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CITY OF MUKILTEO

STORMWATER SITE PLAN

PACIFIC SEAFOOD PROCESSING PLANT

MUKILTEO, WA

SEPTEMBER 2, 2015

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PROJECT OVERVIEW

PROPOSED IMPROVEMENTS

The proposed development consists of the construction of a single commercial building totaling approximately 68,399± SF with 159 parking stalls, stormwater management facilities, utilities and on-site landscaping on a 5.07 acre site in Mukilteo, Washington. The property is currently zoned as planned industrial.

DESIGN CRITERIA

The City of Mukilteo utilizes the 2005 Washington State Department of Ecology Stormwater Management Manual for Western Washington (DOE Manual) drainage requirements. Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition to be matched shall be a pastured land cover.

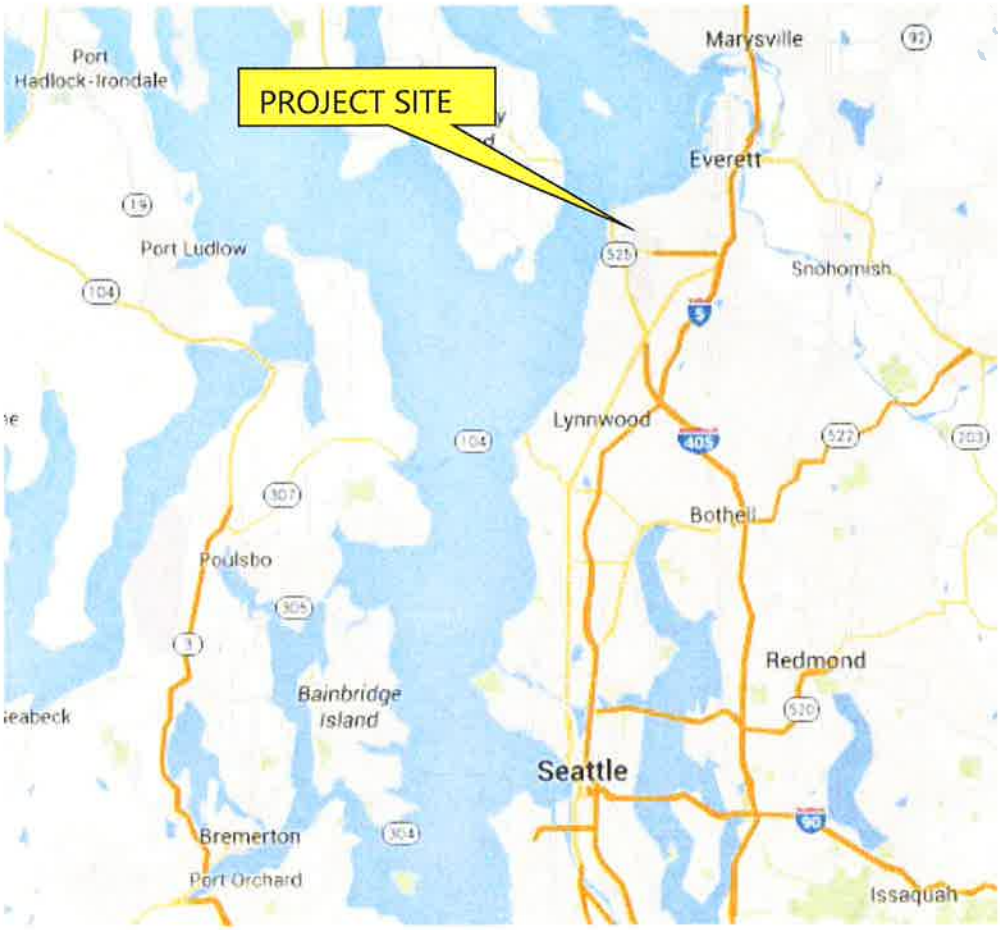
JURISDICTIONAL REQUIREMENTS

Table 1 below summarizes City of Mukilteo stormwater requirements.

TABLE 1

Jurisdictional Requirements	
Duration Analysis:	
2-year:	Reduce to ½ pre-developed duration
50-year:	Match pre-developed
Water Quality Volume:	n/a
Water Quality Flow Rate:	The full 2-year release rate from the detention facility. (0.0879 cfs)
Downstream Analysis:	
Level 1:	¼ mile downstream

PROJECT LOCATION



Location: 8007 44th Avenue West Mukilteo, WA, 98274

Section, Township, Range: SW 1/4, SW 1/4 OF SEC 10, T 28N, R 4E, W.M.

Tax Account Number: 0061160000980, 00611600009701, 28041000301800, 28041000303000 & 28041000301700.

Size: 220,699 SF (5.07 AC)

City, County, State: Mukilteo, Snohomish County, Washington State

Governing Agency: City of Mukilteo

Design Criteria: 2012 Washington State Department of Ecology Stormwater Management Manual for Western Washington

Zoning: PI (Planned Industrial)

MINIMUM REQUIREMENTS

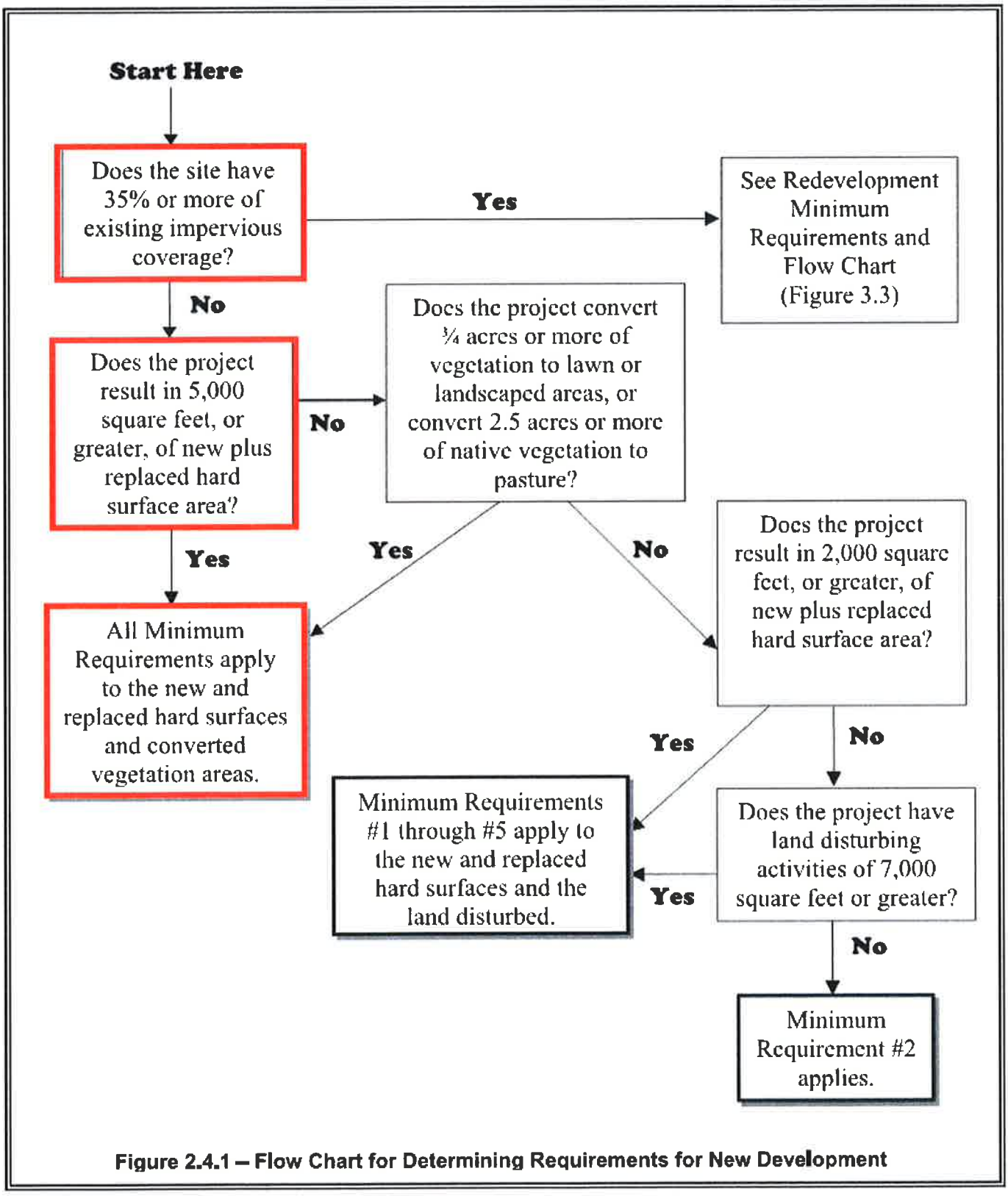


Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

Minimum Requirement #1: Preparation of Stormwater Site Plans
All projects meeting the thresholds in Section 2.4 shall prepare a Stormwater Site Plan for local government review. Stormwater Site Plans shall use site-appropriate development principles, as required and encouraged by local development codes, to retain native vegetation and minimize impervious surfaces to the extent feasible.

> **Response:** A stormwater site plan has been prepared for the development. The stormwater site plan includes the existing and proposed stormwater conditions, WWHM output report, supporting reports, and the SWPPP.

Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPPP)
All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters.
Projects which result in 2,000 square feet or more of new plus replaced hard surface area, or which disturb 7,000 square feet or more of land must prepare a Construction Stormwater Pollution Prevention Plan (SWPPP) as part of the Stormwater Site Plan (see Section 2.5.1). Projects that result in less than 2,000 square feet of new plus replaced hard surface area, or disturb less than 7,000 square feet of land are not required to prepare a Construction SWPPP, but must consider all of the 13 Elements of Construction Stormwater Pollution Prevention and develop controls for all elements that pertain to the project site.

> **Response:** The 13 elements of a SWPPP are addressed in the Construction SWPPP section of this report. A full Construction SWPPP has been prepared for the site and is included in Appendix D.

Minimum Requirement #3: Source Control of Pollution
All known, available and reasonable source control BMPs shall be applied to all projects. Source control BMPs shall be selected, designed, and maintained according to the manual.

> **Response:** Stormwater runoff will be collected and treated onsite using a stormwater filter vault with media cartridges/stacks. Roof drains will tie directly into one of two proposed detention vaults onsite. Roof runoff will be kept separate from runoff from pollution-generating surfaces to the maximum extent possible.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls
Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.

> **Response:** Treated stormwater will flow from a proposed detention vault at the historical discharge rate to an existing Type-II 48-inch catch basin to the northeast of the project site.

Minimum Requirement #5: On-site Stormwater Management
Projects shall employ On-site Stormwater Management BMPs in accordance with the following projects thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts. Projects qualifying as flow control exempt in accordance with Section 2.5.7 of this chapter do not have to achieve the LID performance standard, nor consider bioretention, rain gardens, permeable pavement, and full dispersion if using List #1 or List #2. However, those projects must implement BMP T5.13; BMPs T5.10A, B, or C; and BMP T5.11or T5.12, if feasible.

Project Thresholds:
Projects triggering only Minimum Requirements #1 through #5 shall either:

a. Use On-site Stormwater Management BMPs from List #1 for all surfaces within each type of surface in List #1; or
b. Demonstrate compliance with the LID Performance Standard. Projects selecting this option cannot use Rain Gardens. They may choose to use Bioretention BMPs as described in Chapter 7 of Volume V to achieve the LID Performance Standard.

Projects triggering Minimum Requirements #1 through #9, must meet the requirements in Table 2.5.1.

Response: On-site stormwater runoff will be collected and transported via a system of catch basins and underground storm drainage pipes to an onsite detention vault, then routed to a stormwater filter vault with media cartridges/stacks, then to a second proposed underground detention vault. The treated stormwater will flow from the vault at the historical discharge rate to an existing Type-II 48-inch catch basin to an existing catch basin northeast of the project site.

Low-impact-development (LID) is not feasible due to the sub-surface soils and low infiltration rate. A pilot-infiltration-test was conducted and the results can be found in Appendix B.

Minimum Requirement #6: Runoff Treatment
Thresholds
When assessing a project against the following thresholds, only consider those hard and pervious surfaces that are subject to this minimum requirement as determined in Section 2.4 of this chapter.
The following require construction of stormwater treatment facilities:

- Projects in which the total of, pollution-generating hard surface (PGHS) is 5,000 square feet or more in a threshold discharge area of the project, or
- Projects in which the total of pollution-generating pervious surfaces (PGPS) – not including permeable pavements – is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there will be a surface discharge in a natural or man-made conveyance system from the site.

Response: Stormwater will be treated onsite, via a stormwater filter vault with media cartridges/stacks.

Minimum Requirement #7: Flow Control
Projects must provide flow control to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh waterbody. Flow Control is not required for projects that discharge directly to, or indirectly to a water listed in Appendix I-E.

Response: Pretreated stormwater will be detained onsite and controlled via an internal control structure, and will flow from the vault at the historical discharge rate to an existing Type-II 48-inch catch basin to the northeast of the project site. See the Permanent Stormwater Control Plan section for further information about proposed internal control structures.

Minimum Requirement #8: Wetlands Protection
The requirements below apply only to projects whose stormwater discharges into a wetland, either directly or indirectly through a conveyance system.
Thresholds:
The thresholds identified in Minimum Requirement #6 – Runoff Treatment, and Minimum Requirement #7

– Flow Control shall also be applied to determine the applicability of this requirement to discharges to wetlands.
Standard Requirement:
Projects shall comply with Guide Sheets #1 through #3 in Appendix I-D. They hydrologic analysis shall use the existing hydrologic conditions unless directed otherwise by a regulatory agency with jurisdiction.

> **Response:** No wetlands will be impacted by work performed onsite, or by the proposed drainage system.

Minimum Requirement #9: Operation and Maintenance
An operation and maintenance manual that is consistent with the provisions in Volume V of this manual shall be provided for all proposed stormwater facilities and BMPs, and the party (or parties) responsible for maintenance and operation shall be identified. At private facilities, a copy of the manual shall be retained onsite or within reasonable access to the site, and shall be transferred with the property to the new owner. For public facilities, a copy of the manual shall be retained in the appropriate department. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection by the local government.

> **Response:** Operations and Maintenance checklists for the proposed storm drainage system facilities have been included in Appendix E.

EXISTING CONDITIONS

The project site is located at 8007 44th Avenue West Mukilteo, WA, 98274. The site is approximately 220,699 SF (5.07 acres) and is currently occupied by a mobile home with two detached service garages. There is approximately 25,687.64 SF (0.59 acres) of existing impervious area, and the remainder of the site consists of overgrown fields.

Per the Geotechnical Engineering Report by Redmond Geotechnical Services, dated May 1st, 2015, the site is underlain at a depth of between two to four feet beneath the existing site and/or surface grades by gray to gray-brown, dense, clayey, silty sand with gravel and cobbles and/or glacial till deposits.

The site is bordered to the east by an empty field, to the west by 44th Avenue West, to the north by an existing commercial development, and to the south by another commercial development. The majority of the project site is generally sloping to the northeast corner of the site at an average of 2%. The property does not appear to have any upstream tributary flow onto the site.

SOILS CONDITIONS

Per the Geotechnical Engineering Report by Redmond Geotechnical Services, dated May 1st, 2015, the site is underlain at a depth of between two to four feet beneath the existing site and/or surface grades by gray to gray-brown, dense, clayey, silty sand with gravel and cobbles and/or glacial till deposits.

DEVELOPED CONDITIONS

The proposed development consists of the construction of a single commercial building totaling approximately 68,399± SF with 159 parking stalls, stormwater management facilities, utilities and on-site landscaping on a 5.07 acre site in Mukilteo, Washington. The property is currently zoned as planned industrial.

On-site stormwater runoff will be collected and transported via a system of catch basins and underground storm drainage pipes to an onsite filter vault and two proposed underground detention vaults. The pre-treated stormwater will flow from a vault at the historical discharge rate to an existing Type-II 48-inch catch basin to the northeast of the project site. See the Permanent Stormwater Control Plan section for further information about the onsite conveyance system.

OFFSITE ANALYSIS

The offsite downstream conditions beyond the project were reviewed. As previously mentioned in this report, the proposed project's storm drainage system will connect to the existing Type-II 48-inch catch basin to the northeast of the project boundary. The downstream conveyance system starts at this catch basin and flows to the north. The following is a summary of the downstream system:

Conveyance System – closed pipe and catch basins

Pipe Size – 12-inch (flowing north)

Approximate LF 1st Pipe Reach – 275 feet

Downstream 1st Catch Basin – pipe I.E. ~2 feet deep

Approximate LF 2nd Pipe Reach - 10 feet to outlet at wet area

The downstream analysis ended approximately 10 feet beyond the first catch basin, as the pipe outlets to a wet depression.

PERMANENT STORMWATER CONTROL PLAN

EXISTING SITE HYDROLOGY

As discussed previously, the project site is approximately 220,699 SF (5.07 acres) and is currently occupied by a mobile home with two detached service garages. There is approximately 25,687.64 SF (0.59 acres) of existing impervious area, and the remainder of the site consists of overgrown fields. See table 2 below, for existing conditions as input into WWHM2012.

Table 2

Existing Conditions		
Basin Area (AC)	**Description**	**Grade**
4.39	(A/B Soils) Pasture	Moderate (5%-15%)
0.309	Roads	Flat (0%-2%)
0.115	Roof Tops	Flat (0%-2%)
0.164	Driveways	Flat (0%-2%)

DEVELOPED SITE HYDROLOGY

The proposed development will consist of asphalt paved parking, concrete paved drive aisles, concrete sidewalks, a 68,399± SF building, and approximately 17,996± SF of landscaping/pervious surfaces. See table 3 below, for proposed conditions as input into WWHM2012.

Table 3

Proposed Conditions		
Area (AC)	**Description**	**Grade**
0.413	(A/B Soils) Landscaping/Pervious	Moderate (5%-15%)
1.57	Roof Tops	Flat (0%-2%)
1.64	Driveways	Flat (0%-2%)
0.131	Sidewalks	Flat (0%-2%)
1.22	Parking	Flat (0%-2%)

HYDROLOGIC MODELING

The hydrologic analysis for the project was performed using the computer-modeling program, Western Washington Hydrology Model (WWMH2012), based on matching flow durations. The program effectively models predeveloped and post-developed runoff conditions using flow duration curves for a basin and a given area. The WWHM2012 model for the project site states that current stormwater conveyance system meets 2012 Department of Ecology Stormwater Management Manual standards and city of Mukilteo development standards See Appendix D for the WWHM report.

FLOW CONTROL SYSTEM

In the developed condition, stormwater runoff from the southern portion of the site will be routed via catch basins and underground piping to an onsite detention vault located in the center of the site. Flow from this vault will be routed along with stormwater flow from the northern portion of the site to a stormwater perk filter loaded with cartridges/stacks, then flow into a secondary stormwater detention vault that will detain and release flows via a control structure within the detention vault to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. See below for control structure data.

Name: Vault 1
Width: 32 ft.

Length: 184 ft.
Depth: 10 ft.

Discharge Structure 1
Riser Height: 9 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width: 0.02 ft.
Notch Height: 1.87 ft.
Orifice 1 Diameter: 1.29in. Elevation: 0 ft.
Volume at Riser Head: 51,800 cubic feet

Name: Vault 2
Width: 32 ft.
Length: 60 ft.
Depth: 10 ft.

Discharge Structure 2
Riser Height: 9 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width: 0.012 ft.
Notch Height: 1.87 ft.
Orifice 1 Diameter: 1.33 in. Elevation: 0 ft.
Volume at Riser Head: 19,700 cubic feet

WATER QUALITY SYSTEM

Onsite stormwater will be routed through a stormfilter vault loaded with perk filter cartridges/stacks to ensure that the stormwater conveyance system meets requirements for water quality prior to discharge. The water quality vault was sized using the full 2-year release rate from the detention facility (0.0879 cfs). The vaults inside dimensions are 8ft x 16ft, and will hold approx. 20 18" treatment cartridges.

CONVEYANCE SYSTEM ANALYSIS AND DESIGN

A full conveyance system analysis and design will be provided with the final land use and site development permit submittal.

100-YEAR FLOOD/OVERFLOW CONDITION

The stormwater conveyance system for this project has been designed to address storm events in accordance with common industry practices. In the event of a larger storm, the system may fail. In this case, the runoff from larger events will overflow the control structure in the proposed detention vault, and flow to the intended discharge point, the existing catch basin to the northeast.

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

All erosion and sediment control measures shall be governed by the requirements of the City of Mukilteo. A temporary erosion and sedimentation control plan has been prepared to assist the contractor in complying with these requirements. The Erosion and Sediment Control (ESC) plan is included with the construction plans.

Element 1: Preserve Vegetation/Mark Clearing Limits

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

Element 2: Establish Construction Access

- Limit construction vehicle access and exit to one route, if possible.
- Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMP's, to minimize tracking of sediment onto public roads.
- Locate wheel wash or tire baths on site, if stabilized construction entrance is not effective in preventing tracking sediment onto public roads.
- If sediment is tracked off site, clean the affected roadway thoroughly at the end of the say, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pick up and transport the sediment to a controlled sediment disposal area.
- Conduct street washing only after sediment is removed in accordance with the above bullet.
- Control street wash wastewater by pumping back on-site, or otherwise prevent it from discharging into systems tributary to waters of the State.

Element 3: Control Flow Rates

- Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
- Where necessary to comply with the bullet above, construct stormwater retention or detention facilities s one of the first steps in grading. Assure that detention facilities function properly before constructing site improvements (e.g. impervious surfaces).
- If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.

Element 4: Install Sediment Controls

- Design, install, and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants.
- Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.
- Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

- Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard in Element #3, bullet #1.
- Locate BMPs intended to trap sediment on-site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
- Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

Element 5: Stabilize Soils

- Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base early on areas to be paved, and dust control.
- Control stormwater volume and velocity within the site to minimize soil erosion.
- Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
- Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
    - During the dry season (May 1 - Sept. 30): 7 days
    - During the wet season (October 1 - April 30): 2 days
- Stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.
- Stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways and drainage channels.
- Minimize the amount of soil exposed during construction activity.
- Minimize the disturbance of steep slopes.
- Minimize soil compaction and, unless infeasible, preserve topsoil.

Element 6: Protect Slopes

- Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).
- Divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
- At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.
    - Temporary pipe slope drains must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year and 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover

condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped" area.

- Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
- Place check dams at regular intervals within constructed channels that are cut down a slope.

Element 7: Protect Drain Inlets

- Protect all storm drain inlets made operable during construction so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.
- Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

Element 8: Stabilize Channels and Outlets

- Design, construct, and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:
    - Channels must handle the peak 10-minute velocity of flow from a Type 1A, 10- year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area.
- Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches at the outlets of all conveyance systems.

Element 9: Control Pollutants

- Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants.
- Handle and dispose of all pollutants, including waste materials and demolition debris that occur on-site in a manner that does not cause contamination of stormwater.
- Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest take within the containment structure. Double-walled tanks do not require additional secondary containment.
- Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.
- Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland application, or to the sanitary sewer, with local sewer district approval.

- Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.
- Use BMPs to prevent contamination of stormwater runoff by pH modifying sources. The sources for this contamination 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.
- Adjust the pH of stormwater if necessary to prevent violations of water quality standards.
- Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on-site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.
- Obtain written approval from Ecology before using chemical treatment other than CO2 or dry ice to adjust pH.

Element 10: Control De-Watering

- Discharge foundation, vault, and trench de-watering water, which has similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.
- Discharge clean, non-turbid de-watering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element #8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.
- Handle highly turbid or otherwise contaminated dewatering water separately from stormwater.
- Other treatment or disposal options may include: 1. Infiltration, 2. Transport off-site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters, 3. Ecology-approved on-site chemical treatment or other suitable treatment technologies, 4. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option, and 5. Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

Element 11: Maintain BMPs

- Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
- Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Element 12: Manage the Project

- Phase development projects to the maximum degree practicable and take into account seasonal work limitations.
- Inspection and monitoring – Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit must conduct site inspections and monitoring in accordance with Special Condition S4 of the Construction Stormwater General Permit.

- Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP.
- Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By the initiation of construction, the SWPPP must identify the CESCL or inspector, who must be present on-site or on-call at all times.
- The CESCL or inspector (project sites less than one acre) must have the skills to assess the:
    - Site conditions and construction activities that could impact the quality of stormwater.
    - Effectiveness of erosion and sediment control 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 SWPPP for compliance with the 13 construction SWPPP elements and making appropriate revisions within 7 days of the inspection.
    - Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems not 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 (sites larger than 1 acre).
- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month.

SPECIAL REPORTS AND STUDIES OTHER PERMITS

Geotechnical Engineering Report by Redmond Geotechnical Services dated May 1st, 2015 is included in Appendix B. Also included is the pilot infiltration test results.

OTHER PERMITS

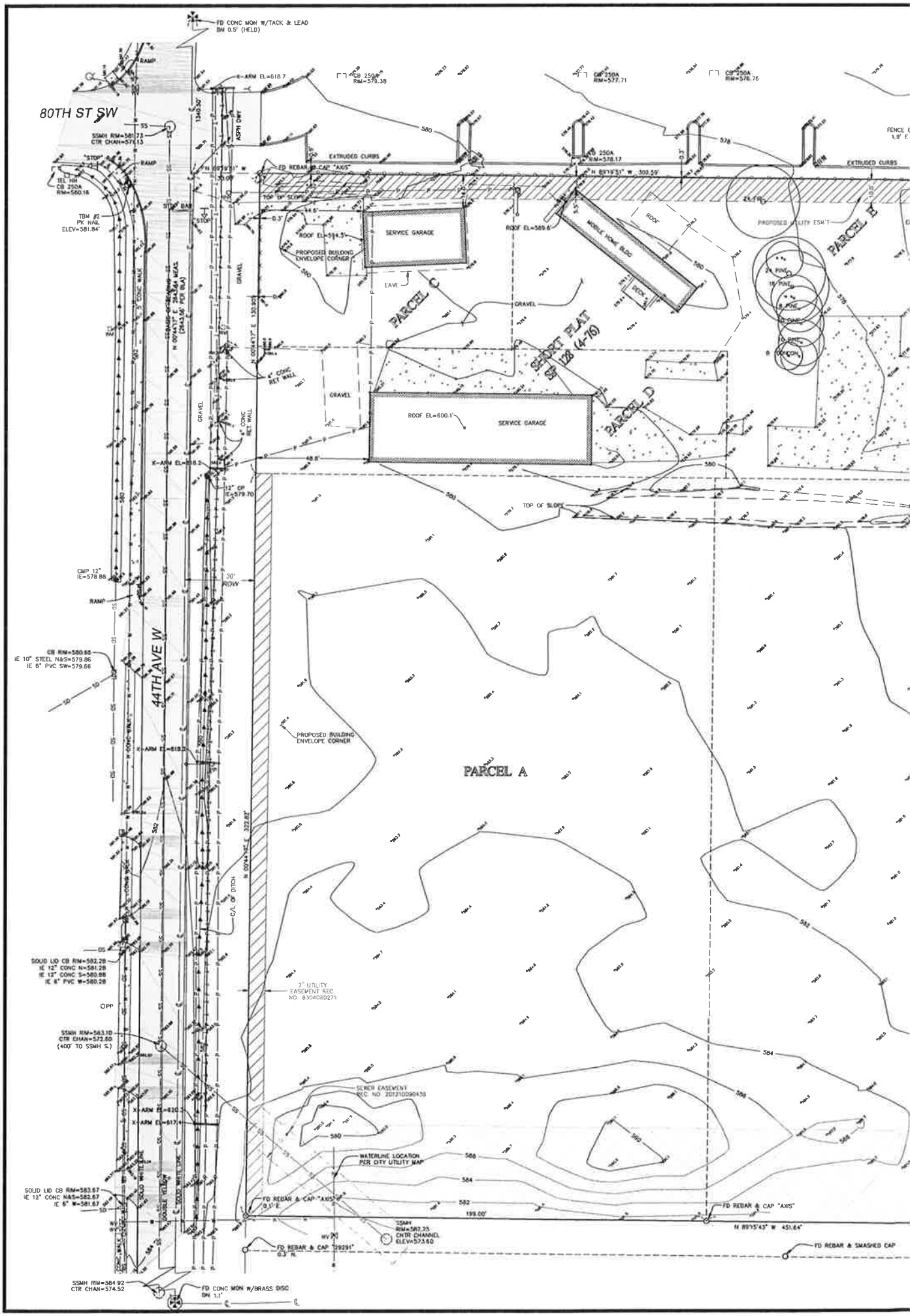
Site development, utility, and building permits will be applied for at a later date.

OPERATION AND MAINTENANCE

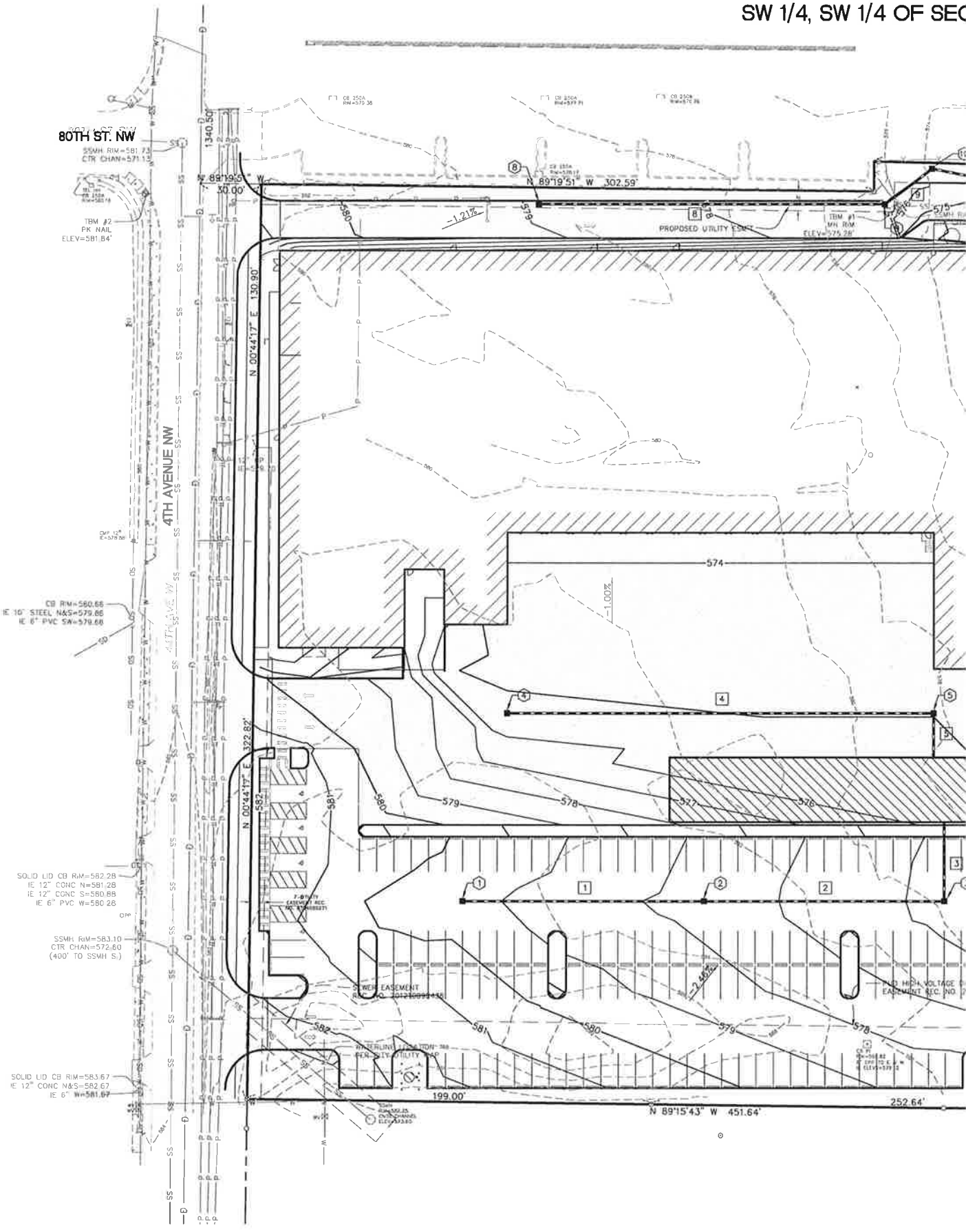
The owner or operator of the project shall be responsible for maintaining the stormwater facilities in accordance with local requirements. Proper maintenance is important for adequate functioning of the stormwater facilities. Operations and maintenance guidelines have been provided in Appendix E.

APPENDIX A

EXISTING CONDITIONS MAP AND PROPOSED GRADING AND DRAINAGE PLAN



80TH ST SW
44TH AVE W
SHORT PLAT
SP 128 (4-76)
PARCEL A
PARCEL C
PARCEL D
PARCEL E
SERVICE GARAGE
MOBILE HOME BLDG
PROPOSED BUILDING ENVELOPE CORNER
EXTRUDED CURBS
TOP OF SLOPE
GRAVEL
EAVE
ROOF EL=600.1'
ROOF EL=589.6'
ROOF EL=594.5'
PROPOSED UTILITY ESM'T
FD CONC MON W/TACK & LEAD DN 0.5' (HELD)
SSMH RIM=581.73 CTR CHAN=571.13
TBM #2 PK NAIL ELEV=581.84'
CMP 12" IE=578.88
CB RIM=580.68 IE 10" STEEL N&S=579.86 IE 6" PVC SW=579.66
SOLID LID CB RIM=582.28 IE 12" CONC N=581.28 IE 12" CONC S=580.88 IE 6" PVC W=580.28
SSMH RIM=583.10 CTR CHAN=572.60 (400' TO SSMH S.)
SOLID LID CB RIM=583.67 IE 12" CONC N&S=582.67 IE 6" W=581.67
SSMH RIM=584.92 CTR CHAN=574.52
FD CONC MON W/BRASS DISC DN 1.1'
7' UTILITY EASEMENT REC NO. 8304080271
SEWER EASEMENT REC NO. 201210090435
WATERLINE LOCATION PER CITY UTILITY MAP
FD REBAR & CAP "AXIS"
FD REBAR & SMASHED CAP
N 89°15'43" W 451.64'
199.00'



B:\Washington\Wukiteo\Pacific Seafood\2Drawings\WUPS_120G.dwg Sep 02, 2015 - 6:21pm

APPENDIX B

GEOTECHNICAL ENGINEERING INVESTIGATION REPORTS

REDMOND GEOTECHNICAL SERVICES

May 29, 2015

Mr. Bill Marczewski
Pacific Seafood Group
1`6797 SE 130th Avenue
Clackamas, Oregon 97015

Dear Mr. Marczewski:

Re: Supplemental Geotechnical Consultation and Field (Pilot) Infiltration Testing Services, Proposed Pacific Seafood Greenfield Processing/Distribution Facility Site, 8007 44th Avenue West, Mukilteo (Snohomish County), Washington

In accordance with the request of Mr. Bill Marczewski of Pacific Seafood Group and as required by the City of Mukilteo and/or the Washington State Department of Ecology, we have completed our evaluation of the soil infiltration rate at the above subject proposed Pacific Seafood Greenfield Processing and Distribution Facility development site. The scope of our work was outlined in our formal proposal to Mr. Bill Marczewski dated May 7, 2015. The subject property is located to the east of 44th Avenue West and south of the intersection with 80th Street SW in Mukilteo (Snohomish County), Washington (see Site Vicinity Map, Figure No. 1).

As you are aware, we recently performed a Geotechnical Investigation at the site the results of which were presented in our formal report dated May 1, 2015. The results of our previous geotechnical investigation at the site revealed that the subject property is underlain at a depth of between two (2) to four (4) feet beneath the existing site and/or surface grades by gray to gray-brown, dense, clayey, silty sand with gravel and cobbles and/or glacial till deposits.

Project Background

We understand that present plans are to develop the subject approximate 5 acre rectangular shaped property with a new processing and distribution facility building. Additionally, we understand that the project will also include construction of new paved parking and access drive areas. Further, we understand that storm water from hard surfaces (i.e., roofs and pavements) is to be collected and disposed of on-site through a suitable storm water infiltration system.

Infiltration Testing

To evaluate the feasibility of subsurface disposal of stormwater, we were present at the site on May 27, 2015 and performed one (1) pilot field infiltration test within the lower easterly portion of the subject property. The testing consisted of a open pit falling head infiltration test in accordance with the Washington State Department of Ecology Stormwater Management Manual for Western Washington Volume III Hydrologic Analysis and Flow Control BMP's test method dated August 2012.

Specifically, one (1) approximate four (4) feet by four (4) feet pilot infiltration test hole was excavated at the approximate location shown on the attached Pilot Infiltration Test Location Plan, Figure No. 2. The test hole was initially excavated to a depth of approximately three (3) feet below the existing site and/or surface grades. The subgrade soils encountered within the test hole excavated at the site consisted of an approximate 24-inch surficial layer of dark brown topsoil and/or organic fill materials inturn underlain by medium to orangish-brown, wet, loose to medium dense, clayey, silty sand (SM).

Following the excavation of the infiltration test hole, a vertical measuring rod marked in half-inch increments was installed in the center of the pit bottom. Water was then placed into the infiltration test hole with a 3-inch diameter rigid pipe and splash plate to a depth of approximately 12 inches to allow the subgrade soils to saturate over time (approximately 6 hours). Following the required saturation period, the infiltration test hole was again filled with approximately 12 inches of water and the cumulative volume and instantaneous flow rate was monitored and recorded every 15 minutes over a one-hour period. After a one-hour period, the water source was stopped and the rate of infiltration in inches per hour (in/hr) was monitored until the infiltration test hole was empty.

Following the conclusion of the infiltration testing, the infiltration test hole was over-excavated to see if the test water had mounded on a shallow restrictive layer or had continued to infiltrate deep into the subsurface soils.

Infiltration Testing Results

The results of the field infiltration testing at the site revealed that the ultimate soil infiltration rate of the underlying clayey silty sand subgrade soil was less than 0.3 inches per hour (in/hr). The above field infiltration rate is based on Redmond Geotechnical Services, LLC observations during our supplemental subsurface exploration work at the site and, based on the results of our previous geotechnical investigation and nineteen (19) drilled test boring explorations, may be considered as representative of other locations across and/or beneath the subject property.

Following the completion of the field infiltration testing, the infiltration test hole was advanced to a depth of approximately five (5) feet below the existing site and/or surface grades to check for deep infiltration and/or mounding.

The results of the deeper test hole excavation revealed that the infiltration test site is underlain at a depth of about three and one-half (3.5) feet by dense glacial till. Additionally, no visual evidence of deeper infiltration was observed within the underlying glacial till deposits. As such, mounding of subsurface water at the contact with the dense glacial till deposits should be considered as was evidence by the presence of ponding surface water across the lower northeasterly portion of the subject property.

Conclusions and Recommendations

Based on the results of our recent pilot infiltration test at the site as well as the results of our previous geotechnical investigation and nineteen (19) test boring explorations across the subject property, we are generally of the opinion that the subject site is unsuitable for stormwater infiltration due to mounding on the near surface dense glacial till deposits found at depths of between two (2) to four (4) feet beneath the existing site and/or surface grades. Although site soil conditions and localized infiltration rates may vary with time and/or with changes in site utilization, the presence of the relatively shallow dense glacial till deposits found beneath the subject site as well as the presence of ponding surface water suggest that infiltration rates greater than 0.3 inches per hour are unlikely. As such, due to the presence of an existing stormwater detention pond located to the east of the subject property, we recommend that consideration be given to utilizing the existing stormwater detention basin for disposal of stormwater from the proposed Pacific Seafood Greenfield Processing and Distribution Facility site.

We appreciate this opportunity to be of service to you at this time and trust that the above information is suitable to your present needs. Should you have any questions regarding the above information or if you require any additional information and/or assistance with this project, please do not hesitate to call.

Sincerely,

Daniel M. Redmond, P.E., G.E.
President/Principal Engineer

EXPIRES: 3-22-17

Attachments:

Figure No. 1 - Site Vicinity Map
Figure No. 2 - Pilot Infiltration Test Location Plan
Figure No. 3 - Key to Exploratory Test Log
Figure No. 4 - Log of Test Pit

MUKILTEO QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

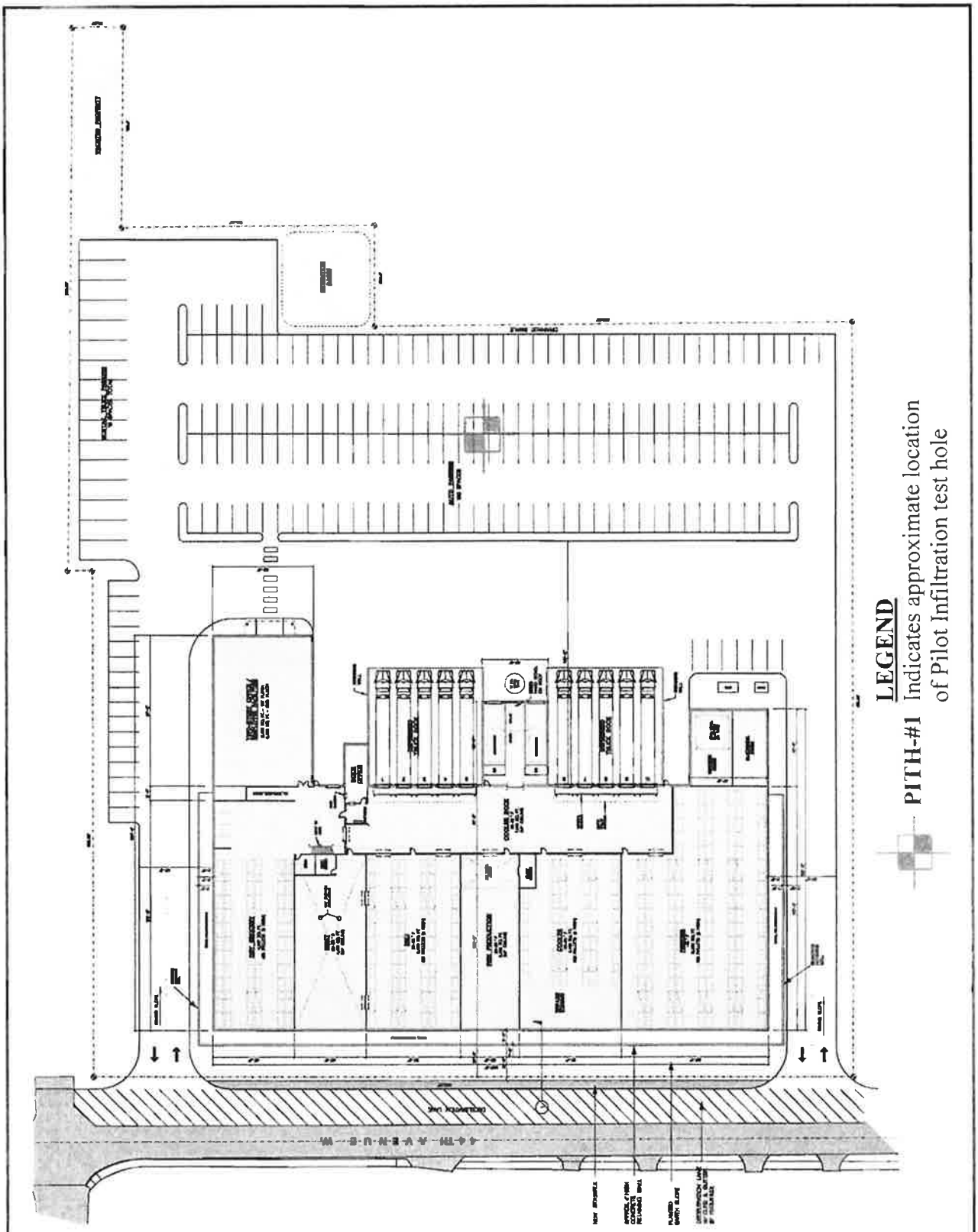
SCALE 1:24000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER

SITE VICINITY MAP

Project No. 1390.001.G	**PACIFIC SEAFOODS DISTRIBUTION FACILITY**	Figure No. 1



LEGEND

PITH-#1 Indicates approximate location of Pilot Infiltration test hole

PILOT INFILTRATION TEST LOCATION PLAN

Project No. 1390.001.G	**PACIFIC SEAFOODS DISTRIBUTION FACILITY**	Figure No. 2

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS				
200	40	10	4	3/4"	3"	12"		
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS	
	FINE	MEDIUM	COARSE	FINE	COARSE			

GRAIN SIZES

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT†
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH‡	BLOWS/FOOT†
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

REDMOND GEOTECHNICAL SERVICES

KEY TO EXPLORATORY TEST PIT LOGS
Unified Soil Classification System (ASTM D-2487)

PACIFIC SEAFOOD DISTRIBUTION FACILITY

Mukilteo, Washington

PROJECT NO.	DATE	

BACKHOE COMPANY: Olson & Olson BUCKET SIZE: 30 inches DATE: 5/27/15

DEPTH (FEET)	BAG SAMPLE	DENSITY TEST	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
						TEST PIT NO. PITH-#1 ELEVATION 574'±
					ML	FILL/TOPSOIL: Dark brown, wet, soft, highly organic, sandy and clayey SILT with bark chips
					SM	NATIVE GROUND: Medium to orangish-brown, wet, loose to medium dense, clayey, silty SAND with occasional gravel (Highly Weathered Glacial Drift)
5						
					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth: 5.0 feet
10						
15						
						TEST PIT NO. ELEVATION
5						
10						
15						

LOG OF TEST PITS

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS SITE | FIGURE NO. 4

REDMOND GEOTECHNICAL SERVICES

April 24, 2015

Mr. Dave Franklin
FFE Architecture and Engineering, Inc.
201 East Lincoln Avenue, Suite 200
Yakima, Washington 98901

Dear Mr. Franklin:

Re: Geotechnical Investigation Services, Proposed Pacific Seafood Greenfield Processing/Distribution Facility Site, 8007 44th Avenue West, Mukilteo (Snohomish County), Washington

Submitted herewith is our report entitled "Geotechnical Investigation Services, Proposed Pacific Seafood Greenfield Processing/Distribution Facility Site, 8007 44th Avenue West, Mukilteo (Snohomish County), Washington". The scope of our services was outlined in our formal proposal to Mr. Bill Marczewski of C.D. Pacific Seafood Group dated February 17, 2015. Written authorization of our services was provided by Mr. Bill Marczewski of Pacific Seafood Group on March 5, 2015.

During the course of our investigation, we have kept you and/or others advised of our schedule and preliminary findings. We appreciate the opportunity to assist you with this phase of the project. Should you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Daniel M. Redmond, P.E., G.E.
President/Principal Engineer

cc: Mr. Bill Marczewski, P.E.
Pacific Seafood Group

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Figure No. 1 - Site Vicinity Map
Figure No. 2 - Site Exploration Plan
Figure No. 3 - Perimeter Footing/Retaining Wall Drain Detail

APPENDIX

Boring Logs and Laboratory Test Data

GEOTECHNICAL INVESTIGATION SERVICES
PROPOSED PACIFIC SEAFOOD GREENFIELD PROCESSING/DISTRIBUTION FACILITY SITE
8007 44TH AVENUE WEST
MUKILTEO (SNOHOMISH COUNTY), WASHINGTON

INTRODUCTION

Redmond Geotechnical Services, LLC is please to submit to you the results of our Geotechnical Investigation at the site of the proposed Pacific Seafood Greenfield Processing/Distribution Facility located to the southeast of the intersection of 44th Avenue West and 80th Street SW in Mukilteo (Snohomish County), Washington. The general location of the subject site is shown on the Site Vicinity Map, Figure No. 1. The purpose of our geotechnical investigation services at this time was to explore the existing subsurface soils and/or groundwater conditions across the subject site and to develop and/or provide appropriate geotechnical design and construction recommendations for the proposed new processing and/or distribution facility project.

PROJECT DESCRIPTION

Based on a review of the proposed site development plan, we understand that present plans for the project will consist of the construction of one (1) new processing and/or distribution facility building. Although the processing and/or distribution facility project is still in the final planning and design stage, we understand that the project will result in the construction of an approximate 63,777 square feet concrete tilt-up structure with steel framing which will house multi-temperature rooms ranging from +32 degrees F storage rooms to a -10 degrees F freezer room as well as other warehouse dry storage, office and employee areas. Additionally, we understand that the new processing and distribution building will be designed to have a common finish floor elevation which will be a dock high facility that will allow for Over the Road (OTR) trucks and trailers to back against the Cool loading dock. Further, we understand that the processing and distribution building height will be approximately 35 feet at the roof peak with an additional 10 feet for mechanical equipment.

Support of the new processing and distribution facility structure is anticipated to include both conventional shallow individual (column) footings and strip (continuous) footings. Structural loading information, although unavailable at this time, is anticipated to be fairly typical for this type of concrete tilt-up and/or warehouse structure and is expected to result in maximum dead plus live continuous (strip) and individual (column) footing loads on the order of about 5.0 to 6.0 kips per lineal foot (klf) and 100 to 120 kips, respectively.

Earthwork and grading operations associated with bringing the subject property to finish design grades are unknown at this time. However, based on the existing sloping site grades, we anticipated that some cuts and/or fills on the order of approximately two (2) to four (4) feet will likely be required in order to lower the higher westerly portion of the site and raise the lower easterly portion of the site.

Other associated site improvements for the project will include new underground utility services, concrete curbs and sidewalks, and landscaping as well as new paved (concrete and/or asphalt) parking and drive areas for automobiles as well as both 18 kip single axle and 34 kip tandem axle trucks and trailers.

SCOPE OF WORK

The purpose of our geotechnical studies was to evaluate the overall site subsurface soil and/or groundwater conditions underlying the site with regard to the proposed new processing and distribution facility construction at the site and any associated impacts or concerns with respect to the processing and distribution center as well as provide appropriate geotechnical design and construction recommendations for the project. Specifically, our geotechnical investigation included the following scope of work items:

1. A detailed field reconnaissance and subsurface exploration program of the soil and ground water conditions underlying the site by means of seventeen (17) exploratory test borings. The exploratory test borings were drilled to depths ranging from about five (9) to fifteen (15) feet beneath existing site grades with track mounted auger drilling equipment at the approximate locations as shown on the Site Exploration Map, Figure No. 2. Additionally, representative samples of the subsurface soils encountered at the site were collected and returned to our laboratory for further examination and testing.

2. Laboratory testing to evaluate and identify pertinent physical and engineering properties of the subsurface soils encountered relative to the planned site development and construction at the site. The laboratory testing program included tests to help evaluate the natural (field) moisture content and dry density, maximum dry density and optimum moisture content, gradational characteristics, and Atterberg Limits as well as direct shear strength, consolidation and "R"-value testing.

3. A literature review and engineering evaluation and assessment of the regional seismicity to evaluate the potential ground motion hazard(s) at the subject site. The evaluation and assessment included a review of the regional earthquake history and sources such as potential seismic sources, maximum credible earthquakes, and reoccurrence intervals as well as a discussion of the possible ground response to the selected design earthquake(s), fault rupture, landsliding, liquefaction, and tsunami and seiche flooding.

4. Engineering analyses utilizing the field and laboratory data as a basis for furnishing recommendations for foundation support of the proposed new processing and distribution facility structure. Recommendations include maximum design allowable contact bearing pressure(s), depth of footing embedment, estimates of foundation settlement, lateral soil resistance, and foundation subgrade preparation. Additionally, construction and/or permanent subsurface water drainage considerations have also been prepared. Further, our report includes recommendations regarding site preparation, placement and compaction of structural fill materials, suitability of the on-site soils for use as structural fill, criteria for import fill materials, and preparation of foundation, pavement and/or floor slab subgrades.

5. Development of various flexible and rigid pavement design sections for both automobile and heavy truck access drive and parking areas.

SITE CONDITIONS

Site Geology

Much of the Puget Sound region was affected by past intrusion of continental glaciation. The last period of glaciation, the Vashon Stade, ended approximately 10,000 to 11,000 years ago. Many of the geomorphic features seen today are a result of scouring and overriding by glacial ice. During the Vashon Stade, the Puget Sound region was overridden by over 3,000 feet of ice. Soil layers overridden by the ice sheet were compacted to a much greater extent than those that were not. A typical sequence includes recessional outwash sand, overlying glacial till or drift, underlain by advance outwash.

Available geologic mapping of the area and/or subject site as shown on the Distribution and Description of Geologic Units in the Mukilteo Quadrangle, Washington by James P. Minard (1982) indicates that the near surface soils consist of glacial till (Qvt). The glacial till unit is described as a non-sorted mixture of clay, silt, sandy, pebbles, and cobbles.

Surface Conditions

The subject property is generally irregular in shape and encompassing a total area of approximately 5.07 acres. The subject property is roughly bounded to the west 44th Avenue West and to the north, south and east by existing and/or developed commercial and/or industrial properties.

The northwesterly portion of the subject site is presently improved which includes two (2) existing commercial and/or shop structures and a mobile home structure as well as paved and/or graveled vehicle parking. Additionally, the northwesterly portion of the site contains an existing concrete slab believed to be associated with a prior structure. Further, the remainder of the easterly and southerly portions of the site are presently unimproved.

Surface vegetation across the unimproved portion of the site generally consists of a moderate growth of grass and weeds as well as some brush while the area around the existing structures also contains some trees.

Topographically, the site is characterized as gently sloping terrain (5 to 10 percent) descending downward towards the northeast with overall topographic relief estimated at about fourteen (14) feet and is estimated to lie between a low of about Elevation 570 feet near the northeasterly corner of the site to a high of about Elevation 586 feet near the southwesterly portion of the site. However, the southwesterly portion of the site has been elevated above its natural site grades with stockpiles which lie at about Elevation 590 feet.

Subsurface Soil Conditions

Our understanding of the subsurface soil conditions underlying the site was developed by means of seventeen (17) exploratory test borings drilled to depths ranging from about five (5) to fifteen (15) feet beneath existing site grades on April 10, 2015 with track mounted auger drilling equipment. The location of the exploratory test borings were located in the field by marking off distances from existing and/or known site features and are shown in relation to the existing and/or proposed site improvements on the Site Exploration Map, Figure No. 2. Detailed logs of the test boring explorations, presenting conditions encountered at each location explored, are presented in the Appendix, Figure No's. A-5 through A-21.

The exploratory test boring excavations performed during this study were observed by staff from Redmond Geotechnical Services, LLC who logged each of the test boring explorations and obtained representative samples of the subsurface soils encountered across the site. Additionally, the elevation of the exploratory test boring excavations were referenced from a Boundary & Topographic Survey prepared by GeoDimensions dated March 24, 2015 and should be considered as approximate. All subsurface soils encountered at the site and/or within the exploratory test boring excavations were logged and classified in general conformance with the Unified Soil Classification System (USCS) which is outlined on Figure No. A-4.

The test boring explorations revealed that the subject site is generally underlain by native soil deposits comprised of glacial drift and/or till deposits of Pleistocene age. However, localized fill soils were also encountered at the site. Specifically, the subsurface soils underlying the project area generally consists of a surficial layer of topsoil materials comprised of about 8 to 18 inches of dark brown, very moist to saturated, very soft to soft, organic to highly organic, sandy, clayey silt. These surficial topsoil materials were inturn underlain by native residual soils composed of an upper layer of medium to orangish-brown, very moist to saturated, loose to medium dense, clayey, silty sand with occasional gravel and roots subgrade soils to depths ranging from about 2 to 3 feet beneath the existing site and/or surface grades. This upper layer of residual soils is considered to be highly weathered glacial drift and is best characterized by relatively low strength and moderately to high compressibility. This upper layer of glacial drift was inturn underlain by gray to gray-brown, very moist, medium dense to dense, clayey, silty sand with gravel and cobbles to the maximum depth explored of about fifteen (15) feet beneath existing site and/or surface grades.

This underlying unit represents the glacial till bedrock deposits and are best characterized by relatively high strength and low compressibility. However, areas of fill soil and/or surface improvements were also found to be present at the site. Specifically, the northwesterly portion of the site contains various gravel base rock and concrete pavements/slabs of approximately 6 inches in depth and/or thickness. Additionally, the central, southerly and easterly portions of the site contain a 6 to 24 inch layer of bark chips. Further, the southwesterly portion of the site contains two (2) large spoil piles which contain approximately 6 to 8 feet of uncompacted silty sand soils. In addition to the above, other evidence of fill placement was observed at the site and to the east of the existing site improvements and/or concrete slab which was observed to consist of a mixture of soil with miscellaneous wood and construction debris.

Groundwater

Groundwater was generally not encountered within any of the exploratory test boring explorations (B-#1 through B-#17) at the time of drilling to depths of at least fifteen (15) feet beneath existing site grades. However, several of the test borings drilled across the central and/or easterly portion of the site encountered seepage. Based on a review of available water wells in the area, the apparent depth to seasonal high groundwater in the area of the subject site is greater than 20 feet. However, groundwater elevations at and/or below the subject site may fluctuate seasonally in accordance with rainfall conditions as well as changes in site utilization. Additionally, due to the presence of relatively low permeability within the underlying medium dense to dense, clayey, silty sand with gravel and cobble glacial till bedrock deposits, surface water was observed to be perch near to and/or at the ground surface at the time of our field work and/or during periods of peak and/or prolonged rainfall.

LABORATORY TESTING

Representative samples of the on-site subsurface soils were collected at selected depths and intervals from various test boring explorations and returned to our laboratory for further examination and testing and/or to aid in the classification of the subsurface soils as well as to help evaluate and identify their engineering strength and compressibility characteristics. The laboratory testing consisted of visual and textural sample inspection, moisture content and dry density determinations, maximum dry density and optimum moisture content, gradation analyses and Atterberg Limits as well as direct shear strength, consolidation and "R"-value tests. Results of the various laboratory tests are presented in the Appendix, Figure No's. A-22 through A-29.

SEISMICITY AND EARTHQUAKE SOURCES

The seismicity of the northwest Washington as well as the Seattle and/or Everett areas, and hence the potential for ground shaking, is controlled by three separate fault mechanisms. These include the Cascadia Subduction Zone (CSZ), the mid-depth intraplate zone, and the relatively shallow crustal zone. Descriptions of these potential earthquake sources are presented below.

The CSZ is located offshore and extends from northern California to British Columbia. Within this zone, the oceanic Juan de Fuca Plate is being subducted beneath the continental North American Plate to the east. The interface between these two plates is located at a depth of approximately 15 to 20 kilometers (km). The seismicity of the CSZ is subject to several uncertainties, including the maximum earthquake magnitude and the recurrence intervals associated with various magnitude earthquakes. Anecdotal evidence of previous CSZ earthquakes has been observed within coastal marshes along the Washington and Oregon coastlines. Sequences of interlayered peat and sands have been interpreted to be the result of large Subduction zone earthquakes occurring at intervals on the order of 300 to 500 years, with the most recent event taking place approximately 300 years ago. A recent study by Geomatrix (1995) suggests that the maximum earthquake associated with the CSZ is moment magnitude (Mw) 8 to 9. This is based on an empirical expression relating moment magnitude to the area of fault rupture derived from earthquakes that have occurred within Subduction zones in other parts of the world. An Mw 9 earthquake would involve a rupture of the entire CSZ. As discussed by Geomatrix (1995) this has not occurred in other subduction zones that have exhibited much higher levels of historical seismicity than the CSZ, and is considered unlikely. For the purpose of this study an earthquake of Mw 8.5 was assumed to occur within the CSZ.

The intraplate zone encompasses the portion of the subducting Juan de Fuca Plate located at a depth of approximately 30 to 50 km below western Washington and western Oregon. Very low levels of seismicity have been observed within the intraplate zone in western Oregon and western Washington. However, much higher levels of seismicity within this zone have been recorded in Washington and California. Several reasons for this seismic quiescence were suggested in the Geomatrix (1995) study and include changes in the direction of Subduction between Oregon, Washington, and British Columbia as well as the effects of volcanic activity along the Cascade Range. Historical activity associated with the intraplate zone includes the 1949 Olympia magnitude 7.1 and the 1965 Puget Sound magnitude 6.5 earthquakes. Based on the data presented within the Geomatrix (1995) report, an earthquake of magnitude 7.25 has been chosen to represent the seismic potential of the intraplate zone.

The third source of seismicity that can result in ground shaking within the Seattle/Everett and northwest Washington area is near-surface crustal earthquakes occurring within the North American Plate. The historical seismicity of crustal earthquakes in this area is higher than the seismicity associated with the CSZ and the intraplate zone.

Liquefaction

Seismic induced soil liquefaction is a phenomenon in which lose, granular soils and some silty soils, located below the water table, develop high pore water pressures and lose strength due to ground vibrations induced by earthquakes. Soil liquefaction can result in lateral flow of material into river channels, ground settlements and increased lateral and uplift pressures on underground structures. Buildings supported on soils that have liquefied often settle and tilt and may displace laterally. Soils located above the ground water table cannot liquefy, but granular soils located above the water table may settle during the earthquake shaking.

Our review of the subsurface soil test boring logs from our exploratory field explorations (B-#1 through B-#17) and laboratory test results indicates that the site is generally underlain by medium dense to dense, clayey, silty sand glacial till deposits to depths of at least 15.0 feet beneath existing site grades.

As such, due to the medium dense to dense characteristics of the underlying clayey, silty sand glacial till bedrock deposits beneath the site, it is our opinion that the soil deposits located beneath the subject site do not have the potential for liquefaction during the design earthquake motions previously described. A more detailed liquefaction assessment was not part of the scope of work for this Geotechnical Investigation.

Landslides

No ancient and/or active landslides were observed or are known to be present on the subject site. Additionally, due to the relatively flat-lying to gently sloping nature of the subject site, the risk of seismic induced slope instability at the site resulting in landslides and/or lateral earth movements does not appear to present a potential geologic hazard.

Surface Rupture

Although the site is generally located within a region of the country known for seismic activity, no known faults exist on and/or immediately adjacent to the subject site. As such, the risk of surface rupture due to faulting is considered negligible.

Tsunami and Seiche

A tsunami, or seismic sea wave, is produced when a major fault under the ocean floor moves vertically and shifts the water column above it. A seiche is a periodic oscillation of a body of water resulting in changing water levels, sometimes caused by an earthquake. Tsunami and seiche are not considered a potential hazard at this site because the site is not near to the coast and/or there are no adjacent significant bodies of water.

Flooding and Erosion

Stream flooding is a potential hazard that should be considered in lowland areas of Snohomish County and Mukilteo. The FEMA (Federal Emergency Management Agency) flood maps should be reviewed as part of the design for the proposed new auto dealership structure and any associated site improvements. Elevations of structures on the site should be designed based upon consultants reports, FEMA (Federal Emergency Management Agency), and Snohomish County requirements for the 100-year flood levels of any nearby creeks and/or streams.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our field explorations, laboratory testing, and engineering analyses, it is our opinion that the site is suitable for the proposed new Pacific Seafood Greenfield Processing and Distribution facility and its associated site improvements provided that the recommendations contained within this report are properly incorporated into the design and construction of the project.

The primary features of concern at the site are 1) the presence of the existing site and/or surface improvements across the northwesterly portion of the site, 2) the presence of existing fill materials at the site, 3) the presence of the extensive layer of topsoil materials across the site, 4) the presence of the upper layer of medium to orangish-brown, loose, clayey, silty sand subgrade soils, 5) the presence of perched and/or surface water, and 6) the relatively dense glacial till bedrock deposits beneath the site.

In regards to the presence of the existing site and/or surface improvements within the northwesterly portion of the site, we are generally of the opinion that carefully monitoring of the site grading and earthwork activities will be required by the Geotechnical Engineer to ensure that all of the old foundation remnants, surface improvements and/or old utility services are properly removed and/or abandoned prior to the placement of any new structural fills and/or site improvements.

With regard to the presence of existing fill materials at the site, we are of the opinion that the fill materials are likely undocumented. Additionally, much of the surficial fill consists of bark chips. Further, the fill materials appear to be poorly compacted and are generally unsuitable for support of the proposed new site improvements. As such, we are generally of the opinion that all of the existing fill soil materials be removed in their entirety down to an approved native subgrade. Additionally, if during the upcoming site grading and earthwork operations it is determined that the existing fill materials contain deleterious materials and/or significant organics, the existing fill materials would be considered unsuitable for use/reuse as structural fill and/or support of the planned new site improvements. However, existing fill materials which are generally free of organics and/or deleterious materials, such as the large stockpiles located in the southwesterly portion of the site, may be used/re-used as structural fill if approved by the Geotechnical Engineer.

In regards to the presence of the extensive layer of topsoil materials across the site, we are generally of the opinion that stripping depths of about 1.0 to 1.5 feet will likely be required during the clearing and site preparation work for the project. However, additional stripping and clearing will be required in areas where the topsoil materials are covered by surficial fill materials.

With regard to the presence of the upper layer of medium to orangish-brown, loose, clayey, silty sand subgrade soils, these soil deposits are believed to represent highly weathered glacial drift. Additionally, these clayey, silty sand soil deposits are presently loose and contain pockets of medium to large sized roots. Further, in their present condition, these loose clayey, silty sand subgrade soils possess low strength and high compressibility characteristics. As such, we are of the opinion that these upper clayey, silty sand subgrade soils should be removed in their entirety down to the surface of the medium dense to dense, clayey, silty sand glacial till bedrock deposits. However, use/re-use of the upper glacial drift soil deposits as structural fill soil may be considered acceptable and approved by the Geotechnical Engineer if the roots and/or organic matter is suitably removed.

In regards to the presence of perched and/or surface water at the site, we are generally of the opinion that all site grading and earthwork operations for the project be performed during the drier summer months which is typically June through September.

With regard to the relatively dense glacial till bedrock deposits beneath the site, we are of the opinion that these glacial till bedrock deposits will provide suitable support of foundations and/or site improvements. However, hard and/or difficult excavation conditions should be anticipated for site excavations which extend into the glacial till deposits.

The following sections of this report provide specific recommendations regarding subgrade preparation and grading as well as foundation and floor slab design and construction for the new Pacific Seafood Greenfield Processing and Distribution Facility project.

Site Preparation

As an initial step in site preparation, we recommend that the proposed new processing and distribution facility building area(s) and its associated structural and/or site improvement area(s) be stripped and cleared of all existing improvements, any existing unsuitable and/or undocumented fill materials, surface debris, existing vegetation, topsoil materials, and/or any other deleterious materials present at the time of construction. In general, we envision that the site stripping to remove existing surface improvements and/or topsoil materials as well as undocumented fill materials will generally be about 6 to 24 inches. However, localized areas requiring deeper removals, such as old foundation remnants as well as the stockpiled undocumented fill materials, will be encountered and should be evaluated at the time of construction by the Geotechnical Engineer. The stripped and cleared materials should be generally be disposed of as they are generally considered organic and unsuitable for use/reuse as structural fill materials. Additionally and as previously noted, following the site clearing and stripping,

Following the completion of the site stripping and clearing work and prior to the placement of any required structural fill materials and/or structural improvements, the upper medium to orangish-brown and loose, clayey, silty sandand/or highly weathered glacial drift subgrade soils should be removed in their entirety down to the surface of the medium dense to dense glacial till bedrock deposits.

The on-site native clayey, silty sand subgrade soil materials are generally considered suitable for use/reuse as structural fill materials provided that they are free of organic materials, debris, and rock fragments in excess of about 6 inches in dimension. However, if site grading is performed during wet or inclement weather conditions, the use of the on-site native soil materials which contain significant silt and clay sized particles will be difficult at best. In this regard, during wet or inclement weather conditions, we recommend that an import structural fill material be utilized which should consist of a free-draining (clean) granular fill (sand & gravel) containing no more than about 5 percent fines. Representative samples of the materials which are to be used as structural fill materials should be submitted to the Geotechnical Engineer and/or laboratory for approval and determination of the maximum dry density and optimum moisture content for compaction.

In general, all site earthwork and grading activities should be scheduled for the drier summer months (June through September) if possible. However, if wet weather site preparation and grading is required, it is generally recommended that the stripping of the existing undocumented fill materials as well as the topsoil materials and/or underlying loose highly weathered glacial drift subgrade soils be accomplished with a tracked excavator utilizing a large smooth-toothed bucket working from areas yet to be excavated. Additionally, the loading of strippings into trucks and/or protection of moisture sensitive subgrade soils may also be required during wet weather grading and construction. Further, we recommend that areas in which construction equipment will be traveling over moisture sensitive subgrade soils be protected by covering the exposed subgrade soils with a geotextile fabric such as Mirafi 600nx followed by at least 12 inches or more of crushed aggregate base rock. The geotextile fabric should have a minimum Mullen burst strength of at least 250 pounds per square inch for puncture resistance and an apparent opening size (AOS) between the U.S. Standard No. 70 and No. 100 sieves.

All structural fill materials placed within the new processing and distribution facility building and/or pavement areas should be moistened or dried as necessary to near (within 3 percent) optimum moisture conditions and compacted by mechanical means to a minimum of 92 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. Structural fill materials should be placed in lifts (layers) such that when compacted do not exceed about 8 inches. Additionally, all fill materials placed within five (5) lineal feet of the perimeter (limits) of the proposed new processing and distribution facility structure and/or pavements should be considered structural fill. All aspects of the site grading should be monitored and approved by a representative of Redmond Geotechnical Services, LLC.

Foundation Support

Based on the results of our investigation, it is our opinion that the site of the proposed new processing and distribution facility is suitable for support of the concrete tilt-up and steel framed structure provided that the following foundation design recommendations are followed. The following sections of this report present specific foundation design and construction recommendations for the planned new processing and distribution facility structure.

Shallow Foundations

In general, conventional shallow continuous (strip) footings and individual (spread) column footings may be supported by properly placed and approved structural fill soils based on an allowable contact bearing pressure of about 2,500 pounds per square foot (psf). However, where higher allowable contact bearing pressures are desired and/or required, an allowable contact bearing pressure of 3,000 psf may be used for design where foundations are supported by the existing medium dense to dense, clayey, silty sand glacial till bedrock deposits. These recommended allowable contact bearing pressures are intended for dead loads and sustained live loads and may be increased by one-third for the total of all loads including short-term wind or seismic loads. In general, continuous strip footings should have a minimum width of at least 16 inches and be embedded at least 18 inches below the lowest adjacent finish grade (includes frost protection). Individual column footings (where required) should be embedded at least 18 inches below grade and have a minimum width of at least 24 inches.

Total and differential settlements of foundations constructed as recommended above and supported by approved structural fill materials and/or native medium dense to dense, clayey, silty sand glacial till bedrock deposits are expected to be well within the tolerable limits for this type of concrete tilt-up and steel framed structure and should generally be less than about 1-inch and 1/2-inch, respectively.

Allowable lateral frictional resistance between the base of the footing element and the supporting subgrade bearing soil can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.35 and 0.50 for native structural fill materials or the medium dense to dense, clayey, silty sand glacial till bedrock deposits, respectively. In addition, lateral loads may be resisted by passive earth pressures on footings poured "neat" against in-situ (native) subgrade soils or properly backfilled with structural fill materials based on an equivalent fluid density of 300 pounds per cubic foot (pcf). This recommended value includes a factor of safety of approximately 1.5 which is appropriate due to the amount of movement required to develop full passive resistance.

Floor Slab Support

In order to provide uniform subgrade reaction beneath concrete slab-on-grade floors, we recommend that the floor slab area be underlain by a minimum of 6 inches of free-draining (less than 5 percent passing the No. 200 sieve), well-graded, crushed rock. The crushed rock should help provide a capillary break to prevent migration of moisture through the slab. Additional moisture protection, where needed, can be provided by using a 15-mil polyolefin geo-membrane sheeting such as StegoWrap.

The base course materials should be compacted to at least 95 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. Where floor slab subgrade materials are undisturbed, firm and stable and where the underslab aggregate base rock section has been prepared and compacted as recommended above, we recommend that a modulus of subgrade reaction of 250 pci be used for design.

Retaining/Below Grade Walls

Retaining and/or below grade walls should be designed to resist lateral earth pressures imposed by native soils or granular backfill materials as well as any adjacent surcharge loads. For walls which are unrestrained at the top and free to rotate about their base, we recommend that active earth pressures be computed on the basis of the following equivalent fluid densities:

Non-Restrained Retaining Wall Pressure Design Recommendations

Slope Backfill (Horizontal/Vertical)	Equivalent Fluid Density/Sand (pcf)	Equivalent Fluid Density/Gravel (pcf)
Level	35	30
3H:1V	60	50
2H:1V	90	80

For walls which are fully restrained at the top and prevented from rotation about their base, we recommend that at-rest earth pressures be computed on the basis of the following equivalent fluid densities:

Restrained Retaining Wall Pressure Design Recommendations

Slope Backfill (Horizontal/Vertical)	Equivalent Fluid Density/Sand (pcf)	Equivalent Fluid Density/Gravel (pcf)
Level	45	35
3H:1V	65	60
2H:1V	95	90

The above recommended values assume that the walls will be adequately drained to prevent the buildup of hydrostatic pressures. Where wall drainage will not be present and/or if adjacent surcharge loading is present, the above recommended values will be significantly higher.

Backfill materials behind walls should be compacted to 90 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. Special care should be taken to avoid overcompaction near the walls which could result in higher lateral earth pressures than those indicated herein. In areas within three (3) to five (5) feet behind walls, we recommend the use of hand-operated compaction equipment.

Pavements

Flexible (AC) and rigid (PCC) pavement design for the project was determined on the basis of projected (anticipated) traffic volume and loading conditions relative to laboratory subgrade soil strength ("R"-value) characteristics. Based on a laboratory subgrade "R"-value of 32 (Resilient Modulus = 5,000 to 10,000) and utilizing the Asphalt Institute Flexible Pavement Design Procedures and/or the American Association of State Highway and Transportation Officials (AASHTO) 1993 "Design of Pavement Structures" manual, we recommend that the flexible asphaltic concrete (AC) and/or rigid Portland Cement Concrete (PCC) pavement section(s) for the automobile and truck drive and/or parking areas at the site consist of the following:

	Asphaltic Concrete Thickness (inches)	**Crushed Base Rock Thickness (inches)**
Automobile Drive & Parking Areas	3.0	9.0
Heavy Truck traffic Areas	5.0	12.0

	Portland Cement Concrete Thickness (inches)	**Crushed Base Rock Thickness (inches)**
Automobile Parking & Drive Areas	5.0	4.0
Heavy Truck Traffic Areas	7.5	6.0

Note: For wet weather construction, we recommend a minimum gravel base rock thickness of at least 12 inches. Additionally, the above recommended flexible and rigid pavement section(s) assumes a design life of 20 and 40 years, respectively. Further, the rigid PCC pavement design assumes a minimum Modulus of Rupture (M.R.) of 3rd point loading of 650 psi and minimum 28 day concrete strength of 4,000 psi.

Pavement Subgrade, Base Course & Asphalt Materials

The above recommended pavement section(s) were based on the design assumptions listed herein and on the assumption that construction of the pavement section(s) will be completed during an extended period of reasonably dry weather. All thicknesses given are intended to be the minimum acceptable. Increased base rock sections and the use of geotextile fabric may be required during wet and/or inclement weather conditions and/or in order to adequately support construction traffic and protect the subgrade during construction. Additionally, the above recommended pavement section(s) assume that the subgrade will be prepared as recommended herein, that the exposed subgrade soils will be properly protected from rain and construction traffic, and that the subgrade is firm and unyielding at the time of paving. Further, it assumes that the subgrade is graded to prevent any ponding of water which may tend to accumulate in the base course.

Pavement base course materials should consist of well-graded 1-1/4 inch and/or 5/8-inch minus crushed base rock having less than 5 percent fine materials passing the No. 200 sieve. The base course and asphaltic concrete materials should conform to the requirements set forth in the latest edition of the Washington Department of Transportation, Standard Specifications for Highway Construction. The base course materials should be compacted to at least 95 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. The asphaltic concrete paving materials should be compacted to at least 92 percent of the theoretical maximum density as determined by the ASTM D-2041 (Rice Gravity) test method.

Excavation/Slopes

Temporary excavations of up to about four (4) feet in depth may be constructed with near vertical inclinations. Temporary excavations greater than about four (4) feet but less than eight (8) feet should be excavated with inclinations of at least 1 to 1 (horizontal to vertical) or properly braced/shored. Where excavations are planned to exceed about eight (8) feet, this office should be consulted. All shoring systems and/or temporary excavation bracing for the project should be the responsibility of the excavation contractor. Permanent cut and/or fill slopes should be constructed no steeper than 2H:1V.

Depending on the time of year in which trench excavations occur, trench dewatering may be required in order to maintain dry working conditions if the invert elevations of the proposed utilities are located at and/or below the groundwater level. If groundwater is encountered during utility excavation work, we recommend placing trench stabilization materials along the base of the excavation. Trench stabilization materials should consist of 1-foot of well-graded gravel, crushed gravel, or crushed rock with a maximum particle size of 4 inches and less than 5 percent fines passing the No. 200 sieve. The material should be free of organic matter and other deleterious material and placed in a single lift and compacted until well keyed.

Surface Drainage/Ground Water

We recommend that positive measures be taken to properly finish grade the site so that drainage waters from the building and landscaping areas as well as adjacent properties or buildings are directed away from the new processing and distribution facility structure foundations and/or floor slabs. All roof drainage should be directed into conduits that carry runoff water away from the processing and distribution facility to a suitable outfall. Roof downspouts should not be connected to foundation drains. A minimum ground slope of about 2 percent is generally recommended in unpaved areas around the building.

Groundwater was generally not encountered at the site in any of the exploratory test borings (B-#1 through B-#17) at the time of drilling to depths of at least 15.0 feet beneath existing site grades. However, surface ponding was present at the time of our field work. Additionally, groundwater elevations in the area and/or beneath the subject site may fluctuate seasonally and may temporarily pond/perch near the ground surface during periods of prolonged rainfall.

As such, based on our current understand of the site grading required to bring the subject site to finish design grades, we are of the opinion that an underslab drainage system is not required for the proposed new processing and distribution facility structure. However, due to the presence of clayey, silty sand subgrade soils within the foundation bearing level of the proposed new processing and distribution facility structure, we are generally of the opinion that a footing/foundation drainage system should be utilized around the perimeter of the proposed processing and distribution facility structure. Additionally, a foundation drain is recommended for any below grade footing and/or retaining walls. A typical recommended perimeter footing and/or retaining wall drain detail is shown on Figure No. 3.

Seismic Design Considerations

Structures at the site should be designed to resist earthquake loading in accordance with the methodology described in the latest edition of the State of Washington Structural Specialty Code and/or Amendments to the 2012 International Building Code (IBC). The maximum considered earthquake ground motion for short period and 1.0 period spectral response may be determined from the Washington Structural Specialty Code and/or Figures 1613 (1) and 1613 (2) of the 2009 National Earthquake Hazard Reduction Program (NEHRP) "Recommended Provisions for Seismic Regulations for New Buildings and Other Structures" published by the Building Seismic Safety Council. We recommend Site Class "C" be used for design per Table 1613.5.2.

Using this information, the structural engineer can select the appropriate site coefficient values (F_a and F_v) from Tables 1613.5.3 (1) and 1613.5.3 (2) of the 2012 IBC to determine the maximum considered earthquake spectral response acceleration for the project. However, we have assumed the following response spectrum for the project:

Table 1. IBC Seismic Design Parameters

Site Class	S_S	S_1	Fa	Fv	S_{MS}	S_{M1}	S_{Ds}	S_{D1}
C	1.450	0.564	1.000	1.300	1.450	0.733	0.967	0.489

Notes: 1. S_S and S_1 were established based on the USGS 2012 mapped maximum considered earthquake spectral acceleration maps for 2% probability of exceedence in 50 years.

2. Fa and Fv were established based on IBC 2012 tables 1613.5.3 (1) and 1613.5.3 (2) using the selected S_S and S_1 values.

CONSTRUCTION MONITORING AND TESTING

We recommend that **Redmond Geotechnical Services, LLC** be retained to provide construction monitoring and testing services during all earthwork operations for the proposed new processing and distribution facility project. The purpose of our monitoring services would be to confirm that the site conditions reported herein are as anticipated, provide field recommendations as required based on the actual conditions encountered, document the activities of the grading contractor and assess his/her compliance with the project specifications and recommendations. It is important that our representative meet with the contractor prior to grading to help establish a plan that will minimize costly overexcavation and site preparation work. Of primary importance will be observations made during site preparation, structural fill placement, footing excavations and construction as well as any retaining wall backfill.

CLOSURE AND LIMITATIONS

This report is intended for the exclusive use of the addressee and/or their representative(s) to use to design and construct the proposed new processing and distribution facility structure and its associated site improvements described herein as well as to prepare any related construction documents. The conclusions and recommendations contained in this report are based on site conditions as they presently exist and assume that the explorations are representative of the subsurface conditions between the explorations and/or across the study area. The data, analyses, and recommendations herein may not be appropriate for other structures and/or purposes. We recommend that parties contemplating other structures and/or purposes contact our office. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. Additionally, the above recommendations are contingent on Redmond Geotechnical Services, LLC being retained to provide all site inspections and construction monitoring services associated with the site grading and earthwork operations as well as all foundation excavation and preparation work for this project. Redmond Geotechnical Services, LLC will not assume any responsibility and/or liability for any engineering judgment, inspection and/or testing services performed by others.

It is the owners/developers responsibility for insuring that the project designers and/or contractors involved with this project implement our recommendations into the final design plans, specifications and/or construction activities for the project. Further, in order to avoid delays during construction, we recommend that the final design plans and specifications for the project be reviewed by our office to evaluate as to whether our recommendations have been properly interpreted and incorporated into the project.

If during any future site grading and construction, subsurface conditions different from those encountered in the explorations are observed or appear to be present beneath excavations, we should be advised immediately so that we may review these conditions and evaluate whether modifications of the design criteria are required. We also should be advised if significant modifications of the proposed site development are anticipated so that we may review our conclusions and recommendations.

LEVEL OF CARE

The services performed by the Geotechnical Engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in the area under similar budget and time restraints. No warranty or other conditions, either expressed or implied, is made.

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APPENDIX

FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATION

Subsurface conditions at the site were explored by drilling seventeen (17) exploratory test borings on April 10, 2015. The approximate location of the test boring explorations are shown in relation to the existing and/or proposed new site improvements on the Site Exploration Map, Figure No. 2.

The test borings were drilled using track mounted auger drilling equipment in general conformance with ASTM Methods in Vol. 4.08, D-1586-94 and D-1587-83. The test borings were drilled to depths ranging from about 5.0 to 15.0 feet beneath existing site grades. Detailed logs of the test borings are presented on the Boring Logs, Figure No's. A-5 through A-21. The soils were classified in accordance with the Unified Soil Classification System (USCS), which is outlined on Figure No. A-4.

The exploration program was coordinated by a field engineer who monitored the drilling and exploration activity, obtained representative samples of the subsurface soils encountered, classified the soils by visual and textural examination, and maintained continuous logs of the subsurface conditions. Disturbed and/or undisturbed samples of the subsurface soils were obtained at appropriate depths and/or intervals and placed in plastic bags and/or with a thin walled ring sample.

Groundwater was generally not encountered within any of the exploratory test borings (B-#1 through B-#17) at the time of drilling at depths of between five (5) to fifteen (15) feet beneath existing site grades. However, perched surface water was present at the site at the time of our field work.

LABORATORY TESTING

Pertinent physical and engineering characteristics of the soils encountered during our subsurface investigation were evaluated by a laboratory testing program to be used as a basis for selection of soil design parameters and for correlation purposes. Selected tests were conducted on representative soil samples. The program consisted of tests to evaluate the existing (in-situ) moisture-density, maximum dry density and optimum moisture content, Atterberg Limits and gradational characteristics as well as direct shear strength, consolidation and "R"-value tests.

Dry Density and Moisture Content Determinations

Density and moisture content determinations were performed on both disturbed and relatively undisturbed samples from the test boring explorations in general conformance with ASTM Vol. 4.08 Part D-216. The results of these tests were used to calculate existing overburden pressures and to correlate strength and compressibility characteristics of the soils. Test results are shown on the test boring logs at the appropriate sample depths.

Maximum Dry Density

One (1) maximum dry density test was performed on representative sample of the upper clayey, silty sand subgrade soils in accordance with ASTM Vol. 4.08 Part D-1557-78. The test was conducted to facilitate classification of the soils and for correlation purposes. Test results appear on Figure No. A-22.

Atterberg Limits

Liquid Limit (LL) and Plastic Limit (PL) tests were performed on a representative sample of the clayey, silty sand subgrade soils in accordance with ASTM Vol. 4.08 Part D-4318-85. The test results were conducted to help facilitate the classification of the subgrade soils and for correlation purposes. The test results are shown graphically on Figure No. A-23.

Gradation Analysis

Gradation analyses were performed on representative samples of the clayey, silty sand subsurface soils in accordance with ASTM Vol. 4.08 Part D-422. The test results were used to classify the soil in accordance with the Unified Soil Classification System (USCS). The test results are shown graphically on Figure No. A-24.

Direct Shear Strength Test

Two (2) Direct Shear Strength tests were performed on remolded samples at a continuous rate of shearing deflection (0.02 inches per minute) in accordance with ASTM Vol. 4.08 Part D-3080-79. The test results were used to determine engineering strength properties and are shown graphically on Figure No's. A-25 and A-26.

Consolidation Tests

One (1) Consolidation test was performed on an undisturbed sample of the upper clayey, silty sand subgrade soils to help assess the compressibility characteristics of the near surface subgrade soils in general conformance with ASTM Vol. 4.08 Part D-2435-80.

Conventional loading increments of 100, 200, 400, ... 12,800 psf were applied after the 100 percent time of primary consolidation was identified and defined foe each loading increment. The sample was unloaded and allowed to rebound after the completion of the loading sequence. Deflection versus time readings were recorded for all load increments from 100 through 12,800 psf. The deflection corresponding to 100 percent primary consolidation was plotted on the consolidation strain versus consolidation pressure curve, which is presented on Figure No. A-27.

"R"-Value Tests

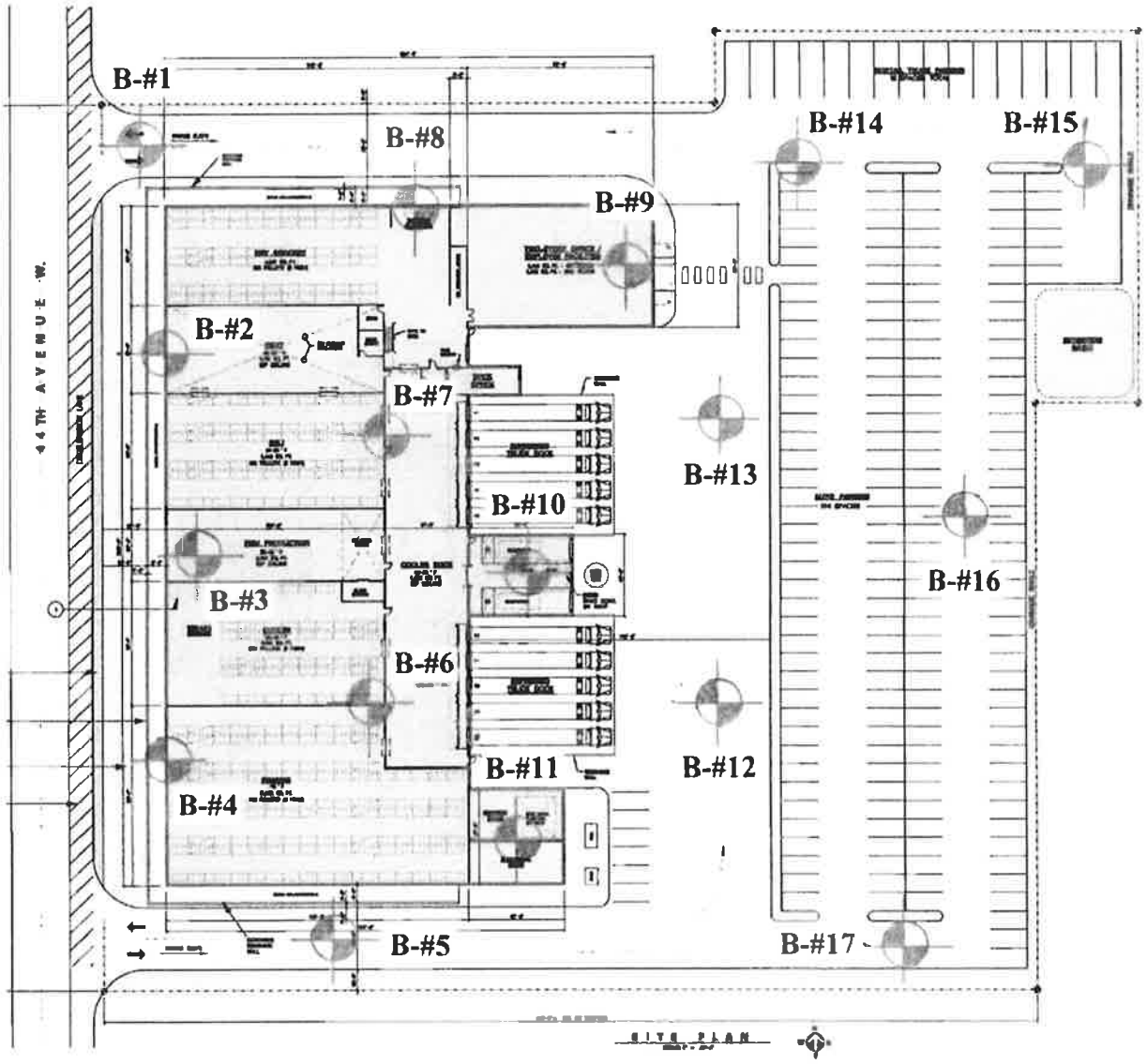
One (1) "R"-value test was performed on a representative sample of the near surface clayey, silty sand subgrade soils in general conformance with ASTM Vol. 4.08 Part D-2844. The test results were used to help evaluate the subgrade soil supporting and performance capabilities when subjected to vehicle traffic loading. The test results are shown on Figure No. A-28.

The following figures are attached and complete the Appendix:

Figure No. A-4	Key To Exploratory Boring Logs
Figure No's. A-5 through A-21	Boring Logs
Figure No. A-22	Maximum Dry Density Test Results
Figure No. A-23	Atterberg Limits Test Results
Figure No. A-24	Gradation Test Results
Figure No's. A-25 and A-26	Direct Shear Strength Test Results
Figure No. A-27	Consolidation Test Results
Figure No. A-28	Results of R (Resistance) Value Test

Appendix "A"

Boring Logs and Laboratory Test Results



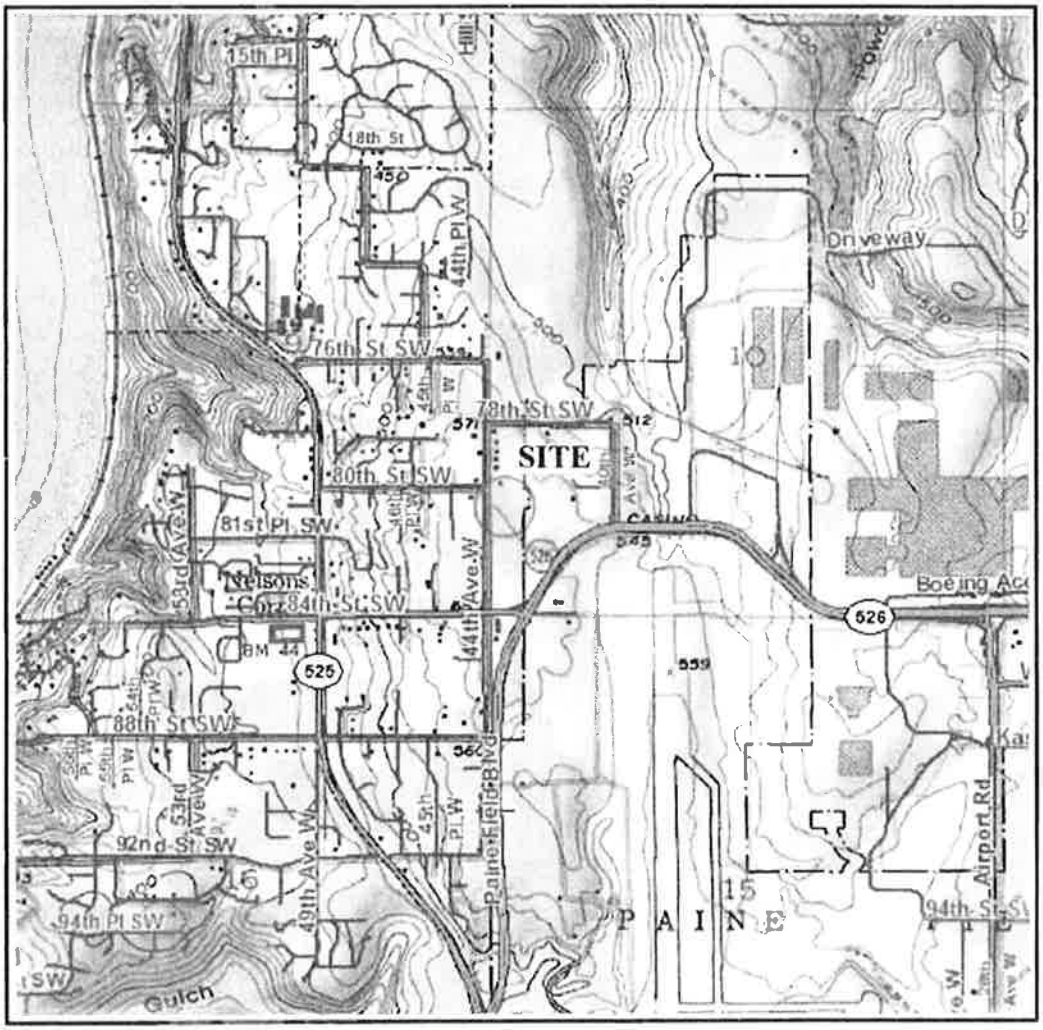
LEGEND

B-#17 Indicates approximate location of exploratory drilled test boring

Approximate Scale: 1"=90'

SITE EXPLORATION PLAN

Project No. 1390.001.G	*PACIFIC SEAFOODS* DISTRIBUTION FACILITY	Figure No. 2



MUKILTEO QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE 1:24 000

1 0 1 MILE

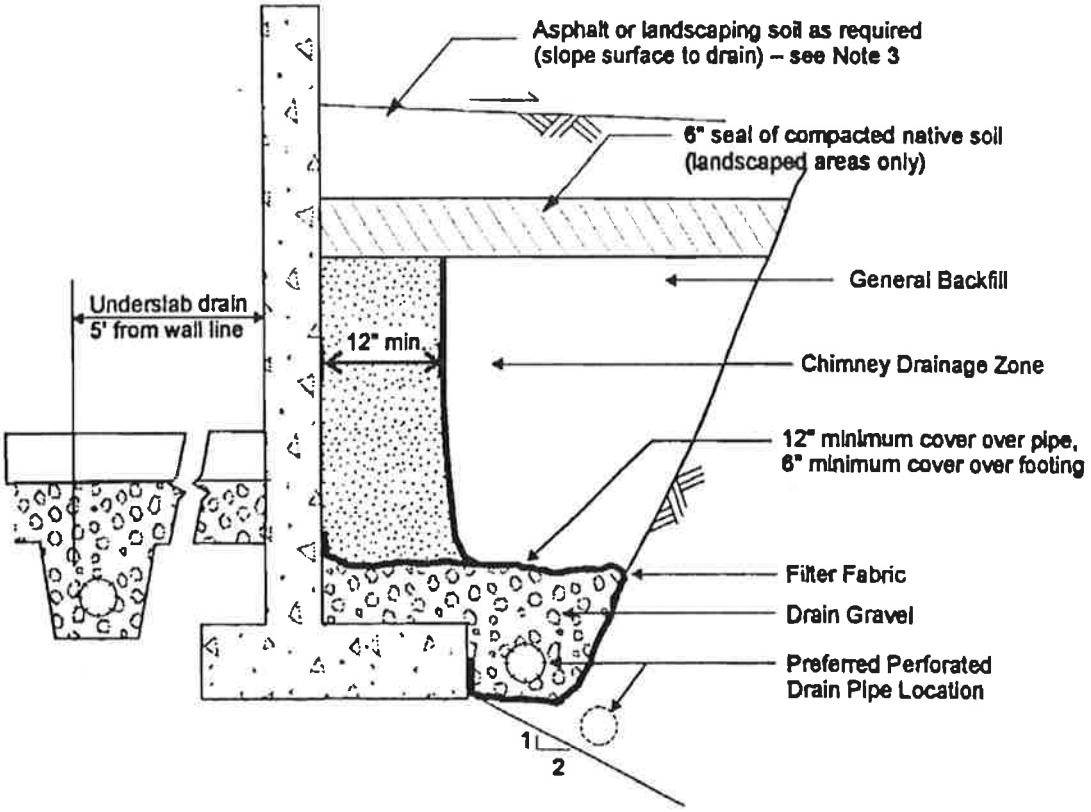
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER

SITE VICINITY MAP

Project No. 1390.001.G	**PACIFIC SEAFOODS DISTRIBUTION FACILITY**	Figure No. 1



SCHEMATIC - NOT TO SCALE

NOTES:

1. Filter Fabric to be non-woven geotextile (Amoco 4545, Mirafi 140N, or equivalent)
2. Lay perforated drain pipe on minimum 0.5% gradient, widening excavation as required. Maintain pipe above 2:1 slope, as shown.
3. All-granular backfill is recommended for support of slabs, pavements, etc. (see text for structural fill).
4. Drain gravel to be clean, washed ¾" to 1½" gravel.
5. General backfill to be on-site gravels, or ¾"-0 or 1½"-0 crushed rock compacted to 92% Modified Proctor (AASHTO T-180).
6. Chimney drainage zone to be 12" wide (minimum) zone of clean washed, medium to coarse sand or drain gravel if protected with filter fabric. Alternatively, prefabricated drainage structures (Miradrain 6000 or similar) may be used.

PERIMETER FOOTING/RETAINING WALL DRAIN DETAIL

Project No. 1390.001.G	PACIFIC SEAFOODS DISTRIBUTION FACILITY	Figure No. 3

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"	
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

GRAIN SIZES

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT †
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH ‡	BLOWS/FOOT †
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

REDMOND GEOTECHNICAL SERVICES
PO Box 20547 • Portland, Oregon 97294

KEY TO EXPLORATORY BORING LOGS
Unified Soil Classification System (ASTM D-2487)

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO.	DATE	Figure No.

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 580'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#1
	X			25.4	ML	Dark brown, wet, soft, organic, sandy, clayey SILT (Topsoil)
	X	27		22.7	SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravels and roots (Highly Weathered Glacial Drift)
5					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 5.0 feet No groundwater encountered at time of exploration
10						
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-5

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 580'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#2
					GM/ML	FILL: Gray-brown, very moist, medium dense, slightly organic, slightly clayey, silty and sandy GRAVEL with topsoil
5	X	26		24.9	SM	NATIVE GROUND: Orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravels and roots (Highly Weathered Glacial Drift)
	X	30		20.5		
10	X	37		19.4	SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 10.0 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-6

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 580'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#3
					ML/ SM	FILL: Dark brown, very moist highly organic, poorly compacted, clayey, sandy SILT to silty SAND
	X	3			ML	NATIVE GROUND: Dark brown, very moist to wet, soft, highly organic, sandy, clayey SILT (OLd Topsoil Zone)
5	X	24			SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weatheted Glacial Drift)
					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
10	X	32				Total Depth = 11.5 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-7

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 585'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#4
					ML	Dark brown, very moist to wet, soft, organic, sandy, clayey SILT (Topsoil)
					SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravels and roots (Highly Weathered Glacial Drift)
	X	24		23.7		
5	X	28		19.7	SM	Gray to gray-brown, very moisr, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
	X	33		18.8		
10						Total Depth = 10.0 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-8

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 588'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#5
5	X	4			SM	FILL: Medium to gray-brown, moist to very moist, poorly compacted, slightly clayey, silty SAND with gravel and traces of organics
	X	5				
					ML	NATIVE GROUND: Dark brown, very moist, soft, slightly organic, sandy, clayey SILT (Old Topsoil Zone)
10	X	29			SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravels and roots (Highly Weathered Glacial Drift)
					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
15						Total Depth = 10.0 feet No groundwater encountered at time of exploration
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-9

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 585'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#6
						FILL: Brown, moist, highly organic, Bark Chips and Topsoil
	X	6		26.8	ML	NATIVE GROUND: Dark brown, very moist to wet, soft, organic, sandy, clayey SILT (Topsoil)
5	X	27		23.0	SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
10	X	35		18.5	SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
15	X	39		18.1		
						Total Depth = 15.0 feet No groundwater encountered at time of exploration
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-10

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 585' ±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#7
					ML	Dark brown, very moist to wet, soft, organic, sandy, clayey SILT (Topsoil)
	X	27			SM	Medium to orangish-brown, very moist to wet, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5	X	26			SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
10	X	33				Total Depth = 11.5 feet Minor groundwater seepage encountered at 2.0 feet at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-11

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 582'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#8
					GM	FILL: Gray-brown, moist, moderately well compacted, silty, sandy GRAVEL (Base)
					ML	NATIVE GROUND: Dark brown, moist to very moist, medium stiff to stiff, clayey, sandy SILT with trace of organics (Old Topsoil Zone)
5	X	23				
	X	34			SM	Medium to orangish-brown, very moist, medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weatheted Glacial Drift)
	X	36			SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
10						Total Depth = 10.0 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-12

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 578'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#9
					PCC	Portland Cement Concrete Slab
	X	5		29.6	GM	FILL: Gray-brown, damp, moderately well compacted, silty, sandy GRAVEL (Base)
5	X	24		21.3	ML	NATIVE GROUND: Dark brown, very moist, medium stiff, sandy, clayey SILT with trace of organics (Old Topsoil Zone)
					SM	Medium to orangish-brown, very moist, medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
10	X	40		17.7	SM	Gray to gray-brown, very moist medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 11.5 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-13

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 581'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#10
					ML	Dark brown, very moist to wet, very soft, highly organic, sandy, clayey SILT (Topsoil)
	X	21			SM	Medium to orangish-brown, wet, loose to medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weatheted Glacial Drift)
5	X	28			SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
	X	35				
10						Total Depth = 10.0 feet No groundwater encountered at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-14

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 588'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#11
5	x	4			SM	FILL: Medium to gray-brown, moist to very moist, poorly compacted, slightly clayey, silty SAND with gravel and traces of organics
	X	5				
					ML	NATIVE GROUND: Dark brown, very moist, soft, slightly organic, sandy, clayey SILT (Old Topsoil Zone)
10	X	23			SM	Medium to orangish-brown, very moist, loose to medium dense, clayey, silty SAND with occasional gravel and roots (Highly Weatheted Glacial Drift)
					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
15	X	36				Total Depth = 15.0 feet No groundwater encountered at time of exploration
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-15

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 582'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#12
					ML	Dark brown, wet to saturated, very soft highly organic, sandy, clayey SILT (Topsoil)
	X	22			SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5	X	33			SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
10						Total Depth = 6.5 feet Groundwater seepage encountered at a depth of 2 feet at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-16

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 578'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#13
					ML	Dark brown, wet to saturated, very soft, highly organic, sandy, clayey SILT (Topsoil)
	X	27			SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 5.0 feet Groundwater seepage encountered at a depth of 1.0 feet at time of exploration
10						
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-17

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 574'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#14
					ML	Dark brown, wet to saturated, very soft, highly organic, sandy, clayey SILT (Topsoil)
	X	24			SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 5.0 feet Groundwater seepage encountered at a depth of 1.0 feet at time of drilling
10						
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-18

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 569'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#15
					ML	Dark brown, saturated, very soft, highly organic, sandy, clayey SILT (Topsoil)
	X	26			SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 5.0 feet Groundwater encountered above surface grades at time of exploration
10						
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-19

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 574'

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#16
						FILL: Bark Chjps
	X	24			ML	NATIVE GROUND: Dark brown, saturated, very soft, highly organic, sandy, clayey SILT (OLd Topsoil Zone)
5					SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
10						Total Depth = 5.0 feet Groundwater encountered at the ground surface at time of exploration
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-20

REDMOND GEOTECHNICAL SERVICES

DRILLING COMPANY: Gregory Drilling RIG: CME 55 DATE: 4/10/15

BORING DIAMETER: 6.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION: 580'±

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#17
					ML	Dark brown, wet to saturated, very soft, highly organic, sandy, clayey SILT (Topsoil)
	X	28			SM	Medium to orangish-brown, wet to saturated, loose, clayey, silty SAND with occasional gravel and roots (Highly Weathered Glacial Drift)
5					SM	Gray to gray-brown, very moist, medium dense to dense, clayey, silty SAND with gravel and cobbles (Glacial Till)
						Total Depth = 5.0 feet Groundwater encountered at the ground surface at time of exploration
10						
15						
20						
25						
30						

BORING LOG

PROJECT NO. 1390.001.G | PACIFIC SEAFOODS | FIGURE NO. A-21

REDMOND GEOTECHNICAL SERVICES

MAXIMUM DENSITY TEST RESULTS

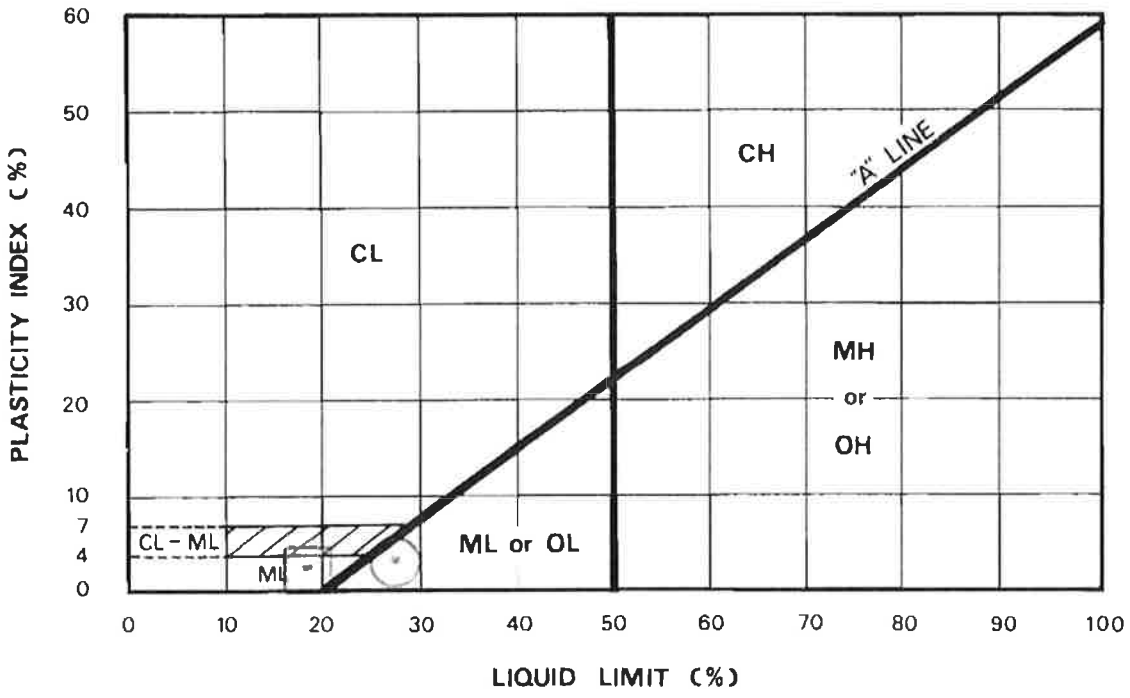
SAMPLE LOCATION	SOIL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-#1 @ 1.0'	Medium to orangish-brown, clayey, silty SAND with gravel	108.0	14.5
B-#1 @ 3.5'	Gray to gray-brown, clayey, silty SAND with gravel and cobbles	112.0	13.0

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (pcf)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSIVE CLASS.

MAXIMUM DENSITY & EXPANSION INDEX TEST RESULTS

PROJECT NO.: 1390.001.G	PACIFIC SEAFOODS	FIGURE NO.: A-22



KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	NATURAL WATER CONTENT %	LIQUID LIMIT %	PLASTICITY INDEX %	PASSING NO. 200 SIEVE %	LIQUIDITY INDEX	UNIFIED SOIL CLASSIFICATION SYMBOL
○	B-#1	1.0	25.4	28.2	3.9	32.2		ML
□	B-#1	3.5	22.7	19.1	3.1	27.1		ML

REDMOND GEOTECHNICAL SERVICES
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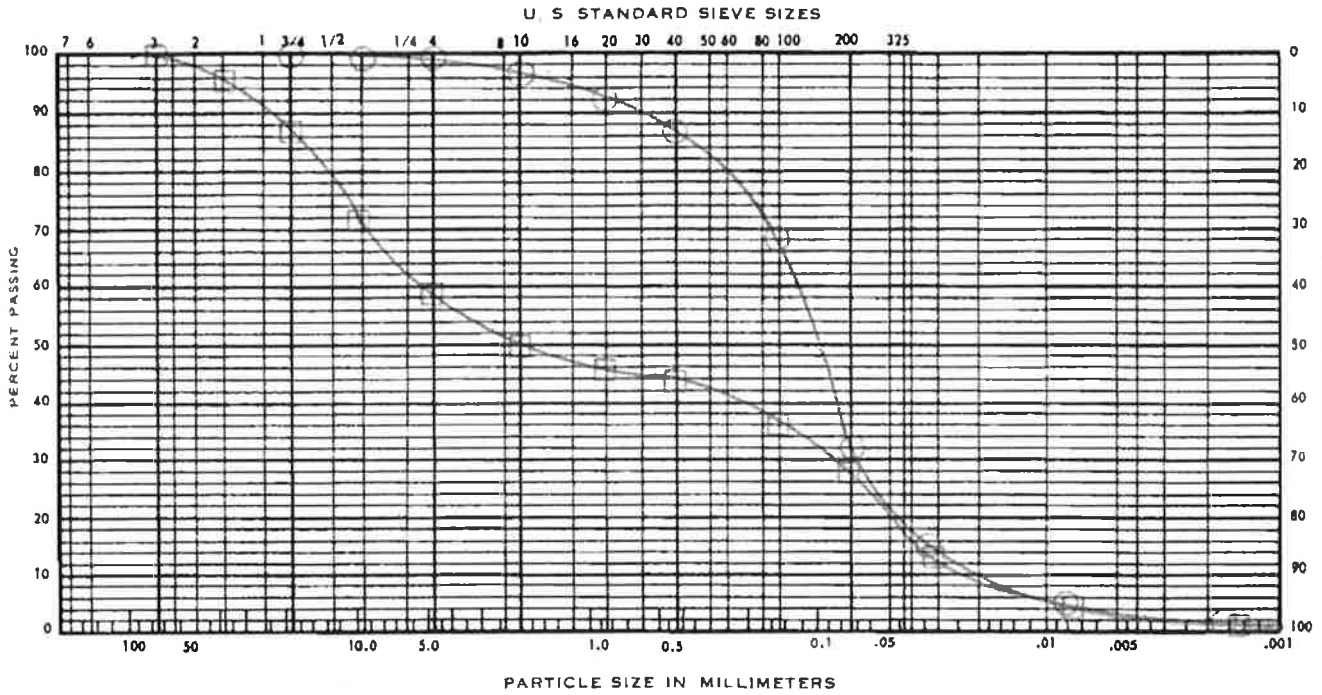
PLASTICITY CHART AND DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO.	DATE	Figure
1390.001.G		A-23

UNIFIED SOIL CLASSIFICATION SYSTEM

(ASTM D 422-72)



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	ELEV. (feet)	UNIFIED SOIL CLASSIFICATION SYMBOL	SAMPLE DESCRIPTION
	B-#1	1.0		SM	Medium to orangish-brown, clayey, silty SAND with occasional gravel
	B-#1	3.5		SM	Gray to gray-brown, clayey, silty SAND with gravel and cobbles

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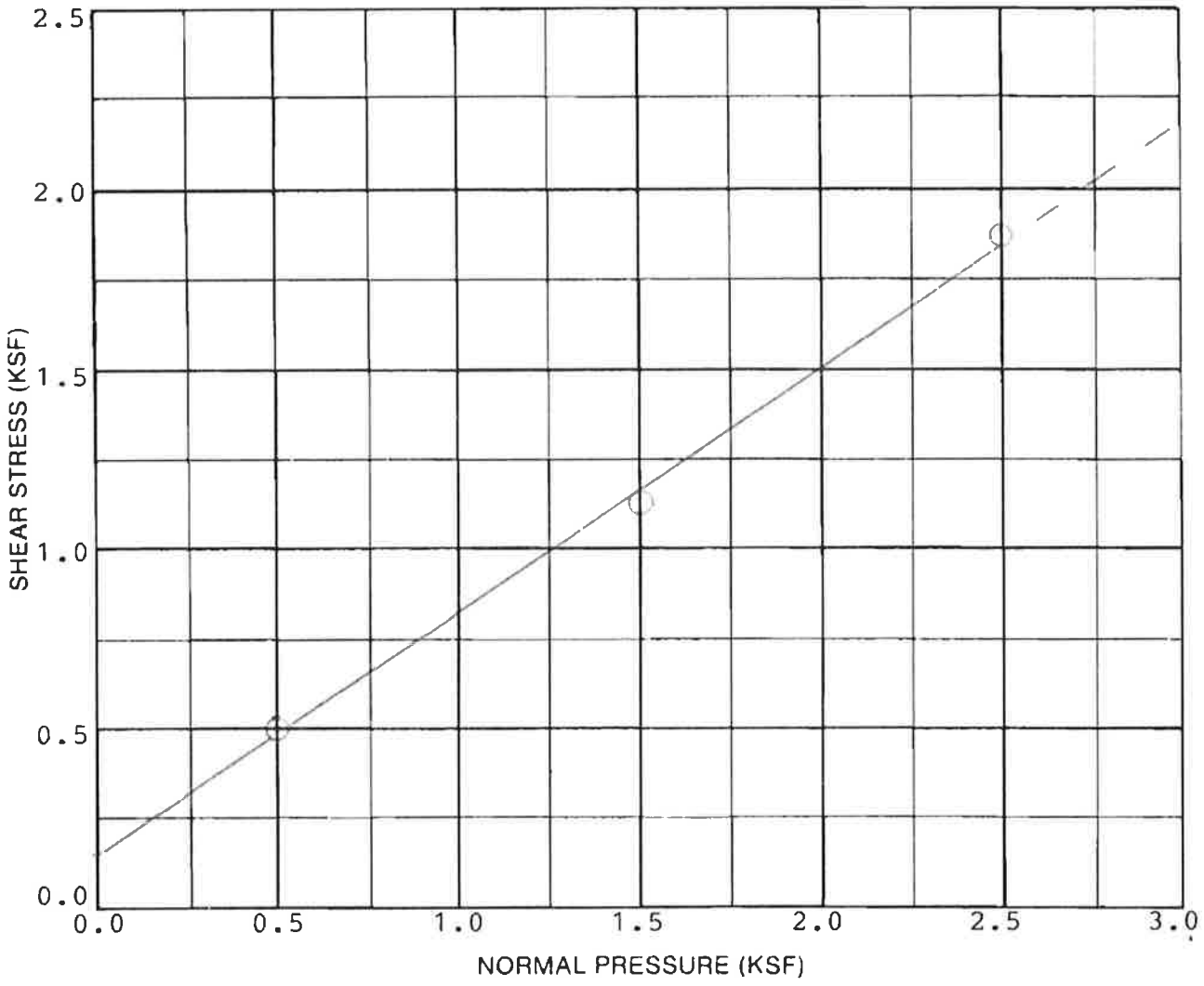
GRADATION TEST DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO.	DATE	FIGURE
1390.001.G		A-24



SAMPLE DATA	
DESCRIPTION: Medium to orangish-brown clayey, silty SAND (Remolded)	
BORING NO.: B-#1	
DEPTH (ft.): 1.0	ELEVATION (ft.):
TEST RESULTS	
APPARENT COHESION (C): 150 psf	
APPARENT ANGLE OF INTERNAL FRICTION (Φ): 32°	

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	0.5	1.5	2.5	
SHEAR STRENGTH (KSF)	0.5	1.1	1.9	
INITIAL H_2O CONTENT (%)	14.5	14.5	14.5	
FINAL H_2O CONTENT (%)	14.2	12.1	8.8	
INITIAL DRY DENSITY (PCF)	98.0	98.0	98.0	
FINAL DRY DENSITY (PCF)	99.6	103.3	105.7	
STRAIN RATE: 0.02 inches per minute				

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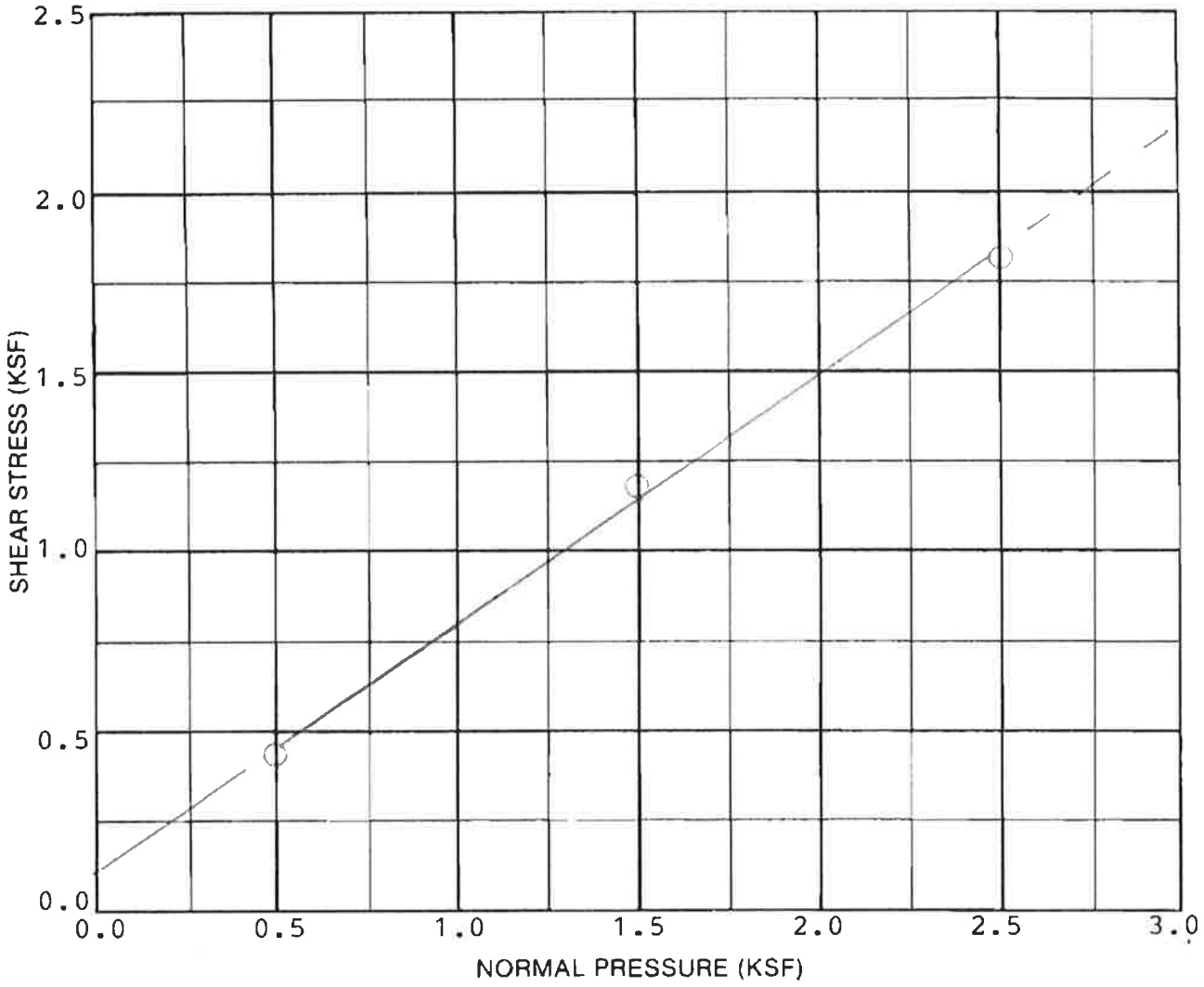
DIRECT SHEAR TEST DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO	DATE

Figure A-25



SAMPLE DATA	
DESCRIPTION: Gray to gray-brown, clayey, silty SAND (Remolded)	
BORING NO. B-#1	
DEPTH (ft.): 3.5	ELEVATION (ft):
TEST RESULTS	
APPARENT COHESION (C): 100 psf	
APPARENT ANGLE OF INTERNAL FRICTION (Φ): 34°	

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	0.5	1.5	2.5	
SHEAR STRENGTH (KSF)	0.45	1.20	1.80	
INITIAL H_2O CONTENT (%)	13.0	13.0	13.0	
FINAL H_2O CONTENT (%)	12.6	10.1	8.5	
INITIAL DRY DENSITY (PCF)	99.0	99.0	99.0	
FINAL DRY DENSITY (PCF)	99.8	103.6	106.7	
STRAIN RATE	0.02 inches per minute			

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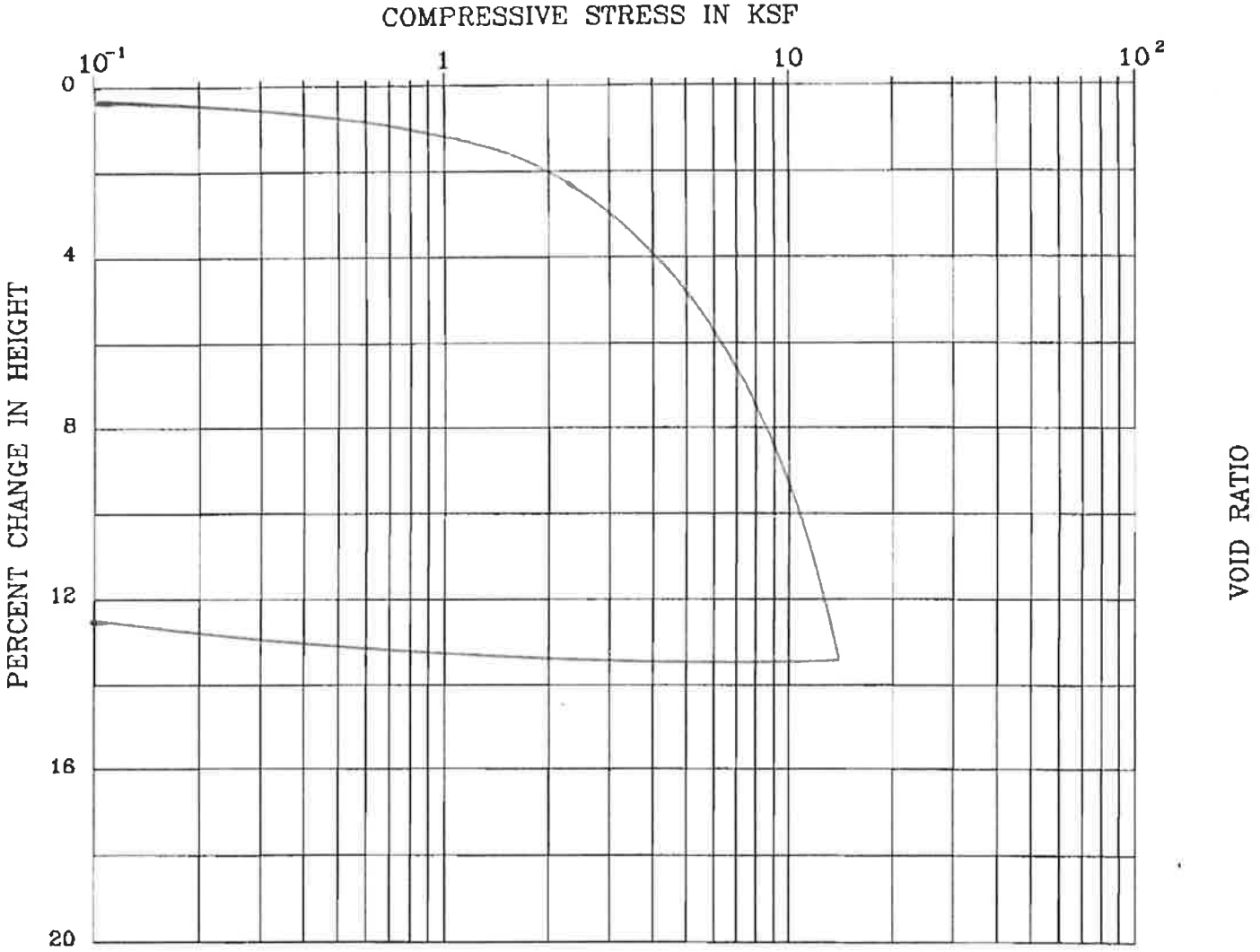
DIRECT SHEAR TEST DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO.	DATE	Figure A-26



BORING : B-#6
DEPTH (ft) : 3.0
SPEC. GRAVITY : 2.5 (assumed)

DESCRIPTION : clayey, silty SAND (SM)
LIQUID LIMIT : 28.2
PLASTIC LIMIT : 24.3

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	26.4	86.7	88.7	
FINAL	16.6	99.3	92.9	

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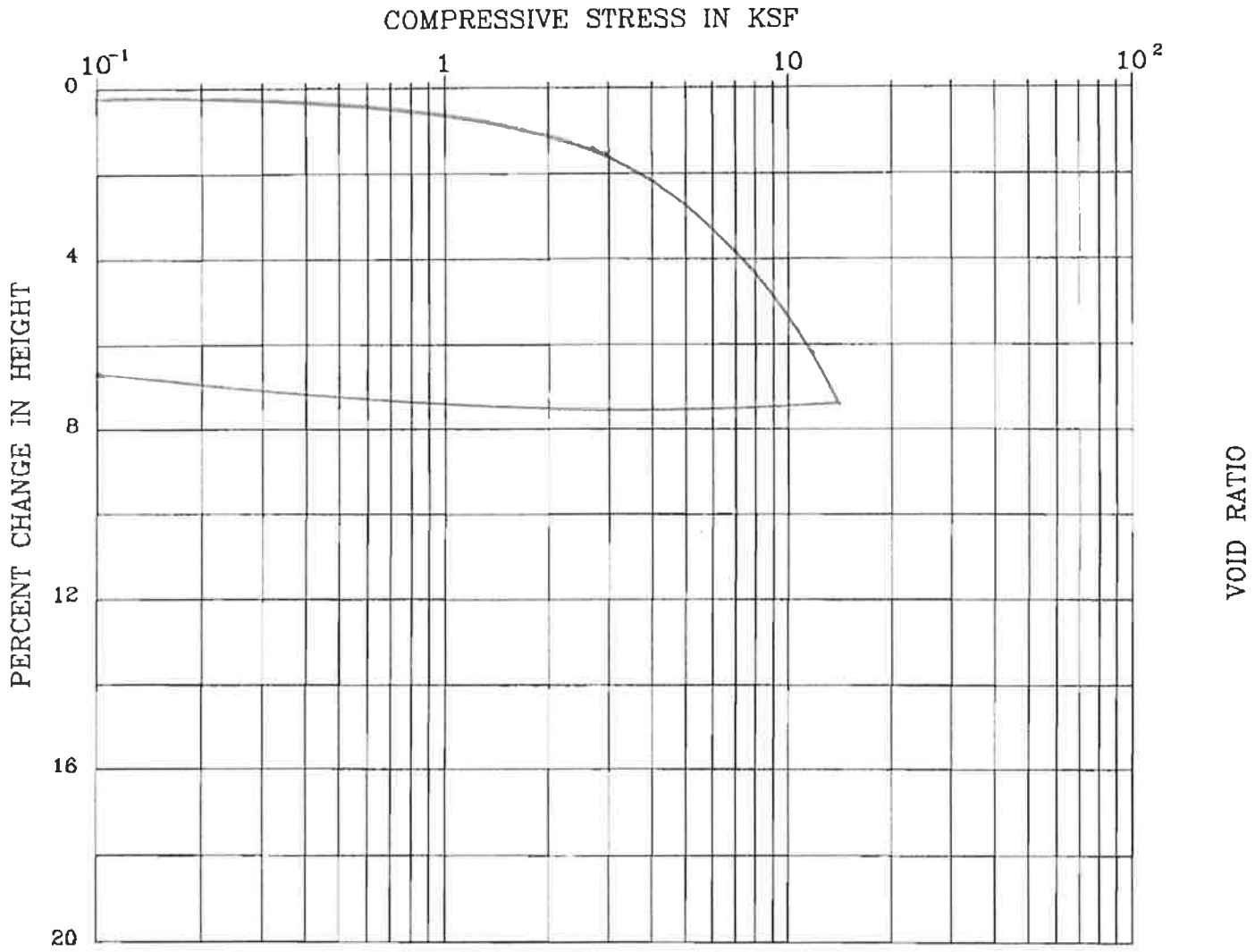
CONSOLIDATION TEST DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO.	DATE	Figure A-27
1390.001.C		



BORING : B-$3 (Remolded) DESCRIPTION : clayey, silty SAND (SM)
DEPTH (ft) : 3.0 LIQUID LIMIT : 28.2
SPEC. GRAVITY : 2.5 (assumed) PLASTIC LIMIT : 24.3

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	15.0	97.5	91.0	
FINAL	10.2	104.4	94.7	

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CONSOLIDATION TEST DATA

PACIFIC SEAFOODS DISTRIBUTION FACILITY
Mukilteo, Washington

PROJECT NO	DATE

Figure A-28

RESULTS OF R (RESISTANCE) VALUE TESTS

SAMPLE LOCATION: B-#1

SAMPLE DEPTH: 1.0 feet bgs

Specimen	A	B	C
Exudation Pressure (psi)	219	329	431
Expansion Dial (o.oool")	0	1	2
Expansion Pressure (psf)	0	3	8
Moisture Content (%)	17.3	14.1	10.7
Dry Density (pcf)	94.4	99.1	103.7
Resistance Value, "R"	22	34	45
"R"-Value at 300 psi Exudation Pressure = 33			

SAMPLE LOCATION: B-#16

SAMPLE DEPTH: 3.5 feet bgs

Specimen	A	B	C
Exudation Pressure (psi)	209	326	433
Expansion Dial (0.0001")	0	1	2
Expansion Pressure (psf)	0	3	8
Moisture Content (%)	17.6	14.5	11.1
Dry Density (pcf)	93.9	98.8	102.6
Resistance Value "R"	20	32	43
"R"-Value at 300 psi Exudation Pressure = 31			

APPENDIX C

STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

FOR

ROUGH GRADING
CONSTRUCTION ACTIVITIES

AT

PACIFIC SEAFOOD - MUKILTEO
44TH AVE. WEST AND 80TH STREET
MUKILTEO, WA 98275

PREPARED BY:

PACLAND

11400 SE 8th St
Suite 345
Bellevue, WA 98004

T (425) 453-9501
F (425) 453-8208
www.PacLand.com

SWPPP PREPARATION DATE
9/2/2015

CONTACT LIST

Pacific Seafood – Mukilteo **Project Engineer: Tom Dargan, P.E.** **Phone: 425.453.9501 x1519**

The Project Superintendent is responsible for overseeing activities and work at a site; has the authority to direct employees and contractors to undertake actions to comply with a Permit, the Clean Water Act, and the site's SWPPP.

Project Superintendent:

Name: _____

Company: _____

Phone (office): _____

Phone (mobile): _____

Project Superintendent:

Name: _____

Company: _____

Phone (office): _____

Phone (mobile): _____

The Certified Erosion and Sediment Control Lead (CESCL) is responsible for actions to comply with the General Permit, the Clean Water Act, EPA Requirements, and the site's SWPPP. ***The CESCL must include his or her certification in this document, Appendix E.***

Project CESCL:

Name: _____

Company: _____

Phone (office): _____

Phone (mobile): _____

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APPENDIX G SPILL REPORT FORM

APPENDIX H NOTICE OF TERMINATION (NOT)

APPENDIX I RECORD OF STABILIZATION AND CONSTRUCTION ACTIVITY DATES

APPENDIX J LOG OF FEDERAL, STATE, OR LOCAL STORM WATER OR OTHER ENVIRONMENTAL INSPECTIONS

APPENDIX K BMP INFORMATION PER 2004 STORMWATER MANAGEMENT MANUAL FOR EASTERN WASHINGTON

APPENDIX L GENERAL PERMIT

Section 1: Introduction

1.1 Introduction

This SWPPP has been prepared for major activities associated with the construction of:

Pacific Seafood Mukilteo – Mukilteo, WA

This SWPPP, including the applicable General Permit, includes the elements necessary to comply with the national General Permit for construction activities administered by the U.S. Environmental Protection Agency (EPA) under the National Pollutant Discharge Elimination System (NPDES) program and all local governing agency requirements. This SWPPP must be implemented before the start of construction.

The Storm Water Pollution Prevention Plan (SWPPP) includes all appendices, the Temporary Erosion and Sedimentation Control Plans included in the Construction Drawings, the Notice of Intent, Notice of Change, Washington State DOE General Permit, Notice of Termination, all records of inspections and activities which are created during the course of the project, and other documents as may be included by reference to this SWPPP. Changes, modifications, revisions, additions or deletions shall become part of this SWPPP as they occur.

The General Contractor and all subcontractors involved with a construction activity that disturbs site soil or who implement a pollutant control measure identified in the Storm Water Pollution Prevention Plan must comply with the following requirements of the National Pollutant Discharge Elimination Systems (NPDES) General Permit ("General Permit") and any local governing agency having jurisdiction concerning erosion and sedimentation control:

A. A Notice of Intent was previously submitted to the Washington State Department of Ecology and an NPDES was issued for this project. Prior to construction beginning, the Contractor will be required to file a Transfer of Coverage. Forms can be found in Appendix C. Notification must be given to:

Washington State Department of Ecology
Attn: Water Quality Program, Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

City of Mukilteo
11930 Cyrus Way
Mukilteo, WA 98275

The Notice of Intent and Notice of Change forms are located in Appendix C. A copy of the existing General Permit is in Appendix L.

B. A copy of the Notice of Intent (NOI), the permit authorization number(s), a description of the project, and the General Contractor's local contact name and number (CESCL) must be posted in a prominent place for public viewing at the construction site until termination of permit coverage has been obtained by a Notice of Termination.

C. A Construction Site Notice (Appendix D) must be completed and posted at the job site entrance with the contractor name, address and phone number. It shall also contain the name, location or a physical description of the location, square footage of the building(s), and amount of acres disturbed by construction.

D. The General Contractor must provide names and addresses of all subcontractors working on this project who will be involved with the major construction activities that disturb site soil ("Sub-Contractor List"). That information must be kept with this SWPPP.

E. The General Contractor and all subcontractors involved with the major construction activities that disturb site soil must certify compliance. That information must be kept with this SWPPP.

F. This SWPPP must be updated each time there are significant modifications to the pollutant prevention system or a change of contractors working on the project who disturb site soil.

G. Discharge of oil or other hazardous substances into storm water or the storm water (storm sewer) system is subject to reporting and cleanup requirements. Refer to the General Permit for additional information.

H. Once the site reaches final stabilization, all permanent erosion and sedimentation controls installed and all temporary erosion and sedimentation controls removed, the General Contractor and Owner must complete a final site inspection. Upon approval by Owner, the Owner and General Contractor, as applicable, must complete and submit a Notice of Termination (NOT).

I. This SWPPP intends to control water-borne and liquid pollutant discharges by some combination of interception, sedimentation, filtration, and containment. The General Contractor and subcontractors implementing this SWPPP must remain alert to the need to periodically refine and update the SWPPP in order to accomplish the intended goals. The General Contractor is ultimately responsible for all site conditions and permit compliance.

J. This SWPPP must be amended as necessary during the course of construction in order to keep it current with the pollutant control measures utilized at the site. Amending the SWPPP does not mean that it has to be reprinted. It is acceptable to add addenda, sketches, new sections, and/or revised drawings. The Temporary Erosion Control Plans showing the

locations of all storm water controls must be posted on the site and updated to reflect the progress of construction.

K. A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated must be maintained until the NOT is filed. Controls must be in place down slope of site disturbing activities prior to the commencement of construction and noted on the Site Map and Record of Stabilization and Construction Activity Dates.

L. A log of all inspections by federal, state, or local storm water or other environmental agencies shall be kept in the General Contractor's SWPPP. The log form can be found in Appendix J and should include the date and time of visit and whether a report was issued or will be issued as a result of the inspection.

1.2 Additional Contacts

Owner:

Name: Bill Marczewski, P.E.
Company: Pacific Seafood
Address: 16797 SE 130th Avenue, Clackamas, OR 97015
Number: (971) 284-5402

Washington State Department of Ecology Emergency Contact:

Kevin Fitzpatrick
(425) 649-7033

Resident Engineer:

Name:
Number:

Emergency Owner Contact (if different than Owner):

Name:
Number:

Section 2: Project Description

2.1 Site Information

A. Site Location - The subject property is located on the southeast corner of 44th Ave West and 80th Street SW (latitude 47° 55' 30.45"N - longitude 122° 17' 33.99" W).

B. Rainfall Information – According to the Western Regional Climate Center Station, precipitation information since 1894 to 2015 normal for this region (Everett Jr College - 452675) has mean monthly rainfall averages as follows:

January	4.54 inches
February	3.25 inches
March	3.57 inches
April	2.70 inches
May	2.34 inches
June	2.12 inches
July	1.04 inches
August	1.20 inches
September	1.98 inches
October	3.39 inches
November	4.65 inches
December	4.96 inches
TOTAL	35.71 inches

C. Quality of Receiving Surface Waters and Wetlands –There are no existing wetlands onsite or immediately downstream of the site. A downstream analysis has been performed to confirm the system's capacity to receive the flows from the site.

D. Threatened and Endangered Species – No known threatened or endangered species at this site.

E. Historic Properties – No known historic properties exist on-site.

2.2 Existing Conditions

A. Site Soils and Land Cover – Site is presently undeveloped. The existing land coverage is mostly pervious and made up of deciduous trees and moderate ground cover. According to the soils report by Redmond Geotechnical Services LLC dated May 2, 2015, the soil conditions consist of a top layer of organic/top soil and gray to gray-brown, dense, clayey, silty sand with gravel and cobbles between 2 and 4 feet below existing grade.

B. Existing Drainage Pattern – Stormwater runoff currently drains from the west and generally collects in a low spot in the northeast. Ultimately the site drainage outlets to an existing catch basin, located offsite to the northeast.

C. Critical Areas – There are no critical areas on the site such as high erosion risk areas, wetlands, streams, or steep slopes (potential landslide area).

D. Existing Topography – The site slopes generally from west to east and southwest to northeast at approximately 2% to 5%. Onsite elevations range from approximately 586' in the southwest corner to approximately 570' at the northeast corner.

2.3 Proposed Construction Activities

A. Proposed Development - The first phase of the project proposes to fill and rough grade the 5-acre site to allow for early earthwork in preparation of the building construction. The second phase of the proposed development will consist of the construction of the building, landscaping, drive aisles, parking, and sidewalks.

   Construction activities include site preparation, TESC installation, excavation, rough grading, and construction of onsite drainage facilities.

B. Proposed Drainage Patterns – The site will generally be graded to slope to the east and northeast, mimicking the existing drainage patterns. The outlet point of compliance will be maintained at the northeast corner of the site.

C. Total Area and Disturbed Area – The entire 5.0-acre site will be disturbed. Including frontage improvements, the total disturbed area will total approximately 5.2 acres.

D. Final Stabilization Measures – The first phase proposes a rough-graded site that is fully stabilized with seeding, mulch, and gravel. The second phase will be stabilized by paving and landscaping.

E. Temporary Erosion and Sedimentation Control Plans – Refer to the construction drawings for the Temporary Erosion and Sedimentation Control Plan and Details.

All slow calculations are provided in Appendix B.

2.3.1 Construction Schedule

Described below are the major construction activities that are the subject of this SWPPP. All activities and the timeframe (beginning and ending dates) shall be noted on the Temporary Erosion and Sedimentation Control Plans and Record of Stabilization and Construction Activity Dates:

1. Hold a pre-construction meeting with the City of Mukilteo.
2. Establish limits of clearing and grading for on-site construction and off-site pond construction.
3. Install stabilized construction entrances.
4. Construct silt and orange construction fencing on-site.
5. Install inlet protection on existing catch basin structures.
6. Clear and grub the site.
7. Construct temporary sediment ponds and outlet conveyance systems.
8. Construct detention vault and inlet and outlet conveyance systems.
9. Start construction of building pad and structures.
10. Begin grading the site.
11. Install utilities, underdrains, storm drainage system, curbs and gutters.
12. Install inlet protection on all storm drainage structures.
13. Prepare site for paving.
14. Pave site.
15. Complete grading and install permanent seeding and planting.
16. Thoroughly clean existing and new storm system upon completion of paving.
17. Hydroseed disturbed ground areas.
18. Remove temporary erosion control measures upon stabilization of entire project site, as approved by governing jurisdiction engineer.

The actual schedule for implementing pollutant control measures will be determined by project construction progress. Down slope protective measures must always be in place before soil is disturbed.

Section 3: Twelve Elements of a SWPPP

3.1 Twelve Elements of a SWPPP

Details and specifications for the BMPs discussed in this section can be found in the project Construction Documents and Appendix K of the SWPPP.

3.1.1 Element #1 – Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. All offsite sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible.

- Preserving Natural Vegetation (BMP C101)
- Buffer Zones (BMP C102)
- High Visibility Plastic or Metal Fence (BMP C103)

3.1.2 Element #2 – Establish Construction Access

All access points from the public street into the construction site shall include a construction exit composed of coarse stone to the dimensions shown on the Construction Drawings. The rough texture of the stone helps to remove clumps of soil adhering to construction vehicle tires through the action of vibration and jarring over the rough surface and the friction of the stone matrix against soils attached to vehicle tires.

The specific BMPs related to establishing construction access that will be used on this project include:

- Stabilized Construction Entrance (BMP C105)
- Wheel Wash (BMP C106)
- Construction Road/Parking Area Stabilization (BMP C107)

Construction access will be provided from 44th Ave W. The construction entrances, haul road and staging area should be installed early in the TESC process to avoid tracking sediment off site. Construction vehicles should remain on the haul road and staging area to the extent possible during construction to minimize sediment transportation.

3.1.3 Element #3 – Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. The specific BMPs for flow control that shall be used on this project include:

- Temporary Sediment Pond (BMP C241)
- Detention Pond or Vault

3.1.4 Element #4 – Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility. The specific BMPs to be used for controlling sediment on this project include:

- Silt Fence (BMP C233)
- Sediment Pond (BMP C241)
- Storm Drain Inlet Protection (BMP C220)
- Detention Pond Or Vault

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize wash-off of sediments from adjacent streets in runoff.

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or bio-filtration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be re-stabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

3.1.5 Element #5 – Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)

Temporary Seeding - Areas may be stabilized temporarily with the use of fast-germinating annual seed, straw mulch, wood cellulose fibers, tackifiers, netting, plastic covering, or blankets. Areas of disturbance shall be temporarily stabilized within 2 days after construction activity ceases between October 1st and May 30th and 7 days between April 1st and September 30th.

Permanent Seeding - All areas at final grade must be seeded within 14 days after completion of the major construction activity. Except for small level spots, seeded areas should generally be protected with mulch.

- Mulching (BMP C121)
- Nets and Blankets (BMP C122)
- Plastic Covering (BMP C123)

- Sodding (BMP C124)
- Topsoiling (BMP C125)
- Polyacrylamide for Soil Erosion Protection (C126)
- Surface Roughening (BMP C130)
- Dust Control (BMP C140)

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

3.1.6 Element #6 – Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

- Temporary and Permanent Seeding (BMP C120)
- Surface Roughening (BMP C130))
- Interceptor Dike and Swale (BMP C200)
- Grass-Lined Channels (BMP C201)
- Channel Lining (BMP C202)
- Check Dams (BMP C207)
- Triangular Silt Dike (Geotextile-Encased Check Dam; BMP C208)

3.1.7 Element #7 – Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.

Catch Basin Inlet Protection

- Gravel and Wire Drop Inlet Protection
- Catch Basin Filters

Catch basin filters will be utilized to keep sediment laden water from entering the public drainage system. Curb and grated inlets are protected from the intrusion of silt and sediment through a variety of measures as shown on the Construction Drawings. The primary mechanism is to place controls in the path of flow sufficient to slow sediment-laden water to allow settlement of suspended soils before discharging into the storm sewer. Controls typically provide a secondary benefit by means of filtration. Grated inlets typically include a sturdy frame wrapped in silt fence or crushed stone-lined perimeter to slow the flow of water. Curb inlets typically include crushed stone barriers held in place with silt fence material or geotextile fabric. Where inlets are located in paved areas the contractor shall install filter fabric in the catch basin.

3.1.8 Element #8 – Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. The specific BMPs for channel and outlet stabilization that shall be used on this project include:

- Grass-Lined Channels (BMP C201)
- Channel Lining (BMP C202)
- Check Dams (BMP C207)
- Triangular Silt Dike (Geotextile-Encased Check Dam - BMP C208)

The drainage system connects to a closed public system; therefore no outlet stabilization will be required.

3.1.9 Element #9 – Control Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

Sanitary wastewater:

- Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.
- Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system or to the sanitary sewer as part of Wheel Wash implementation (BMP C106).

Solid Waste:

- Solid waste will be stored in secure, clearly marked containers.

Hazardous Waste Management and Spill Reporting Plan – Any hazardous or potentially hazardous waste that is brought onto the construction site will be handled properly in order to reduce the potential for stormwater pollution. All materials used on this construction site will be properly stored, handled and dispensed following any applicable label directions. Material Safety Data Sheets (MSDS) information will be kept on site for any and all applicable materials.

Should an accidental spill occur, immediate action will be undertaken by the General Contractor to contain and remove the spilled material. All hazardous materials will be disposed of by the Contractor in the manner specified by local, state, and federal regulations and by the manufacturer of such products. As soon as possible, the spill will be reported to the appropriate state and local agencies. As required under the provisions of the Clean Water Act, any spill or discharge entering the waters of the United States will be properly reported. A spill report form is located in Appendix G.

Any spills of petroleum products or hazardous materials in excess of Reportable Quantities as defined by EPA or the state or local agency regulations, shall be immediately reported to the EPA National Response Center (1-800-424-8802) and **the Washington State Department of Ecology at (360) 407-6300 or 1-800-258-5990**. The reportable quantity for petroleum products is per the State of Washington is any amount that contacts public waterways or public storm systems OR **equal to or greater than 1 gallon** on a commercial project that does not contact public water systems such as creeks, rivers, lakes, or storm systems and **must be reported within 24 hours**.

The EPA guidelines define spills within the public water systems as those that: violate applicable water quality standards; cause a film or "sheen" upon, or discoloration of the surface of the water or adjoining shorelines; or cause a sludge or emulsion to be deposited beneath the

surface of the water or upon adjoining shorelines. The reportable quantity for hazardous materials is per the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and is any hazardous substance with reportable quantity that appears in Table 302.4of 40 CFR parts 302, for other substance not found on this list, the reportable quantity is one pound.

In order to minimize the potential for a spill of hazardous materials to come in contact with storm water, the following steps will be implemented:

- All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete, curing compounds and additives, etc.) will be stored in a secure location, under cover, when not in use.
- The minimum practical quantity of all such materials will be kept on the job site and scheduled for delivery as close to time of use as practical.
- A spill control and containment kit (containing for example, absorbent such as kitty litter or sawdust, acid neutralizing agent, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the storage site.
- All of the product in a container will be used before the container is disposed of. All such containers will be triple rinsed, with water prior to disposal. The rinse water used in these containers will be disposed of in a manner in compliance with state and federal regulations and will not be allowed to mix with stormwater discharges.
- All products will be stored in and used from the original container with the original product label.
- All products will be used in strict compliance with instructions on the product label.
- The disposal of excess or used products will be in strict compliance with instructions on the product label.

Chemical treatments have not been approved for this site. The Civil Engineer of record must be contacted if these are requested to be utilized and the NPDES permit revised by the DOE. The request for chemical treatment form can be found at:

http://www.ecy.wa.gov/biblio/ecy070258.html

3.1.10 Element #10 – Control Dewatering

All dewatering water from open cut excavation, tunneling, foundation work, trench, or underground vaults shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Channels will be stabilized, per Element #8. Clean, non-turbid dewatering water will not be routed through stormwater sediment ponds, and will be discharged to systems tributary to the receiving waters of the State in a manner that does not cause erosion, flooding, or a violation of State water quality standards in the receiving water. Highly turbid dewatering water from soils known or suspected to be contaminated, or from use of construction equipment, will require additional monitoring and treatment as required for the

specific pollutants based on the receiving waters into which the discharge is occurring. Such monitoring is the responsibility of the contractor.

However, the dewatering of soils known to be free of contamination will trigger BMPs to trap sediment and reduce turbidity. At a minimum, geotextile fabric socks/bags/cells will be used to filter this material. Other BMPs to be used for sediment trapping and turbidity reduction include the following:

- Concrete Handling (BMP C151)
- Temporary Sediment Pond (BMP C241)
- Construction Stormwater Chemical Treatment (BMP C250)
- Construction Stormwater Filtration (BMP C 251)
- Use of a sedimentation bag, with outfall to a ditch or swale for small volumes of localized dewatering.

If groundwater is found in an excavation or other area, it will be controlled, treated, and discharged.

3.1.11 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. Maintenance and repair shall be conducted in accordance with each particular BMPs specifications (attached). Visual monitoring of the BMPs will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive, and is temporarily stabilized, the inspection frequency will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

3.1.12 Element #12 – Manage the Project

Erosion and sediment control BMPs for this project have been designed based on the following principles:

- Design the project to fit the existing topography, soils, and drainage patterns.
- Emphasize erosion control rather than sediment control.
- Minimize the extent and duration of the area exposed.
- Keep runoff velocities low.
- Retain sediment on site.

- Thoroughly monitor site and maintain all ESC measures.
- Schedule major earthwork during the dry season.

In addition, project management will incorporate the key components listed below:

As this project site is located west of the Cascade Mountain Crest, the project will be managed according to the following key project components:

Phasing of Construction

- The construction project is being phased to the extent practicable in order to prevent soil erosion, and, to the maximum extent possible, the transport of sediment from the site during construction.
- Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities during each phase of construction, per the Scheduling BMP (C 162).

Seasonal Work Limitations

- From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:
  - Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and
  - Limitations on activities and the extent of disturbed areas; and
  - Proposed erosion and sediment control measures.
- Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance.
- The following activities are exempt from the seasonal clearing and grading limitations:
  - Routine maintenance and necessary repair of erosion and sediment control 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; and
  - Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

Coordination with Utilities and Other Jurisdictions

- Care has been taken to coordinate with utilities, other construction projects, and the local jurisdiction in preparing this SWPPP and scheduling the construction work.

Inspection and Monitoring

- All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. This person has the necessary skills to:
  - Assess the site conditions and construction activities that could impact the quality of stormwater, and
  - Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
- A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.
- Whenever inspection and/or monitoring reveals that the BMPs identified in this SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP

- This SWPPP shall be retained on-site or within reasonable access to the site.
- The SWPPP shall be modified 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 SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

3.2 Controlling Other Pollutants

Control of sediments has been described previously. Other aspects of this SWPPP are listed below:

1. Solid Waste Disposal - No solid materials, including building materials, are allowed to be discharged from the site with storm water. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The containers will be emptied as necessary by a contract trash disposal service and hauled away from the site. The location of solid waste receptacles shall be shown on the Temporary Erosion and Sedimentation Control Plans.

   Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and

servicing operations. If a spill occurs, it must be contained and disposed so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. In this regard, potentially polluting substances should be handled in a manner consistent with the impact they represent.

2. Sanitary Facilities - All personnel involved with construction activities must comply with state and local sanitary or septic system regulations. Temporary sanitary facilities will be provided at the site throughout the construction phase. They must be utilized by all construction personnel and will be serviced by a commercial operator. The location of sanitary facilities shall be shown on the Temporary Erosion and Sedimentation Control Plans.

Section 4: Site Inspections and Monitoring

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

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book. This SWPPP may function as the site log book if desired, or the forms may be separated and included in a separate site log book. However, if separated, the site log book but must be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

4.1 Site Inspection

All BMPs will be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The inspector will be a Certified Erosion and Sediment Control Lead (CESCL) per BMP C160. The name and contact information for the CESCL is provided on the first page of this SWPPP.

Site inspection will occur in all areas disturbed by construction activities and at all stormwater discharge points. Locations where vehicles enter and exit the site must be inspected for evidence of off-site sediment tracking. Stormwater will be examined for the presence of suspended sediment, turbidity, discoloration, and oily sheen. The site inspector will evaluate and document the effectiveness of the installed BMPs and determine if it is necessary to repair or replace any of the BMPs to improve the quality of stormwater discharges. All maintenance and repairs will be documented in the site log book or forms provided in this document. All new BMPs or design changes will be documented in the SWPPP as soon as possible.

4.1.1 Site Inspection Frequency

Site inspections will be conducted at least once a week and within 24 hours following any discharge from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

4.1.2 Site Inspection Documentation

The site inspector will record each site inspection using the site log inspection forms provided in Appendix J. The site inspection log forms may be separated from this SWPPP document, but will be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

4.2 Stormwater Quality Monitoring

4.2.1 Turbidity

Turbidity sampling and monitoring will be conducted during the entire construction phase of the project. Samples will be collected daily at the catch basin immediately downstream of the detention pond. If there is no flow in this catch basin, the attempt to sample will be recorded in the site log book and reported to Ecology in the monthly Discharge Monitoring Report (DMR) as "No Discharge".

The key benchmark turbidity value is 250 nephelometric turbidity units (NTU) for the downstream receiving water body. If the 250 NTU benchmark is exceeded in any sample collected from the sampling manhole, the following steps will be conducted:

1. Ensure all BMPs specified in this SWPPP are installed and functioning as intended.
2. Assess whether additional BMPs should be implemented, and document modified BMPs in the SWPPP as necessary.
3. Sample discharge daily until the discharge is 250 NTU or lower.

If the turbidity exceeds 250 NTU at any time, the following steps will be conducted:

1. Notify Ecology by phone within 24 hours of analysis (see Section 1 of this SWPPP for contact information).
2. Continue sampling daily until the discharge is 250 NTU or lower Initiate additional treatment BMPs such as off-site treatment, infiltration, filtration and chemical treatment within 24 hours, and implement those additional treatment BMPs as soon as possible, but within a minimum of 7 days.
3. Describe inspection results and remedial actions taken in the site log book and in monthly discharge monitoring reports as described in Section 5 of this SWPPP.

4.2.2 pH

Sampling and monitoring for pH will occur during the phase of construction when concrete pouring will be conducted until fully cured (3 weeks from last pour) and discharges are documented to be below pH 8.5. Samples will be collected weekly at the sedimentation pond prior to discharge to surface water. Samples will be analyzed for pH using a calibrated pH meter and recorded in the site log book.

The key benchmark pH value for stormwater is a maximum of 8.5. If a pH greater than 8.5 is measured in the sedimentation trap/pond(s) that has the potential to discharge to surface water, the following steps will be conducted:

1. Prevent (detain) all discharges from leaving the site and entering surface waters or storm drains if the pH is greater than 8.5
2. Implement CO_2 sparging or dry ice treatment in accordance with Ecology BMP C252.
3. Describe inspection results and remedial actions that are taken in the site log book and in monthly discharge monitoring reports as described in Section 5 of this SWPPP.

Section 5: Reporting and Recordkeeping

5.1 Recordkeeping

5.1.1 Site Log Book

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

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book.

5.1.2 Records Retention

Records of all monitoring information (site log book, inspection reports/checklists, etc.), this Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements will be retained during the life of the construction project and for a minimum of three years following the termination of permit coverage in accordance with permit condition S5.C.

5.1.3 Access to Plans and Records

The SWPPP, General Permit, Notice of Authorization letter, and Site Log Book will be retained on site or within reasonable access to the site and will be made immediately available upon request to Ecology or the local jurisdiction. A copy of this SWPPP will be provided to Ecology within 14 days of receipt of a written request for the SWPPP from Ecology. Any other information requested by Ecology will be submitted within a reasonable time. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with permit condition S5.G.

5.1.4 Updating the SWPPP

In accordance with Conditions S3, S4.B, and S9.B.3 of the General Permit, this SWPPP will be modified if the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site or there has been a change in design, construction, operation, or maintenance at the site that has a significant effect on the discharge, or potential for discharge, of pollutants to the waters of the State. The SWPPP will be modified within seven days of determination based on inspection(s) that additional or modified BMPs are necessary to correct problems identified, and an updated timeline for BMP implementation will be prepared.

5.2 Reporting

5.2.1 Discharge Monitoring Reports

If cumulative soil disturbance is 5 acres or larger: Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period, the Permittee shall submit the form as required, with the words "No discharge" entered in the place of monitoring results. The DMR due date is 15 days following the end of each month.

Water quality sampling results will be submitted to Ecology monthly on Discharge Monitoring Report (DMR) forms in accordance with permit condition S5.B. If there was no discharge during a given monitoring period, the form will be submitted with the words "no discharge" entered in place of the monitoring results. If a benchmark was exceeded, a brief summary of inspection results and remedial actions taken will be included. If sampling could not be performed during a monitoring period, a DMR will be submitted with an explanation of why sampling could not be performed.

5.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit are not met, and it causes a threat to human health or the environment, the following steps will be taken in accordance with permit section S5.F:

1. Ecology will be immediately notified of the failure to comply.
2. Immediate action will be taken to control the noncompliance issue and to correct the problem. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Any time turbidity sampling indicates turbidity is 250 nephelometric turbidity units (NTU) or greater or water transparency is 6 centimeters or less, the Ecology regional office will be notified by phone within 24 hours of analysis as required by permit condition S5.A (see Section 5.0 of this SWPPP for contact information).

In accordance with permit condition S4.F.6.b, the Ecology regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water (see Section 5.0 of this SWPPP for contact information).

High stormwater turbidity results may be reported by phone by calling the Ecology regional office:

- **Northwest Region at (425) 649-7000** for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

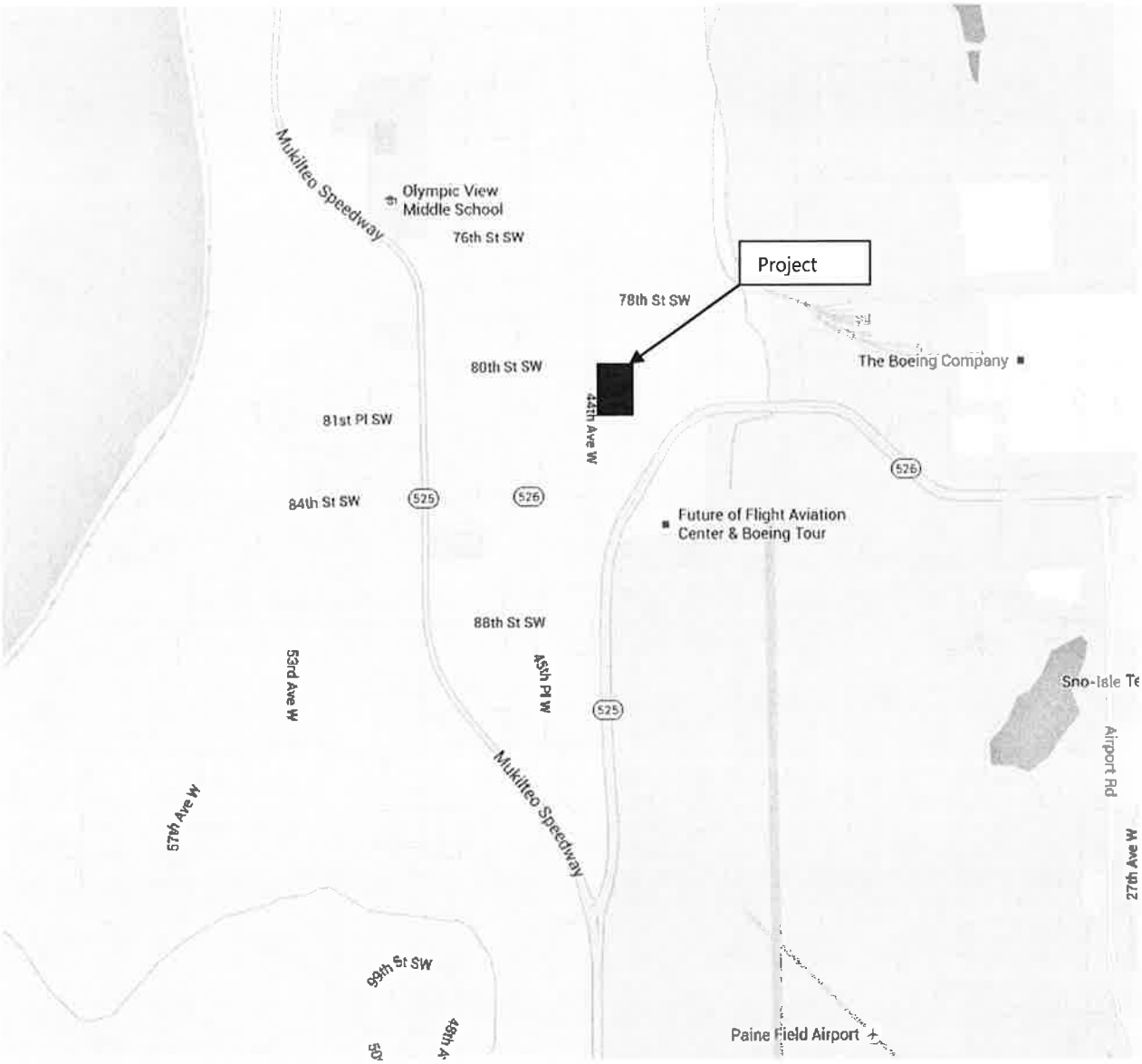
Please state, "I'm reporting a high turbidity construction stormwater discharge of (your sample result) NTUs." Include the following information:

1. Your Name / Phone Number
2. Permit Number
3. City / County of Project
4. Date / Time of Call
5. Date / Time of Sample
6. Project Name

APPENDIX A	VICINITY MAP
APPENDIX B	ENGINEERING CALCULATIONS
APPENDIX C	NOTICE OF INTENT (NOI) & TRANSFER OF OWNERSHIP FORM
APPENDIX D	CONSTRUCTION SITE NOTICE
APPENDIX E	CESCL FORM(S) CONTRACTOR/SUB-CONTRACTOR CERTIFICATION FORM
APPENDIX F	INSPECTION REPORTS
APPENDIX G	SPILL REPORT FORM
APPENDIX H	NOTICE OF TERMINATION (NOT)
APPENDIX I	RECORD OF STABILIZATION AND CONSTRUCTION ACTIVITY DATES
APPENDIX J	LOG OF FEDERAL, STATE, OR LOCAL STORM WATER OR OTHER ENVIRONMENTAL INSPECTIONS
APPENDIX K	BMP INFORMATION PER 2005 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON
APPENDIX L	GENERAL PERMIT

APPENDIX A

VICINITY MAP



PROJECT VICINITY MAP

NTS

APPENDIX B

SEDIMENT POND SIZING CALCULATIONS

Sediment Pond Sizing

The sediment pond was sized according to DOE Standards to accommodate the peak discharge from the 2-year, 24-hour storm event, based on post development site conditions. The WWHM program was used to obtain the 2-year peak discharge of 1.01 cfs. The required surface area was calculated using DOE equation:

$$(SA) = 2*Q_2 / V_{sed}$$

V_{sed} was given as 0.00096 ft/sec. The equation results in a surface area of 2,080 sf. The sediment pond will have a 3.5' settling depth, a 1' sediment storage depth along with 1' of free board totaling to a depth of 5.5'. Since the pond is a hole instead of a berm, there is no spillway. The pond was designed with a surface area of 2,108 sf at the top of the sediment storage, which exceeds the minimum requirement. The top of the sediment pond is at elevation 568', and the bottom is at 562.5', with a proposed length of 52.7', and a width of 40'. The sediment pond will have side slopes of 3:1.

TESC Sediment Pond Riser and Orifice Sizing

Riser diameter sized per Riser Inflow Curves in the 2012 Department of Ecology's Surface Water Design Manual for Western Washington.

$$A_O = \frac{A_S(2h)^{0.5}}{0.6\times 3600 Tg^{0.5}}$$

A_O = Orifice area (square feet)

A_S = Pond surface area (square feet)

h = head of water above orifice (height of riser in feet)

T = dewatering time (24 hours)

g = acceleration of gravity (32.2 feet/second^2)

Orifice diameter (D) in inches is:

$$D = 24\times\sqrt{\frac{A_O}{3.14}}$$

Riser Diameter = 10" minimum

A_S = [(1.01 x 2)/0.00096] = 2,106.77 sf

h = 1.5 feet

T = 24 hours

g = 32.2 feet/second^2

$$A_O = \frac{2108(2\times 1.5)^{0.5}}{0.6\times 3600\times 24\times 32.2^{0.5}} = 0..0124sf$$

$$D = 24\times\sqrt{\frac{0.0124}{3.14}} = 1.508"\sim 1.5"$$

APPENDIX C

NOTICE OF INTENT (NOI)
AND
TRANSFER OF OWNERSHIP FORM

Did you know you can submit your NOI electronically using our secure, easy to use online system? www.ecy.wa.gov/programs/wq/stormwater/construction/enoi.html

DEPARTMENT OF ECOLOGY
State of Washington

NOTICE OF INTENT (NOI) APPLICATION FORM

Construction Stormwater General Permit

Check if applicable:

☐ **Change or Update Permit Information**

☐ **Modification of Permit Coverage**

Permit #WAR_____

Please print or type all sections of this application. All fields are required unless otherwise marked.*(use [tab] to navigate through fields)*

I. Operator/Permittee (Party with operational control over plans and specifications or day-to-day operational control of activities that ensure compliance with Stormwater Pollution Prevention Plan (SWPPP) and permit conditions. Ecology will send correspondence and permit fee invoices to the permittee on record.)

Name:		Company:	
E-mail:		Unified Business Identifier (UBI): *(UBI is a nine-digit number used to identify a business entity.* ***Write "none" if you do not have a UBI number.)***	
Business Phone:	Ext.		
Cell Phone (Optional):	Fax (Optional):		
Mailing Address:		City:	State: / Zip + 4:

II. Property Owner (The party listed on the County Assessor's records as owner and taxpayer of the parcel[s] for which permit overage is requested. Ecology will not send correspondence and permit fee invoices to the Property Owner unless he/she is also the permittee. The Property Owner information will be used for emergency contact purposes.)

Name:		Company (if applicable):	
Business Phone:	Ext.	Unified Business Identifier (UBI): *(UBI is a nine-digit number used to identify a business entity.* ***Write "none" if you do not have a UBI number.)***	
Cell Phone (Optional):	Fax (Optional):		
E-mail:			
Mailing Address:		City:	State: / Zip + 4:

III. On-site Contact Person (Typically the Certified Erosion & Sediment Control Lead or Operator/Permittee)

Name:		Company:	
Business Phone:	Ext.	Mailing Address:	
Cell Phone (Optional)	Fax (Optional):	City:	State: / Zip + 4:
E-mail:			

IV. WQWebDMR (Electronic Discharge Monitoring Reporting)

You must submit monthly discharge monitoring reports using Ecology's WQWebDMR system. To sign up for WQWebDMR, or to register a new site, go to www.ecy.wa.gov/programs/wq/permits/paris/portal.html. If you are unable to submit your DMRs electronically, you may contact Ecology to request a waiver. Ecology will generally only grant waiver requests to those permittees without Internet access. Only a permittee or representative, designated in writing, may request access to or a waiver from WQWebDMR. To have the ability to use the system immediately, **you must submit the Electronic Signature Agreement with your application.** If you have questions on this process, contact Ecology's WQWebDMR staff at WQWebPortal@ecy.wa.gov or 800-633-6193 or 360-407-7097 (local).

V. Site Information

Site or Project Name

Street Address or Location Description (*If the site lacks a street address, list its specific location. For example, Intersection of Highway 61 and 34.)*

_____

Parcel ID#: _____ *(Optional)*

Type of Construction Activity (*check all that apply*):

- ☐ Residential
- ☐ Commercial
- ☐ Industrial
- ☐ Highway or Road (city ,county, state)
- ☐ Utilities (specify): _____.
- ☐ Other (specify):_____.

Site Acreage

Total size of your site/project, including support activities such as off-site equipment staging yards, material storage areas, borrow areas, etc. (that you own/control): _____acres.

Total area of soil disturbance (grading and/or excavating) for ***your*** site/project over the life of the project: _____acres. *(Note: 1 acre = 43,560 ft².)*

Concrete / Engineered Soils

How many yards of concrete will be poured over the life of the project? _____yd³ (**estimate**)

How many yards of recycled concrete will be used over the life of the project? _____yd³ (**estimate**)

Will any engineered soils be used? (For example: manufactured soil stabilizers, fly ash, cement treated base, cement kiln dust, etc.)
☐ Yes ☐ No

City (or nearest city):	Zip Code:	Estimated project start-up date (mm/dd/yy):
County:		Estimated project completion date (mm/dd/yy):

Record the latitude and longitude of the *main entrance* to the site or the approximate center of site.

Latitude: _____°N Longitude: _____°W

VI. Existing Site Conditions

1. Are you aware of contaminated soils present on the site? ☐ Yes ☐ No
2. Are you aware of groundwater contamination located within the site boundary? ☐ Yes ☐ No
3. If you answered yes to questions 1 or 2, will any contaminated soils be disturbed or will any contaminated groundwater be discharged due to the proposed construction activity? ☐ Yes ☐ No

["Contaminated" and "contamination" here mean containing any hazardous substance (as defined in WAC 173-340-200) that does not occur naturally or occurs at greater than natural background levels.]

If you answered yes to Question 3, please provide detailed information on the locations, contaminants, and contaminant concentrations (if known), and pollution prevention and/or treatment Best Management Practices (BMPs) proposed to control the discharge of soil/groundwater contaminants. This information should include related portions of the Stormwater Pollution Prevention Plan (SWPPP) that describe how contaminated and potentially contaminated construction stormwater and dewatering water will be managed.

VII. Stormwater Pollution Prevention Plan (SWPPP)

You must develop a SWPPP prior to starting construction. Do **not** submit your SWPPP with your application. The exception is that Ecology may request a copy of all or part of the SWPPP if you answered yes to the questions in Part VI.

VIII. Best Management Practices (BMPs)

You must use the BMPs listed in the Stormwater Management Manual for Western Washington or the Stormwater Management Manual for Eastern Washington or other manuals approved by Ecology. Alternatively, you may use demonstrably equivalent BMPs on the basis of permit condition S9.C.4. If you intend to use a BMP at your site that is not included in these manuals, but that you believe meets the definition of a *demonstrably equivalent* BMP, you must notify the appropriate regional office. www.ecy.wa.gov/programs/wq/stormwater/construction/contacts.html (See Definitions in the Construction Stormwater General Permit).*

**Note that if you receive permit coverage without indicating the preference for a demonstrably equivalent BMP and later decide to use one, you must provide Ecology with notice of the selection of an equivalent BMP no less than 60 days before the intended use of the equivalent BMP.*

IX. Discharge/Receiving Water Information

Indicate whether your site's stormwater and/or dewatering water could enter surface waters, **directly** and/or **indirectly**:

☐ Water will discharge directly or indirectly (through a storm drain system or roadside ditch) into one or more surface waterbodies (wetlands, creeks, lakes, and all other surface waters and water courses).

If your discharge is to a storm sewer system, provide the name of the operator of the storm sewer system:

(e.g., City of Tacoma): _____

(NOTE: If your stormwater discharges to a storm sewer system operated by the City of Seattle, King County, Snohomish County, City of Tacoma, Pierce County, or Clark County, you must **also** submit a copy of this NOI to the appropriate jurisdiction.)

☐ Water will discharge to ground with 100% infiltration, with no potential to reach surface waters under any conditions.

If your project includes dewatering, you **must** include dewatering plans and discharge locations in your site Stormwater Pollution Prevention Plan.

Location of Outfall into Surface Waterbody

Enter the outfall identifier code, waterbody name, and latitude/longitude of the point(s) where the site has the potential to discharge into a waterbody (the outfall). Enter all locations. **See illustration of Surface Waterbody Outfall locations at the end of this form.**

- Include the names and locations of both direct and indirect discharges to surface waterbodies, even if the risk of discharge is low or limited to periods of extreme weather. **Attach a separate list if necessary.**
- Give each point a unique 1-4 digit alpha numeric code. This code will be used for identifying these points in WQWebDMR.
- Some large construction projects (for example, subdivisions, roads, or pipelines) may discharge into several waterbodies.
- If the creek or tributary is unnamed, use a format such as "unnamed tributary to Deschutes River."
- If the site discharges to a stormwater conveyance system that in turn flows to a surface waterbody, include the surface waterbody name and location.

Outfall Identifier Code. These cannot be symbols. (Maximum of four characters).				Surface Waterbody Name at the Outfall	Latitude Decimal Degrees	Longitude Decimal Degrees
Example: 001A				**Example:** Puget Sound	47.5289047° N	-122.3123550° W
					° N	° W
					° N	° W
					° N	° W

If your site discharges to a waterbody that is on the impaired waterbodies list (e.g., 303[d] list) for turbidity, fine sediment, high pH, or phosphorus, Ecology will require additional documentation before issuing permit coverage and these sites will be subject to additional sampling and numeric effluent limits (per Permit Condition S8). Ecology will notify you if any additional sampling requirements apply. Information on impaired waterbodies is available online at: http://www.ecy.wa.gov/programs/wq/303d/index.html .

X. State Environmental Policy Act (SEPA)

This Notice of Intent (NOI) is incomplete and cannot be approved until the applicable SEPA requirements under Chapter 197-11 WAC are met.

Who is the SEPA lead agency on your site?_____.

Has the SEPA lead agency issued a final decision on your checklist? (if there is a comment period, the SEPA decision is final at the close of the comment period) ☐ **No** ☐ **Yes** ☐ **Exempt* (*attach written documentation if Exempt).**

If No: The NOI is incomplete. Ecology will hold the application until a final SEPA decision is made or the Construction Stormwater NOI public comment period ends, whichever is later. **You must notify Ecology once the SEPA lead agency has issued a final decision following any comment period.**

If Yes: Type of SEPA threshold determination issued: ☐ Determination of Non-Significance (DNS) ☐ Mitigated DNS (MDNS) ☐ Determination of Significance (DS) ☐ Final Environmental Impact Statement (EIS) ☐ Other: _____

- Date when SEPA comment period ended or will end: _____.

Notify Ecology if the SEPA determination is appealed. *More SEPA information is available at: www.ecy.wa.gov/programs/sea/sepa/e-review.html.*

XI. Other Ecology National Pollutant Discharge Elimination System (NPDES) and/or State Waste Discharge Permits

List any other Water Quality permits (Industrial stormwater, Individual stormwater, etc.) for this site:

Name of Water Quality Permit	Permit Number

XII. Public Notice

You must publish a public notice at least once a week for two consecutive weeks with at least seven days between publications, in a newspaper of general circulation in the county in which the construction is to take place. Ecology cannot grant permit coverage sooner than the end of the 30-day public comment period, which begins on the date of the second public notice.

Mail or fax (360-407-6426) the NOI to Ecology on or before the first public notice date. If you fax the public notice to Ecology, you must also mail a hard copy. Failure to do so may delay the issuance of your permit.

Provide the exact dates (mm/dd/yy) that the first and second public notices will appear in the newspaper(s):

Name of the newspaper publishing the notices: _____

First notice: _____/_____/_____

Second notice: _____/_____/_____ (Begins 30-day public comment period.)

For example: First notice: Friday 01/01/14 Second notice: Friday 01/08/14

PUBLIC NOTICE TEMPLATE

Complete this template using project-specific information and submit to a local newspaper with general circulation within the county where the project is located. The language in **bold** is required by WAC 173-226-130 and must be included in its entirety. (Either use the fill-in template below or **attach on a separate sheet of paper, if necessary.**)

(Name of operator/permittee)_____, (address of operator/permittee)_____, **is seeking coverage under the Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit.**

The proposed project, (project name)_____, **is located at** (street address, intersection, crossroads, or other descriptive site location)_____ in (name of nearest city)_____, in (County)_____.

This project involves _____ acres of soil disturbance for _____ construction activities.

(List all construction activities; for example, residential, commercial, industrial, highway, utility).

The receiving water(s) is/are _____ (List all named and un-named surface waterbodies, or ground water if applicable, waters identified in section IX).

Any persons desiring to present their views to the department of Ecology regarding this application may do so in writing within thirty days of the last date of publication of this notice. Comments shall be submitted to the department of Ecology. Any person interested in the department's action on this application may notify the department of their interest within thirty days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320.

Comments can be submitted to:
Department of Ecology
Attn: Water Quality Program, Construction Stormwater
PO Box 47696, Olympia, WA 98504-7696

XIII. Certification of Permittees

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

_____ / _____.

Printed Name / Company | Title

_____ _____

Signature of Operator/Permittee | Date

*** Signature of Operator/Permittee requirements:**

A. For a corporation: By a responsible corporate officer of at least the level of vice president.
B. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively.
C. For a municipality, state, federal, or other public facility: By either a principal executive officer or ranking elected official.

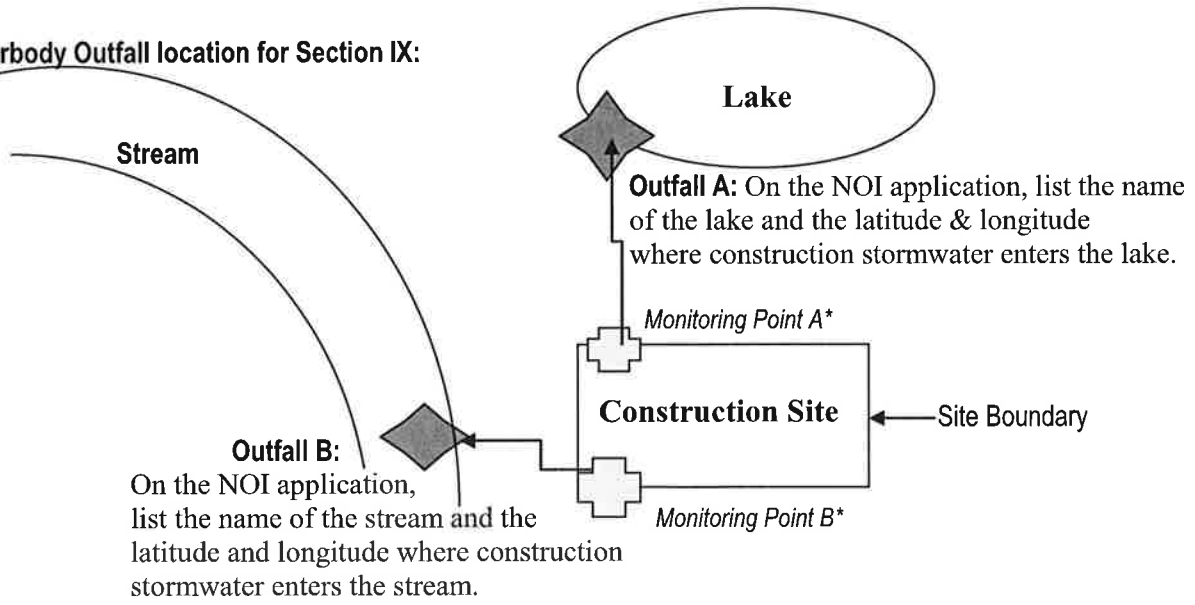
Please sign and return this document to the following address:

Department of Ecology
Attn: Water Quality Program, Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

DO NOT SUBMIT THIS PAGE WITH YOUR APPLICATION

If you have questions about this form, contact the following Ecology staff:			
Location	**Contact Name**	**Phone**	**E-mail**
City of Seattle, and Kitsap, Pierce, and Thurston counties	Josh Klimek	360-407-7451	josh.klimek@ecy.wa.gov
Island, King, and San Juan counties	Clay Keown	360-407-6048	clay.keown@ecy.wa.gov
Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Skagit, Snohomish, Spokane, Stevens, Walla, Whatcom, and Whitman counties.	Shawn Hopkins	360-407-6442	shawn.hopkins@ecy.wa.gov
Benton, Chelan, Clallam, Clark, Cowlitz, Douglas, Grays Harbor, Jefferson, Kittitas, Klickitat, Lewis, Mason, Okanogan, Pacific, Skamania, Wahkiakum, and Yakima counties.	Joyce Smith	360-407-6858	joyce.smith@ecy.wa.gov
If you have questions about WQWebDMR, contact the following Ecology staff:			
You must submit monthly discharge monitoring reports using Ecology's WQWebDMR system. To sign up for WQWebDMR, or to register a new site, go to www.ecy.wa.gov/programs/wq/permits/paris/portal.html. If you are unable to submit your DMRs electronically, you may contact Ecology to request a waiver. Ecology will generally only grant waiver requests to those permittees without internet access. Only a permittee or representative, designated in writing, may request access to or a waiver from WQWebDMR. To have the ability to use the system immediately, **you must submit the Electronic Signature Agreement with your application**. If you have questions on this process, contact Ecology's WQWebDMR staff at WQWebPortal@ecy.wa.gov or 800-633-6193 or 360-407-7097 (local).			

Example Surface Waterbody Outfall location for Section IX:



*Note: The monitoring points are for illustration only and are not required on this Notice of Intent application form. Monitoring point information will be entered on the monthly discharge monitoring report as required for active permits.

To request materials in a format for the visually impaired, call the Water Quality Program at Ecology, 360-407-6600, Relay Service711, or TTY 877-833-6341.

Transfer of Coverage

Industrial Stormwater General Permit

Use this form to transfer permit coverage for all, or a portion of a site, to one or more new operators

Permit # WAR–_____

Specific date that permit responsibility, coverage, and liability is transferred to new operator: _____

Will any of the industrial activities change at this facility? ☐ Yes* ☐ No If yes, explain: _____

*If the Industrial activities substantially change, then the permit cannot be transferred (Special condition S2.D of the General Permit).

Current Operator/Permittee Information

Current Operator/Permittee Name:		Company:	
Signature	Date:	Title:	
Mailing Address:			
City:		State:	Zip:
Business Phone:		Ext.	Fax (Optional):
E-mail:		Cell Phone (Optional):	

New Operator/Permittee Information

I. New Operator / Permittee (all permit correspondence will be mailed here)

ɔntact name/ Title: /		Company name:	
Business Phone: _____ Ext. _____ Cell Phone (Optional): _____ Fax (Optional): _____ E-mail:		Unified Business Identifier (UBI): 9-digit number provided by Dept. of Revenue to business owners. Individuals without a UBI, enter "none."	
Mailing address:	City:	State:	Zip + 4:

II. On-Site Contact Person

Contact name:		Company name:	
Mailing address:	City:	State:	Zip + 4:
Business Phone:		Ext.	Fax (Optional):
E-mail:		Cell Phone (Optional):	

III. Facility Information

Facility Name:	County:	
Street Address (or Location description):	City:	Zip+4:

ɜt the Standard Industrial Classification Code(s) for your facility.

1. ☐☐☐☐ 2. ☐☐☐☐ 3. ☐☐☐☐ 4. ☐☐☐☐

Type of industrial activity on site: _____

IV. Receiving Water Information

Will there be a change in discharge point locations, discharge identifiers, sampling points, or receiving water locations? ☐ Yes ☐ No If yes, complete this section. If no, proceed to Section V.

A. Discharge Point(s) Latitude and Longitude*: Provide latitude and longitude, expressed in decimal degrees, for each of your facility's discharge point(s). List **all** discharge points. (Please use an extra sheet of paper if necessary.) Please use topographic maps and GPS settings that use the 1983 North American Datum (NAD 83).

For the discharge identifier, list the name, number, or letter used on the map to identify the point(s) of discharge. The identifier can only be a maximum of three characters long and **must be unique** for each discharge point.

If you identify more than one discharge point, mark the discharge point(s) you will sample to comply with the permit sampling requirements by checking the "S/P" (sample point) box.

Discharge identifier. These cannot be symbols. (maximum of three characters ex. 01A)	Latitude (decimal degrees)	Longitude (decimal degrees)	S/P	Location description
	° N	° W	☐	
	° N	° W	☐	
	° N	° W	☐	
	° N	° W	☐	
	° N	° W	☐	

NOTE: You must use the unique identifier for the sampling point on each discharge monitoring report (DMR) form you will submit each quarter. Ecology will provide the DMR form when we issue coverage under the permit.

Receiving Water Latitude / Longitude: Provide latitude and longitude, expressed in decimal degrees, of your facility's discharge where it enters the receiving water(s). Please use topographic maps and GPS settings that use the 1983 North American Datum (NAD 83). List all receiving waters for the site. These receiving waters must be listed in the public notice. (Please use an extra sheet of paper if necessary.)

Receiving Water Body	Latitude (decimal degrees)	Longitude (decimal degrees)
	° N	° W
	° N	° W
	° N	° W
	° N	° W
	° N	° W

C. Name of Conveyance System: If you discharge to a municipal stormwater system or other stormwater conveyance system (e.g., Kent stormwater drainage system, roadside ditch), identify the system by name or if unnamed, by other identifier (e.g., 145th street ditch). _____

For assistance with latitude and longitude, refer to either of the following websites: http://www.getlatlon.com **or http://www.epa.gov/tri/report/siting_tool/index.htm. Please convert all latitude and longitude coordinates into decimal degrees format. For help with this process go to: http://www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html*

If your site discharges to a water body that is on the impaired water bodies list (i.e., 303(d) list) you may be required to sample for more parameters. Ecology will notify you if any additional sampling requirements apply. Information on impaired water bodies is available online at: http://www.ecy.wa.gov/programs/wq/stormwater/construction/impaired.html

Before signing, please use the following checklist to ensure this form is complete:

☐ All spaces on this form have been completed (attach additional sheets if necessary).

☐ The transfer form is signed* by both the current permittee and the new permittee(s).
*** Federal regulations require this application is signed by one of the following:**
A. For a corporation: by a principal executive officer of at least the level of vice president;
B. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively or
C. For a municipality, state, federal, or other public facility: by either a principal executive officer or ranking elected official.

☐ New Operator/Permittee: Before you submit this form to Ecology, please retain a copy for your records – this will serve as proof of permit coverage until documentation arrives from Ecology.

V. Certification of New Permittee	
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."	
Printed Name/Company /	Title
Signature	Date

Please sign and return this original document to:

Department of Ecology
Stormwater Unit – Industrial
P. O. Box 47696
Olympia, WA 98504-7696

Location	Contact Name	Phone	E-mail
City of Seattle, Kitsap, Pierce, and Thurston counties	Josh Klimek	360-407-7451	jokl461@ecy.wa.gov
Island, King, and San Juan counties	Clay Keown	360-407-6048	ckeo461@ecy.wa.gov
Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Skagit, Snohomish, Spokane, Stevens, Walla Walla, Whatcom, and Whitman counties.	Shawn Hopkins	360-407-6442	shop461@ecy.wa.gov
Benton, Chelan, Clallam, Clark, Cowlitz, Douglas, Grays Harbor, Jefferson, Kittitas, Klickitat, Lewis, Mason, Okanogan, Pacific, Skamania, Wahkiakum, and Yakima counties.	Joyce Smith	360-407-6858	josm461@ecy.wa.gov

To ask about the availability of this document in a version for the visually impaired call the Water Quality Program at 360-407-6401. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.

APPENDIX D

CONSTRUCTION SITE NOTICE

CONSTRUCTION SITE NOTICE
FOR THE
NPDES GENERAL PERMIT

Contractor Firm:	Fisher Construction Group, Inc.
Contractor Address:	625 Fisher Lane Burlington, WA 98233
Contact Name & Number: (Site Superintendent)	Name: Phone Number:
Project Description:	**Pacific Seafood - Mukilteo** **44th Ave W and 80th Street SW** **Mukilteo, WA 98275** **Approx. 83,000 SF of Industrial** **On 5.07 Acres** **Building, Parking, Landscaping, and Utilities.**

APPENDIX E

CERTIFIED EROSION AND SEDIMENT CONTROL LEAD FORMS (CESCL)

CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

CONTRACTOR/SUBCONTRACTOR CERTIFICATION

Pacific Seafood - Mukilteo; Mukilteo, WA

The General Contractor and all contractors and/or subcontractors and their employees that will implement and maintain the pollution control measures in the SWPPP and/or are involved in ground-disturbing activities on the site must be identified below. Each must sign a statement certifying that they understand the General Permit authorizing storm water discharges during construction. These certifications must be maintained in the SWPPP file.

Contractor Name	Trade
Company Name	Business Phone Number
Business Address	City, State Zip

CERTIFICATION:

"I certify that I understand the term and conditions of the National Pollutant Discharge Elimination System (NPDES) General Permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification. The SWPPP and General Permit have been made available to me to review and I agree to stay in compliance with the permit."

Signature	Date
Printed Name	_____ Initial to confirm SWPPP understanding

Title (Must be an Officer of company if a permit requirement.)

✹ **All employees of contractors and subcontractors have the responsibility of notifying the General Contractor's Superintendent of any Storm Water BMP deficiencies or damage.**

APPENDIX F

INSPECTION REPORTS

DEPARTMENT OF ECOLOGY DISCHARGE MONITORING REPORT
(TO BE ADDED STARTING OCTOBER 1, 2006)

Construction Stormwater
SITE INSPECTION CHECKLIST

Project_____ Permit No._____ Inspector_____ Date_____ Time_____

Site BMPs	Overall Condition	Need Repair?	Comments/Observations
Clearing Limits			
• *Buffer Zones around sensitive areas*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Construction Access/Roads			
• *Stabilized site entrance*	G F P	Y N	
• *Stabilized roads/parking area*	G F P	Y N	
•	G F P	Y N	
Control Flow Rates			
• *Swale*	G F P	Y N	
• *Dike*	G F P	Y N	
• *Sediment pond*	G F P	Y N	
• *Sediment trap*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Install Sediment Controls			
• *Sediment pond/trap*	G F P	Y N	
• *Silt fence*	G F P	Y N	
• *Straw bale barriers*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Preserve Vegetation/Stabilize Soils			
• *Nets and blankets*	G F P	Y N	
• *Mulch*	G F P	Y N	
• *Seeding*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Protect Slopes			
• *Terrace*	G F P	Y N	
• *Pipe slope drains*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Protect Drain Inlets			
• *Inserts*	G F P	Y N	
•	G F P	Y N	
•	G F P	Y N	
Stabilize Channels and Outlets			
• *Conveyance channels*	G F P	Y N	
• *Energy dissipators*	G F P	Y N	
•	G F P	Y N	
Control Pollutants			
• *Chemical Storage Area covered*	G F P	Y N	
• *Concrete handling*	G F P	Y N	
•	G F P	Y N	
Control De-watering			
•	G F P	Y N	

G=Good F=Fair P=Poor Y=Yes N=No

Excerpt from *How to do Stormwater Monitoring,* Publication # 06-10-020

Construction Stormwater
SITE INSPECTION CHECKLIST

Project_____ Permit No._____ Inspector_____ Date_____ Time_____

Will existing BMPs need to be modified or removed, or other BMPs installed? YES NO
IF YES, list the action items to be completed on the following table:

Actions to be Completed	Date Completed/ Initials
1.	
2.	
3.	
4.	
5.	
6.	

Describe current weather conditions

Approximate amount of precipitation since last inspection: _____ inches
and precipitation in the past 24 hours*: _____inches
**based on an on-site rain gauge or local weather data.*

Describe discharging stormwater, if present. Note the presence of suspended sediment, "cloudiness", discoloration, or oil sheen.

Was water quality sampling part of this inspection? YES NO
If yes, record results below (attach separate sheet, if necessary):

Parameter:	Method (circle one)	Result	Units
Turbidity	tube, meter, laboratory		NTU (cm, if tube used)
pH	paper, kit, meter		pH standard units

Is the site in compliance with the SWPPP and the permit requirements? YES NO
If no, indicate tasks necessary to bring site into compliance on the "Actions to be Completed" table above, and include dates each job WILL BE COMPLETED.
If no, has the non-compliance been reported to Dept. of Ecology? YES NO
If no, should the SWPPP be modified: YES NO

Sign the following certification:
"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief."

Inspection completed on:_____ by: (print+signature)_____

Title/Qualification of Inspector:_____

Excerpt from *How to do Stormwater Monitoring,* Publication # 06-10-020

APPENDIX G

SPILL REPORT FORM

Spill Report Form

Pacific Seafood - Mukilteo; 44th Ave W and 80th Street, Mukilteo, WA

Spill Reported by: _____

Date/Time Spill: _____

Describe spill location and events leading to spill: _____

_____

_____

Material spilled: _____

Source of spill: _____

Amount spilled: _____ Amount spilled to waterway: _____

Containment or clean up action: _____

_____

Approximate depth of soil excavation: _____

List Injuries or Personal Contamination: _____

Action to be taken to prevent future spills: _____

_____

Modifications to the SWPPP necessary due to this spill: _____

_____

Agencies notified of the spill: _____

_____

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____ _____

Contractor Superintendent Date

APPENDIX H

NOTICE OF TERMINATION (NOT)

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Termination Form

Construction Stormwater General Permit

Use this form to request termination of permit coverage

Permit # WAR _____

I. Operator/Permittee (Party with operational control over plans and specifications, or day-to-day operational control of activities which ensure compliance with SWPPP and permit conditions. Ecology will send correspondence and permit fee invoices to the permit holder on record.)

Name:	Company:	
Business Phone: Ext. Cell Phone (Optional): Fax (Optional): E-mail:		
Mailing Address:		
City:	State:	Zip + 4:

II. Site Location/Address

Site name:		Total area of soil disturbance for your site/project: _____ acres
Street address (or location description):		
City (or nearest city):	Zip:	County:

III. Construction Activity- The site is eligible for termination by one of the following methods:

☐ The site has undergone final stabilization. The operator has permanently stabilized all exposed soils, removed all temporary BMPs, and eliminated all stormwater discharges associated with construction activity.

☐ Permit coverage on all portions of the site that have not undergone final stabilization (Permit Condition S10.A.1) are being, or have been, transferred (Permit Condition G9), and the Permittee no longer has operational control of the construction activity.

We provided the new owner Transfer of Coverage paperwork on:

☐ All portions of the site that have not undergone final stabilization (Permit Condition S10.A.1) have been sold and the Permittee no longer has operational control of the construction activity. We will not be submitting Transfer of Permit coverage paperwork. (Optional).

Please provide new owner contact info:

IV. Certification of Permittees. Please read the certification statement carefully before signing.

"I certify under penalty of law that all stormwater discharges associated with construction activity from the identified site that are authorized by the National Pollution Discharge Elimination System (NPDES) and State Waste Discharge general permit have been eliminated, or that I no longer own or operate on this site. I understand that by submitting this Notice of Termination that I am no longer authorized to discharge stormwater associated with construction activity by the general permit, and that discharging pollutants in stormwater to waters of the State of Washington is unlawful under the Clean Water Act where the discharge is not authorized by a NPDES permit. I also understand that the submittal of this Notice of Termination does not release the permittee from liability for any violations of this permit or the Clean Water Act."

Operator printed name _____ Title _____

Operator signature _____ Date _____

Instructions for Notice of Termination Form

...mit a Notice of Termination Form to the Department of Ecology when
1.) All stormwater discharges from a construction site are eliminated, and the site has undergone final stabilization.
2.) The site has been sold or transferred to a different operator(s). The permit fees will continue until the permit is terminated.

I. Operator	Give the name, address, and telephone number of the person who is responsible for the permit. This person will also be sent the final fee invoice.
II. Site Location	Enter the street address or location description, including the city or nearest city and county for the construction site. Construction sites that do not have a street address must also provide a legal description in the space provided, or as an attachment.
III. Construction Activity	Indicate: 1. That all stormwater discharges associated with construction activity are eliminated and final stabilization of all exposed soils is completed. Final stabilization means the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures, that prevents erosion. 2. That the permit has been transferred to another responsible party(ies) for management. (***Provide the information required on the Transfer of Coverage form.)*** 3. That all portions of the site that have not undergone final stabilization have been sold.
IV. Certification of Permittee(s)	Read this statement carefully. The operator, or authorized representative of the operator, must print his or her name for clarity, then sign and date the document on the lines provided. (Refer to General Condition G2 in the permit for signatory requirements.)

Please sign and return this original document to the following address and retain a copy for your records:

Department of Ecology
Stormwater Unit – Construction
PO Box 47696
Olympia, WA 98504-7696

Note: Your site remains under permit and subject to all permit conditions until your termination is effective. Continue to comply with permit conditions until the earlier of the following two dates:

1) The date you receive written notification from Ecology that termination is effective.

2) The 31st day following Ecology's receipt of this form.

Questions?

Call:

- **360-407-7451 Josh Klimek** for city of Seattle or counties: Kitsap, Pierce, and Thurston.
- **360-407-6048 Clay Keown**for counties: King, Island, San Juan.
- **360-407-6442 Shawn Hopkins** for counties: Whatcom, Skagit, Snohomish, Ferry, Stevens, Pend Oreille, Lincoln, Spokane, Grant, Adams, Whitman, Franklin, Walla Walla, Columbia, Garfield, and Asotin.
- **360-407-6858 Joyce Smith** for counties: Okanogan, Chelan, Douglas, Kittitas, Yakima, Benton, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, Lewis, Pacific, Grays Harbor, Mason, Jefferson, and Clallam.

To ask about the availability of this document in a version for the visually impaired, call the Water Quality Program at 360-407-6401. Persons with hearing loss may call 711 for Washington Relay Service. Persons with a speech disability may call 877-833-6341.

APPENDIX I

RECORD OF STABILIZATION AND CONSTRUCTION ACTIVITY DATES

SITE STABILIZATION and CONSTRUCTION ACTIVITY DATES

A record of dates when BMPs are installed or removed, stabilization measures are initiated, major grading activities occur, and construction activities temporarily or permanently cease on a portion of the site shall be maintained until final site stabilization is achieved and the Notice of Termination (NOT) is filed. This form must be updated continuously throughout the project until the NOT is filed.

MAJOR STABILIZATION AND GRADING ACTIVITIES

Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
_____

Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
_____

Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
_____

Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
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Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
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Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
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Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
_____

Description of Activity: _____
Site Contractor:_____Begin (date):_____ End (date):_____
Location:_____
_____

APPENDIX J

FEDERAL, STATE, OR LOCAL STORM WATER OR OTHER ENVIRONMENTAL INSPECTOR SITE VISIT LOG

Federal, State, or Local Storm Water or other Environmental Inspector Site Visit Log

Inspectors Name: _____ Agency: _____

Contractors Representative Present: _____

Others Present: _____

Comments: _____

Time and Date: _____ Report Prepared: Yes No

Inspectors Name: _____ Agency: _____

Contractors Representative Present: _____

Others Present: _____

Comments: _____

Time and Date: _____ Report Prepared: Yes No

Inspectors Name: _____ Agency: _____

Contractors Representative Present: _____

Others Present: _____

Comments: _____

Time and Date: _____ Report Prepared: Yes No

Inspectors Name: _____ Agency: _____

Contractors Representative Present: _____

Others Present: _____

Comments: _____

Time and Date: _____ Report Prepared: Yes No

APPENDIX K

BMP INFORMATION AND DETAILS

4.1 Source Control BMPs

BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20-30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
- As required by local governments.

Design and Installation Specifications

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. Local governments may also have ordinances to save natural vegetation and trees.
- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

Plants need protection from three kinds of injuries:

- *Construction Equipment* - This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.
- *Grade Changes* - Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

  When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. A tile

system protects a tree from a raised grade. The tile system should be laid out on the original grade leading from a dry well around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2-3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- *Excavations* - Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

  Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint.

  Backfill the trench as soon as possible.

  Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.
- The windthrow hazard of Pacific silver fir and madronna is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.
- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.
- Thinning operations in pure or mixed stands of Grand fir, Pacific silver fir, Noble fir, Sitka spruce, Western red cedar, Western hemlock,

Pacific dogwood, and Red alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots, and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

Maintenance Standards

- Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.
- If tree roots have been exposed or injured, "prune" cleanly with an appropriate pruning saw or lopers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

BMP C102: Buffer Zones

Purpose

An undisturbed area or strip of natural vegetation or an established suitable planting that will provide a living filter to reduce soil erosion and runoff velocities.

Conditions of Use

Natural buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Vegetative buffer zones can be used to protect natural swales and can be incorporated into the natural landscaping of an area.

Critical-areas buffer zones should not be used as sediment treatment areas. These areas shall remain completely undisturbed. The local permitting authority may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.

Design and Installation Specifications

- Preserving natural vegetation or plantings in clumps, blocks, or strips is generally the easiest and most successful method.
- Leave all unstable steep slopes in natural vegetation.
- Mark clearing limits and keep all equipment and construction debris out of the natural areas. Steel construction fencing is the most effective method in protecting sensitive areas and buffers. Alternatively, wire-backed silt fence on steel posts is marginally effective. Flagging alone is typically not effective.
- Keep all excavations outside the dripline of trees and shrubs.
- Do not push debris or extra soil into the buffer zone area because it will cause damage from burying and smothering.
- 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.

BMP C103: High Visibility Plastic or Metal Fence

Purpose

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits, plastic 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.
- 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 Entrance

Purpose

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or equipment by constructing a stabilized pad of quarry spalls at entrances to construction sites.

Conditions of Use

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 feet of the site.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances 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 4.2 for details. Note: the 100' minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').
- 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 following standards:

Grab Tensile Strength (ASTM D4751)	200 psi min.
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 paved; this can be used as a stabilized entrance. Also consider the installation of excess concrete as a stabilized entrance. During large concrete pours, excess concrete is often available for this purpose.
- Hog fuel (wood-based mulch) may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. Hog fuel is generally less effective at stabilizing construction entrances and should be used only at sites where the amount of traffic is very limited. Hog fuel is not recommended for entrance stabilization in urban areas. The effectiveness of hog fuel is highly variable and it generally requires more maintenance than quarry spalls. The inspector may at any time require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause degradation of the subgrade support over time.
- Fencing (see BMPs C103 and C104) shall be installed as necessary to restrict traffic to the construction entrance.

Maintenance Standards

- Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
- If the entrance 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 street sweeping, an increase in the dimensions of the entrance, or the installation of a 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 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 shall be considered. The sediment would then be washed into the sump where it can be controlled.
- 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 entrance(s), fencing (see BMPs C103 and C104) 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.

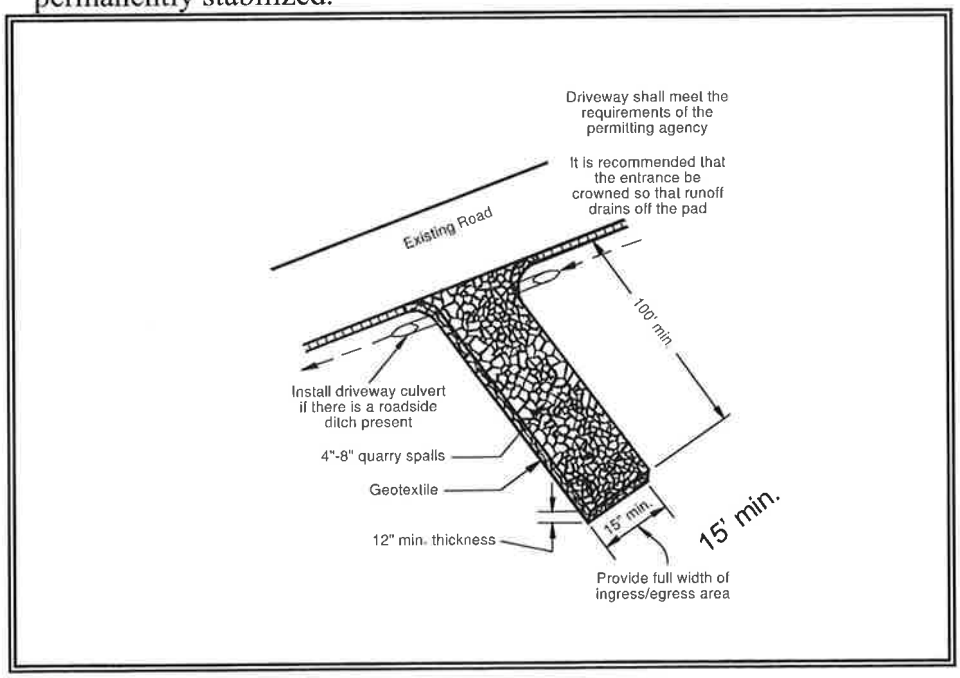


Figure 4.2 – Stabilized Construction Entrance

BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

Conditions of Use

When a stabilized construction entrance (see BMP C105) is not preventing sediment from being tracked onto pavement.

- 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.

Design and Installation Specifications

Suggested details are shown in Figure 4.3. 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.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

Midpoint spray nozzles are only needed in extremely muddy conditions.

Wheel wash systems should be designed with a small grade change, 6 to 12 inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

Maintenance Standards

The wheel wash should start out the day with fresh water.

The wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wash water will need to be changed more often.

Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system, such as closed-loop recirculation or land application, or to the sanitary sewer with proper local sewer district approval.

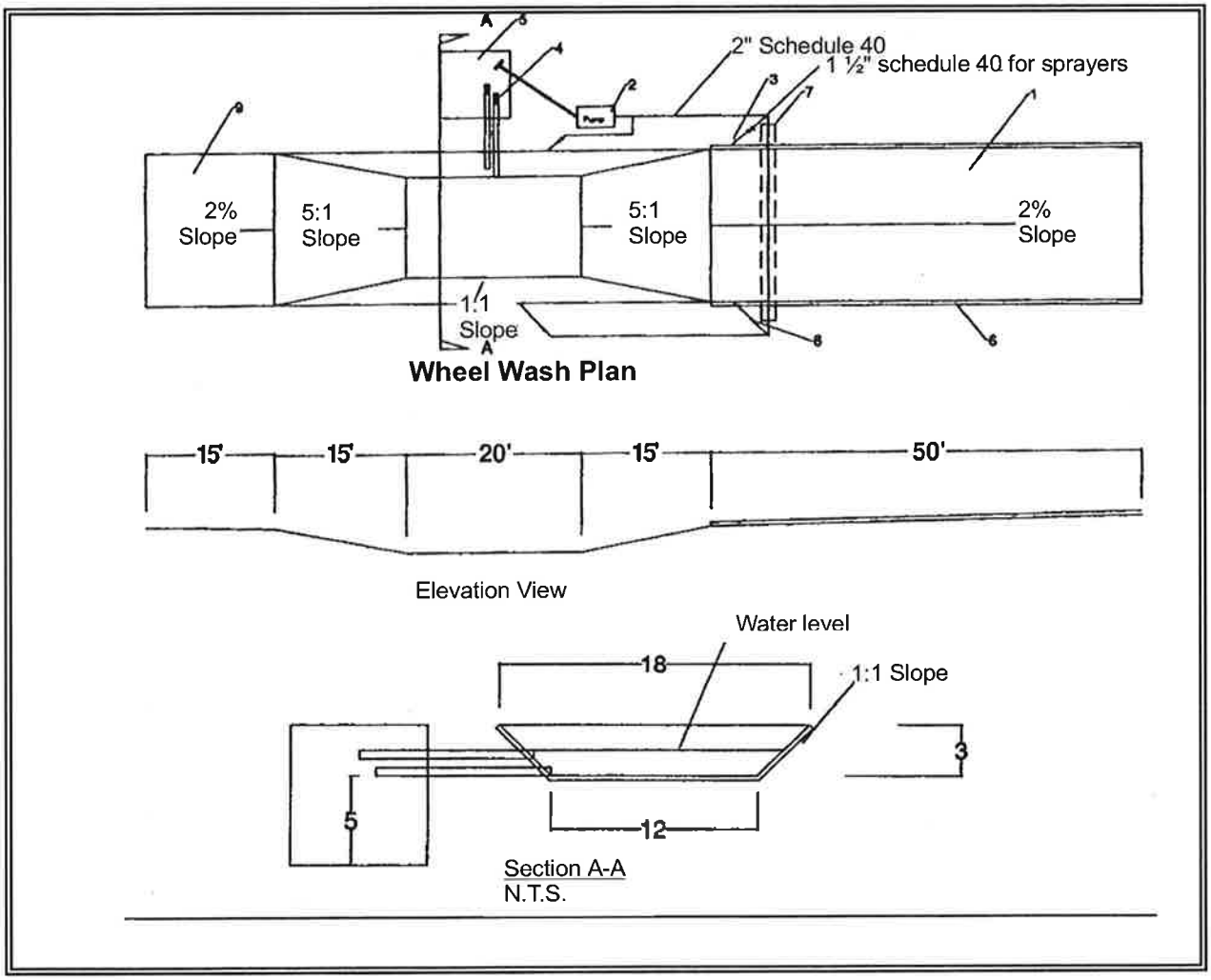


Figure 4.3 Wheel Wash

Notes:

1. Asphalt construction entrance 6 in. asphalt treated base (ATB).
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so can be cleaned with trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot. ATB apron to protect ground from splashing water.

BMP C107: Construction Road/Parking Area Stabilization

Purpose

Stabilizing subdivision roads, parking areas, and other onsite vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

Conditions of Use

- Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
- Fencing (see BMPs C103 and C104) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for roadbase stabilization, pH monitoring and BMPs are necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet-flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the storm drain system (see BMP C220).

Maintenance Standards

- Inspect stabilized areas regularly, especially after large storm events.
- Crushed rock, gravel base, hog fuel, 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.

BMP C120: Temporary and Permanent Seeding

Purpose

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

Conditions of Use

- Seeding may be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a Bonded Fiber Matrix. The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch over hydromulch and blankets.
- Retention/detention ponds should be seeded as required.
- Mulch is required at all times because it protects seeds from heat, moisture loss, and transport due to runoff.
- All disturbed areas shall be reviewed in late August to early September and all seeding should be completed by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- At final site stabilization, all disturbed areas not otherwise vegetated or stabilized shall be seeded and mulched. 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.

Design and Installation Specifications

- Seeding should be done during those seasons most conducive to growth and will vary with the climate conditions of the region. Local experience should be used to determine the appropriate seeding periods.
- The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1. Seeding that occurs between July 1 and August 30 will require irrigation until 75 percent grass cover is established. Seeding that occurs between October 1 and March 30 will require a mulch or plastic cover until 75 percent grass cover is established.
- To prevent seed from being washed away, confirm that all required surface water control measures have been installed.

- The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 is not allowed if they are to be seeded.
- New and more effective restoration-based landscape practices rely on deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, 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 the rototilling process should be done in multiple lifts, or the prepared soil system shall be prepared properly and then placed to achieve the specified depth.
- Organic matter is the most appropriate form of "fertilizer" because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2-10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.
- In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts. It is recommended that areas being seeded for final landscaping conduct soil tests to determine the exact type and quantity of fertilizer needed. This will prevent the over-application of fertilizer. Fertilizer should not be added to the hydromulch machine and agitated more than 20 minutes before it is to be used. If agitated too much, the slow-release coating is destroyed.
- There are numerous products available on the market 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 is a good source of long-term, slow-release, available nitrogen.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. Mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and 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. Any mulch or tackifier product used shall be installed per manufacturer's instructions. Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

- Mulch is always required for seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.
- On steep slopes, Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products should be used. BFM/MBFM products are applied at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Application is made so that a minimum of 95 percent soil coverage is achieved. Numerous products are available commercially and should be installed per manufacturer's instructions. Most products require 24-36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.

BFMs and MBFMs have some advantages over blankets:

- No surface preparation required;
- Can be installed via helicopter in remote areas;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They are at least $1,000 per acre cheaper installed.

In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels. BFMs and MBFMs are good alternatives to blankets in most situations where vegetation establishment is the goal.

- 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. One way to overcome this is to increase seed quantities by up to 50 percent.
- Vegetation establishment can also be enhanced by dividing the hydromulch operation into two phases:
    1. Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift;
    2. Phase 2- Install the rest of the mulch and tackifier over the first lift.

An alternative is to install the mulch, seed, fertilizer, and tackifier in one lift. Then, spread or blow straw over the top of the hydromulch at a rate of about 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:

1. Irrigation
2. Reapplication of mulch
3. Repair of failed slope surfaces

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

- Areas to be permanently landscaped shall provide a healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetal health and vitality, improves hydrologic characteristics, and reduces the need for irrigation. This can be accomplished in a number of ways:

  Recent research has shown that the best method to improve till soils is to amend these soils with compost. The optimum mixture is approximately two parts soil to one part compost. This equates to 4 inches of compost mixed to a depth of 12 inches in till soils. Increasing the concentration of compost beyond this level can have negative effects on vegetal health, while decreasing the concentrations can reduce the benefits of amended soils. Please note: The compost should meet specifications for Grade A quality compost in Ecology Publication 94-038.

  Other soils, such as gravel or cobble outwash soils, may require different approaches. Organics and fines easily migrate through the loose structure of these soils. Therefore, the importation of at least 6 inches of quality topsoil, underlain by some type of filter fabric to prevent the migration of fines, may be more appropriate for these soils.

  Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.

- Areas that will be seeded only and not landscaped may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Native topsoil should be re-installed on the disturbed soil surface before application.
- Seed that is installed as a temporary measure may be installed by hand if it will be covered by straw, mulch, or topsoil. Seed that is installed as a permanent measure may be installed by hand on small areas (usually less than 1 acre) that will be covered with mulch, topsoil, or erosion blankets. The seed mixes listed below include recommended mixes for both temporary and permanent seeding. These mixes, with the exception of the wetland mix, shall be applied at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Local suppliers or the local conservation district should be consulted for their recommendations because 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.

Table 4.1 represents the standard mix for those areas where just a temporary vegetative cover is required.

Table 4.1
Temporary Erosion Control Seed Mix

	% Weight	% Purity	% Germination
Chewings or annual blue grass *Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye - *Lolium perenne*	50	98	90
Redtop or colonial bentgrass *Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover *Trifolium repens*	5	98	90

Table 4.2 provides just one recommended possibility for landscaping seed.

Table 4.2
Landscaping Seed Mix

	% Weight	% Purity	% Germination
Perennial rye blend *Lolium perenne*	70	98	90
Chewings and red fescue blend *Festuca rubra var. commutata* or *Festuca rubra*	30	98	90

This turf seed mix in Table 4.3 is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

Table 4.3
Low-Growing Turf Seed Mix

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) *Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay) *Lolium perenne var. barclay*	30	98	90
Red fescue *Festuca rubra*	20	98	90
Colonial bentgrass *Agrostis tenuis*	5	98	90

Table 4.4 presents a mix recommended for bioswales and other intermittently wet areas.

Table 4.4
Bioswale Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	75-80	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	92	85
Redtop bentgrass *Agrostis alba* or *Agrostis gigantea*	5-10	90	80

* *Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The seed mix shown in Table 4.5 is a recommended low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Other mixes may be appropriate, depending on the soil type and hydrology of the area. Recent research suggests that bentgrass (agrostis sp.) should be emphasized in wet-area seed mixes. Apply this mixture at a rate of 60 pounds per acre.

Table 4.5
Wet Area Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	98	85
Meadow foxtail *Alepocurus pratensis*	10-15	90	80
Alsike clover *Trifolium hybridum*	1-6	98	90
Redtop bentgrass *Agrostis alba*	1-6	92	85

* *Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The meadow seed mix in Table 4.6 is recommended for areas that will be maintained infrequently or not at all and 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. The appropriateness of clover in the mix may need to be considered, as this can be a fairly invasive species. If the soil is amended, the addition of clover may not be necessary.

Table 4.6
Meadow Seed Mix

	% Weight	% Purity	% Germination
Redtop or Oregon bentgrass *Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue *Festuca rubra*	70	98	90
White dutch clover *Trifolium repens*	10	98	90

Maintenance Standards

- Any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) shall be reseeded. If reseeding is ineffective, an alternate method, such as sodding, mulching, or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.

- After adequate cover is achieved, any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

BMP C121: Mulching

Purpose

The purpose of mulching soils is to provide 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 is an enormous variety of mulches that can be used. Only the most common types are discussed in this section.

Conditions of Use

As a temporary cover measure, mulch should be used:

- On disturbed areas that require cover measures for less than 30 days.
- As a cover for seed 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.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table 4.7. Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

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.

Maintenance Standards

- The thickness of the 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 4.7
Mulch Standards and Guidelines

Mulch Material	Quality Standards	Application Rates	Remarks
Straw	Air-dried; free from undesirable seed and coarse material.	2"-3" thick; 5 bales per 1000 sf or 2-3 tons per acre	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. Straw should be used only if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1000 sf or 1500 - 2000 lbs per acre	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 ¾-1 inch clog hydromulch equipment. Fibers should be kept to less than ¾ inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit (unless exempt).	2" thick min.; approx. 100 tons per acre (approx. 800 lbs per yard)	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. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fines to 6 inches in length for texture, variation, and interlocking properties.	2" minimum thickness	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 seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.
Wood-based Mulch	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.	2" thick; approx. 100 tons per acre (approx. 800 lbs. per cubic yard)	This material is often called "hog or hogged fuel." It is usable as a material for Stabilized Construction Entrances (BMP C105) and as a mulch. 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).

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. Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Synthetic nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap. 100 percent synthetic blankets manufactured for use in ditches may be easily reused as temporary ditch liners.

Disadvantages of blankets include:

- Surface preparation required;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They cost at least $4,000-6,000 per acre installed.

Advantages of blankets include:

- Can be installed without mobilizing special equipment;
- Can be installed by anyone with minimal training;
- Can be installed in stages or phases as the project progresses;
- Seed and fertilizer can be hand-placed by the installers as they progress down the slope;
- Can be installed in any weather;
- There are numerous types of blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

Design and Installation Specifications

- See Figure 4.4 and Figure 4.5 for typical orientation and installation of blankets used in channels and as slope protection. Note: these are typical only; all blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of Blankets on Slopes:
    1. Complete final grade and track walk up and down the slope.
    2. Install hydromulch with seed and fertilizer.
    3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
    4. Install the leading edge of the blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal,"U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
    5. Roll the blanket slowly down the slope as installer walks backwards. NOTE: The blanket rests against the installer's legs. Staples are installed as the blanket is unrolled. It is critical that the proper staple pattern is used for the blanket being installed. The blanket is not to be allowed to roll down the slope on its own as this stretches the blanket making it impossible to maintain soil contact. In addition, no one is allowed to walk on the blanket after it is in place.
    6. If the blanket is not long enough to cover the entire slope length, the trailing edge of the upper blanket should overlap the leading edge of the lower blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer consults the manufacturer's information and that a site visit takes place in order to insure that the product specified is appropriate. Information is also available at the following web sites:
    1. WSDOT: http://www.wsdot.wa.gov/eesc/environmental/
    2. Texas Transportation Institute: http://www.dot.state.tx.us/insdtdot/orgchart/cmd/erosion/contents.htm

- Jute matting must be used in conjunction with mulch (BMP C121). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Good contact with the ground must be maintained, and erosion must not occur beneath the net or blanket.
- Any areas of the net or blanket that are damaged or not in close contact with the ground shall be repaired and stapled.
- If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

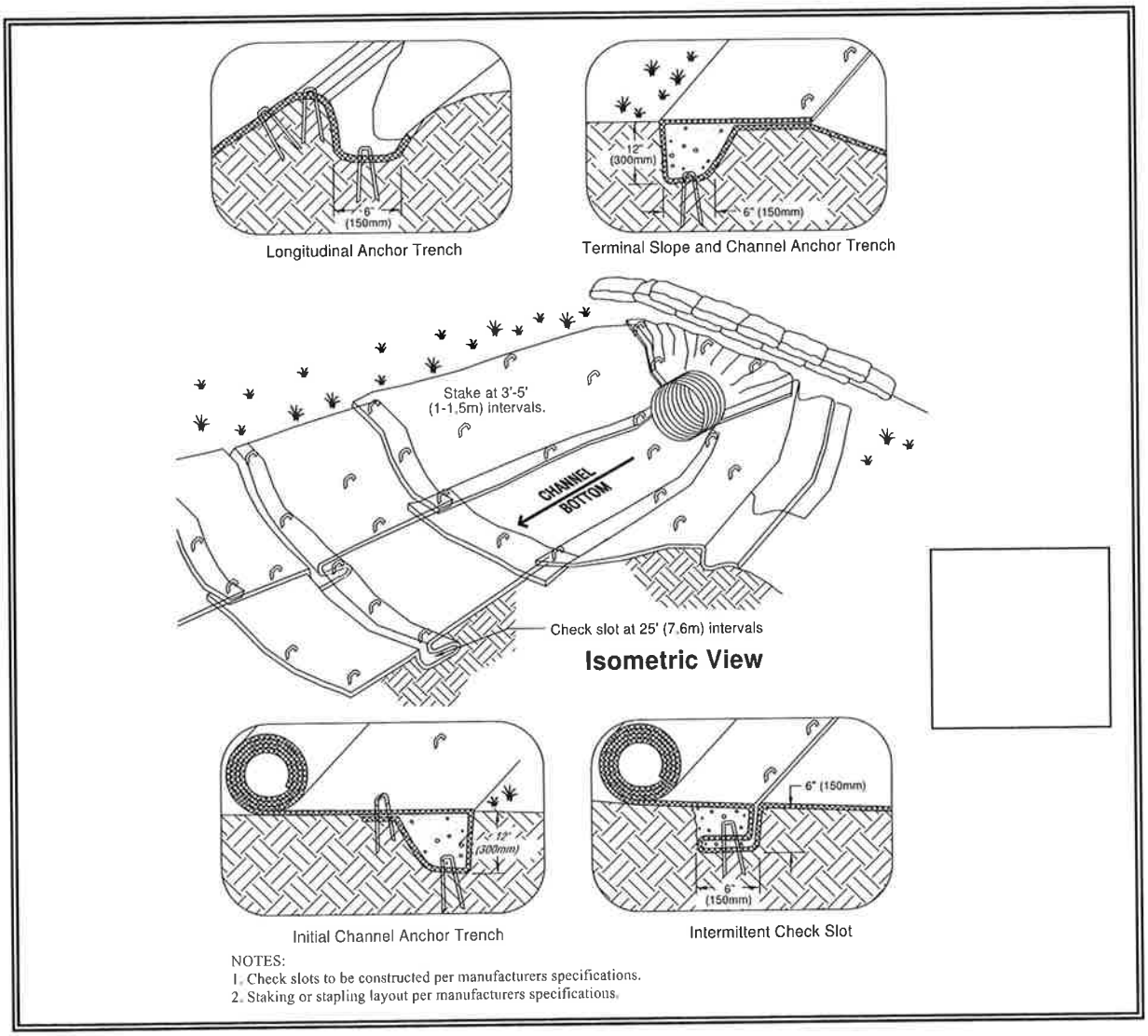


Figure 4.4 – Channel Installation

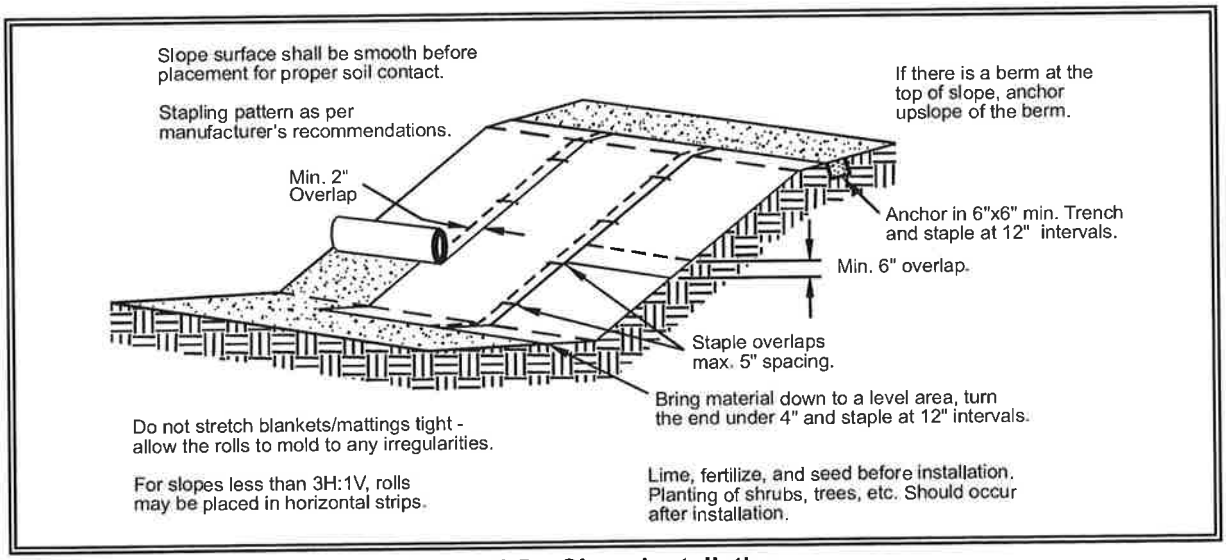


Figure 4.5 – Slope Installation

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

- Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.
- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than six months) applications.
- Clear plastic sheeting can be used over newly-seeded areas to create a greenhouse effect and encourage grass growth if the hydroseed was installed too late in the season to establish 75 percent grass cover, or if the wet season started earlier than normal. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
- Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to $1.50-2.00 per square yard.
- Whenever plastic is used to protect slopes, water collection measures must be installed at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to covey clean rainwater away from bare soil and disturbed areas. At no time is clean runoff from a plastic covered slope to be mixed with dirty runoff from a project.
- Other uses for plastic include:
    1. Temporary ditch liner;
    2. Pond liner in temporary sediment pond;
    3. Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored;
    4. Emergency slope protection during heavy rains; and,
    5. Temporary drainpipe ("elephant trunk") used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
  1. Run plastic up and down slope, not across slope;
  2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet;
  3. Minimum of 8-inch overlap at seams;
  4. On long or wide slopes, or slopes subject to wind, all seams should be taped;
  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 pound a wooden stake through each 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.
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
- When the plastic is no longer needed, it shall be completely removed.
- Dispose of old tires appropriately.

BMP C124: Sodding

Purpose

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

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:

- Shape and smooth the surface to final grade in accordance with the approved grading plan. The swale needs to be overexcavated 4 to 6 inches below design elevation to allow room for placing soil amendment and sod.
- 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. Compost used should meet Ecology publication 94-038 specifications for Grade A quality compost.
- Fertilize according to the supplier's recommendations.
- Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
- 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.
- Roll the sodded area and irrigate.
- 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

Purpose

To provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling is an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but they 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

- Native soils should be left undisturbed to the maximum extent practicable. Native soils disturbed during clearing and grading should be restored, to the maximum extent practicable, to a condition where moisture-holding capacity is equal to or better than the original site conditions. This criterion can be met by using on-site native topsoil, incorporating amendments into on-site soil, or importing blended topsoil.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.
- Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. If an existing soil system is functioning properly it shall be preserved in its undisturbed and uncompacted condition.
- Depending on where the topsoil comes from, or 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. Commercially available mycorrhiza products should be used when topsoil is brought in from off-site.

Design and Installation Specifications

If topsoiling is to be done, the following items should be considered:

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil depth shall be at least 8 inches with a minimum organic content of 10 percent dry weight and pH between 6.0 and 8.0 or matching the pH of the undisturbed soil. This can be accomplished either by returning native topsoil to the site and/or incorporating organic amendments. Organic amendments should be incorporated to a minimum 8-inch depth except where tree roots or other natural

features limit the depth of incorporation. Subsoils below the 12-inch depth should be scarified at least 2 inches to avoid stratified layers, where feasible. The decision to either layer topsoil over a subgrade or incorporate topsoil into the underlying layer may vary depending on the planting specified.

- If blended topsoil is imported, then fines should be limited to 25 percent passing through a 200 sieve.
- 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, recent practices have shown that incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- 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.
- Allow sufficient time in scheduling for topsoil to be spread prior to seeding, sodding, or planting.
- Care must be taken not to apply to subsoil if the two soils have 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 prevent a lack of bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- Ripping or re-structuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.
- 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, silt loam, sandy clay loam, clay loam). Areas of natural ground water recharge should be avoided.
- Stripping shall be confined to the immediate construction area. A 4- 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.

Stockpiling of topsoil shall occur in the following manner:

- Side slopes of the stockpile shall not exceed 2:1.
- An interceptor dike with gravel outlet and silt fence shall surround all topsoil stockpiles between October 1 and April 30. Between May 1

and September 30, an interceptor dike with gravel outlet and silt fence shall be installed if the stockpile will remain in place for a longer period of time than active construction grading.

- Erosion control seeding or covering with clear plastic or other mulching materials of stockpiles shall be completed within 2 days (October 1 through April 30) or 7 days (May 1 through September 30) of the formation of the stockpile. Native topsoil stockpiles shall not be covered with plastic.
- Topsoil shall not be placed 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.
- Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.
- 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:

  1. Topsoil is to be re-installed within 4 to 6 weeks;
  2. Topsoil is not to become saturated with water;
  3. Plastic cover is not allowed.

Maintenance Standards

- Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.

BMP C126: Polyacrylamide 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 through flocculation 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.

In areas that drain to a sediment pond, PAM can be applied to bare soil under the following conditions:

- During rough grading operations.
- 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

PAM may be applied in dissolved form with water, or it may be applied in dry, granular or powdered form. The preferred application method is the dissolved form.

PAM is to be applied at a maximum rate of 2/3 pound PAM per 1000 gallons water (80 mg/L) per 1 acre of bare soil. Table 4.8 can be used to determine the PAM and water application rate for a disturbed soil area. Higher concentrations of PAM **do not** provide any additional effectiveness.

Table 4.8
PAM and Water Application Rates

Disturbed Area (ac)	PAM (lbs)	Water (gal)
0.50	0.33	500
1.00	0.66	1,000
1.50	1.00	1,500
2.00	1.32	2,000
2.50	1.65	2,500
3.00	2.00	3,000
3.50	2.33	3,500
4.00	2.65	4,000
4.50	3.00	4,500
5.00	3.33	5,000

The Preferred Method:

- Pre-measure the area where PAM is to be applied and calculate the amount of product and water necessary to provide coverage at the specified application rate (2/3 pound PAM/1000 gallons/acre).
- PAM has infinite solubility in water, but dissolves very slowly. Dissolve pre-measured dry granular PAM with a known quantity of clean water in a bucket several hours or overnight. Mechanical mixing will help dissolve the PAM. Always add PAM to water - not water to PAM.
- Pre-fill the water truck about 1/8 full with water. The water does not have to be potable, but it must have relatively low turbidity – in the range of 20 NTU or less.
- Add PAM /Water mixture to the truck
- Completely fill the water truck to specified volume.
- Spray PAM/Water mixture onto dry soil until the soil surface is uniformly and completely wetted.

An Alternate Method:

PAM may also be applied as a powder at the rate of 5 lbs. per acre. This must be applied on a day that is dry. For areas less than 5-10 acres, a hand-held "organ grinder" fertilizer spreader set to the smallest setting will work. Tractor-mounted spreaders will work for larger areas.

The following shall be used for application of PAM:

- PAM shall be used in conjunction with other BMPs and not in place of other BMPs.
- Do not use PAM on a slope that flows directly into a stream or wetland. The stormwater runoff shall pass through a sediment control BMP prior to discharging to surface waters.
- Do not add PAM to water discharging from site.
- When the total drainage area is greater than or equal to 5 acres, PAM treated areas shall drain to a sediment pond.
- Areas less than 5 acres shall drain to sediment control BMPs, such as a minimum of 3 check dams per acre. The total number of check dams used shall be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam shall be spaced evenly in the drainage channel through which stormwater flows are discharged off-site.
- On all sites, the use of silt fence shall be maximized to limit the discharges of sediment from the site.
- All areas not being actively worked shall be covered and protected from rainfall. PAM shall not be the only cover BMP used.

- PAM can be applied to wet soil, but dry soil is preferred due to less sediment loss.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- Proper application and re-application plans are necessary to ensure total effectiveness of PAM usage.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over-spray from reaching pavement as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water-this only makes cleanup messier and take longer.
- Some PAMs are more toxic and carcinogenic than others. Only the most environmentally safe PAM products should be used.

  The specific PAM copolymer formulation must be anionic. **Cationic PAM shall not be used in any application because of known aquatic toxicity problems.** Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, will be used for soil applications. Recent media attention and high interest in PAM has resulted in some entrepreneurial exploitation of the term "polymer." All PAM are polymers, but not all polymers are PAM, and not all PAM products comply with ANSI/NSF Standard 60. PAM use shall be reviewed and approved by the local permitting authority. The Washington State Department of Transportation (WSDOT) has listed approved PAM products on their web page.
- PAM designated for these uses should be "water soluble" or "linear" or "non-crosslinked". Cross-linked or water absorbent PAM, polymerized in highly acidic (pH<2) conditions, are used to maintain soil moisture content.
- The PAM anionic charge density may vary from 2-30 percent; a value of 18 percent is typical. Studies conducted by the United States Department of Agriculture (USDA)/ARS demonstrated that soil stabilization was optimized by using very high molecular weight (12-15 mg/mole), highly anionic (>20% hydrolysis) PAM.
- PAM tackifiers are available and being used in place of guar and alpha plantago. Typically, PAM tackifiers should be used at a rate of no more than 0.5-1 lb. per 1000 gallons of water in a hydromulch machine. Some tackifier product instructions say to use at a rate of 3 –

5 lbs. per acre, which can be too much. In addition, pump problems can occur at higher rates due to increased viscosity.

Maintenance Standards

- PAM may be reapplied on actively worked areas after a 48-hour period.
- Reapplication is not required unless PAM treated soil is disturbed or unless turbidity levels show the need for an additional application. If PAM treated soil is left undisturbed a reapplication may be necessary after two months. More PAM applications may be required for steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas. When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.
- Loss of sediment and PAM may be a basis for penalties per RCW 90.48.080.

BMP C130: Surface Roughening

Purpose

Surface roughening aids in the establishment of vegetative cover, reduces runoff velocity, increases infiltration, and provides for sediment trapping through the provision of a rough soil surface. Horizontal depressions are created by operating a tiller or other suitable equipment on the contour or by leaving slopes in a roughened condition by not fine grading them.

Conditions for Use

- All slopes steeper than 3:1 and greater than 5 vertical feet require surface roughening.
- Areas with grades steeper than 3:1 should be roughened to a depth of 2 to 4 inches prior to seeding.
- Areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
- Slopes with a stable rock face do not require roughening.
- Slopes where mowing is planned should not be excessively roughened.

Design and Installation Specifications

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure 4.6 for tracking and contour furrows. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

- Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.
- Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material that sloughs from above, and provides a level site where vegetation can become established. Stairs should be wide enough to work with standard earth moving equipment. Stair steps must be on contour or gullies will form on the slope.
- Areas that will be mowed (these areas should have slopes less steep than 3:1) may have small furrows left by disking, harrowing, raking, or seed-planting machinery operated on the contour.
- Graded areas with slopes greater than 3:1 but less than 2:1 should be roughened before seeding. This can be accomplished in a variety of ways, including "track walking," or driving a crawler tractor up and down the slope, leaving a pattern of cleat imprints parallel to slope contours.
- Tracking is done by operating equipment up and down the slope to leave horizontal depressions in the soil.

Maintenance Standards

- Areas that are graded in this manner should be seeded as quickly as possible.
- Regular inspections should be made of the area. If rills appear, they should be re-graded and re-seeded immediately.

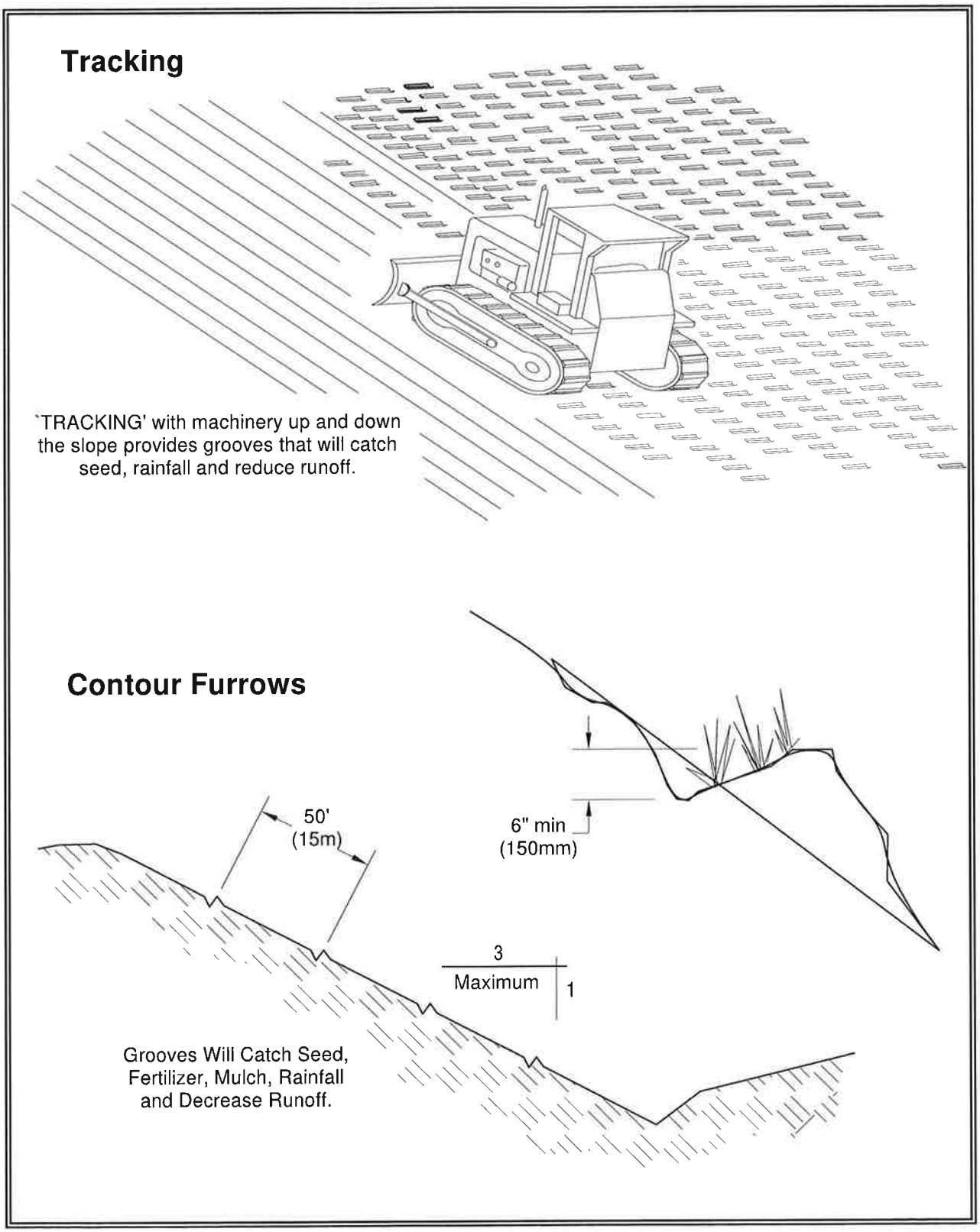


Figure 4.6 – Surface Roughening by Tracking and Contour Furrows

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

Conditions of Use

- In areas (including roadways) subject to surface and air movement of dust where on-site and off-site impacts to roadways, drainage ways, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition, if stable. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control, especially in eastern Washington. Since the wholesale cost of PAM is about $ 4.00 per pound, this is an extremely cost-effective dust control method.

Techniques that can be used for unpaved roads and lots include:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
- Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.

- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. This BMP is intended to minimize and eliminate concrete process water and slurry from entering waters of the state.

Conditions of Use

Any time concrete is used, these management practices shall be utilized. Concrete construction projects include, but are not limited to, the following:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Design and Installation Specifications

- Concrete truck chutes, pumps, and internals shall be washed out only into formed areas awaiting installation of concrete or asphalt.
- Unused concrete remaining in the truck and pump shall be returned to the originating batch plant for recycling.
- Hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels shall be washed off only into formed areas awaiting installation of concrete or asphalt.
- Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed stormwater conveyances.
- Washdown from areas such as concrete aggregate driveways shall not drain directly to natural or constructed stormwater conveyances.
- When no formed areas are available, washwater and leftover product shall be contained in a lined container. Contained concrete shall be disposed of in a manner that does not violate groundwater or surface water quality standards.

Maintenance Standards

Containers shall be checked for holes in the liner daily during concrete pours and repaired the same day.

[Excerpt, see entire document at http://www.ecy.wa.gov/pubs/0510030.pdf]

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state

- The CESCL shall:
  - Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).

    Ecology will maintain a list of ESC training and certification providers at: www.ecy.wa.gov/programs/wq/stormwater.

  OR

  - Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: www.cpesc.net

Specifications

- Certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, on call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

- Maintaining permit file on site at all times which includes the SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.
- Updating all project drawings and the Construction SWPPP with changes made.

- Keeping daily logs, and inspection reports. Inspection reports should include:
    - Inspection date/time.
    - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
    - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:

      1) Locations of BMPs inspected,

      2) Locations of BMPs that need maintenance,

      3) Locations of BMPs that failed to operate as designed or intended, and

      4) Locations of where additional or different BMPs are required.
    - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
    - Any water quality monitoring performed during inspection.
    - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

Minimum Requirements for ESC Training and Certification Courses

General Requirements

1. The course shall teach the construction stormwater pollution prevention guidance provided in the most recent version of:
    a. The Washington State Dept. of Ecology Stormwater Management Manual for Western Washington,
    b. Other equivalent stormwater management manuals approved by Ecology.

2. Upon completion of course, each attendee shall receive documentation of certification, including, at a minimum, a wallet-sized card that certifies completion of the course. Certification shall remain valid for three years. Recertification may be obtained by completing the 8-hour refresher course or by taking the initial 16-hour training course again.

3. The initial certification course shall be a minimum of 16 hours (with a reasonable time allowance for lunch, breaks, and travel to and from field) and include a field element and test.
    a. The field element must familiarize students with the proper installation, maintenance and inspection of common erosion and sediment control BMPs including, but not limited to, blankets, check dams, silt fence, straw mulch, plastic, and seeding.
    b. The test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.

4. The refresher course shall be a minimum of 8 hours and include a test.
    a. The refresher course shall include:
        i. Applicable updates to the Stormwater Management Manual that is used to teach the course, including new or updated BMPs; and
        ii. Applicable changes to the NPDES General Permit for Construction Activities.
    b. The refresher course test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.
    c. The refresher course may be taught using an alternative format (e.g. internet, CD ROM, etc.) if the module is approved by Ecology.

Required Course Elements

1. Erosion and Sedimentation Impacts
    a. Examples/Case studies

2. Erosion and Sedimentation Processes
    a. Definitions
    b. Types of erosion
    c. Sedimentation
        i. Basic settling concepts
        ii. Problems with clays/turbidity

3. Factors Influencing Erosion Potential
    a. Soil
    b. Vegetation
    c. Topography
    d. Climate

4. Regulatory Requirements
    a. NPDES - Construction Stormwater General Permit
    b. Local requirements and permits
    c. Other regulatory requirements

5. Stormwater Pollution Prevention Plan (SWPPP)
    a. SWPPP is a living document – should be revised as necessary
    b. 12 Elements of a SWPPP; discuss suggested BMPs (with examples)
        1. Mark Clearing Limits
        2. Establish Construction Access
        3. Control Flow Rates
        4. Install Sediment Controls
        5. Stabilize Soils
        6. Protect Slopes
        7. Protect Drain Inlets
        8. Stabilize Channels and Outlets
        9. Control Pollutants
        10. Control De-watering
        11. Maintain BMPs
        12. Manage the Project

6. Monitoring/Reporting/Recordkeeping
    a. Site inspections/visual monitoring
        i. Disturbed areas
        ii. BMPs
        iii. Stormwater discharge points
    b. Water quality sampling/analysis
        i. Turbidity
        ii. pH
    c. Monitoring frequency
        i. Set by NPDES permit
        ii. Inactive sites - reduced frequency

d. Adaptive Management
    i. When monitoring indicates problem, take appropriate action (e.g. install/maintain BMPs)
    ii. Document the corrective action(s) in SWPPP
e. Reporting
    i. Inspection reports/checklists
    ii. Discharge Monitoring Reports (DMR)
    iii. Non-compliance notification

Instructor Qualifications

1. Instructors must be qualified to effectively teach the required course elements.

2. At a minimum, instructors must have:

    a. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC), or
    b. Completed a training program for teaching the required course elements, or
    c. The academic credentials and instructional experience necessary for teaching the required course elements.

3. Instructors must demonstrate competent instructional skills and knowledge of the applicable subject matter.

4.2 Runoff Conveyance and Treatment BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a ridge of compacted soil, or a ridge with an upslope swale, at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Where the runoff from an exposed site or disturbed slope must be conveyed to an erosion control facility which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment basin.

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Channel requires a positive grade for drainage; steeper grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Sub-basin tributary area should be one acre or less.
- Design capacity for the peak flow from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution, for temporary facilities. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model. For facilities that will also serve on a permanent basis, consult the local government's drainage requirements.

Interceptor dikes shall meet the following criteria:

Top Width	2 feet minimum.
Height	1.5 feet minimum on berm.
Side Slope	2:1 or flatter.
Grade	Depends on topography, however, dike system minimum is 0.5%, maximum is 1%.
Compaction	Minimum of 90 percent ASTM D698 standard proctor.

Horizontal Spacing of Interceptor Dikes:

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Stabilization depends on velocity and reach

Slopes <5% Seed and mulch applied within 5 days of dike construction (*see BMP C121, Mulching*).

Slopes 5 - 40% Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap or other measures to avoid erosion.

- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

Interceptor swales shall meet the following criteria:

Bottom Width	2 feet minimum; the bottom shall be level.
Depth	1-foot minimum.
Side Slope	2:1 or flatter.
Grade	Maximum 5 percent, with positive drainage to a suitable outlet (such as a sediment pond).
Stabilization	Seed as per *BMP C120, Temporary and Permanent Seeding*, or *BMP C202, Channel Lining*, 12 inches thick of riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.

Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C201: Grass-Lined Channels

Purpose

To provide a channel with a vegetative lining for conveyance of runoff. See Figure 4.7 for typical grass-lined channels.

Conditions of Use

This practice applies to construction sites where concentrated runoff needs to be contained to prevent erosion or flooding.

- When a vegetative lining can provide sufficient stability for the channel cross section and at lower velocities of water (normally dependent on grade). This means that the channel slopes are generally less than 5 percent and space is available for a relatively large cross section.
- Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage ditches in low areas.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a bonded fiber matrix (BFM). The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch in lieu of hydromulch and blankets.

Design and Installation Specifications

Locate the channel where it can conform to the topography and other features such as roads.

- Locate them to use natural drainage systems to the greatest extent possible.
- Avoid sharp changes in alignment or bends and changes in grade.
- Do not reshape the landscape to fit the drainage channel.
- The maximum design velocity shall be based on soil conditions, type of vegetation, and method of revegetation, but at no times shall velocity exceed 5 feet/second. The channel shall not be overtopped by the peak runoff from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution." Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model to determine a flow rate which the channel must contain.
- Where the grass-lined channel will also function as a permanent stormwater conveyance facility, consultant the drainage conveyance requirements of the local government with jurisdiction.
- An **established** grass or vegetated lining is required before the channel can be used to convey stormwater, unless stabilized with nets or blankets.

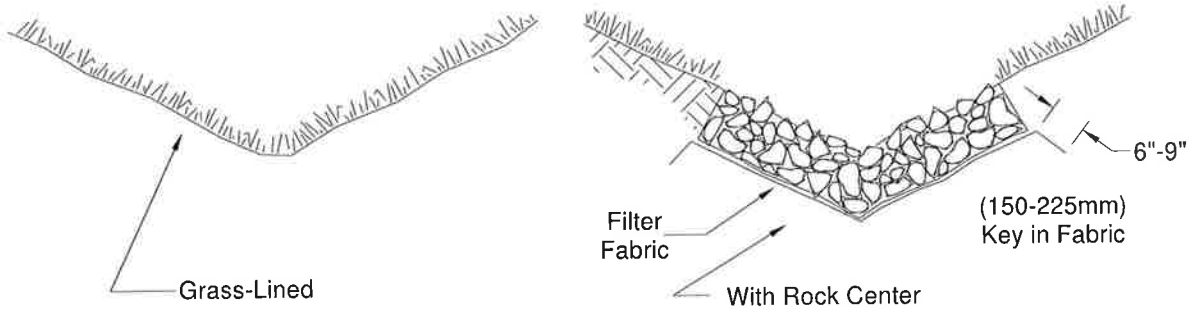
- If design velocity of a channel to be vegetated by seeding exceeds 2 ft/sec, a temporary channel liner is required. Geotextile or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established. See Figure 4.9.
- Check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- If vegetation is established by sodding, the permissible velocity for established vegetation may be used and no temporary liner is needed.
- Do not subject grass-lined channel to sedimentation from disturbed areas. Use sediment-trapping BMPs upstream of the channel.
- **V-shaped grass channels** generally apply where the quantity of water is small, such as in short reaches along roadsides. The V-shaped cross section is least desirable because it is difficult to stabilize the bottom where velocities may be high.
- **Trapezoidal grass channels** are used where runoff volumes are large and slope is low so that velocities are nonerosive to vegetated linings. (Note: it is difficult to construct small parabolic shaped channels.)
- Subsurface drainage, or riprap channel bottoms, may be necessary on sites that are subject to prolonged wet conditions due to long duration flows or a high water table.
- Provide outlet protection at culvert ends and at channel intersections.
- Grass channels, at a minimum, should carry peak runoff for temporary construction drainage facilities from the 10-year, 24-hour storm without eroding. Where flood hazard exists, increase the capacity according to the potential damage.
- Grassed channel side slopes generally are constructed 3:1 or flatter to aid in the establishment of vegetation and for maintenance.
- Construct channels a minimum of 0.2 foot larger around the periphery to allow for soil bulking during seedbed preparations and sod buildup.

Maintenance Standards

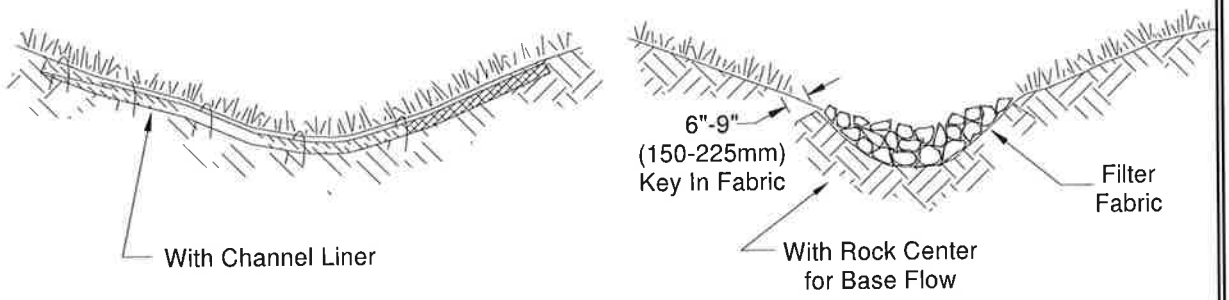
During the establishment period, check grass-lined channels after every rainfall.

- After grass is established, periodically check the channel; check it after every heavy rainfall event. Immediately make repairs.
- It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes.
- Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

Typical V-Shaped Channel Cross-section



Typical Parabolic Channel Cross-Section



Typical Trapezoidal Channel Cross-Section

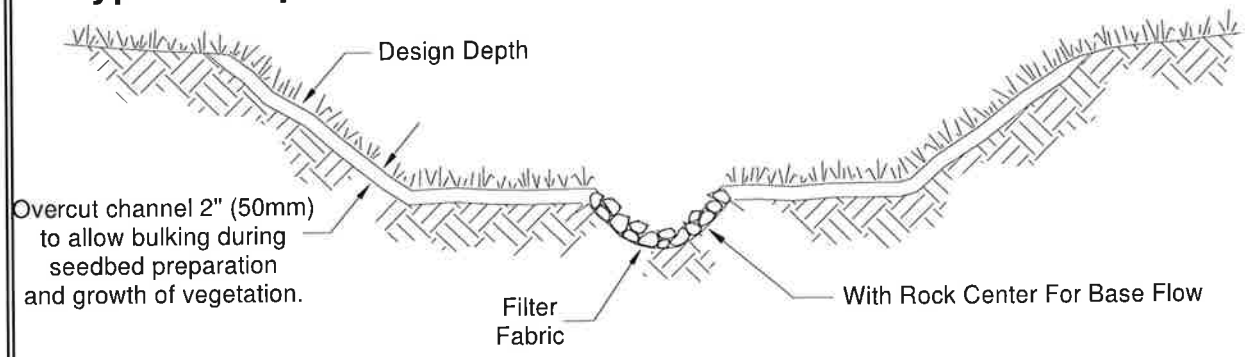
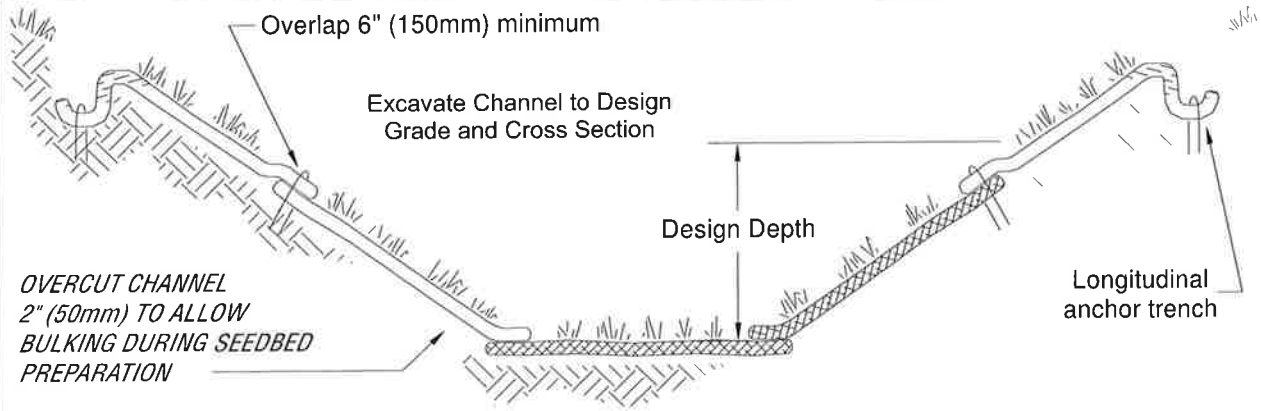
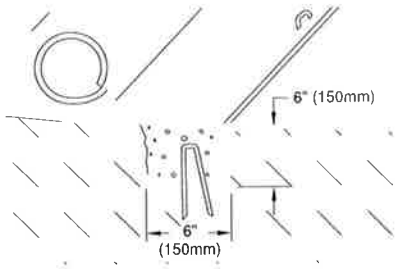


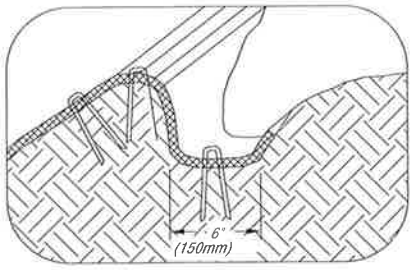
Figure 4.8 – Typical Grass-Lined Channels



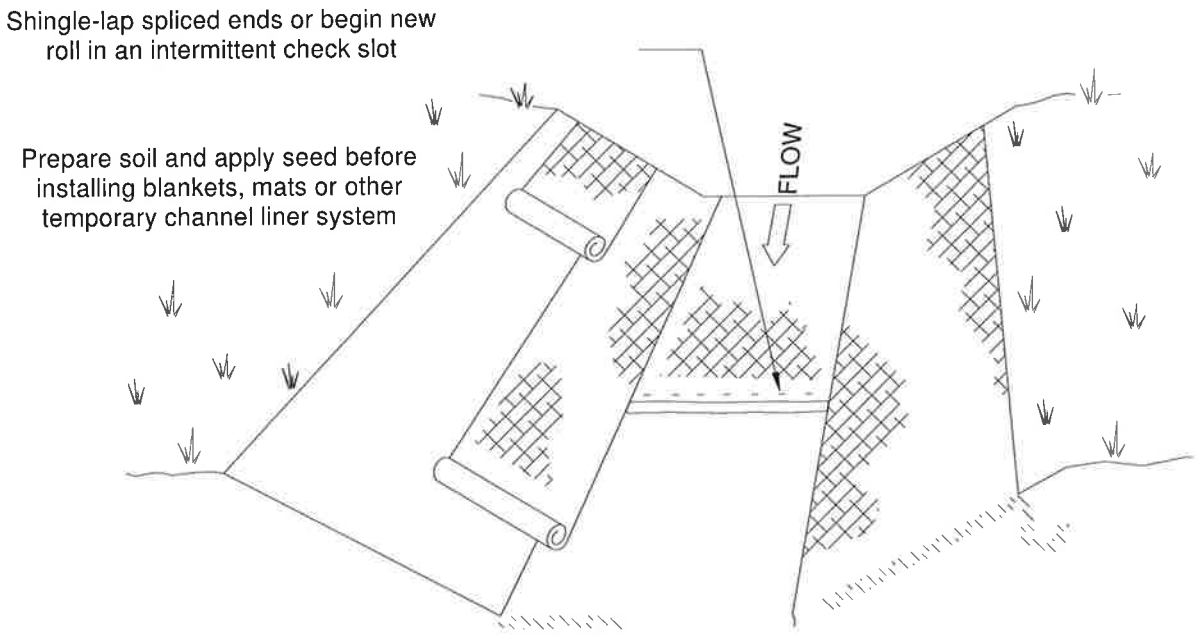


Intermittent Check Slot

TYPICAL INSTALLATION WITH EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS



Longitudinal Anchor Trench



NOTES:
1. Design velocities exceeding 2 ft/sec (0.5m/sec) require temporary blankets, mats or similar liners to protect seed and soil until vegetation becomes established.
2. Grass-lined channels with design velocities exceeding 6 ft/sec (2m/sec) should include turf reinforcement mats.

Figure 4.9 – Temporary Channel Liners

BMP C202: Channel Lining

Purpose

To protect erodible channels by providing a channel liner using either blankets or riprap.

Conditions of Use

When natural soils or vegetated stabilized soils in a channel are not adequat to prevent channel erosion.

- When a permanent ditch or pipe system is to be installed and a temporary measure is needed.
- In almost all cases, synthetic and organic coconut blankets are more effective than riprap for protecting channels from erosion. Blankets can be used with and without vegetation. Blanketed channels can be designed to handle any expected flow and longevity requirement. Some synthetic blankets have a predicted life span of 50 years or more, even in sunlight.
- Other reasons why blankets are better than rock include the availability of blankets over rock. In many areas of the state, rock is not easily obtainable or is very expensive to haul to a site. Blankets can be delivered anywhere. Rock requires the use of dump trucks to haul and heavy equipment to place. Blankets usually only require laborers with hand tools, and sometimes a backhoe.
- The Federal Highway Administration recommends not using flexible liners whenever the slope exceeds 10 percent or the shear stress exceeds 8 lbs/ft^2.

Design and Installation Specifications

See BMP C122 for information on blankets.

Since riprap is used where erosion potential is high, construction must be sequenced so that the riprap is put in place with the minimum possible delay.

- Disturbance of areas where riprap is to be placed should be undertaken only when final preparation and placement of the riprap can follow immediately behind the initial disturbance. Where riprap is used for outlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that it is in place when the pipe or channel begins to operate.
- The designer, after determining the riprap size that will be stable under the flow conditions, shall consider that size to be a minimum size and then, based on riprap gradations actually available in the area, select the size or sizes that equal or exceed the minimum size. The possibility of drainage structure damage by children shall be considered in selecting a riprap size, especially if there is nearby water or a gully in which to toss the stones.
- Stone for riprap shall consist of field stone or quarry stone of approximately rectangular shape. The stone shall be hard and angular and of such quality that it will not disintegrate on exposure to water or

weathering and it shall be suitable in all respects for the purpose intended.

- Rubble concrete may be used provided it has a density of at least 150 pounds per cubic foot, and otherwise meets the requirement of this standard and specification.
- A lining of engineering filter fabric (geotextile) shall be placed between the riprap and the underlying soil surface to prevent soil movement into or through the riprap. The geotextile should be keyed in at the top of the bank.
- Filter fabric shall not be used on slopes greater than 1-1/2:1 as slippage may occur. It should be used in conjunction with a layer of coarse aggregate (granular filter blanket) when the riprap to be placed is 12 inches and larger.

BMP C207: Check Dams

Purpose

Construction of small dams across a swale or ditch reduces the velocity of concentrated flow and dissipates energy at the check dam.

Conditions of Use

Where temporary channels or permanent channels are not yet vegetated, channel lining is infeasible, and velocity checks are required.

- Check dams may not be placed in streams unless approved by the State Department of Fish and Wildlife. Check dams may not be placed in wetlands without approval from a permitting agency.
- Check dams shall not be placed below the expected backwater from any salmonid bearing water between October 1 and May 31 to ensure that there is no loss of high flow refuge habitat for overwintering juvenile salmonids and emergent salmonid fry.

Design and Installation Specifications

Whatever material is used, the dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the dam rather than falling directly onto the ditch bottom.

Check dams in association with sumps work more effectively at slowing flow and retaining sediment than just a check dam alone. A deep sump should be provided immediately upstream of the check dam.

- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.
- Check dams can be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose. They tend to be re-usable, quick and easy to install, effective, and cost efficient.
- Check dams should be placed perpendicular to the flow of water.
- The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Keep the maximum height at 2 feet at the center of the dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2:1 or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.

- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, this is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- Rock check dams shall be constructed of appropriately sized rock. The rock must be placed by hand or by mechanical means (no dumping of rock to form dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges. The rock used must be large enough to stay in place given the expected design flow through the channel.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones. Figure 4.13 depicts a typical rock check dam.

Maintenance Standards

Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall. Sediment shall be removed when it reaches one half the sump depth.

- Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam.
- If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel.

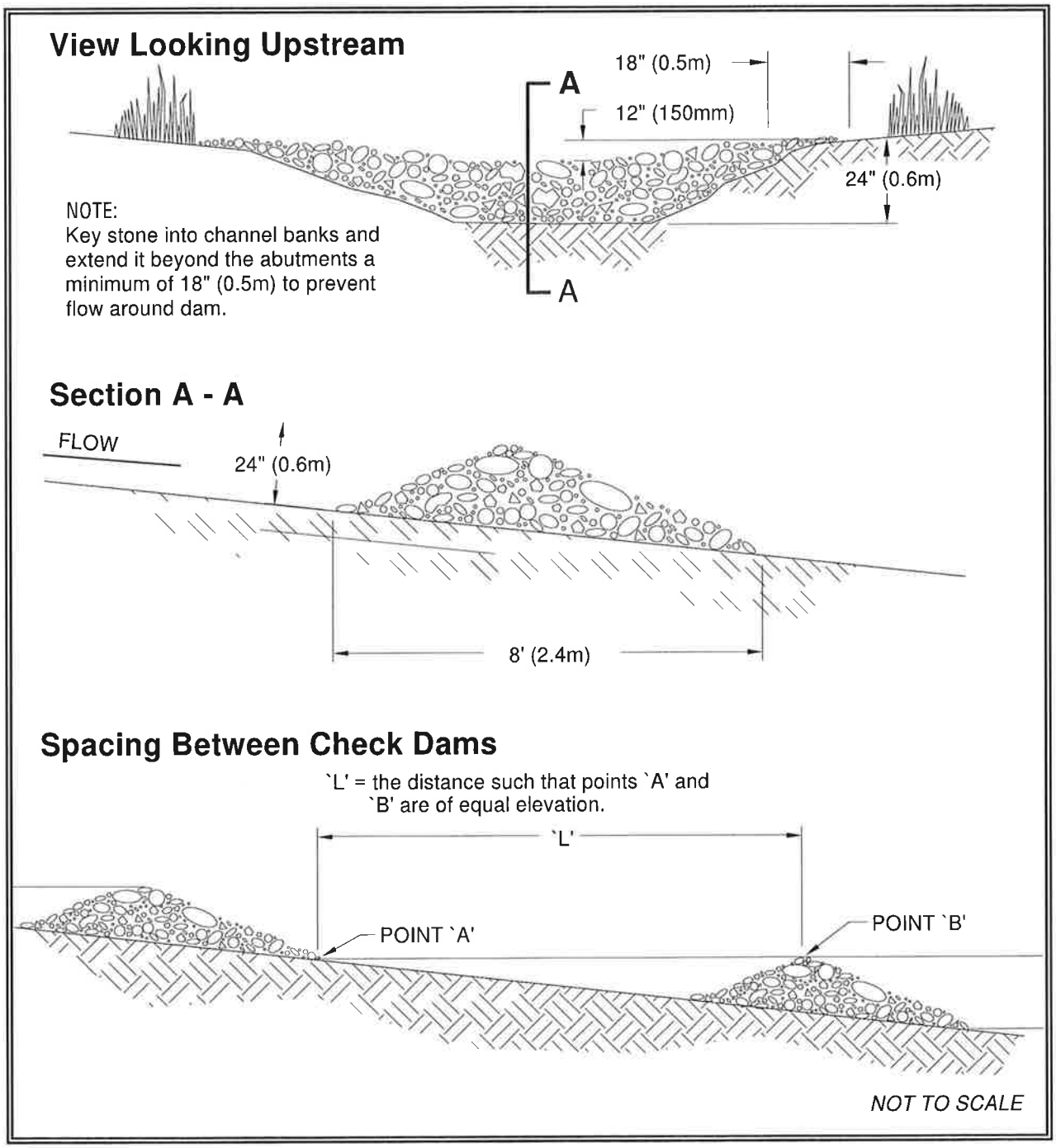


Figure 4.13 – Check Dams

BMP C208: Triangular Silt Dike (Geotextile-Encased Check Dam)

Purpose

Triangular silt dikes may be used as check dams, for perimeter protection, for temporary soil stockpile protection, for drop inlet protection, or as a temporary interceptor dike.

Conditions of use

May be used in place of straw bales for temporary check dams in ditches of any dimension.

- May be used on soil or pavement with adhesive or staples.
- TSDs have been used to build temporary:

  1. sediment ponds;
  2. diversion ditches;
  3. concrete wash out facilities;
  4. curbing;
  5. water bars;
  6. level spreaders; and,
  7. berms.

Design and Installation Specifications

Made of urethane foam sewn into a woven geosynthetic fabric.

It is triangular, 10 inches to 14 inches high in the center, with a 20-inch to 28-inch base. A 2–foot apron extends beyond both sides of the triangle along its standard section of 7 feet. A sleeve at one end allows attachment of additional sections as needed.

- Install with ends curved up to prevent water from flowing around the ends.
- The fabric flaps and check dam units are attached to the ground with wire staples. Wire staples should be No. 11 gauge wire and should be 200 mm to 300 mm in length.
- When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled.
- Check dams should be located and installed as soon as construction will allow.
- Check dams should be placed perpendicular to the flow of water.
- When used as check dams, the leading edge must be secured with rocks, sandbags, or a small key slot and staples.
- In the case of grass-lined ditches and swales, check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.

Maintenance Standards

- Triangular silt dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall.

Sediment shall be removed when it reaches one half the height of the dam.

- Anticipate submergence and deposition above the triangular silt dam and erosion from high flows around the edges of the dam. Immediately repair any damage or any undercutting of the dam.

BMP C220: Storm Drain Inlet Protection

Purpose

To prevent coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. Protection should be provided for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless the runoff that enters the catch basin will be conveyed to a sediment pond or trap. Inlet protection may be used anywhere to protect the drainage system. It is likely that the drainage system will still require cleaning.

Table 4.9 lists several options for inlet protection. All of the methods for storm drain inlet protection are prone to plugging and require a high frequency of maintenance. Drainage areas should be limited to 1 acre or less. Emergency overflows may be required where stormwater ponding would cause a hazard. If an emergency overflow is provided, additional end-of-pipe treatment may be required.

Table 4.9
Storm Drain Inlet Protetion

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding will occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area Requirement: 30' X 30'/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		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 a 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			18 month expected life.

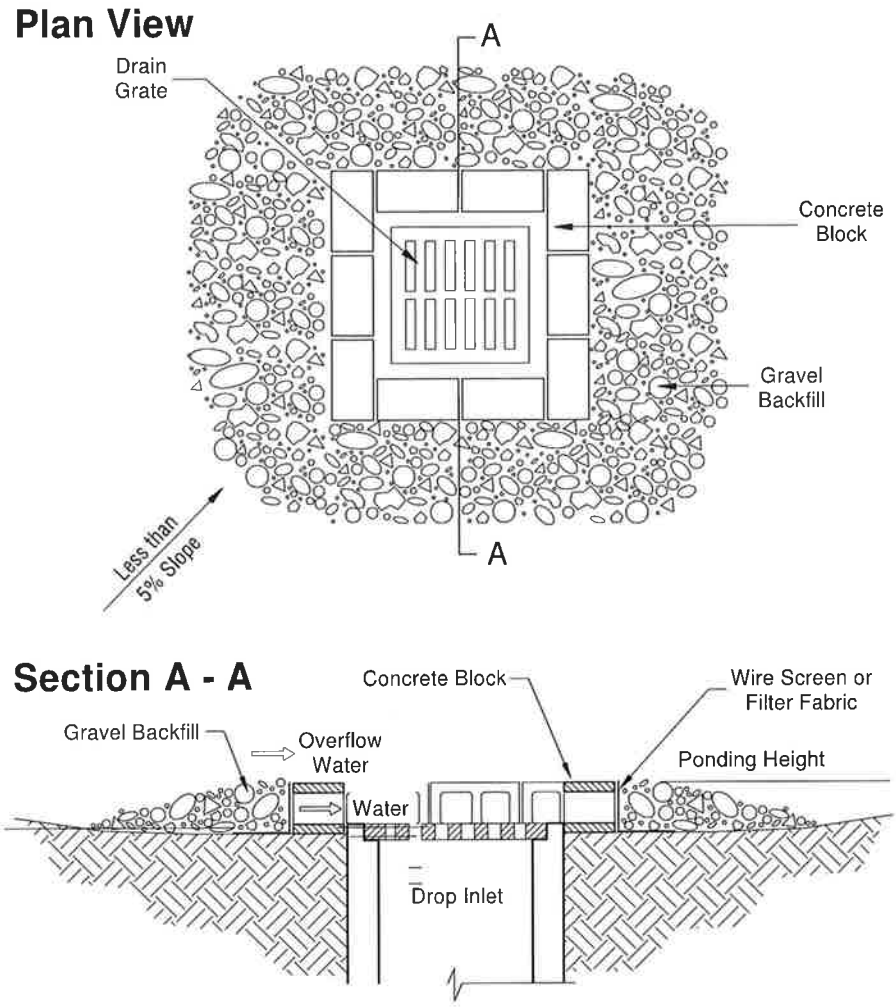
Design and Installation Specifications

Excavated Drop Inlet Protection - An excavated impoundment around the storm drain. Sediment settles out of the stormwater prior to entering the storm drain.

- Depth 1-2 ft as measured from the crest of the inlet structure.
- Side Slopes of excavation no steeper than 2:1.
- Minimum volume of excavation 35 cubic yards.
- Shape basin to fit site with longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water problems.
- Clear the area of all debris.
- 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.
- It may be necessary to build a temporary dike to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter - A barrier formed around the storm drain inlet with standard concrete blocks and gravel. See Figure 4.14.

- Height 1 to 2 feet above inlet.
- Recess the first row 2 inches into the ground for stability.
- Support subsequent courses by placing a 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel just below the top of blocks on slopes of 2:1 or flatter.
- An alternative design is a gravel donut.
- Inlet slope of 3:1.
- Outlet slope of 2:1.
- 1-foot wide level stone area between the structure and the inlet.
- Inlet slope stones 3 inches in diameter or larger.
- Outlet slope use gravel ½- to ¾-inch at a minimum thickness of 1-foot.



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 dowslope side of the structure.

Figure 4.14 – Block and Gravel Filter

Gravel and Wire Mesh Filter - A gravel barrier placed over the top of the inlet. This structure does not provide an overflow.

- Hardware cloth or comparable wire mesh with ½-inch openings.
- Coarse aggregate.
- Height 1-foot or more, 18 inches wider than inlet on all sides.
- Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
- If more than one strip of mesh is necessary, overlap the strips.
- Place coarse aggregate over the wire mesh.
- The depth of the gravel should be at least 12 inches over the entire inlet opening and extend at least 18 inches on all sides.

Catchbasin Filters - Inserts should be designed by the manufacturer for use at construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. The maintenance requirements can be reduced by combining a catchbasin 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.

- 5 cubic feet of storage.
- Dewatering provisions.
- High-flow bypass that will not clog under normal use at a construction site.
- The catchbasin filter is inserted in the catchbasin just below the grating.

Curb Inlet Protection with Wooden Weir – Barrier formed around a curb inlet with a wooden frame and gravel.

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

Block and Gravel Curb Inlet Protection – Barrier formed around an inlet with concrete blocks and gravel. See Figure 4.14.

- 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.

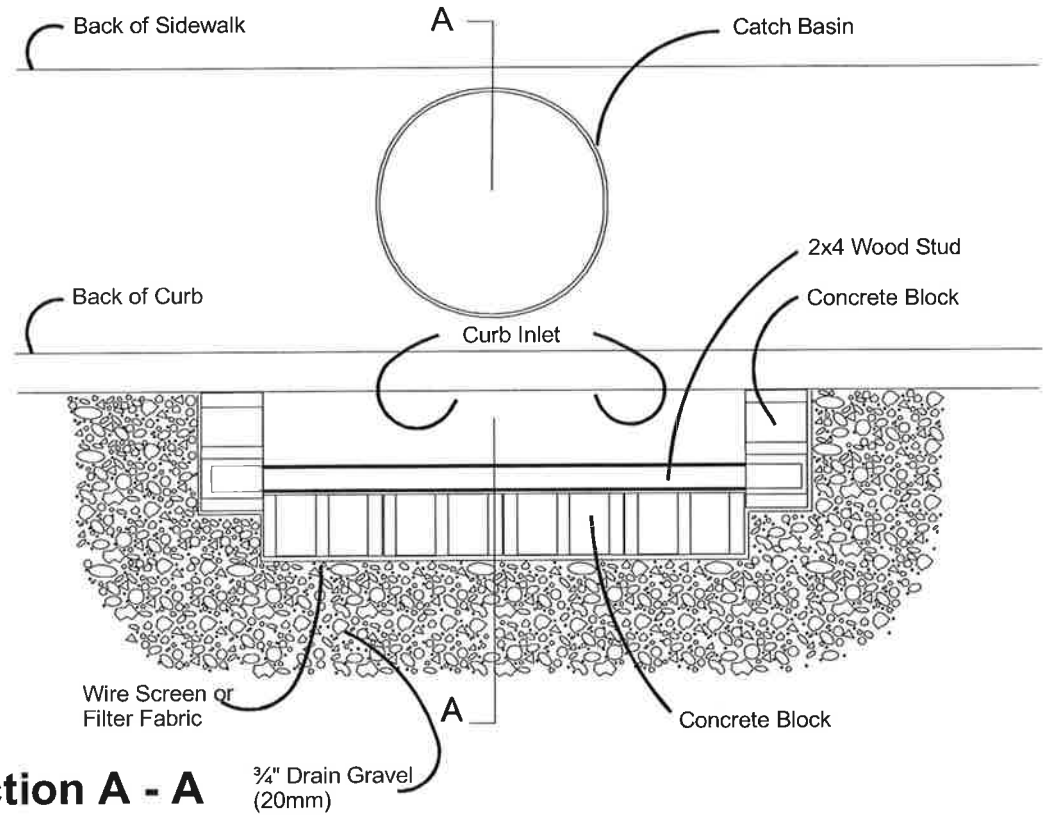
Curb and Gutter Sediment Barrier – Sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure 4.16.

- 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 outside of the berm sized to sediment trap standards for protecting a culvert inlet.

Maintenance Standards

- Catch basin filters should be inspected frequently, especially after storm events. If the insert becomes clogged, it should be cleaned or replaced.
- For systems using stone filters: If the stone filter becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced. Since cleaning of gravel at a construction site may be difficult, an alternative approach would be to use the clogged stone as fill and put fresh stone 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.

Plan View



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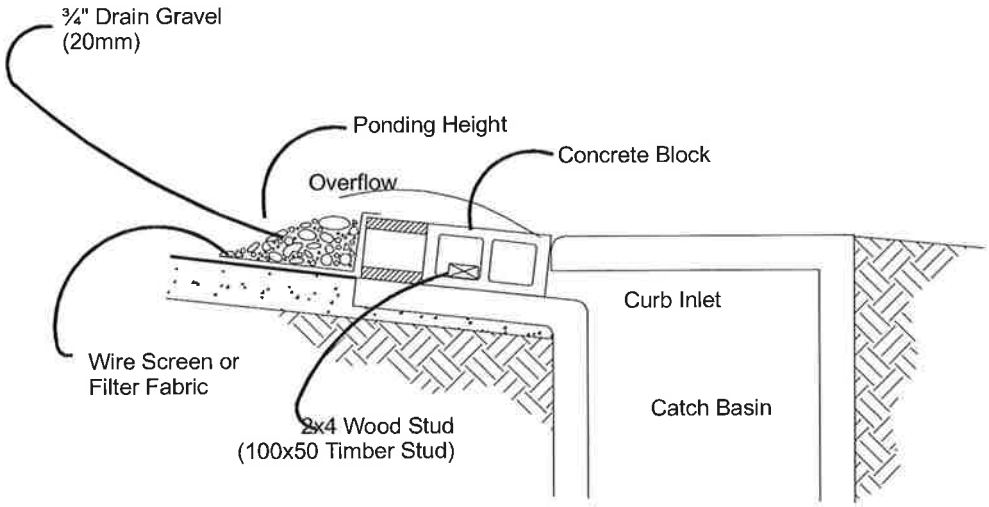
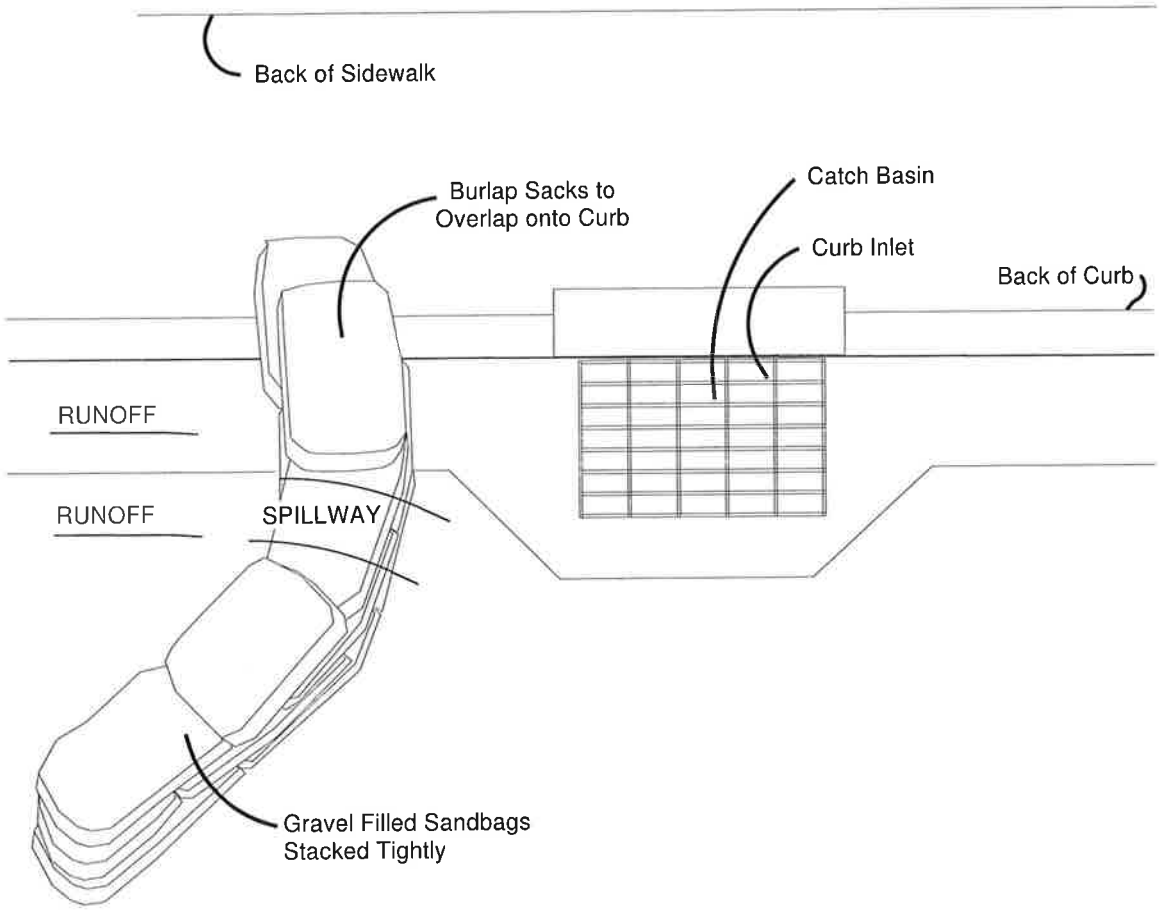


NOTES:
1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

Figure 4.15 – Block and Gravel Curb Inlet Protection

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.

Figure 4.16 – Curb and Gutter Barrier

BMP C233: Silt Fence

Purpose

Use of a 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. See Figure 4.19 for details on silt fence construction.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a silt fence, rather than by a sediment pond, is when the area draining to the fence is one acre or less and flow rates are less than 0.5 cfs.
- Silt fences should not be constructed in streams or used in V-shaped ditches. They are not an adequate method of silt control for anything deeper than sheet or overland flow.

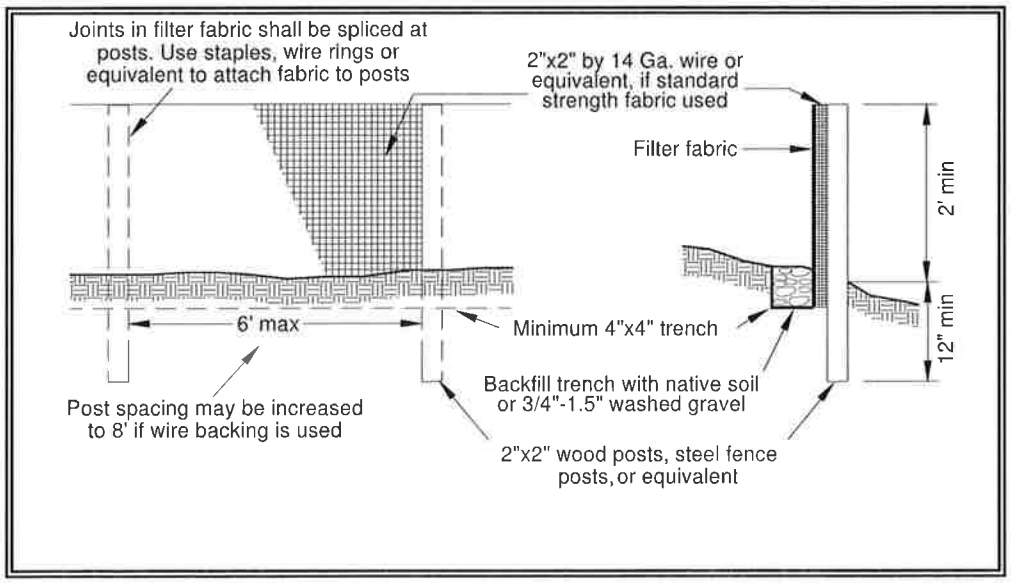


Figure 4.19 – Silt Fence

Design and Installation Specifications

- Drainage area of 1 acre or less or in combination with sediment basin in a larger site.
- Maximum slope steepness (normal (perpendicular) to fence line) 1:1.
- Maximum sheet or overland flow path length to the fence of 100 feet.
- No flows greater than 0.5 cfs.
- The geotextile used shall meet 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 4.10):

Table 4.10 Geotextile Standards	
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film wovens (#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

- Standard strength fabrics shall be supported with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the fabric. Silt fence materials are available that have synthetic mesh backing attached.
- Filter fabric 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.
- 100 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 local regulations.
- Standard Notes for construction plans and specifications follow. Refer to Figure 4.19 for standard silt fence details.

  The contractor shall install and maintain temporary silt fences at the locations shown in the Plans. The silt fences shall be constructed in the areas of clearing, grading, or drainage prior to starting those activities. A silt fence shall not be considered temporary if the silt fence must function beyond the life of the contract. The silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.

  The minimum height of the top of silt fence shall be 2 feet and the maximum height shall be 2½ feet above the original ground surface.

  The geotextile shall be sewn together at the point of manufacture, or at an approved location as determined by the Engineer, to form geotextile lengths as required. All sewn seams shall be located at a support post. Alternatively, two sections of silt fence can be overlapped, provided the Contractor can demonstrate, to the satisfaction of the Engineer, that the overlap is long enough and that the adjacent fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.

The geotextile shall be attached on the up-slope side of the posts and support system with staples, wire, or in accordance with the manufacturer's recommendations. The geotextile shall be attached to the posts in a manner that reduces the potential for geotextile tearing at the staples, wire, or other connection device. Silt fence back-up support for the geotextile in the form of a wire or plastic mesh is dependent on the properties of the geotextile selected for use. If wire or plastic back-up mesh is used, the mesh shall be fastened securely to the up-slope of the posts with the geotextile being up-slope of the mesh back-up support.

The geotextile at the bottom of the fence shall be buried in a trench to a minimum depth of 4 inches below the ground surface. The trench shall be backfilled and the soil tamped in place over the buried portion of the geotextile, such that no flow can pass beneath the fence and scouring can not occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the trench a minimum of 3 inches.

The fence posts shall be placed or driven a minimum of 18 inches. A minimum depth of 12 inches is allowed if topsoil or other soft subgrade soil is not present and a minimum depth of 18 inches cannot be reached. Fence post depths shall be increased by 6 inches if the fence is located on slopes of 3:1 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.

Silt fences shall be located on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

If the fence must cross contours, with the exception of the ends of the fence, gravel check dams placed perpendicular to the back of the fence shall be used to minimize concentrated flow and erosion along the back of the fence. The gravel check dams shall be approximately 1-foot deep at the back of the fence. It shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence. The gravel check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. The gravel check dams shall be located every 10 feet along the fence where the fence must cross contours. The slope of the fence line where contours must be crossed shall not be steeper than 3:1.

Wood, steel or equivalent posts shall be used. Wood posts shall have minimum dimensions of 2 inches by 2 inches by 3 feet minimum length, and shall be free of defects such as knots, splits, or gouges.

Steel posts shall consist of either size No. 6 rebar or larger, ASTM A 120 steel pipe with a minimum diameter of 1-inch, U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft. or other steel posts having equivalent strength and bending resistance to the post sizes listed. The spacing of the support posts shall be a maximum of 6 feet.

Fence back-up 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 ultraviolet radiation as the geotextile it supports.

- Silt fence installation using the slicing method specification details follow. Refer to Figure 4.20 for slicing method details.

  The base of both end posts must be at least 2 to 4 inches above the top of the silt fence fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.

  Install posts 3 to 4 feet apart in critical retention areas and 6 to 7 feet apart in standard applications.

  Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the fabric, enabling posts to support the fabric from upstream water pressure.

  Install posts with the nipples facing away from the silt fence fabric.

  Attach the fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1 inch vertically apart. In addition, each tie should be positioned to hang on a post nipple when tightening to prevent sagging.

  Wrap approximately 6 inches of fabric around the end posts and secure with 3 ties.

  No more than 24 inches of a 36-inch fabric is allowed above ground level.

  The rope lock system must be used in all ditch check applications.

  The installation should be checked and corrected for any deviation before compaction. Use a flat-bladed shovel to tuck fabric deeper into the ground if necessary.

  Compaction is vitally important for effective results. Compact the soil immediately next to the silt fence fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips.

Maintenance Standards

- Any damage shall be repaired immediately.
- If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment pond.
- It is important to check the uphill side of the 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 or remove the trapped sediment.
- Sediment deposits shall either be removed when the deposit reaches approximately one-third the height of the silt fence, or a second silt fence shall be installed.
- If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

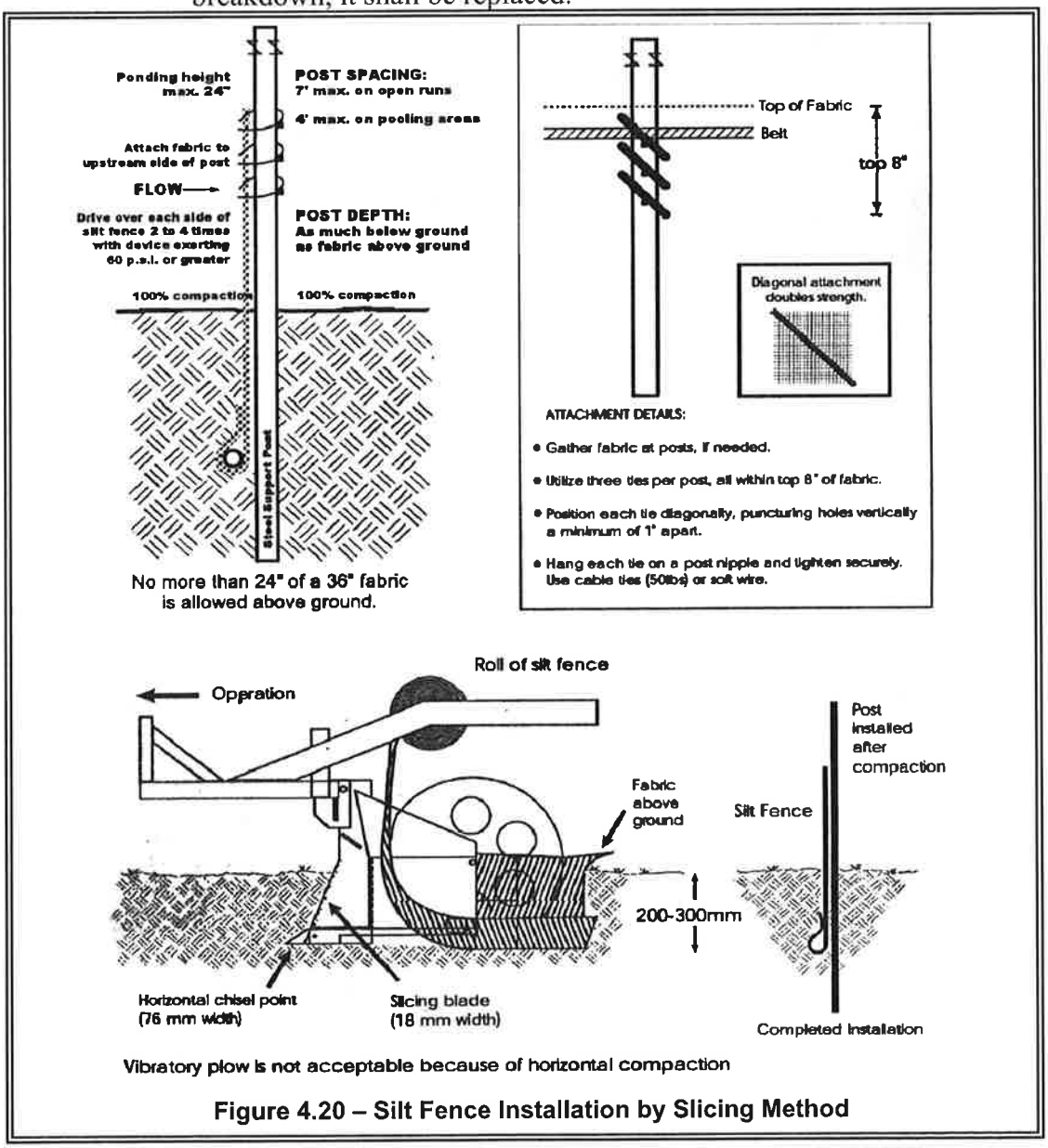


Figure 4.20 – Silt Fence Installation by Slicing Method

BMP C241: Temporary Sediment Pond

Purpose

Sediment ponds remove sediment from runoff originating from disturbed areas of the site. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Consequently, they usually reduce turbidity only slightly.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through a sediment pond or other appropriate sediment removal best management practice.

A sediment pond shall be used where the contributing drainage area is 3 acres or more. Ponds must be used in conjunction with erosion control practices to reduce the amount of sediment flowing into the basin.

Design and Installation Specifications

- Sediment basins must be installed only on sites where failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. Also, sediment traps and ponds are attractive to children and can be very dangerous. Compliance with local ordinances regarding health and safety must be addressed. If fencing of the pond is required, the type of fence and its location shall be shown on the ESC plan.
- Structures having a maximum storage capacity at the top of the dam of 10 acre-ft (435,600 ft^3) or more are subject to the Washington Dam Safety Regulations (Chapter 173-175 WAC).
- See Figure 4.24, Figure 4.25, and Figure 4.26 for details.
- If permanent runoff control facilities are part of the project, they should be used for sediment retention. The surface area requirements of the sediment basin must be met. This may require enlarging the permanent basin to comply with the surface area requirements. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the basin.
- Use of infiltration facilities for sedimentation basins during construction tends to clog the soils and reduce their capacity to infiltrate. If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of 2 feet above final grade. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized. The infiltration pretreatment facility should be fully constructed and used with the sedimentation basin to help prevent clogging.
- Determining Pond Geometry

  Obtain the discharge from the hydrologic calculations of the peak flow for the 2-year runoff event (Q_2). The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used.

Determine the required surface area at the top of the riser pipe with the equation:

SA = 2 x Q_2/0.00096 or
2080 square feet per cfs of inflow

See BMP C240 for more information on the derivation of the surface area calculation.

The basic geometry of the pond can now be determined using the following design criteria:

- Required surface area SA (from Step 2 above) at top of riser.
- Minimum 3.5-foot depth from top of riser to bottom of pond.
- Maximum 3:1 interior side slopes and maximum 2:1 exterior slopes. The interior slopes can be increased to a maximum of 2:1 if fencing is provided at or above the maximum water surface.
- One foot of freeboard between the top of the riser and the crest of the emergency spillway.
- Flat bottom.
- Minimum 1-foot deep spillway.
- Length-to-width ratio between 3:1 and 6:1.
- Sizing of Discharge Mechanisms.

  The outlet for the basin consists of a combination of principal and emergency spillways. These outlets must pass the peak runoff expected from the contributing drainage area for a 100-year storm. If, due to site conditions and basin geometry, a separate emergency spill-way is not feasible, the principal spillway must pass the entire peak runoff expected from the 100-year storm. However, an attempt to provide a separate emergency spillway should always be made. The runoff calculations should be based on the site conditions during construction. The flow through the dewatering orifice cannot be utilized when calculating the 100-year storm elevation because of its potential to become clogged; therefore, available spillway storage must begin at the principal spillway riser crest.

  The principal spillway designed by the procedures contained in this standard will result in some reduction in the peak rate of runoff. However, the riser outlet design will not adequately control the basin discharge to the predevelopment discharge limitations as stated in Minimum Requirement #7: Flow Control. However, if the basin for a permanent stormwater detention pond is used for a temporary sedimentation basin, the control structure for the permanent pond can be used to maintain predevelopment discharge limitations. The size of the basin, the expected life of the construction project, the anticipated downstream effects and the anticipated weather conditions during construction, should be considered to determine the need of additional discharge control. See Figure 4.28 for riser inflow curves.

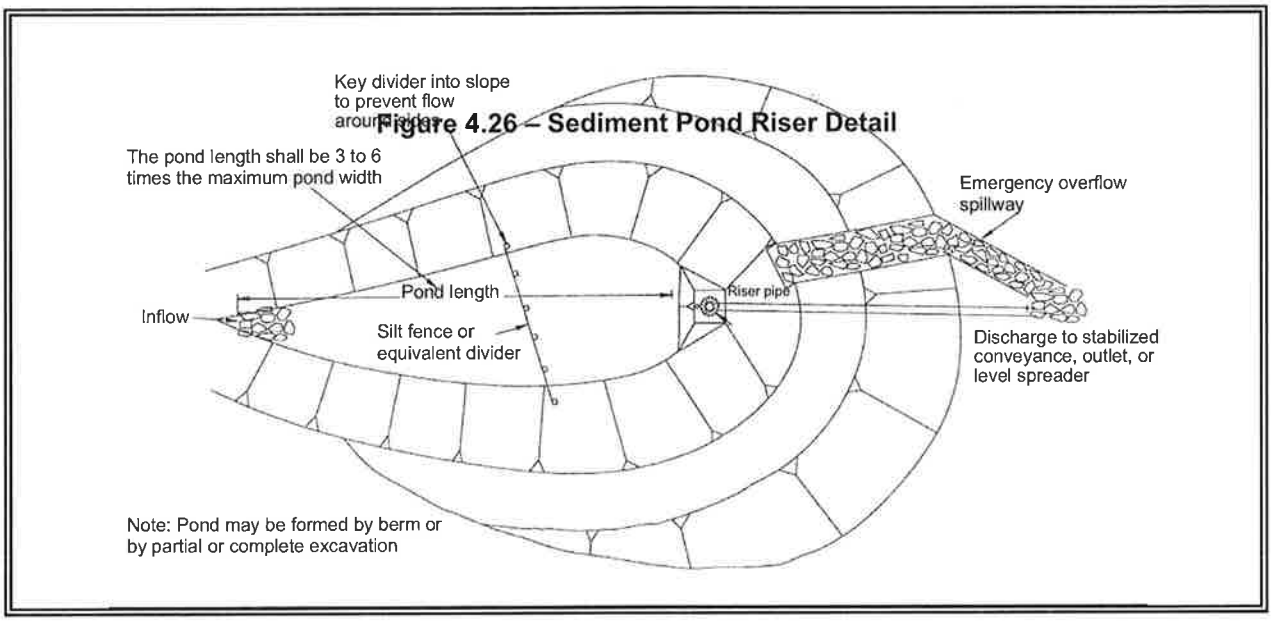


Figure 4.26 – Sediment Pond Riser Detail

Figure 4.24 – Sediment Pond Plan View

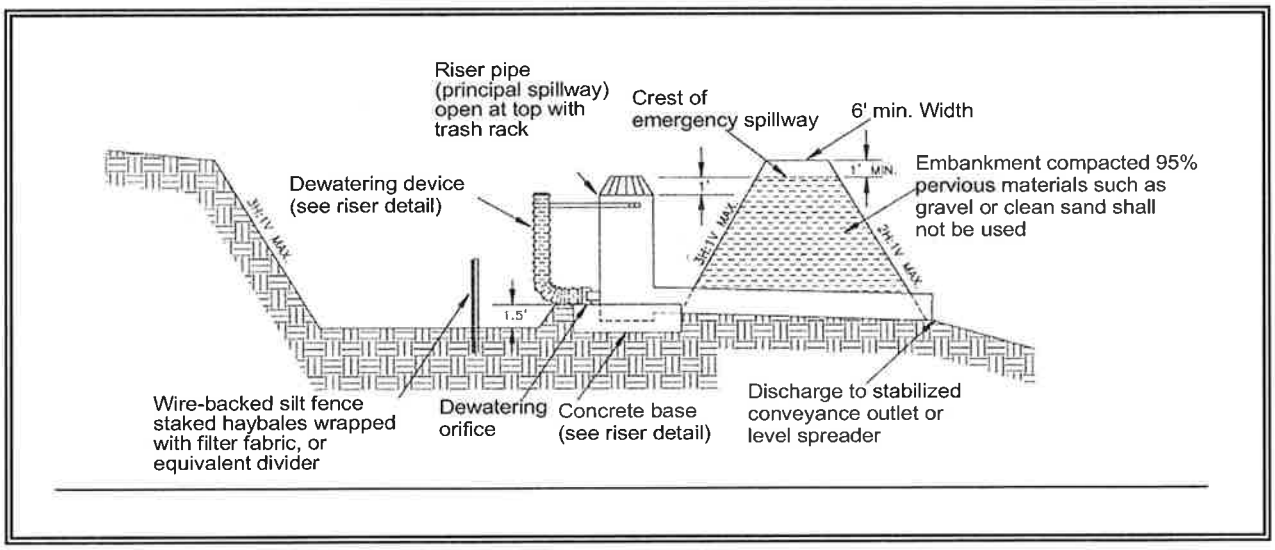


Figure 4.25 – Sediment Pond Cross Section

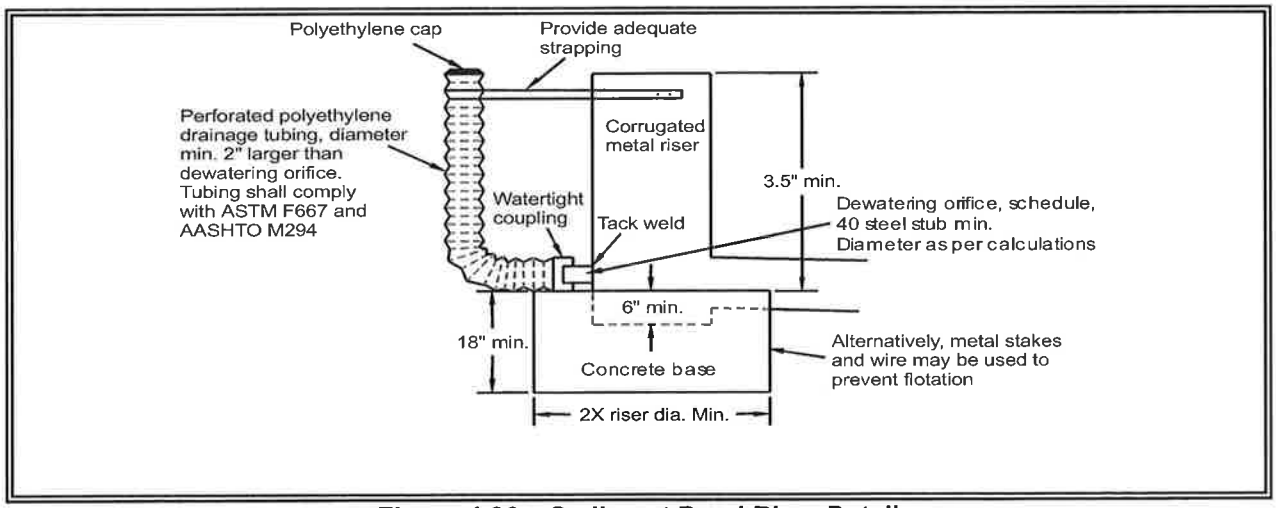


Figure 4.26 – Sediment Pond Riser Detail

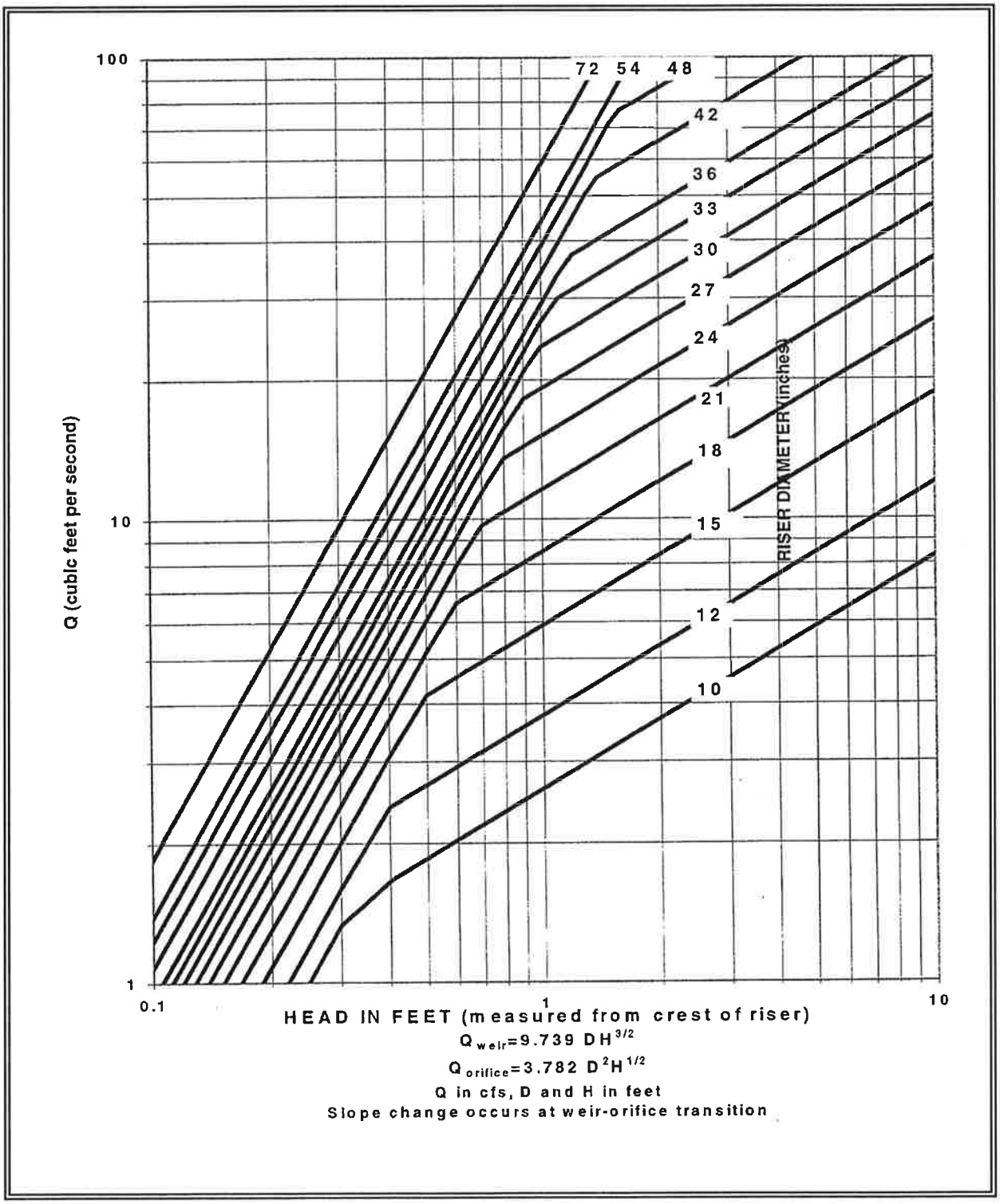


Figure 4.27 – Riser Inflow Curves

Principal Spillway: Determine the required diameter for the principal spillway (riser pipe). The diameter shall be the minimum necessary to pass the pre-developed 10-year peak flow (Q_{10}). Use Figure 4.28 to determine this diameter (h = 1-foot). *Note: A permanent control structure may be used instead of a temporary riser.*

Emergency Overflow Spillway: Determine the required size and design of the emergency overflow spillway for the developed 100-year peak flow using the method contained in Volume III.

Dewatering Orifice: Determine the size of the dewatering orifice(s) (minimum 1-inch diameter) using a modified version of the discharge equation for a vertical orifice and a basic equation for the area of a circular orifice. Determine the required area of the orifice with the following equation:

$$A_o = \frac{A_s(2h)^{0.5}}{0.6\text{x}3600Tg^{0.5}}$$

where A_O = orifice area (square feet)
A_S = pond surface area (square feet)
h = head of water above orifice (height of riser in feet)
T = dewatering time (24 hours)
g = acceleration of gravity (32.2 feet/second^2)

Convert the required surface area to the required diameter D of the orifice:

$$D = 24\text{x}\sqrt{\frac{A_o}{\pi}} = 13.54\text{x}\sqrt{A_o}$$

The vertical, perforated tubing connected to the dewatering orifice must be at least 2 inches larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The orifice should control the flow rate.

- Additional Design Specifications

  The **pond shall be divided** into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between cells. The divider shall be at least one-half the height of the riser and a minimum of one foot below the top of the riser. Wire-backed, 2- to 3-foot high, extra strength filter fabric supported by treated 4"x4"s can be used as a divider. Alternatively, staked straw bales wrapped with filter fabric (geotextile) may be used. If the pond is more than 6 feet deep, a different mechanism must be proposed. A riprap embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of

this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under or around the barrier.

To aid in determining sediment depth, **one-foot intervals** shall be prominently marked on the riser.

If an **embankment** of more than 6 feet is proposed, the pond must comply with the criteria contained in Volume III regarding dam safety for detention BMPs.

- The most common structural failure of sedimentation basins is caused by piping. Piping refers to two phenomena: (1) water seeping through fine-grained soil, eroding the soil grain by grain and forming pipes or tunnels; and, (2) water under pressure flowing upward through a granular soil with a head of sufficient magnitude to cause soil grains to lose contact and capability for support.

  The most critical construction sequences to prevent piping will be:

  1. Tight connections between riser and barrel and other pipe connections.
  2. Adequate anchoring of riser.
  3. Proper soil compaction of the embankment and riser footing.
  4. Proper construction of anti-seep devices.

Maintenance Standards

- Sediment shall be removed from the pond when it reaches 1–foot in depth.
- Any damage to the pond embankments or slopes shall be repaired.

BMP C250: Construction Stormwater Chemical Treatment

Purpose

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Chemical treatment may be used to reduce the turbidity of stormwater runoff.

Conditions of Use

Chemical treatment can reliably provide exceptional reductions of turbidity and associated pollutants. Very high turbidities can be reduced to levels comparable to what is found in streams during dry weather. Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Chemical treatment may be required to protect streams from the impact of turbid stormwater discharges, especially when construction is to proceed through the wet season.

Formal written approval from Ecology and the Local Permitting Authority is required for the use of chemical treatment regardless of site size. The intention to use Chemical Treatment shall be indicated on the Notice of Intent for coverage under the General Construction Permit. Chemical treatment systems should be designed as part of the Construction SWPPP, not after the fact. Chemical treatment may be used to correct problem sites in limited circumstances with formal written approval from Ecology and the Local Permitting Authority.

The SEPA review authority must be notified at the application phase of the project review (or the time that the SEPA determination on the project is performed) that chemical treatment is proposed. If it is added after this stage, an addendum will be necessary and may result in project approval delay.

Design and Installation Specifications

See Appendix II-B for background information on chemical treatment.

Criteria for Chemical Treatment Product Use: Chemically treated stormwater discharged from construction sites must be nontoxic to aquatic organisms. The following protocol shall be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- Treatment chemicals must be approved by EPA for potable water use.
- Petroleum-based polymers are prohibited.

- Prior to authorization for field use, jar tests shall be conducted to demonstrate that turbidity reduction necessary to meet the receiving water criteria can be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability.
- Prior to authorization for field use, the chemically treated stormwater shall be tested for aquatic toxicity. Applicable procedures defined in Chapter 173-205 WAC, Whole Effluent Toxicity Testing and Limits, shall be used. Testing shall use stormwater from the construction site at which the treatment chemical is proposed for use or a water solution using soil from the proposed site.
- The proposed maximum dosage shall be at least a factor of five lower than the no observed effects concentration (NOEC).
- The approval of a proposed treatment chemical shall be conditional, subject to full-scale bioassay monitoring of treated stormwater at the construction site where the proposed treatment chemical is to be used.
- Treatment chemicals that have already passed the above testing protocol do not need to be reevaluated. Contact the Department of Ecology Regional Office for a list of treatment chemicals that have been evaluated and are currently approved for use.

Treatment System Design Considerations: The design and operation of a chemical treatment system should take into consideration the factors that determine optimum, cost-effective performance. It may not be possible to fully incorporate all of the classic concepts into the design because of practical limitations at construction sites. Nonetheless, it is important to recognize the following:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage "adding more is always better" is not the case.
- The coagulant must be mixed rapidly into the water to insure proper dispersion.
- A flocculation step is important to increase the rate of settling, to produce the lowest turbidity, and to keep the dosage rate as low as possible.
- Too little energy input into the water during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much energy can rapidly destroy floc as it is formed.

- Since the volume of the basin is a determinant in the amount of energy per unit volume, the size of the energy input system can be too small relative to the volume of the basin.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a physical filter such as a vegetated swale that would catch any unintended floc discharge.

Treatment System Design: Chemical treatment systems shall be designed as batch treatment systems using either ponds or portable trailer-mounted tanks. Flow-through continuous treatment systems are not allowed at this time.

A chemical treatment system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), a storage pond, pumps, a chemical feed system, treatment cells, and interconnecting piping.

The treatment system shall use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be ponds or tanks. Ponds with constructed earthen embankments greater than six feet high require special engineering analyses. Portable tanks may also be suitable for some sites.

The following equipment should be located in an operations shed:

- the chemical injector;
- secondary containment for acid, caustic, buffering compound, and treatment chemical;
- emergency shower and eyewash, and
- monitoring equipment which consists of a pH meter and a turbidimeter.

Sizing Criteria: The combination of the storage pond or other holding area and treatment capacity should be large enough to treat stormwater during multiple day storm events. It is recommended that at a minimum the storage pond or other holding area should be sized to hold 1.5 times the runoff volume of the 10-year, 24-hour storm event. Bypass should be provided around the chemical treatment system to accommodate extreme storm events. Runoff volume shall be calculated using the methods presented in Volume 3, Chapter 2. If no hydrologic analysis is required for the site, the Rational Method may be used.

Primary settling should be encouraged in the storage pond. A forebay with access for maintenance may be beneficial.

There are two opposing considerations in sizing the treatment cells. A larger cell is able to treat a larger volume of water each time a batch is

processed. However, the larger the cell the longer the time required to empty the cell. A larger cell may also be less effective at flocculation and therefore require a longer settling time. The simplest approach to sizing the treatment cell is to multiply the allowable discharge flow rate times the desired drawdown time. A 4-hour drawdown time allows one batch per cell per 8-hour work period, given 1 hour of flocculation followed by two hours of settling.

The permissible discharge rate governed by potential downstream effect can be used to calculate the recommended size of the treatment cells. The following discharge flow rate limits shall apply:

- If the discharge is directly or indirectly to a stream, the discharge flow rate shall not exceed 50 percent of the peak flow rate of the 2-year, 24-hour event for all storm events up to the 10-year, 24-hour event.
- If discharge is occurring during a storm event equal to or greater than the 10-year, 24-hour event, the allowable discharge rate is the peak flow rate of the 10-year, 24-hour event.
- Discharge to a stream should not increase the stream flow rate by more than 10 percent.
- If the discharge is directly to a lake, a major receiving water listed in Appendix C of Volume I, or to an infiltration system, there is no discharge flow limit.
- If the discharge is to a municipal storm drainage system, the allowable discharge rate may be limited by the capacity of the public system. It may be necessary to clean the municipal storm drainage system prior to the start of the discharge to prevent scouring solids from the drainage system.
- Runoff rates shall be calculated using the methods presented in Volume 3, Chapter 2 for the predeveloped condition. If no hydrologic analysis is required for the site, the Rational Method may be used.

Maintenance Standards

Monitoring: The following monitoring shall be conducted. Test results shall be recorded on a daily log kept on site:

Operational Monitoring

- pH, conductivity (as a surrogate for alkalinity), turbidity and temperature of the untreated stormwater
- Total volume treated and discharged
- Discharge time and flow rate
- Type and amount of chemical used for pH adjustment
- Amount of polymer used for treatment
- Settling time

Compliance Monitoring

- pH and turbidity of the treated stormwater
- pH and turbidity of the receiving water

Biomonitoring

Treated stormwater shall be tested for acute (lethal) toxicity. Bioassays shall be conducted by a laboratory accredited by Ecology, unless otherwise approved by Ecology. **The performance standard for acute toxicity is no statistically significant difference in survival between the control and 100 percent chemically treated stormwater.**

Acute toxicity tests shall be conducted with the following species and protocols:

- Fathead minnow, Pimephales *promelas* (96 hour static-renewal test, method: EPA/600/4-90/027F). Rainbow trout, Oncorhynchus mykiss (96 hour static-renewal test, method: EPA/600/4-90/027F) may be used as a substitute for fathead minnow.
- Daphnid, *Ceriodaphnia* dubia, *Daphnia pulex,* or *Daphnia magna* (48 hour static test, method: EPA/600/4-90/027F).

All toxicity tests shall meet quality assurance criteria and test conditions in the most recent versions of the EPA test method and Ecology Publication # WQ-R-95-80, Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria.

Bioassays shall be performed on the first five batches and on every tenth batch thereafter, or as otherwise approved by Ecology. Failure to meet the performance standard shall be immediately reported to Ecology.

Discharge Compliance: Prior to discharge, each batch of treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits may be established by the water quality standards or a site-specific discharge permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity must be within 5 NTUs of the background turbidity. Background is measured in the receiving water, upstream from the treatment process discharge point. pH must be within the range of 6.5 to 8.5 standard units and not cause a change in the pH of the receiving water of more than 0.2 standard units. It is often possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements shall be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water shall not be taken

from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training: Each contractor who intends to use chemical treatment shall be trained by an experienced contractor on an active site for at least 40 hours.

Standard BMPs: Surface stabilization BMPs should be implemented on site to prevent significant erosion. All sites shall use a truck wheel wash to prevent tracking of sediment off site.

Sediment Removal And Disposal:

- Sediment shall be removed from the storage or treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the decommissioning of the cells. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.
- Sediment may be incorporated into the site away from drainages.

BMP C251: Construction Stormwater Filtration

Purpose

Filtration removes sediment from runoff originating from disturbed areas of the site.

Conditions of Use

Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Filtration may be used in conjunction with gravity settling to remove sediment as small as fine silt (0.5 µm). The reduction in turbidity will be dependent on the particle size distribution of the sediment in the stormwater. In some circumstances, sedimentation and filtration may achieve compliance with the water quality standard for turbidity.

Unlike chemical treatment, the use of construction stormwater filtration does not require approval from Ecology.

Filtration may also be used in conjunction with polymer treatment in a portable system to assure capture of the flocculated solids.

Design and Installation Specifications

Background Information

Filtration with sand media has been used for over a century to treat water and wastewater. The use of sand filtration for treatment of stormwater has developed recently, generally to treat runoff from streets, parking lots, and residential areas. The application of filtration to construction stormwater treatment is currently under development.

Two types of filtration systems may be applied to construction stormwater treatment: rapid and slow. Rapid sand filters are the typical system used for water and wastewater treatment. They can achieve relatively high hydraulic flow rates, on the order of 2 to 20 gpm/sf, because they have automatic backwash systems to remove accumulated solids. In contrast, slow sand filters have very low hydraulic rates, on the order of 0.02 gpm/sf, because they do not have backwash systems. To date, slow sand filtration has generally been used to treat stormwater. Slow sand filtration is mechanically simple in comparison to rapid sand filtration but requires a much larger filter area.

Filtration Equipment. Sand media filters are available with automatic backwashing features that can filter to 50 µm particle size. Screen or bag filters can filter down to 5 µm. Fiber wound filters can remove particles down to 0.5 µm. Filters should be sequenced from the largest to the smallest pore opening. Sediment removal efficiency will be related to particle size distribution in the stormwater.

Treatment Process Description. Stormwater is collected at interception point(s) on the site and is diverted to a sediment pond or tank for removal of large sediment and storage of the stormwater before it is treated by the

filtration system. The stormwater is pumped from the trap, pond, or tank through the filtration system in a rapid sand filtration system. Slow sand filtration systems are designed as flow through systems using gravity.

If large volumes of concrete are being poured, pH adjustment may be necessary.

Maintenance Standards

Rapid sand filters typically have automatic backwash systems that are triggered by a pre-set pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the stormwater stored in the holding pond or tank, backwash return to the pond or tank may be appropriate. However, land application or another means of treatment and disposal may be necessary.

- Screen, bag, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.

APPENDIX L

GENERAL PERMIT

Center 44
NAR012632
6-25-2015

Issuance Date: December 1, 2010
Effective Date: January 1, 2011
Expiration Date: December 31, 2015

CONSTRUCTION STORMWATER GENERAL PERMIT

National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity

State of Washington
Department of Ecology
Olympia, Washington 98504

In compliance with the provisions of
Chapter 90.48 Revised Code of Washington
(State of Washington Water Pollution Control Act)
and
Title 33 United States Code, Section 1251 et seq.
The Federal Water Pollution Control Act (The Clean Water Act)

Until this permit expires, is modified or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions that follow.

Kelly Susewind, P.E., P.G.
Water Quality Program Manager
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions within this permit for additional submittal requirements. Appendix A provides a list of definitions. Appendix B provides a list of acronyms.

Table 1. Summary of Permit Report Submittals

Permit Section	Submittal	Frequency	First Submittal Date
S5.A and S8	High Turbidity/Transparency Phone Reporting	As Necessary	Within 24 hours
S5.B	Discharge Monitoring Report	Monthly*	Within 15 days of applicable monitoring period
S5.F and S8	Noncompliance Notification	As necessary	Immediately
S5.F	Noncompliance Notification – Written Report	As necessary	Within 5 Days of non-compliance
G2.	Notice of Change in Authorization	As necessary	
G6.	Permit Application for Substantive Changes to the Discharge	As necessary	
G8.	Application for Permit Renewal	1/permit cycle	No later than 180 days before expiration
G9.	Notice of Permit Transfer	As necessary	
G20.	Notice of Planned Changes	As necessary	
G22.	Reporting Anticipated Non-compliance	As necessary	

SPECIAL NOTE: *Permittees must submit Discharge Monitoring Reports (DMRs) to the Washington State Department of Ecology monthly, regardless of site discharge, for the full duration of permit coverage. Refer to Section S5.B of this General Permit for more specific information regarding DMRs.

Table 2. Summary of Required On-site Documentation

Document Title	Permit Conditions
Permit Coverage Letter	See Conditions S2, S5
Construction Stormwater General Permit	See Conditions S2, S5
Site Log Book	See Conditions S4, S5
Stormwater Pollution Prevention Plan (SWPPP)	See Conditions S9, S5

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Permit Area

This Construction Stormwater General Permit (CSWGP) covers all areas of Washington State, except for federal and Tribal lands as specified in Special Condition S1.E.3.

B. Operators Required to Seek Coverage Under this General Permit:

1. Operators of the following construction activities are required to seek coverage under this CSWGP:

   a. Clearing, grading and/or excavation that results in the disturbance of one or more acres and discharges stormwater to surface waters of the State; and clearing, grading and/or excavation on sites smaller than one acre that are part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one acre or more and discharge stormwater to surface waters of the State.

      i. This includes forest practices (including, but not limited to, class IV conversions) that are part of a construction activity that will result in the disturbance of one or more acres, and discharge to surface waters of the State (that is, forest practices that prepare a site for construction activities); and

   b. Any size construction activity discharging stormwater to waters of the State that the Department of Ecology ("Ecology"):

      i. Determines to be a significant contributor of pollutants to waters of the State of Washington.

      ii. Reasonably expects to cause a violation of any water quality standard.

2. Operators of the following activities are not required to seek coverage under this CSWGP (unless specifically required under Special Condition S1.B.1.b. above):

   a. Construction activities that discharge all stormwater and non-stormwater to ground water, sanitary sewer, or combined sewer, and have no point source discharge to either surface water or a storm sewer system that drains to surface waters of the State.

   b. Construction activities covered under an Erosivity Waiver (Special Condition S2.C).

   c. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

C. Authorized Discharges:

1. Stormwater Associated with Construction Activity. Subject to compliance with the terms and conditions of this permit, Permittees are authorized to discharge stormwater associated with construction activity to surface waters of the State or to a storm sewer system that drains to surface waters of the State. (Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.)

2. Stormwater Associated with Construction Support Activity. This permit also authorizes stormwater discharge from support activities related to the permitted construction site (for example, an on-site portable rock crusher, off-site equipment staging yards, material storage areas, borrow areas, etc.) provided:

   a. The support activity relates directly to the permitted construction site that is required to have a NPDES permit; and

   b. The support activity is not a commercial operation serving multiple unrelated construction projects, and does not operate beyond the completion of the construction activity; and

   c. Appropriate controls and measures are identified in the Stormwater Pollution Prevention Plan (SWPPP) for the discharges from the support activity areas.

3. Non-Stormwater Discharges. The categories and sources of non-stormwater discharges identified below are authorized conditionally, provided the discharge is consistent with the terms and conditions of this permit:

   a. Discharges from fire-fighting activities.

   b. Fire hydrant system flushing.

   c. Potable water, including uncontaminated water line flushing.

   d. Pipeline hydrostatic test water.

   e. Uncontaminated air conditioning or compressor condensate.

   f. Uncontaminated ground water or spring water.

   g. Uncontaminated excavation dewatering water (in accordance with S9.D.10).

   h. Uncontaminated discharges from foundation or footing drains.

   i. Water used to control dust. Permittees must minimize the amount of dust control water used.

   j. Routine external building wash down that does not use detergents.

   k. Landscape irrigation water.

   The SWPPP must adequately address all authorized non-stormwater discharges, except for discharges from fire-fighting activities, and must comply with Special

Condition S3. At a minimum, discharges from potable water (including water line flushing), fire hydrant system flushing, and pipeline hydrostatic test water must undergo the following: dechlorination to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units (su), if necessary.

D. Prohibited Discharges:

The following discharges to waters of the State, including ground water, are prohibited.

1. Concrete wastewater.
2. Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.
3. Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.1 (see Appendix A of this permit).
4. Slurry materials and waste from shaft drilling.
5. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.
6. Soaps or solvents used in vehicle and equipment washing.
7. Wheel wash wastewater, unless discharged according to Special Condition S9.D.9.d.
8. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to Special Condition S9.D.10.

E. Limits on Coverage

Ecology may require any discharger to apply for and obtain coverage under an individual permit or another more specific general permit. Such alternative coverage will be required when Ecology determines that this CSWGP does not provide adequate assurance that water quality will be protected, or there is a reasonable potential for the project to cause or contribute to a violation of water quality standards.

The following stormwater discharges are not covered by this permit:

1. Post-construction stormwater discharges that originate from the site after completion of construction activities and the site has undergone final stabilization.
2. Non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance, from which there is natural runoff as excluded in 40 CFR Subpart 122.
3. Stormwater from any federal project or project on federal land or land within an Indian Reservation except for the Puyallup Reservation. Within the Puyallup

Reservation, any project that discharges to surface water on land held in trust by the federal government may be covered by this permit.

4. Stormwater from any site covered under an existing NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

5. Stormwater from a site where an applicable Total Maximum Daily Load (TMDL) requirement specifically precludes or prohibits discharges from construction activity.

S2. APPLICATION REQUIREMENTS

A. Permit Application Forms

1. Notice of Intent Form/Timeline

a. Operators of new or previously unpermitted construction activities must submit a complete and accurate permit application (Notice of Intent, or NOI) to Ecology.

b. The operator must submit the NOI at least 60 days before discharging stormwater from construction activities and must submit it on or before the date of the first public notice (see Special Condition S2.B below for details). The 30-day public comment period required by WAC 173-226-130(5) begins on the publication date of the second public notice. Unless Ecology responds to the complete application in writing, based on public comments, or any other relevant factors, coverage under the general permit will automatically commence on the thirty-first day following receipt by Ecology of a completed NOI, or the issuance date of this permit, whichever is later, unless Ecology specifies a later date in writing.

c. Applicants who propose to discharge to a storm or sewer system operated by Seattle, King County, Snohomish County, Tacoma, Pierce County, or Clark County must also submit a copy of the NOI to the appropriate jurisdiction.

d. If an applicant intends to use a Best Management Practice (BMP) selected on the basis of Special Condition S9.C.4 ("demonstrably equivalent" BMPs), the applicant must notify Ecology of its selection as part of the NOI. In the event the applicant selects BMPs after submission of the NOI, it must provide notice of the selection of an equivalent BMP to Ecology at least 60 days before intended use of the equivalent BMP.

e. Permittees must notify Ecology regarding any changes to the information provided on the NOI by submitting an updated NOI. Examples of such changes include, but are not limited to,

i. changes to the Permittee's mailing address,

ii. changes to the on-site contact person information, and

iii. changes to the area/acreage affected by construction activity.

2. Transfer of Coverage Form

The Permittee can transfer current coverage under this permit to one or more new operators, including operators of sites within a Common Plan of Development, provided the Permittee submits a Transfer of Coverage Form in accordance with General Condition G9. Transfers do not require public notice.

B. Public Notice

For new or previously unpermitted construction activities, the applicant must publish a public notice at least one time each week for two consecutive weeks, at least 7 days apart, in a newspaper with general circulation in the county where the construction is to take place. The notice must contain:

1. A statement that "The applicant is seeking coverage under the Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit."

2. The name, address and location of the construction site.

3. The name and address of the applicant.

4. The type of construction activity that will result in a discharge (for example, residential construction, commercial construction, etc.), and the number of acres to be disturbed.

5. The name of the receiving water(s) (that is, the surface water(s) to which the site will discharge), or, if the discharge is through a storm sewer system, the name of the operator of the system.

6. The statement: "Any persons desiring to present their views to the Washington State Department of Ecology regarding this application, or interested in Ecology's action on this application, may notify Ecology in writing no later than 30 days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320. Comments can be submitted to: Department of Ecology, P.O. Box 47696, Olympia, WA 98504-7696 Attn: Water Quality Program, Construction Stormwater."

C. Erosivity Waiver

Construction site operators may qualify for an erosivity waiver from the CSWGP if the following conditions are met:

1. The site will result in the disturbance of fewer than 5 acres and the site is not a portion of a common plan of development or sale that will disturb 5 acres or greater.

2. Calculation of Erosivity "R" Factor and Regional Timeframe:

   a. The project's rainfall erosivity factor ("R" Factor) must be less than 5 during the period of construction activity, as calculated using either the Texas A&M University online rainfall erosivity calculator at: http://ei.tamu.edu/ or EPA's calculator at http://cfpub.epa.gov/npdes/stormwater/lew/lewcalculator.cfm. The period of construction activity starts when the land is first disturbed and ends with final stabilization. In addition:

   b. The entire period of construction activity must fall within the following timeframes:

      i. For sites west of the Cascades Crest: June 15 – September 15.

      ii. For sites east of the Cascades Crest, excluding the Central Basin: June 15 – October 15.

      iii. For sites east of the Cascades Crest, within the Central Basin: no additional timeframe restrictions apply. The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches. For a map of the Central Basin (Region 2), refer to http://www.ecy.wa.gov/pubs/ecy070202.pdf.

3. Construction site operators must submit a complete Erosivity Waiver certification form at least one week before disturbing the land. Certification must include statements that the operator will:

   a. Comply with applicable local stormwater requirements; and

   b. Implement appropriate erosion and sediment control BMPs to prevent violations of water quality standards.

4. This waiver is not available for facilities declared significant contributors of pollutants as defined in Special Condition S1.B.1.b.

5. This waiver does not apply to construction activities which include non-stormwater discharges listed in Special Condition S1.C.3.

6. If construction activity extends beyond the certified waiver period for any reason, the operator must either:

   a. Recalculate the rainfall erosivity "R" factor using the original start date and a new projected ending date and, if the "R" factor is still under 5 and the entire

project falls within the applicable regional timeframe in Special Condition S2.C.2.b, complete and submit an amended waiver certification form before the original waiver expires; or

b. Submit a complete permit application to Ecology in accordance with Special Condition S2.A and B before the end of the certified waiver period.

S3. COMPLIANCE WITH STANDARDS

A. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), ground water quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the National Toxics Rule (40 CFR Part 131.36). Discharges not in compliance with these standards are not authorized.

B. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply all known, available, and reasonable methods of prevention, control, and treatment (AKART). This includes the preparation and implementation of an adequate Stormwater Pollution Prevention Plan (SWPPP), with all appropriate BMPs installed and maintained in accordance with the SWPPP and the terms and conditions of this permit.

C. Ecology presumes that a Permittee complies with water quality standards unless discharge monitoring data or other site-specific information demonstrates that a discharge causes or contributes to a violation of water quality standards, when the Permittee complies with the following conditions. The Permittee must fully:

1. Comply with all permit conditions, including planning, sampling, monitoring, reporting, and recordkeeping conditions.

2. Implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent to BMPs contained in stormwater technical manuals published or approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate BMPs for on-site pollution control. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the Phase I Municipal Stormwater Permit are approved by Ecology.)

D. Where construction sites also discharge to ground water, the ground water discharges must also meet the terms and conditions of this CSWGP. Permittees who discharge to ground water through an injection well must also comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

S4. MONITORING REQUIREMENTS, BENCHMARKS AND REPORTING TRIGGERS

Table 3. Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	Requires CESCL Certification?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

A. Site Log Book

The Permittee must maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements, including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

B. Site Inspections

The Permittee's (operator's) site inspections must include all areas disturbed by construction activities, all BMPs, and all stormwater discharge points. (See Special Conditions S4.B.3 and B.4 below for detailed requirements of the Permittee's Certified Erosion and Sediment Control Lead [CESCL]).

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[1] Soil disturbance is calculated by adding together all areas affected by construction activity. Construction activity means clearing, grading, excavation, and any other activity that disturbs the surface of the land, including ingress/egress from the site.

[2] If construction activity results in the disturbance of 1 acre or more, and involves significant concrete work (1,000 cubic yards of poured or recycled concrete over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer stormwater collection system that drains to other surface waters of the State, the Permittee must conduct pH monitoring sampling in accordance with Special Condition S4.D.

[3] Sites with one or more acres, but fewer than 5 acres of soil disturbance, must conduct turbidity or transparency sampling in accordance with Special Condition S4.C.

[4] Sites equal to or greater than 5 acres of soil disturbance must conduct turbidity sampling using a turbidity meter in accordance with Special Condition S4.C.

Construction sites one acre or larger that discharge stormwater to surface waters of the State must have site inspections conducted by a certified CESCL. Sites less than one acre may have a person without CESCL certification conduct inspections; sampling is not required on sites that disturb less than an acre.

1. The Permittee must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. The Permittee 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, the Permittee must correct the problems identified by:

   a. Reviewing the SWPPP for compliance with Special Condition S9 and making appropriate revisions within 7 days of the inspection.

   b. Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

   c. Documenting BMP implementation and maintenance in the site log book.

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

3. The Permittee must have staff knowledgeable in the principles and practices of erosion and sediment control. The CESCL (sites one acre or more) or inspector (sites less than one acre) must have the skills to assess the:

   a. Site conditions and construction activities that could impact the quality of stormwater, and

   b. Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

4. The SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times. The CESCL must obtain this certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (see BMP C160 in the manual referred to in Special Condition S9.C.1 and 2).

5. The Permittee must summarize the results of each inspection in an inspection report or checklist and enter the report/checklist into, or attach it to, the site log book. At a minimum, each inspection report or checklist must include:

   a. Inspection date and time.

   b. Weather information, the general conditions during inspection and the approximate amount of precipitation since the last inspection, and precipitation within the last 24 hours.

   c. A summary or list of all implemented BMPs, including observations of all erosion/sediment control structures or practices.

   d. A description of the locations:

      i. Of BMPs inspected.

      ii. Of BMPs that need maintenance and why.

      iii. Of BMPs that failed to operate as designed or intended, and

      iv. Where additional or different BMPs are needed, and why.

   e. A description of stormwater discharged from the site. The Permittee must note the presence of suspended sediment, turbidity, discoloration, and oil sheen, as applicable.

   f. Any water quality monitoring performed during inspection.

   g. General comments and notes, including a brief description of any BMP repairs, maintenance or installations made following the inspection.

   h. A summary report and a schedule of implementation of the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

   i. The name, title, and signature of the person conducting the site inspection, a phone number or other reliable method to reach this person, and the following statement: "I certify that this report is true, accurate, and complete to the best of my knowledge and belief."

C. Turbidity/Transparency Sampling Requirements

1. Sampling Methods

   a. If construction activity involves the disturbance of 5 acres or more, the Permittee must conduct turbidity sampling per Special Condition S4.C.

   b. If construction activity involves 1 acre or more but fewer than 5 acres of soil disturbance, the Permittee must conduct either transparency sampling **or** turbidity sampling per Special Condition S4.C.

2. Sampling Frequency

   a. The Permittee must sample all discharge locations at least once every calendar week when stormwater (or authorized non-stormwater) discharges from the site or enters any on-site surface waters of the state (for example, a creek running through a site).

   b. Samples must be representative of the flow and characteristics of the discharge.

   c. Sampling is not required when there is no discharge during a calendar week.

   d. Sampling is not required outside of normal working hours or during unsafe conditions.

   e. If the Permittee is unable to sample during a monitoring period, the Permittee must include a brief explanation in the monthly Discharge Monitoring Report (DMR).

   f. Sampling is not required before construction activity begins.

3. Sampling Locations

   a. Sampling is required at all points where stormwater associated with construction activity (or authorized non-stormwater) is discharged off site, including where it enters any on-site surface waters of the state (for example, a creek running through a site).

   b. The Permittee may discontinue sampling at discharge points that drain areas of the project that are fully stabilized to prevent erosion.

   c. The Permittee must identify all sampling point(s) on the SWPPP site map and clearly mark these points in the field with a flag, tape, stake or other visible marker.

   d. Sampling is not required for discharge that is sent directly to sanitary or combined sewer systems.

4. Sampling and Analysis Methods

   a. The Permittee performs turbidity analysis with a calibrated turbidity meter (turbidimeter) either on site or at an accredited lab. The Permittee must record the results in the site log book in nephelometric turbidity units (NTU).

   b. The Permittee performs transparency analysis on site with a 1¾-inch-diameter, 60-centimeter (cm)-long transparency tube. The Permittee will record the results in the site log book in centimeters (cm). Transparency tubes are available from: http://watermonitoringequip.com/pages/stream.html.

Table 4. Monitoring and Reporting Requirements

Parameter	Unit	Analytical Method	Sampling Frequency	Benchmark Value	Phone Reporting Trigger Value
Turbidity	NTU	SM2130 or EPA 180.1	Weekly, if discharging	25 NTU	250 NTU
Transparency	cm	Manufacturer instructions, or Ecology guidance	Weekly, if discharging	33 cm	6 cm

5. Turbidity/Transparency Benchmark Values and Reporting Triggers

The benchmark value for turbidity is 25 NTU or less. The benchmark value for transparency is 33 centimeters (cm). Note: Benchmark values do not apply to discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus; these discharges are subject to a numeric effluent limit for turbidity. Refer to Special Condition S8 for more information.

a. Turbidity 26 – 249 NTU, or Transparency 32 – 7 cm:

If the discharge turbidity is 26 to 249 NTU; or if discharge transparency is less than 33 cm, but equal to or greater than 6 cm, the Permittee must:

i. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

ii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iii. Document BMP implementation and maintenance in the site log book.

b. Turbidity 250 NTU or greater, or Transparency 6 cm or less:

If a discharge point's turbidity is 250 NTU or greater, or if discharge transparency is less than or equal to 6 cm, the Permittee must complete the reporting and adaptive management process described below.

i. Telephone the applicable Ecology Region's Environmental Report Tracking System (ERTS) number within 24 hours, in accordance with Special Condition S5.F.

- Central Region (Okanogan, Chelan, Douglas, Kittitas, Yakima, Klickitat, Benton): (509) 575-2490

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

These numbers are also listed at the following web site: http://www.ecy.wa.gov/programs/wq/stormwater/construction/permit.html

ii. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

iii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iv. Document BMP implementation and maintenance in the site log book.

v. Continue to sample discharges daily until:

a) Turbidity is 25 NTU (or lower); or

b) Transparency is 33 cm (or greater); or

c) The Permittee has demonstrated compliance with the water quality limit for turbidity:

1) No more than 5 NTU over background turbidity, if background is less than 50 NTU, or

2) No more than 10% over background turbidity, if background is 50 NTU or greater; or

d) The discharge stops or is eliminated.

D. pH Sampling Requirements -- Significant Concrete Work or Engineered Soils

If construction activity results in the disturbance of 1 acre or more, **and** involves significant concrete work (significant concrete work means greater than 1000 cubic yards poured concrete or recycled concrete used over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area

drains to surface waters of the State or to a storm sewer system that drains to surface waters of the state, the Permittee must conduct pH monitoring as set forth below. Note: In addition, discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for high pH are subject to a numeric effluent limit for pH; refer to Special Condition S8.

1. For sites with significant concrete work, the Permittee must begin the pH monitoring period when the concrete is first poured and exposed to precipitation, and continue weekly throughout and after the concrete pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 (su).

2. For sites with engineered soils, the Permittee must begin the pH monitoring period when the soil amendments are first exposed to precipitation and must continue until the area of engineered soils is fully stabilized.

3. During the applicable pH monitoring period defined above, the Permittee must obtain a representative sample of stormwater and conduct pH analysis at least once per week.

4. The Permittee must monitor pH in the sediment trap/pond(s) or other locations that receive stormwater runoff from the area of significant concrete work or engineered soils before the stormwater discharges to surface waters.

5. The benchmark value for pH is 8.5 standard units. Anytime sampling indicates that pH is 8.5 or greater, the Permittee must either:

    a. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters; or

    b. If necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO_2) sparging or dry ice. The Permittee must obtain written approval from Ecology before using any form of chemical treatment other than CO_2 sparging or dry ice.

6. The Permittee must perform pH analysis on site with a calibrated pH meter, pH test kit, or wide range pH indicator paper. The Permittee must record pH monitoring results in the site log book.

S5. REPORTING AND RECORDKEEPING REQUIREMENTS

A. High Turbidity Phone Reporting

Anytime sampling performed in accordance with Special Condition S4.C indicates turbidity has reached the 250 NTU phone reporting level, the Permittee must call Ecology's Regional office by phone within 24 hours of analysis. The web site is http://www.ecy.wa.gov/programs/wq/stormwater/construction/permit.html. Also see phone numbers in Special Condition S4.C.5.b.i.

B. Discharge Monitoring Reports

Permittees required to conduct water quality sampling in accordance with Special Conditions S4.C (Turbidity/Transparency), S4.D (pH), S8 (303[d]/TMDL sampling), and/or G13 (Additional Sampling) must submit the results to Ecology.

Permittees must submit monitoring data using Ecology's WebDMR program. To find out more information and to sign up for WebDMR go to: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html.

Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper copy DMR at:

Mailing Address:
Department of Ecology
Water Quality Program
Attn: Stormwater Compliance Specialist
PO Box 47696
Olympia, WA 98504-7696

Permittees who obtain a waiver not to use WebDMR must use the forms provided to them by Ecology; submittals must be mailed to the address above. Permittees shall submit DMR forms to be received by Ecology within 15 days following the end of each month.

If there was no discharge during a given monitoring period, all Permittees must submit a DMR as required with "no discharge" entered in place of the monitoring results. For more information, contact Ecology staff using information provided at the following web site: http://www.ecy.wa.gov/programs/spills/response/assistancesoil%20map.pdf

C. Records Retention

The Permittee must retain records of all monitoring information (site log book, sampling results, inspection reports/checklists, etc.), Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements for the entire life of the construction project and for a minimum of three years following the termination of permit coverage. Such information must include all calibration and maintenance records, and records of all data used to complete the application for this

permit. This period of retention must be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

D. Recording Results

For each measurement or sample taken, the Permittee must record the following information:

1. Date, place, method, and time of sampling or measurement.
2. The first and last name of the individual who performed the sampling or measurement.
3. The date(s) the analyses were performed.
4. The first and last name of the individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Special Condition S4 of this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Permittee's DMR.

F. Noncompliance Notification

In the event the Permittee is unable to comply with any part of the terms and conditions of this permit, and the resulting noncompliance may cause a threat to human health or the environment, the Permittee must:

1. Immediately notify Ecology of the failure to comply by calling the applicable Regional office ERTS phone number (find at http://www.ecy.wa.gov/programs/spills/response/assistancesoil%20map.pdf) or refer to Special Condition S4.C.5.b.i.
2. Immediately take action to prevent the discharge/pollution, or otherwise stop or correct the noncompliance, and, if applicable, repeat sampling and analysis of any noncompliance immediately and submit the results to Ecology within five (5) days of becoming aware of the violation.
3. Submit a detailed written report to Ecology within five (5) days, unless requested earlier by Ecology. The report must contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Permittee must report any unanticipated bypass and/or upset that exceeds any effluent limit in the permit in accordance with the 24-hour reporting requirement contained in 40 C.F.R. 122.41(l)(6)).

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply. Refer to Section G14 of this permit for specific information regarding non-compliance.

G. Access to Plans and Records

1. The Permittee must retain the following permit documentation (plans and records) on site, or within reasonable access to the site, for use by the operator or for on-site review by Ecology or the local jurisdiction:

   a. General Permit.

   b. Permit Coverage Letter.

   c. Stormwater Pollution Prevention Plan (SWPPP).

   d. Site Log Book.

2. The Permittee must address written requests for plans and records listed above (Special Condition S5.G.1) as follows:

   a. The Permittee must provide a copy of plans and records to Ecology within 14 days of receipt of a written request from Ecology.

   b. The Permittee must provide a copy of plans and records to the public when requested in writing. Upon receiving a written request from the public for the Permittee's plans and records, the Permittee must either:

      i. Provide a copy of the plans and records to the requester within 14 days of a receipt of the written request; or

      ii. Notify the requester within 10 days of receipt of the written request of the location and times within normal business hours when the plans and records may be viewed; and provide access to the plans and records within 14 days of receipt of the written request; or

      Within 14 days of receipt of the written request, the Permittee may submit a copy of the plans and records to Ecology for viewing and/or copying by the requester at an Ecology office, or a mutually agreed location. If plans and records are viewed and/or copied at a location other than at an Ecology office, the Permittee will provide reasonable access to copying services for which a reasonable fee may be charged. The Permittee must notify the requester within 10 days of receipt of the request where the plans and records may be viewed and/or copied.

S6. PERMIT FEES

The Permittee must pay permit fees assessed by Ecology. Fees for stormwater discharges covered under this permit are established by Chapter 173-224 WAC. Ecology continues to assess permit fees until the permit is terminated in accordance with Special Condition S10 or revoked in accordance with General Condition G5.

S7. SOLID AND LIQUID WASTE DISPOSAL

The Permittee must handle and dispose of solid and liquid wastes generated by construction activity, such as demolition debris, construction materials, contaminated materials, and waste materials from maintenance activities, including liquids and solids from cleaning catch basins and other stormwater facilities, in accordance with:

A. Special Condition S3, Compliance with Standards.

B. WAC 173-216-110.

C. Other applicable regulations.

S8. DISCHARGES TO 303(D) OR TMDL WATER BODIES

A. Sampling and Numeric Effluent Limits For Certain Discharges to 303(d)-listed Water Bodies

1. Permittees who discharge to segments of water bodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, high pH, or phosphorus, must conduct water quality sampling according to the requirements of this section, and Special Conditions S4.C.2.b-f and S4.C.3.b-d, and must comply with the applicable numeric effluent limitations in S8.C and S8.D.

2. All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current listing by Ecology of impaired waters (Category 5) that exists on January 1, 2011, or the date when the operator's complete permit application is received by Ecology, whichever is later.

B. Limits on Coverage for New Discharges to TMDL or 303(d)-listed Waters

Operators of construction sites that discharge to a 303(d)-listed water body are not eligible for coverage under this permit *unless* the operator:

1. Prevents exposing stormwater to pollutants for which the water body is impaired, and retains documentation in the SWPPP that details procedures taken to prevent exposure on site; or

2. Documents that the pollutants for which the water body is impaired are not present at the site, and retains documentation of this finding within the SWPPP; or

3. Provides Ecology with data indicating the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retains such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrate:

   a. For discharges to waters without an EPA-approved or -established TMDL, that the discharge of the pollutant for which the water is impaired will meet in-stream water quality criteria at the point of discharge to the water body; or

   b. For discharges to waters with an EPA-approved or -established TMDL, that there is sufficient remaining wasteload allocation in the TMDL to allow construction stormwater discharge and that existing dischargers to the water body are subject to compliance schedules designed to bring the water body into attainment with water quality standards.

   Operators of construction sites are eligible for coverage under this permit if Ecology issues permit coverage based upon an affirmative determination that the discharge will not cause or contribute to the existing impairment.

C. Sampling and Numeric Effluent Limits for Discharges to Water Bodies on the 303(d) List for Turbidity, Fine Sediment, or Phosphorus

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus must conduct turbidity sampling in accordance with Special Condition S4.C.2 and comply with either of the numeric effluent limits noted in Table 5 below.

2. As an alternative to the 25 NTU effluent limit noted in Table 5 below (applied at the point where stormwater [or authorized non-stormwater] is discharged off-site), permittees may choose to comply with the surface water quality standard for turbidity. The standard is: no more than 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or no more than a 10% increase in turbidity when the background turbidity is more than 50 NTU. In order to use the water quality standard requirement, the sampling must take place at the following locations:

   a. Background turbidity in the 303(d)-listed receiving water immediately upstream (upgradient) or outside the area of influence of the discharge.

   b. Turbidity at the point of discharge into the 303(d)-listed receiving water, inside the area of influence of the discharge.

3. Discharges that exceed the numeric effluent limit for turbidity constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit shall sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

Table 5. Turbidity, Fine Sediment & Phosphorus Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Sampling Frequency	Numeric Effluent Limit[1]
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130 or EPA180.1	Weekly, if discharging	25 NTU, at the point where stormwater is discharged from the site; OR In compliance with the surface water quality standard for turbidity (S8.C.1.a)

[1]Permittees subject to a numeric effluent limit for turbidity may, at their discretion, choose either numeric effluent limitation based on site-specific considerations including, but not limited to, safety, access and convenience.

D. Discharges to Water Bodies on the 303(d) List for High pH

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for high pH must conduct pH sampling in accordance with the table below, and comply with the numeric effluent limit of pH 6.5 to 8.5 su (Table 6).

Table 6. pH Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled/Units	Analytical Method	Sampling Frequency	Numeric Effluent Limit
High pH	pH /Standard Units	pH meter	Weekly, if discharging	In the range of 6.5 – 8.5

2. At the Permittee's discretion, compliance with the limit shall be assessed at one of the following locations:

   a. Directly in the 303(d)-listed water body segment, inside the immediate area of influence of the discharge; or

   b. Alternatively, the permittee may measure pH at the point where the discharge leaves the construction site, rather than in the receiving water.

3. Discharges that exceed the numeric effluent limit for pH (outside the range of 6.5 – 8.5 su) constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit shall sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

E. Sampling and Limits for Sites Discharging to Waters Covered by a TMDL or Another Pollution Control Plan

1. Discharges to a water body that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL. Refer to http://www.ecy.wa.gov/programs/wq/tmdl/index.html for more information on TMDLs.

    a. Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges must be consistent with any specific waste load allocations or requirements established by the applicable TMDL.

        i. The Permittee must sample discharges weekly or as otherwise specified by the TMDL to evaluate compliance with the specific waste load allocations or requirements.

        ii. Analytical methods used to meet the monitoring requirements must conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR Part 136. Turbidity and pH methods need not be accredited or registered unless conducted at a laboratory which must otherwise be accredited or registered.

    b. Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but has not identified specific requirements, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    c. Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    d. Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

2. Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus that is completed and approved by EPA before January 1, 2011, or before the date the operator's complete permit application is received by Ecology, whichever is later. TMDLs completed after the operator's complete permit application is received by Ecology become applicable to the Permittee only if they are imposed through an administrative order by Ecology, or through a modification of permit coverage.

S9. STORMWATER POLLUTION PREVENTION PLAN

The Permittee must prepare and properly implement an adequate Stormwater Pollution Prevention Plan (SWPPP) for construction activity in accordance with the requirements of this permit beginning with initial soil disturbance and until final stabilization.

A. The Permittee's SWPPP must meet the following objectives:

1. To implement best management practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. To prevent violations of surface water quality, ground water quality, or sediment management standards.

3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

1. The SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

   a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

   b. Potential erosion problem areas.

   c. The 12 elements of a SWPPP in Special Condition S9.D.1-12, including BMPs used to address each element.

   d. Construction phasing/sequence and general BMP implementation schedule.

   e. The actions to be taken if BMP performance goals are not achieved—for example, a contingency plan for additional treatment and/or storage of stormwater that would violate the water quality standards if discharged.

   f. Engineering calculations for ponds and any other designed structures.

2. The Permittee must modify the SWPPP if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee must then:

   a. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the inspection or investigation.

   b. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than 10 days from the inspection or investigation. If

installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period,

c. Document BMP implementation and maintenance in the site log book.

The Permittee must modify the SWPPP whenever there is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

C. Stormwater Best Management Practices (BMPs)

BMPs must be consistent with:

1. Stormwater Management Manual for Western Washington (most recent edition), for sites west of the crest of the Cascade Mountains; or

2. Stormwater Management Manual for Eastern Washington (most recent edition), for sites east of the crest of the Cascade Mountains; or

3. Revisions to the manuals listed in Special Condition S9.C.1. & 2., or other stormwater management guidance documents or manuals which provide an equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230; or

4. Documentation in the SWPPP that the BMPs selected provide an equivalent level of pollution prevention, compared to the applicable Stormwater Management Manuals, including:

   a. The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.

   b. An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

D. SWPPP – Narrative Contents and Requirements

The Permittee must include each of the 12 elements below in Special Condition S9.D.1-12 in the narrative of the SWPPP and implement them unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits

   a. Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.

b. Retain the duff layer, native top soil, and natural vegetation in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access

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

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

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

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

   e. Conduct street washing only after sediment removal in accordance with Special Condition S9.D.2.d. Control street wash wastewater by pumping back on site or otherwise preventing it from discharging into systems tributary to waters of the State.

3. Control Flow Rates

   a. Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site, as required by local plan approval authority.

   b. Where necessary to comply with Special Condition S9.D.3.a, construct stormwater retention or detention facilities as one of the first steps in grading. Assure that detention facilities function properly before constructing site improvements (for example, impervious surfaces).

   c. If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.

4. Install Sediment Controls

   The Permittee must design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, the Permittee must design, install and maintain such controls to:

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

   b. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of

resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

c. Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Special Condition S9.D.3.a.

d. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

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

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

5. Stabilize Soils

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

b. The Permittee must control stormwater volume and velocity within the site to minimize soil erosion.

c. The Permittee must control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

d. Depending on the geographic location of the project, the Permittee must not allow soils to 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

East of the Cascade Mountains Crest, except for Central Basin*
During the dry season (July 1 - September 30): 10 days
During the wet season (October 1 - June 30): 5 days

The Central Basin*, East of the Cascade Mountains Crest

During the dry Season (July 1 - September 30): 30 days
During the wet season (October 1 - June 30): 15 days

*Note: The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

e. The Permittee must stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

f. The Permittee must stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

g. The Permittee must minimize the amount of soil exposed during construction activity.

h. The Permittee must minimize the disturbance of steep slopes.

i. The Permittee must minimize soil compaction and, unless infeasible, preserve topsoil.

6. Protect Slopes

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

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

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

i. West of the Cascade Mountains Crest: Temporary pipe slope drains must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Temporary pipe slope drains must handle the expected peak flow velocity from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

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

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

7. Protect Drain Inlets

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

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

8. Stabilize Channels and Outlets

a. Design, construct and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:

i. West of the Cascade Mountains Crest: Channels must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow velocity from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

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

9. Control Pollutants

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

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

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

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

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

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

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: 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. (Also refer to the definition for "concrete wastewater" in Appendix A--Definitions.)

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

h. Assure that washout of concrete trucks is performed offsite or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.

i. Obtain written approval from Ecology before using chemical treatment other than CO_2 or dry ice to adjust pH.

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, into a

controlled conveyance system before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other treatment or disposal options may include:

   i. Infiltration.

   ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.

   iii. Ecology-approved on-site chemical treatment or other suitable treatment technologies.

   iv. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

   v. Use of a sedimentation bag with discharge to a ditch or swale for small volumes of localized dewatering.

d. Permittees must handle highly turbid or contaminated dewatering water separately from stormwater.

11. Maintain BMPs

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

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

12. Manage the Project

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

    b. Inspection and monitoring -- Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with Special Condition S4.

    c. Maintaining an updated construction SWPPP -- Maintain, update, and implement the SWPPP in accordance with Special Conditions S3, S4 and S9.

E. SWPPP – Map Contents and Requirements

The Permittee's SWPPP must also include a vicinity map or general location map (for example, a USGS quadrangle map, a portion of a county or city map, or other appropriate map) with enough detail to identify the location of the construction site and receiving waters within one mile of the site.

The SWPPP must also include a legible site map (or maps) showing the entire construction site. The following features must be identified, unless not applicable due to site conditions:

1. The direction of north, property lines, and existing structures and roads.
2. Cut and fill slopes indicating the top and bottom of slope catch lines.
3. Approximate slopes, contours, and direction of stormwater flow before and after major grading activities.
4. Areas of soil disturbance and areas that will not be disturbed.
5. Locations of structural and nonstructural controls (BMPs) identified in the SWPPP.
6. Locations of off-site material, stockpiles, waste storage, borrow areas, and vehicle/equipment storage areas.
7. Locations of all surface water bodies, including wetlands.
8. Locations where stormwater or non-stormwater discharges off-site and/or to a surface water body, including wetlands.
9. Location of water quality sampling station(s), if sampling is required by state or local permitting authority.
10. Areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

S10. NOTICE OF TERMINATION

A. The site is eligible for termination of coverage when it has met any of the following conditions:

1. The site has undergone final stabilization, the Permittee has removed all temporary BMPs (except biodegradable BMPs clearly manufactured with the intention for the material to be left in place and not interfere with maintenance or land use), and all stormwater discharges associated with construction activity have been eliminated; or
2. All portions of the site that have not undergone final stabilization per Special Condition S10.A.1 have been sold and/or transferred (per General Condition G9), and the Permittee no longer has operational control of the construction activity; or

3. For residential construction only, the Permittee has completed temporary stabilization and the homeowners have taken possession of the residences.

B. When the site is eligible for termination, the Permittee must submit a complete and accurate Notice of Termination (NOT) form, signed in accordance with General Condition G2, to:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, Washington 98504-7696

The termination is effective on the date Ecology receives the NOT form, unless Ecology notifies the Permittee within 30 days that termination request is denied because the Permittee has not met the eligibility requirements in Special Condition S10.A.

Permittees transferring the property to a new property owner or operator/permittee are required to complete and submit the Notice of Transfer form to Ecology, but are not required to submit a Notice of Termination form for this type of transaction.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit must be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the general permit must constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications must bear a certification of correctness to be signed:

1. In the case of corporations, by a responsible corporate officer of at least the level of vice president of a corporation;

2. In the case of a partnership, by a general partner of a partnership;

3. In the case of sole proprietorship, by the proprietor; or

4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to the Ecology.

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering

information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records are kept under the terms and conditions of this permit.

B. To have access to and copy – at reasonable times and at reasonable cost -- any records required to be kept under the terms and conditions of this permit.

C. To inspect -- at reasonable times – any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor – at reasonable times – any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved, or

D. When information is obtained that indicates cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

Pursuant to Chapter 43.21B RCW and Chapter 173-226 WAC, the Director may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

A. Violation of any term or condition of this permit.

B. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

D. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

E. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

F. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

G. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

The Director may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee must submit a new application, or a supplement to the previous application, whenever a material change to the construction activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application must be submitted at least sixty (60) days prior to any proposed changes. Filing a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit will be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal at least 180 days prior to the specified expiration date of this permit.

G9. TRANSFER OF GENERAL PERMIT COVERAGE

Coverage under this general permit is automatically transferred to a new discharger, including operators of lots/parcels within a common plan of development or sale, **if**:

A. A written agreement (Transfer of Coverage Form) between the current discharger (Permittee) and new discharger, signed by both parties and containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to the Director; and

B. The Director does not notify the current discharger and new discharger of the Director's intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the written agreement.

When a current discharger (Permittee) transfers a portion of a permitted site, the current discharger must also submit an updated application form (NOI) to the Director indicating the remaining permitted acreage after the transfer.

G10. REMOVED SUBSTANCES

The Permittee must not re-suspend or reintroduce collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information that Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G15. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Special Condition S5.F, and; 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four (4) years, or both.

G20. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, give notice to Ecology of planned physical alterations, modifications or additions to the permitted construction activity. The Permittee should be aware that, depending on the nature and size of the changes to the original permit, a new public notice and other permit process requirements may be required. Changes in activities that require reporting to Ecology include those that will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant change in the nature or an increase in quantity of pollutants discharged, including but not limited to: for sites 5 acres or larger, a 20% or greater increase in acreage disturbed by construction activity.

C. A change in or addition of surface water(s) receiving stormwater or non-stormwater from the construction activity.

D. A change in the construction plans and/or activity that affects the Permittee's monitoring requirements in Special Condition S4.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G21. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it must promptly submit such facts or information.

G22. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee must give advance notice to Ecology by submission of a new application or supplement thereto at least forty-five (45) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, must be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G23. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit. The discharger must submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons will fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director will either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to the construction stormwater general permit, the applicability of the construction stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G24. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW, and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit's applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter

shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G25. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G26. BYPASS PROHIBITED

A. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited for stormwater events below the design criteria for stormwater management. Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, 3 or 4) is applicable.

1. Bypass of stormwater is consistent with the design criteria and part of an approved management practice in the applicable stormwater management manual.

2. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health.

3. Bypass of stormwater is unavoidable, unanticipated, and results in noncompliance of this permit.

   This bypass is permitted only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

c. Ecology is properly notified of the bypass as required in Special Condition S5.F of this permit.

4. A planned action that would cause bypass of stormwater and has the potential to result in noncompliance of this permit during a storm event.

   The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

   a. a description of the bypass and its cause

   b. an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.

   c. a cost-effectiveness analysis of alternatives including comparative resource damage assessment.

   d. the minimum and maximum duration of bypass under each alternative.

   e. a recommendation as to the preferred alternative for conducting the bypass.

   f. the projected date of bypass initiation.

   g. a statement of compliance with SEPA.

   h. a request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated.

   i. steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

5. For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during preparation of the Stormwater Pollution Prevention Plan (SWPPP) and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

   Ecology will consider the following before issuing an administrative order for this type bypass:

   a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

   b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

   c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve, conditionally approve, or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

B. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

APPENDIX A – DEFINITIONS

AKART is an acronym for "all known, available, and reasonable methods of prevention, control, and treatment." AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus, which was completed and approved by EPA before January 1, 2011, or before the date the operator's complete permit application is received by Ecology, whichever is later.

Applicant means an operator seeking coverage under this permit.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: stormwater associated with construction activity, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer means an area designated by a local jurisdiction that is contiguous to and intended to protect a sensitive area.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Calendar Day A period of 24 consecutive hours starting at 12:00 midnight and ending the following 12:00 midnight.

Calendar Week (same as Week) means a period of seven consecutive days starting at 12:01 a.m. (0:01 hours) on Sunday.

Certified Erosion and Sediment Control Lead (CESCL) means a person who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (see BMP C160 in the SWMM).

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Common Plan of Development or Sale means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a

consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Composite Sample means a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increases while maintaining a constant time interval between the aliquots.

Concrete wastewater means any water used in the production, pouring and/or clean-up of concrete or concrete products, and any water used to cut, grind, wash, or otherwise modify concrete or concrete products. Examples include water used for or resulting from concrete truck/mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing). When stormwater comingles with concrete wastewater, the resulting water is considered concrete wastewater and must be managed to prevent discharge to waters of the state, including ground water.

Construction Activity means land disturbing operations including clearing, grading or excavation which disturbs the surface of the land. Such activities may include road construction, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Contaminant means any hazardous substance that does not occur naturally or occurs at greater than natural background levels. See definition of "hazardous substance" and WAC 173-340-200.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater BMPs is documented within a SWPPP, including:

1. The method and reasons for choosing the stormwater BMPs selected.
2. The pollutant removal performance expected from the BMPs selected.
3. The technical basis supporting the performance claims for the BMPs selected, including any available data concerning field performance of the BMPs selected.
4. An assessment of how the selected BMPs will comply with state water quality standards.
5. An assessment of how the selected BMPs will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Department means the Washington State Department of Ecology.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Dewatering means the act of pumping ground water or stormwater away from an active construction site.

Director means the Director of the Washington Department of Ecology or his/her authorized representative.

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such ground water infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

Engineered Soils means the use of soil amendments including, but not limited, to Portland cement treated base (CTB), cement kiln dust (CKD), or fly ash to achieve certain desirable soil characteristics.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to ground water than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, sediment traps, and ponds. Erosion and sediment control BMPs are synonymous with stabilization and structural BMPs.

Final Stabilization (same as fully stabilized or full stabilization) means the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as riprap, gabions or geotextiles) which prevents erosion.

Ground Water means water in a saturated zone or stratum beneath the land surface or a surface water body.

Hazardous Substance means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under chapter 70.105 RCW; any hazardous sub-stance as defined in RCW 70.105.010(14) or any hazardous substance as defined by rule under chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101(14) of the federal cleanup law, 42 U.S.C., Sec. 9601(14); petroleum or petroleum products; and any substance or category of substances, including solid waste decomposition products, determined by the director

by rule to present a threat to human health or the environment if released into the environment. The term hazardous substance does not include any of the following when contained in an underground storage tank from which there is not a release: crude oil or any fraction thereof or petroleum, if the tank is in compliance with all applicable federal, state, and local law.

Injection Well means a well that is used for the subsurface emplacement of fluids. (See Well.)

Jurisdiction means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington Department of Ecology.

Notice of Intent (NOI) means the application for, or a request for coverage under this general permit pursuant to WAC 173-226-200.

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S10 of this permit.

Operator means any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

Permittee means individual or entity that receives notice of coverage under this general permit.

pH means a liquid's measure of acidity or alkalinity. A pH of 7 is defined as neutral. Large variations above or below this value are considered harmful to most aquatic life.

pH monitoring period means the time period in which the pH of stormwater runoff from a site must be tested a minimum of once every seven days to determine if stormwater pH is between 6.5 and 8.5.

Point source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the State. This term does not include return flows from irrigated agriculture. (See Fact Sheet for further explanation.)

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the CWA, nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the CWA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product (40 CFR 122.1).

Receiving water means the water body at the point of discharge. If the discharge is to a storm sewer system, either surface or subsurface, the receiving water is the water body to which the storm system discharges. Systems designed primarily for other purposes such as for ground water drainage, redirecting stream natural flows, or for conveyance of irrigation water/return flows that coincidentally convey stormwater are considered the receiving water.

Representative means a stormwater or wastewater sample which represents the flow and characteristics of the discharge. Representative samples may be a grab sample, a time-proportionate composite sample, or a flow proportionate sample. Ecology's Construction Stormwater Monitoring Manual provides guidance on representative sampling.

Sanitary sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation means the depositing or formation of sediment.

Sensitive area means a water body, wetland, stream, aquifer recharge area, or channel migration zone.

SEPA (State Environmental Policy Act) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention or treatment; or an amount of a pollutant that has a

reasonable potential to cause a violation of surface or ground water quality or sediment management standards.

Significant concrete work means greater than 1000 cubic yards poured concrete or recycled concrete over the life of a project.

Significant Contributor of Pollutants means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State of Washington.

Site means the land or water area where any "facility or activity" is physically located or conducted.

Source control BMPs means physical, structural or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Stabilization means the application of appropriate BMPs to prevent the erosion of soils, such as, temporary and permanent seeding, vegetative covers, mulching and matting, plastic covering and sodding. See also the definition of Erosion and Sediment Control BMPs.

Storm drain means any drain which drains directly into a storm sewer system, usually found along roadways or in parking lots.

Storm sewer system means a means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains designed or used for collecting or conveying stormwater. This does not include systems which are part of a combined sewer or Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Stormwater Management Manual (SWMM) or Manual means the technical Manual published by Ecology for use by local governments that contain descriptions of and design criteria for BMPs to prevent, control, or treat pollutants in stormwater.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Temporary Stabilization means the exposed ground surface has been covered with appropriate materials to provide temporary stabilization of the surface from water or wind erosion. Materials include, but are not limited to, mulch, riprap, erosion control mats or blankets and temporary cover crops. Seeding alone is not considered stabilization. Temporary stabilization is not a substitute for the more permanent "final stabilization."

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a water body can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations must include a "margin of safety" to ensure that the water body can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation must also account for seasonable variation in water quality.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Transparency means a measurement of water clarity in centimeters (cm), using a 60 cm transparency tube. The transparency tube is used to estimate the relative clarity or transparency of water by noting the depth at which a black and white Secchi disc becomes visible when water is released from a value in the bottom of the tube. A transparency tube is sometimes referred to as a "turbidity tube."

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

Uncontaminated means free from any contaminant, as defined in MTCA cleanup regulations. See definition of "contaminant" and WAC 173-340-200.

Waste Load Allocation (WLA) means the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2[h]).

Water quality means the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Waters of the State includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which include lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Well means a bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension. (See Injection well.)

Wheel wash wastewater means any water used in, or resulting from the operation of, a tire bath or wheel wash (BMP C106: Wheel Wash), or other structure or practice that uses water to physically remove mud and debris from vehicles leaving a construction site and prevent track-out onto roads. When stormwater comingles with wheel wash wastewater, the resulting water is considered wheel wash wastewater and must be managed according to Special Condition S9.D.9.

APPENDIX B – ACRONYMS

AKART	All Known, Available, and Reasonable Methods of Prevention, Control, and Treatment
BMP	Best Management Practice
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
cm	Centimeters
CTB	Cement-Treated Base
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
FR	Federal Register
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USC	United States Code
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WQ	Water Quality
WWHM	Western Washington Hydrology Model

APPENDIX D

WWHM REPORT

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	150828 Pacific Seafoods-dual vaults
Site Name:	Pacific Seafoods
Site Address:	8007 44th Avenue West
City:	Mukilteo
Report Date:	9/1/2015
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.80
Version:	2015/05/14

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

PRE

Bypass:	No
GroundWater:	No

Pervious Land Use	Acres
A B, Pasture, Mod	4.394215
Pervious Total	4.394215

Impervious Land Use	Acres
ROADS FLAT	0.309754
ROOF TOPS FLAT	0.115169
DRIVEWAYS FLAT	0.164784
Impervious Total	0.589707
Basin Total	4.983922

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

POST

Bypass:	No
GroundWater:	No

Pervious Land Use	Acres
A B, Pasture, Mod	0.413154
Pervious Total	0.413154

Impervious Land Use	Acres
ROOF TOPS FLAT	1.570243
DRIVEWAYS FLAT	1.6423
SIDEWALKS FLAT	0.131601
PARKING FLAT	1.226624
Impervious Total	4.570768
Basin Total	4.983922

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

Width: 32 ft.
Length: 184 ft.
Depth: 10 ft.
Discharge Structure
Riser Height: 9 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.021 ft.
Notch Height: 1.875 ft.
Orifice 1 Diameter: 1.294 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2
Vault 2

Vault Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.135	0.000	0.000	0.000
0.1111	0.135	0.015	0.014	0.000
0.2222	0.135	0.030	0.020	0.000
0.3333	0.135	0.045	0.025	0.000
0.4444	0.135	0.060	0.029	0.000
0.5556	0.135	0.075	0.032	0.000
0.6667	0.135	0.090	0.035	0.000
0.7778	0.135	0.105	0.038	0.000
0.8889	0.135	0.120	0.041	0.000
1.0000	0.135	0.135	0.044	0.000
1.1111	0.135	0.150	0.046	0.000
1.2222	0.135	0.165	0.048	0.000
1.3333	0.135	0.180	0.050	0.000
1.4444	0.135	0.195	0.052	0.000
1.5556	0.135	0.210	0.054	0.000
1.6667	0.135	0.225	0.056	0.000
1.7778	0.135	0.240	0.058	0.000
1.8889	0.135	0.255	0.060	0.000
2.0000	0.135	0.270	0.062	0.000
2.1111	0.135	0.285	0.063	0.000
2.2222	0.135	0.300	0.065	0.000
2.3333	0.135	0.315	0.067	0.000
2.4444	0.135	0.330	0.068	0.000
2.5556	0.135	0.345	0.070	0.000
2.6667	0.135	0.360	0.071	0.000
2.7778	0.135	0.375	0.073	0.000
2.8889	0.135	0.390	0.074	0.000
3.0000	0.135	0.405	0.076	0.000
3.1111	0.135	0.420	0.077	0.000
3.2222	0.135	0.435	0.078	0.000
3.3333	0.135	0.450	0.080	0.000
3.4444	0.135	0.465	0.081	0.000
3.5556	0.135	0.480	0.082	0.000
3.6667	0.135	0.495	0.084	0.000
3.7778	0.135	0.510	0.085	0.000
3.8889	0.135	0.525	0.086	0.000
4.0000	0.135	0.540	0.088	0.000

4.1111	0.135	0.555	0.089	0.000
4.2222	0.135	0.570	0.090	0.000
4.3333	0.135	0.585	0.091	0.000
4.4444	0.135	0.600	0.092	0.000
4.5556	0.135	0.615	0.093	0.000
4.6667	0.135	0.630	0.095	0.000
4.7778	0.135	0.645	0.096	0.000
4.8889	0.135	0.660	0.097	0.000
5.0000	0.135	0.675	0.098	0.000
5.1111	0.135	0.690	0.099	0.000
5.2222	0.135	0.705	0.100	0.000
5.3333	0.135	0.720	0.101	0.000
5.4444	0.135	0.735	0.102	0.000
5.5556	0.135	0.750	0.103	0.000
5.6667	0.135	0.766	0.104	0.000
5.7778	0.135	0.781	0.105	0.000
5.8889	0.135	0.796	0.106	0.000
6.0000	0.135	0.811	0.107	0.000
6.1111	0.135	0.826	0.108	0.000
6.2222	0.135	0.841	0.109	0.000
6.3333	0.135	0.856	0.110	0.000
6.4444	0.135	0.871	0.111	0.000
6.5556	0.135	0.886	0.112	0.000
6.6667	0.135	0.901	0.113	0.000
6.7778	0.135	0.916	0.114	0.000
6.8889	0.135	0.931	0.115	0.000
7.0000	0.135	0.946	0.116	0.000
7.1111	0.135	0.961	0.117	0.000
7.2222	0.135	0.976	0.120	0.000
7.3333	0.135	0.991	0.125	0.000
7.4444	0.135	1.006	0.131	0.000
7.5556	0.135	1.021	0.138	0.000
7.6667	0.135	1.036	0.146	0.000
7.7778	0.135	1.051	0.154	0.000
7.8889	0.135	1.066	0.162	0.000
8.0000	0.135	1.081	0.171	0.000
8.1111	0.135	1.096	0.179	0.000
8.2222	0.135	1.111	0.189	0.000
8.3333	0.135	1.126	0.200	0.000
8.4444	0.135	1.141	0.211	0.000
8.5556	0.135	1.156	0.249	0.000
8.6667	0.135	1.171	0.264	0.000
8.7778	0.135	1.186	0.280	0.000
8.8889	0.135	1.201	0.296	0.000
9.0000	0.135	1.216	0.313	0.000
9.1111	0.135	1.231	0.855	0.000
9.2222	0.135	1.246	1.845	0.000
9.3333	0.135	1.261	3.127	0.000
9.4444	0.135	1.276	4.645	0.000
9.5556	0.135	1.291	6.366	0.000
9.6667	0.135	1.306	8.270	0.000
9.7778	0.135	1.321	10.34	0.000
9.8889	0.135	1.336	12.56	0.000
10.000	0.135	1.351	14.92	0.000
10.111	0.135	1.366	17.43	0.000
10.222	0.000	0.000	20.06	0.000

Vault 2

Width:	32 ft.
Length:	59.53617690774 ft.
Depth:	10 ft.
Discharge Structure	
Riser Height:	9 ft.
Riser Diameter:	18 in.
Notch Type:	Rectangular
Notch Width:	0.012 ft.
Notch Height:	1.875 ft.
Orifice 1 Diameter:	1.334 in. Elevation:0 ft.
Element Flows To:	
Outlet 1	Outlet 2

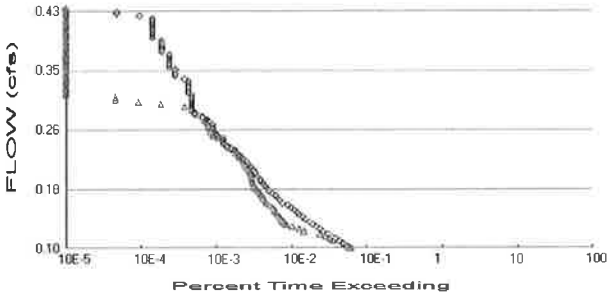
Vault Hydraulic Table

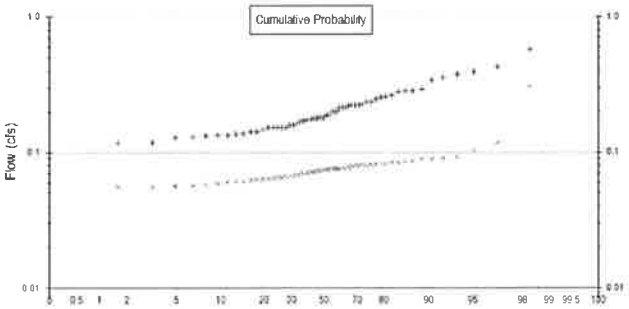
Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.043	0.000	0.000	0.000
0.1111	0.043	0.004	0.015	0.000
0.2222	0.043	0.009	0.022	0.000
0.3333	0.043	0.014	0.027	0.000
0.4444	0.043	0.019	0.031	0.000
0.5556	0.043	0.024	0.034	0.000
0.6667	0.043	0.029	0.038	0.000
0.7778	0.043	0.034	0.041	0.000
0.8889	0.043	0.038	0.044	0.000
1.0000	0.043	0.043	0.046	0.000
1.1111	0.043	0.048	0.049	0.000
1.2222	0.043	0.053	0.051	0.000
1.3333	0.043	0.058	0.054	0.000
1.4444	0.043	0.063	0.056	0.000
1.5556	0.043	0.068	0.058	0.000
1.6667	0.043	0.072	0.060	0.000
1.7778	0.043	0.077	0.062	0.000
1.8889	0.043	0.082	0.064	0.000
2.0000	0.043	0.087	0.066	0.000
2.1111	0.043	0.092	0.067	0.000
2.2222	0.043	0.097	0.069	0.000
2.3333	0.043	0.102	0.071	0.000
2.4444	0.043	0.106	0.073	0.000
2.5556	0.043	0.111	0.074	0.000
2.6667	0.043	0.116	0.076	0.000
2.7778	0.043	0.121	0.077	0.000
2.8889	0.043	0.126	0.079	0.000
3.0000	0.043	0.131	0.081	0.000
3.1111	0.043	0.136	0.082	0.000
3.2222	0.043	0.140	0.083	0.000
3.3333	0.043	0.145	0.085	0.000
3.4444	0.043	0.150	0.086	0.000
3.5556	0.043	0.155	0.088	0.000
3.6667	0.043	0.160	0.089	0.000
3.7778	0.043	0.165	0.090	0.000
3.8889	0.043	0.170	0.092	0.000
4.0000	0.043	0.174	0.093	0.000
4.1111	0.043	0.179	0.094	0.000
4.2222	0.043	0.184	0.096	0.000

4.3333	0.043	0.189	0.097	0.000
4.4444	0.043	0.194	0.098	0.000
4.5556	0.043	0.199	0.099	0.000
4.6667	0.043	0.204	0.101	0.000
4.7778	0.043	0.209	0.102	0.000
4.8889	0.043	0.213	0.103	0.000
5.0000	0.043	0.218	0.104	0.000
5.1111	0.043	0.223	0.105	0.000
5.2222	0.043	0.228	0.106	0.000
5.3333	0.043	0.233	0.107	0.000
5.4444	0.043	0.238	0.109	0.000
5.5556	0.043	0.243	0.110	0.000
5.6667	0.043	0.247	0.111	0.000
5.7778	0.043	0.252	0.112	0.000
5.8889	0.043	0.257	0.113	0.000
6.0000	0.043	0.262	0.114	0.000
6.1111	0.043	0.267	0.115	0.000
6.2222	0.043	0.272	0.116	0.000
6.3333	0.043	0.277	0.117	0.000
6.4444	0.043	0.281	0.118	0.000
6.5556	0.043	0.286	0.119	0.000
6.6667	0.043	0.291	0.120	0.000
6.7778	0.043	0.296	0.121	0.000
6.8889	0.043	0.301	0.122	0.000
7.0000	0.043	0.306	0.123	0.000
7.1111	0.043	0.311	0.124	0.000
7.2222	0.043	0.315	0.126	0.000
7.3333	0.043	0.320	0.130	0.000
7.4444	0.043	0.325	0.134	0.000
7.5556	0.043	0.330	0.138	0.000
7.6667	0.043	0.335	0.143	0.000
7.7778	0.043	0.340	0.148	0.000
7.8889	0.043	0.345	0.153	0.000
8.0000	0.043	0.349	0.158	0.000
8.1111	0.043	0.354	0.163	0.000
8.2222	0.043	0.359	0.169	0.000
8.3333	0.043	0.364	0.176	0.000
8.4444	0.043	0.369	0.183	0.000
8.5556	0.043	0.374	0.205	0.000
8.6667	0.043	0.379	0.214	0.000
8.7778	0.043	0.383	0.223	0.000
8.8889	0.043	0.388	0.232	0.000
9.0000	0.043	0.393	0.242	0.000
9.1111	0.043	0.398	0.784	0.000
9.2222	0.043	0.403	1.774	0.000
9.3333	0.043	0.408	3.056	0.000
9.4444	0.043	0.413	4.574	0.000
9.5556	0.043	0.417	6.296	0.000
9.6667	0.043	0.422	8.199	0.000
9.7778	0.043	0.427	10.26	0.000
9.8889	0.043	0.432	12.49	0.000
10.000	0.043	0.437	14.85	0.000
10.111	0.043	0.442	17.36	0.000
10.222	0.000	0.000	19.99	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 4.394215
Total Impervious Area: 0.589707

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.413154
Total Impervious Area: 4.570768

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.190044
5 year	0.258637
10 year	0.309024
25 year	0.378576
50 year	0.434819
100 year	0.494994

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.072269
5 year	0.090229
10 year	0.103067
25 year	0.120379
50 year	0.134087
100 year	0.148508

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.175	0.067
1950	0.237	0.075
1951	0.202	0.063
1952	0.175	0.056
1953	0.236	0.064
1954	0.293	0.073
1955	0.220	0.080
1956	0.105	0.089
1957	0.180	0.084
1958	0.427	0.067

1959	0.185	0.076
1960	0.158	0.079
1961	0.573	0.076
1962	0.214	0.065
1963	0.256	0.061
1964	0.138	0.057
1965	0.136	0.075
1966	0.141	0.067
1967	0.394	0.064
1968	0.213	0.083
1969	0.376	0.066
1970	0.152	0.063
1971	0.222	0.083
1972	0.284	0.073
1973	0.228	0.070
1974	0.285	0.070
1975	0.215	0.063
1976	0.152	0.074
1977	0.151	0.071
1978	0.118	0.055
1979	0.265	0.068
1980	0.135	0.055
1981	0.152	0.064
1982	0.152	0.081
1983	0.198	0.061
1984	0.178	0.087
1985	0.281	0.081
1986	0.248	0.104
1987	0.222	0.093
1988	0.173	0.084
1989	0.188	0.057
1990	0.128	0.079
1991	0.177	0.077
1992	0.171	0.077
1993	0.134	0.060
1994	0.131	0.075
1995	0.146	0.086
1996	0.181	0.081
1997	0.224	0.312
1998	0.255	0.059
1999	0.118	0.075
2000	0.355	0.090
2001	0.142	0.053
2002	0.133	0.074
2003	0.179	0.076
2004	0.339	0.088
2005	0.162	0.072
2006	0.199	0.081
2007	0.189	0.075
2008	0.158	0.118
2009	0.168	0.070

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.5731	0.3121
2	0.4273	0.1185
3	0.3942	0.1043

4	0.3758	0.0929
5	0.3546	0.0905
6	0.3389	0.0888
7	0.2930	0.0883
8	0.2852	0.0865
9	0.2836	0.0862
10	0.2806	0.0843
11	0.2653	0.0837
12	0.2558	0.0827
13	0.2547	0.0826
14	0.2478	0.0814
15	0.2367	0.0814
16	0.2359	0.0808
17	0.2277	0.0807
18	0.2242	0.0798
19	0.2220	0.0788
20	0.2220	0.0786
21	0.2199	0.0773
22	0.2147	0.0767
23	0.2138	0.0757
24	0.2130	0.0756
25	0.2016	0.0755
26	0.1988	0.0755
27	0.1983	0.0754
28	0.1886	0.0753
29	0.1881	0.0753
30	0.1853	0.0750
31	0.1814	0.0741
32	0.1803	0.0738
33	0.1791	0.0732
34	0.1783	0.0730
35	0.1774	0.0719
36	0.1755	0.0713
37	0.1746	0.0703
38	0.1732	0.0699
39	0.1710	0.0697
40	0.1680	0.0677
41	0.1622	0.0673
42	0.1583	0.0672
43	0.1576	0.0669
44	0.1525	0.0660
45	0.1522	0.0648
46	0.1520	0.0645
47	0.1518	0.0640
48	0.1513	0.0637
49	0.1463	0.0632
50	0.1422	0.0632
51	0.1409	0.0626
52	0.1383	0.0614
53	0.1362	0.0610
54	0.1346	0.0603
55	0.1343	0.0588
56	0.1325	0.0573
57	0.1309	0.0566
58	0.1284	0.0564
59	0.1184	0.0555
60	0.1177	0.0553
61	0.1048	0.0528

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0950	1312	1255	95	Pass
0.0985	1178	1155	98	Pass
0.1019	1042	1030	98	Pass
0.1053	908	757	83	Pass
0.1088	817	692	84	Pass
0.1122	717	595	82	Pass
0.1156	636	507	79	Pass
0.1190	562	313	55	Pass
0.1225	507	269	53	Pass
0.1259	456	216	47	Pass
0.1293	412	183	44	Pass
0.1328	373	169	45	Pass
0.1362	325	156	48	Pass
0.1396	303	149	49	Pass
0.1431	267	139	52	Pass
0.1465	252	134	53	Pass
0.1499	232	128	55	Pass
0.1534	208	119	57	Pass
0.1568	192	108	56	Pass
0.1602	163	99	60	Pass
0.1637	148	95	64	Pass
0.1671	142	89	62	Pass
0.1705	132	85	64	Pass
0.1740	118	81	68	Pass
0.1774	106	76	71	Pass
0.1808	100	72	72	Pass
0.1843	95	67	70	Pass
0.1877	88	65	73	Pass
0.1911	82	64	78	Pass
0.1946	80	63	78	Pass
0.1980	76	62	81	Pass
0.2014	71	60	84	Pass
0.2049	68	59	86	Pass
0.2083	65	56	86	Pass
0.2117	62	54	87	Pass
0.2152	57	51	89	Pass
0.2186	54	49	90	Pass
0.2220	48	47	97	Pass
0.2254	46	44	95	Pass
0.2289	43	42	97	Pass
0.2323	40	39	97	Pass
0.2357	37	36	97	Pass
0.2392	30	33	110	Pass
0.2426	30	30	100	Pass
0.2460	27	27	100	Pass
0.2495	26	26	100	Pass
0.2529	26	23	88	Pass
0.2563	22	20	90	Pass
0.2598	21	19	90	Pass
0.2632	20	18	90	Pass
0.2666	19	18	94	Pass
0.2701	19	17	89	Pass
0.2735	19	16	84	Pass

0.2769	17	16	94	Pass
0.2804	16	15	93	Pass
0.2838	14	14	100	Pass
0.2872	11	12	109	Pass
0.2907	11	11	100	Pass
0.2941	10	10	100	Pass
0.2975	10	8	80	Pass
0.3010	10	4	40	Pass
0.3044	10	2	20	Pass
0.3078	10	1	10	Pass
0.3113	10	1	10	Pass
0.3147	10	0	0	Pass
0.3181	9	0	0	Pass
0.3216	9	0	0	Pass
0.3250	9	0	0	Pass
0.3284	9	0	0	Pass
0.3319	9	0	0	Pass
0.3353	9	0	0	Pass
0.3387	8	0	0	Pass
0.3421	6	0	0	Pass
0.3456	6	0	0	Pass
0.3490	6	0	0	Pass
0.3524	6	0	0	Pass
0.3559	5	0	0	Pass
0.3593	5	0	0	Pass
0.3627	5	0	0	Pass
0.3662	5	0	0	Pass
0.3696	5	0	0	Pass
0.3730	5	0	0	Pass
0.3765	4	0	0	Pass
0.3799	4	0	0	Pass
0.3833	4	0	0	Pass
0.3868	4	0	0	Pass
0.3902	4	0	0	Pass
0.3936	4	0	0	Pass
0.3971	3	0	0	Pass
0.4005	3	0	0	Pass
0.4039	3	0	0	Pass
0.4074	3	0	0	Pass
0.4108	3	0	0	Pass
0.4142	3	0	0	Pass
0.4177	3	0	0	Pass
0.4211	3	0	0	Pass
0.4245	3	0	0	Pass
0.4280	2	0	0	Pass
0.4314	1	0	0	Pass
0.4348	1	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0842 acre-feet
On-line facility target flow:	0.0426 cfs.
Adjusted for 15 min:	0.0481 cfs.
Off-line facility target flow:	0.028 cfs.
Adjusted for 15 min:	0.0317 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 2 POC	☐	490.85			☐	0.00			
Vault 1	☐	490.97			☐	0.00			
Total Volume Infiltrated		981.82	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

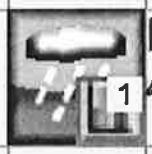
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

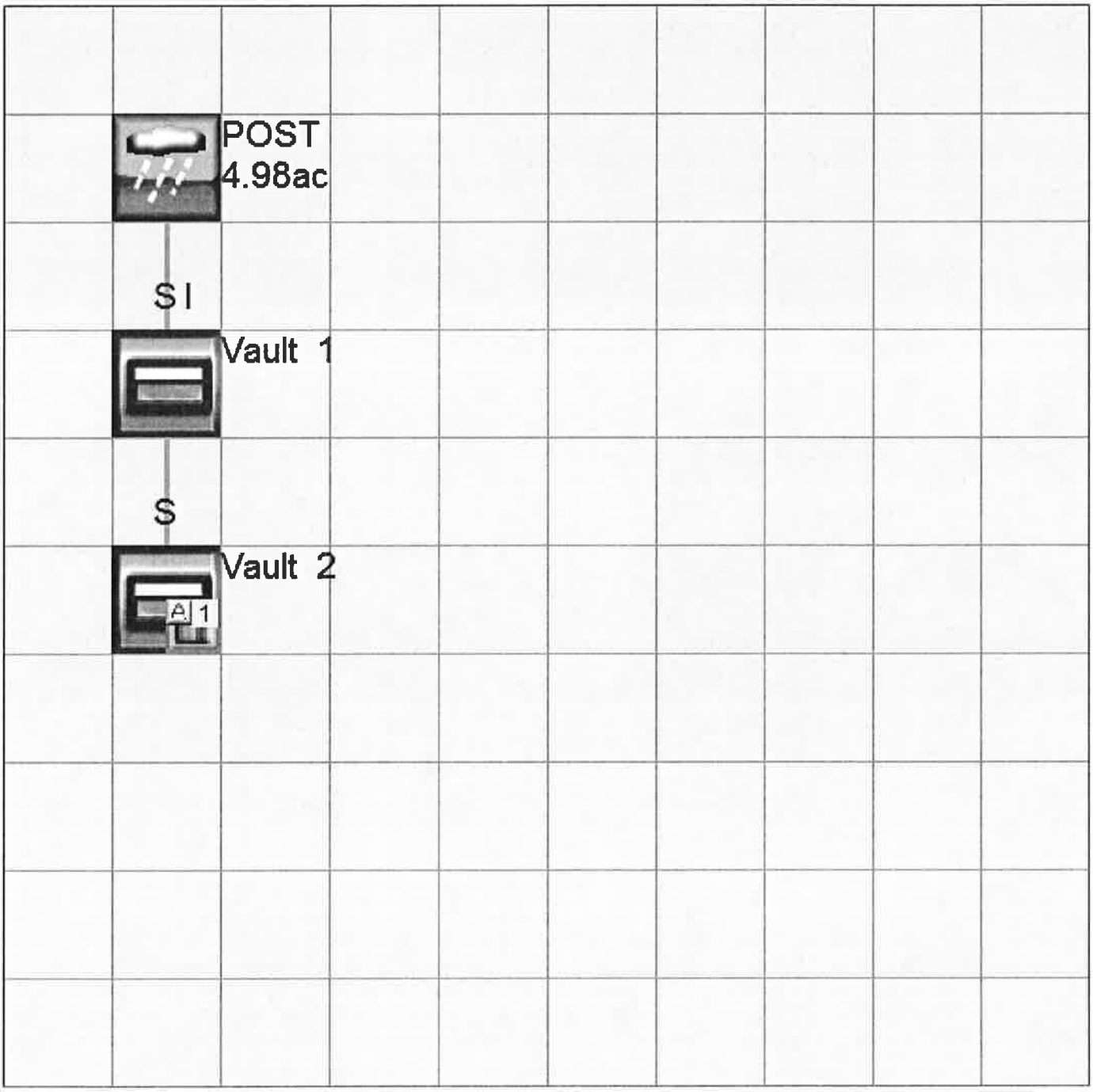
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



PRE
4.98ac

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
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  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
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WDM         26   150828 Pacific Seafoods-dual vaults.wdm
MESSU       25   Pre150828 Pacific Seafoods-dual vaults.MES
            27   Pre150828 Pacific Seafoods-dual vaults.L61
            28   Pre150828 Pacific Seafoods-dual vaults.L62
            30   POC150828 Pacific Seafoods-dual vaults1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        5
      IMPLND        1
      IMPLND        4
      IMPLND        5
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        PRE                          MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    5     A/B, Pasture, Mod       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

```
    5         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

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

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

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

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

END PERLND

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

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

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

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    5         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >       IWATER input info: Part 2          ***
    # -  # ***  LSUR      SLSUR       NSUR      RETSC
    1             400       0.01        0.1        0.1
    4             400       0.01        0.1        0.1
    5             400       0.01        0.1        0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    1              0          0
    4              0          0
    5              0          0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0          0
    4              0          0
    5              0          0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
PRE***
PERLND   5                    4.394215     COPY   501     12
PERLND   5                    4.394215     COPY   501     13
IMPLND   1                    0.309754     COPY   501     15
IMPLND   4                    0.115169     COPY   501     15
IMPLND   5                    0.164784     COPY   501     15

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

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



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

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

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

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

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
```

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.8            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.8            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

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

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01         END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM         26   150828 Pacific Seafoods-dual vaults.wdm
MESSU       25   Mit150828 Pacific Seafoods-dual vaults.MES
            27   Mit150828 Pacific Seafoods-dual vaults.L61
            28   Mit150828 Pacific Seafoods-dual vaults.L62
            30   POC150828 Pacific Seafoods-dual vaults1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        5
      IMPLND        4
      IMPLND        5
      IMPLND        8
      IMPLND       11
      RCHRES        1
      RCHRES        2
      COPY          1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  2                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                        in  out           ***
    5     A/B, Pasture, Mod       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

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

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

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

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

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
   11         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
```

```
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4          0    0    0    0    0
    5          0    0    0    0    0
    8          0    0    0    0    0
   11          0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    5              0         0
    8              0         0
   11              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4             0         0
    5             0         0
    8             0         0
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                   <--Area-->     <-Target->   MBLK    ***
<Name>   #                   <-factor->     <Name>   #   Tbl#    ***
POST***
PERLND   5                       0.4132     RCHRES   1      2
PERLND   5                       0.4132     RCHRES   1      3
IMPLND   4                       1.5702     RCHRES   1      5
IMPLND   5                       1.6423     RCHRES   1      5
IMPLND   8                       0.1316     RCHRES   1      5
IMPLND  11                       1.2266     RCHRES   1      5

******Routing******
RCHRES   1                           1      RCHRES   2      6
RCHRES   1                                  COPY     1     16
RCHRES   2                           1      COPY   501     16
END SCHEMATIC

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



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

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

```
    1     Vault  1                1    1    1    1   28    0    1
    2     Vault  2                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

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

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH     STCOR        KS      DB50        ***
  <------><--------><--------><--------><--------><--------><-------->        ***
    1              1      0.03       0.0       0.0       0.5       0.0
    2              2      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><--------->     <---><---><---><---><---> *** <---><---><---><---><---->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.135170  0.000000  0.000000
  0.111111  0.135170  0.015019  0.014659
  0.222222  0.135170  0.030038  0.020731
  0.333333  0.135170  0.045057  0.025390
  0.444444  0.135170  0.060076  0.029318
  0.555556  0.135170  0.075094  0.032779
  0.666667  0.135170  0.090113  0.035907
  0.777778  0.135170  0.105132  0.038784
  0.888889  0.135170  0.120151  0.041462
  1.000000  0.135170  0.135170  0.043977
  1.111111  0.135170  0.150189  0.046356
  1.222222  0.135170  0.165208  0.048619
  1.333333  0.135170  0.180227  0.050780
  1.444444  0.135170  0.195245  0.052854
  1.555556  0.135170  0.210264  0.054849
  1.666667  0.135170  0.225283  0.056774
  1.777778  0.135170  0.240302  0.058636
  1.888889  0.135170  0.255321  0.060441
  2.000000  0.135170  0.270340  0.062193
```

2.111111	0.135170	0.285359	0.063897
2.222222	0.135170	0.300378	0.065557
2.333333	0.135170	0.315396	0.067176
2.444444	0.135170	0.330415	0.068757
2.555556	0.135170	0.345434	0.070302
2.666667	0.135170	0.360453	0.071814
2.777778	0.135170	0.375472	0.073295
2.888889	0.135170	0.390491	0.074747
3.000000	0.135170	0.405510	0.076171
3.111111	0.135170	0.420529	0.077568
3.222222	0.135170	0.435547	0.078941
3.333333	0.135170	0.450566	0.080291
3.444444	0.135170	0.465585	0.081618
3.555556	0.135170	0.480604	0.082924
3.666667	0.135170	0.495623	0.084210
3.777778	0.135170	0.510642	0.085476
3.888889	0.135170	0.525661	0.086724
4.000000	0.135170	0.540680	0.087954
4.111111	0.135170	0.555698	0.089168
4.222222	0.135170	0.570717	0.090365
4.333333	0.135170	0.585736	0.091546
4.444444	0.135170	0.600755	0.092712
4.555556	0.135170	0.615774	0.093864
4.666667	0.135170	0.630793	0.095002
4.777778	0.135170	0.645812	0.096126
4.888889	0.135170	0.660831	0.097237
5.000000	0.135170	0.675849	0.098336
5.111111	0.135170	0.690868	0.099423
5.222222	0.135170	0.705887	0.100498
5.333333	0.135170	0.720906	0.101561
5.444444	0.135170	0.735925	0.102613
5.555556	0.135170	0.750944	0.103655
5.666667	0.135170	0.765963	0.104687
5.777778	0.135170	0.780982	0.105708
5.888889	0.135170	0.796000	0.106720
6.000000	0.135170	0.811019	0.107722
6.111111	0.135170	0.826038	0.108715
6.222222	0.135170	0.841057	0.109698
6.333333	0.135170	0.856076	0.110674
6.444444	0.135170	0.871095	0.111640
6.555556	0.135170	0.886114	0.112598
6.666667	0.135170	0.901133	0.113549
6.777778	0.135170	0.916151	0.114491
6.888889	0.135170	0.931170	0.115426
7.000000	0.135170	0.946189	0.116353
7.111111	0.135170	0.961208	0.117273
7.222222	0.135170	0.976227	0.120233
7.333333	0.135170	0.991246	0.125387
7.444444	0.135170	1.006265	0.131676
7.555556	0.135170	1.021284	0.138742
7.666667	0.135170	1.036302	0.146363
7.777778	0.135170	1.051321	0.154380
7.888889	0.135170	1.066340	0.162668
8.000000	0.135170	1.081359	0.171126
8.111111	0.135170	1.096378	0.179664
8.222222	0.135170	1.111397	0.189747
8.333333	0.135170	1.126416	0.200508
8.444444	0.135170	1.141435	0.211730
8.555556	0.135170	1.156453	0.249703
8.666667	0.135170	1.171472	0.264914
8.777778	0.135170	1.186491	0.280649
8.888889	0.135170	1.201510	0.296888
9.000000	0.135170	1.216529	0.313616
9.111111	0.135170	1.231548	0.855484
9.222222	0.135170	1.246567	1.845571
9.333333	0.135170	1.261586	3.127444
9.444444	0.135170	1.276604	4.645279
9.555556	0.135170	1.291623	6.366812
9.666667	0.135170	1.306642	8.270275
9.777778	0.135170	1.321661	10.33969

```
9.888889  0.135170  1.336680  12.56267
10.00000  0.135170  1.351699  14.92925
10.11111  0.135170  1.366718  17.43120
END FTABLE  1
FTABLE      2
 92    4
   Depth      Area     Volume  Outflow1 Velocity  Travel Time***
    (ft)   (acres) (acre-ft)    (cfs)   (ft/sec)    (Minutes)***
0.000000  0.043736  0.000000  0.000000
0.111111  0.043736  0.004860  0.015579
0.222222  0.043736  0.009719  0.022033
0.333333  0.043736  0.014579  0.026984
0.444444  0.043736  0.019438  0.031159
0.555556  0.043736  0.024298  0.034836
0.666667  0.043736  0.029158  0.038161
0.777778  0.043736  0.034017  0.041219
0.888889  0.043736  0.038877  0.044065
1.000000  0.043736  0.043736  0.046738
1.111111  0.043736  0.048596  0.049266
1.222222  0.043736  0.053456  0.051671
1.333333  0.043736  0.058315  0.053968
1.444444  0.043736  0.063175  0.056172
1.555556  0.043736  0.068034  0.058293
1.666667  0.043736  0.072894  0.060339
1.777778  0.043736  0.077754  0.062317
1.888889  0.043736  0.082613  0.064235
2.000000  0.043736  0.087473  0.066098
2.111111  0.043736  0.092332  0.067909
2.222222  0.043736  0.097192  0.069673
2.333333  0.043736  0.102052  0.071394
2.444444  0.043736  0.106911  0.073074
2.555556  0.043736  0.111771  0.074716
2.666667  0.043736  0.116630  0.076323
2.777778  0.043736  0.121490  0.077897
2.888889  0.043736  0.126350  0.079439
3.000000  0.043736  0.131209  0.080953
3.111111  0.043736  0.136069  0.082438
3.222222  0.043736  0.140928  0.083897
3.333333  0.043736  0.145788  0.085332
3.444444  0.043736  0.150648  0.086742
3.555556  0.043736  0.155507  0.088130
3.666667  0.043736  0.160367  0.089497
3.777778  0.043736  0.165226  0.090842
3.888889  0.043736  0.170086  0.092169
4.000000  0.043736  0.174946  0.093476
4.111111  0.043736  0.179805  0.094766
4.222222  0.043736  0.184665  0.096038
4.333333  0.043736  0.189524  0.097293
4.444444  0.043736  0.194384  0.098532
4.555556  0.043736  0.199244  0.099757
4.666667  0.043736  0.204103  0.100966
4.777778  0.043736  0.208963  0.102161
4.888889  0.043736  0.213822  0.103342
5.000000  0.043736  0.218682  0.104509
5.111111  0.043736  0.223542  0.105664
5.222222  0.043736  0.228401  0.106807
5.333333  0.043736  0.233261  0.107937
5.444444  0.043736  0.238120  0.109055
5.555556  0.043736  0.242980  0.110163
5.666667  0.043736  0.247840  0.111259
5.777778  0.043736  0.252699  0.112344
5.888889  0.043736  0.257559  0.113419
6.000000  0.043736  0.262418  0.114484
6.111111  0.043736  0.267278  0.115540
6.222222  0.043736  0.272138  0.116585
6.333333  0.043736  0.276997  0.117622
6.444444  0.043736  0.281857  0.118649
6.555556  0.043736  0.286716  0.119667
6.666667  0.043736  0.291576  0.120677
6.777778  0.043736  0.296436  0.121679
```

```
  6.888889  0.043736  0.301295  0.122672
  7.000000  0.043736  0.306155  0.123657
  7.111111  0.043736  0.311014  0.124635
  7.222222  0.043736  0.315874  0.126761
  7.333333  0.043736  0.320734  0.130121
  7.444444  0.043736  0.325593  0.134119
  7.555556  0.043736  0.330453  0.138552
  7.666667  0.043736  0.335312  0.143295
  7.777778  0.043736  0.340172  0.148259
  7.888889  0.043736  0.345032  0.153373
  8.000000  0.043736  0.349891  0.158578
  8.111111  0.043736  0.354751  0.163827
  8.222222  0.043736  0.359610  0.169945
  8.333333  0.043736  0.364470  0.176442
  8.444444  0.043736  0.369330  0.183197
  8.555556  0.043736  0.374189  0.205049
  8.666667  0.043736  0.379049  0.214051
  8.777778  0.043736  0.383908  0.223345
  8.888889  0.043736  0.388768  0.232921
  9.000000  0.043736  0.393628  0.242770
  9.111111  0.043736  0.398487  0.784689
  9.222222  0.043736  0.403347  1.774827
  9.333333  0.043736  0.408206  3.056750
  9.444444  0.043736  0.413066  4.574635
  9.555556  0.043736  0.417926  6.296218
  9.666667  0.043736  0.422785  8.199731
  9.777778  0.043736  0.427645  10.26919
  9.888889  0.043736  0.432504  12.49222
  10.00000  0.043736  0.437364  14.85885
  10.11111  0.043736  0.442224  17.36085
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.8             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.8             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   2 HYDR   RO     1 1         1      WDM   1014 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1         1      WDM   1015 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1      48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

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

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

  MASS-LINK        6
RCHRES     ROFLOW                          RCHRES         INFLOW
  END MASS-LINK    6
```

```
  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT   MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

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APPENDIX E

OPERATIONS AND MAINTENANCE MANUAL