STORMWATER SITE PLAN REPORT

FOR

STEP BY STEP EARLY LEARNING CENTER

C&A PROJ # 21-003

PREPARED FOR:

STEP BY STEP FAMILY SUPPORT CENTER
3303 8TH AVENUE SE #A
PUYALLUP, WA 98372

PREPARED BY:

Cecil & Associates, LLC
PO BOX 598
BOTHELL, WA 98041

JUNE 5, 2025
PERMIT #PRCCP20241109

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Step By Step Early Learning Center

Cecil & Associates Project No. 21-003

June 5, 2025

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1. PROJECT OVERVIEW

1.1: PROJECT DESCRIPTION

The Step By Step Early Learning Center Project (the project) is located 3303 8th Avenue SE in Puyallup, Washington, parcel number 0420253071. The property is zoned ARO and is approximately 3.75 acres in size.

The site is currently developed and contains multiple businesses including Farm 12 Restaurant, Step by Step office space, and Fika Coffee and Cake company in multiple existing buildings. Site improvements include onsite parking, landscaping, and utilities, etc. that support the businesses. The overall property is bordered by 8th Avenue SE to the south, 33rd Street SE to the west, and Van Lierop Park to the north and east. This project will add to prior site improvements constructed around 2018-2019 called the Germaine Korum Center.

This project will remodel and expand an existing auxiliary building to provide classrooms, administrative space, and office space associated with early learning. A portion of the outdoor space will be enhanced with play and multi-purpose landscape areas. To accomplish this, stormwater treatment BMPs that were installed during the 2018 Germaine Korum Center project to provide runoff treatment for parking area will be replaced. Therefore, this project will need to redesign/add runoff treatment BMPs to the existing parking area to replace the impacted treatment BMPs in addition to the new expansion; See Section 4 below for details on the design of this system. In addition, the project will provide a sewer main extension to serve the building expansion and provide a connection for a re-routed (onsite) sewer force main serving under portions of the site. The building expansion will be sprinkled, water service is provided by Valley Water District.

The project will be permitted by the City of Puyallup. The City has adopted the 2019 Department of Ecology Stormwater Management Manual for Western Washington (Stormwater Manual), Puyallup Municipal Code 17.42.010, as a basis for stormwater management requirements. The project will be under stormwater review for Minimum Requirements (MR's) 1-9, assuming it is a redevelopment project per Figure 1-3.2 of the Stormwater Manual. The primary components of the stormwater mitigation plan include roof drain lines, parking area drainage, and runoff treatment BMPs (filter).

Project's that discharge through a manmade conveyance network (stabilized from erosion) to a receiving water listed as a Flow Control Exempt Receiving water are not required to provide flow control per TDA Exemptions listed in I-3.4.7 MR7: Flow Control. The project proposes to maintain the existing storm outfall to a man-made roadside ditch on the east side of 33rd St SE. This ditch flows north and ties into a previously constructed storm trunk line (see discussion in next paragraph) which outfalls into the Puyallup River, a Flow Control Exempt Receiving Water. This project is, therefore, exempt from Flow Control and will provide a capacity analysis for the

existing road-side ditch to verify post-development runoff rates can be conveyed to the flow control exempt water in lieu of installing flow control facilities.

The storm trunk line mentioned above was previously constructed as part of a development to the north of Farm 12. Because the Farm 12 property is located in an area served by this trunk line, a latecomer fee will be assessed in accordance with the "Latecomers Agreement for Reimbursement of Storm Trunkline Extension Project Between the City of Puyallup and Viking JV LLC" (Rec #202306290155), dated 6/29/2023.

1.2: EXISTING CONDITIONS

The existing site (as a whole) consists of two parcels, 0420253070 and 0420253071, 3.75 and 2.48 acres in size respectively. This project will predominantly impact the northern parcel, 0420253071. This section contains a description of both since both parcels are co-owned and operated, and improvements span multiple separate permits.

The site is bordered by public roads to the west and south and public land, Van Lierop Park, to the north and east. It is developed with six existing buildings, parking, and landscape that serve as the existing Farm 12 site including a restaurant, office space, common space, a coffee shop, greenhouse and a residence. Sewer and Stormwater service are provided by the City of Puyallup. An abandoned septic field will be removed, and the previously constructed sewer in 33rd St SE (constructed under a prior permit) will be further extended to serve the new ELC building. Water service is provided by Valley Water District. There are no known critical areas on or adjacent to the site.

A 75' wide Williams Gas easement bisects the property at an angle. Utilities within the Williams Gas easement typically consist of interstate natural gas lines. The applicant has coordinated the project design with Williams and has received approval from Williams for the proposed construction adjacent to the easement.

The site is located approximately 2,300 feet SW of the Puyallup River. From the City of Puyallup Public Data Viewer (online) runoff from the site generally discharges to the north in the 33rd Street SE public storm system consisting of open grass-lined ditch and 24-inch to 42-inch diameter storm lines for approximately 4,350-feet to the Puyallup River outfall. The Puyallup River is a flow control exempt receiving water.

A prior 2018 project called the Germaine Korum Center remodeled several of the buildings and installed new asphalt parking areas throughout the site. Runoff from onsite parking was treated with an engineered stormwater wetland that has been in place ever since. This project will replace the runoff treatment BMP with new building and landscaping, and, therefore, will be required to replace the runoff treatment function originally intended for the wetland. The prior project included an offsite downstream capacity analysis. At the time of the study most of the downstream system consisted of open ditches with culverts under driveways and intersections.

There were a couple of 18-inch culverts and a single 12-inch culvert that appeared to be the limiting factor in conveyance capacity. Since then, storm lines ranging from 24-inch to 42-inch diameter have been installed through most of the downstream to the river, except for approximately 680-feet of grass-line ditch that spans north of the project to the intersection of 5th Avenue SE (north of the project). The 2018 downstream drainage study was based on the 25-year peak runoff rate calculated using WWHM. The capacity of the 12-inch culvert (the restriction in the downstream) was estimated to be 5.2 cfs.

The site is relatively flat and will be considered 'flat,' 0-5% slopes for stormwater modeling purposes. Earthwork Solutions NW, LLC completed six test pits in February, 2017, and classified the site with up to six inches of top soil over predominately sandy silt with shallow groundwater encountered at 3-feet deep and mottling (evidence of higher groundwater) as shallow as 2-feet deep. The record septic drawings verify silty sand and silty loam with groundwater as shallow as 9 inches. The City has the site mapped as Briscot Loam. Based on this, the site will not be suitable for infiltration of stormwater. The landscape plan may contain permeable pavers or pervious landscape features; however, no credit for stormwater infiltration has been assumed for stormwater mitigation purposes. Permeable surfaces may provide unquantifiable benefits and/or be decorative in nature.

The table below was used to quantify existing land surface areas used for estimating existing peak runoff rates from the project area. The table summarizes a takeoff of impervious area estimates based on the *current* site conditions. An aerial photograph from the Pierce County parcel viewer, most current view, estimated to be imagery from a 2023 ortho shows the site area. Slopes across the site are considered 'flat' and soil class C was assumed for stormwater modeling purposes based on the subsurface description above. 15-minute time steps are assumed for calculating peaks in WWHM. The existing surface areas are quantified in the table below.

Existing Surfaces Conditions

	SF	Acres
Other Hard Surface Areas (Incl. Off-Site Imp. Areas)	81,177	1.86
Paved Surface Areas (PGIS)	48,278	1.11
Building (Roof) Areas	52,343	1.20
Pond Area	6,714	0.15
Offsite Impervious Area	8,563	0.20
Total Impervious Area	**188,512**	**4.33**
Total Pervious Area	**84,378**	**1.94**
Total Property Area	264,327	6.07
Total Project Area	272,890	6.26

Runoff peaks from the existing site based on the areas above are shown in the table below.

Flow Frequency Return Periods for Predeveloped.

Return Period	Flow(cfs)
2 year	1.525053
5 year	2.079412
10 year	2.487222
25 year	3.050815
50 year	3.507034
100 year	3.995539

The calculations were completed using version 4.2.19 of WWHM.

PublicGIS

Disclaimer: The map features are approximate and have not been surveyed. Additional features not yet mapped may be present.
Pierce County assumes no liability for variations ascertained by formal survey.

Date: 3/20/2025 11:47 AM

2. CONDITIONS AND REQUIREMENTS

The City has adopted the 2019 Department of Ecology Stormwater Management Manual for Western Washington (Stormwater Manual). The project includes more than 5,000 square feet of new or replaced impervious surface and therefore is required to comply with MR's #1through #9, outlined below.

2.1 MINIMUM REQUIREMENT #1 - PREPARATION OF STORMWATER SITE PLANS

Stormwater Site Plans have been prepared for this project. They are included in the Project's Permit Drawings. The Stormwater Site Plans have been prepared in accordance with Volume I.3.4.1 Stormwater Manual.

2.2 MINIMUM REQUIREMENT #2 -STORMWATER POLLUTION PREVENTION PLANS (SWPPP)

A SWPPP (less than 1 acre project area), showing general construction BMPs, has been prepared. A Temporary Erosion Sedimentation Control Plan (CSWPPP) has also been prepared and included with the Permit Documents. Source control BMPs applicable to every site will be implemented on this project. See section 2.3 below for a list of applicable source control BMPs.

2.3 MINIMUM REQUIREMENT #3 - SOURCE CONTROL OF POLLUTION

Volume I.3.4.3 Stormwater Manual contains a list of operational and source control BMPs that projects must implement if the listed uses are proposed as part of the development. Operational and source BMPs are taken from Volume III, Section 1.1 of the Ecology Manual. The following BMPs are applicable to this project.

S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems: this is an operational BMP and not shown in the plans. An Operations & Maintenance Manual has been prepared to cover the upkeep of the proposed conveyance system. This project is not being permitted for maintenance activities that might result in point-source pollution such as oil spills, etc. Therefore, no additional point source BMPs are required for this project.

Section IV-1 contains a list of source control BMPs applicable to all construction sites including:
S410 BMPs for Correcting Illicit Discharges to Storm Drains

- S453 BMPs for Formation of a Pollution Prevention Team
- S454 BMPs for Preventive Maintenance / Good Housekeeping
- S455 BMPs for Spill Prevention and Cleanup
- S456 BMPs for Employee Training
- S457 BMPS for Inspections
- S458 BMPs for Record Keeping

These BMPs will be implemented for this project.

2.4 MINIMUM REQUIREMENT #4 – PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

Natural drainage patterns will be maintained and discharges from the project will occur at the natural location to the extent practical. The proposed drainage design will discharge to the City's 33rd Street SE storm system.

2.5 MINIMUM REQUIREMENT #5 – ON-SITE STORMWATER MANAGEMENT

The project will follow the list approach (List 3 for flow control exempt projects) to meet the onsite stormwater management requirement. Section 4, below contains an itemized explanation of infeasibility for each stormwater BMP in priority, as required. Generally, infiltration is infeasible due to high groundwater. The landscape plan does contain permeable pavers which will provide unquantified benefits.

2.6 MINIMUM REQUIREMENT #6 – RUNOFF TREATMENT

The Puyallup River is a basic receiving water downstream of the Carbon River. The standard level of stormwater treatment triggered for this project is Basic Treatment. Runoff from the project will be treated by a Modular Wetland Linear (MWL), by Contech, prior to discharging to the public storm. MWL is GULD approved by for Basic Treatment. The offline 15-minute peak water treatment rate was calculated using WWHM for sizing of the filter BMP.

The treatment area includes parking installed in 2018 that was previously treated with an engineered stormwater wetland. This project will add parking and drop off to the improved building. Runoff from the new PGIS will mix with the existing parking area so they will all be treated at the same BMP. See Section 4.2 for treatment areas. Runoff treatment calculations are attached in Appendix A.

2.7 MINIMUM REQUIREMENT #7 – FLOW CONTROL

The downstream receiving water, the Puyallup River, is flow control exempt provided conditions of TDA Exemptions listed in I-3.4.7 MR7: Flow Control are met.

2.8 MINIMUM REQUIREMENT #8 – WETLANDS PROTECTION

There are no known wetlands on or adjacent to the project.

2.9 MINIMUM REQUIREMENT #9 – OPERATION AND MAINTENANCE

The proposed storm drainage system will be owned, operated, and maintained by the site owner. An Operation and Maintenance Manual with provisions consistent with Volume I and Volume V of SWMMWW for all stormwater treatment and flow control facilities/BMPs is attached in Appendix C of this report.

3. EXISTING SITE AND BASIN ASSESSMENT

3.1: DOWNSTREAM ANALYSIS

A site visit was conducted on February 29, 2024, during a period of overcast skies (temps in the low 40's) to review the downstream conditions from the discharge point of the site to ¼ mile or the receiving water, whichever is closer.

The site discharges via culvert on the east side of 33rd Street SE and flows north for approximately 680-feet to the 5th Avenue SE intersection. There the ditch drains into a relatively new 24-inch diameter storm line that conveys runoff north for approximately 700-feet where to the 74th Street E intersection (3-way intersection). Runoff turns west in a 36-inch diameter line for approximately 30-feet. Then turns north again in a 42-inch line. Runoff generally continues in a 42-inch storm line until it discharges to the Puyallup River.

A photo looking north along 33rd Street SE from the project outfall is shown below.

3.2: DOWNSTREAM ASSESSMENT SUMMARY

No capacity, flooding, or erosion problems were observed along the downstream system. In addition, since the storm system is relatively new it is assumed to have been designed to current

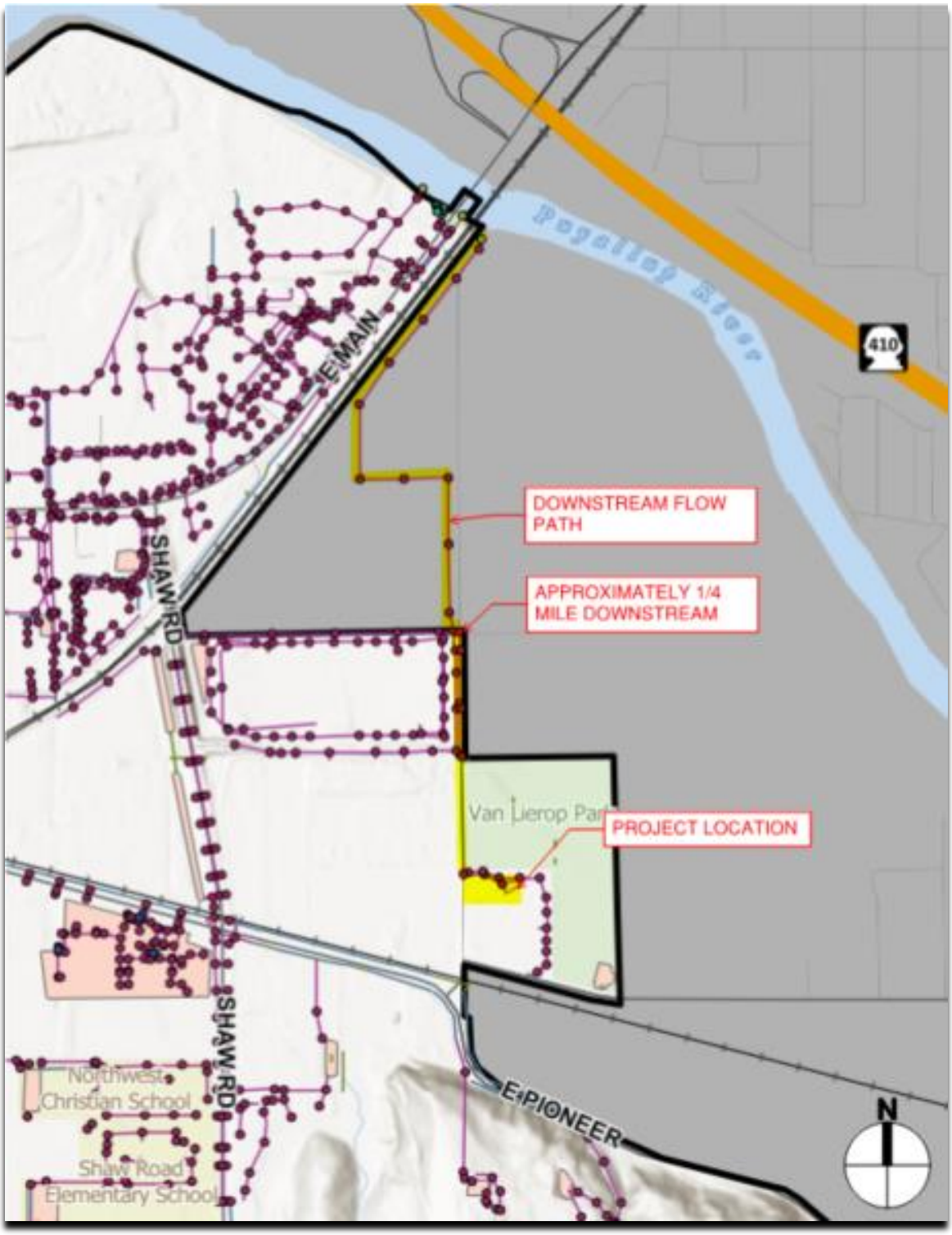
conveyance standards. This project will confirm the conveyance capacity as required for the flow control TDA exemption.

There is a map of the downstream storm system in its current condition at the time of application for reference below.

3.3: UPSTREAM ANALYSIS

There are a couple different upstream concerns. Offsite, 8th Avenue SE is uphill to the SE corner of the site. Runoff from the street should continue to bypass the project area. The road runoff from the street has not been quantified and is assumed to bypass the project based on prior project designs. Onsite, the new water treatment BMP will be for treatment of pollution generating parking surfaces only. Therefore, runoff from roofs and walkways throughout the property will need to continue to bypass the existing parking drainage so it does not contribute to the required treatment runoff rate.

DOWNSTREAM MAP



4. PERMANENT STORMWATER CONTROL

4.1: DESIGN OVERVIEW

The project will expand an old auxiliary barn building to include classrooms, office space, admin, and common area (early learning center). A drop off area will be added to the parking area in addition to several parking stalls. The existing stormwater lines will remain intact to the extent feasible, which includes drainage for most of the existing property and parking area.

However, the improvements will fill an existing stormwater treatment wetland that provides water treatment for parking area permitted in 2018. This project will add impervious (pollution generating) parking area including additional parking stalls and a new drop off lane to the overall tributary area of the parking lot. So, while replacing the existing wetland treatment BMP, the new parking surfaces will be added to the treatment requirement. Roof area for the new/improved early learning center will bypass the water treatment BMP so the roof area does not need to be counted in the sizing of the water treatment BMP.

Runoff treatment for the parking area will be provided via Modular Wetland Linear (soil media contained in an underground concrete vault. A stormwater pump station will be required to pump the treated stormwater. Pumped stormwater will flow through multiple onsite catch basins that will serve to dissipate pump energy and flow velocity prior to discharging to the ditch.

The table below is illustrative of the project improvements and the final site impervious/pervious conditions. Stormwater BMPs were sized using WWHM, the approved stormwater model assuming class C soils.

Developed Surfaces Conditions

	SF	Acres
New + Replaced Impervious Surfaces (NPRHS)	21,555	0.50
New + Replaced Paved Areas	12,105	0.28
New Sidewalk	1,236	0.03
Permeable Pavers (Assumed 50% Impervious Coverage)	1,067	0.02
New + Replaced Other Hard Surface	2,048	0.05
New Building (Roof) Areas	5,099	0.12
Existing Impervious Area Replaced with Landscape	29,449	0.68
* Existing Impervious Area Left in Place	150,500	3.46
*** Total Impervious Area**	**172,055**	**3.95**
Total Pervious (Landscape) Area	**92,272**	**2.12**
Total Property Area	264,327	6.07
Total Project Area	272,890	6.26

** Does not include Offsite Impervious Area*

4.2: WATER QUALITY

The project discharges to a Basic Treatment for stormwater runoff from targeted surfaces. The project will be displacing and existing water treatment wetland designed to treat 1.18 acres of parking area. The new added PGIS includes the expanded parking area plus the walkway areas draining to it. The table below shows the total impervious area required to be treated.

Runoff Treatment Areas

	SF	Acres
New Parking Areas	12,105	0.28
New Sidewalk Areas	1,236	0.03
Existing Parking Areas previously Treated by Pond	48,278	1.11
Existing Walkway Areas previously Treated by Pond	3,500	0.08
Total PGIS Area	**65,119**	**1.50**

Modular Wetland Linear (MWL) filters are GULD approved by the WA State Ecology TAPE program for Basic treatment. MWL are designed as offline treatment filters since they contain an approved internal bypass for high flows (the GULD approval allows this sizing technique). They are sized by treating the water quality flow rate, 15-min time step, as determined using WWHM, the approved stormwater model. Runoff rates exceeding the water treatment event can bypass the filters.

4.3: FLOW CONTROL

The project is flow control exempt, direct discharge to the Puyallup River. Capacity calculations from the Germaine Korum project have been used to verify the 25-year peak discharge rate from the developed project will be contained in the downstream system, a capacity analysis. See Appendix A.

4.4: CONVEYANCE REQUIREMENTS

The capacity of the offsite storm system downstream of the project was evaluated to verify capacity for the project. The prior engineer associated with the Germaine Korum project did multiple cross sections with computational capacity calculations. It was determined that a 12-inch diameter culvert had the smallest capacity at 5.2 cfs. The developed 25-year peak rate from the project is 2.96 cfs, calculated using WWHM. All other sections of the downstream evaluated for capacity exceeded the 25-year peak from the site. In addition, this project is paying a latecomer fee in accordance with the "Latecomers Agreement for Reimbursement of Storm Trunkline Extension Project Between the City of Puyallup and Viking JV LLC" (Rec #202306290155), dated 6/29/2023; for use of the downstream storm lines.

Proposed onsite Pump System:

A pump system will be installed downstream of Modular Wetland Linear filter to lift runoff up to a level where it can drain via gravity to the City's storm system, approximately 10 feet. The pump has been sized to pump the peak rate discharged from the vault at the 25-year peak to account for water treatment overflow, as calculated using WWHM.

4.5: STORMWATER BMP ANALYSIS (MR #5)

The project cannot meet the LID Performance standard; and, therefore, is opting to use List #3 to address this requirement. List #3 divides the developed surfaces into three categories consisting of Lawn and Landscape Areas, Roofs, and Other Hard Surfaces. Stormwater BMPs from the list must be implemented to the maximum extent feasible/possible in the order of priority listed unless the site meets certain infeasibility criteria outlined in each specific BMP specification. The summary below categorizes each surface and describes the BMPs that will be used from the list OR why the BMPs are infeasible in order of priority from the list.

Lawn and Landscape Areas: BMP T5.13: Post-Construction Soil Quality and Depth is required and will be implemented for landscape areas. Conclusion: BMP T5.13 will be implemented to the maximum extent feasible.

Roof Areas: 1) The first BMPs to be considered is Full Infiltration. The project does not have soils suitable for infiltration due to high groundwater. Therefore, this BMP is considered infeasible. 2) Downspout Dispersion – the site does not contain a vegetated flow path required for downspout dispersion. This BMP is infeasible. 3) Perforated stub-out connections – due to high groundwater and low permeability in the native soils perforated stub-out connections are considered infeasible.

Other Hard Surfaces: 1) Sheet Flow Dispersion or Concentrated Flow Dispersion – the site does not contain a vegetated flow path required for dispersion. This BMP is infeasible. Conclusion: Other Hard Surface BMPs are infeasible.

5. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

The project will has provided a Temporary Erosion and Sediment Control (TESC) Plan with the permit documents.

5.1: TESC PLAN ANALYSIS AND DESIGN

The area of disturbance for this project is under one acre and does not trigger coverage under Ecology General Construction Stormwater Discharge Permit. A TESC plan is provided with the application to mitigate impacts of construction stormwater. Each of the 13 Construction SWPPP Elements has been listed below to discuss how the TESC Plan addresses each element.

Clearing and grading activities are only permitted within the areas shown in the permit documents. The Construction SWPPP (TESC Plan) shall be implemented beginning with initial land disturbance and maintained until final project stabilization. Sediment and Erosion control BMPs shall be consistent with the BMPs contained in Volume II-3 Construction Stormwater BMPs.

Element 1: Preserve Vegetation / Mark Clearing Limits

a. Before beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
b. Retain the duff layer, native top soil, and natural vegetation in an undisturbed state to the maximum degree practicable.

Plastic, metal, fabric fence, or other physical barriers may be used to mark the clearing limits. Note the difference between the practical use and proper installation of BMP C233: Silt Fence and the proper use and installation of BMP C103: High-Visibility Fence.

If it is not practical to retain the duff layer in place, then stockpile it on site, cover it to prevent erosion, and replace it immediately when you finish disturbing the site.

Suggested BMPs for Element 1

BMP C101: Preserving Natural Vegetation

BMP C102: Buffer Zones

BMP C103: High-Visibility Fence

BMP C233: Silt Fence

Developed areas of the site that will not be impacted during construction will be clearly marked and delineated. The installation of signage and fencing will be used to delineate temporary pedestrian/vehicle routes to safely manage visitors during construction.

Element 2: Establish Construction Access

Limit construction vehicle access and exit to one route, if possible.

Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking of sediment onto public roads.

Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

If sediment is tracked off site, clean the affected roadway(s) thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or picking up and transporting the sediment to a controlled sediment disposal area.

Conduct street washing only after sediment is removed in accordance with 2.d (above).

Control street wash wastewater by pumping back on site, or otherwise prevent it from discharging into systems tributary to waters of the State.

Suggested BMPs for Element 2

BMP C105: Stabilized Construction Access

BMP C106: Wheel Wash

BMP C107: Construction Road / Parking Area Stabilization

Element 3: Control Flow Rates

Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.

Where necessary to comply with the statement above, construct stormwater infiltration or detention BMPs as one of the first steps in grading. Assure that detention BMPs function properly before constructing site improvements (e.g., impervious surfaces).

If permanent infiltration BMPs are used for temporary flow control during construction, protect these BMPs from siltation during the construction phase.

Conduct a downstream analysis if changes in flows could impair or alter conveyance systems, streambanks, bed sediment, or aquatic habitat. See III-3.2 Preparing a Stormwater Site Plan for off-site analysis guidelines.

Even gently sloped areas need flow controls such as BMP C235: Wattles or other energy dissipation / filtration structures. Place dissipation facilities closer together on steeper slopes. These methods prevent water from building higher velocities as it flows downstream within the construction site.

Control structures designed for permanent detention BMPs are not appropriate for use during construction without modification. If used during construction, modify the control structure to allow for long-term storage of runoff and enable sediment to settle. Verify that the BMP is sized appropriately for this purpose. Restore BMPs to their original design dimensions, remove sediment, and install a final control structure at completion of the project.

Erosion has the potential to occur because of increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site. The local permitting agency may require infiltration or detention BMP designs that provide additional or different stormwater flow control than the designs detailed in this manual. These requirements may be necessary to address local conditions or to protect properties and waterways downstream.

Since this project discharges to a flow control exempt receiving water there are no restrictions in release rates assuming the downstream system can be protected from erosion, flooding, and damage.

Suggested BMPs for Element 3

BMP C209: Outlet Protection

BMP C235: Wattles

BMP C241: Sediment Pond (Temporary use existing pond)

Element 4: Install Sediment Controls

Design, install, and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants.

Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.

Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

Direct stormwater runoff from disturbed areas through BMP C241: Sediment Pond (Temporary) or other appropriate sediment removal BMP, before the runoff leaves a construction site. Runoff from fully stabilized areas may be discharged without a sediment removal BMP.

Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.

Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

Suggested BMPs for Element 4

BMP C233: Silt Fence

BMP C235: Wattles

BMP C241: Sediment Pond (Temporary)

BMP C250: Construction Stormwater Chemical Treatment

BMP C251: Construction Stormwater Filtration

Element 5: Stabilize Soils

Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.

Control stormwater volume and velocity within the site to minimize soil erosion.

Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:

During the dry season (May 1 – September 30): 7 days

During the wet season (October 1 – April 30): 2 days

Stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Stabilize soil stockpiles from erosion, protect with sediment trapping measures, and where possible, locate away from storm drain inlets, waterways and drainage channels.

Minimize the amount of soil exposed during construction activity.

Minimize the disturbance of steep slopes.

Minimize soil compaction and, unless infeasible, preserve topsoil.

Suggested BMPs for Element 5

BMP C120: Temporary and Permanent Seeding

BMP C121: Mulching

BMP C122: Nets and Blankets

BMP C123: Plastic Covering

BMP C124: Sodding

BMP C125: Topsoiling / Composting

BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection

BMP C130: Surface Roughening

BMP C131: Gradient Terraces

BMP C140: Dust Control

Element 6: Protect Slopes

Construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).

Divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on site.

At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.

Place excavated material on the uphill side of trenches, consistent with safety and space considerations.

Place check dams at regular intervals within constructed channels that are cut down a slope.

Suggested BMPs for Element 6

BMP C121: Mulching

BMP C122: Nets and Blankets

BMP C123: Plastic Covering

BMP C124: Sodding

BMP C130: Surface Roughening

Element 7: Protect Drain Inlets

Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

Protect all existing storm drain inlets so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

Keep all approach roads clean. Do not allow sediment and street wash water to enter storm drains without prior and adequate treatment (as defined above) unless treatment is provided before the storm drain discharges to waters of the State.

Inlets should be inspected weekly at a minimum and daily during storm events.

Suggested BMPs for Element 7

BMP C220: Inlet Protection

Element 8: Stabilize Channels and Outlets

Design, construct, and stabilize all on-site conveyance channels to prevent erosion.

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

Suggested BMPs for Element 8

BMP C122: Nets and Blankets

BMP C202: Riprap Channel Lining

BMP C207: Check Dams

BMP C209: Outlet Protection

Element 9: Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The project proponent must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, or to the sanitary sewer, with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: recycled concrete stockpiles, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.

g. Adjust the pH of stormwater if necessary to prevent violations of water quality standards.

h. Assure that washout of concrete trucks is performed off site or in designated concrete washout areas only. Do not wash out concrete truck drums or concrete handling equipment onto the ground, or into storm drains, open ditches, streets, or streams. Washout of small concrete handling equipment may be disposed of in a formed area awaiting concrete where it will not contaminate surface or ground water. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage

or concrete discharge directly to ground water or surface waters of the State is prohibited. Do not wash out to formed areas awaiting infiltration BMPs.

i. Obtain written approval from Ecology before using chemical treatment other than CO2, dry ice, or food grade vinegar to adjust pH.

j. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

Suggested BMPs for Element 9

BMP C151: Concrete Handling

BMP C152: Sawcutting and Surfacing Pollution Prevention

BMP C153: Material Delivery, Storage, and Containment

BMP C154: Concrete Washout Area

BMP C250: Construction Stormwater Chemical Treatment

BMP C251: Construction Stormwater Filtration

BMP C252: Treating and Disposing of High pH Water

Element 10: Control Dewatering

Discharge foundation, vault, and trench dewatering water, which have similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary).

Discharge clean, non-turbid dewatering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element 8: Stabilize Channels and Outlets, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment BMPs.

Handle highly turbid or otherwise contaminated dewatering water separately from stormwater.

Other dewatering treatment or disposal options may include:

- Infiltration.
- Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
- Ecology-approved on-site chemical treatment or other suitable treatment technologies.
- Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.
- Use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering.

Suggested BMPs for Element 10

BMP C203: Water Bars

BMP C236: Vegetative Filtration

Element 11: Maintain BMPs

Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.

Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Suggested BMPs for Element 11

BMP C150: Materials on Hand

BMP C160: Certified Erosion and Sediment Control Lead

Element 12: Manage the Project

Phase development projects to the maximum degree practicable and take into account seasonal work limitations.

Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit (CSWGP) must conduct site inspections and monitoring in accordance with Special Condition S4 of the CSWGP.

Maintain, update, and implement the Construction SWPPP.

Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By the initiation of construction, the Construction SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times.

The project manager must ensure that the project is built in such a way to comply with all Construction SWPPP Elements, as detailed in this section. Considerations for the project manager include, but are not limited to:

- construction phasing
- seasonal work limitations
- coordination with utilities and other contractors
- inspection
- monitoring
- maintaining an updated construction SWPPP
- Phasing of Construction

Phase development projects where feasible in order to prevent soil erosion and transporting of sediment from the site during construction. Revegetate exposed areas and maintain that vegetation as an integral part of the clearing activities for any phase.

Clearing and grading activities for developments shall be permitted only if conducted using an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. Minimize removing trees and disturbing or compacting

native soils when establishing permitted clearing and grading areas. Show on the site plans and the development site 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.

Inspection

All BMPs must be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections must be conducted by a person knowledgeable in the principles and practices of erosion and sediment control. The person must have the skills to 1) assess the site conditions and construction activities that could impact the quality of stormwater, and 2) assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

For construction sites one acre or larger that discharge stormwater to surface waters of the state, a CESCL must be identified in the construction SWPPP; this person must be on-site or on-call at all times. Certification must be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology. See BMP C160: Certified Erosion and Sediment Control Lead.

Appropriate BMPs or design changes shall be implemented as soon as possible 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.

The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

Based on the results of the inspection, construction site operators must correct the problems identified by:

- Reviewing the Construction SWPPP for compliance with the 13 elements and making appropriate revisions within 7 days of the inspection.

- Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request an extension within the initial 10-day response period.

- Documenting BMP implementation and maintenance in the site log book (applies only to sites that have coverage under the Construction Stormwater General Permit).

- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month

- Maintaining an Updated Construction SWPPP

- Retain the Construction SWPPP on-site or within reasonable access to the site.

- Modify the Construction SWPPP whenever there is a change in the 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 Construction SWPPP must be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the Construction SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. Modify the Construction SWPPP as necessary to include additional or modified BMPs designed to correct problems identified. Complete revisions to the Construction SWPPP within seven (7) days following the inspection.

Suggested BMPs for Element 12

BMP C150: Materials on Hand

BMP C160: Certified Erosion and Sediment Control Lead

BMP C162: Scheduling

Element 13: Protect Low Impact Development BMPs

(Note, this project does not contain any LID BMPs that require additional protection)

The primary purpose of On-Site Stormwater Management is to reduce the disruption of the natural site hydrology through infiltration. BMPs used to meet I-3.4.5 MR5: On-Site Stormwater Management (often called LID BMPs) are permanent facilities.

Protect all LID BMPs (including, but not limited to BMP T7.30: Bioretention, BMP T5.14: Rain Gardens, and BMP T5.15: Permeable Pavements) from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the LID 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 Bioretention/Rain Garden soils, and replacing the removed soils with soils meeting the design specification.

Maintain the infiltration capabilities of LID BMPs by protecting against compaction by 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 BMP T5.15: 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.

Permeable 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 BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

Suggested BMPs for Element 13

BMP C103: High-Visibility Fence

BMP C201: Grass-Lined Channels

BMP C207: Check Dams

BMP C233: Silt Fence

Prior to final construction approval, the project site will be stabilized to prevent sediment-laden water from leaving the project site after project completion. All disturbed areas of the project site will be vegetated or otherwise permanently stabilized. At a minimum, disturbed areas will be

seeded and mulched to ensure that sufficient cover will develop shortly after final approval. All temporary ESC measures will be removed within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed. Trapped sediment will be removed or stabilized onsite. Disturbed soil areas resulting from removal of measures or vegetation will be permanently stabilized with pavement, gravel, mulch, seeding or sodding.

6. SPECIAL REPORTS AND STUDIES

The following studies and/or reports were referenced in the compilation of this Drainage Report

- Earth Solutions NW, LLC. Geotechnical Report, dated April 12, 2017.

7. FIGURES

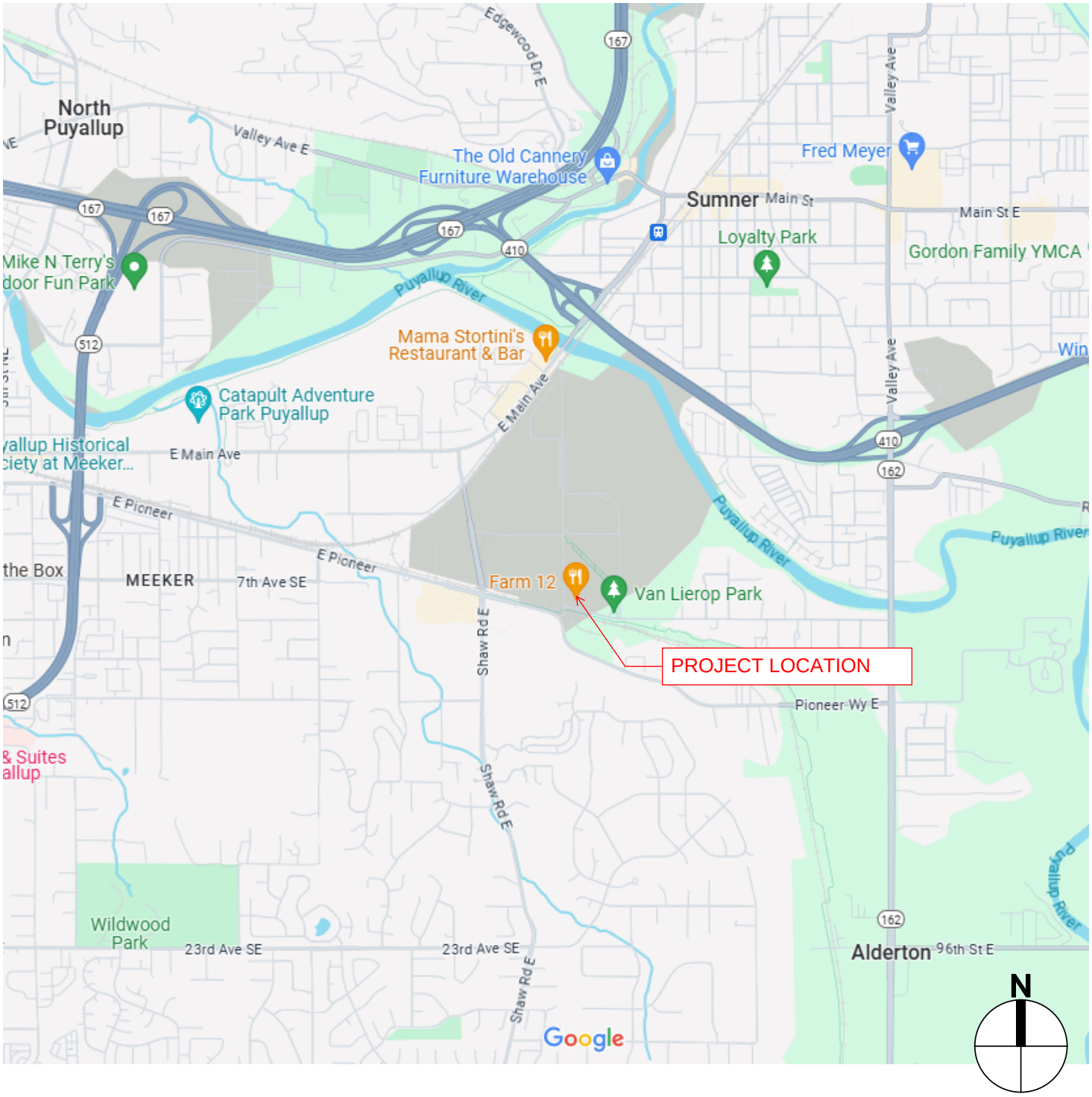
FIGURE 1: VICINITY MAP

FIGURE 2: EXISTING SITE DRAINAGE BASINS

FIGURE 3: DEVELOPED SITE DRAINAGE BASINS

FIGURE 4: SOILS MAP

VICINITY MAP

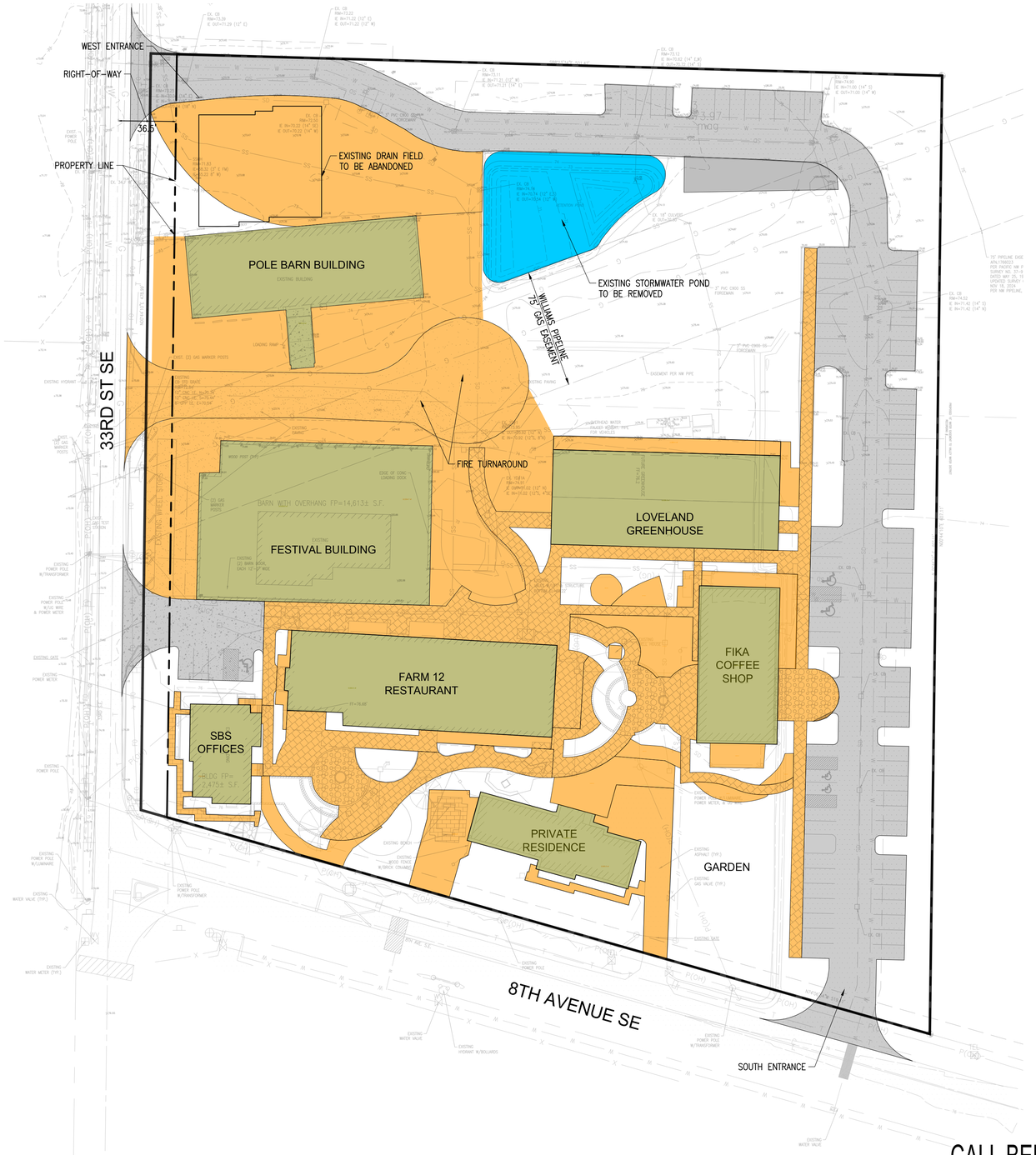


PORTION OF THE SW 1/4, SW 1/4, SEC. 25, TWP 20 N., R. 4 E., W.M.

FIGURE 2 - EXISTING SITE DRAINAGE BASINS

Existing Surfaces Conditions

	SF	Acres
Other Hard Surface Areas (Incl. Off-Site Imp. Areas)	81,177	1.86
Paved Surface Areas (PGIS)	48,278	1.11
Building (Roof) Areas	52,343	1.20
Pond Area	6,714	0.15
Offsite Impervious Area	8,563	0.20
Total Impervious Area	**188,512**	**4.33**
Total Pervious Area	**84,378**	**1.94**
Total Property Area	264,327	6.07
Total Project Area	272,890	6.26



LEGEND

(NOTE: NOT ALL SYMBOLS MAY APPEAR ON THE MAP)

- SURVEY MONUMENT (AS NOTED)
- POWER METER
- POWER POLE
- JUNCTION BOX (AS NOTED)
- CATCH BASIN (CB)
- STORM MANHOLE (SDMH)
- SANITARY SEWER MANHOLE (SSMH)
- CLEANOUT (AS NOTED)
- GAS METER
- GAS VALVE
- WATER VALVE (WV)
- FAUCET
- FIRE HYDRANT(FH) / CONNECTION(FDC)
- WATER MANHOLE
- WATER METER
- BLOW-OFF / AIRVAC
- MONITOR WELL
- SIGN
- IRRIGATION SPRINKLER
- HANDICAP
- CHAIN LINK FENCE
- WOOD FENCE
- HOGWIRE FENCE
- SILT FENCE
- WATER LINE
- GAS LINE
- TELEPHONE LINE (OH) OR (UG)
- POWER LINE (OH) OR (UG)
- STORM LINE
- SEWER LINE
- DECIDUOUS TREE
- CONIFEROUS TREE
- CONCRETE
- GRAVEL/SAND (AS NOTED)
- ASPHALT
- BUILDING LINE

ABBREVIATIONS

(R#)	REFERENCE SURVEYS
(OH)	OVERHEAD
(UG)	UNDERGROUND
(TYP)	TYPICAL
(C)	CALCULATED
(M)	MEASURED

N

HORIZ. 0 20 40 80
Scale In Feet

APPROVED

BY _____
CITY OF PUYALLUP
DEVELOPMENT ENGINEERING

DATE _____

NOTE:
THIS APPROVAL IS VOID AFTER 180 DAYS FROM APPROVAL DATE.

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CALL BEFORE YOU DIG 811
UNDERGROUND SERVICE (USA)

REVISIONS

No.	Description	Date
2	RESPONSE TO 1ST CITY REVIEW	03/21/2025
1	CIVIL PERMIT APPLICATION	07/09/2024

21-003 Project No.
PFA Drawn By
RJC Designed By
RJC Approved By
06/18/2024 Date

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(206) 484-3495
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JEFFREY E. BROWN, AIA
CONTACT

STEP BY STEP
EARLY LEARNING CENTER

EXISTING SITE
DRAINAGE BASINS

PORTION OF THE SW 1/4, SW 1/4, SEC. 25, TWP 20 N., R. 4 E., W.M.

FIGURE 3 - DEVELOPED SITE DRAINAGE BASINS

SURVEY INFORMATION:

HORIZONTAL DATUM:
HORIZONTAL DATUM FOR THIS SURVEY IS NAD 83/91 PER WSDOT. WSDOT MONUMENT ID NO. 2207 WAS HELD FOR POSITION, AND A LINE BETWEEN SAID POINT 2207 AND WSDOT MONUMENT ID NO. 4773 WAS HELD FOR ROTATION, BEING SOUTH 87°21'52" WEST.

VERTICAL DATUM:
VERTICAL DATUM FOR THIS SURVEY IS NAVD88 PER WSDOT. WSDOT MONUMENT ID NO. 3851 WAS HELD FOR ELEVATION, BEING 79.419'(NADV88)

DATES OF SURVEY:
FIELD SURVEY BY BARGHAUSEN CONSULTING ENGINEERS, INC. CONDUCTED IN OCTOBER, 2016. ALL MONUMENTS SHOWN AS FOUND WERE VISITED AT THAT TIME, UNLESS OTHERWISE NOTED.

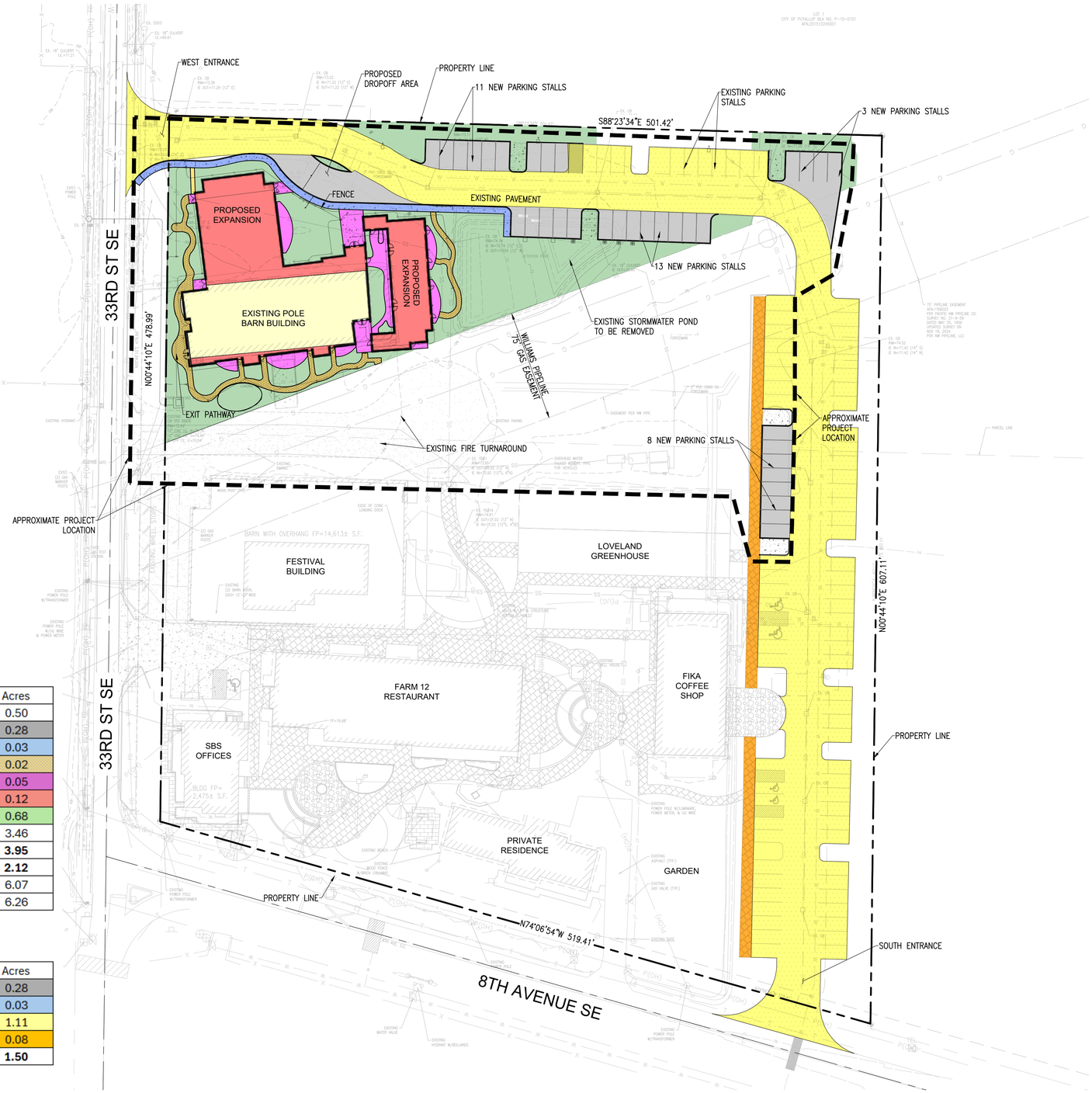
GROSS LOT AREA:
LOT AREA = 272,265± S.F. (6.250± ACRES)

SURVEYOR'S NOTES:
1. ALL DISTANCES SHOWN HEREON ARE IN U.S. SURVEY FEET

LEGAL DESCRIPTION:
THAT PORTION OF THE WEST ONE-THIRD OF THE SOUTH HALF OF THE SOUTHWEST QUARTER OF SECTION 25, TOWNSHIP 20 NORTH, RANGE 4 EAST, WILLAMETTE MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS;

COMMENCING AT THE INTERSECTION OF THE EAST LINE OF SAID WEST ONE-THIRD OF THE SOUTH HALF AND THE NORTH MARGIN OF 80TH STREET EAST;
THENCE NORTH 88°40'46" WEST, 49.23 FEET ALONG SAID NORTH MARGIN TO AN ANGLE POINT;
THENCE NORTH 74°06'46" WEST, 333.37 FEET ALONG SAID NORTH MARGIN TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 00°44'18" EAST, 607.11 FEET;
THENCE NORTH 88°23'27" WEST, 501.42 FEET TO THE EAST MARGIN OF 134TH AVENUE EAST;
THENCE SOUTH 00°44'18" WEST, 478.99 FEET ALONG SAID EAST MARGIN TO SAID NORTH MARGIN;
THENCE SOUTH 74°06'46" EAST, 519.41 FEET ALONG SAID NORTH MARGIN TO THE TRUE POINT OF BEGINNING.

(LOT 2 OF CITY OF PUYALLUP BLA NO. P-15-0101, AUDITOR'S FILE NUMBER 201512245001, RECORDS OF PIERCE COUNTY, WASHINGTON)



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- GAS METER
- GAS VALVE
- WATER VALVE (WV)
- FAUCET
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- WATER MANHOLE
- WATER METER
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- MONITOR WELL
- SIGN
- IRRIGATION SPRINKLER
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- WOOD FENCE
- HOGWIRE FENCE
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- WATER LINE
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- T(XX) TELEPHONE LINE (OH) OR (UG)
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	ABBREVIATIONS
(R#)	REFERENCE SURVEYS
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(UG)	UNDERGROUND
(TYP)	TYPICAL
(C)	CALCULATED
(M)	MEASURED

HORIZ. 0 20 40 80
Scale In Feet

Developed Surfaces Conditions

	SF	Acres
New + Replaced Impervious Surfaces (NPRHS)	21,555	0.50
New + Replaced Paved Areas	12,105	0.28
New Sidewalk	1,236	0.03
Permeable Pavers (Assumed 50% Impervious Coverage)	1,067	0.02
New + Replaced Other Hard Surface	2,048	0.05
New Building (Roof) Areas	5,099	0.12
Existing Impervious Area Replaced with Landscape	29,449	0.68
* Existing Impervious Area Left in Place	150,500	3.46
*** Total Impervious Area**	**172,055**	**3.95**
Total Pervious (Landscape) Area	**92,272**	**2.12**
Total Property Area	264,327	6.07
Total Project Area	272,890	6.26

** Does not include Offsite Impervious Area*

Runoff Treatment Areas

	SF	Acres
New Parking Areas	12,105	0.28
New Sidewalk Areas	1,236	0.03
Existing Parking Areas previously Treated by Pond	48,278	1.11
Existing Walkway Areas previously Treated by Pond	3,500	0.08
Total PGIS Area	**65,119**	**1.50**

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APPROVED
BY _____
CITY OF PUYALLUP
DEVELOPMENT ENGINEERING
DATE _____

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REVISIONS

No.	Description	Date
3	RESPONSE TO 2ND CITY REVIEW	05/30/2025
2	RESPONSE TO 1ST CITY REVIEW	03/31/2025
1	CIVIL PERMIT APPLICATION	07/09/2024

21-003 Project No.
PFA Drawn By
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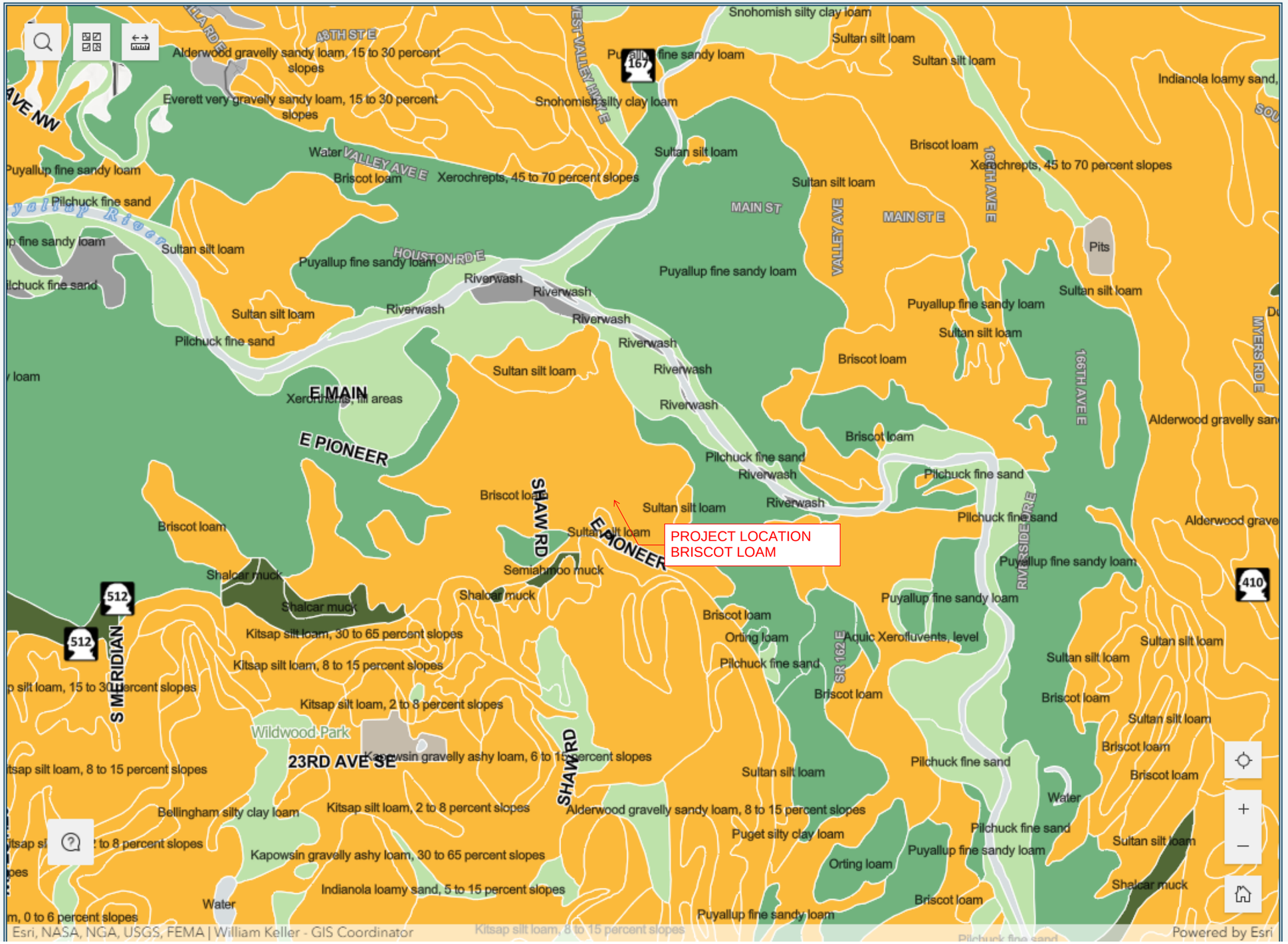
STEP BY STEP
EARLY LEARNING CENTER

DEVELOPED SITE
DRAINAGE BASINS

C2.00

City of Puyallup Public Data Viewer

SOILS MAP



Legend

Environment

Puyallup Soils

- Alfisols
- Andisols
- Entisols
- Gelisols
- Histosols
- Inceptisols
- Mollisols
- Spodosols
- No Soil
- Bodies of Water
- Data Not Available

N

8. APPENDICES

APPENDIX A: SUPPORTING CALCULATIONS

- Peak Runoff Rate Calculations
- Runoff Treatment Calculations
- Conveyance Calculations

APPENDIX B: GEOTECHNICAL REPORT

APPENDIX C: OPERATION & MAINTENANCE MANUAL

APPENDIX A: SUPPORTING CALCULATIONS

SITE PEAK RUNOFF CALCAULTIONS; ALSO USED FOR CONVEYANCE

WWHM2012
PROJECT REPORT

Project Name: Peaks
Site Name: Farm 12
Site Address:
City : Puyallup
Report Date: 6/5/2025
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	1.94
Pervious Total	1.94

Impervious Land Use	acre
ROADS FLAT	4.13
Impervious Total	4.13
Basin Total	6.07

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	2.12
Pervious Total	2.12

Impervious Land Use	acre
ROADS FLAT	3.95
Impervious Total	3.95
Basin Total	6.07

Element Flows To:
Surface Interflow Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.94
Total Impervious Area:4.13

Mitigated Landuse Totals for POC #1
Total Pervious Area:2.12
Total Impervious Area:3.95

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.525053
5 year	2.079412
10 year	2.487222
25 year	3.050815
50 year	3.507034
100 year	3.995539

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.469172
5 year	2.008166
10 year	2.405427
25 year	2.955284
50 year	3.400986
100 year	3.878741

WATER QUALITY CALCULATIONS

WWHM2012
PROJECT REPORT

Project Name: Water Quality
Site Name: Farm 12
Site Address:
City : Puyallup
Report Date: 6/5/2025
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	1.5
Pervious Total	1.5

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.5

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
ROADS FLAT	1.5
Impervious Total	1.5
Basin Total	1.5

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.5
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:1.5

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.031609
5 year	0.049175
10 year	0.058719
25 year	0.068433
50 year	0.074207
100 year	0.078955

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.525676
5 year	0.705629
10 year	0.83642
25 year	1.015425
50 year	1.159088
100 year	1.311876

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.161 **acre-feet**
On-line facility target flow: 0.2221 **cfs.**
Adjusted for 15 min: 0.2221 **cfs.**
Off-line facility target flow: 0.128 **cfs.**
Adjusted for 15 min: 0.128 **cfs.** <- 57.5 GPM

Perlnd and Implnd Changes

No changes have been made.

REFERENCE CONVEYANCE CALCULATIONS FROM GERMAINE KORUM DRAINAGE REPORT

Know what's below. Call before you dig.

DITCH SECTION EXHIBIT - OVERALL

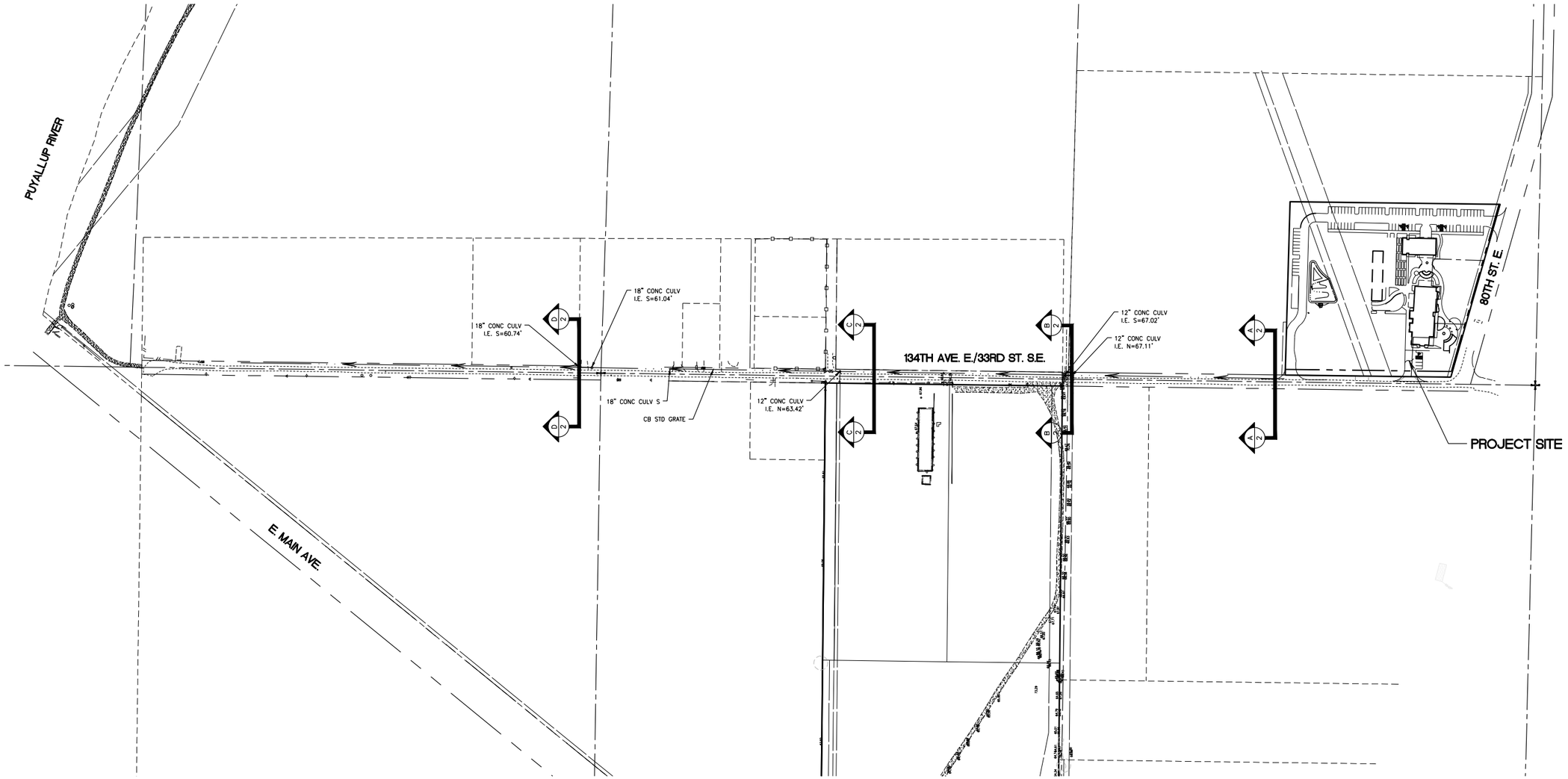
FOR

GERMAINE KORUM CENTER

A PORTION OF THE NW¼ OF THE SW¼ OF SEC. 25, TWP. 20 NORTH, RGE. 4 EAST, W.M.
CITY OF PUYALLUP PIERCE COUNTY WASHINGTON

1"=150'

0 75 150 300



No.	Date	By	Ckd.	Appr.	Revision

Title: DITCH SECTION EXHIBIT - OVERALL FOR GERMAINE KORUM CENTER

For:

STEP BY STEP
PO BOX 488
MILTON, WA 98354
PHONE: 253-896-0903

Scale: Horizontal 1"=150' Vertical -

Designed —
Drawn —
Checked —
Approved —
Date 8/10/18

BERGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH
KENT, WA 98032
(425)251-6222
(425)251-8782 FAX
CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

Job Number 17376

Sheet 1 of 2

File:P:\17000s\17376\exhibit\17376-Ditch Sections.dwg Date/Time:8/23/2018 2:39 PM Scale:1" = 1' TLOUDON Xref: ----

Know what's below. Call before you dig.

DITCH SECTION EXHIBIT-PROFILES

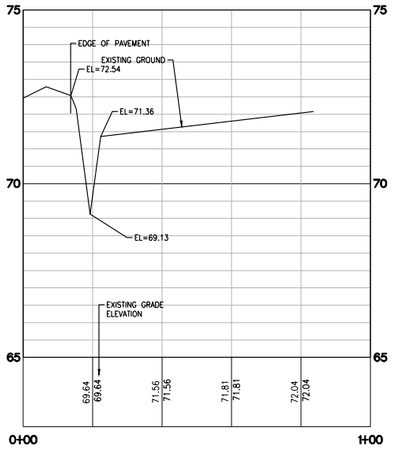
FOR

GERMAINE KORUM CENTER

A PORTION OF THE NW¼ OF THE SW¼ OF SEC. 25, TWP. 20 NORTH, RGE. 4 EAST, W.M.
CITY OF PUYALLUP PIERCE COUNTY WASHINGTON

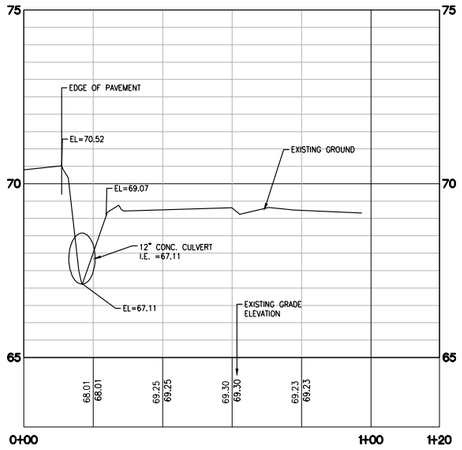
0 10 20 40
HORIZONTAL

0 1 2 4
VERTICAL



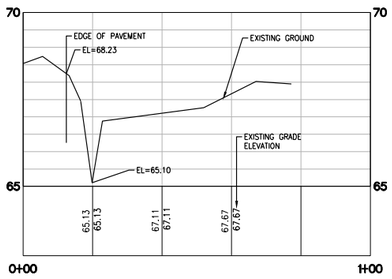
DITCH SECTION A-A

SCALE: H: 1"=20' V: 1"=2'



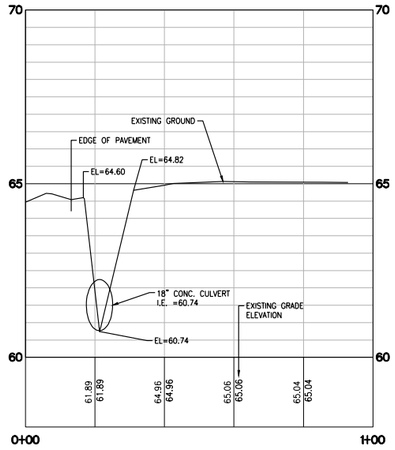
DITCH SECTION B-B

SCALE: H: 1"=20' V: 1"=2'



DITCH SECTION C-C

SCALE: H: 1"=20' V: 1"=2'



DITCH SECTION D-D

SCALE: H: 1"=20' V: 1"=2'

No.	Date	By	Ckd.	Appr.	Revision

Title: DITCH SECTION EXHIBIT FOR GERMAINE KORUM CENTER

For: STEP BY STEP
PO BOX 488
MILTON, WA 98354
PHONE: 253-896-0903

Scale: Horizontal 1"=50' Vertical -

Designed —
Drawn —
Checked —
Approved —
Date 8/10/18

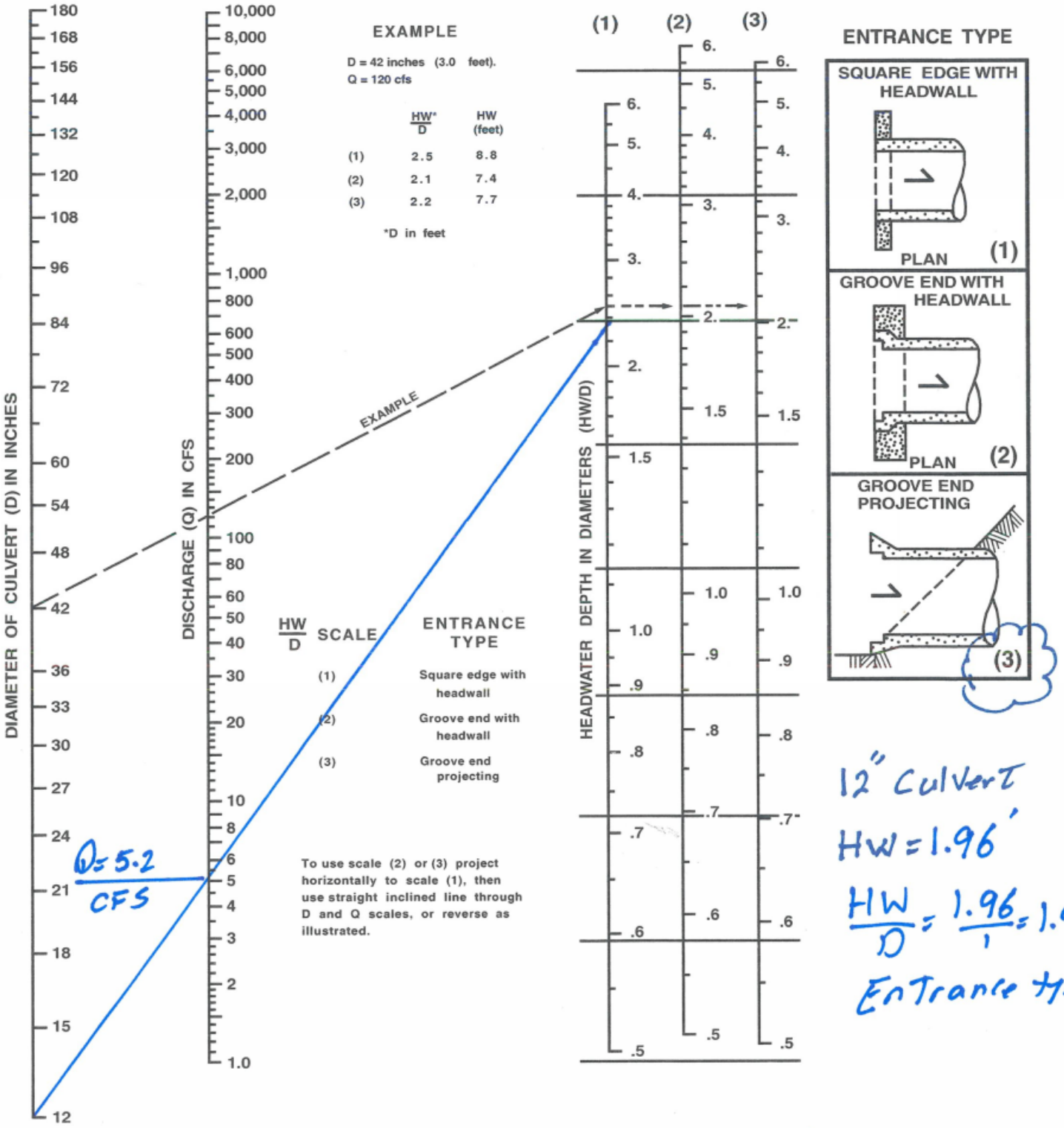
BERGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH
KENT, WA 98032
(425)251-6222
(425)251-8782 FAX
CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

Job Number 17376

Sheet 2 of 2

FileP:\17000s\17376\exhibit\17376-Ditch Sections.dwg Date/Time8/23/2018 2:39 PM Scale;1" = 1' TLOUDON Xref: ----

FIGURE 4.3.1.B
HEADWATER DEPTH FOR SMOOTH INTERIOR PIPE CULVERTS WITH INLET CONTROL



Q = 5.2 CFS

12" Culvert

HW = 1.96'

$\frac{HW}{D} = \frac{1.96}{1} = 1.96$

Entrance type 3

Pipe Capacity Calculations

BARGHAUSEN CONSULTING ENGINEERS, INC.

DATE:_____ PAGE____OF____

ENGINEER: _____

PROJECT #:_____

PROJECT/SUBJECT: Step by Step

Down Stream Drinage analysis Conclusion

1. Estimated 25 year discharge From site = ~~2.65 CFS~~ 2.96 CFS

2. Estimated 25 year Peak Flow From road = 0.88 CFS

Total Estimated 25 year Flow = ~~3.53 CFS~~ 3.84 CFS

3. Estimated ditch / Culvert Capacity:

Section A-A	Q = 13.35 CFS
Section B-B	Q = 20.97 CFS
section C-C	Q = 6.02 CFS
section D-D	Q = 39.31 CFS

12" Culvert Under Head = 5.2 CFS

Existing ditch / Pipe has sufficient capacity For Temporary discharge. IT is recommended that Existing ditch & Culverts to be Cleaned & over grown vegetation to be removed.

APPENDIX B: GEOTECHNICAL REPORT

Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

GEOTECHNICAL ENGINEERING STUDY
GERMAINE KORUM CENTER
611 & 703 - 33rd STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-4960

1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

STEP BY STEP FAMILY SUPPORT CENTER
c/o JEFF BROWN ARCHITECTURE

April 12, 2017

Brett J. Priebe, E.I.T.
Staff Engineer

KEVEN D. HOFFMANN STATE OF WASHINGTON 53734 REGISTERED PROFESSIONAL ENGINEER

04/12/2017

Keven D. Hoffmann, P.E.
Senior Project Engineer

Raymond A. Coglas, P.E.
Principal

GEOTECHNICAL ENGINEERING STUDY
GERMAINE KORUM CENTER
611 & 703 – 33RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-4960

Earth Solutions NW, LLC
1805 – 136th Place Northeast, Suite 201
Bellevue, Washington 98005
Phone: 425-449-4704 Fax: 425-449-4711
Toll Free: 866-336-8710

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER06045.0M

April 12, 2017
ES-4960

Step by Step Family Support Center
c/o Jeff Brown Architecture
12181 C Street South
Tacoma, Washington 98444

Attention: Mr. Jeff Brown

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

Dear Mr. Brown:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Germaine Korum Center, 611 & 703 – 33rd Street Southeast, Puyallup, Washington". Based on the results of our investigation, the proposed development is feasible from a geotechnical standpoint. Our study indicates the site is underlain by alluvium (silty sand and poorly graded sand). During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet below existing grades at the test pit locations.

Where necessary, new structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent bearing soil for new foundations will likely be encountered within the upper three to five feet of existing grades.

Construction of the stormwater detention pond within the northern site area is feasible from a geotechnical standpoint, provided adequate separation between the facility base and the seasonal high groundwater table can be incorporated into final designs. Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet below existing grades. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program, through at least one wet season, is recommended. Additionally, the need to install a pond liner should be anticipated. It is noted that, given the presence of both relatively shallow groundwater and impermeable soils, native soils are not feasible for infiltration from a geotechnical standpoint.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Keven D. Hoffmann, P.E.
Senior Project Engineer

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ES-4960

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Cont'd

ES-4960

GEOTECHNICAL ENGINEERING STUDY
GERMAINE KORUM CENTER
611 & 703 – 33RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-4960

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed development to be completed at 611 & 703 – 33rd Street Southeast in Puyallup, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this study included the following:

- Completing test pits for purposes of characterizing site soils;
- Completing laboratory testing of soil samples collected at the test pit locations;
- Conducting engineering analyses, and;
- Preparation of this report.

The following documents and maps were reviewed as part of our study preparation:

- Conceptual Site Plan, prepared by Jeff Brown Architecture, dated October 10, 2016;
- Boundary and Topographic Survey, prepared by Barghausen Consulting Engineers, Inc., dated October 10, 2016;
- Liquefaction Susceptibility for Pierce County, incorporating data from the Washington State Department of Natural Resources, September 2004;
- Surficial Geologic Map of the Lake Tapps Quadrangle, Washington, by D. R. Crandell, published 1963, and;
- Online Web Soil Survey (WSS) resource, provided by the United States Department of Agriculture (USDA), Natural Resources Conservation Service.

Project Description

We understand the proposed development will be comprised of several one- or two-story structures, two greenhouses, parking areas and drive lanes, and related infrastructure improvements. Many of the existing structures will be retained. Ingress and egress will be provided chiefly by 8th Avenue Southeast. Future, paved overflow parking may be constructed off-site, near the southeastern corner of the property. At the time of report submission, specific grading and building loading plans were not available for review; however, based on our experience with similar projects, the proposed structures will likely be two to three stories in height and constructed utilizing relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads will likely be 1 to 2 kips per lineal foot (klf). Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf).

Based on existing topographic relief across the site, we estimate grade cuts and fills of about 5 to 10 feet may be necessary to establish finish grades for the proposed improvements. We understand stormwater runoff will be managed primarily by a detention pond (pond) located within the northern site area.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that our geotechnical recommendations been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located on the northeast corner of the intersection between 33rd Street Southeast and 8th Avenue Southeast in Puyallup, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The property is comprised of two adjoining tax parcels (Pierce County Parcel Nos. 042025-3070 and -3071) totaling about 6.25 acres.

The site is bordered to the north and east by open farmland, to the south by 8th Avenue Southeast, and the west by 33rd Street Southeast. The Van Lierop Bulb Farm currently occupies the site and is comprised of a single-family residence, several outbuildings, and related improvements. We understand the majority of existing structures will be retained and repurposed as part of the proposed construction. Site topography is essentially level; about two feet of elevation change occurs across the property. Vegetation consists primarily of grass and landscaped features.

Subsurface

An ESNW representative observed, logged, and sampled six test pits, excavated at accessible locations within the property boundaries, on February 28, 2017 using a trackhoe and operator retained by our firm. The test pits were completed for purposes of assessment and classification of site soils as well as characterization of groundwater conditions within areas proposed for new development. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Select soil samples collected at the test pit locations were evaluated in accordance with both Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was encountered generally within the upper one to six inches of existing grades at the test pit locations. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions. Based on our field observations, we estimate topsoil will be encountered across the site with an average thickness of four inches. Deeper pockets of topsoil, however, may be encountered locally throughout the site.

Fill was encountered to a depth of approximately one foot below the existing ground surface (bgs) at TP-6 within a gravel parking area. The fill was characterized as medium dense, silty sand with gravel. Where encountered, fill will likely be suitable for re-use as structural fill, but should be evaluated at the appropriate time of construction by ESNW.

Native Soil

Underlying topsoil, native soils were encountered consisting primarily of medium dense, silty sand (USCS: SM), sandy silt (USCS: ML), and poorly graded sand (USCS: SP). The native soils were observed primarily in a moist to wet condition. Slight to heavy caving, as well as trace to abundant wood debris, was observed within the native soils. The maximum exploration depth was approximately 13.5 feet bgs.

Geologic Setting

The referenced geologic map resource identifies alluvium (Qa) across the site and surrounding areas. As reported on the geologic map resource, alluvium in the Puyallup Valley is chiefly sand. Alluvium is characteristic of modern floodplains and was deposited directly by streams and running water. The referenced WSS resource identifies Briscot loam and Sultan silt loam (Map Unit Symbols: 6A and 42A, respectively) as the primary soil units underlying the subject site. Briscot loam and Sultan silt loam were formed in floodplains. Based on our field observations, native soils on the subject site are generally consistent with the geologic setting outlined in this section.

Groundwater

During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations. Soil mottling was identified within native deposits at about two to three feet bgs. In our opinion, groundwater will likely be encountered within site excavations, particularly within deeper excavations for new utilities and the pond (where necessary). Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches, sumps, and dewatering pumps. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program (discussed in the *Preliminary Detention Pond Design* section of this report), through at least one wet season, is recommended.

Liquefaction Hazard Evaluation

Based on our review of the referenced liquefaction susceptibility map, the subject site is located within a moderate to high liquefaction susceptibility area. The mapped hazard susceptibility is based on the presence of Holocene alluvial deposits and the presence of abandoned channel and meander-bend cutoff features northeast of the subject site, in addition to relatively shallow groundwater. Holocene alluvial deposits are normally consolidated and consist primarily of silty fine to medium sand and relatively clean, fine to medium sand. The supporting documentation included in the referenced liquefaction susceptibility map suggests that, based on review of liquefaction caused by the Loma Prieta earthquake in the Monterey Bay region of California, liquefaction may be concentrated in areas mapped as abandoned channel fill and point-bars within younger fluvial deposits.

Liquefaction Susceptibility

Liquefaction is a phenomenon where saturated or loose soils suddenly lose internal strength and behave as a fluid. This behavior is in response to soil grain contraction and increased pore water pressures resulting from an earthquake or other intense ground shaking. Our field exploration indicates medium dense to dense, native silty sands, silts, and sands (consistent with Holocene alluvium deposits), as well as relatively shallow groundwater, underlie the site. In our opinion, the site presents a moderate susceptibility to liquefaction-induced settlement during a seismic event. Given our understanding that existing structures will largely remain in place, it is our opinion the proposed redevelopment will not increase site susceptibility to liquefaction.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, the suitability of using native soils as structural fill, construction of the detention pond, and installation of site utilities.

In our opinion, the proposed structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent native soil, suitable for support of new foundations, will likely be encountered within the upper three to five feet of existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Construction of the stormwater detention pond within the northern site area is feasible from a geotechnical standpoint, provided adequate separation between the facility base and the seasonal high groundwater table can be incorporated into final designs. Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet below existing grades. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program, through at least one wet season, is recommended. Additionally, the need to install a pond liner should be anticipated. It is noted that, given the presence of both relatively shallow groundwater and impermeable soils, native soils are not feasible for infiltration from a geotechnical standpoint.

This study has been prepared for the exclusive use of the Step by Step Family Support Center and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, performing site clearing and site stripping (as necessary), and removing select, existing structural improvements. Subsequent earthwork procedures will involve relatively minor grading and related infrastructure improvements.

Temporary Erosion Control

Prior to the installation of either initial or final pavement sections, temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered in order to both minimize off-site soil tracking and provide a stable access surface for construction vehicles. Geotextile fabric may also be considered underlying the quarry spalls for greater stability of the temporary construction entrance. Erosion control measures should consist of silt fencing placed around appropriate portions of the site perimeter. Where generated, soil stockpiles should be covered or otherwise protected to reduce the potential for soil erosion during periods of wet weather. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Additional Best Management Practices (BMPs), as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities, as necessary.

Stripping

Topsoil was encountered generally within the upper one to six inches of existing grades at the test pit locations. While we do not anticipate topsoil stripping will be significant, ESNW should be retained to observe site stripping activities at the time of construction. Over-stripping may result in increased project development costs and should be avoided. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas, if desired.

In-situ and Imported Soils

From a geotechnical standpoint, native soils may not be suitable for use as structural fill, unless the soils are at (or slightly above) the optimum moisture content at the time of placement and compaction. Based on relatively appreciable fines contents, native soils should be considered moisture sensitive. Successful use of native soils as structural fill will largely be dictated by the moisture content at the time of placement and compaction. In general, on-site soils that are at (or slightly above) the optimum moisture content at the time of placement and compaction may be used as structural fill. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, if grading activities take place during months of heavy rainfall activity, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill and subsequent import of granular structural fill. Soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Subgrade Preparation

Foundation and slab subgrade surfaces should be placed on competent bearing subgrades. Loose or unsuitable soil conditions encountered below areas of footing and slab elements should be remedied as recommended in this report. Uniform compaction of the foundation and slab subgrade areas (where necessary) will establish a relatively consistent subgrade condition below the foundation and slab elements. ESNW should observe the foundation and slab subgrade prior to placing formwork. Supplementary recommendations for subgrade improvement may be provided at the time of construction and would likely include further mechanical compaction effort and/or overexcavation and replacement with suitable structural fill.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fill placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas is considered structural fill as well. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). More stringent compaction specifications may be required for utility trench backfill zones depending on the responsible utility district or jurisdiction.

Foundations

In our opinion, the proposed structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent native soil, suitable for support of new foundations, should be encountered within the upper three to five feet of existing grades. Where necessary, loose or unsuitable soil conditions exposed at foundation subgrade elevations should be compacted to the specifications of structural fill or overexcavation and replaced with a suitable structural fill. Organic material encountered at structural subgrade elevations should be removed, and grades should be restored with structural fill.

Provided the foundations will be supported as described above, the following parameters may be used for design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.35

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. In accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class E should be used for design. Please refer to the *Liquefaction Susceptibility* section of this report for an assessment of liquefaction risk during a seismic event.

Lateral Spread

Lateral spread is a form of liquefaction where soil is mobilized laterally, usually towards a free-face such as a riverbank. However, there are no creeks or rivers in proximity to the subject site. The Puyallup River is located approximately 2,200 feet to the northeast of the subject site. In our opinion, there is negligible potential for lateral spread to occur at the subject site. As such, the risk of lateral spread affecting the proposed construction is negligible.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed structures should be supported on a well-compacted, firm and unyielding subgrade. Where feasible, native soils exposed at the slab-on-grade subgrade level can likely be compacted in situ to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, prior to construction of the slab.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining crushed rock or gravel should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

• Active earth pressure (yielding condition)	35 pcf (equivalent fluid)
• At-rest earth pressure (restrained condition)	55 pcf
• Traffic surcharge (passenger vehicles)	70 psf (rectangular distribution)*
• Passive earth pressure	300 pcf (equivalent fluid)
• Coefficient of friction	0.35
• Seismic surcharge	7H**

* *Where applicable*
** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design, where applicable.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill can consist of a less permeable soil, if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations. Soil mottling was identified within native deposits at about two to three feet bgs. We estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs, with the shallower groundwater intrusion and soil mottling indicative of an upper seepage zone(s). As such, groundwater should be anticipated within site excavations, particularly in excavations at depth for utilities and the pond. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects. Based on the soil and groundwater conditions observed at the test pit locations, dewatering of excavations extending below five feet bgs would be necessary, particularly if grading occurs during the wetter winter season.

Finish grades must be designed to direct surface drain water away from structures. Water must not be allowed to pond adjacent to structures, slopes or walls. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Feasibility

As indicated in the *Subsurface* section of this report, native soils encountered at depth during our fieldwork were characterized primarily as sandy silt, sandy silt, and poorly graded sand. Based on the results of USDA textural analyses, the native soils were classified primarily as sand, sandy loam, and loam. Irrespective of gravel content, fines contents of the native sand and loam were about 4 to 14 percent and 33 to 64 percent, respectively, at the tested locations.

From a geotechnical standpoint, it is our opinion the native soils are not feasible for design and construction of new infiltration facilities. The native, relatively impermeable deposits and the presence of relatively shallow groundwater intrusion were the primary bases for this opinion. Based on our field observations, groundwater would likely interfere with the successful design, construction, and function of on-site infiltration facilities.

Preliminary Detention Pond Design

We understand a stormwater detention pond is proposed within the northern site area. Groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations, and we estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs. If a definitive groundwater elevation(s) is required, it is our opinion a groundwater-monitoring program should be completed. The program would include installation of one or two piezometers within the proposed pond footprint and subsequent monitoring through at least one wet season. The information would be used to definitively assess seasonal high groundwater levels. ESNW can prepare a groundwater-monitoring program upon request.

Based on the native soil makeup, the need to install a pond liner should be anticipated. The pond liner should consist of a suitable low-permeability option and may include compacted till, clay, a geomembrane material, or concrete. Given the relative permeability of native soils, the need for imported pond-liner material should be anticipated. Where utilized, the impermeable soil liner should be at least 24 inches in thickness and installed around the entire bottom and sides of the pond. The pond-liner material should be installed in loose lifts of six inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557.

The functionality of a pond is largely related to successful construction methods. In our experience, inadequate or poor construction techniques typically result in pond failure (due to leakage). Leakage repairs are difficult to detect and remediate, and as such, are costly and time-consuming to complete. ESNW should observe construction activities for the pond on a full-time basis to verify adequate soil compaction and installation methods and to provide supplementary recommendations, as necessary.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Soils that exhibit high compressive strengths are allowed steeper temporary slope inclinations than are soils that exhibit lower strength characteristics.

Based on the soil conditions encountered at the test pit locations, native soils would be classified as Type C by OSHA and WISHA. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than one-and-one-half horizontal to one vertical (1.5H:1V). The presence of perched groundwater may cause localized sloughing of the temporary slopes due to excess seepage forces. ESNW should observe site excavations to confirm soil types and allowable slope inclinations. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion, and should maintain a gradient of 2H:1V or flatter. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions. Supplementary excavation and slope recommendations may be provided at the time of construction, as necessary.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;
- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

The HMA, ATB and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Final pavement design recommendations, including recommendations for heavy traffic areas, main access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the City of Puyallup may supersede the recommendations provided in this report.

Utility Support and Trench Backfill

In our opinion, native soils may generally be suitable for support of utilities. Organic-rich soils are not considered suitable for direct support of utilities and may require removal at utility grades if encountered. Remedial measures, such as overexcavation and replacement with structural fill and/or installation of geotextile fabric, may be necessary in some areas in order to provide support for utilities. Groundwater may be encountered within utility excavations, and caving of trench walls may occur where groundwater is encountered. Temporary construction dewatering, as well as temporary trench shoring, may be necessary during utility excavation and installation as conditions warrant.

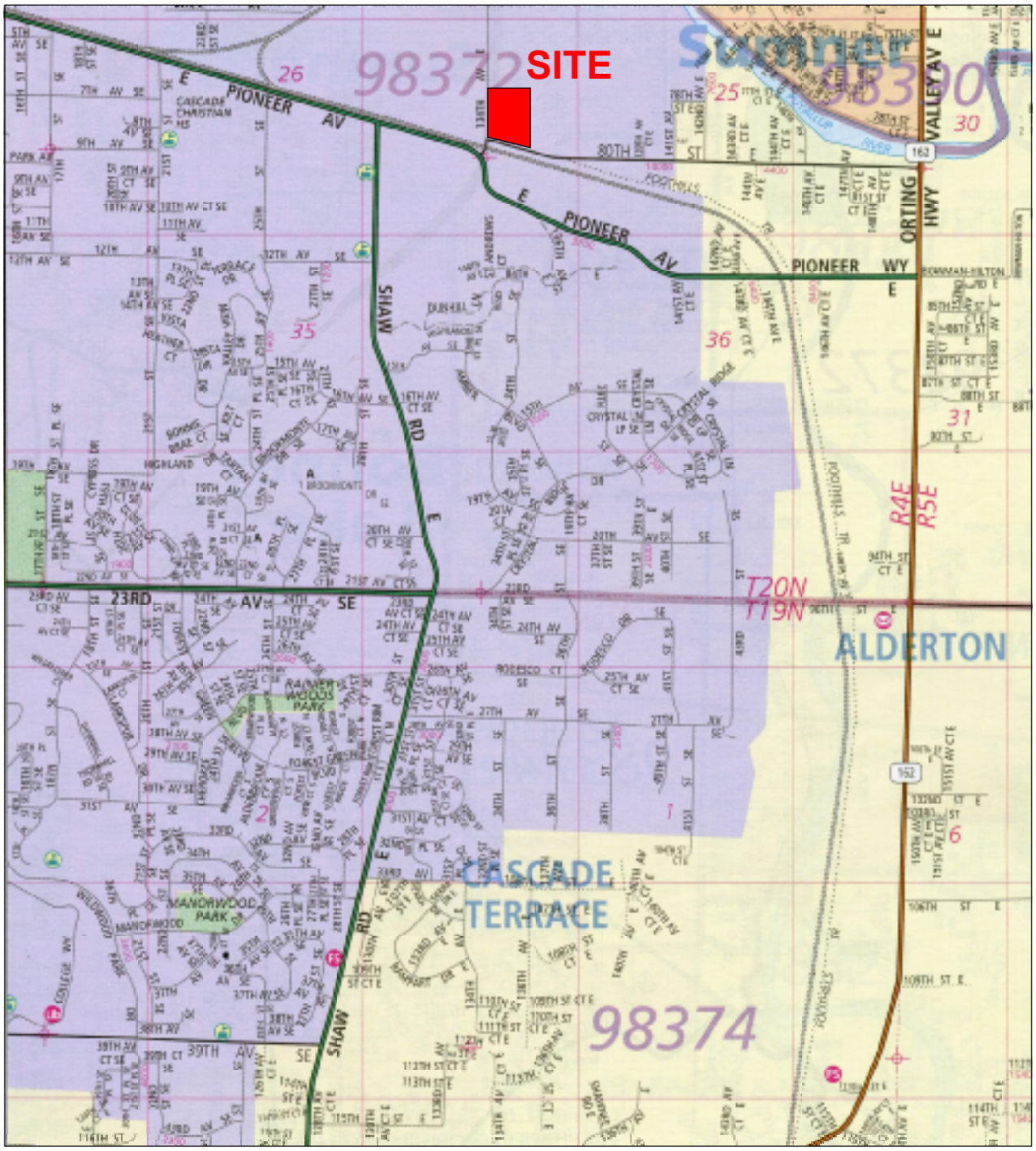
In general, native soils may not be suitable for use as structural backfill throughout utility trench excavations, unless the soils are at (or slightly above) the optimum moisture content at the time of placement and compaction. Structural trench backfill should not be placed dry of the optimum moisture content. Each section of the site utility lines must be adequately supported in appropriate bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the City of Puyallup or other responsible jurisdiction or agency.

LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this study. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
Pierce County, Washington
Map 835
By The Thomas Guide
Rand McNally
32nd Edition

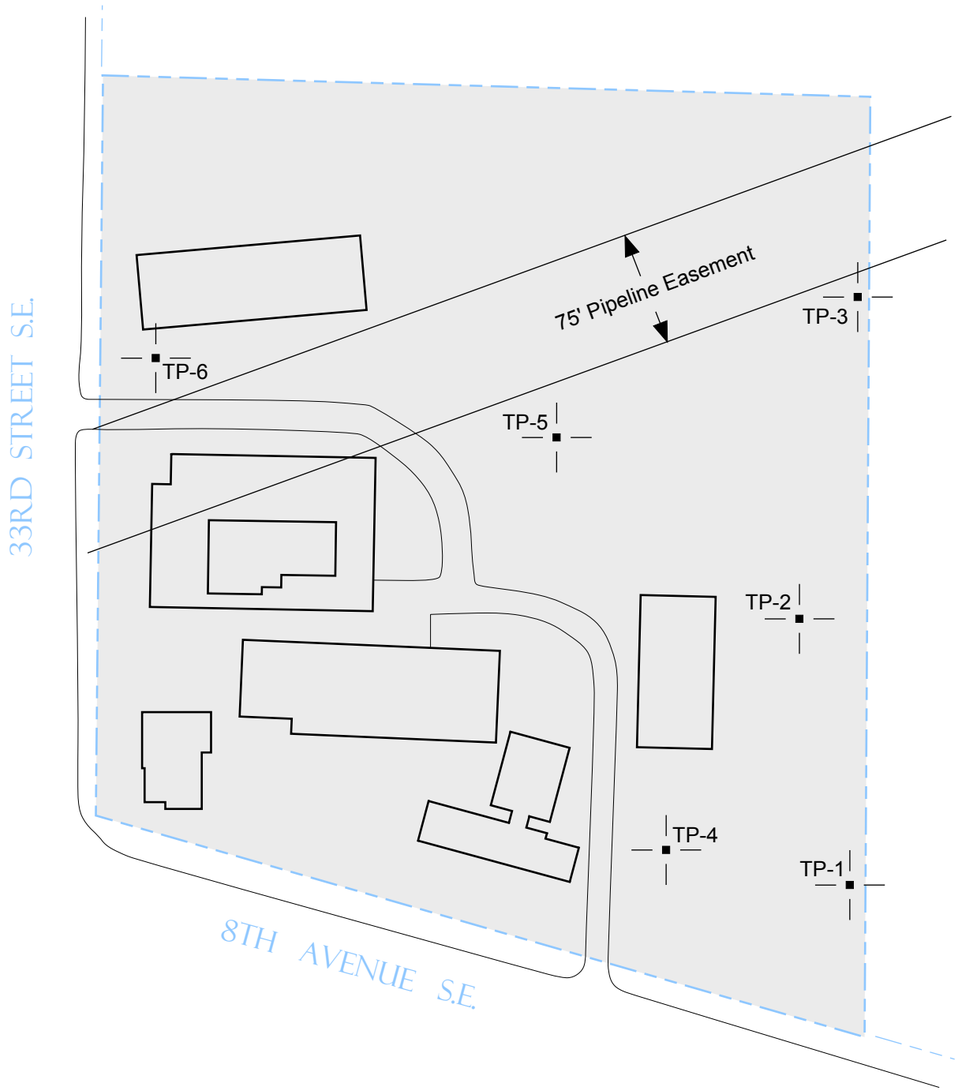
NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-4960, Feb. 2017

Subject Site

Existing Building

NORTH

1"=100' 0 50 100 200 Scale in Feet

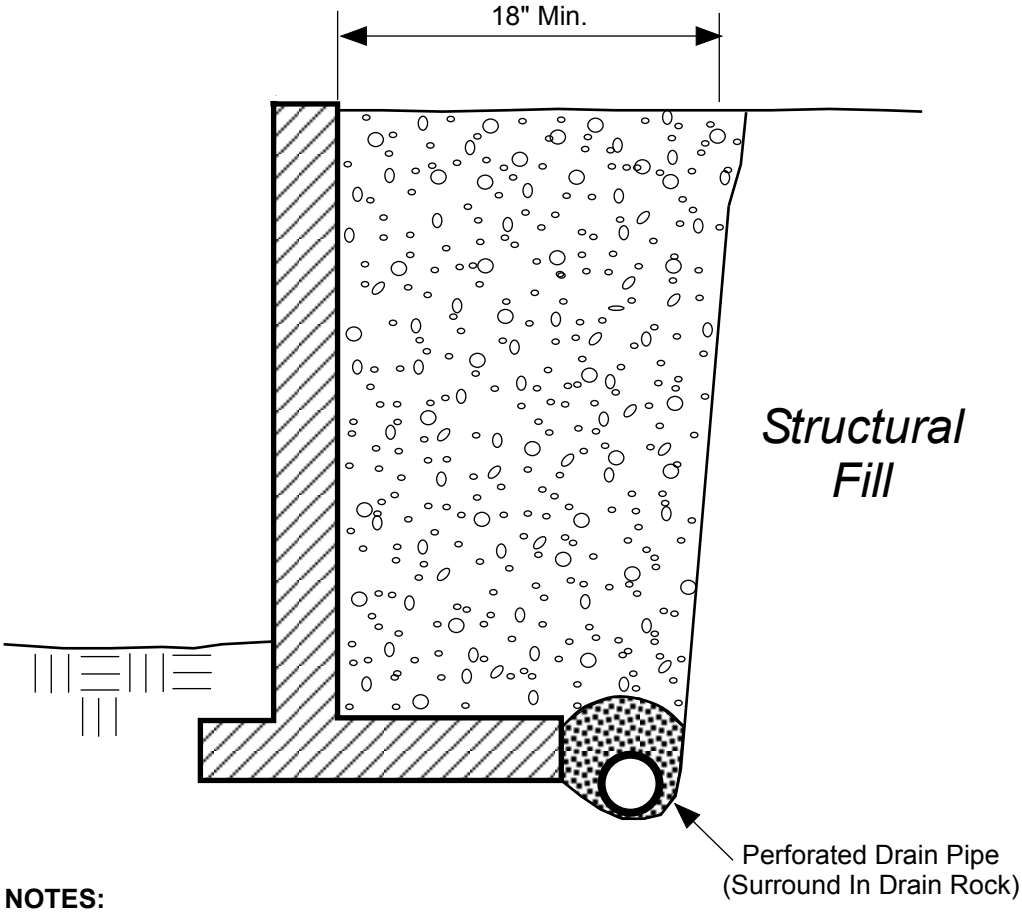
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Germaine Korum Center
Puyallup, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences
Earth Solutions NW LLC

Drwn. By	MRS
Checked By	BJP
Date	04/07/2017
Proj. No.	4960
Plate	2



NOTES:

- Free Draining Backfill should consist of soil having less than 5 percent fines. Percent passing #4 should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free Draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1" Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

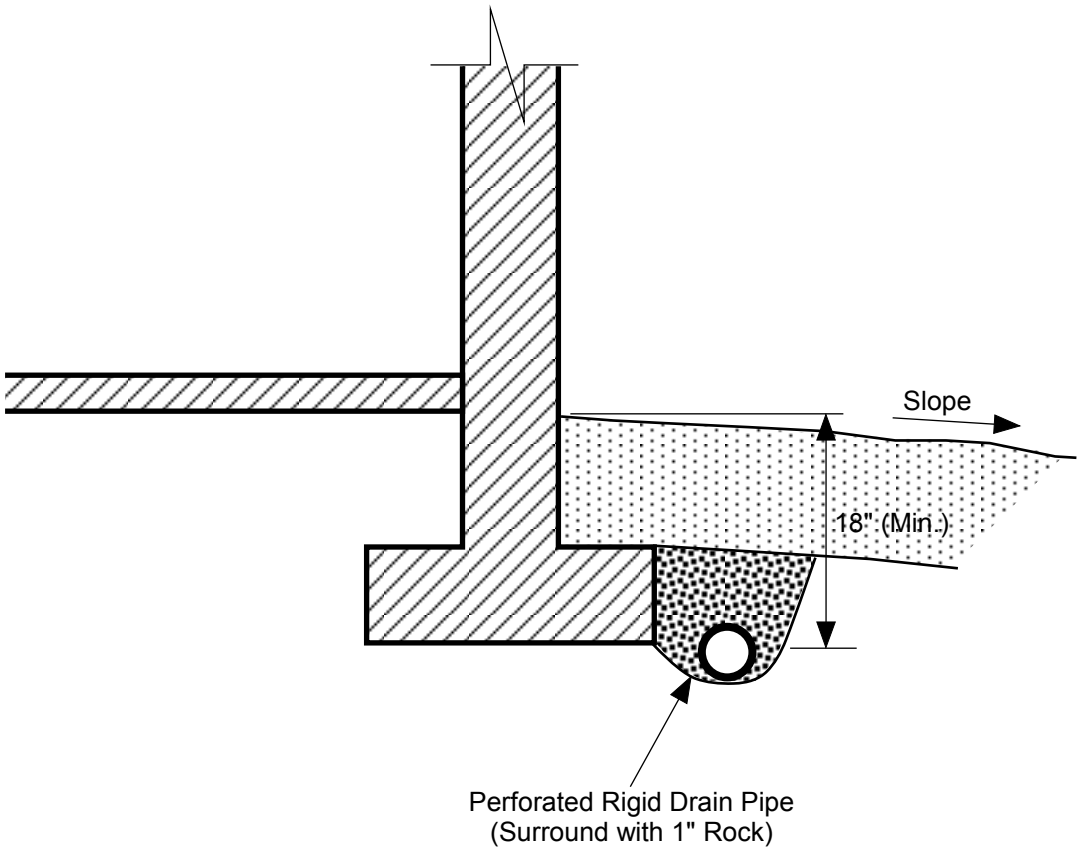
Free Draining Structural Backfill

1 inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

RETAINING WALL DRAINAGE DETAIL
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal; native soil or other low permeability material.

1" Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

FOOTING DRAIN DETAIL
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

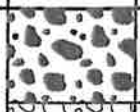
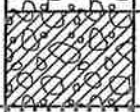
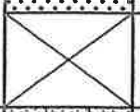
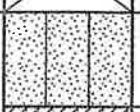
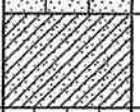
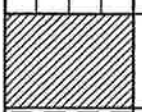
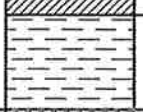
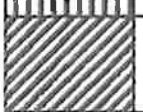
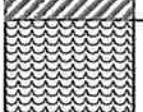
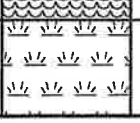
ES-4960

Subsurface conditions at the subject site were explored on February 28, 2017 by excavating six test pits using a trackhoe and operator provided by our firm. The approximate locations of the test pits are illustrated on Plate 2 of this study. The test pit logs are provided in this Appendix. The test pits were advanced to a maximum depth of approximately 13.5 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 74 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Surface Conditions: bare soil **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Brown silty SAND, loose, moist
					-heavy caving to BOH
		MC = 21.50% Fines = 14.00%			-becomes dark brown -mottled texture, increased sand content to BOH [USDA Classification: SAND]
5		MC = 26.60%	SM		-becomes dark gray -becomes medium dense, moist to wet -moderate groundwater seepage -heavily mottled texture
		MC = 56.10%			-silt lenses -abundant wood debris
		MC = 35.20%		9.0	65.0
					Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 5.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 74 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Surface Conditions: bare soil **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 24.20% Fines = 62.90%	ML		Brown sandy SILT, loose, moist -heavy caving to BOH [USDA Classification: LOAM]
2.5					71.5
		MC = 24.50%	SM		Gray silty SAND, loose, moist -mottled texture, increased sand content to BOH -light groundwater seepage
5		MC = 45.40%			-becomes dark gray, medium dense, wet -silt lenses
					-becomes gray
9.0		MC = 27.70%			65.0 Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 4.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 74 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Surface Conditions: bare soil **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Brown silty SAND, loose, moist
					-heavy caving to BOH
		MC = 23.60% Fines = 50.00%			-mottled texture [USDA Classification: fine sandy LOAM]
5		MC = 21.40%	SM		-becomes dark gray, medium dense, moist -light groundwater seepage -increased sand content to BOH
					-gray silt lenses
		MC = 34.00%			-becomes gray, medium dense to dense, moist to wet
10					-trace wood debris
		MC = 30.40%		13.0	-light groundwater seepage 61.0
					Test pit terminated at 13.0 feet below existing grade. Groundwater encountered at 5.0 and 12.5 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 13.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 75 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		0.5 Dark brown TOPSOIL	74.5
					Brown silty SAND, loose, moist	
		MC = 29.00%				
					-mottled texture	
					-light groundwater seepage	
					-becomes dark gray, medium dense, moist	
					-increased sand content to BOH	
5			SM			
		MC = 29.60%				
					-becomes moist to wet	
		MC = 48.20%			-moderate groundwater seepage	
					-abundant wood debris	
10		MC = 27.50%			10.0 [USDA Classification: very fine sandy LOAM]	65.0
		Fines = 32.30%			Test pit terminated at 10.0 feet below existing grade. Groundwater encountered at 3.0 and 8.0 feet during excavation. No caving observed. Bottom of test pit at 10.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 74 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Depth of Topsoil & Sod 1": light gravel and grass **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist -moderate to heavy caving to BOH
2.0					72.0
		MC = 29.20%	SP		Dark gray poorly graded SAND, loose, moist to wet -mottled texture -becomes medium dense
5		MC = 31.70% Fines = 3.50%			[USDA Classification: SAND]
					-moderate groundwater seepage
9.5		MC = 31.70%			64.5 Test pit terminated at 9.5 feet below existing grade. Groundwater encountered at 8.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.5 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington

DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 73 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** —

LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Surface Conditions: gravel **AFTER EXCAVATION** —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND with gravel, medium dense, moist (Fill)
					-cobbles
				1.0	72.0
					Brown silty SAND, medium dense, moist
		MC = 21.90%			-heavy caving to BOH
					-becomes dark gray, medium dense
		MC = 32.10%			-mottled texture, intermittent sand lenses to BOH
5			SM		-becomes moist to wet
				7.5	-moderate groundwater seepage
		MC = 29.50%			65.5
					Test pit terminated at 7.5 feet below existing grade. Groundwater encountered at 7.5 feet during excavation. Caving observed from 2.0 feet to BOH. Bottom of test pit at 7.5 feet.

Appendix B

Laboratory Test Results

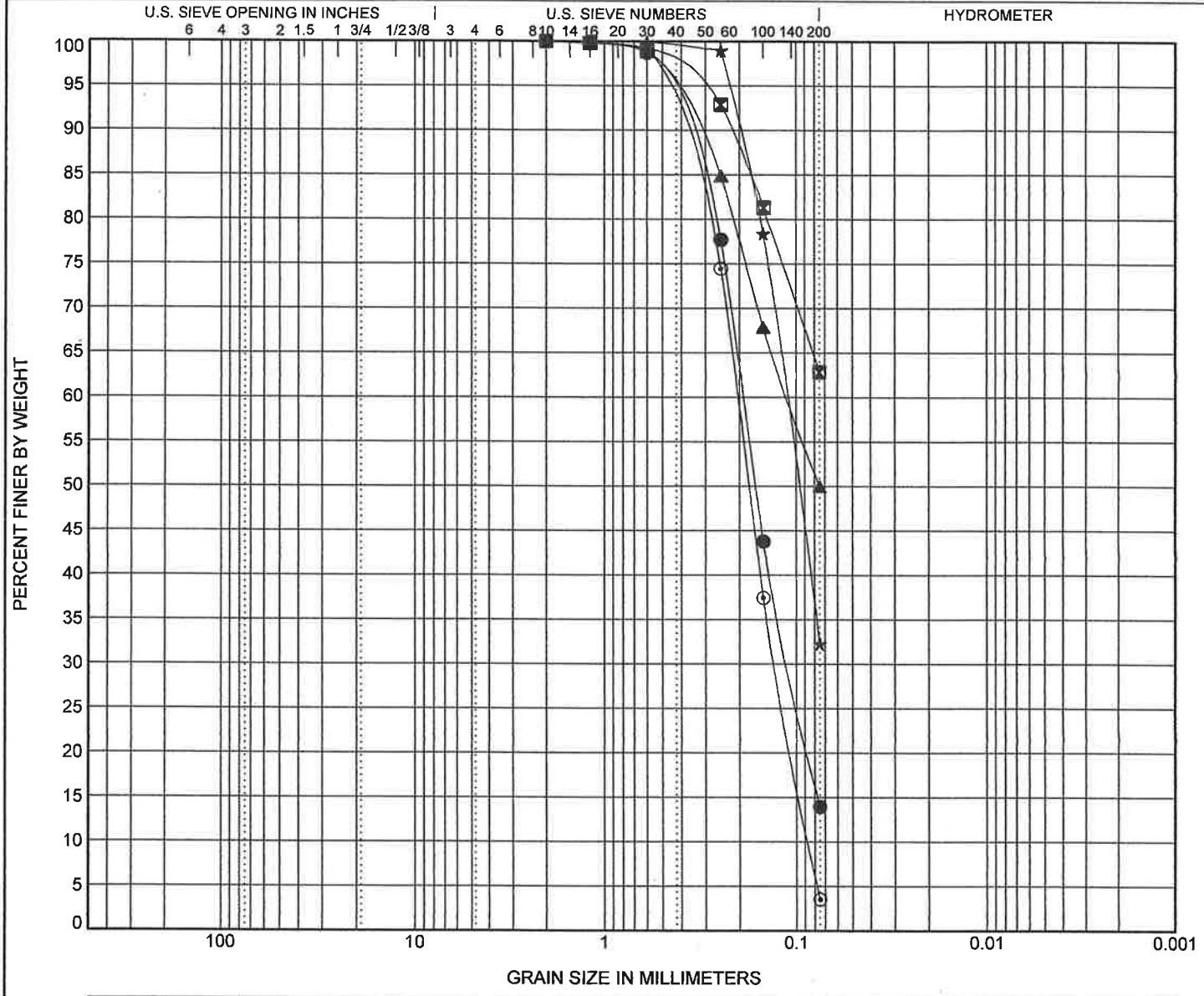
ES-4960

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

CLIENT Step by Step Family Support Center c/o Jeff Brown Architecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER ES-4960 **PROJECT LOCATION** Puyallup



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	Cc	Cu
● TP-1	3.00ft.	USDA: Gray Sand. USCS: SM.		
⊠ TP-2	1.50ft.	USDA: Brown Loam. USCS: Sandy ML.		
▲ TP-3	2.50ft.	USDA: Brown Fine Sandy Loam. USCS: SM.		
★ TP-4	10.00ft.	USDA: Gray Very Fine Sandy Loam. USCS: SM.		
⊙ TP-5	6.00ft.	USDA: Gray Sand. USCS: SP.	0.95	2.39

Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-1	3.0ft.	2	0.191	0.109					14.0	
⊠ TP-2	1.5ft.	2							62.9	
▲ TP-3	2.5ft.	2	0.111						50.0	
★ TP-4	10.0ft.	2	0.114						32.3	
⊙ TP-5	6.0ft.	2	0.205	0.129	0.086				3.5	

GRAIN SIZE USDA ES-4960.GPJ GINT US LAB.GDT 3/8/17

Report Distribution

ES-4960

EMAIL ONLY

Step by Step Family Support Center
c/o Jeff Brown Architecture
12181 C Street South
Tacoma, Washington 98444

Attention: Mr. Jeff Brown

APPENDIX C: OPERATION AND MAINTENANCE MANUAL

OPERATIONS & MAINTENANCE MANUAL

FOR

STEP BY STEP EARLY LEARNING CENTER

C&A PROJ # 21-003

PREPARED FOR:

STEP BY STEP FAMILY SUPPORT CENTER
3303 8TH AVENUE SE #A
PUYALLUP, WA 98372

PREPARED BY:

Cecil & Associates, LLC
PO BOX 598
BOTHELL, WA 98041

JUNE 17, 2024

Appendix V-A: BMP Maintenance Tables

Ecology intends the facility-specific maintenance standards contained in this section to be conditions for determining if maintenance actions are required as identified through inspection. Recognizing that Permittees have limited maintenance funds and time, Ecology does not require that a Permittee perform all these maintenance activities on all their stormwater BMPs. We leave the determination of importance of each maintenance activity and its priority within the stormwater program to the Permittee. We do expect, however, that sufficient maintenance will occur to ensure that the BMPs continue to operate as designed to protect ground and surface waters.

Ecology doesn't intend that these measures identify the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the Permittee shall adjust inspection and maintenance schedules to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel	Vault replaced or repaired to design specifications and is

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Frame and/or Top Slab	determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Any holes - other than designed holes - in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. 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	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	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
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 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.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	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.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear
Operation & Maintenance Manual

MODULAR WETLANDS®

MODULAR WETLANDS® LINEAR OPERATION & MAINTENANCE MANUAL

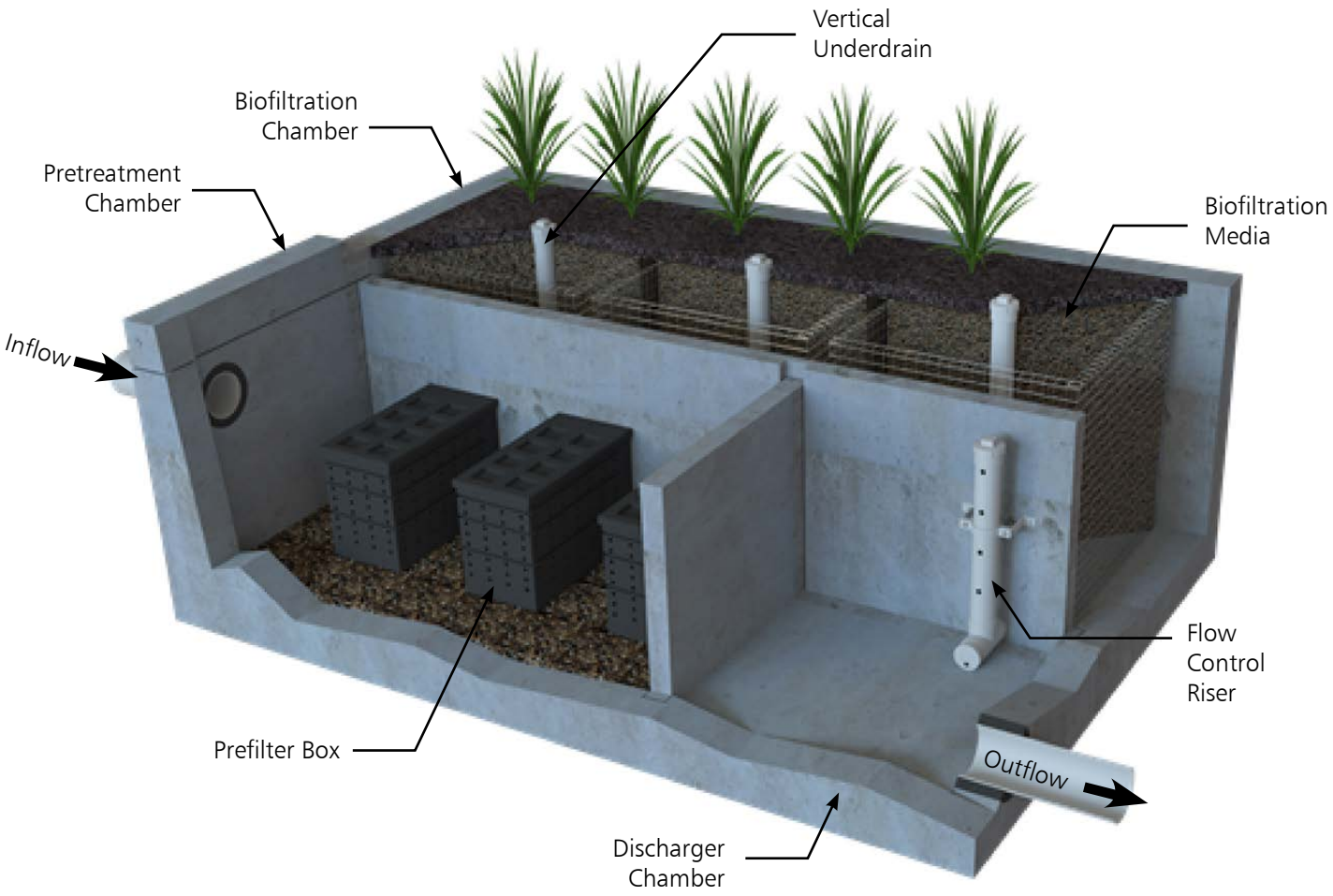
TABLE OF CONTENTS

OVERVIEW

The Modular Wetlands® Linear Biofilter is designed to remove high levels of trash, debris, sediments, nutrients, metals, and hydrocarbons. Its simple design allows for quick and easy installation. The system is housed in a standard precast structure and can be installed at various depths to meet site-specific conditions.

INTRODUCTION

This is the Modular Wetlands Linear Biofilter operation and maintenance manual. Before starting, read the instructions and equipment lists closely. It is important to follow all necessary safety procedures associated with state and local regulations. Some steps required confined space entry. Please contact Contech for more information on pre-authorized third party contractors who can provide installation services in your area. For a list of service providers in your area please visit: www.conteches.com/maintenance.



INSTRUCTIONS

INSPECTION SUMMARY

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the Modular Wetlands Linear:

- Modular Wetlands Linear Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- 7/16" open or closed ended wrench
- Large permanent black marker (initial inspections only - first year)

Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system

INSPECTION AND MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

INSPECTION PROCESS

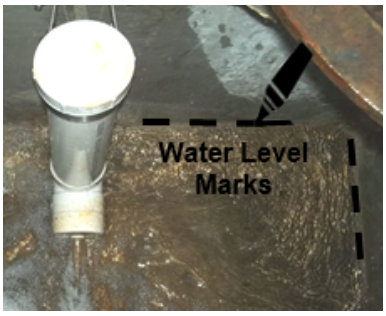
1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The prefilter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and is in need of replacement.

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the orifice control structure, drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating conditions and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above. Generally, the discharge chamber will be clean and free of debris. Inspect the water marks on the side walls. If possible, inspect the discharge chamber during a rain event to assess the amount of flow leaving the system while it is at 100% capacity (pre-treatment chamber water level at peak HGL - top of bypass weir). The water level of the flowing water should be compared to the watermark level on the side walls, which is an indicator of the highest discharge rate the system achieved when initially installed. Record on the form if there is any difference in level from the watermark in inches.

NOTE: During the first few storms, the water level in the outflow chamber should be observed and a 6" long horizontal watermark line drawn (using a large permanent marker) at the water level in the discharge chamber while the system is operating at 100% capacity. The diagram below illustrates where the line should be drawn. This line is a reference point for future inspections of the system.

Water level in the discharge chamber is a function of flow rate and pipe size. Observation of the water level during the first few months of operation can be used as a benchmark level for future inspections. The initial mark and all future observations shall be made when the system is at 100% capacity (water level at maximum level in the pre-treatment chamber). If future water levels are below this mark when the system is at 100% capacity, this is an indicator that maintenance to the pre-filter cartridges may be needed.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.



MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges
- Obstructions in the system or its inlet and/or outlet pipes
- Excessive accumulation of floatables in the pretreatment chamber in which the length and width of the chamber is fully impacted more than 18". See photo below.
- Excessive accumulation of sediment in the pretreatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. The following chart shows photos of the condition of the BioMediaGREEN contained within the pre-filter cartridges. When media is more than 85% clogged, replacement is required.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.

INSPECTION PROCESS

- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models). The following photos show the condition of the BioMediaGREEN contained within the drain down filter. When media is more than 85% clogged, replacement is required.

- Overgrown vegetation.

- Water level in the discharge chamber during 100% operating capacity (pretreatment chamber water level at max height) is lower than the water mark by 20%.

MAINTENANCE SUMMARY

The time has come to maintain your Modular Wetlands® Linear. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

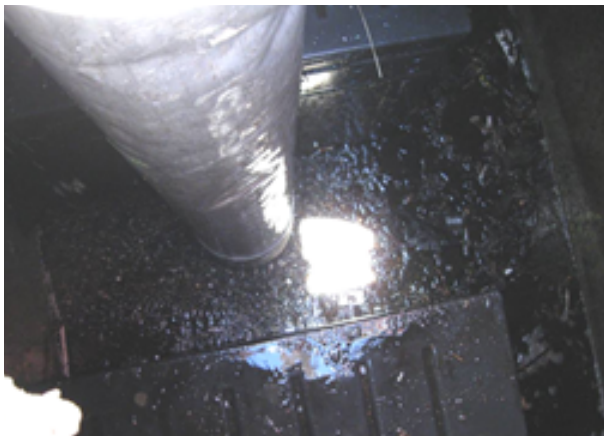
- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.

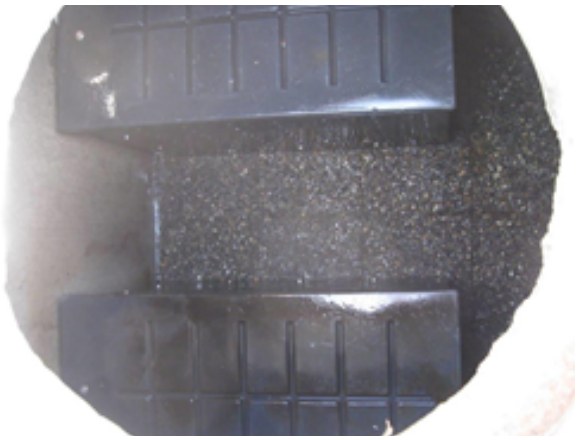
The following is a list of equipment to required for maintenance of the Modular Wetlands® Linear:

- Modular Wetlands Linear Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers
- Protective clothing, flashlight, and eye protection
- 7/16" open or closed ended wrench
- Vacuum assisted truck with pressure washer
- Replacement BioMediaGREEN for pre-filter cartridges if required (order from one of Contech's Maintenance Team members at https://www.conteches.com/maintenance).

MAINTENANCE | PRETREATMENT CHAMBER

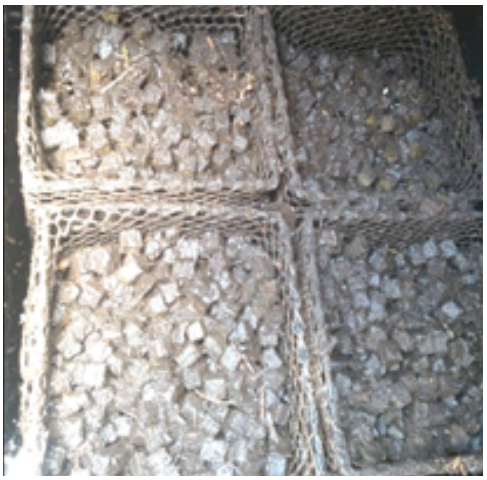
1. Remove access cover over pre-treatment chamber and position vacuum truck accordingly.
2. With a pressure washer, spray down pollutants accumulated on walls and pre-filter cartridges.
3. Vacuum out pre-treatment chamber and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the floor until the pervious pavers are visible and clean.
4. If pre-filter cartridges require media replacement, continue to step 5. If not, replace access cover and move to step 11.





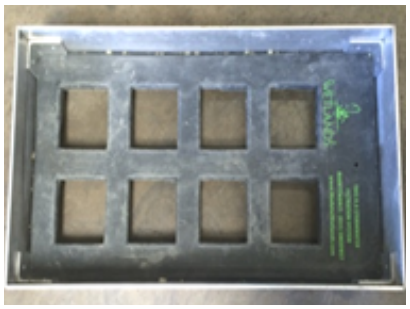
MAINTENANCE | PREFILTER CARTRIDGES

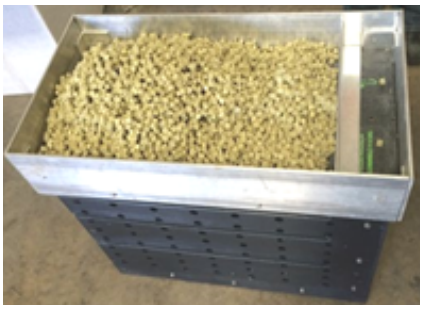
5. After successfully cleaning out the pre-treatment chamber (previous page) enter the pre-treatment chamber.
6. Unscrew the two bolts (circles shown below) holding the lid on each cartridge filter and remove lid.



7. Place the vacuum hose over each individual media filter to suck out filter media.

8. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and it's media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.
9. Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. Utilize the manufacture-provided refilling tray and place on top of the cartridge. Fill the tray with new bulk media and shake down into place. Using your hands, lightly compact the media into each filter cage. Once the cages are full, remove the refilling tray and replace the cartridge top, ensuring bolts are properly tightened.





10. Exit the pre-treatment chamber. Replace access hatch or manhole cover.

MAINTENANCE | BIOFILTRATION CHAMBER

11. In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The Modular Wetlands Linear utilizes vegetation similar to surrounding landscape areas, therefore trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

12. Each vertical under drain on the biofiltration chamber has a removable (threaded cap) that can be taken off to check any blockages or root growth. Once removed, a jetting attachment can be used to clean out the under drain and orifice riser.
13. As with all biofilter systems, at some point the biofiltration media (WetlandMedia) will need to be replaced. Either because of physical clogging of sorptive exhaustion of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading. Utilize the vacuum truck to vacuum out the media by placing the hose into the chamber. Once all the media is removed use the power washer to spray down all the netting on the outer metal cage. Inspect the netting for any damage or holes. If the netting is damaged it can be repaired or replaced with guidance by the manufacturer.
14. Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new WetlandMedia. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1000 and 2000 lbs. A lifting apparatus (backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Fill the media cages up to the same level as the old media. Replant with vegetation.

MAINTENANCE | DISCHARGE CHAMBER

15. Remove access hatch or manhole cover over discharge chamber.
16. Enter chamber to gain access to the drain down filter. Unlock the locking mechanism and lift up drain down filter housing to remove used BioMediaGREEN filter block as shown below. *NOTE: Drain down filter is only found on units installed in California prior to 2023. If no drain down filter is present, skip steps 16 and 17.*

17. Insert a new BioMediaGREEN filter block and lock drain down filter housing back in place.
18. Replace access hatch or manhole cover over discharge chamber.

NOTES

CONTECH® ENGINEERED SOLUTIONS

Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

CONTECH®
ENGINEERED SOLUTIONS

Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspector Name _____ Date ____/____/____ Time _____AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

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800-338-1122

WWW.CONTECHES.COM

CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

Modular Wetlands Maintenance Guide 1/2023

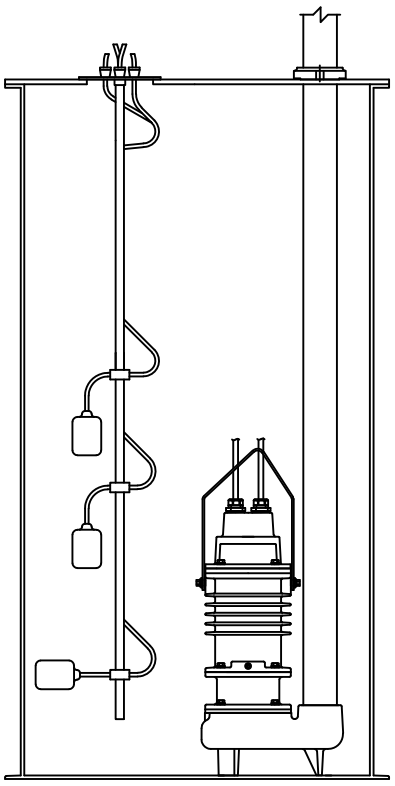
WEIL

SUBMERSIBLE WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

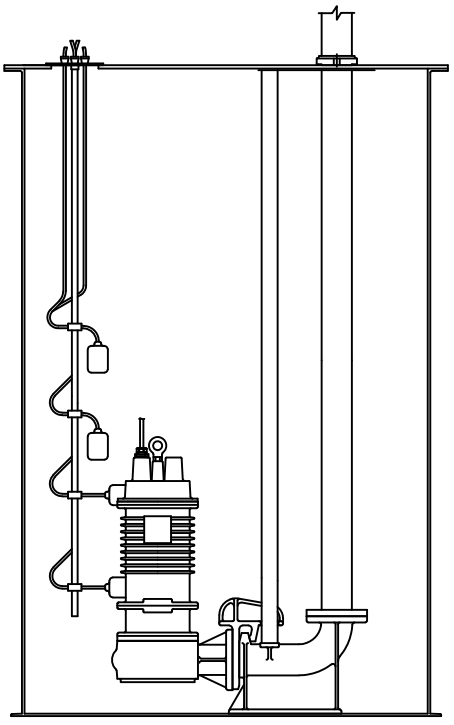
1600
2500

OWNERS INFORMATION

Manufacturer's Number	Date Code



Manufacturer's Number	Date Code



WEIL SUBMERSIBLE WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

INTRODUCTION

This manual contains instruction for installation, operation and maintenance of your pump equipment. Read and study this manual before using the equipment. The pump is a well designed and sturdily constructed machine. When properly installed and given reasonable care and maintenance, it will give many years of service.

SAFETY PRECAUTIONS

Always disconnect the electrical power supply to the motor before working on the unit. **Failure to do so can cause severe electrical shock or death.** If the basement floor is wet or flooded, do not walk on floor until the electrical power has been disconnected. Exercise caution when working in the exposed areas of rotating parts.

RECEIVING

Immediately upon arrival, the equipment should be checked for any shortages and/or damage. Any shortages or damage should be noted on the bill of lading and freight bill, and promptly reported to the transportation company. Claims for shortages or damage must be made in writing to Weil Pump Company Inc., Cedarburg, Wisconsin within 14 days of receipt of equipment.

STORAGE

Pumping equipment should be installed and put into operation as soon as possible. If it is necessary to store the equipment for extended periods, precautions should be taken to prevent corrosion or oxidation. It is recommended that the equipment be stored indoors. The storage area should be dry and have a relatively constant temperature. Exposed machined surfaces should be coated with a rust preventative. The entire unit should be sealed in heavy plastic bag. A desiccant should be placed in the bag before it is sealed. Before sealing the bag, arrange the power cable, and moisture/temperature sensor cable, (if so equipped) in gently curved loops to prevent cables from taking a permanent set.

During storage, the plastic bag should be opened at least once a month, and the rotating assembly of the pump turned several times by hand. This helps prevent point of contact corrosion and maintains rotational integrity. Add desiccant before the bag is resealed. For additional information regarding rust prevention, refer to the American Society for Metals Handbook, under **"Rust Prevention Compounds."**

INSTALLATION

Clean wet well thoroughly before installing pump. Sand, mud, cinders, etc. are abrasives which will damage the mechanical seals.

The pump is ready for installation as shipped. Except as noted above, no lubrication or adjustment is required before initial operation.

Raise and lower the unit by means of a chain or steel cable fastened to the lifting handle provided. **Do not raise, lower, or support the unit by means of the electrical power cable or the moisture sensor cable.** When moving the pump, avoid putting strain on the electrical cables. Set the pump in its final location before connecting the cable(s). Provide adequate headroom above the wet well for future maintenance of the equipment. Install the associated level controls so that the pump is properly immersed. For **intermittent service**, the minimum liquid level must be at least 1" above the pump case.

POWER CABLE

The electrical characteristics shown on the pump nameplate describes the power supply required to operate the pump motor. The user is responsible for providing appropriate branch circuit, motor starter, and overload protection in accordance with local code requirements.

Electrical connections made in the pit, even though above the highest water level, must be sealed to prevent moisture penetration into power or sensor cables through junction boxes. Wiring diagrams for the pump motor are provided. It is important to make connections according to the diagram provided. Incorrect electrical connections will void the warranty.

PIPING

(Refer to Figure 1)

1. Piping should be as short as possible using a minimum number of fittings to avoid excessive friction loss.
2. Pipes should line up "naturally" with the pump discharge and should never be forced together.
3. Discharge piping must be supported by appropriate supports.
4. In a duplex installation, each pump must have its own check valve.

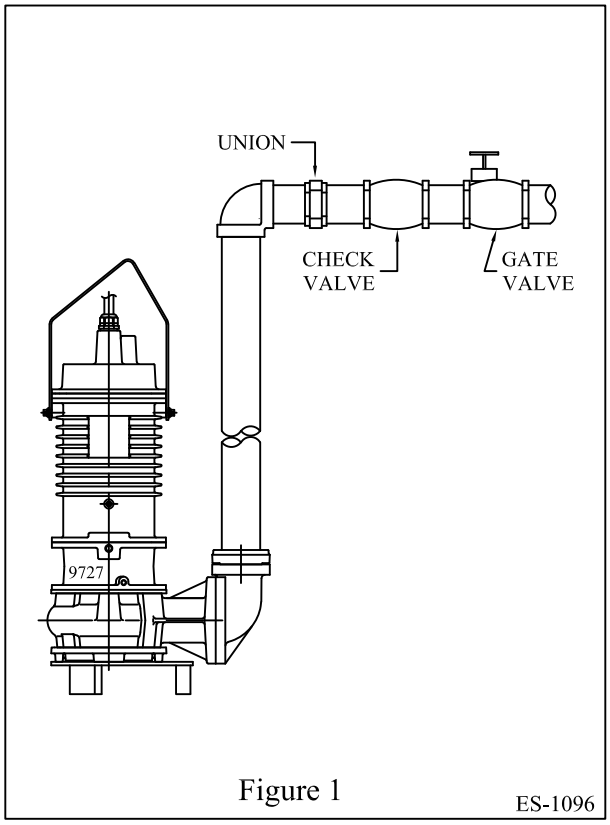


Figure 1

ES-1096

SENSOR OPTION - MOISTURE SENSOR AND TEMPERATURE LIMITER

(Refer to Figure 2)

The pump is equipped with the moisture sensor and temperature limiter when this option is ordered. Connect the moisture sensor to the Weil Alarm-Test Panel as shown in Figure 2. Power supplied to the Alarm-Test Panel must be 115 volts, regardless of the voltage supplied to the pump motor.

Connect the temperature limiter into the pump motor starter control circuit in series with the liquid level control and the starter holding the coil, as shown in Figure 2.

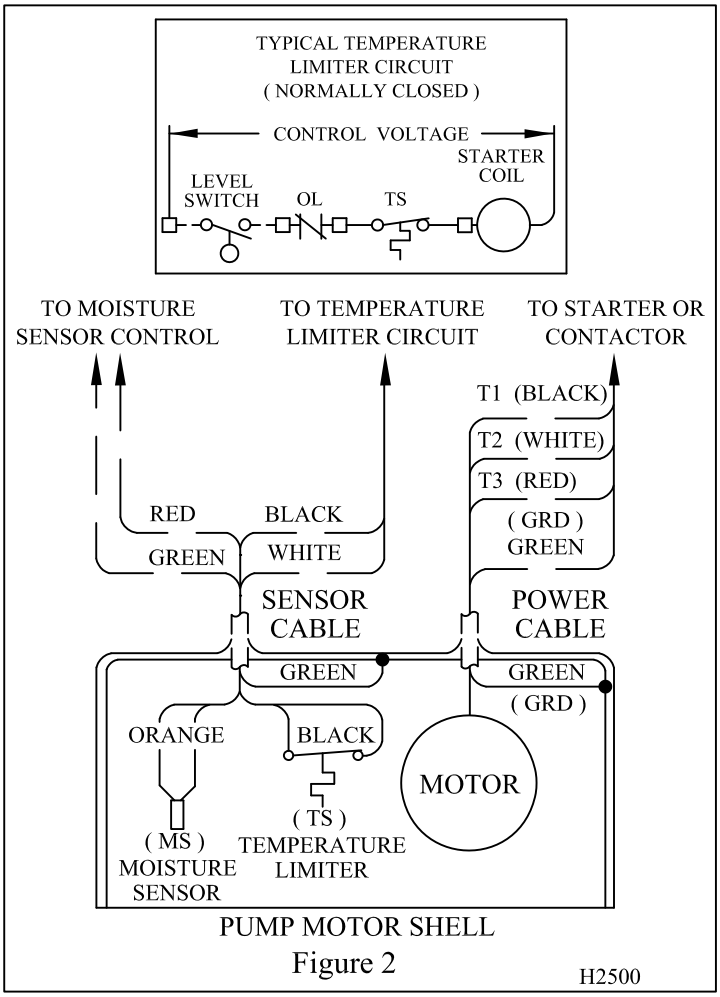


Figure 2

H2500

START-UP PROCEDURE

Before placing pump into general operation, check the following items to insure that no damage will occur to pump motor.

1. Turn shaft manually to ensure it is turning freely.
2. Check voltage, phase, and frequency of the motor, making sure that the same is supplied to unit.
3. Make sure there is proper motor circuit protection.
4. Review piping installation, per "Piping" instructions.
5. Recheck basin to make sure it is free of debris.
6. With pump laying down on its side, apply momentary power to confirm proper impeller rotation.
7. Verify proper operation in a "wet" test startup: check GPM, pressure, amps, volts, audible noise and vibration.
8. Check measured parameters to design conditions.

SAFETY PRECAUTIONS

1. Disconnect and lockout the electrical supply to the motor before working on the unit, or if maintenance is to be performed on the pump in a flooded area.
2. Exercise caution when working in the exposed areas of the rotating parts.
3. In case of severe vibration or unusual noise, shut off pump at once and determine the cause.
4. If frequent tripping of the overload protection occurs, troubleshoot the pump to correct the problem.

TROUBLESHOOTING PUMP

Problem	Probable Cause
Insufficient or No Water Flow	1. Blown fuses or open circuit breakers 2. Poor switch contact 3. Discharge head too high 4. Clogged or damaged impeller 5. Binding shaft 6. Check or gate valve closed 7. Water level below casing
Insufficient Pressure	1. Low voltage 2. Clogged or damaged impeller 3. Motor incorrectly wired 4. Pump may be air-bound
Noisy or Vibrating Pump	1. Misaligned or bent shaft 2. Worn bearings 3. Lack of lubrication 4. Water level below casing 5. Impeller rubbing or damaged 6. Clogged impeller

NOTE

Submersible motors have an air relief slot on the lower mounting flange area. This slot is to prevent air lock. Under normal operation water will spray out of the air relief slot. The normal water level should be above the slot at shut off.

PERIODIC INSPECTION

Periodic inspection of the pump should be performed at six month intervals. The pump should be cleaned of accumulated abrasive particles and debris. The wet well should also be cleaned of accumulated abrasive particles.

Check the motor housing and the seal chamber for moisture in the following manner:

1. Place the pump in a horizontal position in a V-block chamber with the seal chamber plugs facing downward.
2. Remove the plugs and drain the content of the seal chamber in a transparent container and allow the draied liquid to settle.
3. If no water settles to the bottom of the container, the chamber can be refilled with clean oil and the plugs replaced.
4. If water settles in the container, the source of the liquid must be determined and worn and/or damaged seals, O-rings, etc. must be replaced.
5. Turn the pump over, remove the motor shell plug, drain the motor houseing into a transparent container.
6. If no liquid is present, replace the plug.
7. If oil or oil and water are present, the upper seal must be inspected.
8. If only water is present the leakage source is most likly in the motor housing and the condition of the O-rings and/or the cable seal should be checked.

REPLACEMENT PUMPS

Single phase units have starting modules built into the motor. When replaceing exsiting pumps, check for any exsiting external modules, control panel mounted or seperatly mounted. These must be removed or bypassed for proper operation of the pumping unit.

IMPORTANT NOTICE

For warranty consideration contact your local Weil representative before disassembly or repair.

NOTE

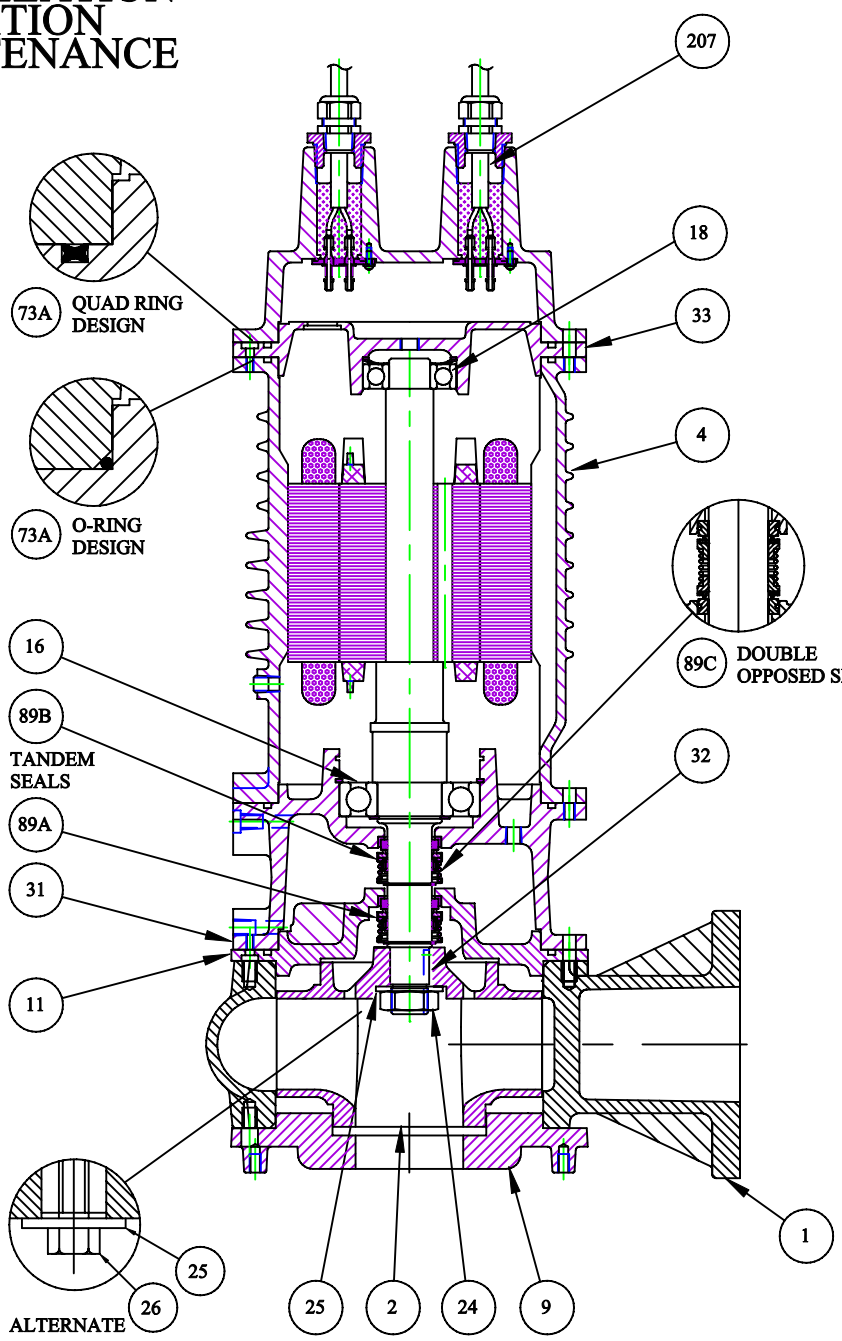
See separate instructions for pump assembly and disassembly.

WEIL

INSTALLATION
OPERATION
MAINTENANCE

Submersible Wastewater Pump

1632 2519
1633 2524
2564



PARTS BREAKDOWN

KEY NO.		DESCRIPTION
1		Case
2		Impeller
4		Motor
9		Suction Cover
11		End Plate
16	●	Ball Bearing, Lower
18	●	Ball Bearing, Upper
25	●	Washer
26	●	Impeller Retaining Screw
31		Seal Chamber
32	●	Impeller Key
33		Bearing Support
73A	●	Gasket, (O-Ring) - (4)
89A	●	Seal, Lower
89B	●	Seal, Upper
89C		Seal, Double Opposed (Optional)
207		Motor Cover Assembly
		Moisture Sensor Probe Assembly (Optional)
		Temperature Limiter (Optional)

Items marked with (●) are included in repair kit 201.585.101 for pumps with motors W-9701, W-9709 and W-9710. Use repair kit 201.360.101 for pumps with motors W-9702, W-9727 and W-9728.

SAFETY PRECAUTIONS

1. Disconnect and lock out the electrical supply to the motor before working on the unit.
2. Lift the pump from the pit with a steel cable or chain attached to the lifting handle at the top of the pump. DO NOT USE THE POWER CABLE FOR THIS PURPOSE.

LUBRICATION

Double sealed prelubricated ball bearings require no further lubrication.

CLEANING OR REPLACEMENT OF IMPELLER

1. With the pump standing vertically, remove the screws holding the seal chamber (31) to the case (1).
2. Carefully lift the motor assembly out of the case.
3. Lay the unit on its side in V-Blocks with the impeller (2) overhanging.
4. Remove the impeller retaining screw (26).
5. Tap the impeller with a soft hammer to loosen. Remove impeller from shaft using opposed pry bars. Remove impeller key (32).
6. Scrape off any deposits on the impeller and inspect it for breaks, cracks, or wear.
7. To reassemble the impeller on the shaft, insert the impeller key in the shaft keyway.
8. Coat exposed area of shaft with anti-seize compound. Align the impeller keyway with the impeller key and carefully push the impeller on to the shaft, tapping gently with a soft hammer.
9. When the impeller is seated on the shaft, place washer (25) over impeller retaining screw and install and tighten the screw. Rotate the impeller by hand to ensure that it turn freely.
10. Set the motor assembly into the case and install and tighten the screws removed in step 1.

REPLACEMENT OF MECHANICAL SEALS

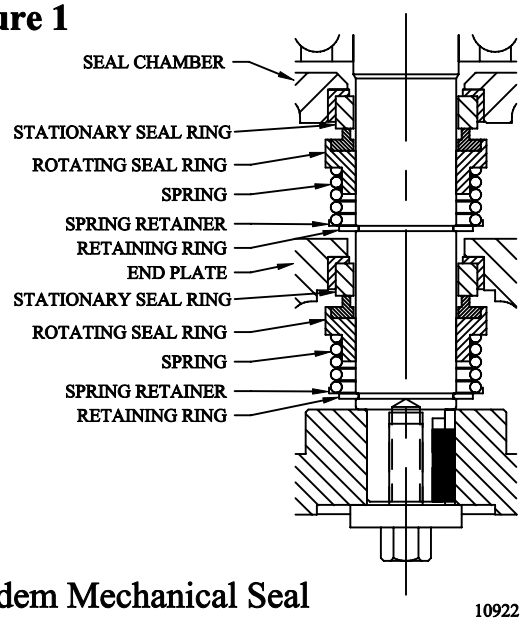
Disassemble case and remove impeller as described in "CLEANING OR REPLACEMENT OF IMPELLER." Drain oil from seal chamber by removing the two pipe plugs and placing unit on its side with drain holes facing down.

DISASSEMBLY - TANDEM SEAL

(Refer to Figure 1)

1. Remove the retaining ring from the shaft and remove the spring retainer and spring.
2. Slide the rotating seal ring off the shaft. TAKE CARE NOT TO SCORE THE SHAFT.
3. Remove the round head machine screws holding the end plate (11) to the seal chamber.

Figure 1



Tandem Mechanical Seal Assembly

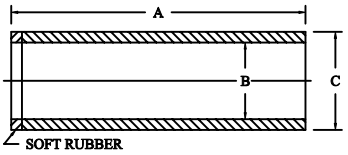
10922

4. Press the stationary seal ring out of the end plate.
5. Remove the retaining ring from the shaft and remove the spring retainer and spring.
6. Slide the rotating seal ring off the shaft. TAKE CARE NOT TO SCORE THE SHAFT.
7. Remove the upper stationary seal ring by pulling with hooked picks behind the outside of the seal ring. If this method fails, break the seal ring with a small chisel and remove the pieces.
8. The mounting seats of both end plate and seal chamber stationary seal rings and the shaft must be cleaned of any adhering particles or deposits before a replacement seal can be installed.

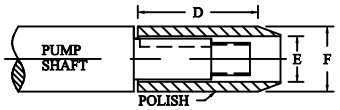
ASSEMBLY - TANDEM SEAL

(Refer to Figure 1)

1. Check the replacement seal to ensure that it is the same type, shaft size and length as the original seal. UPPER SEAL COMPONENTS AND LOWER SEAL COMPONENTS MUST NOT BE INTERCHANGED.
2. Apply a thin coating of lubricating oil or glycerin to the outside surface of the rubber cup of the stationary seal ring. TAKE CARE NOT TO MAR OR DAMAGE THE SEAL FACES.
3. Position seal ring with its face toward the threaded end of the shaft. Gently press the seal ring into its seat using tool 1 shown in Figure 2. APPLY EVEN PRESSURE TO SEAL FACE. The seal is seated to its full depth when the rubber seating cup is flush with the surface of the seal chamber. THE ROTATING SEAL RINGS AND THE STATIONARY SEAL RINGS MUST NOT BE INTERCHANGED.



TOOL 1 - TO INSTALL STATIONARY SEAL RING



TOOL 2 - TO INSTALL ROTARY SEAL RING

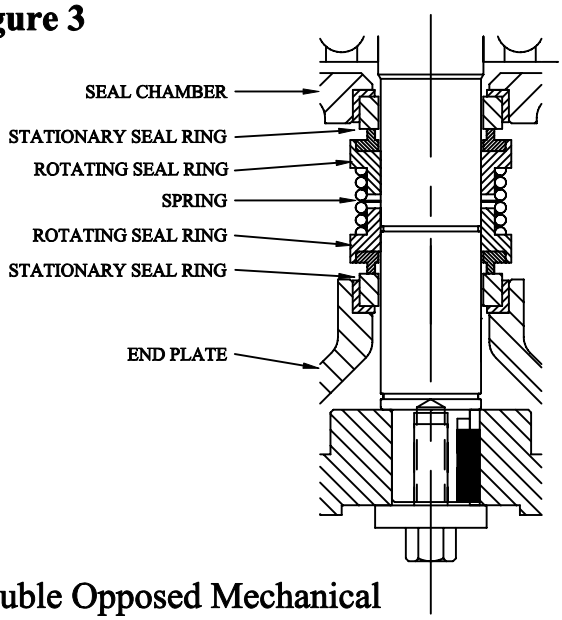
SEAL SIZE	TOOL 1			TOOL 2		
	A	B	C	D	E	F
1 1/8	6	1 5/32	1 3/4	1 5/8	7/8	1 1/8
1 1/2	6	1 9/16	2	3	1 5/16	1 1/2

NOMINAL SEAL SIZE EQUALS SHAFT O.D.

Figure 2

D1102

Figure 3



Double Opposed Mechanical Seal Assembly

10923

4. Apply lubricating oil or glycerin to the inside surface of the bellows and slide the rotating seal ring onto the shaft using tool 2 shown in Figure 2 until the rotating ring seal face contacts the stationary ring seal face.
5. Install the spring, spring retainer and retaining ring.
6. Position the end plate over the shaft and install and tighten the round head machine screws.
7. Apply a thin coat of lubricating oil or glycerin to the outside surfaces of the rubber cup of the stationary seal ring.
8. Position the seal ring with its face toward the threaded end of the shaft. Gently press the seal ring into its seat using tool 1. APPLY EVEN PRESSURE TO SEAL FACE. The seal is seated to its full depth when the rubber seating cup is flush with the face of the end plate.
9. Lubricate inside surface of the rubber bellows of the rotating seal ring and slide it into position so that the seal faces touch.
10. Install the spring, spring holder and retaining ring on the shaft.
11. Refill seal chamber with oil (Mobil EAL 224H or equivalent) up to plug opening and reinstall the two pipe plugs.
12. Remove tool 2 from the shaft and assemble the impeller and case as described under "CLEANING OR REPLACEMENT OF IMPELLER."

DISASSEMBLY - DOUBLE OPPOSED SEAL

(Refer to Figure 3)

1. Remove the round head machine screws holding the end plate to the seal chamber.
2. Press lower stationary seal ring out of end plate and remove the lower and upper rotating seal ring from the motor shaft. TAKE CARE NOT TO SCORE SHAFT.
3. Remove the upper stationary seal ring by pulling with hooked picks behind the outside of the seal ring. If this method fails, break the seal ring with a small chisel and remove the pieces.
4. The mounting seats of both end plate and seal chamber stationary seal rings and the shaft must be cleaned of any adhering particles or deposits before a replacement seal can be installed.

ASSEMBLY-DOUBLE OPPOSED SEAL

(Refer to Figure 3)

1. Check the replacement seal to ensure that it is the same type, shaft size and length as the original seal. UPPER SEAL COMPONENTS AND LOWER SEAL COMPONENTS MUST NOT BE INTERCHANGED.
2. Apply a thin coating of lubricating oil or glycerin to the outside surfaces of the rubber cup of the upper stationary sealring. TAKE CARE NOT TO MAR OR DAMAGE THE SEAL FACE.
3. Position upper stationary seal ring with its face toward the threaded end of the shaft. Gently press the seal ring into its seat using tool 1 shown in Figure 2. APPLY EVEN PRESSURE TO SEAL FACE. The seal is seated to its full depth when the rubber seating cup is flush with the surface of the seal chamber.

4. Slip tool 2 shown in Figure 2 over the end of the shaft, lubricate the rubber bellows inside the upper rotating seal ring and install over tool 2 with seal face away from threaded end of shaft until seal faces touch.
5. Install spring.
6. Lubricate the lower rotating seal ring and slide on to the shaft so that the seal ring face is facing the threaded end of the shaft. DO NOT DAMAGE THE SEAL FACE.
7. Lubricate the outside surfaces of the rubber cup on the lower stationary seal ring.
8. Using tool 1 press the seal ring into the mounting seat in the end plate with the seal face away from the end plate.
9. Carefully place the end plate over the shaft and slide it gently into contact with the seal chamber.
10. Install and tighten the round head machine screws and remove tool 2.
11. Refill seal chamber with oil (Mobil EAL 224H or equivalent) up to plug opening and reinstall the two pipe plugs.
12. Assemble the impeller and case as described under "CLEANING OR REPLACEMENT OF IMPELLER."

DISASSEMBLY - BALL BEARINGS

(Refer to Parts View)

1. Disassemble the case and the impeller as described in "REPLACEMENT OF IMPELLER."
2. Drain the oil from the seal chamber and remove the mechanical seals as described in "REPLACEMENT OF MECHANICAL SEALS." Use great care when removing the mechanical seals if they are to be reused. The stationary seals should not be removed from their seats in the end plate and the seal chamber. The shaft should be wiped clean and lightly lubricated with lubricating oil or glycerin before the rotating seal rings are removed from the shaft. Tool 2 should be used to cover the end of the shaft while the rotating seals and the end plate (with stationary seal ring seated) are removed.
3. If the unit is equipped with moisture sensors, remove the cap screws holding the motor cover (207) to the motor. Slightly raise the motor cover and disconnect the moisture probe leads from the leads of the sensor cable. DO NOT DISCONNECT THE POWER CABLE LEADS TO THE STATOR. Replace the screws finger-tight to prevent movement of the motor cover.
4. Remove the screws holding the motor to the seal chamber.
5. Separate the seal chamber from the motor (the rotor with bearings will remain attached to the seal chamber) and remove the upper bearing wave spring.
6. Using internal retaining ring pliers, remove the retaining ring from the groove in the seal chamber and carefully slide the shaft with ring spacer and bearing out of the seal chamber.
7. Remove tool 2 from the shaft.
8. Using external retaining ring pliers, remove the retaining ring from the shaft. Remove the bearings from the shaft using a three-jaw bearing puller.

ASSEMBLY - BALL BEARING

(Refer to Parts View)

1. Check the replacement bearings to ensure that they are the same size and type as the originals.
2. Use a hand press to assemble bearings to shaft. Assemble the upper bearing (18) to shaft. Place internal ring and ring spacer over shaft before assembling lower bearing (16) to shaft. APPLY NO FORCE TO THE OUTER RACE OF EITHER BEARING. PRESS ONLY ON THE INNER RACE.
3. Insert the shaft with bearing and ring spacer into the bearing bore into the seal chamber.
4. Replace the upper bearing wave spring and hold in place with a dab of grease.
5. Make sure that all mating flanges are clean and that the O-ring is properly positioned. Carefully lower the motor shell over the rotor assembly so that the upper bearing slides into the bore of the upper bearing support and the flanges contact.
6. If the unit is equipped with moisture sensors, remove the motor cover cap screws and prop up the motor cover (207) to "fish" the moisture sensor wires through the channel in the motor shell.
7. Reconnect the moisture sensor leads to the moisture sensor cable leads.
8. Place the O-ring in position. Install and tighten the screws holding the motor cover to the motor and upper bearing support.
9. Install and tighten the screws securing the motor to the seal chamber.
10. Assemble the mechanical seals, impeller, case and suction cover as previously described.
11. Rotate shaft several times by hand to ensure that it turns smoothly.

NOTE

See separate Submersible Sump Pump sheet for general Installation Operation and Maintenance instructions.