



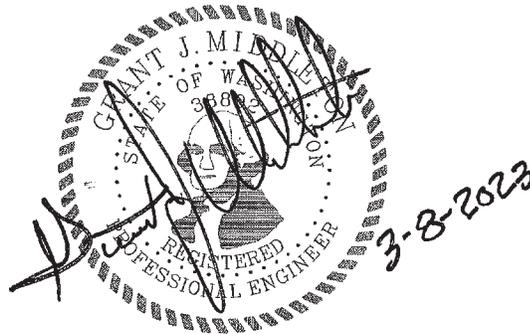
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VELASQUEZ PROPERTY

STORMWATER POLLUTION PREVENTION PLAN

PROPONENT:

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March 8, 2023

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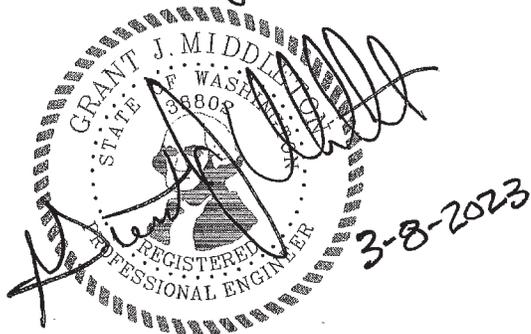
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PROJECT ENGINEER'S CERTIFICATION

I hereby state that this Stormwater Pollution Prevention Plan for the Velasquez Property has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Puyallup and Washington State does not and will not assume liability for the sufficiency, suitability, or performance of stormwater pollution prevention facilities prepared by me.



Grant J. Middleton, P.E.



STORMWATER POLLUTION PREVENTION PLAN

SECTION 1 – CONSTRUCTION STORMWATER POLLUTION PREVENTION ELEMENTS

Stormwater pollution prevention will be maintained during the construction of this site by incorporating standard erosion control methods. The following devices will be used to trap sediment from the cleared areas and prevent it from leaving the site. Inlet protection will also be installed within all existing stormwater catch basins to minimize the possibility of pollution downstream. The following general Washington State Elements shall be upheld at all times during the construction process. Please reference the BMP section in this report.

Element #1: Preserve Vegetation/Mark Clearing Limits

- Prior to beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits. These shall be marked, both in the field and on the plans, to prevent damage and offsite impacts.
- Plastic, metal, or stake wire fence may be used to mark the clearing limits.
- Suggested BMPs:
 - BMP C103: High Visibility Plastic or Metal Fence

Element #2: Establish Construction Access

- Construction vehicle access will use an existing paved access to the property off of Meridian Ave. E and shall be limited to one route, if possible.
- If sediment is tracked off site, public roads shall be cleaned thoroughly at the end of each day, or more frequently during wet weather. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area.
- Street washing is allowed only after sediment is removed in accordance with S9.D.2.d. Street wash wastewater shall be controlled by pumping back on site or otherwise be prevented from discharging into systems tributary to waters of the state.
- Construction access restoration shall be equal to or better than the pre-construction condition.

Element #3: Control Flow Rates

This is not applicable to this proposal due to minimal area of disturbance for the construction of the proposed building.

Element #4: Install Sediment Controls

Inlet sediment protection will be provided for affected catch basins within proposed work area.

Element #5: Stabilize Soils

- Exposed and unworked soils shall be stabilized 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.
- Depending on the geographic location of the project, no soils shall remain exposed and unworked for more than the time periods set forth below to prevent erosion:

West of the Cascade Mountains Crest:

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

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

The time period may be adjusted by a local jurisdiction, if the Jurisdiction can show that local precipitation data justify a different standard.

- Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.
- Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.
- Suggested BMPs:
 - BMP C120: Temporary and Permanent Seeding
 - BMP C121: Mulching
 - BMP C124: Sodding
 - BMP C125: Topsoiling

Element #6: Protect Slopes

This is not applicable as the site is flat and no slopes will be created during construction.

Element #7: Protect Drain Inlets

- All storm drain inlets made operable during construction shall be protected so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.
- Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).
- Suggested BMPs:
 - BMP C220: Storm Drain Inlet Protection

Element #8: Stabilize Channels and Outlets

This is not applicable to this proposal due to there being no exposed channels or outlets.

Element #9: Control Pollutants

- All pollutants, including waste materials and demolition debris, that occur on site during construction shall be handled and disposed of in a manner that does not cause contamination of surface water.
- Cover, containment, and protection from vandalism shall be provided 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 shall include secondary containment.
- Maintenance, fueling, and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures. Contaminated surfaces shall be cleaned immediately following any spill incident.
- BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to: 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. Permittees shall adjust the pH of stormwater if necessary to prevent violations of water quality standards.
- Permittees shall obtain written approval from Ecology prior to using chemical treatment, other than CO₂ or dry ice to adjust pH.

Element #10: Control Dewatering

This is not applicable to this proposal due to only a small portion of the total parcel area being developed to construct building.

Element #11: Maintain BMPs

- All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function in accordance with BMP specifications.
- All temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Element #12: Manage the Project

- Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to ensure continued performance of their intended function. Conduct site inspections and monitoring in accordance with all applicable county and Construction Stormwater General Permit requirements.
- Maintaining an updated Construction SWPPP – Maintain, update, and implement the Construction SWPPP in accordance with the Construction Stormwater General Permit requirements and the requirements outlined in this Element (#12).
- Project sites disturbing less than 1 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 shall be present onsite or on-call at all times.

Additional Guidance for Site Inspections:

- The CESCL (or other inspector for sites disturbing less than 1 acre) must have the skills to assess the:
 - Site conditions and construction activities that could impact the quality of stormwater.
 - Effectiveness of Construction SWPPP measures used to control the quality of stormwater discharges.
- 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 Construction SWPPP elements and making appropriate revisions within 7 days of the inspection.
 - Immediately begin 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 site inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge locations 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 1 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.) Note that for projects that require a CESCL per BMP C160, additional requirements may apply. The inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month during the dry season only (May 1 through September 30).

Additional Guidance:

- Seasonal Work Limitations: From October 1 through April 30, clearing, grading, and other soil disturbing activities is permitted only if shown to the satisfaction of the county that the site operator will prevent silt-laden runoff from leaving the site through a combination of the following:
 - Compliance with Construction SWPPP Element #5 to Stabilize Soil and BMP Usage.
 - Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters.
 - Limit activities and the extent of disturbed areas.
 - Proposed Construction SWPPP measures.

- Based on the information provided and/or local weather conditions, the county may expand or restrict the seasonal limitation onsite disturbance. The county shall take enforcement action –such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:
 - If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard.
 - If clearing and grading limits or Construction SWPPP measures shown in the approved plan are not maintained.

The following activities are exempt from the seasonal clearing and grading limitations:

- Routine maintenance and necessary repair of Construction SWPPP BMPs.
 - Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil.
 - Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed Construction SWPPP facilities.
- Coordination with Utilities and Other Contractors: The primary project applicant shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.
 - Inspection and Monitoring: All BMPs must be inspected, maintained, and repaired as needed to ensure 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 Construction SWPPP measures used to control the quality of stormwater discharges. 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.

Inspection reports and daily logs must be available onsite with the Construction SWPPP and shall be submitted to the county upon request at any time during the course of the project.

- Maintaining an Updated Construction SWPPP: Retain the Construction SWPPP onsite 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 county 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.

Element #13: Protect Low Impact Development BMPs

- Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.
- See Section 3.3 for more details on protecting LID BMPs.

Suggested BMPs:

- BMP C103: High Visibility Fence
- BMP C233: Silt Fence

SECTION 2 – PROJECT DESCRIPTION

This Stormwater Site Plan has been prepared to obtain a site development permit for this project proposal. The project scope is to proposed a new building onsite. The project area is approximately 9,950 sf with the roof area of the proposed building at 5,355 sf. The zoning falls under the ML – Limited Manufacturing. The sites parcel number 2105200140. The address of the site is 2315 Inter Ave.

The proposed building will be provided with a roof drain tightline around the perimeter of the building footprint to collect and convey roof drainage to a properly sized infiltration trench where stormwater will be infiltrated into the native soils below. Emergency overflow will be provided via bubbling up through an inlet grate and flowing overland to the existing storm pond. All other disturbed areas will be amended per DOE BMP T5.13. Stormwater BMPS have been designed per the 2019 DOE Stormwater Management Manual.

SECTION 3 – EXISTING SITE CONDITIONS

There is currently a building with an associated paved parking lot located on the subject property and the majority of the property is currently covered with impervious pavement and building roof surfaces. The existing building and parking lot with remain as is.

The site's existing topography is flat. The whole site has an approximate topographic elevation of ± 60.0 .

SECTION 4 – ADJACENT AREAS

Surrounding properties consist of commercial and some residential properties. Inter Ave. is immediately adjacent to the site to the south.

SECTION 5 – CRITICAL AREAS

There are no wetlands and/or critical areas in the direct vicinity of this project.

SECTION 6 – SOILS

Per the NRCS soils information, the site consists of Briscot loam. This soil is a nearly level soil that is poorly drained. It formed in alluvium. The permeability is moderately high to high. See Appendix "B" of this report for additional existing soils information.

A geotechnical study was completed by GeoResources dated April 8, 2022. They concluded that infiltration of stormwater was feasible and recommended using a design infiltration rate of 2 in/hr. See the geotechnical report located in Appendix "B" for additional information.

SECTION 7 – EROSION PROBLEM AREAS

We are not aware of areas of particular concern on this project site with regards to erosion problems.

SECTION 8 – CONSTRUCTION PHASING

The proposed construction sequence will be as follows:

1. Obtain required permits.
2. Call City of Puyallup Inspector for pre-construction meeting.
3. Clearly flag all limits of clearing and grading per approved plans.
4. Install ex. catch basin inlet protection and sediment control devices.
5. Clear and grade site per approved plans.
6. Install utilities (i.e. – sanitary, power, cable, etc.)
7. Provide catch basin protection until the road & storm drain system is completed and all exposed slopes are seeded & stabilized for erosion & sedimentation.
8. Note: The building contractor is responsible for maintenance of storm system during building and landscape construction.
9. Hydroseed and/or mulch slopes and other exposed areas immediately after grading is completed as outlined in “erosion control notes”.
10. Clean out and test all storm drain facilities.
11. Inspect and maintain all erosion control facilities at regular intervals & complete required report. Clean as required until risk of sedimentation has passed.
12. Provide catch basin protection until storm drain system is completed and all exposed slopes are seeded & stabilized for erosion & sedimentation

SECTION 9 – CONSTRUCTION SCHEDULE

Construction of this project is anticipated to begin in the Summer of 2023.

During the wet season from October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days at a time.

SECTION 10 – FINANCIAL/OWNERSHIP RESPONSIBILITIES

The property owner's agent is responsible for the initiation of any necessary bonds and/or other financial securities are:

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SECTION 11 – ENGINEERING CALCULATIONS

See Stormwater Site Plan for all engineering calculations.

SECTION 12 – EROSION CONTROL SPECIALIST

No erosion control specialist has been appointed at this time. Once one is established, he/she will be reported to the City of Puyallup.

APPENDIX "A"
BMPs

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burying and smothering vegetation.

- Vegetative buffer zones for streams, lakes or other waterways shall be established by the local permitting authority or other state or federal permits or approvals.

Maintenance Standards

Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed. Replace all damaged flagging immediately. Remove all materials located in the buffer area that may impede the ability of the vegetation to act as a filter.

BMP C103: High-Visibility Fence

Purpose

High-visibility fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances, exits, or internal roads.
- Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High-visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high-visibility orange. The fence tensile strength shall be 360 lbs/ft using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233: Silt Fence to act as high-visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure II-3.1: Stabilized Construction Access for details. Note: the 100' minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').

Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table II-3.2: Stabilized Construction Access Geotextile Standards.

**Table II-3.2: Stabilized Construction Access
Geotextile Standards**

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.

**Table II-3.2: Stabilized Construction Access
Geotextile Standards (continued)**

Geotextile Property	Required Value
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the Quarry Spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between Dually truck tires, and then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the Stabilized Construction Access remains effective. To remain effective, the BMP must prevent sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized Construction Accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table II-3.3: Stabilized Construction Access Alternative Material Requirements.

**Table II-3.3: Stabilized
Construction Access
Alternative Material
Requirements**

Sieve Size	Percent Passing
2½"	99-100

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**Table II-3.3: Stabilized
Construction Access
Alternative Material
Requirements
(continued)**

Sieve Size	Percent Passing
2"	65-100
¾"	40-80
No. 4	5 max.
No. 100	0-2
% Fracture	75 min.

- All percentages are by weight.
- The sand equivalent value and dust ratio requirements do not apply.
- The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

Maintenance Standards

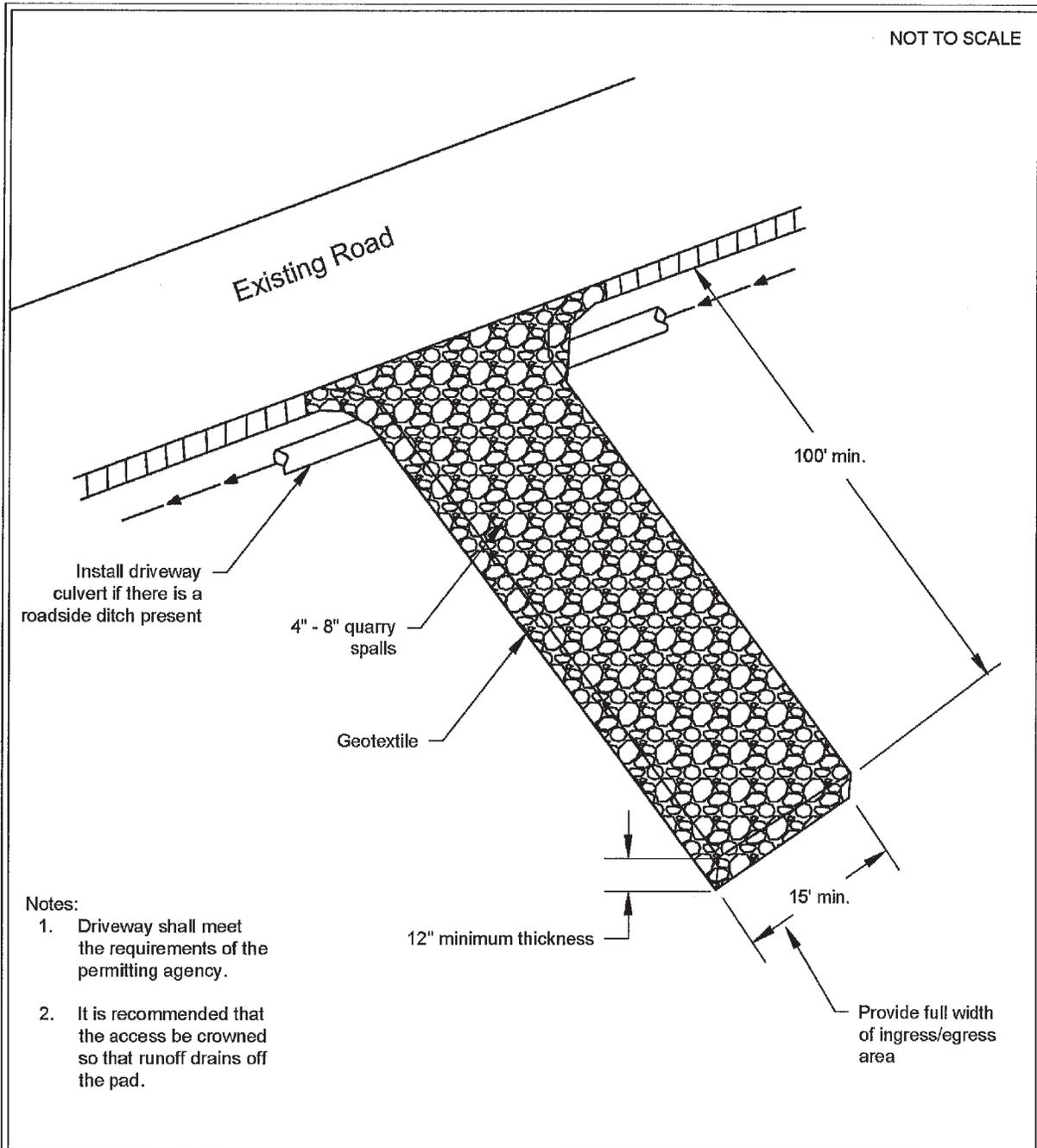
Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.

- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Ab

Figure II-3.1: Stabilized Construction Access



Notes:

1. Driveway shall meet the requirements of the permitting agency.
2. It is recommended that the access be crowned so that runoff drains off the pad.



Stabilized Construction Access

Revised June 2018

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Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

~~**BMP C106: Wheel Wash**~~

~~**Purpose**~~

~~Wheel washes reduce the amount of sediment transported onto paved roads by washing dirt from the wheels of motor vehicles prior to the motor vehicles leaving the construction site.~~

~~**Conditions of Use**~~

- ~~• Use a wheel wash when BMP C105: Stabilized Construction Access is not preventing sediment from being tracked off site.~~
- ~~• Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.~~
- ~~• Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.~~
- ~~• Wheel wash wastewater is not stormwater. It is commonly called process water, and must be discharged to a separate on-site treatment system that prevents discharge to waters of the State, or to the sanitary sewer with local sewer district approval.~~
- ~~• Wheel washes may use closed-loop recirculation systems to conserve water use.~~
- ~~• Wheel wash wastewater shall not include wastewater from concrete washout areas.~~
- ~~• When practical, the wheel wash should be placed in sequence with BMP C105: Stabilized Construction Access. Locate the wheel wash such that vehicles exiting the wheel wash will enter directly onto BMP C105: Stabilized Construction Access. In order to achieve this, BMP C105: Stabilized Construction Access may need to be extended beyond the standard installation to meet the exit of the wheel wash.~~

~~**Design and Installation Specifications**~~

~~Suggested details are shown in Figure II-3.2: Wheel Wash. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.~~

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~~Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.~~

~~Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.~~

~~Perform street cleaning at the end of each day or more often if necessary.~~

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP T5.13: Post-Construction Soil Quality and Depth.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed

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before water flow; install sod in the channel bottom — over top of hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See BMP T5.13: Post-Construction Soil Quality and Depth.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:
 - Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
 - Phase 2- Install the rest of the mulch and tackifier over the first lift.

Or, enhance vegetation by:

- Installing the mulch, seed, fertilizer, and tackifier in one lift.
- Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
- Hold straw in place with a standard tackifier.

Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

- Irrigation.
- Reapplication of mulch.
- Repair of failed slope surfaces.

This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bonded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).

- Seed may be installed by hand if:
 - Temporary and covered by straw, mulch, or topsoil.
 - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in Table II-3.4: Temporary and Permanent Seed Mixes include

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recommended mixes for both temporary and permanent seeding.

- Apply these mixes, with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a rate of 60 pounds per acre.
- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used, depending on the soil type and hydrology of the area.

Table II-3.4: Temporary and Permanent Seed Mixes

Common Name	Latin Name	% Weight	% Purity	% Germination
Temporary Erosion Control Seed Mix				
A standard mix for areas requiring a temporary vegetative cover.				
Chewings or annual blue grass	<i>Festuca rubra</i> var. <i>commutata</i> or <i>Poa annua</i>	40	98	90
Perennial rye	<i>Lolium perenne</i>	50	98	90
Redtop or colonial bentgrass	<i>Agrostis alba</i> or <i>Agrostis tenuis</i>	5	92	85
White dutch clover	<i>Trifolium repens</i>	5	98	90
Landscaping Seed Mix				
A recommended mix for landscaping seed.				
Perennial rye blend	<i>Lolium perenne</i>	70	98	90
Chewings and red fescue blend	<i>Festuca rubra</i> var. <i>commutata</i> or <i>Festuca rubra</i>	30	98	90
Low-Growing Turf Seed Mix				
A turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.				
Dwarf tall fescue (several varieties)	<i>Festuca arundinacea</i> var.	45	98	90
Dwarf perennial rye (Barclay)	<i>Lolium perenne</i> var. <i>barclay</i>	30	98	90
Red fescue	<i>Festuca rubra</i>	20	98	90
Colonial bentgrass	<i>Agrostis tenuis</i>	5	98	90
Bioswale Seed Mix				
A seed mix for bioswales and other intermittently wet areas.				
Tall or meadow fes-	<i>Festuca arundin-</i>	75-80	98	90

All

Table II-3.4: Temporary and Permanent Seed Mixes (continued)

Common Name	Latin Name	% Weight	% Purity	% Germination
cue	<i>acea</i> or <i>Festuca elatior</i>			
Seaside/Creeping bentgrass	<i>Agrostis palustris</i>	10-15	92	85
Redtop bentgrass	<i>Agrostis alba</i> or <i>Agrostis gigantea</i>	5-10	90	80
Wet Area Seed Mix				
A low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.				
Tall or meadow fescue	<i>Festuca arundinacea</i> or <i>Festuca elatior</i>	60-70	98	90
Seaside/Creeping bentgrass	<i>Agrostis palustris</i>	10-15	98	85
Meadow foxtail	<i>Alepocurus pratensis</i>	10-15	90	80
Alsike clover	<i>Trifolium hybridum</i>	1-6	98	90
Redtop bentgrass	<i>Agrostis alba</i>	1-6	92	85
Meadow Seed Mix				
A recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.				
Redtop or Oregon bentgrass	<i>Agrostis alba</i> or <i>Agrostis oregonensis</i>	20	92	85
Red fescue	<i>Festuca rubra</i>	70	98	90
White dutch clover	<i>Trifolium repens</i>	10	98	90

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum,

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permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
- In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre. Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10 percent tackifier. Achieve a minimum of 95 percent soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include:
 - BFM and MBFMs do not require surface preparation.
 - Helicopters can assist in installing BFM and MBFMs in remote areas.
 - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
 - Installing BFM and MBFMs can save at least \$1,000 per acre compared to blankets.

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Maintenance Standards

Reseed any seeded areas that fail to establish at least 75 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, nets, or blankets.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes run-off.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are a variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

For seeded areas, mulch may be made up of 100 percent:

- cottonseed meal;
- fibers made of wood, recycled cellulose, hemp, or kenaf;

- compost;
- or blends of these.

Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.

Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Recycled cellulose may contain polychlorinated biphenyl (PCBs). Ecology recommends that products should be evaluated for PCBs prior to use.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

Any mulch or tackifier product used shall be installed per the manufacturer's instructions.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table II-3.6: Mulch Standards and Guidelines. Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of "Compost" is selected, it should be a coarse compost that meets the size gradations listed in Table II-3.5: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Table II-3.5: Size Gradations of Compost as Mulch Material

Sieve Size	Percent Passing
3"	100%
1"	90% - 100%
3/4"	70% - 100%
1/4"	40% - 100%

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult the Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Maintenance Standards

The thickness of the mulch cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
Straw	Quality Standards	Air-dried; free from undesirable seed and coarse material.
	Application Rates	2"-3" thick; 5 bales per 1,000 sf or 2-3 tons per acre
	Remarks	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	Quality Standards	No growth inhibiting factors.
	Application Rates	Approx. 35-45 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre
	Remarks	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about 3/4 - 1 inch clog hydromulch equipment. Fibers should be kept to less than 3/4 inch.
Compost	Quality Standards	No visible water or dust during handling. Must be produced per <u>WAC 173-350</u> , Solid Waste Handling Standards, but may have up to 35% biosolids.
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs per cubic yard)
	Remarks	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Compost used for mulch has a coarser size gradation than compost used for <u>BMP C 125: Topsoiling / Composting</u> or <u>BMP T5.13: Post-Construction Soil Quality and Depth</u> . It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use near wetlands or near phosphorous impaired water bodies.
Chipped Site Vegetation	Quality Standards	Gradations from fines to 6 inches in length for texture, variation, and interlocking properties. Include a mix of various sizes so that the average size is between 2- and 4- inches.
	Application Rates	2" thick min.;

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Table II-3.6: Mulch Standards and Guidelines (continued)

Mulch Material	Guideline	Description
	Remarks	<p>This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If permanent seeding or planting is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.</p> <p>Note: thick application of this material over existing grass, herbaceous species, and some groundcovers could smother and kill vegetation.</p>
Wood-Based Mulch	Quality Standards	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs. per cubic yard)
	Remarks	This material is often called "wood straw" or "hog fuel". The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	Quality Standards	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.
	Application Rates	2" thick min.
	Remarks	Cost-effective protection when applied with adequate thickness. A minimum of 95-percent of the wood strand shall have lengths between 2 and 10-inches, with a width and thickness between 1/16 and 1/2-inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. [Specification 9-14.4(4) from the <i>Standard Specifications for Road, Bridge, and Municipal Construction</i> (WSDOT, 2016)]

~~BMP C122: Nets and Blankets~~

~~Purpose~~

~~Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows.~~

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3. Provide a minimum of 8-inch overlap at the seams.
 4. On long or wide slopes, or slopes subject to wind, tape all seams.
 5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
 6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
 7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
 8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
 - If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

BMP C124: Sodding

Purpose

The purpose of sodding is to establish turf for immediate erosion protection and to stabilize drainage paths where concentrated overland flow will occur.

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Conditions of Use

Sodding may be used in the following areas:

- Disturbed areas that require short-term or long-term cover.
- Disturbed areas that require immediate vegetative cover.
- All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.

Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

1. Shape and smooth the surface to final grade in accordance with the approved grading plan. Consider any areas (such as swales) that need to be overexcavated below design elevation to allow room for placing soil amendment and sod.
2. Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. See <https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost> for further information.
3. Fertilize according to the sod supplier's recommendations.
4. Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
5. Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
6. Roll the sodded area and irrigate.
7. When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

BMP C125: Topsoiling / Composting

Purpose

Topsoiling and composting provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling and composting are an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Use this BMP in conjunction with other BMPs such as BMP C120: Temporary and Permanent Seeding, BMP C121: Mulching, or BMP C124: Sodding. Implementation of this BMP may meet the post-construction requirements of BMP T5.13: Post-Construction Soil Quality and Depth.

Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but also serve as effective biofilters for urban pollutants and, by supporting more vigorous plant growth, reduce the water, fertilizer and pesticides needed to support installed landscapes. Topsoil does not include any subsoils but only the material from the top several inches including organic debris.

Conditions of Use

- Permanent landscaped areas shall contain healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetative health and vitality, improves hydrologic characteristics, and reduces the need for irrigation.
- Leave native soils and the duff layer undisturbed to the maximum extent practicable. Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. Preserve existing soil systems in undisturbed and uncompacted conditions if functioning properly.
- Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.
- Restore, to the maximum extent practical, native soils disturbed during clearing and grading to a condition equal to or better than the original site condition's moisture-holding capacity. Use on-site native topsoil, incorporate amendments into on-site soil, or import blended topsoil to meet this requirement.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.
- Beware of where the topsoil comes from, and what vegetation was on site before disturbance. Invasive plant seeds may be included and could cause problems for establishing native plants, landscaped areas, or grasses.
- Topsoil from the site will contain mycorrhizal bacteria that are necessary for healthy root growth and nutrient transfer. These native mycorrhiza are acclimated to the site and will provide optimum conditions for establishing grasses. Use commercially available mycorrhiza products when using off-site topsoil.

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Design and Installation Specifications

Meet the following requirements for disturbed areas that will be developed as lawn or landscaped areas at the completed project site:

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil shall have:
 - A minimum depth of 8-inches. Scarify subsoils below the topsoil layer at least 4-inches with some incorporation of the upper material to avoid stratified layers, where feasible. Ripping or re-structuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.
 - A minimum organic content of 10% dry weight in planting beds, and 5% organic matter content in turf areas. Incorporate organic amendments to a minimum 8-inch depth except where tree roots or other natural features limit the depth of incorporation.
 - A pH between 6.0 and 8.0 or matching the pH of the undisturbed soil.
 - If blended topsoil is imported, then fines should be limited to 25 percent passing through a 200 sieve.
- Mulch planting beds with 2 inches of organic material
- Accomplish the required organic content, depth, and pH by returning native topsoil to the site, importing topsoil of sufficient organic content, and/or incorporating organic amendments. When using the option of incorporating amendments to meet the organic content requirement, use compost that meets the compost specification for Bioretention (See BMP T7.30: Bioretention), with the exception that the compost may have up to 35% biosolids or manure.
- Sections 3 through 7 of *Building Soil: Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington (Stenn et al., 2016)*, provides useful guidance for implementing whichever option is chosen. It includes guidance for pre-approved default strategies and guidance for custom strategies. Check with your local jurisdiction concerning its acceptance of this guidance.
- The final composition and construction of the soil system will result in a natural selection or favoring of certain plant species over time. For example, incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- Allow sufficient time in scheduling for topsoil spreading prior to seeding, sodding, or planting.
- Take care when applying top soil to subsoils with contrasting textures. Sandy topsoil over clayey subsoil is a particularly poor combination, as water creeps along the junction between the soil layers and causes the topsoil to slough. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method to promote bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- Field exploration of the site shall be made to determine if there is surface soil of sufficient quantity and quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam,

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silt loam, sandy clay loam, and clay loam). Avoid areas of natural ground water recharge.

- Stripping shall be confined to the immediate construction area. A 4-inch to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All surface runoff control structures shall be in place prior to stripping.
- Do not place topsoil while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.
- In any areas requiring grading, remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas. Reapply stockpiled topsoil to other portions of the site where feasible.
- Locate the topsoil stockpile so that it meets specifications and does not interfere with work on the site. It may be possible to locate more than one pile in proximity to areas where topsoil will be used.
- Stockpiling of topsoil shall occur in the following manner:
 - Side slopes of the stockpile shall not exceed 2H:1V.
 - Between October 1 and April 30:
 - An interceptor dike with gravel outlet and silt fence shall surround all topsoil.
 - Within 2 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.
 - Between May 1 and September 30:
 - An interceptor dike with gravel outlet and silt fence shall surround all topsoil if the stockpile will remain in place for a longer period of time than active construction grading.
 - Within 7 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.
- When native topsoil is to be stockpiled and reused the following should apply to ensure that the mycorrhizal bacterial, earthworms, and other beneficial organisms will not be destroyed:
 - Re-install topsoil within 4 to 6 weeks.
 - Do not allow the saturation of topsoil with water.
 - Do not use plastic covering.

Maintenance Standards

- Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.
- Establish soil quality and depth toward the end of construction and once established, protect from compaction, such as from large machinery use, and from erosion.

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- Plant and mulch soil after installation.
- Leave plant debris or its equivalent on the soil surface to replenish organic matter.
- Reduce and adjust, where possible, the use of irrigation, fertilizers, herbicides and pesticides, rather than continuing to implement formerly established practices.

BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection

Purpose

Polyacrylamide (PAM) is used on construction sites to prevent soil erosion.

Applying PAM to bare soil in advance of a rain event significantly reduces erosion and controls sediment in two ways. First, PAM increases the soil's available pore volume, thus increasing infiltration and reducing the quantity of stormwater runoff. Second, it increases flocculation of suspended particles and aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

Conditions of Use

PAM shall not be directly applied to water or allowed to enter a water body. Stormwater runoff shall pass through a sediment pond prior to discharging to surface waters.

PAM can be applied to bare soil under the following conditions:

- During rough grading operations.
- In Staging areas.
- Balanced cut and fill earthwork.
- Haul roads prior to placement of crushed rock surfacing.
- Compacted soil roadbase.
- Stockpiles.
- After final grade and before paving or final seeding and planting.
- Pit sites.
- Sites having a winter shut down. In the case of winter shut down, or where soil will remain unworked for several months, PAM should be used together with mulch.

Design and Installation Specifications

- Do not use PAM on a slope that flows directly into a stream or wetland.
- Do not add PAM to water discharging from the site.

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thickness is 2 feet.

- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.
- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.11 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-3.10: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

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Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

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- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

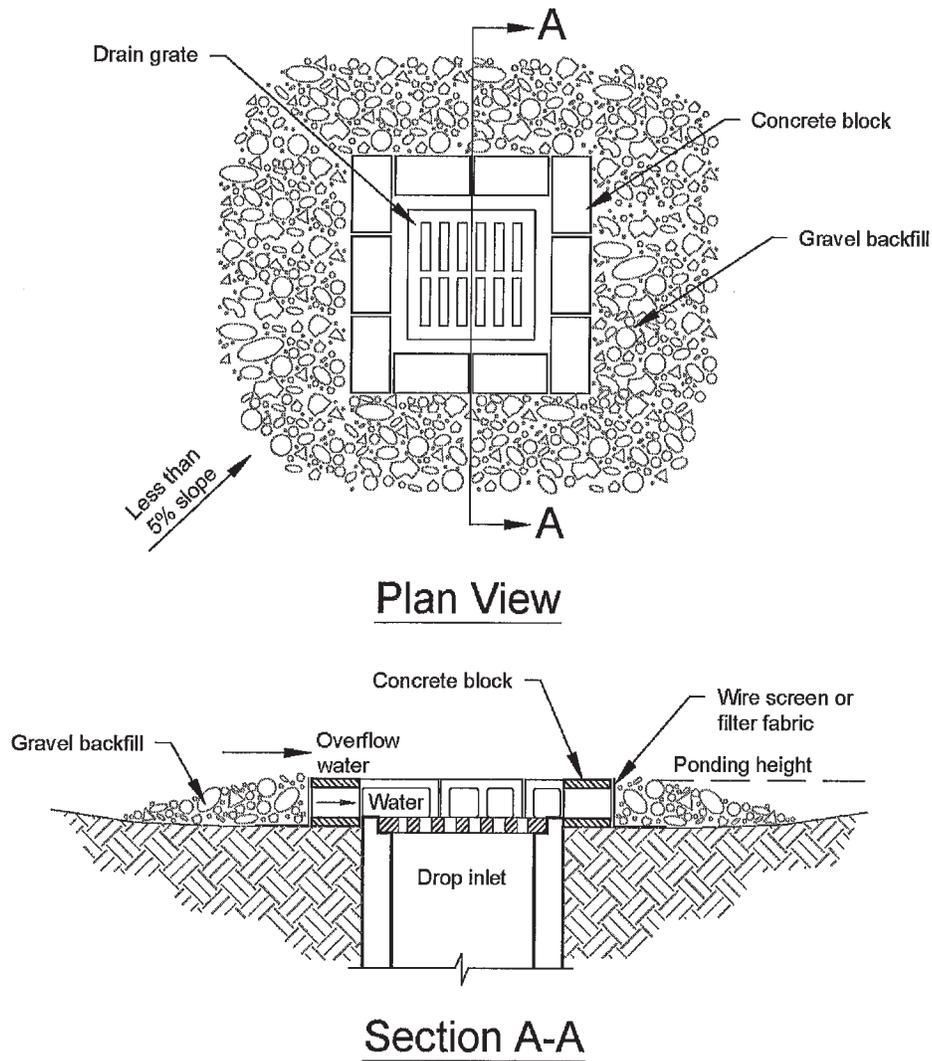
Block and Gravel Filter

A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
 - Provide a slope of 3H:1V on the upstream side of the berm.
 - Provide a slope of 2H:1V on the downstream side of the berm.
 - Provide a 1-foot wide level stone area between the gravel berm and the inlet.
 - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
 - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

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Figure II-3.17: Block and Gravel Filter



Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

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ECOLOGY
State of Washington

Block and Gravel Filter

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Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
 - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
 - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
 - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

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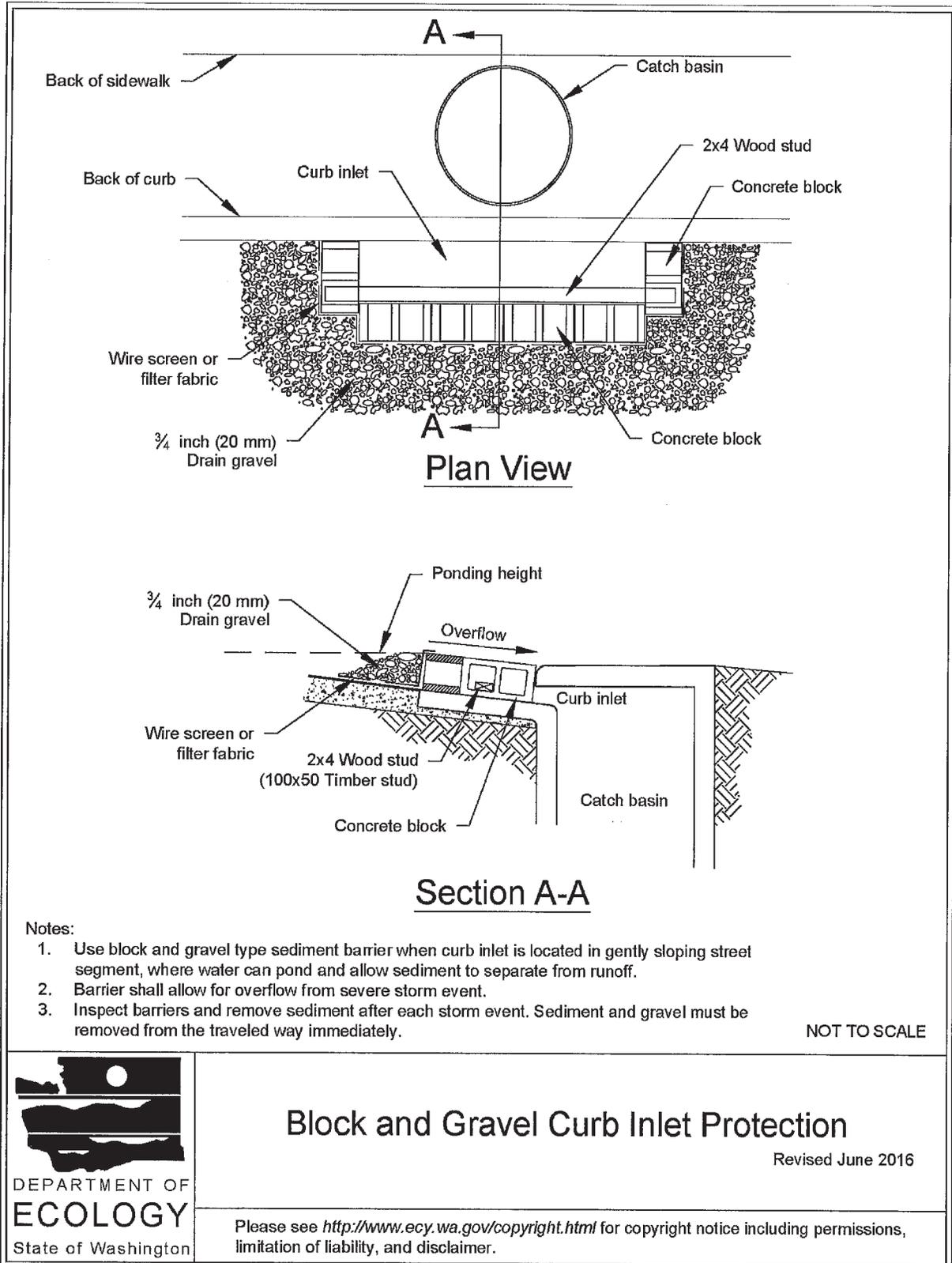
Block and Gravel Curb Inlet Protection

Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

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Figure II-3.18: Block and Gravel Curb Inlet Protection



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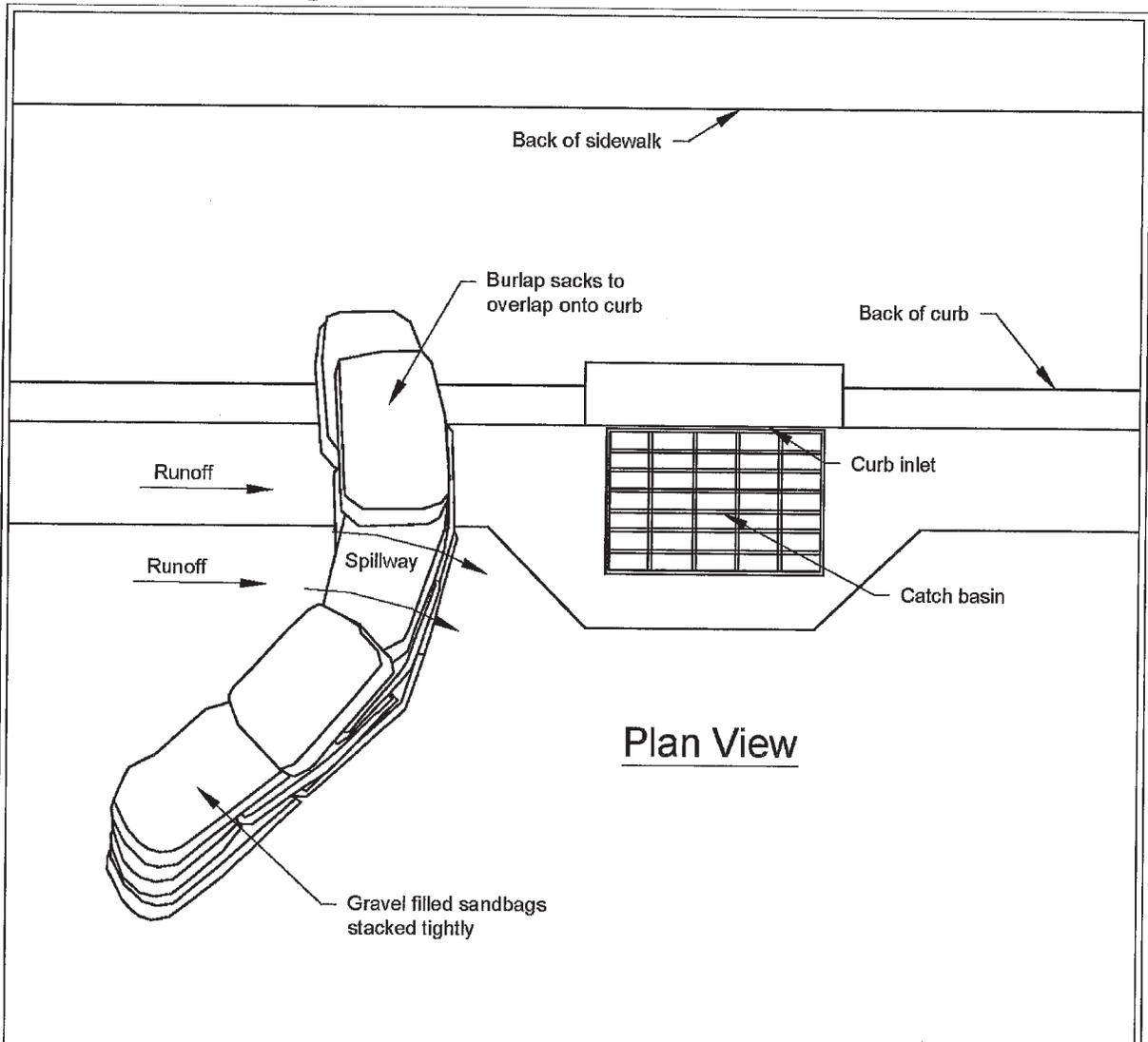
Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

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Figure II-3.19: Curb and Gutter Barrier



Plan View

Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Curb and Gutter Barrier

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Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

~~**BMP 0231: Brush Barrier**~~

~~**Purpose**~~

~~The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.~~

~~**Conditions of Use**~~

- ~~Brush barriers may be used downslope of disturbed areas that are less than one-quarter acre.~~
- ~~Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be directed to a sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment trapping BMP, is when the area draining to the barrier is small.~~
- ~~Brush barriers should only be installed on contours.~~

~~**Design and Installation Specifications**~~

- ~~Height: 2 feet (minimum) to 5 feet (maximum).~~
- ~~Width: 5 feet at base (minimum) to 15 feet (maximum).~~
- ~~Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.~~

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BMP C233: Silt Fence

Purpose

Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

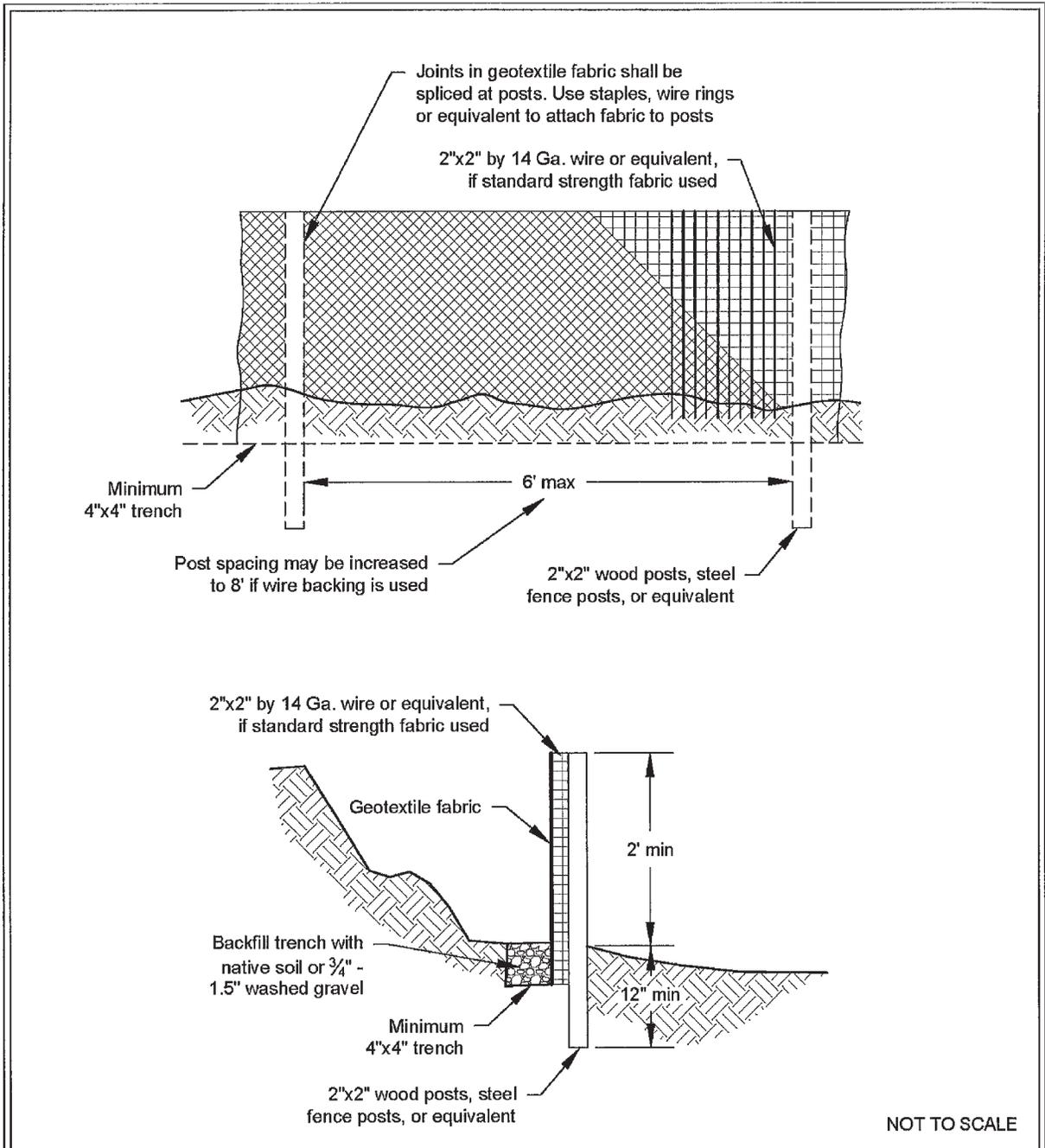
Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

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Figure II-3.22: Silt Fence



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Silt Fence

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Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table II-3.11: Geotextile Fabric Standards for Silt Fence):

Table II-3.11: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec ⁻¹ minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

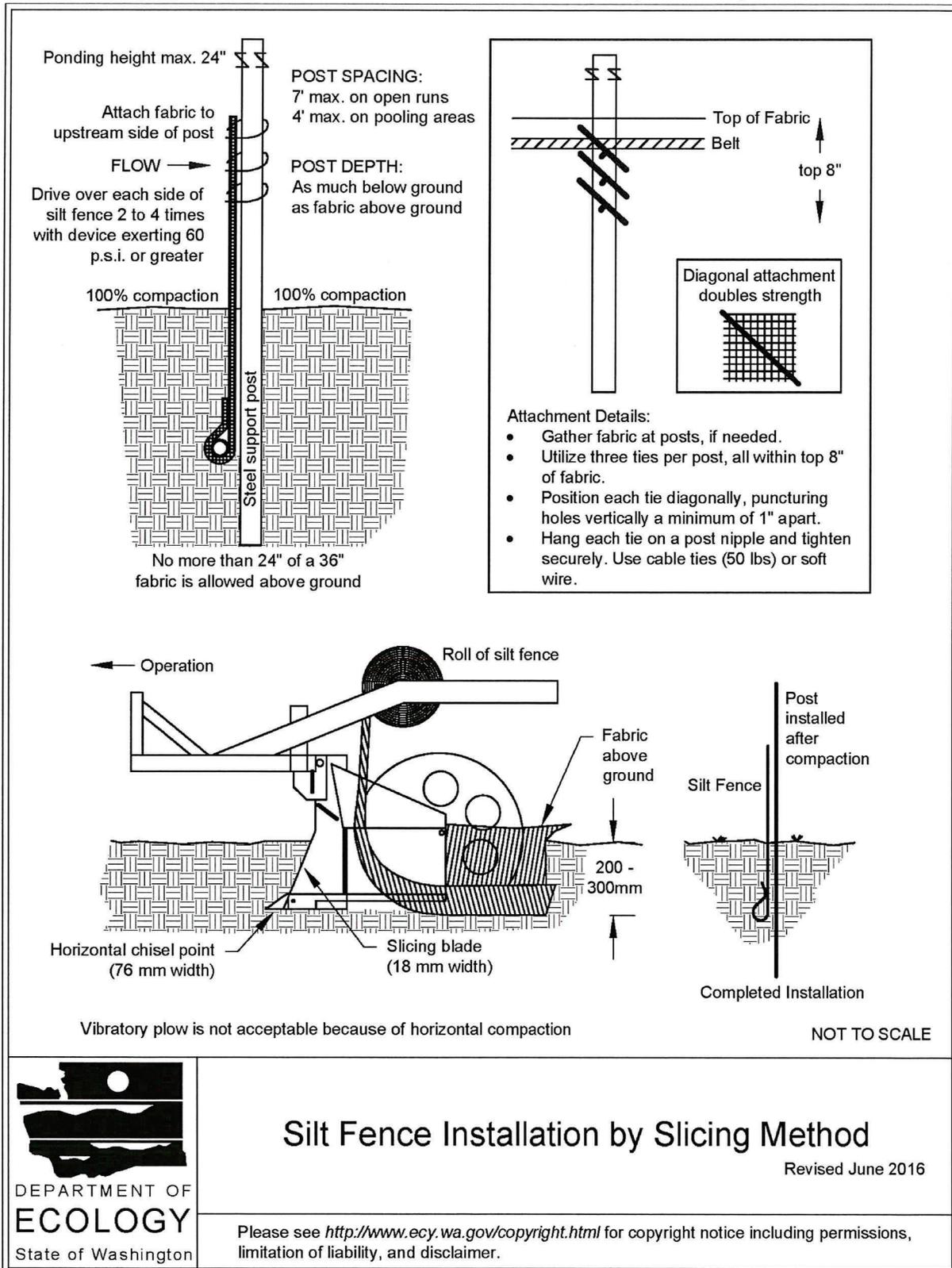
- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure II-3.22: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:
 1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
 2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.

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3. The silt fence shall have a 2-foot min. and a 2½-foot max. height above the original ground surface. water
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap. and
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing. neck until
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh. or the
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports. s. The
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min. dard
9. Drive or place the silt fence posts into the ground 18-inches min. A 12-inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading. each post
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either: sure
 - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges. sl.
 - No. 6 steel rebar or larger. e
 - ASTM A 120 steel pipe with a minimum diameter of 1-inch. he
 - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft. ect
 - Other steel posts having equivalent strength and bending resistance to the post sizes listed above. ovel
11. Locate silt fences on contour as much as possible, except at the ends of the fence,

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Figure II-3.23: Silt Fence Installation by Slicing Method



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Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

~~BMP C234: Vegetated Strip~~

~~Purpose~~

~~Vegetated strips reduce the transport of coarse sediment from a construction site by providing a physical barrier to sediment and reducing the runoff velocities of overland flow.~~

~~Conditions of Use~~

- ~~Vegetated strips may be used downslope of all disturbed areas.~~
- ~~Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to BMP C241: Sediment Pond (Temporary) or other sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a vegetated strip, rather than by a sediment trapping BMP, is when the following criteria are met (see Table II-3.12: Contributing Drainage Area for Vegetated Strips):~~

Table II-3.12: Contributing Drainage Area for Vegetated Strips

Average Contributing Area Slope	Average Contributing Area Percent Slope	Max Contributing area Flowpath Length
1.5H : 1V or flatter	67% or flatter	100 feet
2H : 1V or flatter	50% or flatter	115 feet
4H : 1V or flatter	25% or flatter	150 feet
6H : 1V or flatter	16.7% or flatter	200 feet
10H : 1V or flatter	10% or flatter	250 feet

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APPENDIX "B"
MISCELLANEOUS
INFORMATION

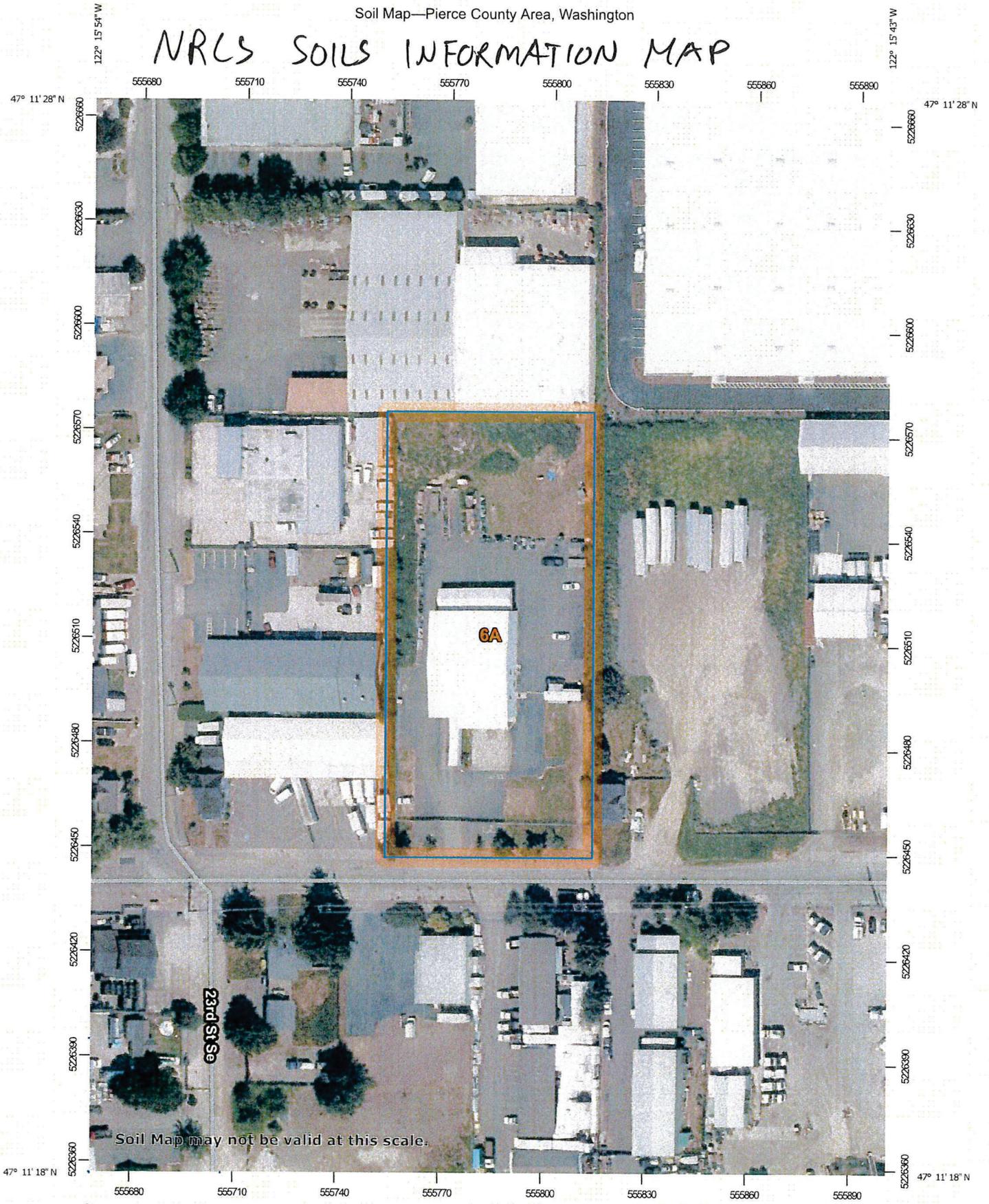
LARSON & ASSOCIATES, INC.
SURVEYORS, ENGINEERS AND PLANNERS
9027 PACIFIC AVENUE, SUITE 4
TACOMA, WA 98444 (253) 474-3404

VICINITY MAP



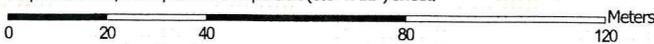
Map data ©2023 500 ft

NRLS SOILS INFORMATION MAP



Soil Map may not be valid at this scale.

Map Scale: 1:1,500 if printed on A portrait (8.5" x 11") sheet.



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



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Briscot loam	1.9	100.0%
Totals for Area of Interest		1.9	100.0%

B4

Pierce County Area, Washington

6A—Briscot loam

Map Unit Setting

National map unit symbol: 2hrc
Elevation: 20 to 250 feet
Mean annual precipitation: 30 to 55 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Briscot, drained, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Briscot, Drained

Setting

Landform: Flood plains
Parent material: Alluvium

Typical profile

H1 - 0 to 11 inches: loam
H2 - 11 to 38 inches: stratified fine sand to silt loam
H3 - 38 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 35 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Seasonally Wet Soils (G002XN202WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Minor Components

Briscot, undrained

Percent of map unit: 5 percent

Landform: Flood plains

Other vegetative classification: Seasonally Wet Soils
(G002XN202WA)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Pierce County Area, Washington

Survey Area Data: Version 18, Sep 8, 2022

Table B.5. Major Soil Groups in Pierce County.

Soil Type ¹	Hydrologic Soil Group	Soil Type ¹	Hydrologic Soil Group
ALDERWOOD (68)	C	NIMUE (18)	B
ALKIRIDGE (3)	C	NISQUALLY (2)	A
AQUIC XEROFLUVENTS (4)	D	NORMA (6)	D
BARNESTON (36)	B	OAKES (16)	B
BELLICUM (7)	B	OGARTY (5)	C
BELLINGHAM (5)	D	OHOP (7)	C
BOROHEMISTS (4)	D	ORTING (6)	D
BOW (25)	D	PHEENEY (12)	C
BRISCOT (5)	C	PILCHUCK (9)	C
BUCKLEY (17)	D	PITCHER (22)	B
CATTCREEK (16)	B	PLAYCO (22)	B
CINEBAR (7)	B	PUYALLUP (13)	B
DUPONT (9)	D	RAGNAR (3)	B
ETHANIA (22)	B	REICHEL (7)	B
EVERETT (48)	A	RIVERWASH (2)	D
FOSS (2)	B	ROCK OUTCROP (7)	D
GREENWATER (6)	A	RUGLES (7)	B
GROTTO (4)	A	SCAMMAN (21)	D
HARSTINE (78)	C	SHALCAR (2)	D
HAYWIRE (10)	C	SPANNA (2)	D
HUMAQUEPTS (6)	D	SPANAWAY (47)	A
INDEX (2)	A	STAHL (5)	C
INDIANOLA (24)	A	SULSAVAR (2)	B
JONAS (30)	B	SULTAN (7)	C
KAPOWSIN (127)	D	TISCH (4)	D
KITSAP (11)	C	TUSIP (7)	B
KLABER (2)	D	TYPIC UDIFLUVENTS (3)	B
LARRUPIN (5)	B	UDIFLUVENTS (2)	B
LITTLEJOHN (8)	C	VAILTON (8)	B
LYNNWOOD (3)	A	VOIGHT (3)	B
MASHEL (15)	B	WILKESON (19)	B
MCKENNA (5)	D	WINSTON (4)	B
MOWICH (4)	D	XEROCHREPTS (19)	B
NAGROM (7)	C	ZYNBAR (29)	B
NATIONAL (7)	B	ZYNBAR Till Substratum (6)	C
NEILTON (8)	A		

The number in () refers to the approximate total square miles of the soil type within Unincorporated Pierce County excluding federal lands.

National Flood Hazard Layer FIRMette



122°16'8"W 47°11'35"N



122°15'31"W 47°11'11"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE)
Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with draining areas of less than one square mile Zone Z
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee, See Notes, Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS OF FLOOD HAZARD

- NO SCREEN
- Area of Minimal Flood Hazard Zone X
- Effective LOMPRs
- Area of Undetermined Flood Hazard Zone

OTHER AREAS

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

GENERAL STRUCTURES

- 20.2
- 17.5
- 8
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

OTHER FEATURES

- Digital Data Available
- No Digital Data Available
- Unmapped

MAP PANELS

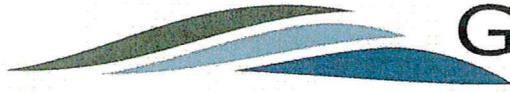


The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/3/2023 at 3:20 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



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April 8, 2022

CIMCO
13615 – 122nd Street East
Puyallup, Washington 98374
(253) 224-4428

Attn: Rick Valesquez
rick@cimcopnw.com

Soils Report: Stormwater Feasibility
Proposed Commercial Development
2315 Inter Ave
Puyallup, Washington
PN: 2105200140
Doc ID: CIMCO.InterAve.SR

INTRODUCTION

This stormwater *Soils Report* addresses the feasibility of onsite infiltration of stormwater runoff generated by the proposed commercial development to be constructed at 2315 Inter Avenue in Puyallup, Washington. The approximate site location is shown on the attached Site Location Map, Figure 1.

Our understanding of this project is based on our email correspondence with you and representatives from Larson & Associates (Larson); our review of the provided *Topographic Survey* by Larson dated October 7, 2021; our understanding of the City of Puyallup development codes; and our experience in the area. The site consists of a single tax parcel which is currently developed with an existing building, paved parking areas, and utilities. We understand that you propose to construct a new building that will add or replace about 5,000 square feet of hard surfacing.

To provide flexibility in the final design of the site development we proposed a scope of work consistent with creating more than 5,000 square feet of impervious surface. We understand the City of Puyallup (the City) is requiring a *Soils Report* be prepared in accordance with the 2019 *Stormwater Management Manual for Western Washington* (SWMMWW), which included in-situ infiltration testing and wet season groundwater monitoring.

SCOPE

The purpose of our services was to evaluate the surface and subsurface conditions at the site as a basis for developing and providing geotechnical stormwater recommendations for the proposed development. Specifically, our scope of services for the project included the following:

1. Reviewing the available geologic, hydrogeologic, and geotechnical data for the site area;
2. Exploring surface and subsurface conditions by reconnoitering the site and excavating a series of test pits 3 at select locations across the site and installing 2 shallow (less than 10 feet) piezometers in selected test pits;

3. Performing one small-scale pilot infiltration test (PIT) at the site;
4. Describing surface and subsurface conditions, including soil type, depth to groundwater, if encountered, and an estimate of seasonal high groundwater levels;
5. Monitoring of groundwater levels at the site during the prescriptive wet season;
6. Providing our opinion about the feasibility of onsite infiltration in accordance with the 2019 SWMMWW, including a preliminary design infiltration rate based on in-situ testing, as applicable; and,
7. Preparing a *Soils Report* that satisfies the 2019 SWMMWW requirements and summarizes our site observations and conclusions, our geotechnical recommendations and design criteria, along with the supporting data.

The above scope of work was summarized in our *Proposal for Geotechnical Engineering Services* dated November 29, 2021. We received written authorization to proceed with our scope of work from you on December 3, 2021.

SITE CONDITIONS

Surface Conditions

The site is located at 2315 Inter Avenue in Puyallup, Washington within an area of existing commercial development. Based on information obtained from the Pierce County Public GIS website, the site is generally rectangular in shape, measures approximately 200 feet wide (east to west) by 400 to 405 feet long (north to south) and encompasses about 1.86 acres. The site is bounded by Inter Avenue to the south, single-family residence to the east, and by existing commercial development to the north and west.

The site generally flat with less than 2 feet of topographic relief. The vegetation in the area of the proposed development had been generally cleared and consisted of grasses, brambles, and other low lying native and invasive species. No areas of surficial erosion, seeps, or springs were observed at the time of our reconnaissance. Standing water was not observed in the existing pond/depressions on the northwest and portions of the site at the time of our December 2021 site visit. The existing site topography is shown on the Site Exploration Map, Figure 2.

Site Soils

The USDA Natural Resource Conservation Services (NRCS) Web Soil Survey maps the site as being underlain by Briscot loam soils (6A). The Briscot soil type 6A is derived from alluvium, form on slopes of 0 to 2 percent and has a "slight" potential for erosion when exposed. The upper, weathered soil horizons are listed in hydrologic soils group B, while the deeper soil horizons are listed in hydrologic soils group D. A copy of the referenced NRCS Soils Map for the site area is included as Figure 3.

Site Geology

The draft of the *Geologic Map of the Puyallup 7.5-Minute Quadrangle, Washington* (Troost et al.) maps the site and surrounding area as being underlain by alluvium (Qal). Alluvium generally consists of a poorly sorted, lightly stratified mixture of silts and sands that may contain localized deposits of clay and gravel that were deposited by fluvial processes. The alluvial deposits are considered

normally consolidated and generally have moderate strength and compressibility characteristics where undisturbed. An excerpt of the above referenced map is included as Figure 4.

Subsurface Explorations

On December 21, 2021, we visited the site and monitored the excavation of three test pits to depths of 6.5 to 8.0 feet below the existing ground surface, one of which was completed as a PIT. Our representative logged the subsurface conditions encountered in each test pit and obtained representative soil samples. We also performed in-situ infiltration testing at 2 feet below existing grades in PIT-1. The test pits were excavated by a small track-mounted excavator operated by a licensed earthwork contractor working for GeoResources. Table 1, below, summarizes the approximate functional locations, surface elevations, and termination depths of our explorations.

**TABLE 1:
APPROXIMATE LOCATIONS, ELEVATIONS, AND DEPTHS OF EXPLORATIONS**

Exploration Number	Functional Location	Surface Elevation (feet)	Termination Depth (feet)	Termination Elevation ¹ (feet)
TP-1	East portion of proposed development	60	6.5	53.5
TP-2	West portion of proposed development	60	8.0	52.0
PIT-1	Central portion of proposed development	60	5.0	55.0

Notes:
1 = Surface elevation estimated from the provided by the Pierce County Public GIS contours based on NAVD 88

The specific number, locations, and depths of our explorations were selected based on the configuration of the proposed development and were adjusted in the field based on consideration for underground utilities, existing site conditions, site access limitations and encountered stratigraphy. Soil densities presented on the logs were based on the difficulty of excavation and our experience. Representative soil samples obtained from the test pits were placed in sealed plastic containers and then taken to our laboratory for further examination and testing as deemed necessary. The test pits were then backfilled with the excavated soils and bucket tamped, but not otherwise compacted.

The subsurface explorations excavated as part of this evaluation indicate the subsurface conditions at specific locations only, as actual subsurface conditions can vary across the site. Furthermore, the nature and extent of such variation would not become evident until additional explorations are performed or until construction activities have begun. Based on our experience and extent of prior explorations in the area, it is our opinion that the soils encountered in the explorations are generally representative of the soils at the site.

The approximate locations and numbers of our test pits are shown on the attached Site Exploration Map, Figure 2. The soils encountered were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D: 2488. The USCS is included in Appendix A as Figure A-1, while the descriptive logs of our test pits are included as Figure A-2.

Subsurface Conditions

At the locations of our explorations, we encountered generally uniform subsurface conditions that in our opinion confirmed the mapped stratigraphy at the site. In general, our test pit explorations encountered about 1.2 to 1.4 feet of brown topsoil in a loose, moist condition mantling about 3.8 to 4.2 feet of iron-oxide stained brown to dark grey silty sand in a loose, moist condition. These surficial soils were underlain by iron-oxide stained mottled dark grey to black silty sand in a loose and wet condition to the full depth explored. We interpret the soils encountered at the site to be consistent with alluvium deposits. Table 2 below summarizes the soils encountered in our explorations.

TABLE 2:
APPROXIMATE THICKNESS, DEPTHS, AND ELEVATION OF ENCOUNTERED SOIL TYPES

Exploration Number	Thickness of Topsoil (Feet)	Thickness of Surficial Silty Sand (feet)	Depth to Restrictive SILT Layer(s) (feet)	Depth to Deeper Silty Sand (feet)	Elevation ¹ of Deeper Silty Sand (feet)
TP-1/P-1	0.5	5.0	5.5	6.0	54.0+
TP-2/P-2	0.5	2.5	3.0	3.5	56.5 – 52.5
PIT-1	0.5	2.5	NE	3.0	57.0

Notes:
 1 = Surface elevation estimated from the provided by the Pierce County Public GIS contours based on NAVD 88
 NE = Not encountered
 + = Did not encounter silt layer beneath silty sand

Laboratory Testing

Geotechnical laboratory tests were performed on select samples retrieved from the test pits to estimate index engineering properties of the soils encountered. Laboratory testing included visual soil classification per ASTM D: 2488 and ASTM D: 2489, moisture content determinations per ASTM D: 2216, and grain size analyses per ASTM D: 6913 standard procedures. The results of the laboratory tests are summarized below in Table 3 and graphical outputs are included in Appendix B.

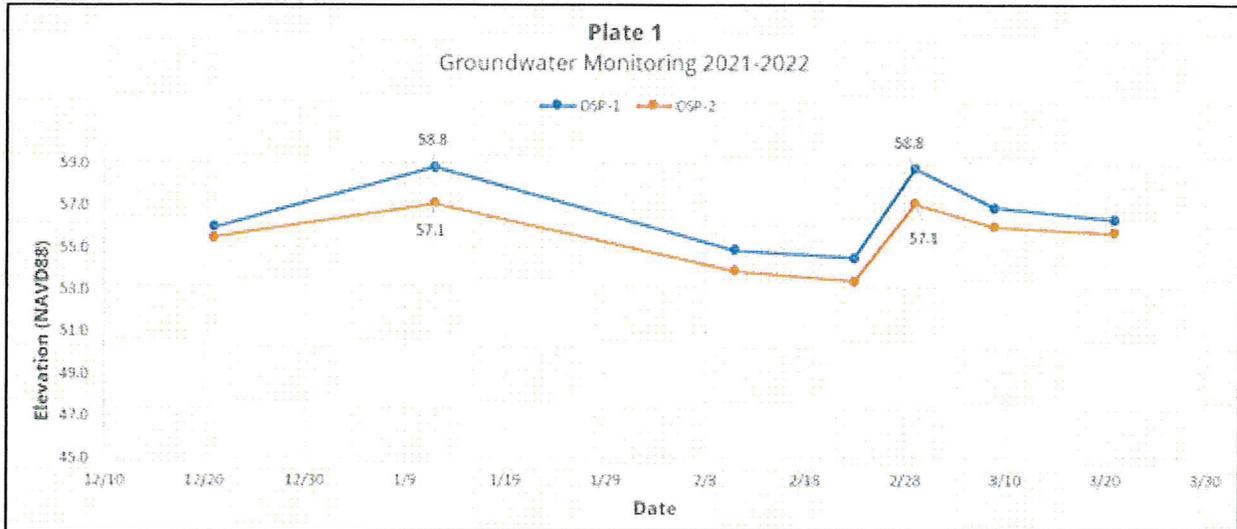
TABLE 3:
LABORATORY TEST RESULTS FOR ON-SITE SOILS

Sample	Soil Type	Lab ID	Gravel Content (percent)	Sand Content (percent)	Silt/Clay Content (percent)	D10 Ratio (mm)
PIT-1, S-2, 5'	SM	103087	0	82.1	17.9	>0.075

Groundwater Conditions

At the time of exploration, groundwater seepage was observed at depths of 4 to 4.5 feet below existing grades. Groundwater monitoring wells were installed at the site at the time of exploration. The locations of the observation wells are shown on the Site & Exploration Plan, Figure 2. Groundwater readings for the observation wells were manually measured on a bi-monthly basis from December 21, 2021 to March 21, 2022.

Based on our wet season monitoring, it appears that seasonal high groundwater occurs at about Elevation 59 feet (NAVD 88) at the locations monitored, approximately 1.2 feet below the ground surface. These levels were recorded on January 12, 2022 and March 1, 2022. Plate 1, below, summarizes the groundwater levels recorded as part of our groundwater monitoring program during our monitoring period.



We anticipate fluctuations in the local groundwater levels will occur in response to precipitation patterns, off site construction activities, and site utilization. As such, water level observations made at the time of our field investigation may vary from those encountered during the construction phase. Analysis or modeling of anticipated groundwater levels during construction is beyond the scope of this report.

CONCLUSIONS AND RECOMMENDATIONS

Based on our site reconnaissance and subsurface explorations, it is our opinion that shallow onsite infiltration is feasible for the proposed development if grades at the site are raised to protect and maintain the required vertical separation from groundwater. We measured an infiltration rate of 1 inch per hour in the silty sand soils observed at about 2 feet below existing grades at the site. Further conclusions and recommendations are contained herein.

Infiltration Recommendations

Based on our subsurface explorations, infiltration testing, and groundwater monitoring, it is our opinion that stormwater infiltration via permeable pavement is feasible at the site, provided the bottom of the facility is located at elevation 59 (NAVD88) or higher. This elevation is based on the topographic information obtained from the Pierce County Public GIS and should be surveyed in the field.

Permeable Pavement

Per the 2019 SWMMWW, permeable pavement is considered feasible if there is at least 1 foot of clearance from the expected bottom elevation of the infiltration facility to the seasonal high ground water table. For the purposes of this infiltration feasibility evaluation, we have assumed that, at a minimum, the standard permeable pavement section (6 inches of pavement over 6 inches of storage course) would be used. Deeper trenches and thicker storage courses may be designed by a civil engineer where the vertical separation requirements can be met.

As previously stated, we performed one PIT at about 2 feet below existing grades in the silty sand soils and measured 1 inch per hour. After applying appropriate correction factors to this rate, in accordance with the 2019 SWMMWW for site variability ($F_{variability}$), testing method ($F_{testing}$) and maintenance for situation biofouling ($F_{maintenance}$), a long-term design infiltration rate of 0.34 inches for the permeable pavement should be used for this project. Depending on the proposed storage course thickness, site grades will likely need to be raised at least 1 foot to meet the vertical separation requirements for permeable pavement.

Downspout Infiltration

For the purposes of this infiltration feasibility evaluation, we have assumed that, at a minimum, the standard infiltration trench section (6 inches of topsoil over a 2 foot deep trench) would be used. Based on our site observations, groundwater monitoring, and subsurface explorations, it is our opinion that deeper infiltration using trench systems will likely be feasible at the site during the drier months of the year. Because the PIT results indicate limited infiltration in the shallow soils, we completed one soil gradation analyses on the sandier alluvium soils encountered at about 3 to 5 feet below grades the 2019 SWMMWW and in accordance with ASTM D6913. Based on our gradation analysis, a design infiltration rate of 2 inches per hour be used for infiltration facilities located within the sandier soils encountered between elevations 55 to 57 feet (NAVD88) in the areas of test pit TP-2 and PIT-1. The soils in the area of test pit TP-1 at that depth had interlaced layers of mottled silt that would not be conducive to infiltration. Appropriate correction factors for testing have been applied to this value in accordance with the 2019 SWMMWW.

It should be noted that based on our groundwater monitoring, the 1-foot separation will likely not be met during the majority of the winter wet season unless grades are raised about 0.5 to 1.5 feet. Overflows that are directed to an appropriate discharge point should be incorporated into the design of this project. Alternatively, dispersion into the existing system could also be considered for this project and may prove to be more cost effective.

All proposed infiltration facilities should be designed and constructed in accordance with the 2019 SWMMWW. All minimum separations, setback requirements, and infeasibility criteria per 2019 SWMMWW should be considered prior to the selection, design and location of any stormwater facility for the proposed development.

LIMITATIONS

We have prepared this report for use by CIMCO and other members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our subsurface explorations, data from others

and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

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

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

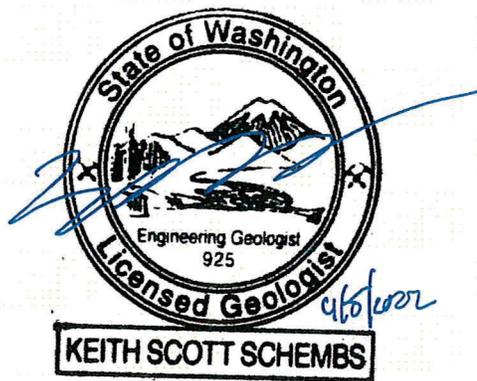
If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide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



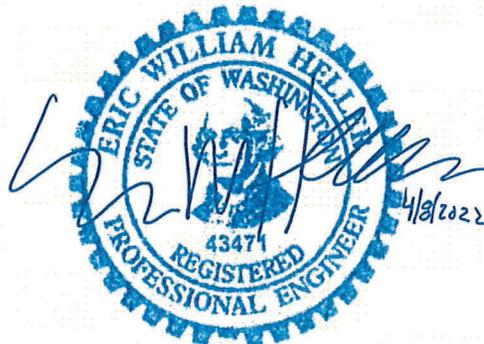
We have appreciated the opportunity to be of service to you on this project. If you have any questions or comments, please do not hesitate to call at your earliest convenience.

Respectfully submitted,
GeoResources, LLC


Andrew E. Schnitger, EIT
Staff Engineer



Keith S. Schembs, LEG
Principal

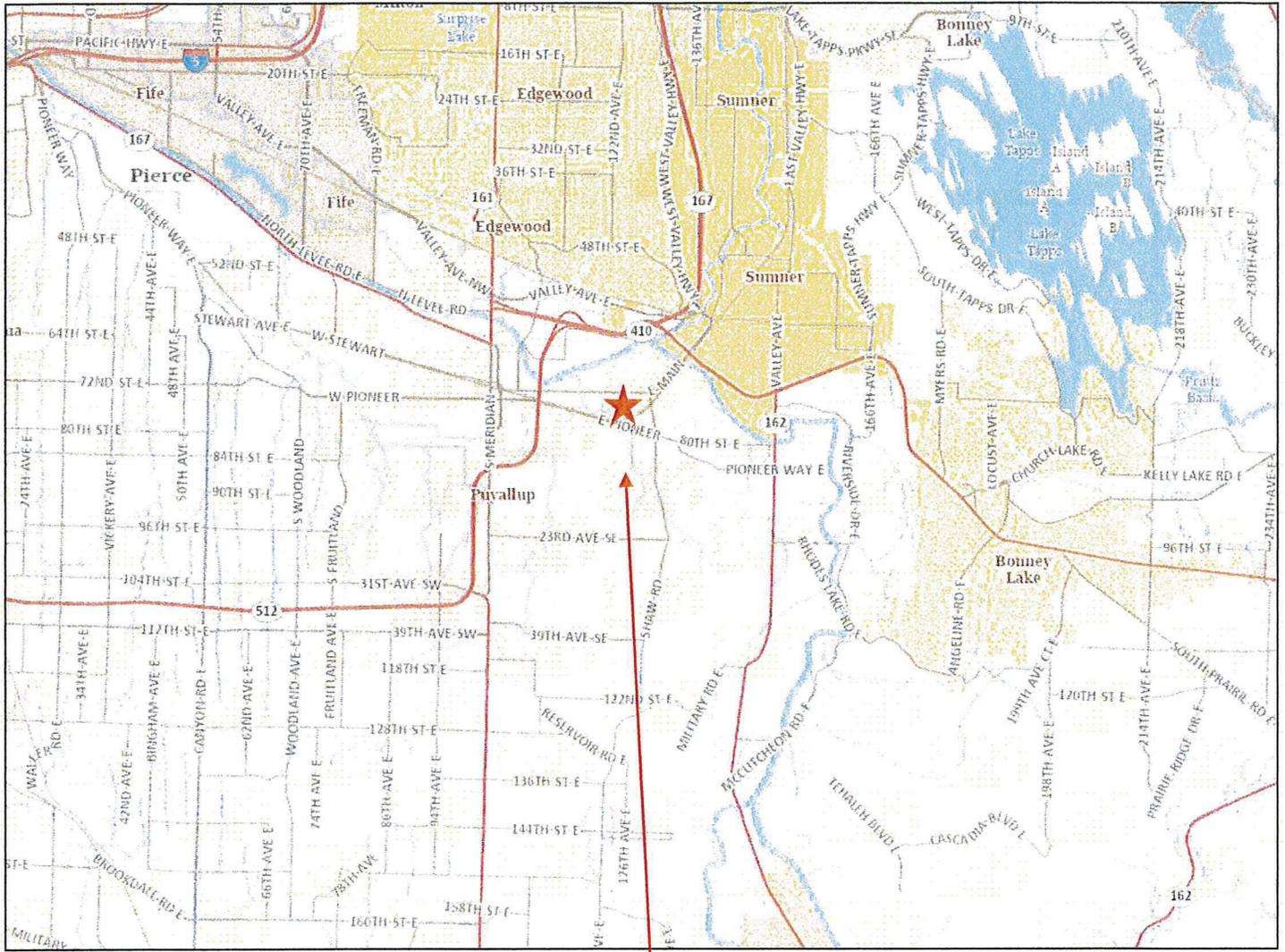


Eric W. Heller, PE
Senior Geotechnical Engineer

AES:KSS:EWH/aes

DocID: CIMCO.InterAve.SR

Attachments: Figure 1: Site Location Map
Figure 2: Site Exploration Map
Figure 3: NRCS Soils Map
Figure 4: Geologic Map
Appendix A: Subsurface Explorations
Appendix B: Laboratory Results



Approximate Site Location

(map created from Pierce County Public GIS <http://matterhorn3.co.pierce.wa.us/publicgis/>)

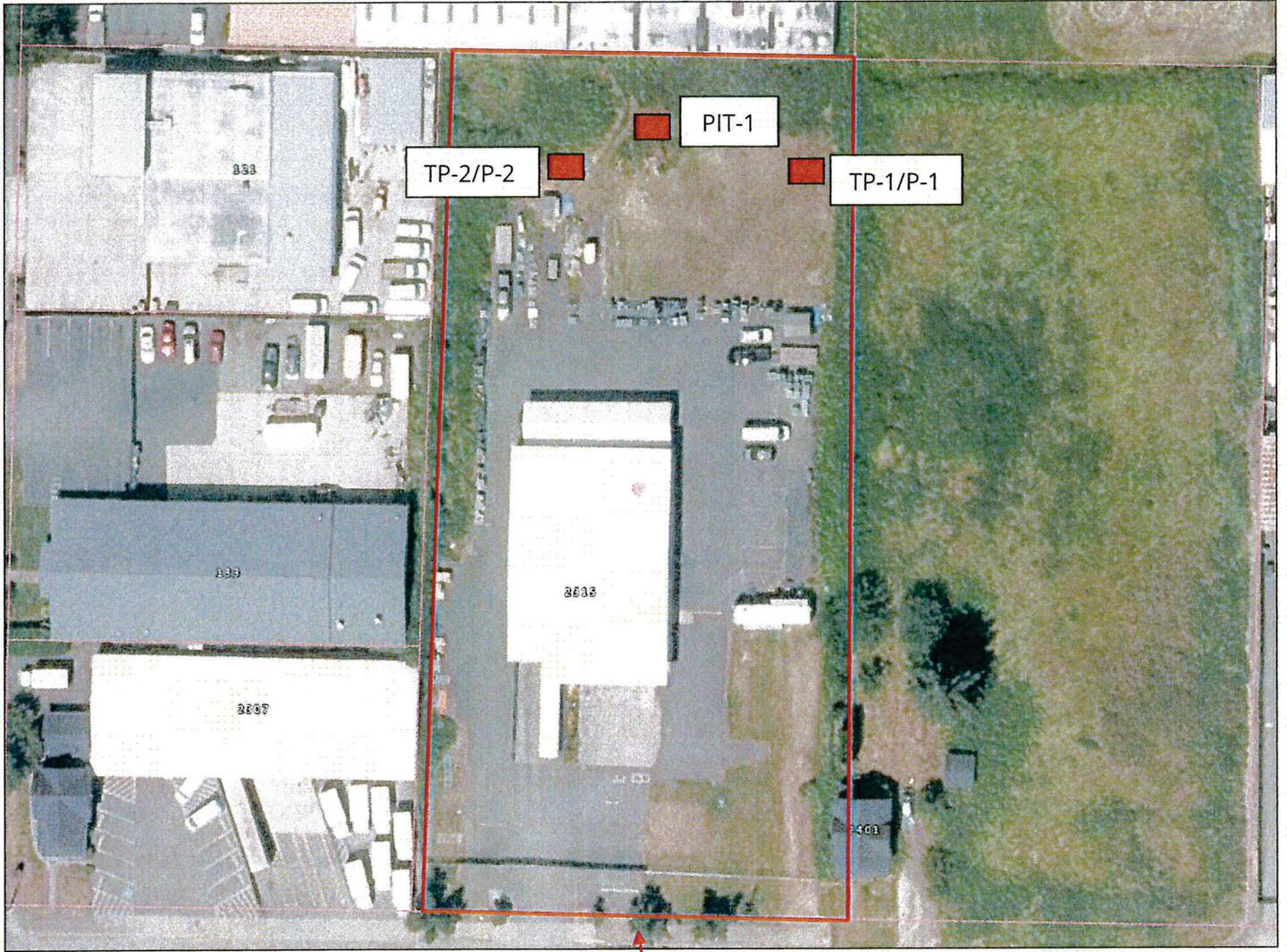


Not to Scale

Site Location Map

Proposed Commercial Development
 2315 Inter Avenue
 Puyallup, Washington
 PN: 2105200140

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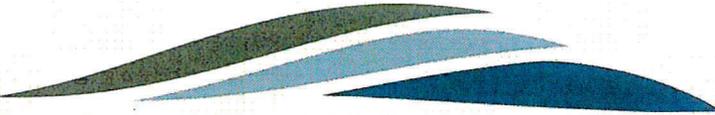
Approximate Site Location

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

 Number and approximate location of test pit/Pilot Infiltration Test



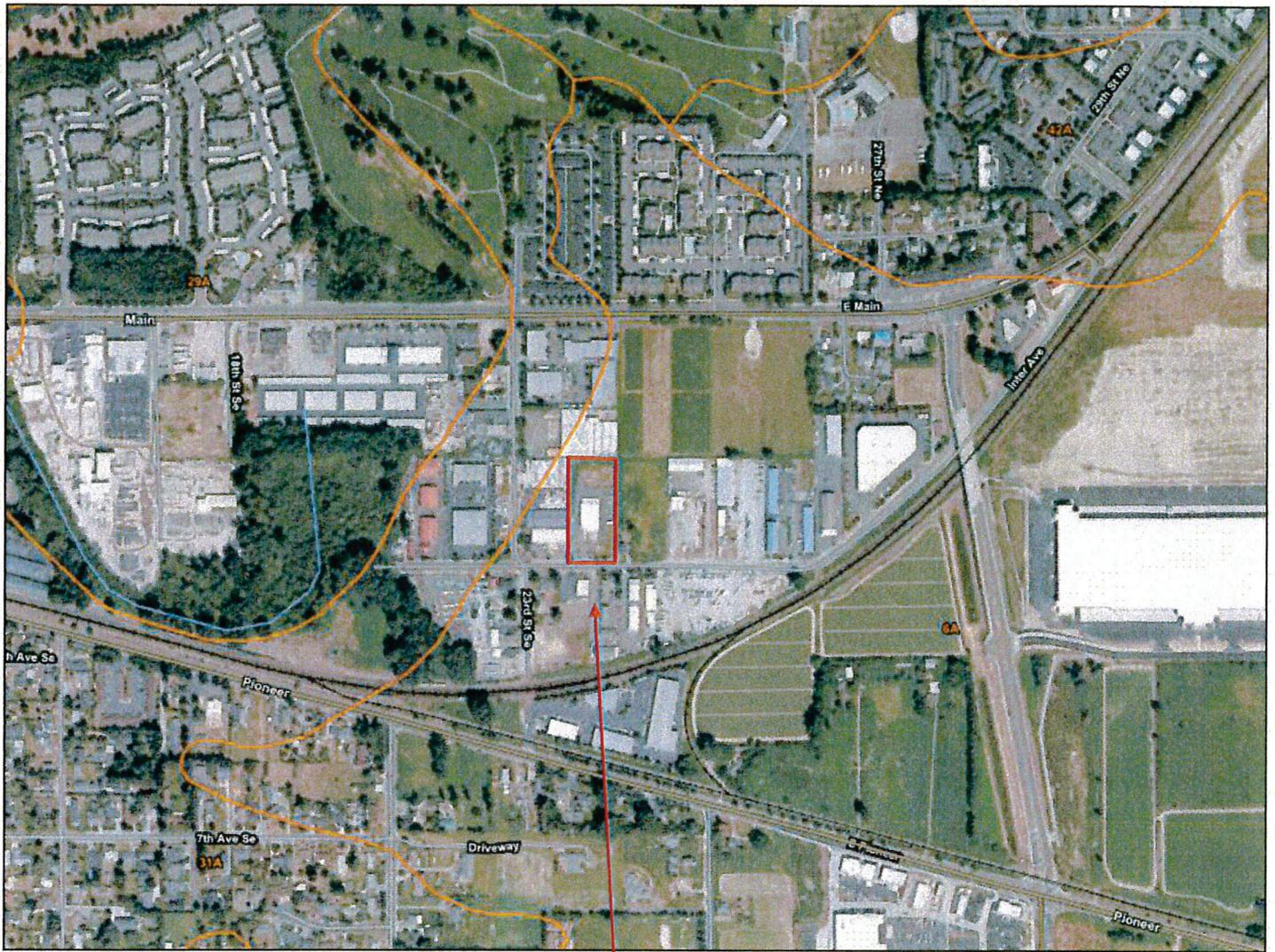
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Site & Exploration Map
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Approximate Site Location

Map created from Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>)

Soil Type	Soil Name	Parent Material	Slopes	Erosion Hazard	Hydrologic Soils Group
6A	Briscot loam	Alluvium	-	Slight	D
31A	Puyallup fine sandy loam	Alluvium	0 to 3	Slight	B

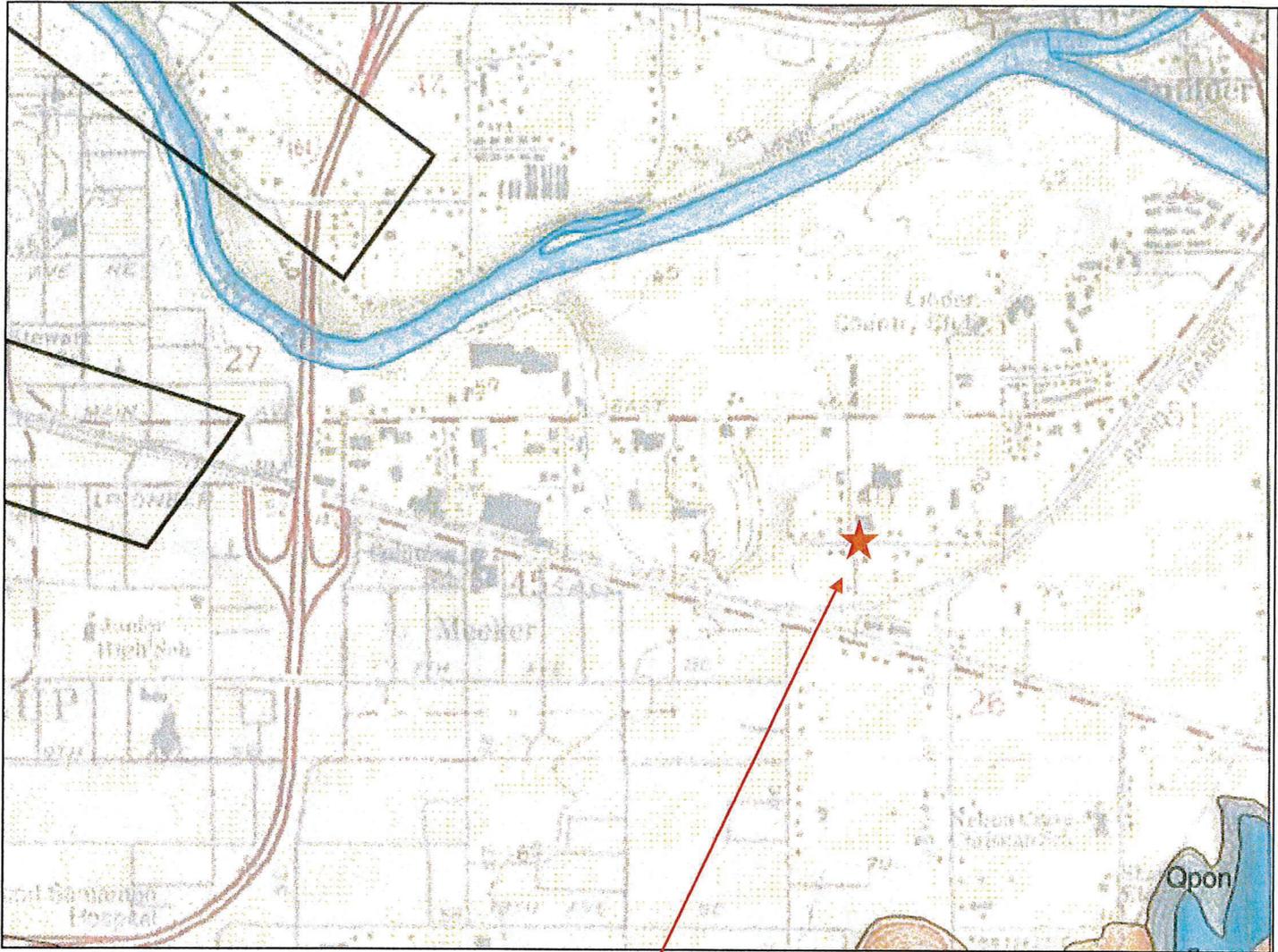


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NRCS Soils Map

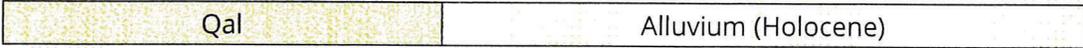
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Approximate Site Location

An excerpt from the draft the *Geologic Map of the Puyallup 7.5-minute Quadrangle, Washington* by Kathy G. Troost (in review)



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Geologic Map
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Doc ID: CIMCO.InterAve.F	April 2022	Figure 4
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Appendix A

Subsurface Explorations

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS	GRAVEL More than 50% Of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
		GRAVEL WITH FINES	GP	POORLY-GRADED GRAVEL
	SAND More than 50% Of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
		SAND WITH FINES	SP	POORLY-GRADED SAND
FINE GRAINED SOILS	SILT AND CLAY Liquid Limit Less than 50	INORGANIC	ML	SILT
		ORGANIC	CL	CLAY
	SILT AND CLAY Liquid Limit 50 or more	INORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
		ORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	More than 50% Passes No. 200 Sieve	INORGANIC	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

- Dry- Absence of moisture, dry to the touch
- Moist- Damp, but no visible water
- Wet- Visible free water or saturated, usually soil is obtained from below water table



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Unified Soils Classification System

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Figure A-1

Test Pit TP-1

Location: West portion of parcel
Approximate Elevation: 60' (NAVD88)

Depth (ft)	Soil Type	Soil Description
0 - 0.5	-	Topsoil
0.5 - 3.0	SM	Brown silty SAND (loose, moist) (alluvium)
3.0 - 5.5	SM/ML	Gray, orange iron oxide stained silty SAND, interbedded gray mottled silt (medium dense/stiff, moist to wet) (alluvium)
5.5 - 6.0	ML	Gray mottled SILT (stiff, wet) (alluvium)
6.0 - 6.5	SP	Gray SAND (medium dense, wet) (alluvium)

Terminated at 3.2 feet below ground surface.

No caving observed.

Slow groundwater seepage observed at 4 feet below existing grades.

Test Pit TP-2

Location: SW central portion of parcel
Approximate Elevation: 60' (NAVD88)

Depth (ft)	Soil Type	Soil Description
0 - 0.5	-	Topsoil
0.5 - 3.0	SM	Reddish brown silty SAND (loose to medium dense, moist) (alluvium)
3.0 - 3.5	ML	Light gray SILT (medium stiff, moist) (alluvium)
3.5 - 6.0	SP	Gray mottled SAND (medium dense, wet) (alluvium)
6.0 - 7.5	SM	Gray mottled silty SAND (medium dense, wet) (alluvium)
7.5 - 8.0	ML	Gray SILT (stiff, wet) (alluvium)

Terminated at 8.0 feet below ground surface.

No caving observed.

Slow groundwater observed at 4.5 feet below ground surface

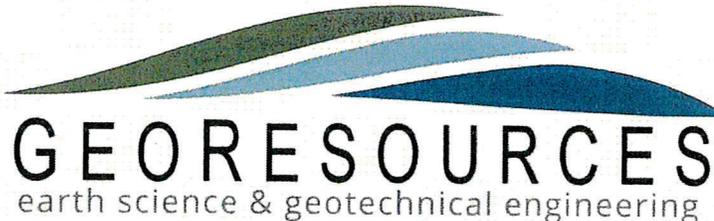
Logged by: AES

Observed on: December 21, 2021

Test Pit Logs

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Figure A-2

Pilot Infiltration Test PIT-1

Location: West portion of parcel
Approximate Elevation: 60' (NAVD88)

Depth (ft)	Soil Type	Soil Description
0 - 0.5	-	Topsoil
0.5 - 2.0	SM	Reddish brown silty SAND (loose to medium dense, moist) (alluvium)
2.0 - 3.0	SM	Gray silty SAND (medium dense, moist) (alluvium)
3.0 - 5.0	SM	Gray mottled silty SAND (medium dense, moist) (alluvium)

Infiltration testing performed at 2 feet below existing grades.
Measured 1 inch per hour.
Overexcavated to 5 feet below existing grades.
No caving observed.
No groundwater seepage observed.

Logged by: AES

Observed on: December 21, 2021



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Test Pit Logs

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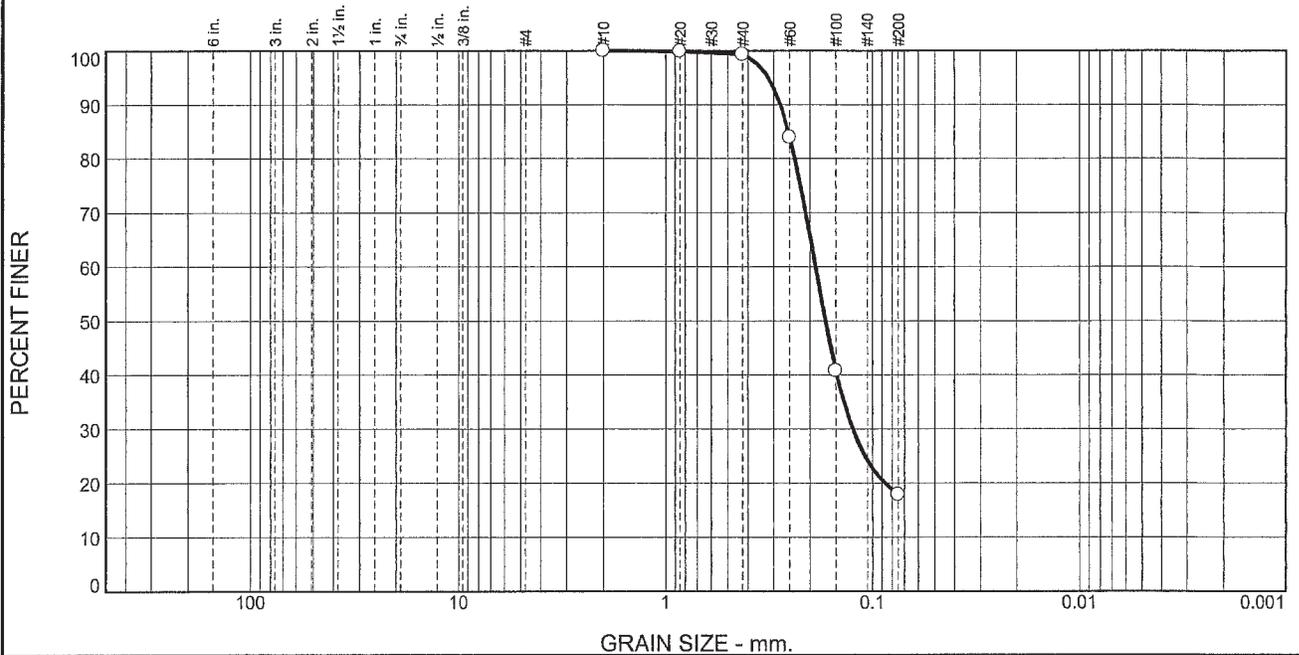
Doc ID: CIMCO.InterAve.F

April 2022

Figure A-3

Appendix B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.7	81.4	17.9	

Test Results (ASTM D 6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	99.9		
#40	99.3		
#60	83.9		
#100	40.8		
#200	17.9		

* (no specification provided)

Material Description

Silty SAND (SM)

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.2787 D₈₅= 0.2542 D₆₀= 0.1879
D₅₀= 0.1683 D₃₀= 0.1245 D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural Moisture: 22%

Date Received: 12/21/21 Date Tested: 3/24/22

Tested By: MAW

Checked By: KSS

Title: PM

Location: PIT-1, S-2, 5'
Sample Number: 103087

Date Sampled: 12/21/21

GeoResources, LLC Fife, WA	Client: CIMCO Project: Proposed Commercial Development Project No: CIMCO.InterAve Figure B-1
-------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------

Tested By: _____ Checked By: _____

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These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.