0004	0.0000
1.4615	0.0068	0.0010	0.0005	0.0000
1.5137	0.0066	0.0011	0.0005	0.0000
1.5659	0.0063	0.0012	0.0006	0.0000

1.6181	0.0061	0.0013	0.0006	0.0000
1.6703	0.0058	0.0014	0.0007	0.0000
1.7225	0.0056	0.0015	0.0007	0.0000
1.7747	0.0054	0.0016	0.0008	0.0000
1.8269	0.0052	0.0017	0.0009	0.0000
1.8791	0.0050	0.0018	0.0009	0.0000
1.9313	0.0047	0.0019	0.0010	0.0000
1.9835	0.0045	0.0020	0.0010	0.0000
2.0357	0.0043	0.0021	0.0013	0.0000
2.0879	0.0041	0.0022	0.0014	0.0000
2.1401	0.0040	0.0024	0.0017	0.0000
2.1923	0.0038	0.0025	0.0018	0.0000
2.2445	0.0036	0.0027	0.0019	0.0000
2.2967	0.0034	0.0028	0.0021	0.0000
2.3489	0.0032	0.0029	0.0021	0.0000
2.4011	0.0031	0.0031	0.0021	0.0000
2.4533	0.0029	0.0033	0.0021	0.0000
2.5055	0.0027	0.0034	0.0021	0.0000
2.5577	0.0026	0.0036	0.0021	0.0000
2.6099	0.0024	0.0038	0.0021	0.0000
2.6621	0.0023	0.0040	0.0021	0.0000
2.7143	0.0021	0.0042	0.0021	0.0000
2.7665	0.0020	0.0044	0.0021	0.0000
2.8187	0.0019	0.0046	0.0021	0.0000
2.8709	0.0017	0.0048	0.0021	0.0000
2.9231	0.0016	0.0050	0.0021	0.0000
2.9753	0.0015	0.0052	0.0021	0.0000
3.0275	0.0014	0.0054	0.0021	0.0000
3.0797	0.0013	0.0057	0.0021	0.0000
3.1319	0.0012	0.0059	0.0021	0.0000
3.1841	0.0011	0.0062	0.0021	0.0000
3.2363	0.0010	0.0064	0.0021	0.0000
3.2885	0.0009	0.0067	0.0021	0.0000
3.3407	0.0008	0.0070	0.0021	0.0000
3.3929	0.0007	0.0072	0.0021	0.0000
3.4451	0.0006	0.0075	0.0021	0.0000
3.4973	0.0005	0.0078	0.0021	0.0000
3.5495	0.0005	0.0081	0.0021	0.0000
3.6016	0.0004	0.0084	0.0021	0.0000
3.6538	0.0003	0.0087	0.0021	0.0000
3.7060	0.0003	0.0091	0.0021	0.0000
3.7500	0.0002	0.0093	0.0021	0.0000

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
3.7500	0.0154670	0.009337	0.0000	0.0014	0.0000
3.8022	0.0158430	0.010154	0.0000	0.0014	0.0000
3.8544	0.0162240	0.010991	0.0000	0.0017	0.0000
3.9066	0.0166090	0.011848	0.0000	0.0018	0.0000
3.9588	0.0169990	0.012725	0.0000	0.0018	0.0000
4.0110	0.0173930	0.013623	0.0000	0.0019	0.0000
4.0632	0.0177910	0.014541	0.0000	0.0019	0.0000
4.1154	0.0181950	0.015480	0.0000	0.0020	0.0000
4.1676	0.0186020	0.016441	0.0000	0.0020	0.0000
4.2198	0.0190140	0.017422	0.0000	0.0021	0.0000
4.2720	0.0194310	0.018426	0.0230	0.0021	0.0000
4.3242	0.0198520	0.019451	0.1418	0.0022	0.0000
4.3764	0.0202780	0.020498	0.3059	0.0022	0.0000

4.4286	0.0207080.021568	0.4809	0.0022	0.0000
4.4808	0.0211430.022660	0.6330	0.0023	0.0000
4.5330	0.0215820.023775	0.7387	0.0023	0.0000
4.5852	0.0220260.024913	0.8104	0.0024	0.0000
4.6374	0.0224740.026075	0.8712	0.0024	0.0000
4.6896	0.0229260.027260	0.9281	0.0025	0.0000
4.7418	0.0233840.028468	0.9816	0.0025	0.0000
4.7500	0.0234560.028661	1.0324	0.0025	0.0000

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

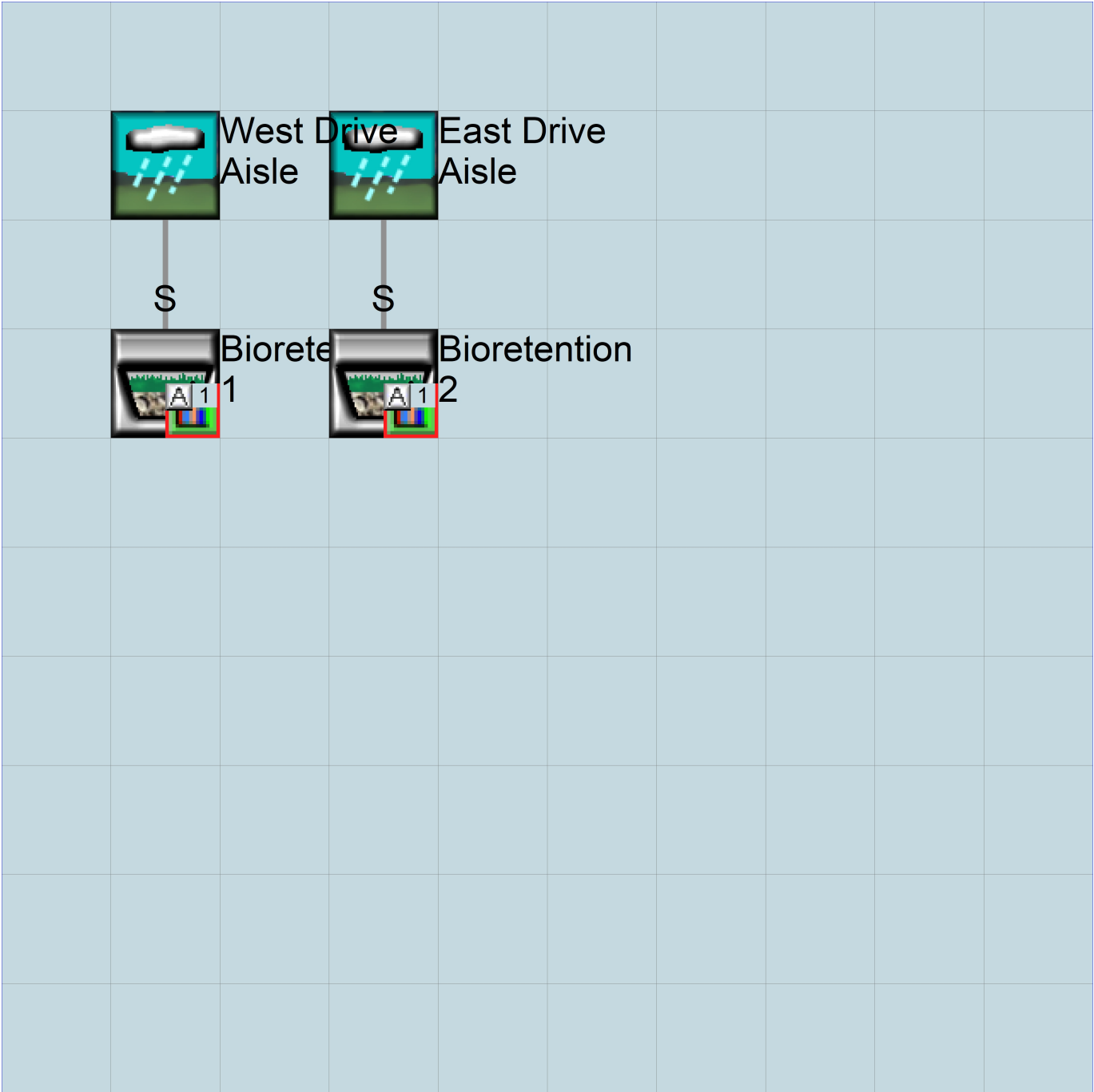
IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic

Mitigated Schematic



Mitigated UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1901 10 01      END      2059 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      treatment.wdm
MESSU    25      Mittreatment.MES
          27      Mittreatment.L61
          28      Mittreatment.L62
          30      POctreatment1.dat
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

```
IMPLND      5
GENER        2
RCHRES       1
RCHRES       2
GENER        4
RCHRES       3
RCHRES       4
COPY         1
COPY        501
DISPLY       1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1      Surface retention 1      MAX      1      2      30      9
```

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1      1      1
501    1      1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
#      # OPCODE ***
2      24
4      24
```

END OPCODE

PARM

```
#      #      K ***
2      0.
4      0.
```

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 KVARV 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
END GEN-INFO
*** Section IWATER***

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
5 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
END PRINT-INFO

IWAT-PARM1
<PLS > IWATER variable monthly parameter value flags ***
# - # CSNO RTOP VRS VNN RTLI ***
5 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
END IWAT-PARM2

IWAT-PARM3
<PLS > IWATER input info: Part 3 ***

```

```

# - # ***PETMAX      PETMIN
5          0          0
END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->          <--Area-->      <-Target->      MBLK      ***
<Name> #          <-factor->      <Name> #      Tbl#      ***
East Drive Aisle***
IMPLND 5          0.091      RCHRES 3          5
West Drive Aisle***
IMPLND 5          0.184      RCHRES 1          5

*****Routing*****
IMPLND 5          0.091      COPY 1          15
IMPLND 5          0.184      COPY 1          15
RCHRES 1          1          RCHRES 2          8
RCHRES 3          1          RCHRES 4          8
RCHRES 2          1          COPY 501        16
RCHRES 1          1          COPY 501        17
RCHRES 4          1          COPY 501        16
RCHRES 3          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
GENER 2 OUTPUT TIMSER .00111111      RCHRES 1          EXTNL OUTDGT 1
GENER 4 OUTPUT TIMSER .00111111      RCHRES 3          EXTNL OUTDGT 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      ***
1      Surface retentio-019      2      1      1      1      28      0      1
2      Bioretention 1          1      1      1      1      28      0      1
3      Surface retentio-021      2      1      1      1      28      0      1
4      Bioretention 2          1      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
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
END PRINT-INFO

```

HYDR-PARM1

#	VC	Flags for each HYDR Section				ODFVFG for each possible exit					ODGTFG for each possible exit					FUNCT for each possible exit				
		A1	A2	A3																
		FG	FG	FG	FG	*	*	*	*	*	*	*	*	*	*	*	*	*		
1	0	1	0	0	4	5	0	0	0	0	1	0	0	0	2	1	2	2	2	
2	0	1	0	0	4	0	0	0	0	0	0	0	0	0	2	2	2	2	2	
3	0	1	0	0	4	5	0	0	0	0	1	0	0	0	2	1	2	2	2	
4	0	1	0	0	4	0	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

END HYDR-PARM2

HYDR-INIT

#	VOL	Initial value of COLIND for each possible exit					Initial value of OUTDGT for each possible exit				
		ac-ft									
1	0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

END HYDR-INIT

END RCHRES

SPEC-ACTIONS

```

*** User-Defined Variable Quantity Lines
***
***      <----->
*** kwd  varnam  optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
<****> <-----> <-----> <-> <-----><-----><-----><-----> <-><-> <-><-> <-> ***
UVQUAN  vol2    RCHRES  2  VOL      4
UVQUAN  v2m2    GLOBAL   WORKSP  1      3
UVQUAN  vpo2    GLOBAL   WORKSP  2      3
UVQUAN  v2d2    GENER    2  K      1      3
*** User-Defined Variable Quantity Lines
***
***      <----->
*** kwd  varnam  optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
<****> <-----> <-----> <-> <-----><-----><-----><-----> <-><-> <-><-> <-> ***
UVQUAN  vol4    RCHRES  4  VOL      4
UVQUAN  v2m4    GLOBAL   WORKSP  3      3
UVQUAN  vpo4    GLOBAL   WORKSP  4      3
UVQUAN  v2d4    GENER    4  K      1      3
*** User-Defined Target Variable Names
***
***      <----->
*** kwd  varnam  ct  vari  s1 s2 s3  frac oper  addr or
<****> <-----><-> <-----><-----><-----> <-----> <-> <-----><-----><-----> <-><-> <-><-> <-> ***
UVNAME  v2m2    1  WORKSP  1      1.0 QUAN  addr or
UVNAME  vpo2    1  WORKSP  2      1.0 QUAN  addr or
UVNAME  v2d2    1  K      1      1.0 QUAN  addr or
*** User-Defined Target Variable Names
***
***      <----->
*** kwd  varnam  ct  vari  s1 s2 s3  frac oper  addr or
<****> <-----><-> <-----><-----><-----> <-----> <-> <-----><-----><-----> <-><-> <-><-> <-> ***
UVNAME  v2m4    1  WORKSP  3      1.0 QUAN  addr or
UVNAME  vpo4    1  WORKSP  4      1.0 QUAN  addr or
UVNAME  v2d4    1  K      1      1.0 QUAN  addr or

```


2.087912	0.006078	0.003483	0.003336
2.140110	0.005835	0.003664	0.004034
2.192308	0.005597	0.003850	0.004209
2.244505	0.005364	0.004043	0.004627
2.296703	0.005135	0.004242	0.005000
2.348901	0.004910	0.004447	0.005000
2.401099	0.004690	0.004660	0.005000
2.453297	0.004475	0.004878	0.005000
2.505495	0.004264	0.005104	0.005000
2.557692	0.004057	0.005336	0.005000
2.609890	0.003855	0.005576	0.005000
2.662088	0.003658	0.005822	0.005000
2.714286	0.003465	0.006076	0.005000
2.766484	0.003276	0.006337	0.005000
2.818681	0.003092	0.006605	0.005000
2.870879	0.002913	0.006881	0.005000
2.923077	0.002738	0.007164	0.005000
2.975275	0.002567	0.007455	0.005000
3.027473	0.002402	0.007753	0.005000
3.079670	0.002240	0.008060	0.005000
3.131868	0.002083	0.008374	0.005000
3.184066	0.001931	0.008697	0.005000
3.236264	0.001783	0.009027	0.005000
3.288462	0.001639	0.009366	0.005000
3.340659	0.001500	0.009713	0.005000
3.392857	0.001366	0.010068	0.005000
3.445055	0.001236	0.010432	0.005000
3.497253	0.001111	0.010805	0.005000
3.549451	0.000990	0.011186	0.005000
3.601648	0.000873	0.011577	0.005000
3.653846	0.000761	0.011976	0.005000
3.706044	0.000654	0.012384	0.005000
3.750000	0.000551	0.012838	0.005000

END FTABLE 2

FTABLE 1

21 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.000551	0.000000	0.000000	0.000000		
0.052198	0.019831	0.001024	0.000000	0.003333		
0.104396	0.020262	0.002070	0.000000	0.004121		
0.156593	0.020697	0.003139	0.000000	0.004237		
0.208791	0.021137	0.004231	0.000000	0.004353		
0.260989	0.021582	0.005346	0.000000	0.004469		
0.313187	0.022031	0.006484	0.000000	0.004585		
0.365385	0.022484	0.007646	0.000000	0.004701		
0.417582	0.022942	0.008832	0.000000	0.004817		
0.469780	0.023404	0.010041	0.000000	0.004933		
0.521978	0.023871	0.011275	0.023036	0.005049		
0.574176	0.024343	0.012533	0.141755	0.005165		
0.626374	0.024819	0.013816	0.305923	0.005281		
0.678571	0.025299	0.015125	0.480884	0.005397		
0.730769	0.025784	0.016458	0.633045	0.005513		
0.782967	0.026274	0.017816	0.738745	0.005629		
0.835165	0.026768	0.019201	0.810413	0.005745		
0.887363	0.027266	0.020611	0.871236	0.005861		
0.939560	0.027769	0.022047	0.928082	0.005977		
0.991758	0.028277	0.023510	0.981641	0.006093		
1.000000	0.028357	0.023743	1.032426	0.006111		

END FTABLE 1

FTABLE 4

73 4

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.015467	0.000000	0.000000		
0.052198	0.015154	0.000006	0.000000		
0.104396	0.014786	0.000014	0.000000		
0.156593	0.014423	0.000022	0.000000		
0.208791	0.014064	0.000033	0.000000		
0.260989	0.013710	0.000045	0.000000		

0.313187	0.013360	0.000058	0.000009
0.365385	0.013015	0.000074	0.000012
0.417582	0.012674	0.000092	0.000015
0.469780	0.012337	0.000111	0.000023
0.521978	0.012006	0.000133	0.000035
0.574176	0.011678	0.000157	0.000049
0.626374	0.011356	0.000183	0.000051
0.678571	0.011037	0.000212	0.000066
0.730769	0.010723	0.000244	0.000086
0.782967	0.010414	0.000278	0.000110
0.835165	0.010109	0.000315	0.000126
0.887363	0.009809	0.000355	0.000137
0.939560	0.009513	0.000398	0.000169
0.991758	0.009222	0.000444	0.000204
1.043956	0.008935	0.000493	0.000229
1.096154	0.008653	0.000546	0.000243
1.148352	0.008375	0.000602	0.000244
1.200549	0.008102	0.000662	0.000288
1.252747	0.007833	0.000725	0.000336
1.304945	0.007569	0.000793	0.000389
1.357143	0.007309	0.000864	0.000408
1.409341	0.007054	0.000939	0.000447
1.461538	0.006803	0.001018	0.000510
1.513736	0.006557	0.001101	0.000524
1.565934	0.006315	0.001189	0.000577
1.618132	0.006078	0.001281	0.000628
1.670330	0.005845	0.001378	0.000650
1.722527	0.005617	0.001479	0.000728
1.774725	0.005394	0.001575	0.000812
1.826923	0.005174	0.001676	0.000901
1.879121	0.004960	0.001781	0.000906
1.931319	0.004749	0.001891	0.000978
1.983516	0.004544	0.002005	0.000973
2.035714	0.004343	0.002125	0.001329
2.087912	0.004146	0.002249	0.001390
2.140110	0.003954	0.002378	0.001681
2.192308	0.003766	0.002512	0.001754
2.244505	0.003583	0.002652	0.001928
2.296703	0.003404	0.002796	0.002083
2.348901	0.003230	0.002946	0.002083
2.401099	0.003060	0.003102	0.002083
2.453297	0.002895	0.003263	0.002083
2.505495	0.002734	0.003430	0.002083
2.557692	0.002578	0.003603	0.002083
2.609890	0.002427	0.003781	0.002083
2.662088	0.002279	0.003965	0.002083
2.714286	0.002137	0.004156	0.002083
2.766484	0.001999	0.004353	0.002083
2.818681	0.001865	0.004556	0.002083
2.870879	0.001736	0.004765	0.002083
2.923077	0.001611	0.004981	0.002083
2.975275	0.001491	0.005203	0.002083
3.027473	0.001376	0.005432	0.002083
3.079670	0.001264	0.005668	0.002083
3.131868	0.001158	0.005910	0.002083
3.184066	0.001056	0.006160	0.002083
3.236264	0.000958	0.006416	0.002083
3.288462	0.000865	0.006680	0.002083
3.340659	0.000776	0.006951	0.002083
3.392857	0.000692	0.007229	0.002083
3.445055	0.000613	0.007515	0.002083
3.497253	0.000538	0.007808	0.002083
3.549451	0.000467	0.008109	0.002083
3.601648	0.000401	0.008417	0.002083
3.653846	0.000339	0.008733	0.002083
3.706044	0.000282	0.009058	0.002083
3.750000	0.000230	0.009380	0.002083

END FTABLE 4
 FTABLE 3
 21 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.000230	0.000000	0.000000	0.000000		
0.052198	0.015843	0.000817	0.000000	0.001389		
0.104396	0.016224	0.001654	0.000000	0.001717		
0.156593	0.016609	0.002511	0.000000	0.001765		
0.208791	0.016999	0.003388	0.000000	0.001814		
0.260989	0.017393	0.004286	0.000000	0.001862		
0.313187	0.017791	0.005204	0.000000	0.001910		
0.365385	0.018195	0.006143	0.000000	0.001959		
0.417582	0.018602	0.007104	0.000000	0.002007		
0.469780	0.019014	0.008085	0.000000	0.002055		
0.521978	0.019431	0.009089	0.023036	0.002104		
0.574176	0.019852	0.010114	0.141755	0.002152		
0.626374	0.020278	0.011161	0.305923	0.002200		
0.678571	0.020708	0.012231	0.480884	0.002249		
0.730769	0.021143	0.013323	0.633045	0.002297		
0.782967	0.021582	0.014438	0.738745	0.002345		
0.835165	0.022026	0.015576	0.810413	0.002394		
0.887363	0.022474	0.016738	0.871236	0.002442		
0.939560	0.022926	0.017923	0.928082	0.002490		
0.991758	0.023384	0.019131	0.981641	0.002539		
1.000000	0.023456	0.019324	1.032426	0.002546		

END FTABLE 3
END FTABLES

EXT SOURCES

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WDM	2	PREC ENGL 1	PERLND	1	999	EXTNL	PREC
WDM	2	PREC ENGL 1	IMPLND	1	999	EXTNL	PREC
WDM	1	EVAP ENGL 1	PERLND	1	999	EXTNL	PETINP
WDM	1	EVAP ENGL 1	IMPLND	1	999	EXTNL	PETINP
WDM	2	PREC ENGL 1	RCHRES	1		EXTNL	PREC
WDM	2	PREC ENGL 1	RCHRES	3		EXTNL	PREC
WDM	1	EVAP ENGL 0.5	RCHRES	1		EXTNL	POTEV
WDM	1	EVAP ENGL 1	RCHRES	2		EXTNL	POTEV
WDM	1	EVAP ENGL 0.5	RCHRES	3		EXTNL	POTEV
WDM	1	EVAP ENGL 1	RCHRES	4		EXTNL	POTEV

END EXT SOURCES

EXT TARGETS

<-Volume-> <Name>	<-Grp> #	<-Member-><--Mult-->Tran <Name> # #<-factor-->strg	<-Volume-> <Name>	<Member> #	Tsys tem	Tgap strg	Amd strg	*** ***
RCHRES	2	HYDR RO 1 1 1	WDM	1008	FLOW	ENGL	REPL	
RCHRES	2	HYDR STAGE 1 1 1	WDM	1009	STAG	ENGL	REPL	
RCHRES	1	HYDR STAGE 1 1 1	WDM	1010	STAG	ENGL	REPL	
RCHRES	1	HYDR 0 1 1 1	WDM	1011	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	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 0 1 1 1	WDM	1015	FLOW	ENGL	REPL	

END EXT TARGETS

MASS-LINK

<Volume> <Name>	<-Grp> #	<-Member-><--Mult--> <Name> # #<-factor-->	<Target> <Name>	<-Grp> #	<-Member->*** <Name> # #***
MASS-LINK		5			
IMPLND	IWATER	SURO 0.083333	RCHRES	INFLOW	IVOL
END MASS-LINK		5			
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	16				
RCHRES	ROFLOW			COPY	INPUT MEAN
END MASS-LINK	16				
MASS-LINK	17				
RCHRES	OFLOW	OVOL	1	COPY	INPUT MEAN
END MASS-LINK	17				
END MASS-LINK					
END RUN					

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APPENDIX F

320 Todd Rd

Operation and Maintenance Manual

Stormwater from the Todd Rd development project area is collected and infiltrated using permeable pavement. Roof downspouts and bioswales will collect stormwater and be routed to an infiltration gallery in the center of the site.

This document provides guidelines for operation and maintenance of the stormwater management facilities at the Todd Rd site. Much of this O & M Manual is adapted from the *2021 Pierce County Stormwater Management and Site Development Manual*, the Puget Sound Partnership's *Low Impact Development Technical Guidance Manual for Puget Sound, December 2012* (LID Manual) and the Department of Ecology's *2019 Stormwater Management Manual for Western Washington* (DOE Manual).

Infiltration Gallery

Design

The proposed infiltration gallery on site is designed to provide stormwater flow control through the infiltration of stormwater runoff generated on site. The infiltration gallery receives runoff from the roof drains and leaders and bioswales, which is collected through stormwater pipes and conveyed to the infiltration trench. Some pavement runoff sheetflows to one of two bioswales and is conveyed to the underground infiltration gallery. The remaining pavements on-site are permeable and runoff is infiltrated on site. Landscape areas generally infiltrate runoff onsite.

The infiltration gallery has been sized using the WWHM based on the following criteria:

- Trench Area: 2,940 SF
- Effective Depth of 3.0-feet
- Design Infiltration Rate of 0.48 in/hr
- Side slopes H/V: 0
- Infiltrate 100% of runoff up to of the 100-year storm

Operation and Maintenance

Infiltration trenches require periodic maintenance to prevent clogging and maintain infiltration capacity, including:

- Clearing debris from pipe inlets.
- Clearing accumulated trash, debris, excessive vegetation and sediment from inlet pipes.
- Maintain emergency overflow free of debris and vegetation.
- Clearing sediment from drain pipes/cleanouts

See Appendix A for infiltration pond maintenance standards, procedures, and tracking log.

Inspection

During storm events, infiltration ponds should be inspected annually during a storm event for infiltration capacity. The water quality design storm volume should infiltrate within 48 hours and empty within 24 hours of the most recent storm event.

Inlet and outlet pipes should be inspected annually for damage.

Permeable Pavement

Design

The proposed permeable pavement on site is designed to provide stormwater flow control through the infiltration of stormwater runoff generated on site. The permeable asphalt and permeable concrete will infiltrate the runoff generated from the permeable asphalt and permeable concrete.

The Permeable Pavement has been sized using the WWHM based on the following criteria:

- 4" Permeable Concrete
- 1" ASTM #8 Stone
- 6" ASTM #57 Stone
- Design Infiltration Rate of 0.38 in/hr
- Infiltrate 100% of runoff up to of the 100-year storm

Operation and Maintenance

Permeable Pavement require periodic maintenance to prevent clogging and maintain infiltration capacity, including:

- Check if elevation of adjacent planted area is too high, or slopes towards pavement and can be regraded (protect permeable pavement with temporary plastic prior to regrading)
- Mulch and/or plant all of the exposed soils that may erode to the pavement surface
- Clean surface debris from pavement surface using one or a combination of the following methods:
 - Vacuum/sweep permeable paved walkways and paved parking lot with brush brooms and high efficiency regenerative air or vacuum sweeper, respectively.
 - Clearing deposited soil, sediment, debris, trash, vegetation and/or other materials from permeable pavement or adjacent surfacing.
 - Wash permeable pavement with hand held pressure washers with rotating brushes.
- Fill potholes or small cracks with patching mixes.
- Cut and replace areas with large cracks and settlement.

See Appendix A for permeable pavement maintenance standards, procedures, and tracking log.

Inspection

During storm events, permeable pavement should be inspected annually during a storm event for infiltration capacity. The permeable pavement should be monitored for ponding on the surface or if the

water flows off the permeable pavement surface during a rain event. If this occurs, the permeable pavement should be evaluated for potential causes.

During non-storm events, the permeable pavement should be evaluated annually or after a storm event for deposited soil, sediment, debris, trash, vegetation and/or other materials. Permeable pavement should also be evaluated annually for major cracks or trip hazards and concrete spalling and raveling.

During the Summer, permeable pavement should be checked for moss growth that could inhibit infiltration or poses a safety hazard.

Sources:

Pierce County Stormwater Management and Site Development Manual 2021

Puget Sound Partnership Low Impact Development Technical Guidance Manual for Puget Sound, December 2012

Department of Ecology Stormwater Management Manual for Western Washington 2019

APPENDIX A

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	Any trash and debris which exceed five cubic feet per 1,000 square feet. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in the Pierce County Noxious Weeds List . (Apply requirements of adopted integrated pest management policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. <i>(Coordinate with Tacoma-Pierce County Health Department) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.</i>
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. <i>(Coordinate removal/cleanup with Pierce County Surface Water Management 253-798-2725 and/or Dept. of Ecology Spill Response 800-424-8802.)</i>
General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. <i>(Coordinate with Tacoma-Pierce County Health Department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)</i>
General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility returned to design function. <i>(Contact WDFW Region 6 to identify the appropriate Nuisance Wildlife Control Operator)</i>
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. <i>Apply insecticides in compliance with adopted integrated pest management policies.</i>
General	Performance	Check crest gauge against design expectations (see Maintenance and Source Control Manual).	Crest gauge results reflect design performance expectations. Reading recorded. County notified if not meeting design performance.
Crest Gauge	Crest Gauge Missing/ Broken	Crest gauge is not functioning properly, has been vandalized, or is missing.	Crest gauge present and functioning. Repair/replace crest gauge if missing or broken.
Storage Area	Water Not Infiltrating	Water ponding in infiltration basin after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90 percent of its designed capabilities. If 2 inches or more sediment is present, remove).	Facility infiltrates as designed. Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than one-half full.	Filter bag less than one-half full. Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Water flows through filter. Replace gravel in rock filter if needed.
Trenches	Observation Well (Use Surface of Trench if Well is Not Present)	Water ponds at surface during storm events. Less than 90 percent of design infiltration rate.	Remove and replace/clean rock and geomembrane.
Ponds	Vegetation	Exceeds 18 inches.	Grass or groundcover mowed to a height no greater than 6 inches.
Ponds	Vegetation	Bare spots.	No bare spots. Revegetate and stabilize immediately.
Side Slopes of Pond	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. <i>If erosion is occurring on compacted slope, a professional engineer should be consulted to resolve source of erosion.</i>
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works.	Dike is built back to the design elevation. <i>If settlement is significant, a professional engineer should be consulted to determine the cause of the settlement.</i>
Pond Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.	No water flow through pond berm. Piping eliminated. Erosion potential eliminated. <i>Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</i>
General	Hazard Trees	If dead, diseased, or dying trees are identified.	Hazard trees removed. <i>(Use a certified Arborist to determine health of tree or removal requirements).</i>
General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Pond Berms (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees on berms removed. <i>If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.</i>
Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees on emergency spillways removed. <i>If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.</i>
Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway.	Rocks and pad depth restored to design standards. (Riprap on inside slopes need not be replaced.)
Emergency Overflow/ Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. <i>If erosion is occurring on compacted berms a professional engineer should be consulted to resolve source of erosion.</i>
Presettling Ponds and Vaults	Facility or sump filled with Sediment and/or Debris	6 inches or designed sediment trap depth of sediment.	No sediment present in presettling pond or vault. Sediment is removed.
Drain Rock	Water Ponding	If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events. If buried drain rock, observe drawdown through observation port or cleanout.	No water ponding on surface during storm events. <i>Clear piping through facility when ponding occurs. Replace rock material/sand reservoirs as necessary. Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill.</i>

If you are unsure whether a problem exists, contact a professional engineer.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	"Dump no pollutants" (or similar) stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste-Drains to Stream" or "Only rain down the drain"/ "Puget Sound starts here") painted or embossed on or adjacent to all storm drain inlets.
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inlet capacity by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.
General	Trash and Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
General	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
General	Trash and Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
General	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.
General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch.	No holes and cracks in the top slab allowing material to run into the basin.
General	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
General	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
General	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
General	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
General	Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
General	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. <i>(Coordinate removal/cleanup with Pierce County Surface Water Management 253-798-2725 and/or Dept. of Ecology Spill Response 800-424-8802.)</i>
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is in place and secured.
Catch Basin Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.
Catch Basin Cover	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Grates	Grate Opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.
Grates	Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.
Grates	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, contact a professional engineer.

#22 – Maintenance Checklist for Conveyance Systems (Pipes and Ditches):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Pipes	Sediment & Debris	Accumulated sediment that exceeds 20 percent of the diameter of the pipe.	Pipe cleaned of all sediment and debris.
Pipes	Vegetation	Vegetation that reduces free movement of water through pipes.	Vegetation does not impede free movement of water through pipes. <i>Prohibit use of sand and sealant application and protect from construction runoff.</i>
Pipes	Damaged (Rusted, Bent or Crushed)	Protective coating is damaged: rust is causing more than 50 percent deterioration to any part of pipe.	Pipe repaired or replaced.
Pipes	Damaged (Rusted, Bent or Crushed)	Any dent that significantly impedes flow (i.e. decreases the cross section area of pipe by more than 20 percent).	Pipe repaired or replaced.
Pipes	Damaged (Rusted, Bent or Crushed)	Pipe has major cracks or tears allowing groundwater leakage.	Pipe repaired or replaced.
Open Ditches	Trash & Debris	Dumping of yard wastes such as grass clippings and branches. Unsightly accumulation of non-degradable materials such as glass, plastic, metal, foam, and coated paper.	No trash or debris present. Trash and debris removed and disposed of as prescribed by the County.
Open Ditches	Sediment Buildup	Accumulated sediment that exceeds 20 percent of the design depth.	Ditch cleaned of all sediment and debris so that it matches design.
Open Ditches	Vegetation	Vegetation (e.g. weedy shrubs or saplings) that reduces free movements of water through ditches.	Water flows freely through ditches. Grassy vegetation should be left alone.
Open Ditches	Erosion Damage to Slopes	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	No erosion damage present. Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
Open Ditches	Erosion Damage to Slopes	Any erosion observed on a compacted berm embankment.	<i>If erosion is occurring on compacted berms a professional engineer should be consulted to resolve source of erosion.</i>
Open Ditches	Rock Lining Out of Place or Missing (If Applicable)	Native soil is exposed beneath the rock lining.	Rocks replaced to design standards.

If you are unsure whether a problem exists, contact a professional engineer.

#32 – Maintenance Checklist for Permeable Pavement:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Facility – General Requirements	Unstable Adjacent Area	Runoff from adjacent pervious areas deposits soil, mulch, or sediment on pavement.	No deposited soil or other materials on permeable pavement or other adjacent surfacing. All exposed soils that may erode to pavement surface mulched and/or planted.
Facility – General Requirements	Wearing Course Covered by Adjacent Vegetation	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge.	Vegetation does not impede function of adjacent facilities or pose as safety hazard. Groundcovers and shrubs trimmed to avoid overreaching the sidewalks, paths and street edge.
Porous asphalt or pervious cement concrete	NA	None. Maintenance to prevent clogging with fine sediment.	Conventional street sweepers equipped with vacuums, water, and brushes or pressure washer used to restore permeability. Vacuum or pressure wash the pavement two to three times annually.
Porous asphalt or pervious cement concrete	NA	None. Maintenance to prevent clogging with fine sediment.	Use of sand and sealant application prohibited. Protect from construction runoff.
Porous asphalt or pervious cement concrete	Cracks	Major cracks or trip hazards.	Potholes or small cracks filled with patching mixes. Large cracks and settlement addressed by cutting and replacing the pavement section.
Porous asphalt or pervious cement concrete	NA	Utility cuts.	Any damage or change due to utility cuts replaced in kind.
All Pavement Types	Leaf and Debris Accumulation	Fallen leaves or debris.	Removed/disposed.
Interlocking concrete paver blocks	Missing or Damaged Paver Block	Interlocking paver block missing or damaged.	Individual damaged paver blocks removed and replaced or repaired per manufacturer's recommendations.
Interlocking concrete paver blocks	Settlement	Settlement of surface. When deviation from original grade impedes function.	Original grade re-established. May require resetting.
All pavement types	All Pavement Types	Sediment or debris accumulation between paver blocks, on surface of pavement, or in grid voids.	Sediment at surface does not inhibit infiltration. Remove/dispose of sediment.
Interlocking concrete paver blocks	Void material is missing or low	Loss of aggregate material between paver blocks.	Refill per manufacturer's recommendations.
Open-celled paving grid with gravel	Loss of Aggregate Material in Paving Grid	Loss of aggregate material in grid.	Aggregate gravel level maintained at the same level as the plastic rings or no more than 0.25 inch above the top of rings. Refill per manufacturer's recommendations.

#32 – Maintenance Checklist for Permeable Pavement:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Open-celled paving grid with grass	Lack of Grass Coverage	Loss of soil and/or grass material in grid.	Refill and/or replant per manufacturer's recommendations. Growing medium restored, facility aerated and reseeded or planted, and vegetated area amended as needed.
Inlet/outlet pipe	Pipe is Damaged	Pipe is damaged.	Pipe is repaired/replaced.
Inlet/outlet pipe	Pipe is Clogged	Pipe is clogged.	Roots or debris is removed.
Inlet/outlet pipe	Erosion	Native soil exposed or other signs of erosion damage present.	No eroded or scoured areas Cause of erosion or scour is addressed.
Underdrain pipe	Blocked Underdrain	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period).	Underdrains and orifice free of sediment and debris. Jet clean or rotary cut debris/roots from underdrain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Spill Prevention and Response	NA	Storage or use of potential contaminants in the vicinity of facility.	Spill prevention measures exercised whenever handling or storing potential contaminants.
Spill Prevention and Response	Release of Pollutants	Any evidence of contaminants such as oil, gasoline, concrete slurries, paint, etc.	Spills are cleaned up as soon as possible to prevent contamination of stormwater. No contaminants or pollutants present. <i>(Coordinate source control, removal, and/or cleanup with Pierce County Surface Water Management 253-798-2725 and/or Dept. of Ecology Spill Response 800-424-8802.)</i>

If you are unsure whether a problem exists, contact a professional engineer.

Log Sheet

Use copies of this log sheet to keep track of when maintenance checks occur and what items, if any, are repaired or altered. The completed sheets will serve as a record of past maintenance activities and will provide valuable information on how your facilities are operating. This information will be useful for future requirements regarding the types of facilities that are installed. It helps to keep all log sheets in a designated area so that others can easily access them.

Date Checked: ____/____/____ Checked By: Name: _____ Position: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone Number: (____) _____
--

<u>Part of Facility Checked</u>	<u>Observations</u> <i>(List things that should be done)</i>	<u>Follow-up Actions Taken</u>	<u>Date Action Taken</u>