# *Technical Information Report*

*PREPARED FOR:*

Tukwila School District
4640 South 128th Street
Tukwila, WA 98168

*PROJECT:*

Cascade View Elementary
School Modernization
13601 32nd Avenue South
Tukwila, WA 98168
2180111.10

*PREPARED BY:*

Jesse Newman, EIT
Project Engineer

*REVIEWED BY:*

Douglas G. Tapp, PE
Principal

*DATE:*

October 2018

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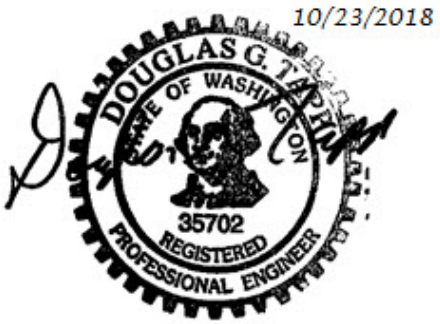



I hereby state that this Technical Information Report for the Cascade View Elementary School Modernization project was prepared by me or under my supervision, and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Tukwila does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

# *Table of Contents*

# *Section 1*

## Project Overview

# 1.0 Project Overview

## 1.1 Purpose and Scope

This report presents the drainage design and study for the modular building addition and supporting improvements to Cascade View Elementary School, located at 13601 32nd Avenue South, Tukwila, Washington (Parcel 1623049038). The parcel totals 8.5 acres and the project site is approximately 0.31 acre. Refer to Figure 1-2, Site Vicinity Map, for a depiction of the site location.

The proposed project includes construction of a modular building addition, resurfacing a play area, rerouting an existing ADA ramp, and construction of supporting infrastructure for the new addition. The site area specifically includes the building addition, the ADA ramp, and the play area, which is the only source of land disturbance with new and replaced impervious surface area. This building addition is located in the northwest quadrant of the parcel, on the southwest portion of the school. Demolition includes approximately 2,787 square feet of existing impervious area and 7,569 square feet of existing landscaping. Stormwater flows will be routed to an existing detention facility located northeast of the building addition, matching the existing drainage pattern.

Stormwater management is to comply with the 2016 King County *Surface Water Design Manual (KCSWDM)*, as adopted by City of Tukwila.

## 1.2 Existing Conditions

The existing developed parcel includes a northern terrace currently occupied by the existing school, playgrounds, and asphalt parking lots along the north and east sides of the property, and a higher southern terrace occupied by a pervious athletic field. Covered concrete walks provide pedestrian access to the separate buildings. The 32nd Avenue South right-of-way provides ingress and egress to the property. The overall topographic relief across the site is 33 feet. Sloped landscaping between the existing paved playground and the existing athletic field provides 6 feet of grade change.

The project area is a small portion of the existing developed parcel. The existing condition of the project area proposed for redevelopment consists of site walk, an existing shed and container, and an existing paved play area. A storm conveyance system crosses the project site from west to east. The topographic relief across the project site is 14 feet. The existing school is located at a low flat area, and landscaped area slopes toward the project site. A grated catch basin collects runoff and the existing conveyance system routes the stormwater to the east, toward the existing flow control facility. The concrete walk crossing the site in the northwesterly direction drains to a catch basin located in landscaping, beneath an existing container. Stormwater runoff discharges into an underground flow control facility, located underneath the main entry driveway and parking, northeast of the project site. The proposed project site drains to this singular discharge point, referred to as Threshold Discharge Area 1 (TDA 1). Refer to Figure 1-3a, Existing Conditions Map.

A geotechnical report was prepared by GeoEngineers, Inc., dated August 20, 2018 (Figure 6-1). In general, GeoEngineers observed about 2 to 3 inches of grass sod, underlain by silty sand with gravel (what they interpreted as weathered glacial till) to a depth of 9 to 12 inches. Underlying the weathered glacial till, GeoEngineers observed dense to very dense sand with silt and gravel and silty sand with gravel and occasional cobbles; GeoEngineers interpreted this soil to be glacial till. No groundwater was observed, though the geotechnical investigation occurred during the dry season. According to the King County Soil Survey (Figure 1-4), the site soils consist of glacial till deposits.

## 1.3 Developed Conditions

The proposed project includes construction of a modular addition to Cascade View Elementary, a new site walk, and a repaved play area. The proposed project is located on the southwest portion of the existing school. The proposed modular addition consists of two modular buildings connected with a covered walkway. Stormwater improvements include roof drains, foundation drains, and bio-retention facilities. The building addition's downspouts will drain to bio-retention facilities, which, along with the footing drains, will discharge to a new conveyance system that connects to the existing storm system. The existing conveyance system discharges east of the project site. Downstream of the project site, stormwater is routed to the existing flow control facility, which discharges to the public storm system serving 32nd Avenue South.

The project site area is about 13,600 square feet, with 4,365 square feet of new plus replaced non-pollution generating impervious area. Figure 1-3b, Developed Conditions Map, depicts these areas. The project site developed drainage patterns are analyzed and discussed in further detail in Section 4.0, Flow Control, Low Impact Development (LID), and Water Quality Facility Analysis and Design.

## Section 1.0 Figures

# TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

## Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: Tukwila School District

Phone: 206-901-8000

Address: 4640 S 144th Street
Tukwila, WA 98168

Project Engineer: Bethany, PE

Company: AHBL, Inc.

Phone: 206-267-2425

## Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: Cascade View Elementary School

DPER Permit #: _____

Location Township: 23 N

Range: 04 E

Section: 16

Site Address: 13601 32nd AVE S
Tukwila, WA 98168

## Part 3 TYPE OF PERMIT APPLICATION

- ☐ Landuse (e.g.,Subdivision / Short Subd. / UPD)
- ☑ Building (e.g.,M/F / Commercial / SFR)
- ☐ Clearing and Grading
- ☐ Right-of-Way Use
- ☐ Other _____

## Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other _____
- ☐ Shoreline Management
- ☐ Structural Rockery/Vault/_____
- ☐ ESA Section 7

## Part 5 PLAN AND REPORT INFORMATION

**Technical Information Report**

Type of Drainage Review (check one):

- ☑ Full
- ☐ Targeted
- ☐ Simplified
- ☐ Large Project
- ☐ Directed

Date (include revision dates): _____

Date of Final: _____

**Site Improvement Plan (Engr. Plans)**

Plan Type (check one):

- ☑ Full
- ☐ Modified
- ☐ Simplified

Date (include revision dates): _____

Date of Final: _____

## Part 6 SWDM ADJUSTMENT APPROVALS

Type (circle one): (Standard) / Experimental / Blanket

Description: (include conditions in TIR Section 2)

_____

_____

_____

Approved Adjustment No. _____ Date of Approval: _____

# TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

## Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / (No)

Start Date: _____

Completion Date: _____

Describe: _____

_____

_____

Re: KCSWDM Adjustment No. _____

## Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : _____

Special District Overlays: _____

Drainage Basin: _____

Stormwater Requirements: _____

## Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- ❑ River/Stream _____
- ❑ Lake _____
- ❑ Wetlands _____
- ❑ Closed Depression _____
- ❑ Floodplain _____
- ❑ Other _____
  _____
- ❑ Steep Slope _____
- ❑ Erosion Hazard _____
- ❑ Landslide Hazard _____
- ❑ Coal Mine Hazard _____
- ❑ Seismic Hazard _____
- ❑ Habitat Protection _____
- ❑ _____

## Part 10 SOILS

| Soil Type | Slopes | Erosion Potential |
|---|---|---|
| **Till** | **0-30%** | **MID** |
| | | |
| | | |
| | | |

- ❑ High Groundwater Table (within 5 feet)
- ❑ Other _____
- ❑ Sole Source Aquifer
- ❑ Seeps/Springs

❑ Additional Sheets Attached

# TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| Part 11 DRAINAGE DESIGN LIMITATIONS | |
|---|---|
| REFERENCE | LIMITATION / SITE CONSTRAINT |
| ❑ Core 2 – Offsite Analysis | |
| ❑ Sensitive/Critical Areas | |
| ❑ SEPA | |
| ❑ LID Infeasibility | |
| ❑ Other | |
| ❑ | |
| ❑ Additional Sheets Attached | |

| Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area) | |
|---|---|
| **Threshold Discharge Area:** (name or description) | Project Site |
| **Core Requirements (all 8 apply):** | |
| Discharge at Natural Location | Number of Natural Discharge Locations: |
| Offsite Analysis | Level: 1 / 2 / 3 dated: |
| Flow Control (include facility summary sheet) | Level: 1 / 2 / 3 or Exemption Number<br>Flow Control BMPs |
| Conveyance System | Spill containment located at: Flow Control Riser Tee |
| Erosion and Sediment Control / Construction Stormwater Pollution Prevention | CSWPP/CESCL/ESC Site Supervisor:<br>Contact Phone:<br>After Hours Phone: |
| Maintenance and Operation | Responsibility (circle one): (Private) / Public<br>If Private, Maintenance Log Required: (Yes) / No |
| Financial Guarantees and Liability | Provided: (Yes) / No |
| Water Quality (include facility summary sheet) | Type (circle one): Basic / Sens. Lake / Enhanced Basic / Bog<br>or Exemption No.<br>Landscape Management Plan: Yes / No |
| **Special Requirements (as applicable):** | |
| Area Specific Drainage Requirements | Type: CDA / SDO / MDP / BP / LMP / Shared Fac. / None<br>Name: |
| Floodplain/Floodway Delineation | Type (circle one): Major / Minor / Exemption / None<br>100-year Base Flood Elevation (or range):<br>Datum: |
| Flood Protection Facilities | Describe: |

# TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area) | |
|---|---|
| Source Control<br>(commercial / industrial land use) | Describe land use:<br>Describe any structural controls: |
| Oil Control | High-use Site: Yes / (No)<br>Treatment BMP: _____<br>Maintenance Agreement: Yes / No<br>with whom? _____ |
| **Other Drainage Structures** | |
| Describe: | |

**Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS**

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION

- ☑ Clearing Limits
- ☑ Cover Measures
- ☑ Perimeter Protection
- ☑ Traffic Area Stabilization
- ☑ Sediment Retention
- ☑ Surface Water Collection
- ☑ Dewatering Control
- ☑ Dust Control
- ☑ Flow Control
- ☑ Protection of Flow Control BMP Facilities (existing and proposed)
- ☑ Maintain BMPs / Manage Project

MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION

- ☑ Stabilize exposed surfaces
- ☑ Remove and restore Temporary ESC Facilities
- ☑ Clean and remove all silt and debris, ensure operation of Permanent Facilities, restore operation of Flow Control BMP Facilities as necessary
- ☑ Flag limits of SAO and open space preservation areas
- ☐ Other _____

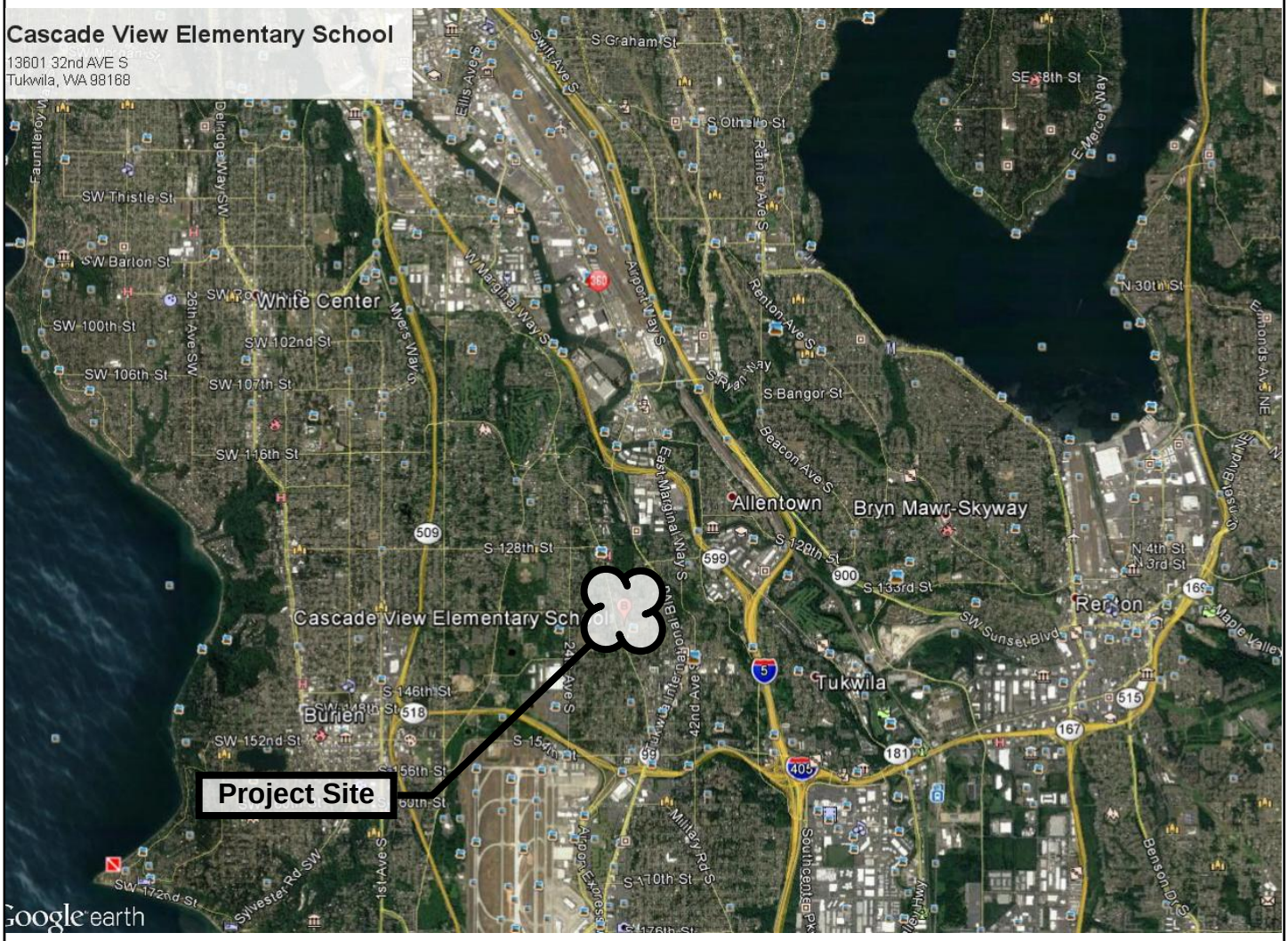
**Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch)**

| Flow Control | Type/Description | Water Quality | Type/Description |
|---|---|---|---|
| ☐ Detention | _____ | ☐ Vegetated Flowpath | _____ |
| ☐ Infiltration | _____ | ☐ Wetpool | _____ |
| ☐ Regional Facility | _____ | ☐ Filtration | _____ |
| ☐ Shared Facility | _____ | ☐ Oil Control | _____ |
| ☐ Flow Control BMPs | _____ | ☐ Spill Control | _____ |
| ☐ Other | _____ | ☐ Flow Control BMPs | _____ |
| | | ☐ Other | _____ |

# TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| Part 15 EASEMENTS/TRACTS | | Part 16 STRUCTURAL ANALYSIS |
|---|---|---|
| ❑ Drainage Easement<br>❑ Covenant<br>❑ Native Growth Protection Covenant<br>❑ Tract<br>❑ Other _____ | | ❑ Cast in Place Vault<br>❑ Retaining Wall<br>❑ Rockery > 4' High<br>❑ Structural on Steep Slope<br>❑ Other _____ |

| Part 17 SIGNATURE OF PROFESSIONAL ENGINEER |
|---|
| I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate.<br><br>_____<br>*Signed/Date* |

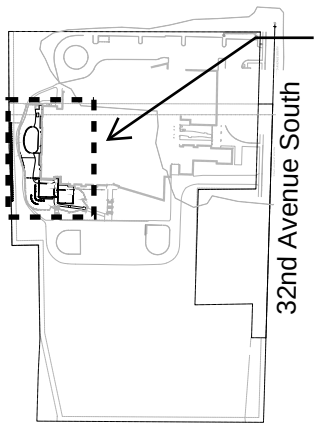



1200 6th Avenue, #1620
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX
www.ahbl.com

**Cascade View Elementary School**

Vicinity Map

**Figure 1-2**




Scale 1"=400'

Legend

| Description | Quantity | Unit |
|---|---|---|
| EXISTING IMPERVIOUS AREA | 4,309 | sf |

GRAPHIC SCALE

0 10 20 40

1" = 20 FEET

EXISTING PLAY AREA

BIG TOY

4x4 POST (TYP)

6' CHAIN LINK

CONC EDGING

2x2" IRON PIPES

FF=347.10

FF=347.11

FF=347.09

AHBL #106
NAIL AND WASHER
N:178950.2486
E:1279278.2810
ELEV: 352.62

STCB 11056 RIM=346.72
8" PVC E IE=342.09
8" PVC NW IE=342.02

ROOF=370.59

EXISTING BUILDING

CONTAINER

SHED

PROPOSED MODULAR BUILDING

TO STCB 10832, TDA 1

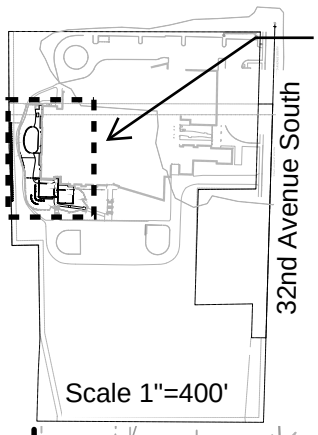
FLOW ARROWS

AHBL
1200 6th Avenue
Suite 1620
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX

**CASCADE VIEW ELEMENTARY**

**DEVELOPED CONDITIONS MAP**

**FIG 1-3a**




Legend

| Description | Quantity | Unit |
|---|---|---|
| IMPERVIOUS TO REMAIN | 1,522 | sf |
| NEW IMPERVIOUS AREA | 26 | sf |
| NEW IMPERVIOUS TO BIO 1 | 826 | sf |
| NEW IMPERVIOUS TO BIO 2 | 869 | sf |
| REPLACED IMPERVIOUS AREA | 1,584 | sf |
| REPLACED IMPERVIOUS TO BIO 1 | 744 | sf |
| REPLACED IMPERVIOUS TO BIO 2 | 316 | sf |
| TOTAL DISTURBED AREA | 13,599 | sf |

**TOTAL NEW+ REPLACED IMPERVIOUS AREA=4365 SF**

**143 SF REMOVED EXISTING IMPERVIOUS AREA**

GRAPHIC SCALE

0 10 20 40

1" = 20 FEET

PROPOSED PLAY AREA

EXISTING BUILDING

PROPOSED WALK

PROPOSED MODULAR BUILDING

PROPOSED ROCK WALL

CONSTRUCTION LIMITS

PROPOSED WALK

PROPOSED MODULAR BUILDING

TO STCB 10832, TDA 1

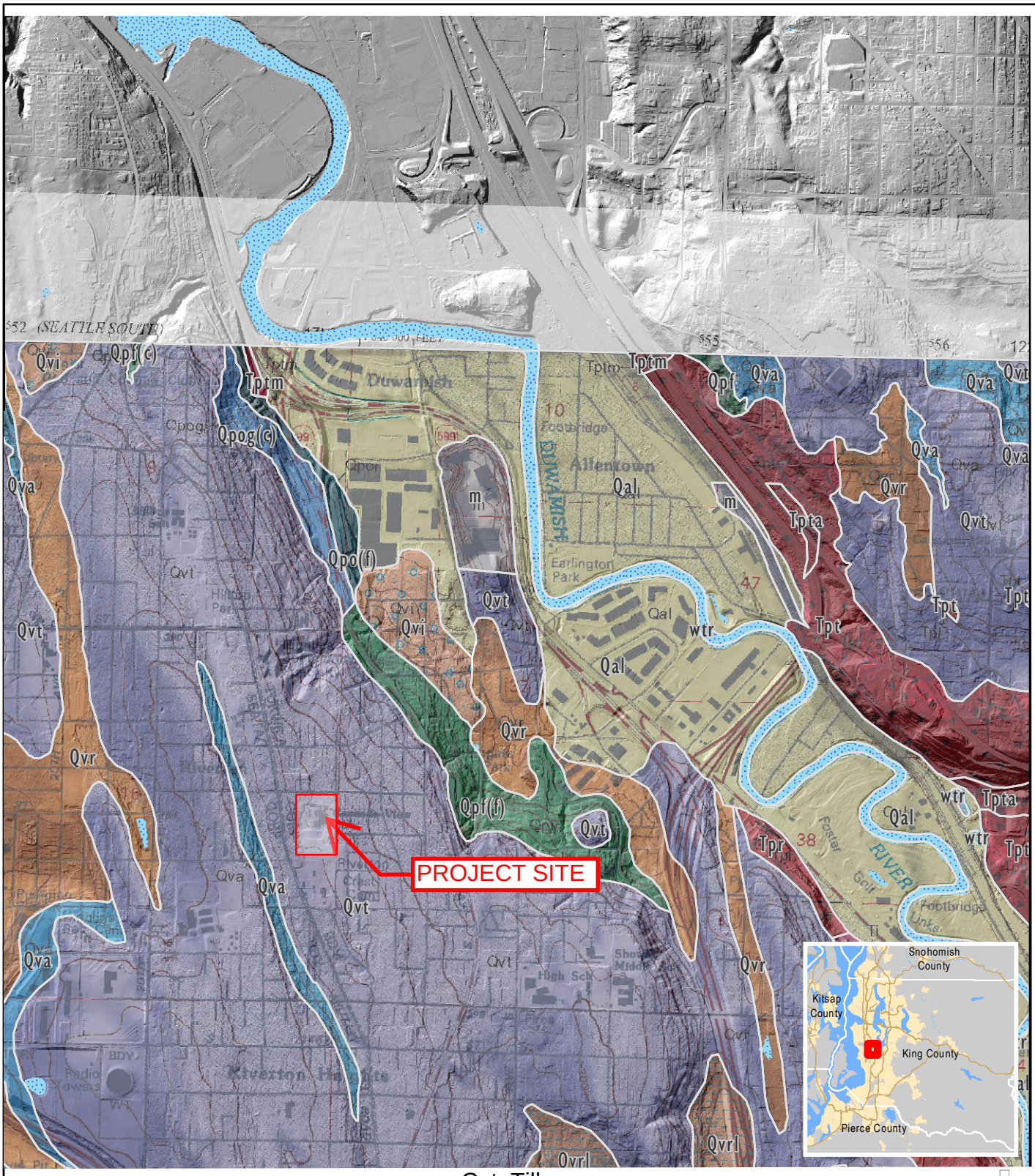
PROPOSED RAMP

AHBL
1200 6th Avenue
Suite 1620
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX

**CASCADE VIEW ELEMENTARY**

**DEVELOPED CONDITIONS MAP**

**FIG 1-3b**




DATA SOURCES / REFERENCES:
KING CO: STREETS, PARCELS 12/16
USGS: SIM-2855

Qvt: Till
Qvi: Ice-contact deposits
Qvr: Recessional lacustrine deposits
Qal: Alluvium (Holocene)

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**Cascade View Elementary School**

Soil Survey

**Fig. 1-4**

# *Section 2*

## Conditions and Requirements Summary

# 2.0 Conditions and Requirements Summary

## 2.1 Conditions of Approval

Conditions of Approval will be included in the final Technical Information Report, as required.

## 2.2 Core Requirements

### 2.2.1 CR 1 – Discharge at the Natural Location

All stormwater runoff will be discharged at the natural location. In the existing conditions, stormwater runoff sheet flows toward the catch basin (STCB 10832), which drains to an existing flow control facility. The flow control facility discharges to the city storm system within 32nd Avenue South. In the developed conditions, the roof runoff, foundation drains, and upstream flows are captured by a new conveyance system. The new conveyance system connects to the existing conveyance system, which continues to flow east and then north to the existing flow control facility and, therefore, continuing to discharge at its natural location.

### 2.2.2 CR 2 – Offsite Analysis

The discharge location of the project site is from a flow control structure located at the northeast corner of the parcel. This structure hydraulically connects to the existing detention facility located under the entry parking lot located adjacent to the east property line, where the existing site catch basins and area drain discharge as well. In the developed condition, a hydraulic analysis will be performed to be sure that there is no change in runoff to the detention facility.

This project constructs 1,721 square feet of new impervious surface area. According to Section 1.2.2, Exception Requirement 2, in the *KCSWDM,* the proposed project is exempt from Core Requirement 2 if the project adds less than 2,000 square feet of new impervious surface, and less than 0.75 acre of new pervious surface. Because the project constructs less than 2,000 square feet of new impervious surface, this project is exempt from Core Requirement 2.

AHBL staff walked 1 mile downstream of the project site and field inspected the area. The downstream path was well defined, with no signs of erosion or sedimentation. No signs of flooding or overtopping of the downstream were observed. No downstream complaints were reported downstream of the project site. The project will not create or aggravate potential downstream problems.

### 2.2.3 CR 3 – Flow Control

The Cascade View Elementary School is exempt from Core Requirement 3, because the project meets the basic exemption of the following:

1. Less than 5,000 square feet of new plus replaced impervious surface will be created, and

2. Less than 0.75 acre of new pervious surface will be added.

This project creates 4,365 square feet of new plus replaced impervious surface area; therefore, flow control is not required. Refer to Figure 1-3b, Developed Conditions Map, for areas.

### 2.2.4 CR 4 – Conveyance System

The conveyance system design will be assessed once the building permit application is submitted. Refer to Section 5.0 for more information.

### 2.2.5 CR 5 – Erosion and Sediment Control

An erosion and sediment control plan was developed for this site in accordance with the *KCSWDM* and the *King County Stormwater Pollution Prevention Manual (KCSPPM)*. The full erosion and sediment control plan is described further in Section 8.0 and in the project plans.

### 2.2.6 CR 6 – Maintenance and Operations

The onsite drainage facilities are privately maintained by Tukwila Public Schools. An Operations and Maintenance manual is provided in Section 10.0.

### 2.2.7 CR 7 – Financial Guarantees and Liability

Financial guarantees are not required for publically funded projects or public organizations per Washington Administrative Code.

### 2.2.8 CR 8 – Water Quality

The project site is exempt from Core Requirement 8. The project site meets the surface area exemption, Exemption 1. The project site meets the following criteria:

1. Less than 5,000 square feet of new plus replaced pollution generating impervious surface (PGIS) that is not fully dispersed will be created, and

2. Less than 0.75 acre of new pollution generating pervious surface (PGPS) that is not fully dispersed will be added.

This project does not include any new or replaced pollution generating impervious area; therefore, water quality is not required.

### 2.2.9 CR 9 – Flow Control BMPs

Flow control Best Management Practices (BMPs) were evaluated to meet the core requirements. The project falls under the requirements for Large Lot BMP (see Section 4.0).

## 2.3 Special Requirements

### 2.3.1 SR 1 – Other Adopted Area-Specific Requirements

The project site discharges to the Duwamish River approximately 2.2 miles downstream from the project site. The Duwamish River water quality holds the following status:

Category 5 – 303(d) Water:

- PCBs; Alpha-BHC; 4, 4’ –DDE; 4, 4’ –DDT; 4, 4’ –DDD; PH; Temperature

Category 2 Water:

- Bis(2-Ethylhexyl) phthalate; Dissolved Oxygen

Category 1 Water:

- 1,2-Diphenylhydrazine; 2,4-Dinitrotoluene; Anthracene; Fluorene; Ammonia-N; 2,4-Dichlorphenol; Chloride; 2,4-Dinitrophenol; Hexachlorocyclopentadiene; Chlordane; Pentachlorophenol; Dimethyl phthalate; Bis(2-chloroethyl)ether; N-Nitrosodiphenylamine; 1,2-Dichlorobenzene; 1,3-Dichlorobenzene; Mercury; Bacteria; Hexachlorobutadiene; 2,4,6 – Trichlorophenol; Nitrobenzene; 1,4-Dichlorobenzene; Hexachloroethane; 3,3' Dichlorobenzidine; Bis(2-chloroisopropyl)ether

The threshold for this requirement, stated in SR 1, Section 1.3.1, is as follows:

*"IF a proposed project is in a designated Critical Drainage Area or in an area included in an adopted master drainage plan, basin plan, salmon conservation plan, stormwater compliance plan, flood hazard management plan, lake management plan, or shared facility drainage plan."*

The requirement stated in SR 1, Section 1.3.1, is as follows:

*"THEN the proposed project shall comply with the drainage requirements of the Critical Drainage Area, master drainage plan, basin plan, salmon conservation plan, stormwater compliance plan, flood hazard management plan, lake management plan, or shared facility drainage plan, respectively."*

This project was not determined to be in a critical drainage area, nor were any plans listed above found for this property.

Therefore, the project is not subject to SR 1.

### 2.3.2 SR 2 – Floodplain/Floodway Delineation

Flood Insurance Rate Map No. 53033C0960 F, Panel 960 of 1725, was consulted for this project and did not show any floodplains on the project site. Refer to Figure 2-1 of this section.

### 2.3.3 SR 3 – Flood Protection Facilities

The project does not contain, will not construct, and is not adjacent to any existing flood protection facilities.

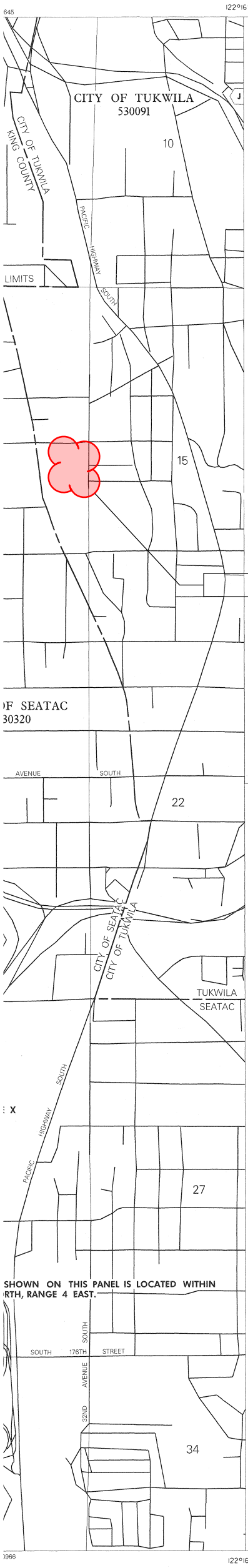
### 2.3.4 SR 4 – Source Controls

The proposed project consists of a building addition. The *KCSPPM* will be referenced for source control measures, in addition to erosion and sediment control measures, during construction. For construction source controls, see Section 8.0, CSWPPP Analysis and Design. For post-construction source controls, see Section 10.0, Operations and Maintenance Plan.

### 2.3.5 SR 5 – Oil Control

The project does not fit the definition of a high-use site; therefore, it is not subject to oil control requirements.

## Section 2.0 Figures




THIS AREA IS SHOWN ON MAP NUMBER 53033C0957

THIS AREA IS SHOWN ON MAP NUMBER 53033C0959

## LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line. Elevation in Feet. See Map Index for Elevation Datum.
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.
- RM7 — Elevation Reference Mark
- M2 — River Mile
- 97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

## NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and/or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:
SEPTEMBER 29,1989

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
Revised May 16, 1995 to update map format.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

# NATIONAL FLOOD INSURANCE PROGRAM

# FIRM
## FLOOD INSURANCE RATE MAP

KING COUNTY, WASHINGTON AND INCORPORATED AREAS

**PANEL 960 OF 1725**
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| BURIEN, CITY OF | 530321 | 0960 | F |
| KING COUNTY, UNINCORPORATED AREAS | 530071 | 0960 | F |
| SEATAC, CITY OF | 530320 | 0960 | F |
| TUKWILA, CITY OF | 530091 | 0960 | F |

**MAP NUMBER 53033C0960 F**

**MAP REVISED: MAY 16, 1995**

Federal Emergency Management Agency

AHBL
1200 6th Avenue, #1620
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX
www.ahbl.com

**Cascade View Elementary School**

Flood Insurance Rate Map

JOB NO. 2160786.10

DATE: 01/30/17

**Fig. 2-1**

# *Section 3*

## Offsite Analysis

# 3.0 Offsite Analysis

This project is exempt from offsite analysis. Please see Section 2.2.2 for further explanation.

# *Section 4*

## Flow Control, Low Impact Development (LID) and Water Quality Facility Analysis and Design

# 4.0 Flow Control, Low Impact Development (LID), and Water Quality Facility Analysis and Design

## 4.1 Flow Control

### 4.1.1 Existing Site Hydrology (Part A)

The existing project site consists of a shed, a container, a paved play area, a paved walk, and an existing ramp, totaling about 4,300 square feet of impervious surface and 9,290 square feet of pervious surface. The storm runoff from the concrete walks and landscaping is tight-lined or sheet flows to the catch basin located east of the project site (STCB 10832). The catch basin discharges flows east in a storm pipe that eventually connects to an existing stormwater flow control facility northeast of the project site. The entire site connects into the same TDA, TDA 1 (see Figure 1-3a).

### 4.1.2 Developed Site Hydrology (Part B)

The developed site will construct a modular building in the landscaped area south of the southwest portion of the existing school. A portion of the modular building addition will cover the existing walk, and another portion covers the existing container and shed. The existing impervious and pervious surfaces within the building footprint will be demolished to accommodate the proposed design. The total developed impervious surface area is 4,365 square feet of new roof area and existing covered concrete walk.

The developed site hydrology includes supporting infrastructure for the new addition: roof drains, footing drains, and storm improvements. The building addition's roof downspouts connect to bio-retention facilities, which then connect to the existing conveyance system. The existing conveyance system flows east of the project area. Downstream of the project site, stormwater is routed to the existing flow control facility, which discharges to the natural discharge point located at the public storm system serving 32nd Avenue South. The conveyance system will meet the requirements of the *KCSWDM*. Calculations will be provided with the building permit submittal (see Figure 1-3b).

### 4.1.3 Performance Standards (Part C)

**Area-Specific Flow Control Facility Standard**

This project is exempt from flow control requirements (see Section 2.2.3).

**Flow Control BMP Requirements**

Flow Control BMPs are required per CR 9. The project area totals about 13, 600 square feet. The proposed site includes 4,365 square feet of impervious area, including new (1,721 square feet) and replaced (2,644 square feet) impervious areas. The project falls under the Large Lot Low Impervious BMP Requirements.

Below is a summary of the Flow Control BMPs (per Section 1.2.9.2.3 of the *KCSWDM*) that the project reviewed for use:

1. **BMP Option 1:**

    a. **Full dispersion**: The project area was evaluated for full dispersion of target impervious surfaces. It was determined that full dispersion is infeasible because of no available area and the soils in the area consist of till deposits, which provide little to no potential for infiltration.

2. **BMP Option 2:**

    a. **Full infiltration of roof runoff**: Soils are till deposits, with little to no potential for infiltration. No formal infiltration facilities are proposed.

3. **BMP Option 3:**

    a. **Full Infiltration**: Soils are till deposits, with little to no potential for infiltration. No formal infiltration facilities are proposed.

    b. **Limited Infiltration**: Soils are till deposits, with little to no potential for infiltration. No formal infiltration facilities are proposed.

    c. **Bioretention**: The project site will use bio-retention facilities that have underdrains connected to a tight-lined onsite storm system.

    d. **Permeable Pavement:** The project site was evaluated for permeable pavement. It was found that permeable pavement is infeasible because there is not enough area available, and all surrounding areas are matching adjacent existing standard concrete.

4. **BMP Option 4:**

    a. **Basic Dispersion**: The project site was evaluated for basic dispersion. It was found that basic dispersion is infeasible because there is no available natural vegetated area for runoff to disperse to.

5. **BMP Option 5:**

    a. **Reduced Impervious Surface Credit:** The project site was evaluated for applying the reduced impervious surface credit. It was found that the reduced impervious surface credit is infeasible because there is no area to reduce.

    b. **Native Growth Retention Credit:** The project site was evaluated for applying the native growth retention credit. It was found that there is no native growth available onsite.

**Perforated Roof Drain for Connection**

All roof drains are proposed to drain into under-drained bio-retention facilities; therefore, perforated roof drain for connection was not assessed.

**Conveyance System Capacity Standards**

The storm conveyance system will be analyzed as stipulated by the *KCSWDM*. Refer to Section 2.2.4 for explanation of compliance.

### 4.1.4 Flow Control System (Part D)

This project is exempt from flow control requirements (see Section 2.2.3).

### 4.1.5 Water Quality System (Part E)

This project is exempt from water quality systems (see Section 2.2.8).

# *Section 5*

## Conveyance System Analysis and Design

# 5.0 Conveyance System Analysis and Design

Conveyance will be analyzed upon permit submission.

## Section 5.0 Figures

(To be included in a later submittal)

# *Section 6*

## Special Reports and Studies

## 6.0 Special Reports and Studies

GeoEngineers, Inc. prepared a Geotechnical Engineering Services Report, dated August 20, 2018 (see Figure 6-1).

## Section 6.0 Figures

FIGURE 6-1

# Geotechnical Engineering Services Report

Tukwila School District – Cascade View
Elementary School Improvements
Tukwila, Washington

*for*
**Tukwila School District, No. 406**

August 20, 2018

GeoEngineers
Earth Science + Technology

# Geotechnical Engineering Services Report

Tukwila School District – Cascade View
Elementary School Improvements
Tukwila, Washington

*for*
**Tukwila School District, No. 406**

August 20, 2018

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

# Geotechnical Engineering Services Report

## Tukwila School District – Cascade View Elementary School Improvements Tukwila, Washington

**File No. 23537-003-00**

**August 20, 2018**

Prepared for:

Tukwila School District, No. 406
c/o KMB Architects
906 Columbia Street SW, Suite 400
Olympia, Washington 98501

Attention: Jeffrey Feeney, PE

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
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CHRISTOPHER ROBERT NEWTON
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PROFESSIONAL ENGINEER

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8/20/18

Morgan McArthur, PE
Associate Geological Engineer

CRN: MM: tlm

cc: Andreia Brown, KMB Architects

# Table of Contents



**LIST OF FIGURES**

## APPENDICES

## INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services for the proposed Cascade View Elementary School Improvements project. The project site is located at 13601 32nd Avenue South in Tukwila, Washington, as shown on the Vicinity Map, Figure 1. Our services have been completed in general accordance with our signed agreement dated July 24, 2018.

Our project understanding is based on a meeting with KMB Architects (project manager) and Rolluda Architects (project architect) on July 12, 2018 and a preliminary site plan provided during the meeting.

We understand that two new modular classrooms are proposed. Locations currently under consideration are on the southwest corner of the existing building and adjacent to the south-central portion of the existing building. Both locations are within areas currently surfaced with grass. We assume that foundations for the modular building(s) will consist of slab-on-grade with thickened edges or shallow spread footings with stem walls.

We understand that stormwater infiltration or detention facilities may or may not be necessary for the proposed site improvements, depending on the footprint of new impermeable area added as part of this project. If planned, we assume stormwater infiltration facilities will be designed and constructed in accordance with the 2016 King County Surface Water Design Manual (SWDM). We did not complete a stormwater infiltration evaluation as part of this study but are available to provide these services if requested.

## SCOPE OF SERVICES

The purpose of our services is to explore subsurface conditions to form a basis for developing geotechnical design and construction recommendations for the proposed improvements. Our specific scope of services included the following tasks:

1. Reviewing readily available published geologic data and our relevant in-house files for existing information on subsurface conditions in the project vicinity.
2. Visiting the project site to mark out exploration locations and contact the “One-Call” Utility Notification Center, as required by Washington State law. We also subcontracted a private utility locator.
3. Exploring subsurface conditions within the project area by advancing four test pits using subcontracted rubber-tire backhoe equipment and operator. The test pits were excavated to depths between about 5 and 10 feet below ground surface (bgs).
4. Conducting geotechnical laboratory testing on selected soil samples.
5. Providing geotechnical seismic design information in accordance with 2015 International Building Code (IBC) criteria and discuss our opinion on the potential for surface rupture, liquefaction and lateral spreading at the site. We did not complete a quantitative liquefaction and lateral spreading analysis for this study.

6. Providing recommendations for site preparation and earthwork. We discuss temporary erosion and sedimentation controls, temporary and permanent cut slopes, fill placement and compaction requirements, wet weather considerations, groundwater handling and site drainage.
7. Providing recommendations for shallow spread footing design, including foundation bearing surface preparation, allowable soil bearing pressure, lateral resistance values and estimates of settlement.
8. Providing design considerations for slab-on-grade design, including subgrade preparation, modulus of subgrade reaction and capillary break thickness and materials.
9. Providing recommended active, passive and at-rest lateral earth pressures for retaining walls. We also provide recommendations for seismic surcharge pressures and drainage criteria.

## SITE CONDITIONS

### Surface Conditions

The site is bounded by residential properties to the north, east and west, and a business and church property to the south. Also bounding the site to the east are 32nd Avenue South and a cemetery.

The existing school building is in the approximate northern half of the campus. Other existing development features include asphalt paved driveways, parking lots and blacktop areas, sidewalks, landscaping, playground areas and a grass field.

Site topography slopes gently upward from east to west and is generally flat around the building perimeter. To the western and southern sides of the building, there are slopes up to about 12 feet tall, sloping upward away from the building perimeter. The slope to the west extends to the west property line and the slope to the south separates the southern half of the campus. The southern half of the campus includes a blacktop, playground areas and a grass field.

### Literature Review

The geologic information we reviewed in the project vicinity includes the *Geologic Map of the Des Moines 7.5' Quadrangle, King County, Washington* (Booth and Waldron 2004). Glacial soil deposits underlie the site and surrounding areas. These deposits are the result of glaciations that occurred during the Vashon Stade of the Fraser Glaciation, approximately 10,000 to 15,000 years ago. Surface soils at the site are primarily mapped as glacial till ($Q_{vt}$). Glacial till is described as a dense, compact mixture of sand, silt and gravel deposited by a glacier.

### Subsurface Conditions

#### Subsurface Explorations and Laboratory Testing

We explored subsurface conditions at the site by excavating four test pits (TP-1 through TP-4) at the approximate locations shown on the attached Site Plan, Figure 2. A description of our subsurface exploration program and summary exploration logs are provided in Appendix A.

Selected samples collected from our test pits were tested in our laboratory to confirm field classifications and to evaluate pertinent engineering properties. Our laboratory testing program included grain-size

analyses and moisture content determinations. A summary of our laboratory testing program and the test results are provided in Appendix A.

#### Soil and Groundwater Conditions

In our explorations, we typically observed about 2 to 3 inches of grass sod. Beneath the sod, we observed silty sand with gravel in a medium dense condition to a depth of about 9 to 12 inches bgs. We interpret this material to be weathered glacial till. Underlying the weathered glacial till, we observed sand with silt and gravel and silty sand with gravel and occasional cobbles in a dense to very dense condition, which we interpret to be glacial till, extending to the full depths explored. In exploration TP-4, along the south sidewall we observed silt with occasional sand in a very stiff condition beginning at a depth of about 3 feet bgs and extending to the full depth explored. We interpret this material to be an isolated lens of silty glacial till embedded within the typical glacial till matrix observed in our explorations.

We did not observe the regional groundwater table or perched groundwater in our explorations. Based on our experience, it is not uncommon for glacial till soils to contain isolated zones of perched groundwater. Though not observed in our explorations, we anticipate that perched groundwater could be present at the site depending on soil conditions, rainfall amounts, irrigation activities and other factors. We anticipate that perched groundwater levels will generally be highest during the wet season, typically October through May.

## CONCLUSIONS AND RECOMMENDATIONS

### Primary Geotechnical Considerations

Based on our understanding of the project, the explorations performed for this study and our experience, it is our opinion that the proposed improvements can be designed and constructed generally as envisioned with regard to geotechnical considerations. A summary of the primary geotechnical considerations for the project is provided below and is followed by our detailed recommendations.

- We did not identify liquefiable soils in our explorations, and in our opinion the risk of liquefaction occurring at this site is very low.
- Proposed structures at the site can be supported using shallow foundations and slabs-on-grade, provided that the foundation bearing surfaces are prepared as recommended. We do not anticipate that significant overexcavation will be required, unless isolated areas of loose, or otherwise unsuitable areas are encountered near foundation grade.
- Soils observed at the site contain a significant quantity of fines, and, therefore, could be difficult or impossible to work with when wet or become easily disturbed if exposed to wet weather. Depending on the intended use of the material and the moisture/weather conditions, it may be difficult to re-use on-site soils as structural fill.

### Seismic Design Considerations

Based on subsurface conditions encountered in our explorations and our understanding of the geologic conditions in the site vicinity, the site may be characterized as Class C in accordance with the 2015 International Building Code (IBC) Design Manual. Seismic design parameters are provided in Table 1, below.

**TABLE 1. 2015 IBC SEISMIC DESIGN CRITERIA**

| Site Coefficient | Site Factor | MCE[1] Spectral Response | Design Spectral Response[2] |
|---|---|---|---|
| $S_S$ = 1.502 g | $F_a$ = 1.0 | $S_{MS}$ = 1.502 g | $S_{DS}$ = 1.001 g |
| $S_1$ = 0.563 g | $F_v$ = 1.3 | $S_{M1}$ = 0.732 g | $S_{D1}$ = 0.488 g |

Notes:

[1] MCE = Maximum Considered Earthquake

[2] Design spectral response = 2/3 * MCE response

## Peak Ground Acceleration

The peak ground acceleration (PGA) is used in seismic analyses such as liquefaction, lateral spreading, and seismic slope stability as well as assessing seismic surcharge loads for retaining walls. Based on our understanding of site conditions, we recommend using a PGA equal to 0.624g for the project site as determined in accordance with Section 11.8.3 of American Society of Civil Engineers (ASCE) Standard 7-10.

## Liquefaction

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include loose to medium dense sands to silty sands that are below the water table. The *Liquefaction Susceptibility Map of King County, Washington* (Palmer, et al. 2004) indicates the site soils have a "very low" liquefaction potential. Based on observations and experience, we concur that the potential for liquefaction at the site is very low.

## Lateral Spreading Potential

Lateral spreading related to seismic activity typically involves lateral displacement of large, surficial blocks of non-liquefied soil when a layer of underlying soil loses strength during seismic shaking. Lateral spreading usually develops in areas where sloping ground or large grade changes (including retaining walls) are present. Based on our understanding of the liquefaction risk at the site and the proposed improvements it is our opinion that the risk of lateral spreading is low.

## Surface Rupture Potential

According to the Washington State Department of Natural Resources Interactive Natural Hazards Map (accessed August 15, 2018), there are no mapped faults within about 1¾ miles of the site. Based on the proximity of the site to the nearest mapped fault, it is our opinion the risk for surface rupture at this site is low.

## Site Development and Earthwork

### General

We anticipate that site development and earthwork will include excavating for shallow foundations, utilities and other improvements, establishing subgrades for foundations and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

### Clearing and Stripping

We anticipate that clearing and stripping depths at the site will typically be on the order of about 6 inches to remove sod and associated root network at the surface. However, it is likely that greater stripping depths will be required in areas of heavier vegetation, lower lying areas or in areas containing trees.

During stripping operations excessive disturbance of surficial soils may occur, especially if left exposed to wet conditions. Disturbed soils may require additional remediation during construction and grading.

We encountered cobbles in our explorations as well as a small boulder in exploration TP-3. Although boulders were not observed in our other explorations, boulders could be present in the glacial till soils in other areas of the site. The contractor should be prepared to remove boulders and cobbles, if encountered during grading or excavation. Boulders may be removed from the site or used in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

### Erosion and Sedimentation Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an erosion and sedimentation control plan will reduce impacts to the project where erosion-prone areas are present. The plan should be designed in accordance with applicable county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;
- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;
- Confining sediment to the project site;
- Inspecting and maintaining control measures frequently.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan. Where sloped areas are present, some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

### Temporary Excavations

Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

In general, temporary cut slopes at this site should be inclined no steeper than about 1½H to 1V (horizontal to vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surcharge loads are anticipated. Temporary covering with heavy plastic sheeting should be used to protect slopes during periods of wet weather.

### Groundwater Handling Considerations

Based on our understanding of the proposed site improvements we do not anticipate that the regional groundwater table will be encountered during excavations at the site.

We did not encounter groundwater in our explorations at the depths explored. However, in our experience, it is not uncommon for perched groundwater to be present within glacial till soils. Therefore, perched groundwater could be present at other areas of the site. The interface between the weathered glacial till and glacial till and contacts between more permeable and less permeable zones within the glacial till are likely locations for accumulation of perched groundwater. Groundwater handling needs will typically be lower during the summer and early fall months. We anticipate that shallow perched groundwater can be handled adequately with sumps, pumps, and/or diversion ditches, as necessary. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

### Surface Drainage

Surface water from roof downspouts, driveways and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not be connected to wall or foundation drains.

### Subgrade Preparation

Subgrades that will support structures and roadways should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping and before placing structural fill. We recommend that subgrades for structures and roadways be evaluated, as appropriate, to identify areas of yielding or soft soil. Probing with a steel probe rod or proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a

ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

### Subgrade Protection and Wet Weather Considerations

Most of the near-surface soils observed in our explorations contain a significant quantity of fines and will be susceptible to disturbance during periods of wet weather. The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any month of the year. It may be possible to conduct earthwork at the site during wet weather months provided appropriate measures are implemented to protect exposed soil. If earthwork is scheduled during the wet weather months we offer the following recommendations:

- Measures should be implemented to remove or eliminate the accumulation of surface water from work areas. The ground surface in and around the work area should be sloped so that surface water is directed away and graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Protective surfacing such as placing asphalt-treated base (ATB) or haul roads made of quarry spalls or a layer of free-draining material such as well-graded pit-run sand and gravel may be necessary to limit disturbance to completed areas. Minimum quarry spall thicknesses should be on the order of 12 to 18 inches. Typically, minimum gravel thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection.

## Fill Materials

#### Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. We recommend that washed crushed rock or select granular fill, as described below, be used for structural fill during wet weather. If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable. Weather and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill.

Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, we recommend that structural fill consist of material similar to "Select

Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the Washington State Department of Transportation (WSDOT) Standard Specifications.

### Select Granular Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), or 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

### Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to "gravel backfill for pipe zone bedding" described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

### Trench Backfill

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that trench backfill material consist of material similar to "Select Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the WSDOT Standard Specifications. Where excavations occur in the wet, alternative materials such as select granular fill should be considered.

### On-Site Soil

Based on our subsurface explorations and experience, it is our opinion that existing site soils may be considered for use as structural fill and trench backfill, provided that it can be adequately moisture conditioned, placed and compacted as recommended and does not contain organic or other deleterious material. Based on our experience, the silty sands at the site are extremely moisture sensitive and will be very difficult or impossible to properly compact when wet.

In addition, it is likely that existing soils will be above optimum moisture content (OMC) when excavated, unless earthwork activities take place in the middle of summer. Even then, the soil could still be above OMC when excavated. Soils placed and compacted above OMC are typically difficult to work with and may have trouble achieving adequate compaction. If earthwork occurs during a typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions or lack of drying space/time, we recommend the use of imported structural fill or select granular fill, as described above.

### Fill Placement and Compaction

#### *General*

To obtain proper compaction, fill soil should be compacted near OMC and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 8- to 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical

means. During fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

#### *Area Fills and Pavement Bases*

Fill placed to raise site grades and materials under pavements and structural areas should be placed on subgrades prepared as previously recommended. Fill material placed below structures and footings should be compacted to at least 95 percent of the theoretical maximum dry density (MDD) per ASTM International (ASTM) D 1557. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the MDD. Fill placed deeper than 2 feet below pavement sections should be compacted to at least 90 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically around 85 to 90 percent of the MDD.

#### *Backfill Behind Walls*

Backfill behind retaining walls or below-grade structure walls should be compacted to between 90 and 92 percent of the MDD. Overcompaction of fill placed directly behind walls should be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet behind walls.

#### *Trench Backfill*

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 90 percent of the MDD. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment as necessary.

### Foundation Support

#### *General*

The proposed structures at the site can be satisfactorily supported on continuous wall and isolated column footings. Exterior footings should be established at least 18 inches below the lowest adjacent grade. Interior footings can be founded a minimum of 12 inches below the top of the floor slab. Isolated column and continuous wall footings should have minimum widths of 24 and 18 inches, respectively.

Based on the groundwater conditions in our explorations and our understanding of the proposed footing elevations (bottom of footings established at or within a few feet of existing site grade) it is our opinion footing drains are not necessary to maintain bearing support as provided in this report. However, because of the potential for near-surface seepage during wetter times of the year and from irrigation and potential landscaping, footing drains should be considered to maintain drier conditions around the structure and to reduce groundwater seepage that could migrate below the building slab.

The sections below provide our recommendations for foundation bearing surface preparation and foundation design parameters.

***Foundation Bearing Surface Preparation***

Shallow footing excavations should be performed using a smooth-edged bucket to limit bearing disturbance. Foundations should bear on existing proof compacted native glacial till soils or on structural fill extending to these soils. The bearing surface should be compacted as necessary to a firm, unyielding condition. Loose or disturbed materials present at the base of footing excavations should be removed or compacted.

If structural fill is placed below footings as either replacement of overexcavated soils or to establish a bearing pad, we recommend the structural fill extend laterally beyond the foundation perimeter a distance equal to the depth of fill (measured from the base of the footing where necessary), or 3 feet, whichever is less.

Foundation bearing surfaces should not be exposed to standing water. If water is present in the excavation, it must be removed before placing formwork and reinforcing steel. Protection of exposed soil, such as placing a 6-inch thick layer of crushed rock or a 3- to 4-inch layer of lean-mix concrete, could be used to limit disturbance to bearing surfaces.

Prepared foundation bearing surfaces should be evaluated by a member of our firm prior to placement of formwork or reinforcing steel to verify that bearing surface has been prepared in accordance with our recommendations or to provide recommendations for remediating unsuitable bearing soils.

***Allowable Soil Bearing Pressure***

Shallow foundations bearing on subgrades prepared as recommended may be designed using an allowable soil bearing pressure of 4,000 pounds per square foot (psf). This bearing pressure applies to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

***Foundation Settlement***

Disturbed soil must be removed from the base of footing excavations and the bearing surface should be prepared as recommended. Provided these measures are taken, we estimate the total static settlement of shallow foundations will be on the order of 1 inch or less for the bearing pressures presented above. Differential settlements could be on the order of ¼ to ½ inch between similarly loaded foundations or over a distance of 50 feet of continuous footings. The settlements should occur rapidly, essentially as loads are applied. Settlements could be greater than estimated if disturbed or saturated soil conditions are present below footings.

***Lateral Resistance***

The ability of the soil to resist lateral loads is a function of the base friction, which develops on the base of foundations and slabs, and the passive resistance, which develops on the face of below-grade elements of the structure as these elements move into the soil. For cast-in-place foundations supported in accordance with the recommendations presented above, the allowable frictional resistance on the base of the foundation may be computed using a coefficient of friction of 0.40 applied to the vertical dead-load forces. If precast foundations are included as part of project plans, we can provide specific recommendations for

base friction resistance for precast foundations. The allowable passive resistance on the face of the foundation or other embedded foundation elements may be computed using an equivalent fluid density of 330 pounds per cubic foot (pcf).

These values include a factor of safety of about 1.5. The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The top foot of soil should be neglected when calculating passive lateral earth pressure unless the area adjacent to the foundation is covered with pavement or a slab-on-grade.

## Slab-on-Grade Floors

Slab-on-grade floors should bear on existing native glacial till soils or on structural fill extending to these soils and should be prepared as recommended in the "Subgrade Preparation" section of this report. We recommend the slab subgrades be observed by a member of our firm during construction. Disturbed areas should be compacted, if possible, or removed and replaced with compacted structural fill. In all cases, the exposed soil should be compacted to a firm and unyielding condition.

We recommend the slab-on-grade floors be underlain by a minimum 6-inch-thick capillary break layer consisting of clean sand and gravel, crushed rock, or washed rock. The capillary break material should contain less than 3 percent fine material based on the percent passing the ¾-inch sieve size. Provided that loose soil is removed and the subgrade is prepared as recommended, we recommend slabs-on-grade be designed using a modulus of subgrade reaction of 250 pounds per cubic inch (pci). We estimate that settlement for slabs-on-grade constructed as recommended will be less than ¾ inch for a floor load of up to 500 psf.

Based on our understanding of subsurface conditions at the site it is our opinion that an underslab drain system is not necessary. If dry slabs are required (e.g., where adhesives are used to anchor carpet or tile to slab), a waterproof liner may be placed as a vapor barrier below the slab.

## Retaining Walls and Below-Grade Structures

### Design Parameters

We recommend the following lateral earth pressures be used for design of conventional retaining walls and below-grade structures. Our design pressures assume that the ground surface around the retaining structures will be level or near level. If drained design parameters are used, drainage systems must be included in the design in accordance with the recommendations presented in the "Drainage" section below.

- Active soil pressure may be estimated using an equivalent fluid density of 35 pcf for the drained condition.
- Active soil pressure may be estimated using an equivalent fluid density of 80 pcf for the undrained condition; this value includes hydrostatic pressures.
- At-rest soil pressure may be estimated using an equivalent fluid density of 55 pcf for the drained condition.
- At-rest soil pressure may be estimated using an equivalent fluid density of 90 pcf for the undrained condition; this value includes hydrostatic pressures.

- For seismic considerations, a uniform lateral pressure of 14 H psf (where H is the height of the retaining structure or the depth of a structure below ground surface) should be added to the lateral earth pressure.
- An additional 2 feet of fill representing a typical traffic surcharge of 250 psf should be included if vehicles are allowed to operate within a zone equal to the height of the retaining walls. Other surcharge loads should be considered on a case-by-case basis.

The active soil pressure condition assumes the wall is free to move laterally 0.001 H, where H is the wall height. The at-rest condition is applicable where walls are restrained from movement. The above recommended lateral soil pressures do not include the effects of sloping backfill surfaces or surcharge loads, except as described. Overcompaction of fill placed directly behind retaining walls or below-grade structures must be avoided to limit lateral pressures placed on the wall. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet of retaining walls and below-grade structures.

Retaining wall foundation bearing surfaces should be prepared following the "Foundation Bearing Surface Preparation" section of this report. Provided bearing surfaces are prepared as recommended, retaining wall foundations may be designed using the allowable soil bearing value and lateral resistance values presented above for building foundation design. We estimate settlement of retaining structures will be similar to the values previously presented for structure foundations.

### Drainage

If retaining walls or below-grade structures are designed using drained parameters, a drainage system behind the structure must be included to collect water and prevent the buildup of hydrostatic pressure against the structure. We recommend the drainage system include a zone of free-draining backfill a minimum of 18 inches in width against the back of the wall. The drainage material should consist of coarse sand and gravel containing less that 5 percent fines based on the fraction of material passing the ¾-inch sieve.

A perforated, rigid, smooth-walled drain pipe with a minimum diameter of 4 inches should be placed along the base of the structure within the free-draining backfill and extend for the entire wall length. The drain pipe should be metal or rigid PVC pipe and be sloped to drain by gravity. Discharge should be routed to appropriate discharge areas and to reduce erosion potential. Cleanouts should be provided to allow routine maintenance. We recommend roof downspouts or other types of drainage systems not be connected to retaining wall drain systems.

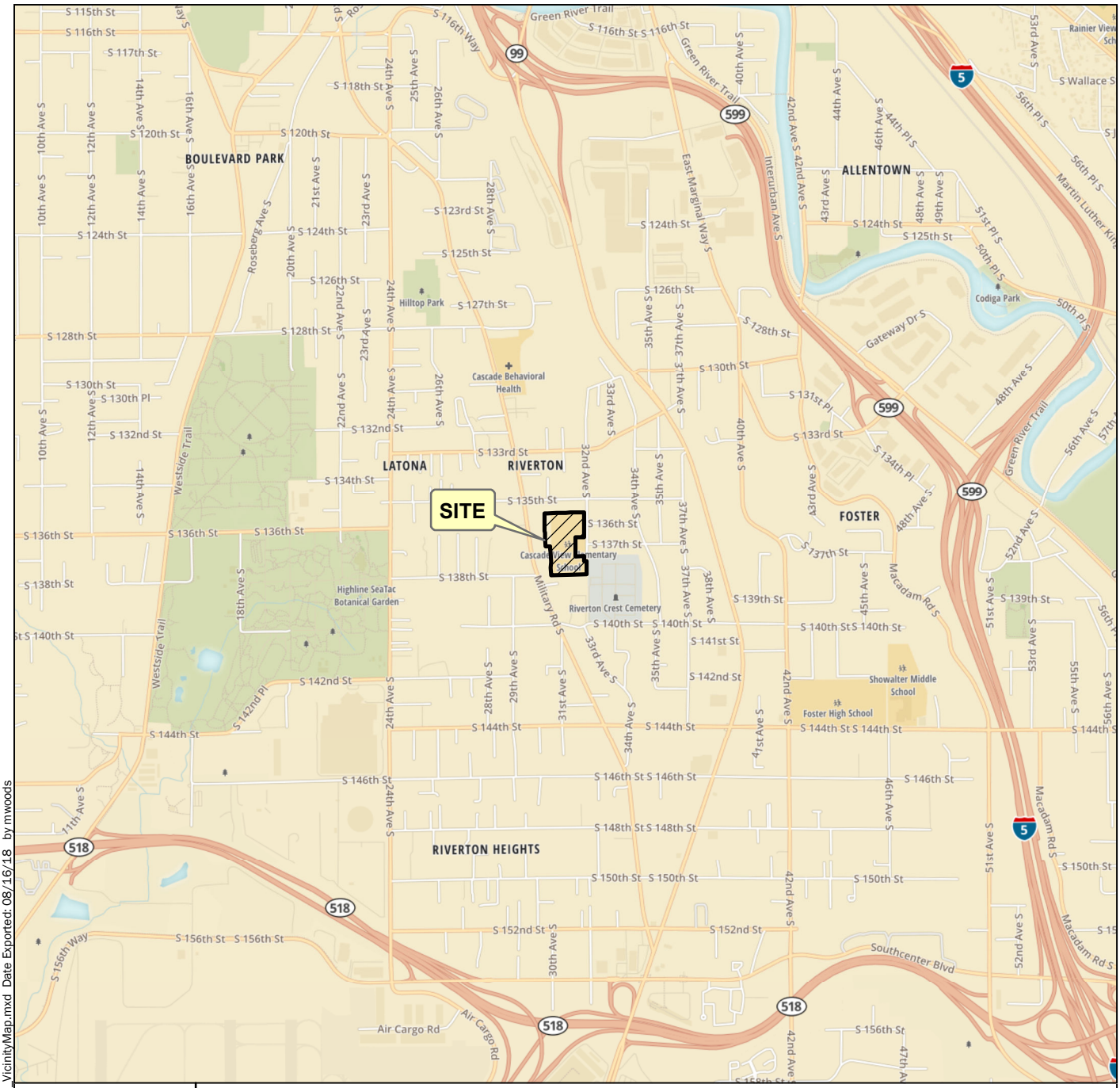
## LIMITATIONS

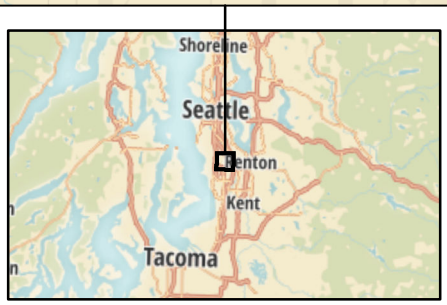
We have prepared this report for Tukwila School District, No. 406 for the Cascade View Elementary School Improvements project in Tukwila, Washington. Tukwila School District may distribute copies of this report to owner's authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared.

The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.




N
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2,000 0 2,000

Feet

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

**Vicinity Map**

Cascade View Elementary School Improvements
Tukwilla, Washington

GeoEngineers

**Figure 1**

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**Legend**

Site Boundary

TP-1 Test Pit by GeoEngineers, 2018

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 5/13/2018.

Projection: NAD83 Washington State Planes, North Zone, US Foot

N W E S

100 0 100
Feet

**Site Plan**

Cascade View Elementary School Improvements
Tukwila, Washington

GeoEngineers

**Figure 2**

\\geoengineers.com\WAN\Projects\23\23537003\CAD\00\GeoTech\23537003_F02_Site Plan.dwg TAB:F02 Date Exported: 08/16/18 - 14:15 by mwoods

# APPENDIX A
## Subsurface Explorations and Laboratory Testing

# APPENDIX A
# SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

## Subsurface Explorations

### Test Pits

Subsurface conditions for the proposed Cascade View Elementary School Improvements project were explored by excavating four test pits on July 26, 2018 at the approximate locations shown on Figure 2. The test pits were excavated to depths between about 5 and 10 feet below ground surface (bgs) using a subcontracted backhoe and operator to GeoEngineers. After each test pit was completed, the excavation was backfilled using the generated material. The backfill was compacted using the bucket of the backhoe.

Our field representative obtained samples, classified the soils encountered, and maintained a detailed log of each exploration. The relative densities noted on the test pit logs are based on the difficulty of excavation and our experience and judgment. The samples were collected and retained in sealed plastic bags and then transported back to our office. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-5.

The locations of the test pits were determined via an electronic tablet with global positioning system (GPS) software. The locations of the explorations should be considered approximate.

## Laboratory Testing

Soil samples obtained from the borings were transported to GeoEngineers laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classification.

Our testing program consisted of the following:

- Two grain-size distribution analyses (SA)
- Two moisture content determinations (MC)

Tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures. The following sections provide a general description of the tests performed.

### Sieve Analysis (SA)

Grain-size distribution analyses were completed on selected samples in general accordance with ASTM Test Method D 6913. This test method covers the quantitative determination of the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (µm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figure A-6 presents the results of our sieve analyses.

### Moisture Content (MC)

The moisture content of selected samples was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The results are presented on the test pit logs at the depth tested.

## SOIL CLASSIFICATION CHART

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

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

## ADDITIONAL MATERIAL SYMBOLS

| SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|
| | AC | Asphalt Concrete |
| | CC | Cement Concrete |
| | CR | Crushed Rock/ Quarry Spalls |
| | SOD | Sod/Forest Duff |
| | TS | Topsoil |

### Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

### Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

### Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

### Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

### Laboratory / Field Tests

| | |
|---|---|
| %F | Percent fines |
| %G | Percent gravel |
| AL | Atterberg limits |
| CA | Chemical analysis |
| CP | Laboratory compaction test |
| CS | Consolidation test |
| DD | Dry density |
| DS | Direct shear |
| HA | Hydrometer analysis |
| MC | Moisture content |
| MD | Moisture content and dry density |
| Mohs | Mohs hardness scale |
| OC | Organic content |
| PM | Permeability or hydraulic conductivity |
| PI | Plasticity index |
| PP | Pocket penetrometer |
| SA | Sieve analysis |
| TX | Triaxial compression |
| UC | Unconfined compression |
| VS | Vane shear |

### Sheen Classification

| | |
|---|---|
| NS | No Visible Sheen |
| SS | Slight Sheen |
| MS | Moderate Sheen |
| HS | Heavy Sheen |

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

# Key to Exploration Logs

GeoEngineers

Figure A-1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date Excavated | 7/26/2018 | Total Depth (ft) | 10 | Logged By<br>Checked By | SAH<br>CRN | Excavator<br>Equipment | Kelly's Excavating<br>Komatsu WB 140 (Backhoe) | Groundwater not observed<br>Caving not observed |
| Surface Elevation (ft)<br>Vertical Datum | 350<br>NAVD88 | | | Easting (X)<br>Northing (Y) | 1279319<br>178880 | Coordinate System<br>Horizontal Datum | WA State Plane North<br>NAD83 (feet) | |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | SOD | Approximately 2 inches sod (grass) | | | |
| | | | | | SM | Brown-gray silty fine to medium sand with gravel and occasional organic matter (fine roots) (medium dense, moist) (weathered glacial till) | | | |
| 349 | 1 | | | | SM | Gray silty fine sand with occasional gravel and cobbles (very dense, moist) (glacial till) | | | |
| 348 | 2 | ✓ | 1 SA | | | | 5 | 22 | |
| 347 | 3 | | | | | | | | |
| 346 | 4 | | | | SM | Gray silty fine to coarse sand with gravel and occasional cobbles (very dense, moist) | | | |
| 345 | 5 | ✓ | 2 | | | | | | |
| 344 | 6 | | | | | | | | |
| 343 | 7 | | | | | Grades to dense | | | |
| 342 | 8 | ✓ | 3 | | | | | | |
| 341 | 9 | | | | | Grades to very dense | | | |
| 340 | 10 | ✓ | 4 | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

# Log of Test Pit TP-1

GeoEngineers

Project: Cascade View Elementary School Improvements
Project Location: Tukwila, Washington
Project Number: 23537-003-00

Figure A-2
Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date Excavated | 7/26/2018 | Total Depth (ft) | 5.75 | Logged By SAH<br>Checked By CRN | Excavator Kelly's Excavating<br>Equipment Komatsu WB 140 (Backhoe) | Groundwater not observed<br>Caving not observed |
| Surface Elevation (ft)<br>Vertical Datum | 350<br>NAVD88 | Easting (X)<br>Northing (Y) | 1279363<br>178904 | Coordinate System<br>Horizontal Datum | WA State Plane North<br>NAD83 (feet) | |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | SOD | Approximately 2 inches sod (grass) | | | |
| | | | | | SM | Brown-gray silty fine to medium sand with gravel and occasional cobbles (medium dense, moist) (weathered glacial till) | | | |
| 349 | 1 | | | | SM | Gray silty fine to coarse sand with gravel and occasional cobbles (very dense, moist) (glacial till) | | | |
| 348 | 2 | | | | | | | | |
| | | 1 | 1 MC | | | | 4 | | |
| 347 | 3 | | | | | | | | |
| 346 | 4 | | | | | | | | |
| 345 | 5 | | | | | | | | |
| | | 2 | 2 | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

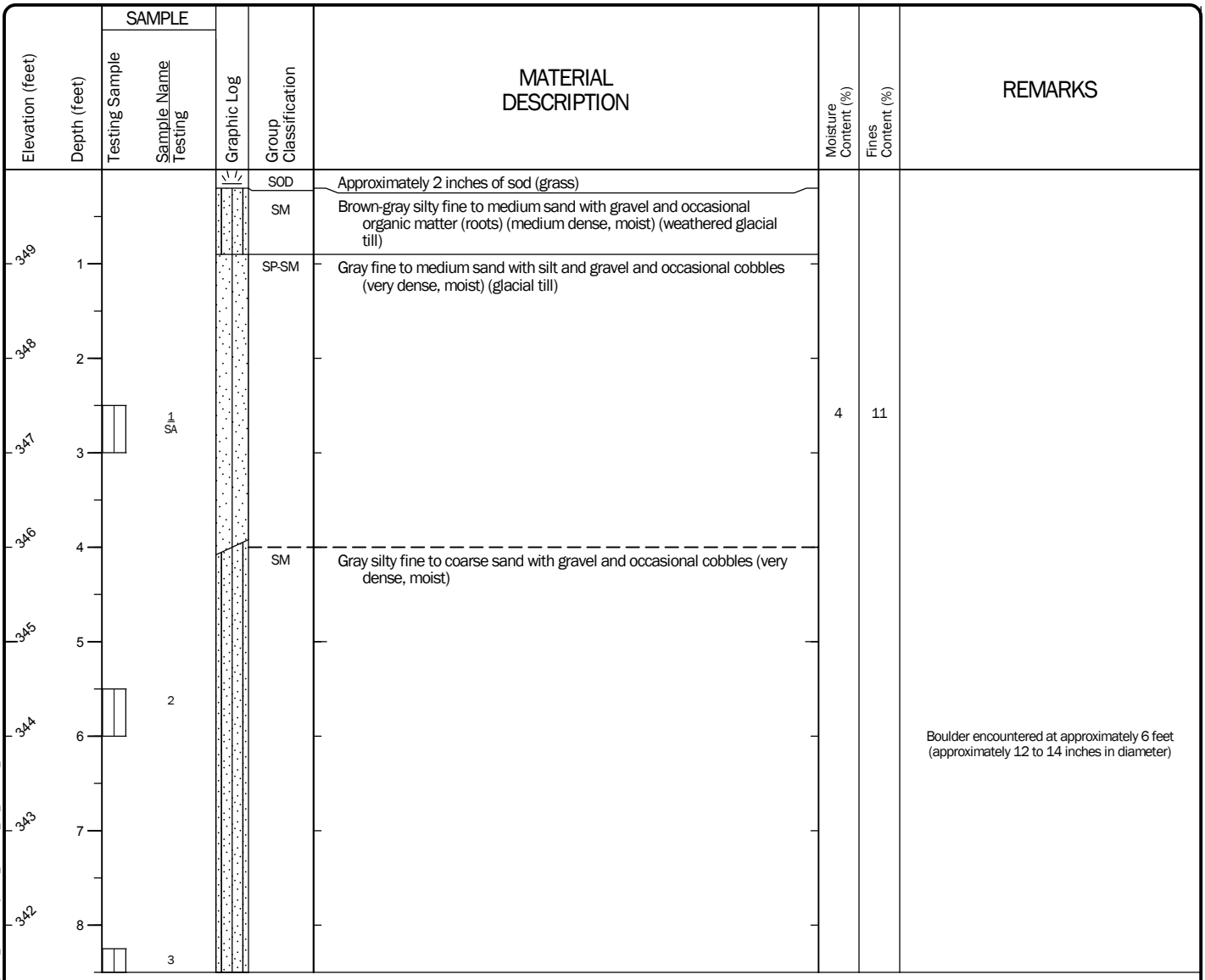
# Log of Test Pit TP-2

GeoEngineers

Project: Cascade View Elementary School Improvements
Project Location: Tukwila, Washington
Project Number: 23537-003-00

Figure A-3
Sheet 1 of 1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date Excavated | 7/26/2018 | Total Depth (ft) | 8.5 | Logged By<br>Checked By | SAH<br>CRN | Excavator<br>Equipment | Kelly's Excavating<br>Komatsu WB 140 (Backhoe) | Groundwater not observed<br>Caving not observed |
| Surface Elevation (ft)<br>Vertical Datum | 350<br>NAVD88 | | | Easting (X)<br>Northing (Y) | 1279400<br>178898 | Coordinate System<br>Horizontal Datum | WA State Plane North<br>NAD83 (feet) | |




Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

# Log of Test Pit TP-3

GeoEngineers

Project: Cascade View Elementary School Improvements
Project Location: Tukwila, Washington
Project Number: 23537-003-00

Figure A-4
Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date Excavated | 7/26/2018 | Total Depth (ft) | 5 | Logged By SAH<br>Checked By CRN | Excavator Kelly's Excavating<br>Equipment Komatsu WB 140 (Backhoe) | Groundwater not observed<br>Caving not observed |
| Surface Elevation (ft)<br>Vertical Datum | 350<br>NAVD88 | Easting (X)<br>Northing (Y) | 1279528<br>178876 | Coordinate System<br>Horizontal Datum | WA State Plane North<br>NAD83 (feet) | |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | SOD | Approximately 3 inches sod (grass) | | | |
| | | | | | SM | Brown-gray silty fine to medium sand with gravel and occasional organic matter (roots) (medium dense, moist) (weathered glacial till) | | | |
| 349 | 1 | | | | SM | Gray silty fine to coarse sand with gravel and occasional cobbles (very dense, moist) (glacial till) | | | |
| 348 | 2 | | 1 MC | | | | 6 | | |
| 347 | 3 | | | | | | | | On south sidewall of test pit, brown-gray silt with occasional sand (very stiff, moist) was encountered at approximately 3 feet to termination depth |
| 346 | 4 | | 2 | | | | | | |
| 345 | 5 | | | | | | | | 6-inch diameter pvc drain pipe encountered at approximately 5 feet depth on east side of test pit. Pipe is oriented in north/south direction and was observed to be installed within a narrow trench that was backfilled with similar soils observed in the test pit |

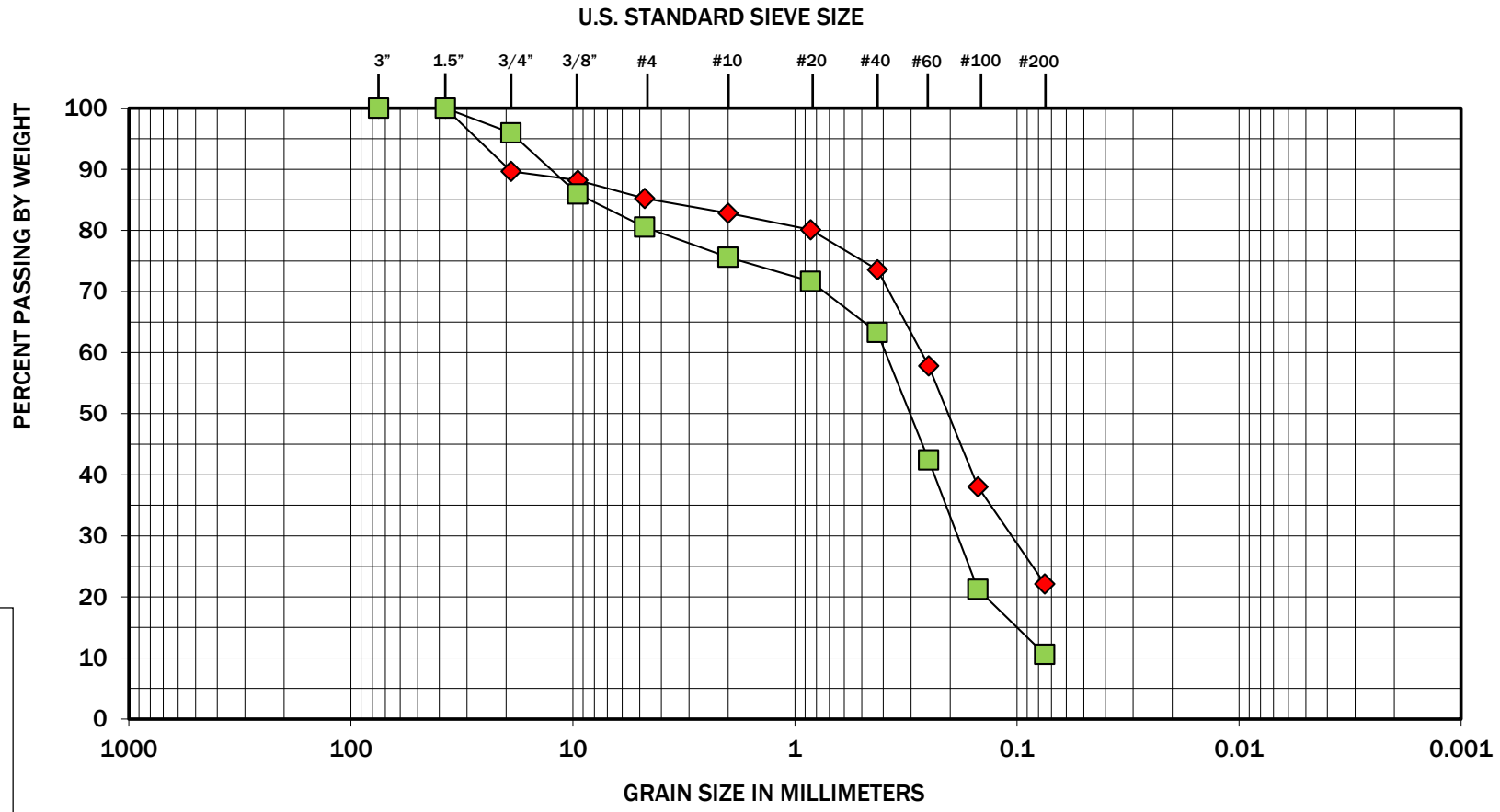
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

# Log of Test Pit TP-4

GeoEngineers

Project: Cascade View Elementary School Improvements
Project Location: Tukwila, Washington
Project Number: 23537-003-00

Figure A-5
Sheet 1 of 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| Symbol | Test Pit Number | Depth (feet) | Moisture (%) | Laboratory Soil Description |
|---|---|---|---|---|
| ◆ | TP-1 | 2 | 5 | Silty fine sand with occasional gravel (SM) |
| ■ | TP-3 | 2.5 | 4 | Fine to medium sand with silt and gravel (SP-SM) |



The grain size analysis results were obtained in general accordance with ASTM D 6913.

GeoEngineers

Figure A-6

Cascade View Elementary School Improvements
Tukwila, Washington

Sieve Analysis Results

# APPENDIX B
## Report Limitations and Guidelines for Use

## APPENDIX B
## REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

### Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

### Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Tukwila School District, No. 406 and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with Tukwila School District, No. 406 dated July 24, 2018 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

### A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for Cascade View Elementary School in Tukwila, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

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

For example, changes that can affect the applicability of this report include those that affect:

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

### Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

### Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

### Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

### Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

### Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions

presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

### Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

### A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

### Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

### Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and

- encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

### Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

### Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

# *Section 7*

## Other Permits

## 7.0 Other Permits

The project area is less than 1 acre; therefore, the project does not require a National Pollution Discharge Elimination System (NPDES) Permit and Construction Stormwater General Permit from Washington State Department of Ecology.

# *Section 8*

## CSWPPP Analysis and Design

# 8.0 CSWPPP Analysis and Design

The proposed improvements comply with guidelines set forth in the *KCSWDM* and the *KCSPPM*. The plan will include erosion/sedimentation control features designed to prevent sediment-laden runoff from leaving the site or from adversely affecting critical water resources during construction. A stormwater pollution prevention and spill plan has been developed.

## 8.1 ESC Plan Analysis and Design (Part A)

The erosion potential of the site is influenced by four major factors: soil characteristics, vegetative cover, topography, and climate. Erosion/sedimentation control (ESC) is achieved by a combination of structural measures, cover measures, and construction practices that are tailored to fit the specific site.

The following measures will be used to control sedimentation/erosion processes:

1. Clearing Limits: All areas to remain undisturbed during the construction of the project will be delineated prior to any site clearing or grading.

2. Cover Measures: Disturbed areas will be covered, as required in Section D.2.1.2 of the *KCSWDM*.

3. Perimeter Protection: The project site predominantly slopes toward the center of the site, where inlet protection is provided. As a result, no perimeter protection is proposed. If at any point it is determined that the perimeter may be compromised, the contractor may use straw wattles.

4. Traffic Area Stabilization: A stabilized construction entrance consisting of existing asphalt of the parking lot will be used by construction traffic.

5. Sediment Retention: Filter fabric protection will be provided on all new and existing catch basins downstream of construction activities.

6. Surface Water Collection: The project site predominantly slopes toward the center of the site, where inlet protection is provided. Straw wattles may be used to direct runoff from construction area to the catch basins where inlet protection is provided. All stormwater will be tested for NTU levels above background NTU to determine treatment requirements prior to discharge from the site.

7. Dewatering Control: Water resulting from construction site dewatering activities will be treated by the existing stormwater flow control facility before being released into the public storm system.

8. Dust Control: Dust control measures will be implemented when exposed soils are dry to the point that wind transport is possible and roadways, drainage ways, or surface waters are likely to be impacted.

9. Flow Control: Surface water from disturbed areas will be routed through the existing flow control facility.

10. Control Pollutants: Refer to section 8.2 for the Stormwater Pollution Prevention and Spill (SWPPS) Plan.

11. Protect Existing and Proposed Flow Control BMPs: Protection measures will be maintained until project stabilization is achieved.

12. Maintain BMPs: BMPs will be maintained throughout the duration of the project.

13. Manage the Project: The project will be managed to ensure the success of the protective ESC and SWPPS design.

### 8.1.1 ESC Maintenance

All ESC measures shall be maintained and reviewed on a regular basis, as prescribed in the maintenance requirements of each BMP proposed.

### 8.1.2 ESC Supervisor

The applicant will designate an ESC supervisor who shall be responsible for maintenance and review of ESC, and for compliance with all permit conditions relating to ESC. The ESC supervisor must be available for rapid response to ESC problems.

The ESC supervisor will review the site at least once a month during the dry season, weekly during the wet season, and within 24 hours of significant storms. The City of Tukwila may require that a written record of these reviews be kept onsite, with copies submitted to the City within 48 hours (also see Section 8.2.3 below). The City may also require that the applicant designate an ESC supervisor with demonstrated expertise in ESC to perform these reviews and to be responsible for ESC due to the sensitive areas on or within the project site. The qualifications of such a person shall include at least several years of construction supervision or inspection.

### 8.1.3 Documentation

If City of Tukwila requires that a written record be maintained, a standard ESC Maintenance Report may be used. A copy of all required maintenance reports shall be kept onsite throughout the duration of construction. Detailed maintenance requirements for each ESC measure are provided in Section 8-2.

### 8.1.4 Review Timing

During the wet season, weekly reviews shall be carried out every 6 to 8 calendar days. During the dry season, monthly reviews shall be carried out within 3 days of the calendar day for the last inspection (e.g., if an inspection occurred on June 6, then the next inspection must occur between July 3 and July 9). Reviews shall also take place within 24 hours of significant storms. In general, a significant storm is one with more than 0.5 inch of rain in 24 hours or less.

## 8.2 Stormwater Pollution Prevention and Spill (SWPPS) Plan Design (Part B)

*The below draft SWPPS Plan design is awaiting input from the contractor and the owner for specific items. An updated plan will be provided with the building permit submittal.*

The Stormwater Pollution Prevention and Spill (SWPPS) Plan includes three elements: a site plan, a pollution prevention report, and a spill prevention and cleanup report. This report includes identifying the expected sources of potential pollution and spills that may occur during construction, and works to develop a plan to prevent pollution and spills. It also develops a plan to mitigate spills that may occur. The SWPPS Plan will be kept onsite at all times during construction. The general contractor will be responsible to ensure that subcontractors are aware of the SWPPS Plan and a form or record will be provided stating that all subcontractors have read and agree to the SWPPS Plan. An employee training worksheet is provided for the contractor's use (see Figure 8-3).

A SWPPS Site Plan will be submitted. The SWPPS Site Plan, Pollution Prevention Report, and Spill Prevention and Cleanup Report were developed and BMPs were selected based on Section 2.3.1.4 of the *KCSWDM* and the *KCSPPM*. *(The below plan will be updated with input from the owner and contractor.)*

### 8.2.1 Pollution and Spill Prevention Source Controls and BMPs

The sources of pollution and spills are identified below, and the BMPs to be used for each source for prevention of both pollution and spills are listed below:

**Liquids** that will be handled or stored onsite are the following: _____. Containers will be stored as shown on _____ and include the following types and sizes: _____.

Tight-fitting lids shall be placed on all containers containing liquids. Containers shall be covered with plastic sheeting during rain events. Drip pans or absorbent materials shall be placed beneath all mounted container taps and at all potential drip and spill locations during filling and unloading of containers. Containers shall be stored such that if a container leaks or spills, the contents will not be discharged, flow, or be washed into the storm drainage system, surface water, or groundwater. Appropriate spill cleanup materials shall be stored and maintained near the container storage area. Storage area shall be swept and cleaned as needed. Area shall not be hosed down such that water drains to the storm drainage system or neighboring areas. Containers shall be checked daily for leaks and spills and replaced as necessary. All spilled liquids will be collected and disposed of properly. Spill control devices shall be routinely inspected on a weekly basis.

**Dry pesticides and fertilizers** if stored onsite shall be covered with plastic sheeting or stored in a sealed container. Materials shall be stored on pallets or another raised method to prevent contact with stormwater runoff. Alternatively, the materials shall be contained in a manner such that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater. Maintenance requirements are the same as liquid materials described above.

**Chemicals** that will be handled or stored onsite are the following: _____. Containers will be stored _____.

BMPs and Maintenance requirements are the same as liquids unless otherwise listed.

**Soil, sand, and other erodible materials** shall be stored onsite as shown on TESC detail plans.

**Fueling** shall not occur onsite. If fueling does occur onsite, the contractor shall develop a containment plan for spills and provide lighting and signage if fueling occurs at night in conformance with the *KCSPPM*.

**Maintenance and repair of vehicles** shall not occur onsite. If maintenance or repair of vehicles does occur onsite, the contractor shall develop a spill prevention plan in conformance with the *KCSPPM*.

**Truck wheel washing** is not expected at a large scale due to small area of disturbance for the project. All other **vehicle washing** shall occur in a controlled manner, such that runoff is collected and disposed of in a legal manner.

**Rinsing of hand tools** shall occur as located on the TESC plans (to be provided with the building permit submittal). Water for washing shall be collected and disposed of in a legal manner.

**Contaminated soils** are not expected. If encountered, contaminated soils will be covered with plastic to prevent stormwater from carrying pollutants away to surface or ground waters. Appropriate spill cleanup materials, such as brooms, dustpans, vacuum sweepers, etc., shall be stored and maintained near the storage area. Storage area shall be swept and cleaned as needed. Area shall not be hosed down such that water drains to the storm drainage system, groundwater, surface water, or neighboring areas.

During **concrete and asphalt construction**, the contractor shall provide the following BMPs or equivalent measures, methods or practices as required:

1. Drip pans, ground cloths, heavy cardboard or plywood wherever concrete, asphalt and asphalt emulsion chunks and drips are likely to fall unintentionally, such as beneath extraction points from mixing equipment.

2. Storm drain inlet protection is being provided as shown on TESC plans (to be provided). Storm drains shall be covered to prevent concrete and asphalt from entering the storm system.

3. Concrete, concrete slurry, and rinse water shall be contained and collected and shall not be washed or allowed to discharge into storm drain, ditch, or neighboring parcels. All collected runoff shall be properly disposed of.

4. Contractor shall designate an area where application and mixing equipment cleaning will be conducted. Rinse water and slurry shall be collected, contained, and disposed of in a legal manner.

5. Routine maintenance: the pouring area shall be swept at the end of each day or more frequently if needed. Loose aggregate chunks and dust shall be collected. Areas shall not be hosed down.

The contractor may provide the following optional BMPs if the above do not provide adequate source controls:

1. Cover portable mixing equipment with an awning or plastic sheeting to prevent contact with rainfall.

2. Provide catch basin inserts configured for pollutant removal.

**pH elevated water** shall not be discharged from the site. Contractor shall monitor stormwater for pH prior to discharging from the site. Contractor shall implement a pH treatment plan if pH is not within the natural range.

### 8.2.2 Responsible Personnel and Contact Information

____[name]____ with ____[company]____ shall be responsible for pollution and spill prevention and cleanup and can be contacted at ____[phone]____ or ____[email]____.

Contractor shall fill out the attached Pollution Prevention Team Worksheet (see Figure 8-3).

### 8.2.3 Pollution and Spill Prevention Worksheets

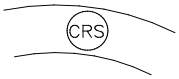
Pollution prevention, BMP implementation reports, material inventory worksheets, pollutant source identification worksheet, and spill/leak report may be found attached as Figure 8-3.

### 8.2.4 Disposal Methods

Contractor shall dispose of contaminated soils and water in a legal manner. Options include the following: _____.

## Section 8.0 Figures

## D.2.1.4.2 CONSTRUCTION ROAD/PARKING AREA STABILIZATION

Code: CRS Symbol: 


### 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

1. Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
2. Fencing (see Section D.2.1.1) 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

1. 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 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. *Note: If the area will be used for permanent road or parking installation later in the project, the subgrade will be subject to inspection.*
2. **Temporary road gradients** shall not exceed 15 percent. Roadways shall be carefully graded to drain transversely. 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 designed in accordance with the standards given in Section D.2.1.6.4 (p. D-64) and directed to a sediment pond or trap.
3. 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 vegetated wetlands. If runoff is allowed to sheet flow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
4. In order to control construction traffic, the County may require that **signs** be erected on site informing construction personnel that vehicles, other than those performing clearing and grading, are restricted to stabilized areas.
5. If construction roads do not adequately reduce trackout to adjacent property or roadways, a wheel wash system will be required.

### Maintenance Standards

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.

## D.2.1.5 SEDIMENT RETENTION

Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.2.1.3, p. D-33). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, sediment ponds and traps are not required. A 10-year peak flow using the approved model with 15-minute time steps shall be used for sediment pond/trap sizing if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see below). At the County's discretion, sites may be worked during the dry season without sediment ponds and traps if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. For small sites, use the criteria defined in Section D.2.1.3, Perimeter Protection to determine minimum flow path length. If the site work has to be extended into the wet season, a back-up plan must be identified in the CSWPP plan and implemented. Protection of catch basins is required for inlets that are likely to be impacted by sediment generated by the project and that do not drain to an onsite sediment pond or trap. Sediment retention facilities shall be installed prior to grading of any contributing area and shall be located so as to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

**Purpose:** The purpose of sediment retention facilities is to remove sediment from runoff generated from disturbed areas.

**When to Install:** The facilities shall be constructed as the first step in the clearing and grading of the site. The surface water conveyances may then be connected to the facilities as site development proceeds.

**Measures to Use:** There are three sediment retention measures in this section. The first two, sediment traps and ponds, serve the same function but for different size catchments. All runoff from disturbed areas must be routed through a trap or pond except for very small areas at the perimeter of the site small enough to be treated solely with perimeter protection (see Section D.2.1.3, p. D-33). The third measure is for catch basin protection. It is only to be used in limited circumstances and is not a primary sediment treatment facility. It is only intended as a backup in the event of failure of other onsite systems.

**Use of Permanent Drainage Facilities:** All projects that are constructing permanent facilities for runoff quantity control are strongly encouraged to use the rough-graded or final-graded permanent facilities for ponds and traps. This includes combined facilities and infiltration facilities. When permanent facilities are used as temporary sedimentation facilities, the surface area requirements of sediment traps (for drainages less than 3 acres) or sediment ponds (more than 3 acres) must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the pond shall be enlarged to comply with the surface area requirement. The permanent pond shall also be divided into two cells as required for sediment ponds. Either a permanent control structure or the temporary control structure described in Section D.2.1.5.2 may be used. 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 pond.

If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of three feet above final grade. Excavation should be done with a backhoe working at "arms length" to minimize disturbance and compaction of the infiltration surface. Additionally, any required pretreatment facilities shall be fully constructed prior to any release of sediment-laden water to the facility. Pretreatment and shallow excavation are intended to prevent the clogging of soil with fines. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized (see Section D.2.4.5, p. D-115).

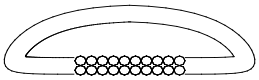
**Selection of the Design Storm:** In most circumstances, the developed condition 2-year peak flow using the approved model with 15-minute time steps is sufficient for calculating surface area for ponds and traps and for determining exemptions from the sediment retention and surface water collection requirements

(Sections D.2.1.5 and D.2.1.6, respectively). In some circumstances, however, the approved model 10-year 15-minute peak flow should be used. Examples of such circumstances include the following:

- Sites that are within ¼ mile of salmonid streams, wetlands, and designated sensitive lakes such as Lake Sammamish
- Sites where significant clearing and grading is likely to occur during the wet season
- Sites with downstream erosion or sedimentation problems.

**Natural Vegetation:** Whenever possible, sediment-laden water shall be discharged into onsite, relatively level, vegetated areas. This is the only way to effectively remove fine particles from runoff. This can be particularly useful after initial treatment in a sediment retention facility. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system, not replace it because of the possibility of pump failure or runoff volume in excess of pump capacity.

## D.2.1.5.1 SEDIMENT TRAP

Code: ST Symbol: 

### Purpose

Sediment traps remove sediment from runoff originating from disturbed areas of the site. Sediment traps are typically designed to only remove sediment as small as medium silt (0.02 mm). As a consequence, they usually only result in a small reduction in turbidity.

### Conditions of Use

A sediment trap shall be used where the contributing drainage area is 3 acres or less.

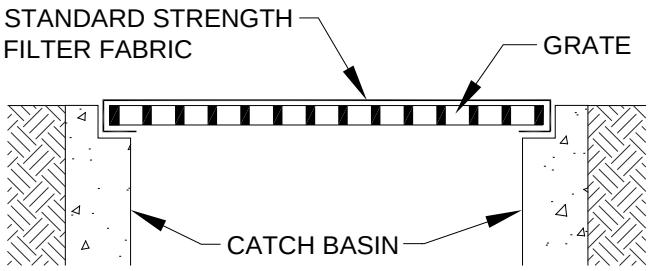
### Design and Installation Specifications

1. See Figure D.2.1.5.A for details.
2. If permanent runoff control facilities are part of the project, they should be used for sediment retention (see "**Use of Permanent Drainage Facilities**" on page D-47).
3. To determine the trap geometry, first calculate the design surface area (*SA*) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS(Q_2/V_S)$$

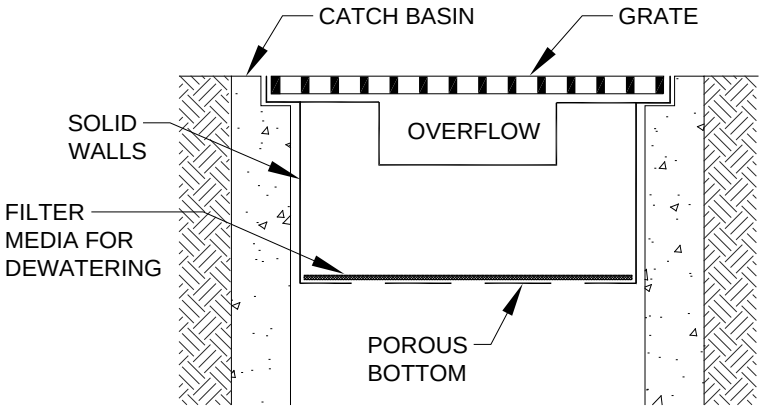
where $Q_2$ = Design inflow (cfs) from the contributing drainage area based on the developed condition 2-year or 10-year peak discharge using the approved model with 15-minute time steps as computed in the hydrologic analysis. The approved model 10-year 15-minute peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection, or if the pond discharge path leaves the ***site*** (note provisions must made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the project ***site*** during construction, see Section D.3.9, Flow Control). If no hydrologic analysis is required, the Rational Method may be used (Section 3.2.1 of the King County *Surface Water Design Manual*).

**FIGURE D.2.1.5.E FILTER FABRIC PROTECTION**




**NOTE:** ONLY TO BE USED WHERE PONDING OF WATER ABOVE THE CATCH BASIN WILL NOT CAUSE TRAFFIC PROBLEMS AND WHERE OVERFLOW WILL NOT RESULT IN EROSION OF SLOPES.

**FIGURE D.2.1.5.F CATCH BASIN INSERT**




**NOTE:** THIS DETAIL IS ONLY SCHEMATIC. ANY INSERT IS ALLOWED THAT HAS:

- A MIN. 0.5 C.F. OF STORAGE,
- THE MEANS TO DEWATER THE STORED SEDIMENT,
- AN OVERFLOW, AND
- CAN BE EASILY MAINTAINED.

## D.2.1.6 SURFACE WATER COLLECTION

All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged downslope of any disturbed areas. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.2.1.3). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, surface water controls are not required. A 10-year approved model 15-minute peak flow shall be used for sizing surface water controls if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see the introduction to Section D.2.1.5). At the County's discretion, sites may be worked during the dry season without surface water controls, if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas. Surface water controls shall be installed concurrently with rough grading.

**Purpose:** The purpose of surface water control is to collect and convey surface water so that erosion is minimized, and runoff from disturbed areas is treated by a sediment pond or trap. Surface water control essentially consists of three elements:

1. Interception of runoff on and above slopes
2. Conveyance of the runoff to a sediment pond or trap (if the runoff was collected from a disturbed area)
3. Release of the runoff downslope of any disturbed areas.

**When to Install:** Surface water controls shall be constructed during the initial grading of an area and must be in place before there is any opportunity for storm runoff to cause erosion.

**Measures to Install:** Interceptor dikes/swales intercept runoff, ditches and pipe slope drains convey the runoff, and riprap or level spreaders help release the runoff in a non-erosive manner. Each measure is to be used under different circumstances so there is very little overlap. However, the two options for releasing water in a non-erosive manner, outlet protection and level spreaders, can be somewhat interchangeable. See Figure D.2.1.6.A for a schematic drawing demonstrating the use of these measures.

## D.2.1.7 DEWATERING CONTROL

Any runoff generated by dewatering shall be treated through construction of a sediment trap (Section D.2.1.5.1) when there is sufficient space or by releasing the water to a well vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be more effectively utilized for treatment. Discharge of sediment-laden water from dewatering activities to surface and storm waters is prohibited. If dewatering occurs from areas where the water has come in contact with new concrete, such as tanks, vaults, or foundations, the pH of the water must be monitored and must be neutralized prior to discharge. Clean non-turbid dewatering water, such as well point ground water can be discharged to systems tributary to, or directly to surface waters provided the flows are controlled so no erosion or flooding occurs. Clean water must not be routed through a stormwater sediment pond. Highly turbid or contaminated dewatering water must be handled separately from stormwater.

**Purpose:** To prevent the untreated discharge of sediment-laden water from dewatering of utilities, excavated areas, foundations, etc.

**When to Install:** Dewatering control measures shall be used whenever there is a potential for runoff from dewatering of utilities, excavations, foundations, etc.

**Measures to install:**

1. Foundation, vault, excavation, and trench dewatering water that has similar characteristics to stormwater runoff at the site shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Foundation and trench dewatering water **that has similar characteristics to stormwater runoff** at the site must be disposed of through one of the following options depending on site constraints:
   a) Infiltration,
   b) Transport offsite in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute surface waters,
   c) Discharge to the sanitary sewer discharge with local sewer district approval if there is no other option, or
   d) Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.
2. Clean, non-turbid dewatering water, such as well-point ground water, may be discharged via stable conveyance to systems tributary to surface waters, provided the dewatering flow does not cause erosion or flooding of receiving waters.
3. **Highly turbid or contaminated dewatering water (high pH or other) shall be handled separately** from stormwater. See Section D.2.2 (p. D-74), *SWPPS Measures*.

## D.2.1.8 DUST CONTROL

Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources or adjacent properties.

**Purpose:** To prevent wind transport of dust from exposed soil surfaces onto roadways, drainage ways, and surface waters.

**When to Install:** Dust control shall be implemented when exposed soils are dry to the point that wind transport is possible and roadways, drainage ways, or surface waters are likely to be impacted. Dust control measures may consist of chemical, structural, or mechanical methods.

**Measures to Install:** Water is the most common dust control (or palliative) used in the area. When using water for dust control, the exposed soils shall be sprayed until wet, but runoff shall not be generated by spraying. Calcium chloride, Magnesium chloride, Lignin derivatives, Tree Resin Emulsions, and Synthetic Polymer Emulsions may also be used for dust control. Exposed areas shall be re-sprayed as needed. Oil shall not be used for dust control. The following table lists many common dust control measures. Some of the measures are not recommended for use in King County and must have prior approval prior to use from the DPER inspector assigned to specific projects.

**TABLE D.2.1.8.A DUST CONTROL MEASURES**

| METHOD | CONSIDERATIONS | SITE PREPARATION | RECOMMENDED APPLICATION RATE |
|---|---|---|---|
| Water | -Most commonly used practice<br>-Evaporates quickly<br>-Lasts less than 1 day | For all liquid agents:<br>-Blade a small surface<br>-Crown or slope surface to avoid ponding<br>-Compact soils if needed<br>-Uniformly pre-wet at 0.03 – 0.3 gal/sq yd<br>-Apply solution under pressure. Overlap solution 6 – 12 inches<br>-Allow treated area to cure 0 – 4 hours<br>-Compact area after curing<br>-Apply second treatment before first treatment becomes ineffective | 0.125 gal/sq yd every 20 to 30 minutes |
| Salts Calcium Chloride (CaCl) | -Restricts evaporation<br>-Lasts 6-12 months<br>-Can be corrosive<br>-Less effective in low humidity<br>-Can build up in soils and leach by rain | | Apply 38% solution at 1.21L/m2 (0.27 gal/yd2) or as loose dry granules per manufacturer |
| Magnesium Chloride (MgCl) | -Restricts evaporation<br>-Works at higher temperatures and lower humidity than CaCl<br>-May be more costly than CaCl | | Apply 26 – 32% solution at 2.3 L/m2 (0.5 gal/yd2) |
| Sodium Chloride (NaCl) | -Effective over smaller range of conditions<br>-Less expensive<br>-Can be corrosive<br>-Less effective in low humidity | | Per Manufacturer |
| Silicates | -Generally expensive<br>-Available in small quantities<br>-Require Second application | | |
| Surfactants | -High evaporation rates<br>-Effective for short time periods<br>-Must apply frequently | | |
| Copolymers | -Forms semi-permeable transparent crust<br>-Resists ultraviolet radiation and moisture induced breakdown<br>-Last 1 to 2 years | | 750 – 940 L/ha (80 – 100 gal/ac) |
| Petroleum Products | -Used oil is prohibited as a dust control method<br>-Bind soil particles<br>-May hinder foliage growth<br>-Environmental and aesthetic concerns<br>-Higher cost | | Use 57 – 63% resins as base. Apply at 750 – 940 L/ha (80-100 gal/ac) |
| Lignin Sulfonate | -Paper industry waste product<br>-Acts as dispersing agent<br>-Best in dry climates<br>-Can be slippery<br>-Will decrease Dissolved Oxygen in waterways therefore cannot be used adjacent to surface water systems | | Loosen surface 25-50 mm (1 – 2 inches) Need 4-8% fines |
| Vegetable Oils | -Coat grains of soils, so limited binding ability<br>-May become brittle<br>-Limited availability | | Per Manufacturer |
| Spray on Adhesives | -Available as organic or synthetic<br>-Effective on dry, hard soils<br>-Forms a crust<br>-Can last 3 to 4 years | | Per Manufacturer |

## D.2.1.9 FLOW CONTROL

Surface water from disturbed areas must be routed through the project's onsite flow control facility or other provisions must made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the project site during construction.

**Purpose:** The purpose of surface water flow control is to mitigate increases in runoff peaks that occur during construction as a result of clearing vegetation, compacting the soil, and adding impervious surface. Such increases can cause or aggravate downstream flooding and erosion.

**When to Install:** Surface water flow control shall be installed or otherwise provided prior to any clearing and/or grading of the site, except that required to construct the surface water flow control facilities.

**Measures to Use:** The project's onsite flow control facility or other equivalent storage facility that meets the peak-matching performance criteria stated above.

## D.2.1.10 PROTECT EXISTING AND PROPOSED FLOW CONTROL BMPS

Protection measures shall be applied/installed and maintained so as to prevent adverse impacts to existing flow control BMPs and areas of proposed flow control BMPs for the project. Adverse impacts can prompt the requirement to restore or replace affected BMPs.

**Purpose:** The purpose of protecting existing and proposed flow control BMP areas is to avoid sedimentation and soil compaction that would adversely affect infiltration, and also avoid contamination by other pollutants.

**When to Install:** Flow control BMP area protection shall be installed or otherwise provided prior to any clearing and/or grading of the site, except that required to construct flow control BMPs.

**Measures to Use:**

1. Protect all flow control BMPs and proposed BMP footprints from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the flow control BMPs.
2. BMPs shall be restored to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP shall include, at a minimum, removal of sediment and any sediment-laden bioretention soils, and replacing the removed soils with soils meeting the design specification. Replacement with a new fully-functioning BMP may be required if restoration to the fully-functioning condition can’t be accomplished.
3. Prevent compacting Bioretention BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
4. Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements.
5. Pavements fouled with sediments or no longer passing an initial infiltration text must be cleaned using procedures from the local stormwater manual or the manufacturer’s procedures.
6. Keep all heavy equipment off existing soils under flow control BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

**Additional Guidance**

See Chapter 5: Precision Site Preparation and Construction in the *LID Technical Guidance Manual for Puget Sound* for more detail on protecting LID integrated management practices. Note that the LID Technical Guidance Manual for Puget Sound (2012) is for additional informational purposes only. The

guidance within this manual must be followed if there are any discrepancies between this manual and the LID Technical Guidance Manual for Puget Sound (2012).

## D.2.1.11 MAINTAIN PROTECTIVE BMPS

Protection measures shall be maintained to assure continued performance of their intended function, to prevent adverse impacts to existing flow control BMPs and areas of proposed flow control BMPs, and protect other disturbed areas of the project.

**Purpose:** The purpose of maintaining protective BMPs is to provide continuous erosion and sediment control protection throughout the life of the project, and avoid sedimentation, soil compaction and contamination by other pollutants that would adversely affect infiltration and surface runoff.

**When to Maintain:** Protection measures shall be monitored per Section D.2.4.4 at a minimum, and promptly maintained to fully functioning condition as necessary to assure continued performance of their intended function.

**Measures to Use:**

1. 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.
2. Remove all temporary erosion and sediment control BMPs prior to final construction approval, or within 30 days after achieving *final* site stabilization or after the temporary BMPs are no longer needed.
3. Provide protection to all BMPs installed for the permanent control of stormwater from sediment and compaction. All BMPs that are to remain in place following completion of construction shall be examined and placed in full operating conditions. If sediment enters the BMPs during construction, it shall be removed and the BMP shall be returned to the conditions specified in the construction documents or as required for full BMP replacement.
4. Remove or stabilize trapped sediment on site. Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.

## D.2.1.12 MANAGE THE PROJECT

Coordination and timing of site development activities relative to ESC concerns (Section D.2.4), and timely inspection, maintenance and update of protective measures (Section D.2.3) are necessary to effectively manage the project and assure the success of protective ESC and SWPPS design and implementation.

Projects shall assign a qualified CSWPP Supervisor (Section D.2.3.1) to be the primary contact for ESC and SWPPP issues and reporting, coordination with subcontractors and implementation of the CSWPP plan as a whole.

**Measures to Use:**

1. Phase development projects to the maximum degree practicable and take into account seasonal work limits.
2. 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 the Construction Stormwater General Permit and King County requirements.
3. Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP in accordance with the Construction Stormwater General Permit and King County requirements.
4. Projects that disturb one or more acres must have, site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL) (see Section D.2.3.1). Project sites less than one acre (not part

of a larger common plan of development or sale) may have a person without CESCL certification conduct inspections. By the initiation of construction, the SWPPP must identify the CESCL or inspector, who shall 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 all 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 (applies only to sites that have coverage under the Construction Stormwater General Permit).
- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month

# D.2.2 SWPPS MEASURES

This section details the SWPPS measures that are required to prevent, reduce, or eliminate the discharge of pollutants to onsite or adjacent stormwater systems or watercourses from construction-related activities such as materials delivery and storage, onsite equipment fueling and maintenance, demolition of existing buildings and disposition of demolition materials and other waste, and concrete handling, washout and disposal.. These SWPPS measures represent *Best Management Practices (BMPs)*[8] for the control of pollutant drips and spills as well as other impacts related to construction such as increased pH in concrete construction and handling activities. Compliance with each of the SWPPS measures, and with any project-specific control measures, to the extent applicable and necessary to meet the performance criteria in Section D.2.2, and compliance with the CSWPP implementation requirements in Section D.2.4, constitutes overall compliance with King County's CSWPP Standards.

*Note: Additional measures shall be required by the County if the existing standards are insufficient to protect adjacent properties, drainage facilities, or water resources.*

The standards for each individual SWPPS measure are divided into four sections:

1. Purpose
2. Conditions of Use
3. Design and Installation Specifications
4. Maintenance Requirements.

Note that the "Conditions of Use" always refers to site conditions. As site conditions change, SWPPS measures must be changed to remain in compliance with the requirements of this appendix.

Whenever compliance with King County SWPPS Standards is required, all of the following SWPPS measures must be considered for application to the project site as detailed in the following sections. The construction pollutant generating concerns addressed by the BMPs that follow include:

- Concrete handling, washout and disposal(specifically portland cement concrete)
- Sawcutting and surfacing activities
- Materials delivery, storage and containment
- Filtration and chemical treatment of construction water to facilitate disposal or discharge to approved locations
- Reporting requirements and documentation availability for specific BMP processes

Additionally, several of the ESC BMPs described in Section D.2.1 can be applicable to the SWPPS plan, e.g., use of cover, fencing and access protection to protect temporary materials storage locations. The applicant’s material supplier may be a resource (subject to King County approval) for BMPs to address specific project applications or proposals. Conditions of approval on adjustments may also specify additional requirements for the SWPPS plan.

[8] *Best Management Practices (BMPs)* means the best available and reasonable physical, structural, managerial, or behavioral activities, that when singly or in combination, eliminate or reduce the contamination of surface and/or ground waters.

# D.2.2.1 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. Concrete spillage or concrete discharge to surface waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the state.

## Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction projects include, but are not limited to, curbs, sidewalks, roads, bridges, foundations, floors, stormwater vaults, retaining walls, driveways and runways.

## Design and Installation Specifications

1. Assure that washout of concrete trucks, chutes, pumps, and internals is performed at an approved off-site location or in designated concrete washout areas. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Refer to BMP D.2.2.2 (p. D-76) for information on concrete washout areas.
2. Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas.
3. Wash off hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels into formed areas only.
4. Wash equipment difficult to move, such as concrete pavers in areas that do not directly drain to natural or constructed stormwater conveyances.
5. Do not allow washdown from areas, such as concrete aggregate driveways, to drain directly to natural or constructed stormwater conveyances.
6. Contain washwater and leftover product in a lined container when no formed areas are available,. Dispose of contained concrete in a manner that does not violate ground water or surface water quality standards.
7. Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
8. Refer to BMPs D.2.2.7 and D.2.2.8 for pH adjustment requirements.
9. Refer to the Construction Stormwater General Permit for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (greater than 1,000 cubic yards poured concrete or recycled concrete used over the life of a project).
    - The use of engineered soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

## Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

# D.2.2.3 SAWCUTTING AND SURFACING POLLUTION PREVENTION

## Purpose

Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to surface waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State.

## Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to, sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing

## Design and Installation Specifications

1. Vacuum slurry and cuttings during cutting and surfacing operations.
2. Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
3. Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
4. Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
5. Do not allow process water generated during hydro-demolition, surface roughening or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose process water in a manner that does not violate ground water or surface water quality standards.
6. Handle and dispose cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

## Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and vacuum trucks.

# D.2.2.4 MATERIAL DELIVERY, STORAGE AND CONTAINMENT

## Purpose

Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

## Conditions of Use

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g. Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds
- Any other material that may be detrimental if released to the environment

## Design and Installation Specifications

The following steps should be taken to minimize risk:

1. Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
2. Material Safety Data Sheets (MSDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
3. Hazardous material storage on-site should be minimized.
4. Hazardous materials should be handled as infrequently as possible.
5. During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
6. Materials should be stored in secondary containments, such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
7. Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, and within secondary containment.
8. If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

## Material Storage Areas and Secondary Containment Practices:

1. Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
2. Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.

3. Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
4. Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
5. Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
6. During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
7. Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
8. The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3”x 4’
    - 2-Oil Absorbent Socks 3”x 10’
    - 12-Oil Absorbent Pads 17”x19”
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

**TABLE D.2.2.9.A CTB/CKD Soil Amendment BMPs**

| Category of Action | Specific Action | CTB/CKD Best Management Practices |
|---|---|---|
| 3. Lay-down Mixing Equipment | | A. Exposure of CTB/CKD materials to air to be minimized. Delivery tankers shall be set up to place CTB/CKD directly into spreading trucks or equipment.<br>B. CTB/CKD operations are only allowed during daylight hours.<br>C. Tarps or dust bags will be used over the discharge truck hose at unloading to prevent dust particles for becoming airborne.<br>D. Unloading will occur at the lowest possible pump pressure.<br>E. Unloading and mixing will be avoided on high wind days. PSAPCA Section 9.15 prohibits visible emissions of fugitive dust.<br>F. CTB/CKD to be placed on ground by large wheeled spreaders designed for this purpose capable of measuring application.<br>G. When spreading CTB/CKD it shall be kept 2-3 feet away from untreated areas boundaries to prevent the material from migration and contaminating outside the treatment zone.<br>H. Treatment area will be kept damp/wet at all times CTB/CKD is being spread and mixed. Skirting around applicator/spreader and mixer is required to minimize CTB/CKD dust.<br>I. CTB/CKD is to be roto-tilled into soil immediately after being spread onto soils and shall be done with a skirted tiller.<br>J. Direct auguring machine that measures, spreads, and mixes CTB/CKD in one operation is preferred.<br>K. Compaction will be complete within 2 hours after CTB/CKD application. |

| TABLE D.2.2.9.A CTB/CKD Soil Amendment BMPs | | |
|---|---|---|
| **Category of Action** | **Specific Action** | **CTB/CKD Best Management Practices** |
| 4. Site Management | Work Progress and Weather Conditions | A. Dust suppression by use of water trucks shall be used on areas where work on dry soil is performed and potential airborne contamination may occur.<br>B. The volume of CTB/CKD allowed on site will be limited to the amount that can be used within a normal workday. Every effort will be made to forecast the daily delivery rate to match the daily on-site use rate.<br>C. CTB/CKD will not be added to soils at a rate that exceeds the ability of on-site resources to immediately commence mixing and compacting.<br>D. No work will occur in rain heavier than drizzle, or under drizzle that exceeds 6 hours duration, or under any rainfall which generates runoff from the areas being worked.<br>E. Should the weather change to stop the application, remaining CTB/CKD will be covered and contained to prevent stormwater from entering storage containment, and causing runoff.<br>F. All vehicles and equipment leaving the treatment area/site must be cleaned/washed to prevent CTB/CKD from leaving site. Wash water will be contained and treated as needed.<br>G. CTB/CKD contact water in the wheel wash will be removed from the site via a vactor truck for transport to an approved off-site treatment or disposal facility in accordance with all federal, state, and local laws and regulations; or, if permitted, to the sanitary sewer system. |
| 5. Surface Water Collection | | A. Surface runoff from the treated areas is to be collected and stored in onsite sealed treatment tanks.<br>B. A rigid schedule of TESC inspection, maintenance, and drainage controls will be maintained.<br>C. Temporarily plugging and using detention facilities is not allowed as a storage practice.<br>D. Runoff from compacted areas amended with CTB/CKD will be directed to previously sealed tank(s) until pH levels of water are verified to be within acceptable background water limits. No uncontrolled discharge or infiltration from the sealed tank(s) will be allowed.<br>E. Drainage from areas amended with CTB/CKD within the past 72 hours will be prevented from co-mingling with any other project drainage. |

**TABLE D.2.2.9.A CTB/CKD Soil Amendment BMPs**

| Category of Action | Specific Action | CTB/CKD Best Management Practices |
|---|---|---|
| 6. Discharge Compliance | Applicable Regulations | A. Any and all discharges from this site will be in compliance with all applicable federal, state, and local laws and regulations pertaining to health and safety, water, air, waste, and wildlife, including the Federal Clean Water Act, Clean Air Act, and Endangered Species Act. Laboratory analysis of water is required prior to discharge to verify compliance.<br>B. No infiltration is allowed to occur if pH readings are above 8.5 standard pH units, or below 6.5 standard pH units.<br>C. A pH meter must be used to determine levels. pH meter is to be calibrated following proper QA/QC procedures. Fresh buffers are to be available to re-calibrate as needed.<br>D. A log of turbidity and pH readings will be kept on site for inspection.<br>E. All treatment of water must be directed, bench tested, monitored and verified by a qualified water quality specialist.<br>F. Treated area water runoff shall not enter the permanent stormwater system.<br>G. Stormwater drainage system within treatment area is to be cleaned out prior to use for regular water runoff conveyance from untreated areas. Water from cleanout is to be tested and treated following the approved treatment criteria. |
| 7. Natural Treatment and Discharge | | A. The preferred method of disposal of the treatment water will be discharge to the sanitary sewer, provided a permit is obtained to do so.<br>B. If infiltration is proposed, the area of infiltration is to be identified, capacity confirmed, and a contingency discharge plan in place in the event facilities fail to infiltrate.<br>C. For infiltration, pH limits shall be strictly adhered to.<br>D. If a permit to discharge to the sanitary sewer is not obtained, a National Pollutant Discharge Elimination System (NPDES) discharge permit is required from Ecology. The retention volume of the lined pond(s) will also be increased to ensure complete control of the retained volume. Monitoring, bench testing, and controlled discharge rates, with prior approval by Ecology, would be needed prior to discharge to an approved off-site surface drainage system. Sites that currently have NPDES permits will need to amend permit prior to discharge to cover this action. County approval is still required.<br>E. Per KCC 9.12, discharges into receiving drainage systems shall not have acid or basic pH levels.<br>F. Sealed storage tanks shall be used to reduce turbidity and pH before discharge. |

| TABLE D.2.2.9.A CTB/CKD Soil Amendment BMPs | | |
|---|---|---|
| **Category of Action** | **Specific Action** | **CTB/CKD Best Management Practices** |
| 8. Chemical Treatment | | A. Carbon dioxide sparging (dry ice pellets) may be used as the chemical treatment agent to reduce the water pH.<br>B. Any means of water treatment to reduce pH will require an NPDES discharge permit from Ecology. Permit would only be granted after bench testing performed by an independent qualified party.<br>C. Active mixing will cease if the residual retention water volume falls below the ability to treat and properly dispose of contact storm water.<br>D. Discharge would only occur after the approval of Ecology, following bench testing and consultation with Ecology.<br>E. All materials for chemical treatment will be on site and property stored, during all phases of CTB/CKD treatment. |
| 9. Water Quality | Monitoring | A. Turbidity and pH will be monitored on a twice-daily basis, prior to operations and immediately upon ceasing operations, and these measurements will be recorded. Monitoring will also occur immediately after any storm event of ½ inch in 24 hours, or water migration to the retention pond(s), and the measurements recorded. If the pH approaches 8.0, monitoring frequency will increase.<br>B. Turbidity and pH monitoring will occur in all treatment facilities, stormwater detention facilities, infiltration areas (if infiltration is used), and in all surface water areas adjacent to site where stormwater potentially discharges. Additional upstream surface water sites will be established to determine background levels of turbidity and pH.<br>C. All water quality monitoring data will be conducted and evaluated by an independent, qualified party and conducted using professionally supportable test protocols and QA/QC procedures. |
| 10. Reporting | Ecology and DPER | A. All water quality monitoring data will be included in weekly DPER TESC reports to DPER, and in weekly NPDES reports to Ecology.<br>B. All work, testing, and monitoring associated with the application of CTB/CKD shall be observed by engineer. The engineer shall prepare and submit a report to the assigned DPER project inspector indicating BMPs were/were not being met.<br>C. Copies of all reports and logs will be available on site during the soil and surface runoff treatment activities. |

| TABLE D.2.2.9.A CTB/CKD Soil Amendment BMPs | | |
|---|---|---|
| **Category of Action** | **Specific Action** | **CTB/CKD Best Management Practices** |
| **Other elements to consider:** | | |
| . Water Quality – Soils | Source Controls | A. There may be very small amounts of concrete washout produced onsite as a result of construction of erosion control measures during reclamation. Concrete washout, if any, would be retained in a lined enclosure of at least 6-ml visqueen or plastic sheeting, with no outlet. The washout retention enclosure would be isolated and separate from any CTB/CKD area runoff. Contents of the lined concrete washout enclosure will be removed from the site via a vactor truck for disposal in an approved off-site treatment or disposal facility in accordance with all federal, state, and local laws and regulations. Signed trip tickets, as proof of proper disposal, will be provided to Ecology and DPER. |
| . Water Quality – pH | Cover Measures | A. Areas amended with CTB/CKD for compaction after CTB/CKD addition will be covered with plastic or visqueen sheeting, or other impervious material by the end of each working day.<br>B. Temporary cover will be maintained over all compacted areas amended with CTB/CKD until testing confirms that pH levels are stabilized to background measurements. [Note: Curing to avoid pH effects has no relationship to the rate at which material can be compacted in multiple lifts. Compaction will commence immediately after application and mixing, and multiple lifts will occur as quickly as each lift is compacted and ready to accept the next.]<br>C. Should weather conditions prevent mixing, any unmixed CTB/CKD remaining on site will be enclosed in a sealed containment, such as portable silo, or removed from site. |

## ***Processing Requirements for Use of High pH Soil Amendments on Construction Sites***[10]

### Purpose

This section establishes procedures for implementing BMPs when using high pH soil amendments on construction sites. See Table D.2.2.9.A for a description of the BMPs. This section outlines an expedited review process and typical approval conditions that will allow contractors and builders to use soil amendments without impacting water quality. Additional BMPs may be required based upon site specific conditions that may warrant more protection. This policy is limited to those amendments, defined below, commonly known to add stability to sloppy soil conditions but which can alter water runoff quality.

[10] Excerpted from the King County *Stormwater Pollution Prevention Manual (SPPM)*, BMP Info Sheet #11

**Authority:** KCC 9.12.025 prohibits discharges of polluted or contaminated water into surface or storm water drainage systems. The purpose of this statute is to protect surface and ground water by regulating the discharge of potentially contaminated surface water. If soil amendments are proposed with an initial application, an environmental review is required, under SEPA, which assesses impacts, provides public input and mitigated conditions for its use.

*King County Road Design and Construction Standards*, Sections 4.04 and 4.05 also require an engineered design for use of a soil amendment on road surfaces or around drainage systems. The design may incorporate a thorough assessment of soil composition and laboratory analysis. The *Surface Water Design Manual* authorizes DPER to adopt BMPs for the control and protection of surface water. Currently, for all sites, the BMPs established in this policy are the minimum standards that shall be applied.

## Procedure

An applicant may apply for use of soil amendments allowed under this policy anytime during the permit application review or after the permit has been issued and site construction is underway. After making a submittal to DPER, the applicant may receive approval conditions. Conditions may vary from site to site, but typically will include many of the BMPs included in this policy.

Applicants should identify any use of soil amendments as early in the process as possible to avoid delays in obtaining approval for use during the construction phase. If a site has known soil and water conditions that might make work during rainy periods difficult, they may want to plan to use soil amendments on their site. Obviously, if this issue is addressed at the permit review phase, implementation in the field can occur without delay. However, because of the potential risks of surface water pollution discharge and required treatment, an environmental assessment will be necessary before conditions for use can be established.

## Limitations

This policy applies to the intended use of soil amendments in areas that will be covered by impervious surfaces. For areas not covered by impervious surfaces, additional reviews, study, and BMPs may be required. In addition, alterations to original approved use plans will require a resubmittal for approval. Approval for the use of the soil amendments in unincorporated King County can only occur by strictly following the procedures contained herein and not by any other approval obtained from DPER.

## Submittal Requirements

To obtain approval for the use of soil amendments allowed under this policy, the applicant shall prepare a submittal package to DPER that includes the following:

- Letter to DPER requesting use of soil amendments at a construction site allowed under this policy.
- Document or letter attachment that identifies source of materials and description of mixing and laydown process, plan for disposal of treated contact water, sanitary sewer permits and/or BMPs, and special precautions proposed to prevent the contamination of surface or stormwater drainage systems, other than 'sealed' drainage systems.
- Site Plan: Show a site plan map which:
    1) Shows overall grading plan showing existing and proposed contours.
    2) Identifies sensitive areas and permanent or temporary drainage facilities.
    3) Identifies areas that soil amendment is planned.
    4) Shows depths of application and percent of amendment to be used.
    5) Shows location of special wheel wash facility.
    6) Shows location of collection and conveyance swales or pipes for contact water.
    7) Shows location of sealed storage/treatment tanks or temporary ponds (fully lined).

8) Identifies any discharge point from the site into natural drainage systems.

9) Includes soil log locations that identify seasonal high groundwater areas.

- Report and analysis of engineering mix design which includes depths of application and percent of amendment usage.
- For proposals that use CKD and CKD additive, provide analysis of source material for soluble contaminants. Include a description of fuel source.
- Monitoring criteria, including locations for pH and turbidity testing.
- Provide contingency plan should use of soil amendment and site and weather conditions result in polluted or contact water entering natural drainage systems.
- Provide contact information or water quality specialist assigned to monitor application of soil amendments and BMPs.

If the project is under construction, the applicant shall contact the DPER inspector assigned to the project to initiate a review for compliance with the BMPs and requirements herein. Otherwise contact the planner or engineer assigned to review the permit or land use application.

## Review and Approval

Once the review has been completed, the applicant shall be notified by letter which stipulates the conditions of approval. Prior to authorizing the use of soil amendments at the site, the applicant shall provide a special restoration financial guarantee cash deposit in the amount as determined by the existing, established processes. Note: It remains the applicant/contractor's responsibility to comply with any other applicable state or federal regulations such as use of NIOSH respiratory protection, safety goggles, gloves and protective clothing whenever using hazardous materials.

## Applicable Standards

Typically, all proposals using soil amendments in unincorporated King County shall have these conditions as standard requirements:

1. Prior to any application of CKD/CTB, the general contract shall hold a preconstruction meeting with the assigned DPER inspector at least 3 working days in advance.
2. CKD will not be permitted for use in areas adjacent to or in proximity to wetlands and streams areas. CTB may or may not be permitted in these areas.
3. Areas not covered by impervious surfaces:
    - CKD will not be permitted in areas that will not be covered by impervious surfaces.
    - If CTB is proposed in these areas, an analysis of whether or not the soil amendment will change the post-development runoff characteristics and the permanent stormwater facilities were sized appropriately shall be submitted for review. Use of CTB in areas not permanently covered by impervious surface may require re-sizing of the permanent stormwater facilities.
4. If CKD is proposed, the contractor shall provide mill certificates verifying the product composition. The contractor/developer must be prepared to follow BMPs during and after soil treatment and be prepared to treat runoff from the treatment area(s) immediately. All stormwater collection systems must be in place and all equipment (pH meters, dry ice, etc.) must be onsite.
5. Collection of stormwater (see BMP #5 in Table D.2.2.9.A):
    - Stormwater from the application area shall be kept separate from and prevented from comingling with uncontaminated stormwater.
    - During the application of CKD/CTB, stormwater runoff shall be collected in temporary collection systems and shall not be allowed to enter the permanent facilities. Permanent drainage systems

shall be capped to prevent contact stormwater from entering the inlets of the catch basins. Stormwater from the application area shall not be collected in the temporary/permanent detention ponds, even if the underlying soils are 'impermeable'.

6. Treatment: If necessary, pH adjustment shall be done in the collection tanks or temporary ponds and not in the permanent detention ponds.
7. Disposal options: The proposal to use CKD/CTB must contain a disposal plan that may include one or a combination of sanitary sewer or approved offsite disposal. Treated contact water may be discharged to the sanitary sewer if authorizations are obtained from the King County Industrial Waste Program (206-263-3000) and the local sewer district. All discharge conditions (e.g. pH, settleable solids) must be followed. If a sanitary sewer is not available at the site, contact water may be transported offsite to an approved site for disposal and proof of proper disposal must be submitted to King County. All authorizations for disposal shall be obtained prior to CKD/CTB application.
    - Infiltration: Depending on the site conditions, pH-adjusted stormwater may be infiltrated. Prior to infiltration, pH must be between 6.5 and 8.5.
    - Surface Water: Contact water from the application area shall not be discharged to surface waters, even if treatment has adjusted the pH.
8. Emergency backup plan: An emergency backup plan must be prepared and ready to implement to handle large quantities of stormwater.
9. Monitoring shall be conducted to determine that contact stormwater is not leaving the site. Offsite monitoring shall also be conducted to identify impacts to adjacent water bodies. Bonding may be required to cover mitigation of impacts and restoration.
10. A soils specialist will establish the mixing percentage for onsite soils. Soil amendments will never occur in excess of the ability of the onsite equipment and resources to meet all BMP requirements.
11. For sites one acre or larger, a National Pollutant Discharge Elimination System (NPDES) Construction Stormwater permit must be obtained from Ecology. NPDES permits and 'Stormwater Pollution Prevention Plans (SWPPPs) must be amended and the use of CKD/CTB must be approved by Ecology prior to application.

The contractor/developer shall comply will all federal, state, and local regulations. A health and safety plan may be required for the protection of King County inspectors.

Additional BMPs may be applicable depending on mix design, proximity of wetlands or streams (e.g. within 300 feet of class/type I and 100 feet or less for other types) and site conditions.

## D.2.2.10 MAINTAIN PROTECTIVE BMPS

Pollutant protection measures shall be maintained to assure continued performance of their intended function. Reporting and documentation shall be kept current and made available to DPER as indicated.

**Purpose:** The purpose of maintaining protective BMPs is to provide effective pollutant protection when and where required by the plan and the project, and to provide timely and relevant project information.

**When to Maintain:** Protection measures shall be monitored per Section D.2.4.4 at a minimum, continuously during operation, and promptly maintained to fully functioning condition as necessary to assure continued performance of their intended function. Documentation shall be kept current per specific BMP requirements.

**Measures to Use:**

1. Maintain and repair all pollutant control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
2. Maintain and repair storage locations for equipment and materials associated with BMP processes. Conduct materials disposal in compliance with County regulatory requirements.

3. As required, provide current reporting and performance documentation at an accessible location for the site inspector and other DPER staff.
4. Remove all temporary pollutant control BMPs prior to final construction approval, or within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

## D.2.2.11 MANAGE THE PROJECT

SWPPP requirements shall be implemented and managed as part of the overall CSWPP plan. Concrete construction and its impacts are primary among pollutant concerns on site development projects. Fueling operations and materials containment of treatment chemicals and other project materials are also typical pollutant concerns. Operations that produce these and other pollutants are often conducted by subcontractors and their laborers, yet may require specific protective measures, documentation and reporting. Protective measures and BMPs need to be made available prior to construction and suitable oversight provided to assure inspection, monitoring and documentation requirements are met.

Projects shall assign a qualified CSWPP Supervisor (Section D.2.3.1) to be the primary contact for SWPPP and ESC issues and reporting, coordination with subcontractors and implementation of the CSWPP plan as a whole.

**Measures to Use:**

1. Phase development projects to the maximum degree practicable and take into account seasonal work limits.
2. 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 the Construction Stormwater General Permit and King County requirements. Coordinate with subcontractors and laborers to assure the SWPPP measures are followed.
3. Documentation and reporting: – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Document site inspections and monitoring in accordance with the Construction Stormwater General Permit, specific BMP conditions and King County requirements. Log sheets provided in Reference Section 8 may be used if appropriate. Follow reporting requirements and provide documentation as requested to DPER staff.
4. Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP in accordance with the Construction Stormwater General Permit and King County requirements. Obtain approval for specific SWPPP measures (e.g., chemical treatments of stormwater) well in advance of need. Coordinate SWPPP plan updates with the site inspector (see Section D.2.4.1).

# ESC MAINTENANCE REPORT

Performed By: _____
Date: _____
Project Name: _____
DPER Permit #: _____

**Clearing Limits**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Visible | OK ____ | Problem |
| Intrusions | OK ____ | Problem |
| Other | OK ____ | Problem |

**Mulch**

| | | |
|---|---|---|
| Rills/Gullies | OK ____ | Problem |
| Thickness | OK ____ | Problem |
| Other | OK ____ | Problem |

**Nets/Blankets**

| | | |
|---|---|---|
| Rills/Gullies | OK ____ | Problem |
| Ground Contact | OK ____ | Problem |
| Other | OK ____ | Problem |

**Plastic**

| | | |
|---|---|---|
| Tears/Gaps | OK ____ | Problem |
| Other | OK ____ | Problem |

**Seeding**

| | | |
|---|---|---|
| Percent Cover | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Mulch | OK ____ | Problem |
| Other | OK ____ | Problem |

**Sodding**

| | | |
|---|---|---|
| Grass Health | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Other | OK ____ | Problem |

**Perimeter Protection including Silt Fence**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Flow Control BMP protection**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sedimentation | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Intrusions | OK ____ | Problem |
| Other | OK ____ | Problem |

**Brush Barrier**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Vegetated Strip**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Construction Entrance**

| | | |
|---|---|---|
| Dimensions | OK ____ | Problem |
| Sediment Tracking | OK ____ | Problem |
| Vehicle Avoidance | OK ____ | Problem |
| Other | OK ____ | Problem |

Wheel Wash
- Dimensions OK ____ Problem
- Sed buildup or tracking OK ____. Problem
- Other OK ____ Problem

**Construction Road**
- Stable Driving Surf. OK ____ Problem
- Vehicle Avoidance OK ____ Problem
- Other OK ____ Problem

**Sediment Trap/Pond**
- Sed. Accumulation OK ____ Problem
- Overtopping OK ____ Problem
- Inlet/Outlet Erosion OK ____ Problem
- Other OK ____ Problem

**Catch Basin/Inlet Protection**
- Sed. Accumulation OK ____ Problem
- Damage OK ____ Problem
- Clogged Filter OK ____ Problem
- Other OK ____ Problem

**Interceptor Dike/Swale**
- Damage OK ____ Problem
- Sed. Accumulation OK ____ Problem
- Overtopping OK ____ Problem
- Other OK ____ Problem

**Pipe Slope Drain**
- Damage OK ____ Problem
- Inlet/Outlet OK ____ Problem
- Secure Fittings OK ____ Problem
- Other OK ____ Problem

**Ditches**
- Damage OK ____ Problem
- Sed. Accumulation OK ____ Problem
- Overtopping OK ____ Problem
- Other OK ____ Problem

**Outlet Protection**
- Scour OK ____ Problem
- Other OK ____ Problem

**Level Spreader**
- Damage OK ____ Problem
- Concentrated Flow OK ____ Problem
- Rills/Gullies OK ____ Problem
- Sed. Accumulation OK ____ Problem
- Other OK ____ Problem

**Dewatering Controls**
- Sediment OK ____ Problem

**Dust Control**
- Palliative applied OK ____ Problem

**Miscellaneous**
- Wet Season Stockpile OK ____ Problem
- Other OK ____ Problem

**Comments:**

**Actions Taken:**

**Problems Unresolved:**

| **Pollution Prevention Team** | **Completed by:** _____<br>**Title:** _____<br>**Date:** _____ |
|---|---|
| Responsible Official:_____ | Title:_____ |
| Team Leader:_____ | Office Phone:_____ |
| | Cell Phone #:_____ |
| | Pager #:_____ |
| Responsibilities:<br>_____<br>_____<br>_____ | |
| (1)_____ | Title:_____ |
| | Office Phone:_____ |
| | Pager #:_____ |
| | Cell Phone:_____ |
| Responsibilities:<br>_____<br>_____<br>_____ | |
| (2)_____ | Title:_____ |
| | Office Phone:_____ |
| | Pager #:_____ |
| | Cell Phone #:_____ |
| Responsibilities:<br>_____<br>_____<br>_____ | |

| **Employee Training** | **Completed by:** _____<br>**Title:** _____<br>**Date:** _____ | | |
|---|---|---|---|
| **Describe the annual training of employees on the SWPPP, addressing spill response, good housekeeping, and material management practices.** | | | |
| **Training Topics**<br>**1.) LINE WORKERS** | **Brief Description of Training Program/Materials (e.g., film, newsletter course)** | **Schedule for Training (list dates)** | **Attendees** |
| **Spill Prevention and Response** | | | |
| **Good Housekeeping** | | | |
| **Material Management Practices** | | | |
| **2.) P2 TEAM:** | | | |
| **SWPPP Implementation** | | | |
| **Monitoring Procedures** | | | |

**List of Significant Spills and Leaks**

**Completed by:**_____

**Title:**_____

**Date:**_____

**List all spills and leaks of toxic or hazardous pollutants that were significant but are not limited to, release of oil or hazardous substances in excess of reportable quantities. Although not required, we suggest you list spills and leaks of non-hazardous materials.**

| Date (month/day/year) | Location (as indicated on site map) | Description | | | | Response Procedure | | Preventive Measure Taken |
|---|---|---|---|---|---|---|---|---|
| | | Type of Material | Quantity | Source, If Known | Reason for Spill/Leak | Amount of Material Recovered | Material No longer exposed to Stormwater (Yes/No) | |
| | | | | | | | | |
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| **Potential Pollutant Source Identification** | **Completed by:** _____<br>**Title:** _____<br>**Date:** _____ |
|---|---|

**List all potential stormwater pollutants from materials handled, treated, or stored on-site.**

| Potential Stormwater Pollutant | Stormwater Pollutant Source | Likelihood of pollutant being present in your stormwater discharge. If yes, explain |
|---|---|---|
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| | | |
| | | |

**Material Inventory**

**Completed by:** _____

**Title:** _____

**Date:** _____

**List materials handled, treated, stored, or disposed of at the project site that may potentially be exposed to precipitation or runoff.**

| Material | Purpose/Location | Quantity (Units) (indicate per/wk. or yr.) Used | Produced | Stored | | Likelihood of contact with stormwater If Yes, describe reason | | Past Spill or Leak Yes | No |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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# *Section 9*

## Bond Quantities, Facility Summaries, and Declaration of Covenant

## 9.0 Bond Quantities, Facility Summaries, and Declaration of Covenant

Financial guarantees are not required for publically funded projects or public organizations per Washington Administrative Code.

# *Section 10*

## Operations and Maintenance Plan

# 10.0 Operations and Maintenance Plan

The drainage facilities detailed in this report will be privately owned and maintained.

## 10.1 Facility Descriptions

### 10.1.1 Conveyance Systems

The storm system will transport stormwater runoff from the redeveloped portion of the property to the existing conveyance system and existing flow control facility, and then to the downstream system within 32nd Avenue South. To work properly, pipes must be kept free of silt and other debris.

## 10.2 Maintenance Tasks

A Storm Facility Maintenance Checklist Worksheet will be provided.

## 10.3 Maintenance Requirements

A copy of the Maintenance Requirements for Flow Control, Conveyance, and Water Quality Facilities will be provided.

## Section 10.0 Figures

# STORM FACILITY MAINTENANCE CHECKLIST

**Property:** Cascade View Elementary School
**Property Owner:** Tukwila School District
**Property Address:** 13601 32nd Ave S, Tukwila, WA 98168
**Inspection Date:**
**Completed by:**

The following items shall be inspected. Further detailed instructions for maintenance can be found in the Operations and Maintenance Manual provided in the Technical Information Report.

## 1. Catch Basins/Area Drains

| COMPLETED | ITEM |
|---|---|
| | Clear of: |
| ☐ | 1. Trash and debris |
| ☐ | 2. Sediment |
| ☐ | 3. Structural damage to frame and or top slab |
| ☐ | 4. Cracks in basin walls or bottom |
| ☐ | 5. Vegetation |
| ☐ | 6. Chemicals or pollution |
| ☐ | 7. Settlement/misalignment |
| | The following are in satisfactory working condition: |
| ☐ | 8. Cover/metal grate lid (in place, free of obstructions) |
| ☐ | 9. Cover locking mechanism (bolts are present and pose no difficulty in removal) |
| ☐ | 10. Ladder (no missing or damaged rungs) |

## 2. Conveyance Pipes

| COMPLETED | ITEM |
|---|---|
| | Clear of: |
| ☐ | 1. Trash and debris |
| ☐ | 2. Sediment |
| ☐ | 3. Vegetation |



*Civil Engineers*
*Structural Engineers*
*Landscape Architects*
*Community Planners*
*Natural Resource Ecologists*
*Land Surveyors*
*Neighbors*

TACOMA
2215 North 30th Street
Suite 300
Tacoma, WA 98403-3350
253.383.2422 TEL
253.383.2572 FAX

SEATTLE
1200 6th Avenue
Suite 1620
Seattle, WA 98101-3117
206.267.2425 TEL
206.267.2429 FAX

SPOKANE
827 West First Avenue
Suite 301
Spokane, WA 99201-3912
509.252.5019 TEL
509.315.8862 FAX

www.ahbl.com

## NO. 5 – CATCH BASINS AND MANHOLES

| Maintenance Component | Defect or Problem | Condition When Maintenance is Needed | Results Expected When Maintenance is Performed |
|---|---|---|---|
| Structure | Sediment | Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin. | Sump of catch basin contains no sediment. |
| | Trash and debris | Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%. | No Trash or debris blocking or potentially blocking entrance to catch basin. |
| | | Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin. | No trash or debris in the catch basin. |
| | | Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane). | No dead animals or vegetation present within catch basin. |
| | | Deposits of garbage exceeding 1 cubic foot in volume. | No condition present which would attract or support the breeding of insects or rodents. |
| | Damage to frame and/or top slab | Corner of frame extends more than ¾ inch past curb face into the street (If applicable). | Frame is even with curb. |
| | | Top slab has holes larger than 2 square inches or cracks wider than ¼ inch. | Top slab is free of holes and cracks. |
| | | Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab. | Frame is sitting flush on top slab. |
| | Cracks in walls or bottom | Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound. | Catch basin is sealed and is structurally sound. |
| | | Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks. | No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe. |
| | Settlement/ misalignment | Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment. | Basin replaced or repaired to design standards. |
| | Damaged pipe joints | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of inlet/outlet pipes. |
| | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint. | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Inlet/Outlet Pipe | Sediment accumulation | Sediment filling 20% or more of the pipe. | Inlet/outlet pipes clear of sediment. |
| | Trash and debris | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables). | No trash or debris in pipes. |
| | Damaged | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe. |

## NO. 5 – CATCH BASINS AND MANHOLES

| Maintenance Component | Defect or Problem | Condition When Maintenance is Needed | Results Expected When Maintenance is Performed |
|---|---|---|---|
| Metal Grates (Catch Basins) | Unsafe grate opening | Grate with opening wider than $^{7}/_{8}$ inch. | Grate opening meets design standards. |
| | Trash and debris | Trash and debris that is blocking more than 20% of grate surface. | Grate free of trash and debris. footnote to guidelines for disposal |
| | Damaged or missing | Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance**. | Grate is in place and meets design standards. |
| Manhole Cover/Lid | Cover/lid not in place | Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**. | Cover/lid protects opening to structure. |
| | Locking mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work. | Mechanism opens with proper tools. |
| | Cover/lid difficult to Remove | One maintenance person cannot remove cover/lid after applying 80 lbs. of lift. | Cover/lid can be removed and reinstalled by one maintenance person. |

## NO. 6 – CONVEYANCE PIPES AND DITCHES

| Maintenance Component | Defect or Problem | Conditions When Maintenance is Needed | Results Expected When Maintenance is Performed |
|---|---|---|---|
| Pipes | Sediment & debris accumulation | Accumulated sediment or debris that exceeds 20% of the diameter of the pipe. | Water flows freely through pipes. |
| | Vegetation/roots | Vegetation/roots that reduce free movement of water through pipes. | Water flows freely through pipes. |
| | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint. | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| | Damage to protective coating or corrosion | Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe. | Pipe repaired or replaced. |
| | Damaged | Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe. | Pipe repaired or replaced. |
| Ditches | Trash and debris | Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes. | Trash and debris cleared from ditches. |
| | Sediment accumulation | Accumulated sediment that exceeds 20% of the design depth. | Ditch cleaned/flushed of all sediment and debris so that it matches design. |
| | Noxious weeds | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public. | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be. |
| | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint. | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| | Vegetation | Vegetation that reduces free movement of water through ditches. | Water flows freely through ditches. |
| | Erosion damage to slopes | Any erosion observed on a ditch slope. | Slopes are not eroding. |
| | Rock lining out of place or missing (If Applicable) | One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil. | Replace rocks to design standards. |

# *Section 11*

## Conclusion

## 11.0 Conclusion

The proposed site improvements were designed to meet the 2016 King County *Surface Water Design Manual (KCSWDM)*, as adopted by the City of Tukwila.

The stormwater management facilities were designed to provide the following:

- Flow Control BMPs for LID were assessed and applied to the project site, if feasible.
- The proposed storm system will be designed to convey the 25-year peak flow and convey as much of the 100-year peak flow as possible to prevent erosion and flooding. The design and calculations for the conveyance system will be included in Section 5.0 with the building permit submittal.

This analysis is based on data and records either supplied to or obtained by AHBL. These documents are referenced within the text of the analysis. The analysis was prepared utilizing procedures and practices within the standard accepted practices of the industry. We conclude that this project, as schematically represented, will not create any new problems within the downstream drainage system. This project will not noticeably aggravate any existing downstream problems relative to either water quality or quantity.

AHBL, Inc.

Jesse Newman, EIT
Project Engineer

JN/lsk

October 2018

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