Drainage and Erosion Control Report

Lakeside Industries, Inc. Recycled Asphalt Product (RAP) Storage Tent

Prepared for:

Lakeside Industries, Inc.
PO Box 7016
Issaquah, Washington 98027

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Prepared by:
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Tacoma, Washington 98409

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Phone: (253) 474-9449

November 2022

Job Number 19,765

sitts&hill

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PROJECT ENGINEERS CERTIFICATION

I hereby state that this Drainage and Erosion Control Plan/Construction SWPPP for the **Recycled Asphalt Product (RAP) Storage Tent** has been prepared by me or under my supervision and meets the requirements of the Thurston County Drainage Design and Erosion Control Manual and the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Thurston County does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1 Proposed Project Description

1.1 Project Permits

This report is being prepared for an application to store recycled asphalt product (RAP) and to recycle asphalt. The application is being submitted to Thurston County. This report has been prepared in accordance with the June 2022 Thurston County Drainage Design & Erosion Control Manual (hereafter, 'the Manual'). The project currently operates under a Department of Ecology Sand and Gravel General Permit.

1.2 Project Location

The project is located at 11125 Durgin Road SE over one parcel. The project site located in Section 17, Township 18 North, Range 1 East of the Willamette Meridian. Based on County GIS; the project is within the McAllister Creek Basin of the Nisqually River Watershed. The project site, which has been previously developed by Lakeside Industries, Inc. (Lakeside) and permitted by Thurston County, drains to a wetpond, for water quality treatment, then to an infiltration pond; there is no discharge of stormwater from the site. Please see the Vicinity Map, included as Figure 1 of this report.

1.3 Property Boundaries and Zoning

The project parcel, APN 21817140200, is zoned RR1/5 Rural Residential per Thurston County GIS. The total tax parcel area is 24.98 acres.

1.4 Project Description

The project proposes a new RAP storage tent. The tent, which is 71.5' x 215' (15,373 SF), is proposed over existing asphalt pavement.

1.5 Timing of the Project

Construction will commence upon issuance of permits. Construction should take about a month.

1.6 Summary of Core Requirements

The RAP storage tent, which is supported by concrete ecology blocks placed on the existing asphalt surface, represents the project area: 15,373 SF of replaced impervious surface. Per the flow charts from the Manual, Core Requirements #1-#5 apply to the new and replaced hard surfaces (the RAP Storage Tent) and the land disturbed (no land will be disturbed). The flow charts from the Manual have been included as Figures 2 and 3 of this Report.

1.6.1 CR #1 – Preparation of Stormwater Site Plans

This report and the accompanying drawings satisfy this requirement.

1.6.2 CR #2 - Construction Stormwater Pollution Prevention

Please see the Construction Stormwater Pollution Prevention Plan (CSWPPP), included as Attachment 1 of this Report. This plan was prepared in accordance with the Manual and includes a discussion of the 13 required elements and reference to any applicable BMPs are included in the CSWPPP.

1.6.3 CR #3 - Source Control of Pollution

Source control BMPs for construction sites are included in the Construction Stormwater Pollution Prevention Plan (CSWPPP). The CSWPPP is included as Attachment 1 to this Report. A Maintenance and Source Control Plan is not required for this project; there are no new drainage facilities required or proposed. The site operates in accordance with a Department of Ecology Sand and Gravel General Permit; the existing stormwater infrastructure is maintained and in good working condition.

1.6.4 CR #4 - Preservation of Natural Drainage Systems and Outfalls

In both the existing and proposed conditions, runoff will be directed to the existing onsite stormwater management facilities – an existing wetpond and infiltration pond.

1.6.5 CR #5 - On-site Stormwater Management

The project triggers Minimum Requirements #1-5. Therefore, the project has reviewed the stormwater management BMPs from LID Performance Standard List #3 to satisfy this requirement. Please see section 8.2 of this report.

1.6.6 CR #11 - Offsite Analysis and Mitigation

Section 8.3 of this report satisfies this Core Requirement.

Figure 1 - Vicinity Map

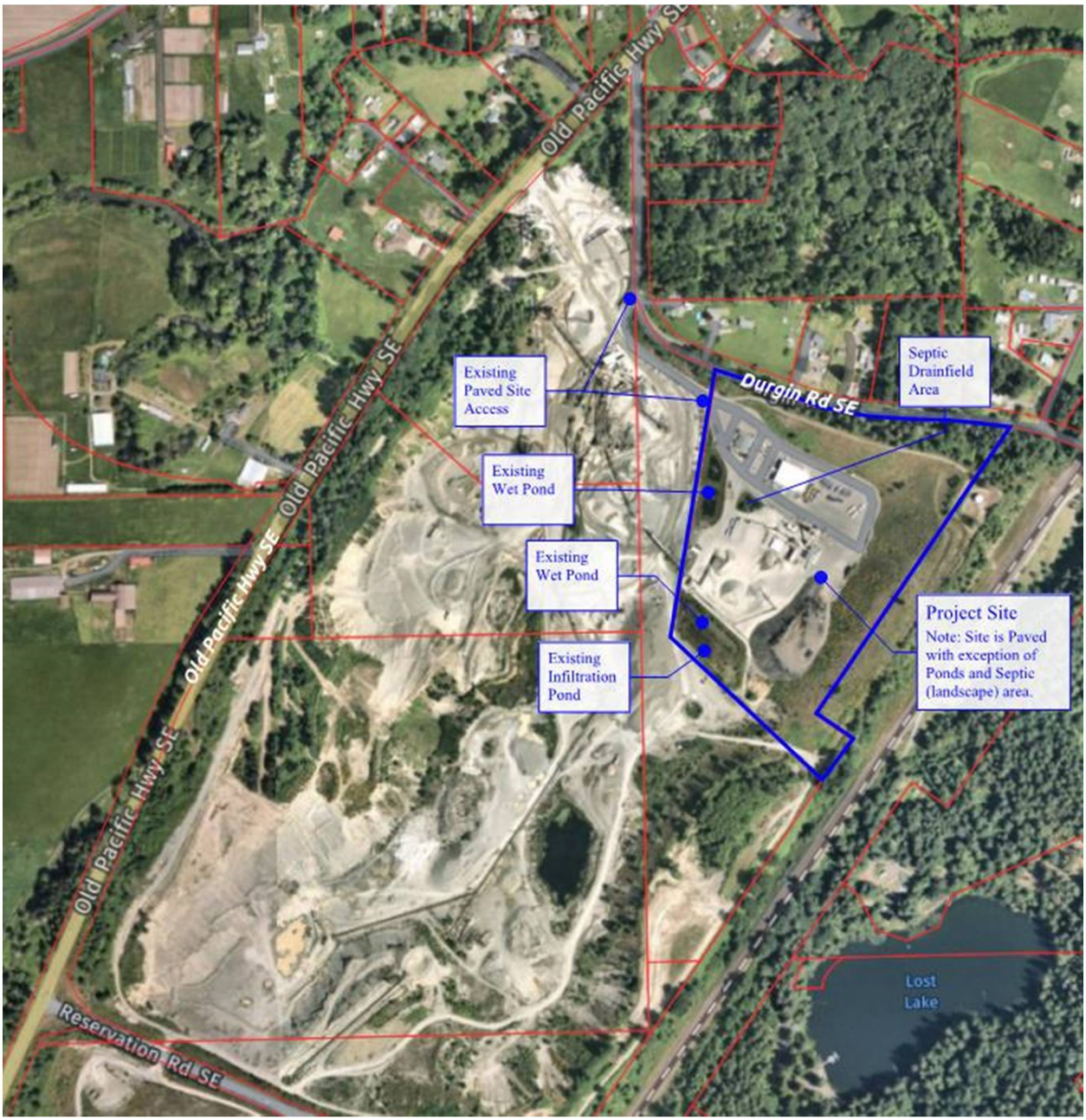


Figure 2 - Flow Chart for Determining Core Requirements

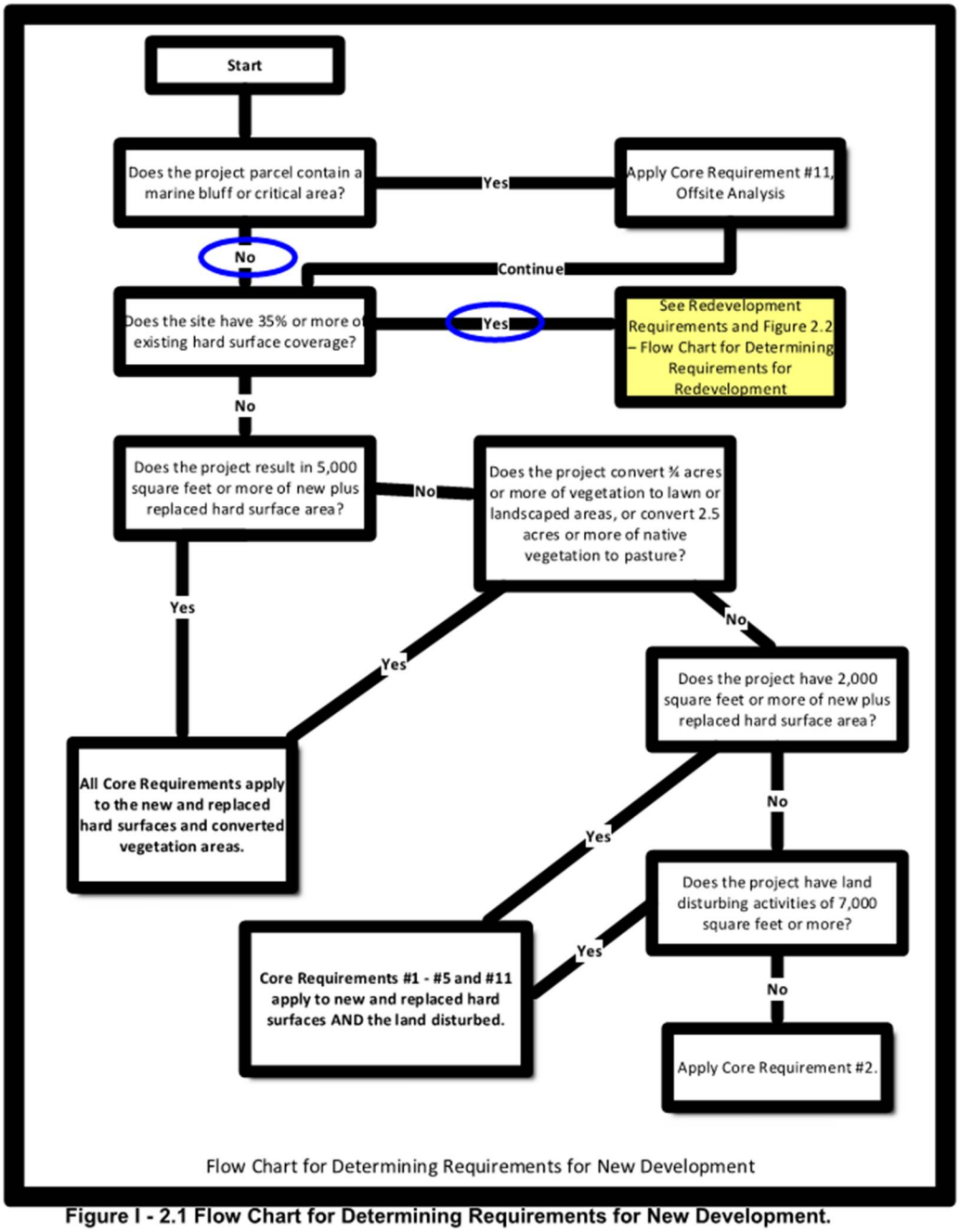


Figure I - 2.1 Flow Chart for Determining Requirements for New Development.

Figure 3 - Flow Chart for Determining Core Requirements

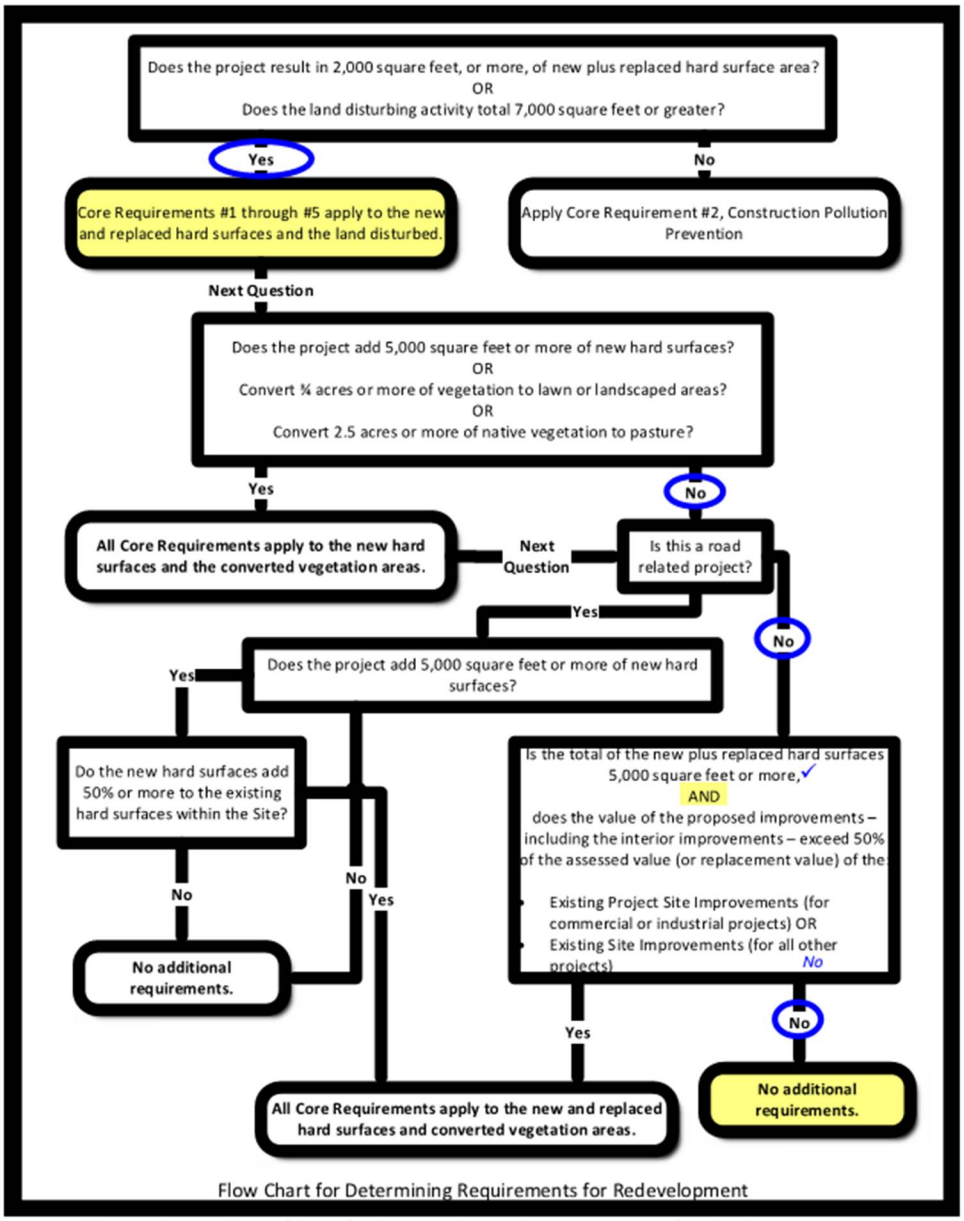


Figure I - 2.2 Flow Chart for Determining Requirements for Redevelopment

2 Existing Site Conditions

The existing project area is comprised of asphalt pavement and is gently sloped at about 2% to drain to the existing stormwater management facilities that are located on the south and west portion of the site (a wetpond and an infiltration pond). Because the project area is fully stabilized, there is a low potential for erosion. Areas adjacent to the project site are also paved. There is a vegetated sloped area southeast of the project area, which will not be disturbed or impacted as a part of this project. There are no existing erosion concerns or flooding concerns located on or near the project site. Please see Figure 1 of this Report, which depicts the existing conditions. The report for the original site's development has been included for reference in Attachment 3 of this Report.

Based on a review of soils information available through the NRCS, site soils are comprised primarily of Everett very gravelly, sandy loam. A copy of the NRCS soils report for the project area is included in Attachment 3.

Based on a review of available County GIS maps, there do not appear to be any mapped or observed critical areas within the project vicinity. The closest wetland area mapped on County GIS is south of the parcel; about 750' away from the project site. Another wetland area is identified on GIS north of the parcel, about 845' away from the project site. The site is not within a FEMA-defined flood hazard area. Critical area mapping information is included in Attachment 3.

3 Geotechnical Report

A geotechnical report was prepared during the site's original development by Pacific Rim Soil and Water. A copy of the previously approved report is included in Attachment 3 of this Report. Please note that no new infiltration facilities are required or proposed; the geotechnical report has been included for reference only.

4 Wells and Septic Systems

There are no existing wells or septic systems that will be altered or impacted as a result of this project. The existing septic system that serves the property is located near the center of the site; in the vegetated area south of the shop building. There are several resource protection wells on the property. A map of the resource protection wells has been included as Attachment 3 of this Report.

5 Fuel Tanks

There are no underground fuel tanks within the project area. If fuel tanks are found during construction that will be impacted by the project; the contractor shall contact Thurston County Environmental and Health for specific instructions.

6 Analysis of the 100-year Flood

The project is not within the 100-year flood hazard zone. Please see the FEMA map, included in Attachment 3.

7 Aesthetic Considerations for Facilities

This section is not applicable – no new drainage facilities are required or proposed.

8 Facility Sizing and Offsite Analysis

No new drainage facilities are required or proposed. All stormwater runoff that is generated by the new RAP Storage Tent will continue to sheet to the existing onsite stormwater management facilities – an existing wetpond and an infiltration pond.

8.1 Project Area Tabulations

The project area is 15,373 SF. The storage tent (which is supported by concrete ecology blocks), will be placed over existing asphalt pavement. Therefore; the project area is comprised entirely of replaced impervious surface.

Existing Hard Surfaces:	15,373 SF (asphalt)
Effective Impervious Surfaces:	15,373 SF (replaced impervious)
Converted Vegetated Areas:	0 SF
Replaced PGHS:	0 SF
New PGHS:	0 SF
Disturbed Area:	0 SF
Undisturbed Pervious Surfaces	0 SF
Existing Significant Trees/Veg,	None

(RAP tent supported by ecology blocks placed on existing asphalt)

8.2 Proposed BMP Design

The site is subject to Core Requirement #5 and therefore shall employ stormwater management BMPs as described in Section 2.4.6 of the Manual. The project does not trigger Core Requirement #7 (Flow Control) and the project does not select to meet the LID performance standard. Per Figure I-2.4 of the Manual, the BMPs provided in List #3 have been considered in the order presented. Below is a list of the surfaces and a description of the BMPs considered, together with the feasibility/applicability to the project:

Lawn and Landscaped Areas

<u>BMP LID.02: Post Construction Soil Quality & Depth</u>

The project does not propose any lawn or landscaped areas, so this BMP is not applicable.

Roof Areas

<u>BMP LID.04: Downspout Infiltration Systems</u>

The proposed RAP Tent structure cannot accommodate a gutter or downspouts; this BMP is not feasible as described in the Manual. Please note, however, that all stormwater will be directed to the existing infiltration pond where stormwater runoff generated by the replaced asphalt surface was directed; which satisfies the intent of the BMP.

<u>BMP LID.05: Downspout Dispersion Systems</u>

The proposed RAP Tent structure cannot accommodate a gutter or downspouts; the surrounding area is entirely paved and there is insufficient room for a dispersion area. This BMP is not feasible as described in the manual.

<u>BMP LID.04A Perforated Stub-out Connections</u>

The proposed RAP Tent structure cannot accommodate a gutter or downspouts; this BMP is not feasible as described in the Manual. Please note, however, that all stormwater will be directed to the existing infiltration pond where stormwater runoff generated by the replaced asphalt surface was directed.

Other Hard Surfaces
BMP LID.06: Sheet Flow Dispersion
No other hard surfaces are proposed; this BMP is not applicable to the project.

BMP LID.07: Concentrated Flow Dispersion
No other hard surfaces are proposed; this BMP is not applicable to the project.

8.3 Off-Site Analysis
An offsite analysis is required for projects that discharge stormwater offsite. All runoff generated by the project area is directed to an existing, permitted, infiltration pond that is adequately functioning– there is no discharge offsite. Therefore, an offsite analysis is not required.

9 Utilities
Utilities are neither required nor proposed to service the RAP Storage Tent. The tent is proposed to protect material from rainfall and stormwater run-on.

10 Covenants, Dedications, Easements
No covenants, dedications, or easements are required or proposed as a part of this project.

11 Property Owners Association Articles of Incorporation
Not Applicable

12 Other Permits or Conditions Placed on the Project
There are no additional permits required related to the construction of drainage facilities. The project will apply for permits, on an as-needed basis and as required by the County.

Attachment 1 Construction Stormwater Pollution Prevention Plan

Due to the limited scope of this project and because the RAP Storage Tent is proposed over existing paved surface; there is a very low potential for erosion or stormwater pollution resulting from the proposed construction. The entire project area is paved and will remain paved during and after construction.

Below is a discussion of each of the thirteen Construction Stormwater Pollution Prevention Elements and a summary of applicable BMPs. Design, installation, and maintenance of any specific BMP should be carried out in accordance with the Manual and any further instructions detailed in the construction plans. Included in Attachment 1 are the requirements for each BMP identified in this report.

Element 1- Preserve Vegetation/Mark Clearing Limits

The project is proposed entirely over existing paved surfaces and none of the surfaces will be cleared – the asphalt will remain in-tact. Work limits will be identified in the field from the construction plans. The proposed RAP Storage tent is supported by ecology blocks placed on the existing asphalt pavement.

Applicable BMPs: None

Element 2- Establish Construction Access

Construction vehicles will access the site from the existing paved (stabilized) entrance off of Durgin Road. Construction vehicles will be routed across more than 1,500 feet of existing paved surface between the driveway and the project area. Any debris generated as a result of construction activity will be swept clean to prevent tracking onto paved areas. Sweeping onsite already regularly occurs, as necessary, since the site operates under an existing Department of Ecology Sand and Gravel permit.

Applicable BMPs: N/A

Element 3- Control Flow Rates

The existing paved surface is tributary to an existing infiltration pond for stormwater management. There will be no increases in stormwater runoff as a result of this project; the existing and proposed project conditions consist entirely of impervious coverage.

Applicable BMPs: N/A

Element 4- Install Sediment Controls

The project will not expose any soils to rainfall/surface water runoff. The RAP Storage tent will be supported by ecology blocks placed directly on the existing paved surface.

Applicable BMPs: N/A

Element 5- Stabilize Soils

The project will not expose any site soils to rainfall/surface water runoff. The RAP Storage tent will be supported by ecology blocks placed directly on the existing paved surface.

Applicable BMPs: N/A

Element 6- Protect Slopes
The project does not propose the disturbance of any sloped areas. The RAP Storage tent will be supported by ecology blocks placed directly on the existing paved surface.

Applicable BMPs: N/A

Element 7- Protect Drain Inlets
The project does not propose the disturbance of any site areas. The RAP Storage tent will be supported by ecology blocks placed directly on the existing paved surface. The project area sheets directly to the existing stormwater management facilities (wetpond and infiltration pond); there are no drainage inlets requiring protection.

Applicable BMPs: N/A

Element 8- Stabilize Channels and Outlets
There are no temporary or permanent channels or outlets that will require stabilization during project construction.

Applicable BMPs: N/A

Element 9- Control Pollutants
Fueling of construction vehicles and other motorized equipment occurs at permitted fuel dispensing facilities or by mobile fueling equipment operations and in accordance with the Ecology issued Sand and Gravel General Permit. Construction equipment shall be inspected daily as part of regular maintenance activities. Any leaks or other sources of contamination shall be repaired immediately. Spillage or other discharges of pollutants shall be reported within 24 hours. Also, the contractor will maintain any materials necessary for rapid cleanup of spills.

Applicable BMPs: BMP C153: Material Delivery, Storage, and Containment

Element 10- Control De-Watering
De-Watering will not be required to accommodate the proposed improvements. There are no excavations required or proposed for this project.

Applicable BMPs: N/A

Element 11- Maintain BMPs
The information included herein outlines why no installed Construction BMPs are required for the project. The project should be managed by a Certified Erosion and Sediment Control Lead, as necessary, to ensure that the project maintains compliance with State and Local standards.

Applicable BMPs: BMP C150: Materials On Hand
BMP C160: Certified Erosion and Sediment Control Lead

Element 12- Manage the Project
This Construction Stormwater Pollution Prevention Plan will be retained on-site during construction. A County inspector will be notified if changes are made to the project. Changes may occur if there are significant modifications to the design, construction, operation, or maintenance of the proposed drainage system or BMPs.

The contractor will designate at least one person as a responsible representative in charge of TESC and water quality protection during the pre-construction meeting.

Applicable BMPs: BMP C150: Materials On Hand

Element 13- Protect Low Impact Development BMPs

All stormwater runoff will be fully infiltrated via the existing infiltration pond. There are no proposed LID BMPs as part of this project.

Applicable BMPs: N/A

Project Description

The project proposes a new recycled asphalt product (RAP) storage tent. The covering tent, which is 71.5' x 215' (15,373 SF), is proposed over existing asphalt pavement. Construction will commence upon issuance of permits. Construction should take about a month.

Total Project Area:	15,373 sf
Total Impervious Area:	15,373 sf
Total Disturbed Area:	0 sf – RAP Storage Tent is placed atop existing paving
Total Volume of Cut and Fill:	0 CY cut and 0 CY fill

Existing Site Conditions

The existing project area is comprised of asphalt pavement and is gently sloped at about 2% to drain to the existing stormwater management facilities that are located on the south portion of the site. Because the project area is fully stabilized, there is a low potential for erosion. Areas adjacent to the project site are also paved. There is a vegetated sloped area southeast of the project area, which will not be disturbed or impacted as a part of this project. There are no existing erosion or flooding concerns on or near the project site.

Critical Areas

Based on a review of available County GIS maps, there do not appear to be any mapped or observed critical areas within the project vicinity. The closest wetland area mapped on County GIS is south of the parcel; about 750' away from the project site. Another wetland area is identified on GIS north of the parcel, about 845' away from the project site. The site is not within a FEMA-defined flood hazard area. Critical area mapping information is included as Attachment 3.

Soils

Based on a review of soils information available through the NRCS, site soils are comprised primarily of Everett very gravelly, sandy loam. A copy of the NRCS soils report for the project area is included in Attachment 3. No soils will be exposed as a part of this project.

Construction Phasing

The project is proposed in one phase. The RAP Storage Tent will take about a month to construct. Since the site is fully stabilized with pavement and the tent is proposed over the existing pavement, the project can occur during the wet or the dry season.

Financial/Ownership Responsibilities
Lakeside Industries, Inc. will be responsible for the initiation of bonds and/or other financial securities, if they are required.

BMP C150: Materials on Hand

Purpose

Quantities of erosion prevention and sediment control materials can be kept on the project site at all times for regular maintenance and emergency situations such as unexpected heavy summer rains. Having these materials on-site reduces the time needed to implement BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric, and steel "T" posts.
- Materials are stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or developer could keep a stockpile of materials that are available to be used on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum that will cover numerous situations includes:

Table II - 3.10 Materials on Hand

Material	Measure	Quantity
Clear Plastic, 6 mil	100 foot roll	1-2
Drainpipe, 6- or 8-inch diameter	25 foot section	4-6
Sandbags, filled	each	25-50
Straw Bales for mulching,	approx. 50# each	10-20
Quarry Spalls	ton	2-4
Washed Gravel	cubic yard	2-4
Geotextile Fabric	100 foot roll	1-2
Catch Basin Inserts	each	2-4
Steel "T" Posts	each	12-24

Silt fence material	Lineal feet	200
Straw Wattles	Lineal feet	100

Maintenance Standards

- All materials with the exception of the quarry spalls, steel "T" posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials used as needed.

BMP C153: Material Delivery, Storage and Containment

Purpose

To prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or water courses from material delivery and storage by minimizing on-site hazardous materials storage, storing materials in a designated area, and installing 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

To minimize risk, do the following:

- Locate temporary storage area away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all stored materials. Chemicals should be kept in their original labeled containers.
- Minimize on-site hazardous material storage.
- Handle hazardous materials as infrequently as possible.
- During the wet weather season (October 1 – April 30), store materials in a covered area when possible.
- Store materials in secondary containments such as an earthen dike, a 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.

- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.
- 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:

- 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.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain precipitation from a 25-year, 24-hour storm event, plus 10 percent of the total enclosed container volume of all containers, or 110 percent of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- 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.
- Provide sufficient separation between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (October 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- 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" x 19"
- 1-Pair Splash Resistant Goggles
- 3-Pair Nitrile Gloves
- 10-Disposable Bags with Ties
- Instructions.

Maintenance Standards

- 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.

- Re-stock spill kit materials as needed.

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

To ensure compliance with all local, state, and federal erosion and sediment control and water quality requirements by designating at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL).

Conditions of Use

A CESCL shall be made available on projects disturbing ground 1 acre or larger and that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections; sampling is not required on sites that disturb less than an acre.

The CESCL shall:

- Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see Ecology's 2012 Stormwater Management Manual for Western Washington for details).

  Ecology will maintain a list of ESC training and certification providers at: https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control

OR

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

Specifications

- CESCL certification shall remain valid for 3 years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region but must be on site whenever earthwork activities are occurring that could generate release of turbid water.

- Duties and responsibilities of the CESCL shall include, but are not limited to the following:
    - Maintaining permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
    - Directing BMP installation, inspection, maintenance, modification, and removal.
    - Updating all project drawings and the Construction SWPPP with changes made.
    - Completing any sampling requirements including reporting results using electronic Discharge Monitoring Reports (WebDMR). Keeping daily logs, and inspection reports. Inspection reports shall include:
        - Inspection date/time.
        - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
        - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
            1. Locations of BMPs inspected
            2. Locations of BMPs that need maintenance
            3. Locations of BMPs that failed to operate as designed or intended
            4. Locations of where additional or different BMPs are required.
    - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
    - Any water quality monitoring performed during inspection.
    - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

Attachment 2 Maintenance & Source Control

The site is already implementing BMPs in accordance with Federal, State and County programs – the site operates under DOE's Sand and Gravel General Permit. No additional BMPs have been implemented as a result of this project.

Per Section 1.7 of Volume IV of the Thurston County Manual, "businesses already implementing BMPs in accordance with other federal, state, or county programs usually do not have to implement additional BMPs. Persons or businesses qualifying for exemptions include businesses required to obtain a general or individual NPDES permit for stormwater discharges (who must comply with the requirements of that permit)."

Attachment 3 Supplemental Site Maps and Reports

NRCS Soils Report
2005 Approved Drainage and Erosion Control Report
Thurston County Wetland Map (GIS)
FEMA Flood Hazard Map
DOE Well Map and Log Information

NRCS Soils Report

United States Department of Agriculture

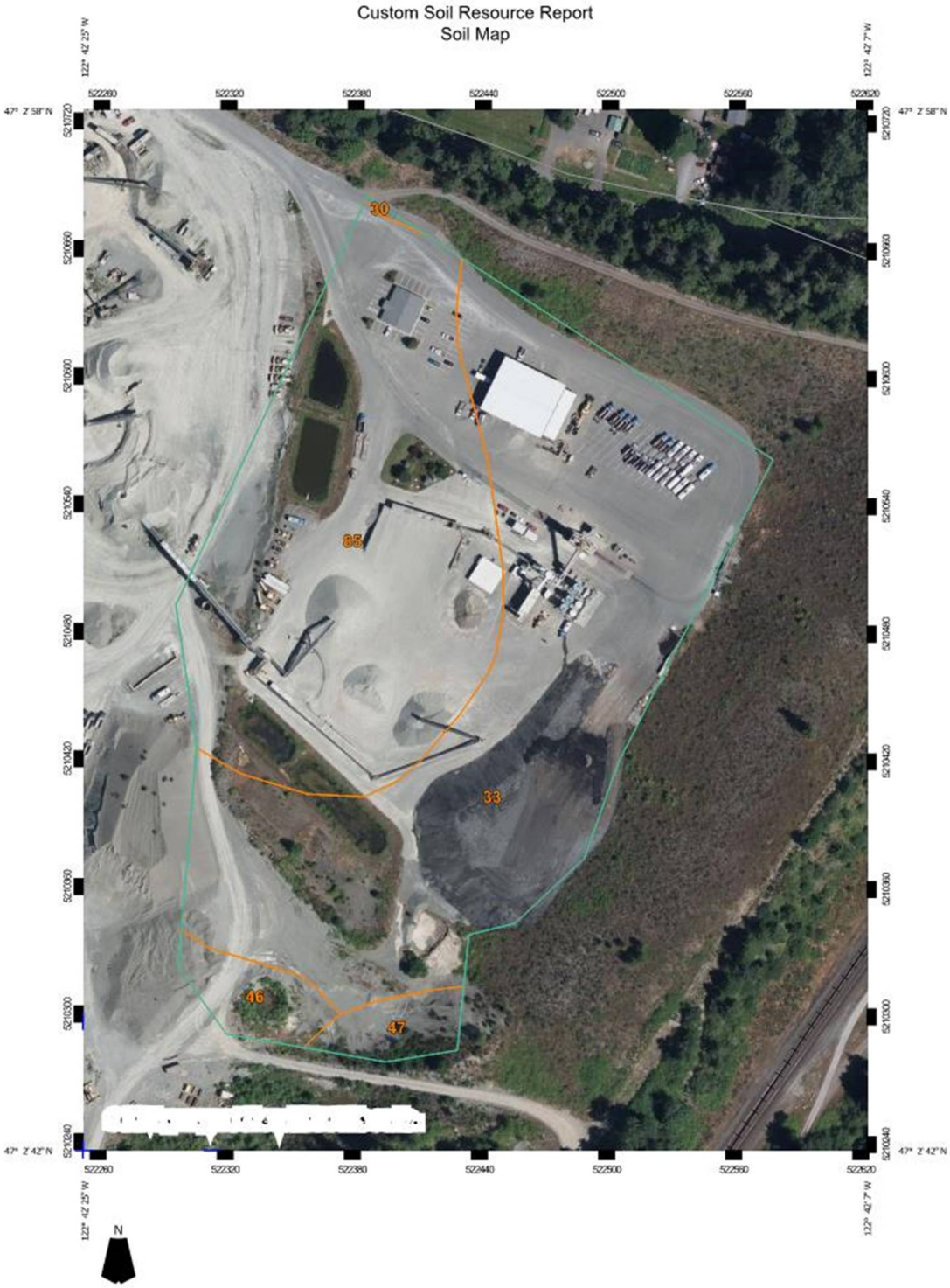
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Thurston County Area, Washington

June 20, 2022


Custom Soil Resource Report
Soil Map
30
85
33
46
47
N

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 15, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 18, 2020—Jul 20, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
30	Dystric Xerochrepts, 60 to 90 percent slopes	0.0	0.1%
33	Everett very gravelly sandy loam, 8 to 15 percent slopes	9.3	53.3%
46	Indianola loamy sand, 0 to 5 percent slopes	0.5	3.1%
47	Indianola loamy sand, 5 to 15 percent slopes	0.4	2.5%
85	Pits, gravel	7.2	41.0%
Totals for Area of Interest		**17.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

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Thurston County Area, Washington

30—Dystric Xerochrepts, 60 to 90 percent slopes

Map Unit Setting

National map unit symbol: 2nd8r
Elevation: 0 to 3,280 feet
Mean annual precipitation: 50 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Dystric xerochrepts and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dystric Xerochrepts

Setting

Landform: Escarpments
Parent material: Colluvium and glacial till

Typical profile

H1 - 0 to 4 inches: very gravelly sandy loam
H2 - 4 to 30 inches: very gravelly sandy loam
H3 - 30 to 34 inches: very gravelly sandy loam

Properties and qualities

Slope: 60 to 90 percent
Depth to restrictive feature: 20 to 72 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Skipopa

Percent of map unit: 5 percent
Hydric soil rating: No

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33—Everett very gravelly sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t62b
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Moraines, eskers, kames
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA)

Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA)
Hydric soil rating: No

Minor Components

Alderwood
Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Indianola
Percent of map unit: 10 percent
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

46—Indianola loamy sand, 0 to 5 percent slopes

Map Unit Setting
National map unit symbol: 2t62k
Elevation: 0 to 980 feet
Mean annual precipitation: 30 to 81 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 170 to 210 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Indianola and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Indianola

Setting
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glacial outwash

Typical profile
Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 6 inches: loamy sand
Bw1 - 6 to 17 inches: loamy sand

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Bw2 - 17 to 27 inches: sand
BC - 27 to 37 inches: sand
C - 37 to 60 inches: sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XV402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA)
Other vegetative classification: Droughty Soils (G002XV402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 8 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Everett

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Norma

Percent of map unit: 2 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

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47—Indianola loamy sand, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t635
Elevation: 0 to 980 feet
Mean annual precipitation: 30 to 81 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 170 to 210 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Indianola and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Indianola

Setting

Landform: Terraces, kames, eskers
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 6 inches: loamy sand
Bw1 - 6 to 17 inches: loamy sand
Bw2 - 17 to 27 inches: sand
BC - 27 to 37 inches: sand
C - 37 to 60 inches: sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA)

Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XS401WA)
Hydric soil rating: No

Minor Components

Alderwood
Percent of map unit: 8 percent
Landform: Hills, ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Everett
Percent of map unit: 5 percent
Landform: Moraines, eskers, kames
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Norma
Percent of map unit: 2 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

85—Pits, gravel

Map Unit Composition
Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

2005 Approved Drainage & Erosion Control Report

LAKESIDE INDUSTRIES ASPHALT PLANT

SUPT/APPL 990457
Drainage and Erosion
Control Report

Prepared for:

Lakeside Industries
PO Box 7016
Issaquah, WA 98027

(360) 491-5460

October 31, 2005

RECEIVED
NOV - 7 2005
Development Review

Prepared by:

Erik B. Ainsworth, PE

Reviewed by:

Steven D. Hatton, PE
HATTON GODAT PANTIER
1840 Barnes Blvd SW
Tumwater, WA 98512
(360) 943-1599

Project No: 04-190
Project Name: LAKESIDE INDUSTRIES ASPHALT PLANT
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Appendix A – Soils Report and Analysis

Appendix B – Drainage Exhibit

Appendix C – Hydraulic Calculations

I. PROJECT ENGINEER'S CERTIFICATE

I hereby certify that this Drainage and Erosion Control Report for **LAKESIDE INDUSTRIES ASPHALT PLANT**, **DURGIN ROAD**, **THURSTON COUNTY**, Washington, has been prepared by me or under my direct supervision and meets minimum standards of **THURSTON COUNTY** and normal standards of engineering practice. I understand that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

Signature

11/1/05
Date

STEVEN D. HATTON
STATE OF WASHINGTON
24193
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES: 11-27-05

Seal

II. THURSTON REGION FACILITY SUMMARY FORM

Complete one for each facility (detention/retention, coalescing plate filter, etc.) on the project site. Attach 8½ " by 11" sketch showing location of facility.

Proponent's facility name or identifier (e.g., Pond A):	**Pond A,**
Name of road or street to access facility:	**DURGIN ROAD**
Hearings Examiner case number:	
Development Review Project No. / Bldg. Permit No.:	**SOPT/APPL 990457**
Parcel Number(s):	**21817130200**

To Be Completed By Utility Staff:

Utility facility number:..... _____

Parcel number status, (num, 1ch) ..... _____
0-Known; 1-Public; 2-Unknown; 3-Unassigned

Basin and sub-basin, (num, 6ch)..... _____
(2ch-Basin; 2ch-Sub-basin; 2ch-Future

Responsible jurisdiction, (alpha, 1ch)..... _____
O-Olympia; C-County; T-Tumwater; L-Lacey

Part 1 – Project Name and Proponent

Project name:	**LAKESIDE INDUSTRIES ASPHALT PLANT**
Project owner:	**Lakeside Industries**
Project contact:	**PO Box 7016**
Address:	**Issaquah, WA 98027**
Phone:	**(360) 491-5460**
Project proponent (if different):	
Address:	
Phone:	
Project engineer:	**Erik B. Ainsworth, PE**
Firm:	**HATTON GODAT PANTIER**
Phone number:	**(360) 943-1599**

Part 2 – Project Location

Section..... 17

Township 18N

Range 1E

Names and addresses of adjacent property owners:

_____

_____

_____

_____

Part 3 – Type of Permit Application

Type of permit (e.g., commercial building): _____

Other permits (❄):

- ☐ DOF /W HPA
- ☐ COE Wetlands
- ☐ FEMA
- ☐ Shoreline Management
- ☐ Encroachment
- ☐ Other _____
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ Floodplain
- ☐ Rockery/Retaining Wall
- ☒ Grading

Other agencies (Federal, State, Local, etc.) that have or will review this Drainage and Erosion Control Plan: **NONE**

Part 4 – Proposed Project Description

What stream basin is the project in (e.g., Percival, Woodland, etc.)? Medicine Creek

Zoning:..... Rural Residential - Special Use Permit

On-site:

Residential Subdivision:

Number of lots .....

Lot size (average, acres).....

Building Permit/Commercial Plat:

Building(s) (footprint, acres) **0.31**

Concrete paving (acres) **9.67**

Gravel surface (acres).....

Lattice block paving (acres).....

Public roads-including gravel shoulder (acres) .....

Private roads-including gravel shoulder (acres) .....

On-site impervious surface total (acres) 9.99

Part 5 – Pre-developed Project Site Characteristics:

Stream through site (y/n) .....**NO**

Name ..... **N/A**

DNR Type ..... **N/A**

Type of feature this facility discharges to (i.e., lake, stream, intermittent stream, pothole, roadside ditch, sheetflow to adjacent property, etc.):

Infiltration into Groundwater

Swales (y/n) ..... **N**

Steep slopes-steeper than 10% (y/n) ..... **Y**

Erosion hazard (y/n) ..... **N**

100-year floodplain (y/n)..... **N**

Wetlands (y/n)..... **N**

Seeps/springs (y/n)..... **N**

High groundwater table (y/n) ..... **N**

Other .....

Part 6 – Facility Description

Basin A:

Total area tributary to facility including off-site (acres)	7.42
Total on-site area tributary to facility (acres)	7.42
Design impervious area tributary to facility (acres)	5.76
Design landscaped area tributary to facility (acres)	1.66
Design total tributary area to facility (acres)	7.42

Enter "1" for type of facility:

Wet pond detention	1
Wet pond water surface area (acres)	0.144
Dry pond detention	
Underground detention	
Infiltration pond	1
Drywell infiltration	
Coalescing plate separator	
Centrifuge separator	
Other	

Outlet type (enter "1" for each type present):

Filter	
Oil/water separator	
Single orifice	
Multiple orifices	
Weir	
Spillway	1
Pump(s)	
Other	

Basin B:

Total area tributary to facility including off-site (acres)	6.22
Total on-site area tributary to facility (acres)	6.22
Design impervious area tributary to facility (acres)	3.19
Design landscaped area tributary to facility (acres)	3.03
Design total tributary area to facility (acres)	6.22

Enter "1" for type of facility:

Wet pond detention	1
Wet pond water surface area (acres)	0.080

Dry pond detention	
Underground detention	
Infiltration pond	1
Drywell infiltration	
Coalescing plate separator	
Centrifuge separator	
Other	

Outlet type (enter "1" for each type present):

Filter	
Oil/water separator	
Single orifice	
Multiple orifices	
Weir	
Spillway	1
Pump(s)	
Other	

Part 7 – Release to Groundwater

Design percolation rate to groundwater (if applicable) ..... **12 inches per hour**

Part 8 – Release to Surface Water (if applicable)

Not applicable.

III. DRAINAGE REPORT

Section 1 – Project Description

This project proposes to construct an asphalt concrete plant on a leased portion of the Holroyd Gravel Pit through the provisions of the site plan review process. The project includes the construction of a 3600 sf office building, 10000 sf shop and fueling station in addition to the batch asphalt plant. This project is located on the south side of Durgin Road and is bordered by the Burlington Northern Railroad to the east in Section 17, Township 18 North, Range 1 East, W.M. Thurston County, Washington. GEODATA gave the legal description for this parcel as 18-17-1E L7 SURVEY 12/147. An existing private road running through the Holroyd pit will provide access to the site. All runoff from the developed portion of the site will be directed to the wet ponds for treatment where it will then be released to the infiltration pond. The treated stormwater will be released to the infiltration pond via a reverse sloped pipe with a down turned elbow. This will prevent floating pollutants from entering the infiltration facility. The standards for design of this project was the 1994, Thurston County Drainage Design & Erosion Control Manual.

Section 2 – Existing Conditions

The site is currently being used as a gravel pit. The east slope is currently being mined. The hillside on the north and east sides of the site are approximately 2:1. Generally speaking the portion of the site to be developed has slopes ranging from 2 to 10%. Burlington Northern Railroad borders the site to the east. The Holroyd Gravel Pit borders the site to the west, south. The developed land to the north is low-density residential lots ranging 5 or more acres.

Section 3 – Soils Report

According to the soils report prepared by Pacific Rim Soil & Water, The soils on site are classified by the Soil Survey of Thurston County as Everett very gravelly sandy loam. The infiltration tests run by Pacific Rim revealed infiltration rates in excess of 90 inches per hour. The design rate of 12 inches per hour was used for this project.

Section 4 – Wells and Septic Systems

Records at Thurston County and the Department of Ecology were searched in order to locate wells and septic systems that may be located within the setback distances from the stormwater pond or ponds. In addition, the Project Engineer, or someone under his direct supervision, has visited the site to verify the presence or absence of wells and septic systems as best can be done visually without trespassing onto other properties. All wells and septic systems found to be located within the setback distances from the stormwater pond or ponds have been shown on the plans.

Section 5 – Fuel Tanks

Records at Thurston County and the Department of Ecology were searched in order to locate the presence of above and below ground fuel storage tanks that may be located within the setback distances from the stormwater pond or ponds. In addition, the Project Engineer, or someone under his direct supervision, has visited the site to verify the presence or absence of fuel tanks as best can be done visually without trespassing onto other properties. All fuel tanks found to be located within the setback distances from the stormwater pond or ponds have been shown on the plans.

Section 6 – Sub-basin Description

The site is broken into 2 sub-basin that are treated in separate wetponds but then flow to a single infiltration pond. The sub-basin is isolated from the adjacent parcels due to the presence of roadways, adjacent drainage systems extremely high existing infiltration rates or grade breaks. Sub-basin 'A' drains to the northwest portion of the site and covers approximately 7.42 acres. Sub-basin 'B' drains to the south portion of the site and covers approximately 6.22 acres. See Appendix B for tributary area map and preliminary drainage plan.

Section 7– Analysis of 100-Year Flood

The Federal Emergency Management Agency prepares maps for all areas within Thurston County, including the incorporated cities therein. Panel # 530188 0215 C depicts the areas, if any, subjected to flooding in the vicinity of this proposal. By inspection of this map, this proposal appears to be located in Zone C, an area of minimal flooding. This area, therefore, is not located within the 100-year flood plain.

Section 8 – Aesthetic Considerations

All above ground stormwater facilities will be hydroseeded upon completion. In addition, the water quality wet pond will be planted with a variety of wetland species both in the permanent pool and along the fringes of the permanent water surface. Additional landscaping shall also be provided throughout the project in conformance with the approved landscaping and tree restoration plan, as applicable, and as otherwise required by the approving authority.

Section 9 – Facility Sizing and Downstream Analysis

Infiltration Pond Sizing Calculations:

Step 1) Calculate the sub-basin areas.
The basin map in Appendix B shows the estimated contributing area.

Tributary Areas

Total Contributing Area	***13.64 Ac***
Total Impervious Area	***8.96 Ac***
Landscaped Pervious Area	***4.69 Ac.***
Percent Impervious	*65.64 %*

Step 2) Calculate the required minimum storage volume. The site is located within of the Medicine Creek sub-basin and regular detention standards apply as per the release requirements as published in the Thurston County Drainage and Erosion Control Design Manual.

Minimum Storage Requirements:
1,571 CF/acre disturbed pervious area
4,714 CF/acre impervious area
Minimum Volume:
(4,714 ft^3/ac) 8.96 ac + (1,571 ft^3/ac) 4.69 ac = 49,580 ft^3

Step 3) Calculate the infiltration rate.

Infiltration Rate = 23,230*12in/hr/60min/hr/60sec/min/12in/ft = 6.45 cfs

Step 4) Calculate the volume of the infiltration pond.

Appendix C includes printouts from a spreadsheet, which calculates the stage storage volumes of the pond, and the discharge from the control structure. This spreadsheet also provides data for producing the routing curve for the computer program.

Step 5) Using level pool routing techniques route the 100 year 24-hour events through the pond to size the pond.

Appendix C includes printouts from Hydra for the 100-year events showing the staged storage requirements and the minimum storage volumes required.

Please note that the Hydra printouts only provided volume stored in the pond and the release rate, and does not include water surface elevation. The water surface elevation must be obtained from the routing calculation performed on an Excel spreadsheet. Refer to Appendix C for both Hydra printouts and routing curve calculations.

Required Volume per SBUH Analysis = *19,501 ft^3 (Ref. Appendix C)*

Actual Volume Provided = *73,188 ft^3@ Elevation 26.50 feet*

Stormwater Treatment:

For stormwater treatment the site will be broken into two separate basins and treated in two separate wetponds. The wetpond bottom area will be sized per TC DDECM to have a bottom area of at least 2-½% of the tributary impervious area. Each pond will be split into two cells, a fore bay and main pond. All ditches and wetponds will be lined to prevent contaminants from infiltrating into groundwater.

The fore bay will drain via a siphon and overflow pipe. The siphon will not drain the fore bay until the water surface elevation is 0.5 feet above the wetpond design water surface elevation. When the fore bay begins to flow it will drain down the pond to the design water surface elevation. This will create a trap that will provide spill storage. This storage will allow time to manually shut off the siphon and clean up the spill prior to releasing stormwater to the second treatment cell. A slide gate on the inlet pipe can also be closed to contain large spills during cleanup.

Treatment Basin A:
Stormwater will be treated using a wet pond. To prevent spills from entering the infiltration pond the wet pond will be split up into two cells as discussed above. The siphon spill control volume for wetpond A is 2500 cf.

Wet Pond Sizing Calculations:

The drainage manual requirements for wet ponds require a surface area of water over 3 feet deep equal to or greater than 2.5% of the impervious area draining to the facility.

Step 1) Calculate the impervious area draining to the wet pond.

Based on the basin map, the wet pond receives approximately 5.76 acres of impervious asphalt and building area.

Step 2) Calculate the required surface area with a minimum 3-foot depth.

*Req. Surface Area = 2.5% * 5.76 ac * 43560 ac/SF = 6,273 SF*

Actual Surface Area = 6,635 SF

Step 3) The length to width ratio of the wet pond was established at approximately a 3 to 1 ratio.

Treatment Basin B:
Stormwater will be treated using a wet pond. To prevent spills from entering the infiltration pond the wet pond will be split up into two cells as discussed above. The siphon spill control volume for wetpond B is 1,850 cf.

Wet Pond Sizing Calculations:

The drainage manual requirements for wet ponds require a surface area of water over 3 feet deep equal to or greater than 2.5% of the impervious area draining to the facility.

Step 1) Calculate the impervious area draining to the wet pond.

Based on the basin map, the wet pond receives approximately 3.19 acres of impervious asphalt and building area.

Step 2) Calculate the required surface area with a minimum 3-foot depth.

*Req. Surface Area = 2.5% * 3.19 ac * 43560 ac/SF = 3,479 SF*

Actual Surface Area = 3,614 SF

Step 3) The length to width ratio of the wet pond was established at approximately a 3 to 1 ratio.

There is no anticipated runoff from this site therefore no downstream analysis is required.

Section 10 – Covenants, Dedications, and Easements

All stormwater facilities located on private property shall be owned, operated, and maintained by the property owners, their heirs, successors, and assigns. The property owners shall enter into an agreement with the governing body, a copy of which is included in Part V of this report. The agreement requires maintenance of the stormwater facilities in accordance with the maintenance plan provided and shall grant easement for access to the governing body to inspect the stormwater facilities. The agreement also makes provisions for the governing body to make repairs, after due notice is given to the owners, if repairs are necessary to ensure proper performance of the stormwater system and if the owners fail to make the necessary repairs. The cost of said repairs shall be borne by the property owners, their heirs, successors, and assigns.

Section 11 – Articles of Incorporation

All residential subdivisions shall form a Homeowner's Association for the purpose of assigning responsibility and liability for the operation and maintenance of stormwater facilities jointly serving lots within the subdivision. The association is not required for facilities that serve a single property owner. Articles of Incorporation shall be developed for the association and submitted to the governing body prior to final project approval.

IV. EROSION CONTROL PLAN

Section 1 – Construction Sequence

Prior to commencing any grading or filling upon the site, all erosion control measures, including installation of a stabilized construction entrance, shall be installed in accordance with this plan and the details shown on the drawings. More specifically, the following construction sequence shall be observed:

1. Construction on this site shall be conducted substantially in accordance with the construction sequence described on the plans and in this erosion control plan. Deviations from this sequence shall be submitted to the project engineer and permitting jurisdiction. Deviations must be approved prior to any site disturbing activity not contained within these plans.

2. For each phase of the development of this site, the following general sequence shall be observed:

    a. Install perimeter filter fabric fence as shown.

    b. Install inlet protection for existing inlets in the vicinity of areas to be disturbed.

    c. Call for inspection by the project engineer.

    d. Construct temporary sedimentation trap(s) and outlet(s).

    e. Perform grading directing site runoff towards the sediment trap prior to discharge from the site.

    f. Install temporary piping, as required, to direct runoff towards the sediment trap.

3. Once the site is disturbed, continue operations diligently toward completion.

4. Monitor all erosion control facilities, and repair, modify, or enhance as directed or as required.

Section 2 – Trapping Sediment

Sediment ponds shall be constructed at the beginning of each phase of construction to perform as temporary sediment traps. Protection of offsite properties against sedimentation is an absolute necessity. Additional measures may be required to provide full protection of downstream areas. Additional measures may include, but are not limited to, use of sediment bags in existing catch basins, increased filters within sediment ponds such as hay bales, introduction of coagulants to the sediment ponds, and other such measures. Continuous monitoring of the erosion control systems, depending upon site and weather conditions, shall be ongoing throughout project development.

Vehicle tracking of mud off-site shall be avoided. Installation of a stabilized construction entrance shall be installed at the start of construction at the exit point to be used by equipment. This entrance is a minimum requirement and may be supplemented if tracking of mud onto public rights-of-way becomes excessive. Washing down roads daily to remove excessive mud may be required. Wash water shall be directed to the temporary sediment traps installed on-site and shall not be allowed to discharge downstream without treatment.

Section 3 – Site Restoration

Disturbed areas on and off-site shall be hydroseeded or otherwise landscaped or stabilized upon project completion to provide permanent erosion control where required. Erosion control measures shall remain in place until final site stabilization is imminent (e.g., paving scheduled with a favorable weather forecast).

Section 4 – Geotechnical Analysis

Existing slopes in the area of the stormwater ponds are at a maximum of 3-5%. The temporary sediment ponds will be excavated into the native soil. No embankment is required.

Section 5 – Inspection Sequence

The Project Engineer, or someone under his direct supervision, and the permit authority shall inspect the temporary erosion control facilities (construction entrance, sediment traps, and erosion control barriers) prior to commencement of construction. During and following construction, the Engineer shall inspect the construction of the permanent stormwater facilities and report to the permit authority his findings as to performance and operability of the completed system.

Section 6 – Control of Pollutants other than Sediments

A centralized equipment marshalling area and containment area is to be provided on-site for equipment maintenance and storage of any equipment service materials. An area on-site will be selected as a temporary debris and stockpile area for materials that will be removed from the site. Erosion control containment and berming of this area will be provided for pollutant containment and sheeting provided for coverage or lining if applicable.

V. STORMWATER MAINTENANCE PLAN

LAKESIDE INDUSTRIES ASPHALT PLANT
October 28, 2005

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Return to:
Thurston County Storm & Surface Water
2000 Lakeridge Dr. SW
Olympia, WA 98502

RESIDENTIAL
AGREEMENT TO MAINTAIN
STORMWATER FACILITIES AND TO IMPLEMENT A
POLLUTION SOURCE CONTROL PLAN
BY AND BETWEEN
THURSTON COUNTY (HEREINAFTER "JURISDICTION")
AND
LAKESIDE INDUSTRIES
THEIR HEIRS, SUCCESSORS, OR ASSIGNS
(HEREINAFTER "OWNERS")

GRANTOR: LAKESIDE INDUSTRIES

GRANTEE: THURSTON, COUNTY OF

LEGAL DESCRIPTION: 93 FT W OF NE COR, THENCE W ALG SD N LN 210 FT; THENCE S10 DEGREES 57 MIN W 439.9FT M/L TO N SD OF DURGIN RD

ASSESSOR'S TAX PARCEL NO.: 21817130200

The upkeep and maintenance of stormwater facilities and the implementation of pollution source control best management practices (BMPs) is essential to the protection of water resources. All property Owners are expected to conduct business in a manner that promotes environmental protection. This Agreement contains specific provisions with respect to maintenance of stormwater facilities and use of pollution source control BMPs.

LEGAL DESCRIPTION:

93 FT W OF NE COR, THENCE W ALG SD N LN 210 FT; THENCE S10 DEGREES 57 MIN W 439.9FT M/L TO N SD OF DURGIN RD

Whereas, the OWNERS have constructed improvements, including but not limited to, buildings, pavement, and stormwater facilities on the property described above. In order to further the goals of the Jurisdiction to ensure the protection and enhancement of water resources, the Jurisdiction and the OWNERS hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

OWNERS SHALL:

(1) Implement the stormwater facility maintenance program included herein as Attachment "A".

(2) Implement the pollution source control program included herein as Attachment "B".

(3) Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by appointment at 2416 Hogum Bay Rd. SE, Lacey, WA 98503. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected as specified in the attached instructions or more often if necessary. The OWNERS are encouraged to photocopy the individual checklists in Attachment "A" and use them to complete its inspections. These completed checklists would then, in combination, comprise the log book.

(4) Submit an annual report to the Jurisdiction regarding implementation of the programs referenced in (1) and (2) above. The report must be submitted on or before May 15 of each calendar year and shall contain, at a minimum, the following:

(a) Name, address, and telephone number of the businesses, the persons, or the firms responsible for plan implementation, and the person completing the report.

(b) Time period covered by the report.

(c) A chronological summary of activities conducted to implement the programs referenced in (1) and (2) above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties, include a copy of the invoice for services.

(d) An outline of planned activities for the next year.

(5) Execute the following periodic major maintenance on the subdivision's stormwater facilities: sediment removal from ponds, managing vegetation in wet ponds, resetting orifice sizes and elevations, and adding baffles.

THE JURISDICTION SHALL:

(1) Maintain all stormwater system elements in the public rights-of-way, such as catch basins, oil-water separators, and pipes.

(2) Provide technical assistance to the OWNERS in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and as Jurisdiction time and resources permit.

(3) Review the annual report and conduct a minimum of one (1) site visit per year to discuss performance and problems with the OWNERS.

(4) Review this agreement with the OWNERS and modify it as necessary at least once every three (3) years.

REMEDIES:

(1) If the Jurisdiction determines that maintenance or repair work is required to be done to the stormwater facilities located in the subdivision, the Jurisdiction shall give the OWNERS notice of

the specific maintenance and/or repair required. The Jurisdiction shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the Jurisdiction, written notice will be sent to the OWNERS stating the Jurisdiction's intention to perform such maintenance and bill the OWNERS for all incurred expenses.

(2) If at any time the Jurisdiction determines that the existing system creates any imminent threat to public health or welfare, the Jurisdiction may take immediate measures to remedy said threat. No notice to the persons listed in Remedies (1), above, shall be required under such circumstances. All other OWNER'S responsibilities shall remain in effect.

(3) The OWNERS grant unrestricted authority to the Jurisdiction for access to any and all stormwater system features for the purpose of performing maintenance or repair as may become necessary under Remedies (1) and/or (2).

(4) The OWNERS shall assume responsibility for the cost of maintenance and repairs to the stormwater facility, except for those maintenance actions explicitly assumed by the Jurisdiction in the preceding section. Such responsibility shall include reimbursement to the Jurisdiction within 90 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the Jurisdiction will be borne by the parties responsible for said reimbursements.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the Jurisdiction. It shall run with the land and be binding on all parties having or acquiring any right, title, or interest, or any part thereof, of real property in the subdivision. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof, or interest therein, and to the benefit of all citizens of the Jurisdiction.

_____
Owner

_____
Owner

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, _____ _____and _____ known to be the individual(s) described, and who executed the foregoing instrument and acknowledge that they signed the same as their free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this _____ day of _____, 200__.

_____
Notary Public in and for the State of
Washington, residing in _____
My commission expires _____

Dated at _____, Washington, this _____ day of _____, 200___.

_____
Thurston County

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, _____ _____who executed the foregoing instrument and acknowledge the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute the said instrument.

Given under my hand and official seal this _____ day of _____, 200__.

_____
Notary Public in and for the State of
Washington, residing in _____
My commission expires _____

APPROVED AS TO FORM:

_____

II. STORMWATER FACILITY MAINTENANCE GUIDE

INTRODUCTION

What is Stormwater Runoff?

When urban and suburban development covers the land with buildings, streets and parking lots, much of the native topsoil, duff, trees, shrubs and grass are replaced by asphalt and concrete. Rainfall that would have soaked directly into the ground instead stays on the surface as *stormwater runoff* making its way into storm drains (including man-made pipes, ditches, or swale networks), stormwater ponds, surface and groundwater, and eventually to Puget Sound.

What is a Storm Drain System and how does it work?

The storm drain system for most developments includes measures to *carry, store, cleanse, and release* the stormwater. Components work together to reduce the impacts of development on the environment. Impacts can include *flooding* which results in property damage and blocked emergency routes, *erosion* which can cause damage to salmon spawning habitat, and *pollution* which harms fish and/or drinking water supplies.

The storm drain system provides a safe method to carry stormwater to the treatment and storage area. Swales and ponds filter pollutants from the stormwater by *physically* settling out particles, *chemically* binding pollutants to pond sediments, and *biologically* converting pollutants to less harmful compounds. Ponds also store treated water, releasing it gradually to a nearby stream or to groundwater.

What does Stormwater Runoff have to do with Water Quality?

Stormwater runoff must be treated because it carries litter, oil, gasoline, fertilizers, pesticides, pet wastes, sediments, and anything else that can float, dissolve or be swept along by moving water. Left untreated, polluted stormwater can reach nearby waterways where it can harm and even kill aquatic life. It can also pollute groundwater to the extent that it requires treatment before it is suitable for drinking. Nationally, stormwater is recognized as a major threat to water quality. Remember to keep everything out of stormwater systems except the rainwater they are designed to collect.

Your Stormwater Facility

Different types of ponds are designed for different purposes. For example, wet ponds primarily provide treatment of stormwater. Dry ponds or infiltration ponds are designed to provide storage for stormwater and allow for its gradual release downstream or into the ground.

Who is Responsible for Maintaining Stormwater Facilities?

All stormwater facilities require maintenance. Regular maintenance ensures proper functioning and preserves visual appeal. This Stormwater Facility Maintenance Guide was designed to explain how stormwater facilities work and provide user-friendly, straightforward guidance on facility maintenance.

You are responsible for regularly maintaining privately owned ponds, catch basins, pipes and other drainage facilities on your property. Stormwater facilities located in public rights-of-way are maintained by local governments.

How to Use the Stormwater Facility Maintenance Guide

This Maintenance Guide includes a Site Plan specific to your development and a Facility Key that identifies the private stormwater facilities you are responsible for maintaining. A "Quick List" of maintenance activities has also been included to help you identify the more routine needs of your facility.

Included in This Guide

- Comprehensive Maintenance Checklists that provide specific details on required maintenance
- Pollution Prevention Tips that list ways to protect water quality and keep storm drain systems functioning smoothly
- Resources to provide more information and technical assistance

A Regional Approach to Stormwater Management

The Cities of Lacey, Olympia and Tumwater together with Thurston County are taking steps to educate and involve area residents in water quality issues and stormwater management. Stormwater runoff is a widespread cause of water quality impairment and stream degradation. The jurisdictions are working together with residents, businesses, community groups and schools to address this problem. This guide focuses on providing information on ways that you can reduce stormwater impacts through pollution prevention and proper facility maintenance.

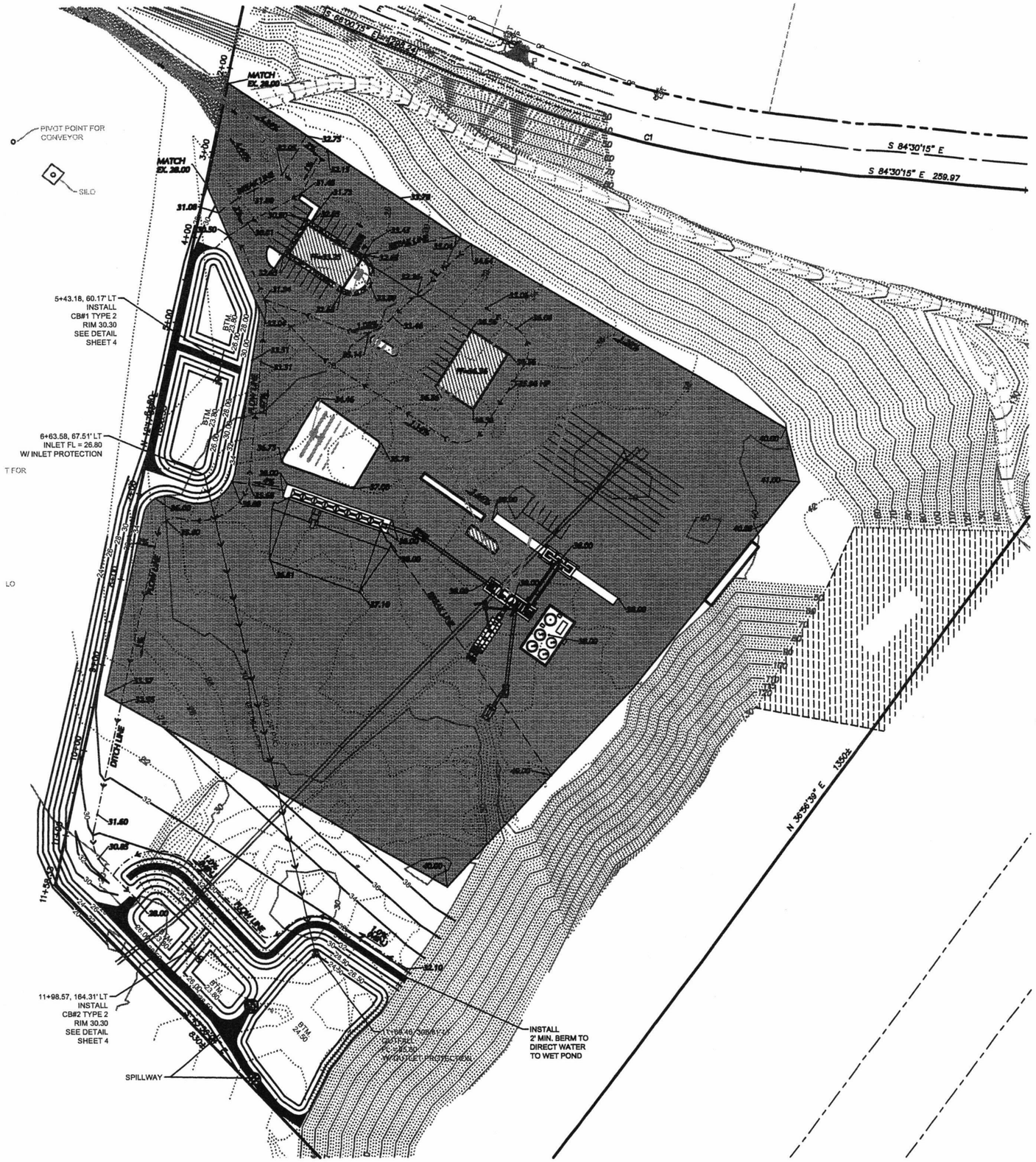
YOUR STORMWATER FACILITIES

This section consists of two parts that are to be used together: the ***Facility Key*** and the ***Site Plan***. Review the site plan and identify the numbers denoting a feature of the system. Then check the facility key for the feature type and checklist name.

FACILITY KEY

The stormwater facility in your neighborhood is comprised of the following elements:

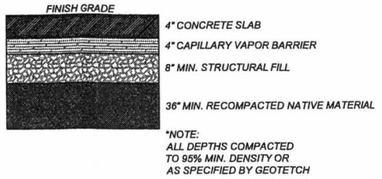
Type of Feature & Checklist Name	Location on Site Plan
Ponds	2
Catch Basins, Manholes, and Inlets	3
Fencing, Shrubbery Screens, and Gates	4
Conveyance Pipes, Ditches, and Swales	6
Grounds and Landscaping	7
Access Roads and Easements	8
Drywells, French Drains, or Downspouts	See individual lot site plan.



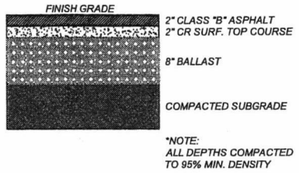
SCALE: 1" = 60'

NE 1/4 SEC. 17, TWP. 18N, RGE. 1E., W.M.

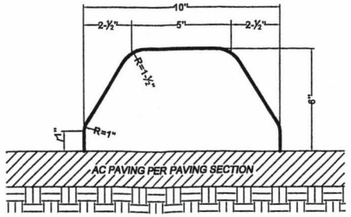
VERTICAL DATUM
THURSTON COUNTY
CONTROL POINT #863
SURFACE MONUMENT WITH 2" BRASS CAP
OLD PACIFIC HWY MON P.C. STA.846+04.80
CENTER ROAD 0.24 MILE SW DURGIN RD &
0.35 MILES NE RESERVATION RD
NGVD 29 ELEV.=23.56



BUILDING PAD DETAIL
N.T.S.



ONSITE PAVEMENT SECTION
N.T.S.



ONSITE EXTRUDED CONCRETE CURB DETAIL
NTS

ACCEPTED AS NOTED
THURSTON COUNTY ROADS & TRANSPORTATION SVS.
DEVELOPMENT REVIEW SECTION

BY: _____

ACCEPTANCE DATE: _____

EXPIRES 2 YEARS FROM ACCEPTANCE DATE

DESIGNED BY: ERA
DRAWN BY: JLO
CHECKED BY:
DATE: JULY 2005
SCALE: H 1" = 60'
V

STEVEN D. HATTON
STATE OF WASHINGTON
24193
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 11-27-05

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
1840 BARNES BOULEVARD S W
TUMWATER, WA 98512
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:

LAKESIDE ASPHALT PLANT

HOLROYD GRAVEL PIT
THURSTON COUNTY, WA
GRADING / DRAINAGE PLAN

AGENCY NO. _____
SHEET: 3 OF 10
INDEX: 04-19Grading.dwg
JOB: 04-190

QUICK LIST

The following is an abbreviated checklist of the most common types of maintenance required. Please go over this checklist after heavy rains. The list represents minimum maintenance to be performed and should be completed in conjunction with the other checklists for an effective maintenance program.

- ☐ Inspect catch basin grates to see that they are not clogged or broken. Remove twigs, leaves, or other blockages. Contact the local jurisdiction to replace the grate if it is broken.
- ☐ Inspect inlet and outlet pipes for blockages. Clear all blockages.
- ☐ Inspect filter strip, swale and pond walls for erosion or caved in areas.
- ☐ Inspect riprap (rocks) at the inlets and outlets of culverts and other pipes. If they are silted in or eroded away, replace them.

MAINTENANCE CHECKLISTS

The Maintenance Checklists in this packet are for your use when inspecting the stormwater facilities on your property. This packet has been customized so that only the checklists for your facilities are included. If you feel you are missing a checklist, or you have additional facilities not identified or addressed in this packet, please contact your local jurisdiction.

The checklists are in tabular format for ease of use. Each describes the area to inspect, inspection frequency, what to look for, and what action to take. A log sheet is included toward the end of the chapter to help you track maintenance of your storm drainage system.

Although it is not intended for the maintenance survey to involve anything too difficult or strenuous, there are a few tools that will make the job easier and safer including:

- A flashlight
- A long pole or broom handle
- Some kind of pry bar or lifting tool for pulling manhole and grate covers
- Gloves

A resource list is included in the next chapter. Here you will find the phone numbers of the agencies referred to in the tables, as well as the contractors and consultants who designed and constructed your facilities.

SAFETY WARNING: In keeping with OSHA regulations, you should never stick your head or any part of your body into a manhole or other type of confined space. When looking into a manhole or catch basin, stand above it and use the flashlight to help you see. Use a long pole or broom handle to check sediment depths in confined spaces. *NO PART OF YOUR BODY SHOULD BREAK THE PLANE OF THE OPEN HOLE.*

Ponds

There are essentially three kinds of ponds: treatment ponds, infiltration ponds, and detention ponds. Although each pond has unique maintenance requirements, there are also many things they have in common. Your facility is a(n) INFILTRATION pond.

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Entire Pond	Quarterly	Yard waste such as grass clippings and branches in basin; presence of glass, plastic, metal, foam, or coated paper.	Remove trash and debris and dispose of properly.
Entire Pond	Quarterly	Vegetation that may constitute a public hazard, e.g., tansy ragwort, poison oak, stinging nettles, devilsclub.	Remove invasive or noxious vegetation. Do not spray chemicals on vegetation without obtaining guidance from WSU Cooperative Extension and approval from City or County.
Entire Pond	Quarterly	Presence of chemicals such as natural gas, oil, and gasoline, noxious odor, or sludge.	First, attempt to locate source of pollution; then call Moderate Risk Waste program at Thurston County Environmental Health to report the hazard.
Entire Pond	Quarterly	Sparse, weedy, or overgrown grass in grassy (dry/infiltration) ponds; presence of invasive species or sparse growth of plants in wet ponds.	Grassy ponds: selectively thatch, aerate, and re-seed ponds. Grass should be kept less than 8 inches high. Wet ponds: hand-plant nursery-grown wetland plants in bare areas. Contact WSU Cooperative Extension for guidance on invasive species. Pond bottoms should have uniform dense coverage of desired plant species.
Entire Pond	Quarterly	Evidence of rodent holes if facility is a dam or berm. Water should not flow through rodent holes.	Destroy rodents and repair dam or berm. Contact Thurston County Health Department for guidance.
Entire Pond	Quarterly	Nuisance insects such as wasps, hornets or mosquitoes that may interfere with maintenance	Destroy or remove insects. Contact WSU Cooperative Extension for guidance.
Entire Pond	Annually	Confirmation that trees are not interfering with maintenance (i.e., mowing, silt removal, or access.)	Prune tree limbs to allow for maintenance. Some trees may be cut.
Inlet	Annually	Confirmation that the riprap under the inlet pipe is intact and that no native soil is exposed. Also, look for accumulations of sediment greater than half the height of the rocks.	Replace rocks and/or remove sediment.
Outlet	Quarterly	A free-flowing overflow that is clear of debris.	Replace riprap if missing. Remove trash or debris and dispose of properly.
Side Slopes	Annually	Signs of erosion around inlets and outlets. Inspect berms for signs of sliding or settling. Take action if eroded damage is over 2 inches deep and where there is potential for continued erosion.	Attempt to determine the cause of erosion and repair it. Stabilize slopes by reinforcing with rock, planting grass, or compacting soil. Contact WSU Cooperative Extension for guidance on slope reinforcement.
Storage Area	Annually	Sediment build-up on pond bottom. A buried or partially buried outlet structure or very slow infiltration rate may indicate significant sediment deposits.	Remove the sediment and re-seed the pond if necessary to improve infiltration and control erosion.
Dikes	Annually	Significant settling of any part of dike.	Build dike back to the original elevation.
Emergency Overflow/ Spillway	Annually	Intact riprap protective area. Repair if any native soil is exposed.	Replace rocks so all native soil is covered.
Trench Drain	Quarterly	Confirmation that the grate is clear of debris and that the drain is not plugged.	Remove debris from grate, clean drain.

Catch Basins, Manholes, and Inlets

These structures are typically located in the streets and public rights-of-way. Local jurisdictions are responsible for routine maintenance of the pipes and catch basins in rights-of-way, while you are responsible for keeping the grates clear of debris in all areas as well as pipes and catch basins in private areas.

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Catch basin opening	During and after major storms	Accumulation of trash or debris in front of catch basin opening that prevents water from flowing in	Remove blocking trash or debris with a rake and clean off the grate.
Catch basin	Quarterly	Sediment or debris in the basin. No more than half the depth from the bottom of the pipe to the bottom of the basin should be allowed to accumulate. Use a long stick or broom handle to poke into sediment and determine depth.	Remove debris from catch basin.
Inlet and outlet pipes	Quarterly	Trash or debris in the pipes that has exceeded 1/5 of their height. Ensure there are not tree roots or other vegetation growing in the pipes.	Remove trash or debris from inlet and outlet pipes.
Inlet and outlet pipe joints	Annually	Cracks wider than ½ inch and longer than 12-inches at the joint of any inlet or outlet pipe. Also check for evidence of sediment entering the catch basin through cracks.	Repair cracks or replace the joints.
Grate	Quarterly	Cracks longer than 2 inches or multiple cracks.	Replace grate if necessary.
Frame	Quarterly	Confirmation that the frame is sitting flush on top of the concrete structure (slab). A separation of more than ¾ inch between the frame and the slab should be corrected.	Repair or replace the frame so it is flush with the slab.
Catch basin	Annually	Cracks wider than ½ inch and longer than 3 feet. Also check for any evidence of sediment entering the catch basin through cracks. Determine whether or not the structure is sound.	Replace or repair the basin. Contact a professional engineer for evaluation.
Catch basin	Quarterly	Chemicals such as natural gas, oil, and gasoline have may have entered the catch basin. Check for noxious odor or oily sludge.	Clean out catch basin. Contact your local jurisdiction or Thurston County Environmental Health if you detect a color, odor, or oily sludge.
Oil / water separator (downturned elbow or "T" in catch basin)	Quarterly	Significant sludge, oil, grease, or scum layer covering all or most of the water surface.	Remove the catch basin lid and skim off oil layer. Pour oil into a disposable container, seal container, wrap securely in newspaper, and place in trash. Water surface should be clear of oily layer.
Pipe elbow	Quarterly	Damage to top or bottom of pipe; determine whether pipe is plumb.	If pipe is broken, replace pipe in accordance with approved plans on file with your local jurisdiction.

Fencing, Shrubbery Screens, and Gates

Fences and shrubbery screens aren't typically required for stormwater ponds. If the slopes of the sides are too steep, usually some kind of barricade is constructed.

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Fence or shrubbery screen	Quarterly	Inspect the fence or screen to ensure that it blocks easy entry to the facility. Make sure erosion hasn't created an opening under fence.	Mend the fence, repair erosion, or replace the shrubs to form a solid barrier.
Shrubbery screen	Quarterly	Confirm that shrubbery is not growing out-of-control or that it is not infested with weeds.	Trim and weed shrubbery to provide appealing aesthetics. Do not use chemicals to control weeds.
Wire Fences	Annually	Confirmation that fence is still in alignment.	Straighten posts and rails if necessary.
Wire Fences	Annually	Missing or loose tension wire.	Replace or repair tension wire so it holds fabric.
Wire Fences	Annually	Missing, loose, or sagging barbed wire.	Replace or repair barbed wire so that it doesn't sag between posts.
Wire Fences	Annually	Rust or scaling	Paint or coat rusting or scaling parts with a protective coating.
Wire Fences	Quarterly	Confirm that there are no holes in the fabric or fencing.	Repair holes so that there are no openings in the fabric or fencing.
Gate	Quarterly	Confirm that the gate is not broken, jammed, or missing and that it opens easily.	Repair or replace the gate to allow entry of maintenance people and equipment. If a lock is used, make sure you have a key.

Conveyance Pipes, Ditches, and Swales

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Pipes	Annually	Confirmation that accumulated sediment has not exceeded 20% of the diameter of the pipe and that vegetation has not reduced free movement of water through pipes. Ensure that the protective coating is not damaged and rusted. Dents should not significantly impede flow. Pipe should not have major cracks or tears allowing water to leak out.	Clean pipes of all sediment and debris. Remove all vegetation so that water flows freely through pipes. Repair or replace pipe as necessary.
Open ditches	Quarterly	Yard waste or litter in the ditch.	Remove trash and debris and dispose of properly.
Open ditches	Annually	Confirmation that accumulated sediment has not exceeded 20% of the depth of the ditch.	Clean ditch of all sediment and debris.
Open ditches & Swales	Annually	Vegetation (e.g., weedy shrubs or saplings) that reduces the free movement of water through ditches or swales.	Clear blocking vegetation so that water flows freely through ditches. Grassy vegetation should be left alone.
Open ditches & Swales	Quarterly	Signs of erosion. Inspect slopes for signs of sloughing or settling. Action is needed where eroded damage is over 2 inches deep and where potential for continued erosion exists.	Eliminate causes of erosion. Stabilize slopes by using appropriate erosion control measures (e.g., reinforce with rock, plant grass, compact soil.)
Open ditches & Swales	Annually	Adequate rock placement in splash pad, check dam or lining. Native soil should not be visible.	Replace rocks to design standard.
Swales	Quarterly	Adequate grass coverage. Take action if coverage is sparse and weedy, or areas are overgrown with woody vegetation.	Aerate soils, reseed and mulch bare areas. Keep grass less than 8 inches high. Remove woody growth, regrade, and reseed as necessary.
Swales	Quarterly	Confirmation that swale has not been filled in or blocked by structures, shrubbery, etc.	If possible, speak with homeowner and request that the swale area be restored.
Swales	Annually	Standing water in swale or very slow flow velocity. Stagnation.	A survey may be needed to verify grades. Grades should be between 1-5%.

Grounds and Landscaping

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Landscaped Areas	Quarterly	Uncontrolled weed growth in landscaped areas.	If possible, pull weeds by hand to avoid using chemical weed controls.
Landscaped Areas	Quarterly	Presence of poison ivy or other poisonous vegetation or insect nests.	Remove poisonous vegetation or insect nests.
Landscaped Areas	Quarterly	Yard waste or litter	Remove and dispose of properly.
Landscaped Areas	Quarterly	Noticeably visible rills in landscaped areas.	Identify the causes of erosion and take steps to slow down or disperse the water. Fill in contour; seed area.
Trees and shrubs	Annually	Split, broken or otherwise damaged tree parts and shrubs	Trim trees and shrubs to restore shape. Replace severely damaged trees and shrubs.
Trees and shrubs	Annually	Blown down or knocked over trees or shrubs	Replant trees or shrubs, inspecting for injury to stem or roots. Replace if severely damaged.
Trees and Shrubs	Annually	Exposed roots, inadequate support, severe leaning	Place stakes and rubber-coated ties around young trees/shrubs for support.

Access Roads and Easements

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
General	One Time	Adequate access to your stormwater facilities for maintenance vehicles.	If there is not enough access, check with your local jurisdiction to determine whether an easement exists. If so, a maintenance road may need to be constructed.
Access road	Quarterly	Debris that could damage vehicle tires (glass or metal).	Clear all potentially damaging debris.
Access road	Annually	Any obstructions that reduce clearance above and along the road to less than 14 feet.	Clear along and over roadway so there is enough clearance.
Road surface	Annually	Potholes, ruts, mushy spots, or woody debris that limit access by maintenance vehicles.	Add gravel or remove wood as necessary.
Shoulders and ditches	Annually	Erosion along the roadway.	Repair erosion with additional soil or gravel.

Drywells, French Drains, or Downspouts

INSPECTION AREA	FREQUENCY	LOOK FOR	ACTION
Downspout	Annually	Water overflowing from the downspout over the ground.	First clean the gutters and downspouts. If this doesn't solve the problem, a larger drywell may be required.
Roof	Annually	Moss and algae taking over the shadier parts of the shingles.	Disconnect flexible part of the downspout leading to the drywell. Remove moss. Pressure washing or use of fatty acid solutions instead of highly toxic pesticides or chlorine bleach is preferred. Install a zinc strip as a preventative.

RESOURCE LISTING

If you suspect a problem exists, please contact your local jurisdiction at one of the numbers below and ask for Technical Assistance.

Contact Numbers:

Lacey Water Resources	(360) 491-5600
Olympia Sewer & Stormwater Engineering	(360) 753-8768
Tumwater Public Works (Engineering)	(360) 754-4140
Yelm Public Works	(360) 458-3244
Thurston County (Storm & Surface Water)	(360) 754-4681
WSU Cooperative Extension	(360) 786-5445

Developer Information:

Lakeside Industries
PO Box 7016
Issaquah, WA 98027
(360) 491-5460

Engineer's Information:

HATTON GODAT PANTIER
1840 Barnes Blvd SW
Tumwater, WA 98512
(360) 943-1599

LOG SHEET

Use log sheets to track maintenance checks and what items, if any, are repaired or altered. The completed sheets will serve as a record of maintenance activity and will provide valuable information about how your facilities are operating. Log sheets should be kept in a dry, readily accessible place.

INSPECTION DATE: _____

PERFORMED BY: _____

PHONE NUMBER: _____ **ADDRESS:** _____

POSITION ON HOA: _____ **CITY, ST, ZIP:** _____

PART OF FACILITY INSPECTED	OBSERVATIONS (LIST REQUIRED MAINTENANCE ACTIVITIES)	ACTION TAKEN	DATE OF ACTION

III. POLLUTION SOURCE CONTROL PROGRAM

Purpose

Many products and practices commonly used in and around the home are hazardous to both the environment and us. Many of these products can end up in our stormwater systems and groundwater. This document gives alternatives, where possible, for those types of products and practices. The Best Management Practices (BMPs) described here, include "good housekeeping" practices that everyone can use.

Recommended Pollution Control Practices For Homeowners

It has been said that the average home today contains more chemicals than the average chemical lab of 100 years ago. When many of these chemicals are used industrially, they can be subject to various health and safety standards; yet these same substances are used freely and often carelessly in our homes.
The BMPs in this section are divided into four categories: **Household Hazardous Wastes**, **Pesticides**, **Remodeling**, and **Septic Maintenance**. Each section includes information on available alternatives.

Household Hazardous Wastes

Many of the cleaning agents, solvents, polishes, etc. commonly used in the home are considered hazardous. These products may be toxic, corrosive, reactive, flammable, and/or carcinogenic. It is critical that these products are handled with care and are properly disposed of. A list of common household hazardous materials is presented in Table 1.
In addition, many hazardous household chemicals persist for long periods of time in the environment. Manufacturers may truthfully state that a product is "biodegradable"; most products are biodegradable, but what is important is the rate at which they are broken down and the products they are broken down into. The term "biodegradable" on its own is misleading at best, unless the product is rapidly degraded into harmless substances.
It is important to note here that the term "biodegradable" currently has no legal definition in this state. This means that any product can use this term according to the manufacturer's own definition. This definition may not be at all similar to the consumer's perception. The following ideas will help you reduce the risks of stormwater and ground water contamination from many household products:

Household Product Management:

1. Read product labels before purchasing. Toxic product labels will carry many warnings. Either bypass such products or purchase in small quantities. If you cannot use the entire product, try to give it away instead of disposing of it. Thurston County periodically facilitates product exchanges for leftover paints and other hazardous wastes. Call the Thurston County Health Department at (360) 754-4111 for more information.
2. Buy only those detergents that contain little or no phosphorus. Phosphorus can cause algae blooms if washed into lakes or streams. Most detergents that are low or phosphate free are labeled as such.
3. Use no more than the manufacturer's suggested amount of any cleanser. More is not necessarily better.

4. Products such as oven cleanser, floor wax, furniture polish, drain cleaners, and spot removers often contain toxic chemicals. Buy the least toxic product available or use a non-toxic substitute if one can be found. For example, ovens can be cleaned by applying table salt to spills, then scrubbing with a solution of baking soda and water. Table 2 lists substitutes for many commonly used household products.

   If it is necessary to use a product that contains toxic chemicals, use the product only as directed. Do not combine products, as they may become more dangerous when mixed (e.g., mixing chlorine bleach and ammonia produces dangerous gases). Use eye protection and rubber gloves as appropriate.

   Contact the Hazardous Substance Hotline at 1-800-633-7585 if you have any questions regarding disposal of a product or empty container. The County has both hazardous waste collection days and permanent facilities where residents can bring hazardous wastes. Call the Thurston County Health Department at (360) 754-4111 for more information.

5. Chemicals left over from activities, such as photography and auto repair, are hazardous and should not be flushed down the sink. This is especially important if your home is hooked up to a septic system. Toxic chemicals can kill the beneficial bacteria in the tank used to treat sewage and can pollute water supply wells.

6. Be sure all containers are clearly labeled.

7. Common batteries (not automobile) are one of the largest sources of heavy metals (such as lead, nickel, cadmium, and mercury) found in landfills. Instead of throwing them away, dispose of them at a hazardous waste collection site.

Automotive Usage, Care And Maintenance:

From a waste management standpoint, automobile maintenance is best done by professionals at facilities designed to handle, store, and dispose of the waste products properly. Many of these facilities do an excellent job of dealing with waste oils, antifreezes, other fluids, batteries and tires. They often charge a small fee to cover the added expenses, but it's worth it. However if you repair your car at home, please consider these helpful tips:

1. Cars should be serviced regularly. Leaky lines or valves should be replaced.

2. Dumping oil, degreasers, antifreeze, and other automotive liquids into a stream or a storm drain violates city, county and state laws or ordinances. Do not dump them onto the ground because they will end up in stormwater runoff or in groundwater. Do not use oil to reduce dust levels on unpaved areas. Instead, recycle used oil and antifreeze. Keep them in separate containers. Call the Recycling Hotline at 1-800-RECYCLE or call the Thurston County Health Department for the location of the nearest recycling center or, inquire whether your local automotive service center recycles oil. Some may also take used oil filters.

3. Wrap empty oil or antifreeze containers in several layers of newspaper, tie securely and place in a covered trashcan. Antifreeze is sweet tasting, but poisonous to people, fish, pets and wildlife.

4. Sweep your driveway instead of hosing it down. Fluids and heavy metals associated with automobiles can build up on driveway surfaces and be washed into local surface or groundwater when driveways are hosed down.

5. When washing vehicles, do so over your lawn or where you can direct soapsuds onto the lawn or another vegetated area to keep the soaps from washing into the storm drain system or local surface water. Your stormwater pond cannot cleanse soapy water.

6. Small spills of oil and other fluids can be absorbed with materials such as kitty litter or sawdust. Wrap the used absorbent and any contaminated soil in a plastic bag and place in the garbage.

   If a spill reaches surface water, you must notify the nearest regional office of the Department of Ecology Immediately! The Southwest Regional Office number is (360) 407-6300 or call 911. There are fines for failure to notify the appropriate agency when a spill occurs.

7. De-icing chemicals (various types of salt) can harm concrete less than three years in age, burn vegetation, and be corrosive to cars and other metal objects. De-icing chemicals and their additives can be toxic. (Cyanide is formed from the breakdown of a common anti-caking agent used in de-icing chemicals.)

   Urea salts are an alternative to other types of salt de-icers, but great care must be used in applying them. These salts contain large quantities of nitrogen, which can severely burn plants and encourage algae growth if over-applied.

   The use of these chemicals should be minimized or avoided. Instead, shovel walks clear and apply a dusting of sand to improve footing.

TABLE 1. HAZARDOUS HOUSEHOLD SUBSTANCES LIST

AUTO, BOAT AND EQUIPMENT MAINTENANCE	REPAIR AND REMODELING	CLEANSING AGENTS
Batteries	Adhesives, glues, cements	Oven cleaners
Waxes and cleansers	Roof coatings, sealants	Degreasers and spot removers
Paints, solvents and thinners	Caulking and sealants	Toilet, drain and septic tank cleaners
Additives	Epoxy resins	Polishes, waxes and strippers
Gasoline	Solvent-based paints	Deck, patio and chimney cleaners
Flushes	Solvents and thinners	Solvent cleaning fluids
Auto repair materials	Paint removers and strippers	
Motor oil		
Diesel oil		
Antifreeze		
PESTICIDES	**HOBBY AND RECREATION**	**MISCELLANEOUS**
Insecticides	Paints, thinners and solvents	Ammunition
Fungicides	Chemicals (photo and pool)	Asbestos
Rodenticides	Glues and cements	Fireworks
Molluscicides	Inks and dyes	
Wood preservatives	Glazes	
Moss retardants	Chemistry sets	
Herbicides	Bottled gas	
Fertilizers	White gas	
	Charcoal starter fluid	

Source: Guidelines for Local Hazardous Waste Planning, Ecology, No. 87-18 1987.

TABLE 2. NON- OR LESS TOXIC ALTERNATIVES TO TOXIC PRODUCTS

HAZARDOUS PRODUCT	ALTERNATIVE(S)
Air fresheners	Set out a dish of vinegar; simmer a potpourri of cinnamon and cloves; set out herbal bouquets or potpourri in open dishes; burn scented candles
Bleach	Borax or oxygen bleaches or reduce bleach by ½ and add ¼ - ½ C baking soda; line dry clothes
Brass polish	Worcestershire sauce
Chrome polish	Apple cider vinegar; a paste of baking soda and water; a lemon
Coffee pot cleaner	Vinegar; remove coffee stains with moist salt paste
Copper cleaner	Mixture of lemon juice and salt or tomato catsup
Drain cleaner	Use a plunger followed by ½ C baking soda mixed in ½ C vinegar. Let sit 15 minutes, pour into drain followed by 2 qt. boiling water.
Furniture polish	Linseed, olive or almond oils; a mixture of 3 parts olive oil to 1 part white vinegar; a mixture of 1T lemon oil and 1 pint mineral oil
Garbage disposal deodorizer	Lemon rind or baking soda
Glass cleaner	Mixture of 2T vinegar and 1quart water
Grease remover	Paste of borax and water on damp cloth
Ink stain remover	Spray with non-aerosol hairspray before washing
Laundry soap	Borax; baking soda; washing soda
Linoleum floor cleaner	Mixture of 1 C white vinegar and 2 gallons water
Mildew remover	Equal parts vinegar and salt
Mothballs	Cedar chips or blocks; dried tansy, lavender or peppercorns
Oil spills	Kitty litter; sawdust
Oil stain remover	White chalk rubbed into stain prior to washing
Oven cleaner	Cover fresh spills with salt; scrape off after the oven cools. A soda water solution will cut grease. Paint ammonia on spills with a paintbrush, then rinse off.
Paint brush softener	Hot vinegar
Paint stripper	Use mechanical sanding instead of chemical strippers
Paint or grease remover	Wear gloves or try baby oil
Pet odor remover	Cider vinegar
Pitch or sap remover	Butter, margarine or vegetable shortening
Porcelain stain remover	Baking soda
Refrigerator deodorizer	Open box of baking soda
Rug/carpet cleaner	(General) Use a soap-based non-aerosol rug shampoo, vacuum when dry. (Spots) Pour club soda or sprinkle cornmeal or cornstarch on the rug, let sit for at least 30 minutes; vacuum.
Rust remover	Lemon juice and sunlight
Rusty bolt remover	Carbonated beverage
Scorch mark remover	Grated onion
Scouring powder	Baking soda or non-chlorine scouring powder
Silver polish	Soak silver in warm water with 1T soda, 1T salt and a piece of aluminum foil.
Stainless steel polish	Mineral oil
Toilet bowl cleaner	Paste mixture of borax and lemon juice
Tub and tile cleaner	¼ C soda and ½ C white vinegar mixed with warm water
Upholstery spot remover	Club soda
Water mark remover	Toothpaste
Water softener	¼ C vinegar

Pesticides[1] And Fertilizers

Pesticides and fertilizers are commonly used by homeowners in their quest for bigger, healthier plants and greener, lusher lawns. These chemicals are often overused and misapplied. These chemicals are easily introduced into stormwater runoff and can cause algae blooms (fertilizers) or kill off aquatic organisms (pesticides).

Fertilizer Management:

Fertilizing a lawn can be done in an environmentally sensitive manner. Here are some ideas:

1. Before fertilizing, test your soil's pH by using a readily available kit, or through tests provided by WSU Cooperative Extension. Use only the recommended amount of fertilizer, and any soil amendments, such as lime, that are recommended in your test results.
2. Use fertilizers that are appropriate for your area and for the types of plants you are growing. Work the fertilizer into the soil directly around the plant's drip line. By incorporating the fertilizer in the soil, there will be less likelihood of contaminated runoff. Contact the Thurston Conservation District for more information.
3. Water before fertilizing. Water enough to dampen the ground thoroughly, but not enough to cause surface runoff. Dampening the soil prevents fertilizer from being washed from the surface of dry soil in the first rain or watering after application
4. Many soils can benefit from the use of organic fertilizers such as compost or peat. Not only do these substances add nutrients to soil, they also increase the porosity of the soil and increase its ability to hold water.
5. Slow release fertilizers (which are generally resin-coated) can be used in addition to organic fertilizers. They are not mobile in the soil, and are only applied once.

Integrated Pest Management:

Rather than bringing out the sprayer whenever a pest infestation occurs in the garden, consider using Integrated Pest Management (also known as IPM). IPM emphasizes the evaluation of all factors including environmental effects before chemicals are applied. Pesticides should only be used as a last resort. Some of the tactics that can be used to decrease or eliminate the use of pesticides include:

1. Use of Natural Predators, Pathogens: Because chemical sprays generally kill many beneficial insects instead of just the target pest, it may be necessary to introduce natural predators back into the garden. Ladybugs, lacewings, predatory wasps, and nematodes are all commercially available. Garter snakes and toads are also predators and should not be eliminated from the garden.

   There are some bacteria, viruses, and insect parasites that are specific to pests and will not harm other insects or animals. A commonly used bacterium in the Puget Sound area is Bacillus thuringiensis (Bt), which is intended to control infestations of tent caterpillars. Products containing Bt are available at your nursery.
2. Habitat Changes: Many times a change of habitat can control pest infestations. Removal of old tires can cut down on the mosquito population by removing a convenient water-filled location for them to breed in. Crop rotation, even in a small garden, can reduce the number of pest

[1] As used here, the word pesticide can mean any herbicide, insecticide, rodenticide, miticide, or other types of chemicals used in the same manner.

infestations. Removing last year's leaves from under rose bushes can cut down on the incidence of mildew and blackspot, as these fungi overwinter in dead leaves.

3. Timing: Crops that can overwinter (such as leeks or carrots) should be planted in the fall. This gives them time to become established before pests arrive in the spring.
4. Mechanical: Many eggs, larvae, cocoons, and adult insects can be removed by hand. Be sure that the insect is properly identified prior to removing it so those beneficial insects are not destroyed in error. Drowning insects in plain water or spraying them with soapy water are alternatives to squashing them.
5. Resistant Plants: Plants that are native to this area are often more resistant to pests and climate, etc. than are introduced plants. Many plant cultivars have been developed which are resistant to such diseases as verticilium wilt and peach leaf curl. Grass seed mixes are also available for lawns that need much less watering, mowing, and chemical use.
6. Growing Conditions: Plants, such as hostas, that require some shade are more susceptible to pests when they are growing in the sun. Improperly fertilized or watered plants are less vigorous in growth and tend to attract pests. Plants that prefer an acid soil, such as azaleas, will perform better and be less susceptible to pests when they are grown in soil with the proper pH.
7. Chemicals: Chemicals are a small part of the IPM plan and should be applied only as needed after reviewing all other alternatives.

Pesticide Management:

When use of a chemical is the best or only option, follow these simple guidelines:

1. Know your target pest before spraying. Use the pesticide according to the manufacturer's instructions and buy only the needed quantity. Many pesticides have a limited shelf life and may be useless or degrade into even more toxic compounds if for extended periods of time.
2. Do not apply more than the specified amount. Overuse can be dangerous to your health as well as the health of wildlife and the environment. If more than one chemical can be used to control the pest, choose the least toxic. The word "caution" on the label means that the chemical is less toxic than one that is labeled "warning".
3. Do not spray on windy days, in the morning of what will be a very hot day, or when rain is likely. Herbicides can drift and injure valuable ornamental plants. Do not water heavily after application. Plants should be lightly watered BEFORE application to prevent burning of the foliage, and to help evenly spread the chemical.
4. Never apply pesticides near streams, ponds, or wetlands (exception: approved applications for aquatic weeds). Do not apply pesticides to bare eroded ground (exception: use of low toxicity herbicides such as Round-up to allow growth of desired planting in small areas). Many pesticides bind to soil particles and can be easily carried into a stream or storm drain.
5. Pesticides should be stored well away from living areas. Ideally, the storage area should have a cement floor and be insulated from temperature extremes. Always keep pesticides in their original containers with labels in tact. Labels often corrode and become illegible in this climate and may have to be taped onto the container.
6. Federal law now requires that all pesticides be labeled with the appropriate disposal method. Leftovers should never be dumped anywhere, including a landfill. Take unwanted pesticides to the County's hazardous waste collection days or Hazo House at the landfill.

7. Empty containers should be triple-rinsed and the rinse water used as spray. Once containers are triple-rinsed, they are not considered hazardous waste and may be disposed of in most landfills. However, call your local landfill before putting the container in the garbage.
8. If a pesticide is spilled onto pavement, it can be absorbed using kitty litter or sawdust. The contaminated absorbent should be bagged, labeled and taken to Hazo House.
9. If the pesticide is spilled onto dirt, dig up the dirt, place it in a plastic bag and take it to Hazo House.
10. Many pest control companies and licensed applicators have access to pesticides that are more toxic than those available to the consumer. Check with the company before they spray indoors or outdoors to find out what spray they will be using and what precautions, if any, are necessary after the operator leaves.

Home Remodeling

Remodeling uses some of the most toxic substances found in the home. Paints, preservatives, strippers, brush cleaners, and solvents all contain a wide range of chemicals, some of which are suspected to be carcinogenic (cancer causing). These products should never be dumped in a landfill or put down a sewer or septic system.

1. When building a deck consider using wood or wood alternatives such as recycled wood/plastic decking instead of concrete. Wood decking allows rainwater to drip onto the ground below, keeping it from becoming surface runoff.
2. Decks and sidewalks can also be built out of brick interlocking pavers or modular concrete. If these surfaces are placed on a bed of well-drained soil gravel or sand, rainwater can infiltrate into the ground around them.
3. To reduce disposal problems, buy only the needed amount. Used turpentine or brush cleaner can be filtered and reused. Paint cans should be allowed to dry and then be disposed of during a hazardous waste collection day or at Hazo House.
4. Leftover paint can be given away, for example to a theater group. Contact the Thurston County Health Department at (360) 754-4111 for other options.
5. Roof downspouts can be adjusted to infiltrate runoff to a well drained area. The runoff from them can enter a gravel bed where it can infiltrate into the ground. For design criteria, see your jurisdiction's drainage manual.
6. When gardening on slopes, reduce the potential for surface runoff by using terraces across the face of the hill. These can be as simple as little soil "bumps" or more elaborate using timbers, masonry or rock walls.

Septic System Care and Management

While septic systems do not seem to have a direct relationship with stormwater runoff, they can in some instances be related.

1. Roof drains and stormwater runoff should be diverted away from drainfields. Excess water reduces the capacity of the drainfield to absorb effluent from the septic tank.
2. Water from hot tubs should not be drained into a septic system all at once. They are not designed to handle large volumes of chlorinated water. Either use the water on plants in the yard, or drain the hot tub slowly over a period of days.

3. Septic tanks should be pumped regularly. Ponded water, damp places in the yard, foul odors and/or a dark gray or black soil color may indicate septic drain field failure. Effluent from a malfunctioning septic can cause disease and nitrate problems in groundwater. For septic system assistance, contact the Thurston County Health Department at (360) 786-5490.

References

Puget Sound Water Quality Authority, Managing Nonpoint Pollution - an Action Plan for Puget Sound Watersheds, 88-31, June 1989.
Washington State Dept. of Ecology, Water Quality Guide - Recommended Pollution Control practices for Homeowners and Small Farm Operators 87-30, revised June 1991.
Washington State Dept. of Ecology, Hazardous Waste Pesticides, 89-41, August 1989.

IV. GLOSSARY

BEST MANAGEMENT PRACTICE (BMP) - Structures, conservation practices, or regulations that improve quality of runoff or reduce the impact of development on the quantity of runoff.

BIOFILTER (SWALE) - A wider and flatter vegetated version of a ditch over which runoff flows at uniform depth and velocity. Biofilters perform best when vegetation has a thick mat of roots, leaves, and stems at the soil interface (such as grass).

BIOFILTRATION - The process through which pollutant concentrations in runoff are reduced by filtering runoff through vegetation.

BUFFER - The zone that protects aquatic resources by providing protection of slope stability, attenuation of runoff, and reduction of landslide hazards. An integral part of a stream or wetland ecosystem, it provides shading, input of organic debris, and coarse sediments to streams. It also allows room for variation in stream or wetland boundaries, habitat for wildlife, and protection from harmful intrusion.

CATCH BASIN - An inlet for stormwater set into the ground, usually rectangular and made of concrete, and capped with a grate that allows stormwater to enter.

CHECK DAM - A dam (e.g., rock, earthen, log) used in channels to reduce water velocities, promote sediment deposition, and/or enhance infiltration.

COMPOST STORMWATER FILTER - A treatment facility that removes sediment and pollutants from stormwater by percolating water through a layer of specially prepared bigleaf maple compost.

CONSTRUCTED WETLAND - A wet pond with dead storage at varied depths and planted with wetland plants to enhance its treatment capabilities.

CONTROL STRUCTURE (FLOW RESTRICTOR) - A manhole and/or pipe structure with a flow-regulating or metering device such as a weir or plates with small holes known as orifices. This structure controls the rate at which water leaves the pond.

CONVEYANCE - A mechanism or device for transporting water including pipes, channels (natural and man-made), culverts, gutters, manholes, etc.

CRITICAL AREA - Areas such as wetlands, streams, steep slopes, etc. as defined by ordinance or resolution by the jurisdiction. Also known as "environmentally sensitive areas."

CULVERT - A conveyance device (e.g., concrete box, pipe) that conveys water from a ditch, swale, or stream under (usually across) a roadway or embankment.

DEAD STORAGE - The volume of storage in a pond below the outlet that does not drain after a storm event. This storage area provides treatment of the stormwater by allowing sediments to settle out.

DETENTION FACILITY - A facility (e.g., pond, vault, pipe) in which surface and storm water is temporarily stored.

DETENTION POND - A detention facility in the form of an open pond.

DISPERSION TRENCH - An open-top trench filled with riprap or gravel that takes the discharge from a pond, spreads it out, and spills (bubbles) the flow out along its entire length. Dispersion trenches are used to simulate "sheet flow" of stormwater from an area, and are often used to protect sensitive adjacent areas, such as wetlands.

DRAINAGE SYSTEM - The combination of Best Management Practices (BMPs), conveyances, treatment, retention, detention, and outfall features or structures on a project.

DROP STRUCTURE - A structure for dropping water to a lower elevation and/or dissipating energy. A drop may be vertical or inclined.

DRY POND - A detention facility that drains completely after a storm. This type of pond has a pipe outlet at the bottom.

EASEMENT - A right afforded a person to make limited use of another's real property. Typical easements are for pipes or access to ponds, and may be 15 to 20 feet wide.

EMERGENCY OVERFLOW OR SPILLWAY - An area on the top edge of the pond that is slightly lower in elevation than areas around it. This area is normally lined with riprap. The emergency overflow is used only if the primary and secondary outlets of the pond fail, in the event of extreme storms, or if the infiltration capability of the pond becomes significantly diminished. If the emergency overflow ever comes into play, it may indicate the pond needs to be upgraded.

ENERGY DISSIPATER - A rock pad at an outlet designed to slow the velocity, spread out the water leaving the pipe or channel, and reduce the potential for erosion.

FREEBOARD - The vertical distance between the design high water mark and the elevation of the top of the pond. Most ponds have one to two feet of freeboard to prevent them from overflowing.

INFILTRATION - The soaking of water through the soil surface into the ground (percolation). (Many ponds are designed to fully infiltrate stormwater, and thus do not have a regularly used discharge pipe.)

INFILTRATION FACILITY (or STRUCTURE) - A facility (pond or trench) that retains and percolates stormwater into the ground, having no discharge (to any surface water) under normal operating conditions.

JUNCTION - Point where two or more drainage pipes or channels converge (e.g., a manhole).

JURISDICTION - Olympia, Lacey, Tumwater, or Thurston County (as applicable).

LINED POND or CONVEYANCE - A facility, the bottom and sides of which have been made impervious (using, for example, a plastic liner or clay/silt soil layer) to the transmission of liquids.

LIVE STORAGE - The volume of storage in a pond above the outlet that drains after a storm event. This storage area provides flood control and habitat protection for nearby streams.

MANHOLE - A larger version of a catch basin, often round, with a solid lid. Manholes allow access to underground stormwater pipes for maintenance.

NATURAL CHANNEL - Stream, creek, river, lake, wetland, estuary, gully, swale, ravine, or any open conduit where water will concentrate and flow intermittently or continuously.

OIL-WATER SEPARATOR - A structure or device used to remove oil and greasy solids from water. They operate by using gravity separation of liquids that have different densities. Many catch basins have a downturned elbow that provides some oil-water separation.

OUTFALL - The point where water flows from a man-made conduit, channel, or drain into a water body or other natural drainage feature.

RETENTION FACILITY - An infiltration facility.

RETENTION POND - A retention facility that is an open pond.

REVETMENTS - Materials such as rock or keystones used to sustain an embankment, such as in a retaining wall.

RIP RAP - Broken rock, cobbles, or boulders placed on earth surfaces, such as on top of a berm for the emergency overflow, along steep slopes, or at the outlet of a pipe, for protection against the action of water. Also used for entrances to construction sites.

RUNOFF - Stormwater.

SAND FILTER - A treatment facility that removes sediment and pollutants from stormwater by percolating water through a layer of sand.

STORMWATER - That portion of precipitation that falls on property and that does not naturally percolate into the ground or evaporate, but flows via overland flow, channels or pipes into a defined surface water channel, or a constructed infiltration facility. Stormwater includes washdown water and other wastewater that enters the drainage system.

SWALE - A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot. This term is used interchangeably with "BIOFILTER".

TRASH RACK or BAR SCREEN - A device (usually a screen or bars) that fits over a pipe opening to prevent large debris such as rocks or branches from entering and partially blocking the pipe.

WET POND - A stormwater treatment pond designed with a dead storage area to maintain a continuous or seasonal static water level below the pond outlet elevation.

APPENDIX A – Soils Report and Analysis

PACIFIC RIM SOIL & WATER

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October 8, 1997

Report File Number: M97-0084
Report Subject: Soil assessment for stormwater facility design
Location: The project site is the proposed Lakeside Asphalt Plant, located at the Holroyd gravel pit, southeast of the intersection of Durgin Road and the Old Pacific Highway; within the SE ¼ of Section 17, Township 18N, Range 1E.

Soils were assessed on September 30, 1997 by Lisa Palazzi, (ARCPACS certified soil specialist). The intent of this work was to assess on-site soil conditions that would affect stormwater facility design.

MAPPED SOIL SERIES DESCRIPTIONS:

According to the Thurston County Soil Survey, the following soil series are mapped on or near the site: the Dystric Xerochrepts 60-90% slopes[1]; the Everett very gravelly sandy loam (classified

[1] Dystric Xerochrept, generally meaning the soil has limited horizon development (ept), has a pale-colored, low base saturation surface horizon (ochr), has developed under climate conditions of wet winters and droughty summers (xer), and has a low base saturation subsurface soil, generally indicating a poor nutrient status (dystric), has a mesic temperature regime (mean annual temperature ranges from 8° to 15° C (47° - 59° F).

as a sandy-skeletal, mixed, mesic Andic Xerochrept[2]); gravel pits; the Puyallup silt loam, (classified a coarse-loamy over sandy or sandy skeletal, mixed, mesic Fluventic Haploxeroll[3]); and the Xerorthents.

The Dystric Xerochrepts are steep, gravelly side slope soils mapped along the south side of Durgin Road into the northern portion of the site. Everett soils are mapped south of the Dystric Xerochrepts soil unit across the majority of the project site. Xerorthents are simply fill materials mapped as thin band that parallels both sides of the Burlington Northern Railroad, and of course, the Holroyd pit is mapped as a gravel pit. Puyallup soils are mapped offsite north of Durgin Road on the lower elevation floodplains adjacent to the Nisqually River. Please refer to the attached soil map for details on soil map unit boundaries.

For your information, standard characteristics of the mapped soil series are described in Appendix I. Please note that the SCS soil series maps and descriptions characterize expected characteristics in only the top 60-100 inches of soil. Furthermore, the map units can have extensive inclusions of other soil types, and in some rare cases, can be entirely in error. Please refer to the discussion in the text below for specifics information on observed site soil conditions.

SITE GEOMORPHOLOGY AND SOILS DESCRIPTION

The proposed Lakeside Asphalt Plant project area (approximately 15 acres) is located in the Holroyd gravel pit, between the Old Pacific Highway and the Burlington Northern Railroad, south of Durgin Road. Currently, the property is owned by the gravel mine operation, and a great proportion of the proposed plant site is still buried under many feet of gravel.

The proposed asphalt plant project includes an office, shop, the asphalt plant, and a fuel dock with two 10,000 gallon fuel tanks, with about 90% of the project area paved. The proposed site is located along the northeastern edge of the active gravel mining/sorting area. Only the far western end of the proposed site has a surface elevation close to finished grade. Therefore, pits were excavated only in that area, at either end of a proposed stormwater infiltration pond. Please refer to the attached project map for details.

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[2] Sandy-skeletal, mixed, mesic Andic Xerochrept, generally meaning, soil has minimal horizon development (ept), the surface epipedon has a pale color and low base saturation (ochr), the soil has developed under climatic conditions of wet winters and dry summers (xer), and the soil properties show influence of volcanic input (andic), has a mesic temperature regime (mean annual temperature ranges from 8° to 15° C (47° - 59° F), has no specific mineralogic source (mixed), has 15-50% sand by weight and greater than 35% coarse fragments by volume (sandy-skeletal).

[3] Coarse-loamy over sandy or sandy skeletal, mixed, mesic Fluventic Haploxeroll, generally meaning the soil has a dark-colored, surface horizon with high base-saturation (oll), has developed under climate conditions of wet winters and droughty summers (xer), is otherwise a typical xeroll (hapl), has very little soil development (entic), is expected to flood in most years (fluv), has developed under conditions of a mesic climate (mean annual temperature ranges from 8° to 15° C (47° - 59° F), has no specific mineralogic source (mixed), near the soil surface, has >15% sand content and <18% clay content by dry weight (coarse-loamy), and underneath may have 35% coarse fragment content and is either sandy or loamy sand with less than 50% very fine sand content (sandy or sandy skeletal).

Site topography is relatively complex due to gravel mining. Currently the far western end of the project site is at about 22-24 feet elevation, and the far eastern end is at about 160 feet elevation. According to the attached proposed site layout, after construction grading, the elevation across most the project site will be around 40 feet with steep slopes at the western end grading up to meet the current ridge top.

According to USGS Nisqually quad map, the nearest natural bodies of water include: **1)** Lost Lake; located less than ¼ mile southeast of the site. Surface elevation of the lake is shown as 8 feet on the USGS quad map (1959, photo revised 1968) and as 15.1 feet on the Thurston County aerial survey maps (6-9-86); **2)** the Nisqually River, located about ¾ mile to the east, surface elevation at less than 20; and **3)** Medicine Creek, whose headwaters start about ½ mile to the east (east of Lost Lake), then drains north and west around the project site. According to County aerial topography maps, elevation at the creek source is about 25 feet elevation, and it drops to between 20 and 25 feet as it drains around the north end of the site. The creek elevations are approximate and could easily vary ±5 feet. But in any case, it should be apparent that there is a shallow regional groundwater table in the area that should be taken into account when designing not only stormwater management, but all aspects of the asphalt plant project.

Two soil pits were excavated and described in the proposed northwest stormwater facility area. Both pits were extremely gravelly overall. Pit 1 had a crushed rock fill surface to about 20 inches underlain with gravelly native substrate to 39 inches, then a weakly cemented layer to 49 inches that is currently perching water. The extremely gravelly, loose soils below the cemented zone (below 49 inches) were well-drained with expected percolation rates in excess of 50 inches per hour, based on past tests in similar soil types. Pit 2 had about 5 feet of compacted very gravelly sandy loam fill at the surface. But the underlying loose, extremely gravelly soils are similar to those in the base of Pit 1, expected to percolate at greater than 50 inches per hour.

Both pits had groundwater at about 11 feet depth. This appears to be at about the same depth as we expect for the regional groundwater table, based on an assumption of surface elevation being around 24 feet, then groundwater would be at about 13 feet. We should assume then that groundwater elevation below the site will fluctuate with the regional water table. We were unable to get any detailed information on water surface elevations in this area during last winter, but believe that the groundwater may have risen significantly, possibly to over the surface in some areas. Last winter, infrared aerial photos taken in January (1997) show that groundwater rose to above the surface in the southern portions of the gravel pit -- to between 15 and 20 feet elevation. Unfortunately, we were unable to obtain documented information on whether the regional groundwater table rose any higher by end of winter.

In summary, the soils in the targeted infiltration area at the northwest end of the project site were for the most part formed in an extremely gravelly glacial outwash deposit expected to percolate at rates in excess of 50 inches per hour. Infiltration facility design (and other site safety features that are intended to protect groundwater quality) will be limited to some degree by depth to seasonal groundwater, the depth to which could vary from year to year as a result of seasonal rainfall

patterns. If the base of the facility lies within 3 vertical feet of a seasonal water table, the effective infiltration rate will be reduced as a result of groundwater mounding below the facility and slower lateral transmission rates. We assume that on the average, the winter water table below this site will be at around 15 feet elevation. But that has the potential to rise significantly during periods of extended rainfall. If proposed design places the infiltration facility base within 3 feet of the expected 15-foot elevation winter water table, it is highly recommended to install an emergency overflow that will allow flood waters to drain to a safe area, i.e., an area where flooding will not damage buildings or other human-made structures.

I hope this report provides enough information to proceed with project planning. Please call if you have any questions or require additional detail or clarification on any of these issues.

Thank You,

Lisa Palazzi
ARCPACS certified soil specialist
Certification #3313

APPENDIX I
SOIL PROFILE DESCRIPTIONS

APPENDIX I

Pit 1

Horiz	Dpth	CF	Txt
A	0-20	100	Gravels and Crushed Rock (loose)
B	20-39	70	XGrLCS (1-2" gravels)
C1cw	39-49	90	XGrCS (2-4" gravels)
C2	49-60	70	XGrLMS (10-20" cobbles)
C3	60-121	85	XGrCS (½-3" gravels)

Gravel deposit with a weakly cemented zone from 39-49 inches that is currently perching water. However, once breached, the gravels and cobbles below are well-drained until we hit groundwater at 11 feet (± 6"). Percolation rates in gravels will be in excess of 50 inches per hour (ignoring effects of shallow groundwater). Assume surface at 24 feet – groundwater is at 13 feet.

Pit 2

Horiz	Dpth	CF	Txt
Fill	0-60	40	VGrSL (compacted fill)
B	60-121	85	XGrLMS (1-2" gravels)
C1	120+	85	XGrLMS (1-2" gravels)

Surface 5 feet is compacted gravelly sandy loam fill – surface is sealed and ponding. Gravels below 5 feet are well-drained to top of water table at about 11 feet (+/-6"). Recommend to keep surface fill out of base. Rates in gravels at greater than 5 feet will exceed 50" per hour based on tests in similar soils.

APPENDIX II
SOIL SERIES DESCRIPTIONS

APPENDIX II

DYSTRIC XEROCHREPTS

The Dystric Xerochrepts (60-90% slopes) are moderately deep to very deep, well-drained soils on escarpments formed in glacial till and colluvium. No single profile is typical of these soils, but generally, there are 26 to 60 inches of very gravelly sandy loams underlain by compact glacial till.

Average soil percolation rates are expected to be moderate (0.6-2 inches per hour) through the upper soils and very slow (less than 0.06 inches per hour) through the till. Runoff is rapid and hazard from water erosion is severe.

These areas are suitable for woodland with limitations related to steep slopes, and seasonal limitations on trafficability. They can have significant silt content and therefore be highly erodible and unstable. Mass failure can occur at any time, but is exacerbated by activities that disturb vegetation or toeslopes. Trees can be prone to windthrow due to shallow root systems. For that reason, slope stabilization with plants should focus on establishment of shrubby and herbaceous rather than tree-form vegetation.

EVERETT SERIES

The Everett series is a very deep, somewhat excessively drained soil found on terraces and glacial outwash plains. Generally, the texture becomes coarser and more gravelly with depth, ranging from very gravelly (35-65% gravel) sandy loams near the surface, extremely gravelly sandy loam or loamy sand down to approximately 30 inches, and extremely gravelly (>65% gravel) sand at depths greater than 30 inches.

Soil permeability is rapid (6-20 inches per hour) to very rapid (>20 inches per hour) below 3 inches depth.

These soils are suitable for homesites with a few restrictions. Cutbanks will slough severely and should be avoided to control erosion. Septic absorption field and stormwater facility design is limited by poor filtering capacity -- i.e. these soils drain too rapidly to provide adequate treatment. It is suggested that community sewage systems be used to avoid contamination of water supplies. Grass-lined swales or sand-lined ponds may be encouraged for pretreatment of stormwater prior to infiltration.

PUYALLUP SERIES

The Puyallup silt loams are very deep, well-drained soils formed on floodplains in recent alluvium. These soils are highly variable, but generally, the upper 10 inches is a dark brown silt loam cap, and the underlying horizons range from fine sandy loams to loamy sands, sometimes with gravels.

Average soil permeability near the surface is moderately rapid (2-6 inches per hour). These soils are expected to flood occasionally for brief periods between November and April.

The Puyallup soils are generally suitable for hayland, pasture, cropland, or woodland. The main

limitations are the flooding and low available water capacity. Furthermore, the surface is highly compactible if trafficked when wet. These soils are unsuited for homesites.

APPENDIX III
DEFINITIONS

APPENDIX III
DEFINITIONS

Column Headings:

Horiz = horizon: This word refers to the horizontal bands of soil that form at various depths from the surface as a result of either accumulation of organic materials or leaching of clays and salts by water. "A" horizons generally have an accumulation of organic materials. "B" horizons generally have an accumulation of clays or salts. "C" horizons are generally either undifferentiated parent material or are below the zone of major biological activity. A small letter following the capital letter provides additional information. "Bw" describes a "cambic" or barely developed B horizon; A "cw", "cs" or "ci" after a B or C describes a horizon with weak cementation, strong cementation, and induration respectively. An "r" after a B or C indicates that the horizon is dominated by saprolyte, which is rotten rock -- i.e. rock that is so decomposed that it is almost soil. An "R" after a C indicates that the C horizon is predominantly hard, undecomposed bedrock. A "2" in front of a B or C horizon indicates that the subsoils have a different parent material than the overlying soils.

Dpth = depth: gives the distance from the surface for the top and bottom of each horizon.

Col = color: gives a Munsell Book color chip code. The Munsell color codes (example: 10YR 3/4) give information on the hue (10YR), value (3), and chroma (4) of the soil. Soil color can be used to infer parent material, percent organic content, or soil drainage characteristics. For example, soils with both low chroma and value (example: 10YR 2/2) are very dark-colored and tend to have high organic matter contents; soils with a Munsell chroma code of 2 or less (example: 10YR 7/2) may be poorly drained.

The following value/chrome color codes correspond to the following soil color names for the two most commonly used HUE pages 10YR and 2.5Y:

10YR HUE COLOR NAME	VALUE/CHROMA	2.5Y HUE COLOR NAME	VALUE/CHROMA
white	8/1, 8/2	white	N8/, 8/2
light gray	7/1, 7/2	light gray	N7/, 7/2
gray	6/1, 5/1	gray	N6/, N5/
dark gray	4/1	dark gray	N4/
very dark gray	3/1	very dark gray	N3/
black	2/1	black	N2/
very pale brown	8/3, 8/4, 7/3, 7/4	pale yellow	8/4, 7/4
light brownish gray	6/2	light brownish gray	6/2
grayish brown	5/2	grayish brown	5/2
dark grayish brown	4/2	dark grayish brown	4/2
very dark grayish brown	3/2	very dark grayish brown	3/2
very dark brown	2/2	light brownish gray	6/2
yellow	8/6, 8/8, 7/6, 7/8	grayish brown	5/2
pale brown	6/3	dark grayish brown	4/2
brown	5/3	very dark grayish brown	3/2
dark brown	4/3, 3/3	pale yellow	8/4, 7/4
light yellowish brown	5/4	light yellowish brown	6/4
brownish yellow	6/6, 6/8	light olive brown	5/4, 5/6
yellowish brown	5/4, 5/6, 5/8	olive brown	4/4
dark yellowish brown	4/4, 4/6, 3/4, 3/6	yellow	8/6, 8/8, 7/6, 7/8
		olive yellow	6/6, 6/8

Txt = texture: describes the relative dominance in size of soil particles smaller than 2 mm diameter. Sand, silt, and clay are the three size classes with sand being largest and clay being smallest. The textural names are applied based on the weight percentage of sand (S), silt (Si), and clay (C). The field estimate of percent sand, silt and clay are given with the textural name.

CF = percent coarse fragments. Coarse fragments are defined as any mineral fragment in the soil greater than 2mm diameter. If needed, coarse fragments are also described in terms of various size classes -- gravel, cobble, stone, etc. Abbreviations associated with CF percentages will be: Co = cobbly (coarse fragments >3"diameter), Cn = concretions (small, round pebble-like fragments formed by soil minerals dissolving and then re-precipitating). If no abbreviation is included, assume that the percent CF is describing gravels (coarse fragments >2mm and <3" in diameter).

If coarse fragment content is expressed as 15-35 percent, the fine fraction (soil particles less than 2 mm diameter) textural call is modified and defined as gravelly (i.e. gravelly loam or gravelly silty clay); 35-65 percent is very gravelly; greater than 65 percent is defined as extremely gravelly.

Struc = structure: describes the shape and size of the natural soil clods. Soil with strong structure is generally considered to be stable and well developed. Soils that are periodically disturbed generally have poor structure. Fine textured soils with weak structure often have poor percolation capabilities.

OM = percent organic matter. In mineral soils, organic matter decreases with distance from the soil surface. Low percentages (3% or less) at the surface can indicate erosion problems. Increased percentages below the surface can indicate a buried surface (fill on the surface). Organic matter improves structure and fertility. Surface OM% in mineral soils ranges from 4 to 20%. When OM% is greater than 20%, the soil may be classified as an organic rather than mineral soil. This is generally indicative of saturated and/or cold conditions in the soil.

Root = rooting depth: can be used to locate layers in the soil that may restrict growth or water movement.

Mott = mottles: are an indication that the soil goes through alternating periods of extended saturation and drying.

Perc = percolation rate. The percolation rate is an estimate of inches per hour water percolation through the soil. The range in percolation rates as devised by the SCS are as follows:

Class	Estimated inches/hour
Very slow	less than 0.06
Slow	0.06-0.2
Moderately slow	0.2-0.6
Moderate	0.6-2.0
Moderately rapid	2.0-6.0
Rapid	6.0-20
Very rapid	more than 20

The field estimate is made based on soil texture, percent coarse fragments, and other soil features. such as indication of cementing and the presence of mottles.

Type = soil type: as defined in Article IV, Rules and Regulations of the Thurston County Board of Health Governing Disposal of Sewage (same as State definition). These groupings have been recently reviewed and revised at the State level, but in general indicate soil texture and relative percent of coarse fragments with the Type 1 soils being the most coarse-textured with the highest coarse fragment percentage and the Type 6 soils being the finest textued.

Similar to soil percolation rate estimates, the field typing estimate is based on interpretation of effects of soil texture, percent coarse fragments, and other soil features, such as indication of cementing and the presence of mottles. In general, soil type 1 is too coarse textured to allow for a standard design. Some pre-treatmetn design is used. then the native soils are used for disposal of the treatred effluent.: Soil types 3 and 4 are generally preferred, although some type 4's may be limited to some degree by slow percolation; type 5 soils percolate very slowly and are generally less desireable due to how easily they are hydraulically overloaded, but mound or pressure distribution systems can be used in some cases to compensate for these limitations; type 6 soils are unsuited due to minimal percolation.

%C = Percent clay content as estimated using hand-texture techniques in the field.

FIELD DATA ABBREVIATIONS

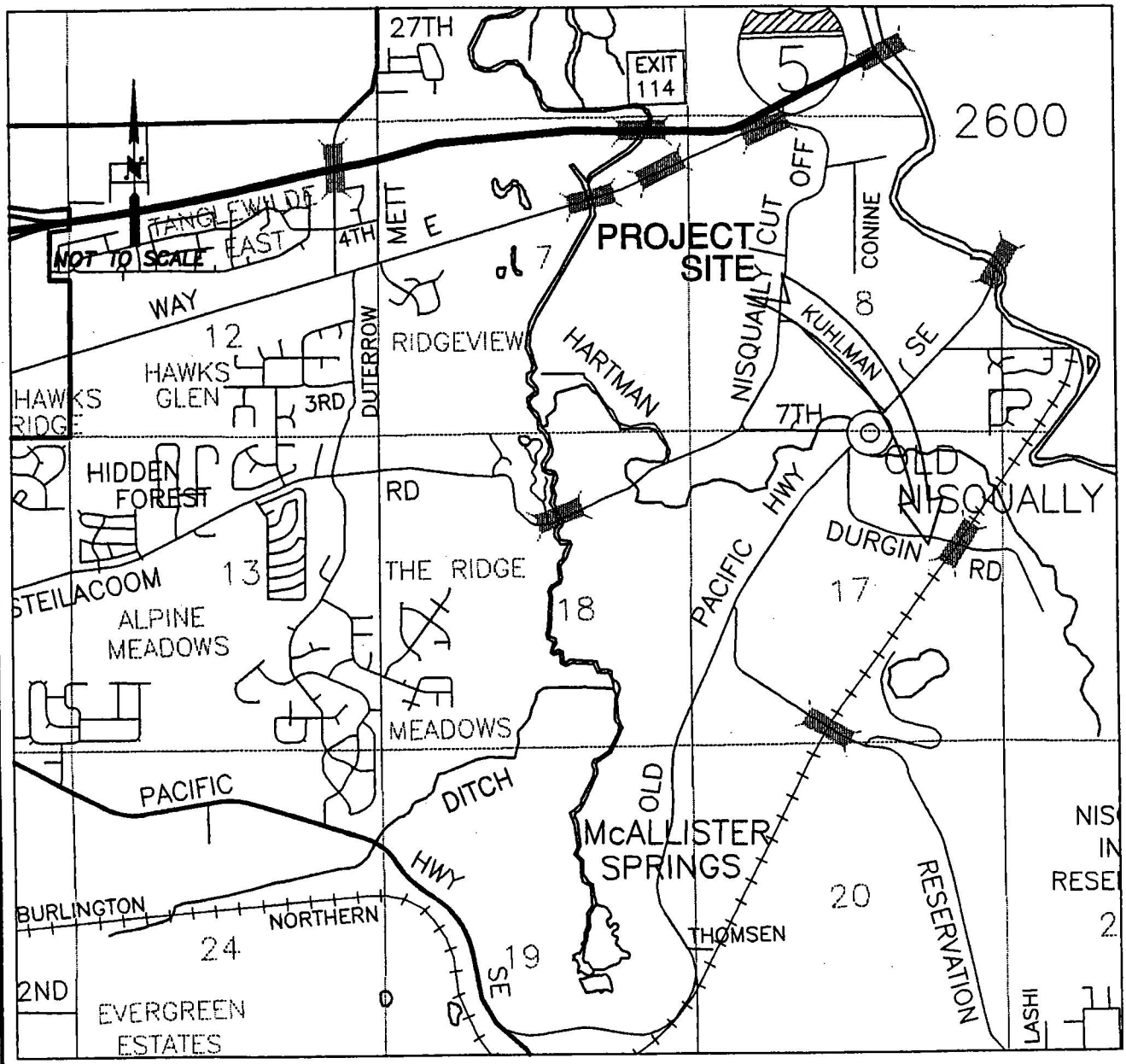
Texture codes	Roots	Mottles	Structure
L = Loam(y)	First letter	First letter	SG = single grained or loose. no structure
Si = Silt(y)	M = Many	M = Many	MS = Massive, meaning no structure, but not single grained
S = Sand(y)	C = Common	C = Common	First letter represents the strength of the structure
C = Clay(ey)*	F = Few	F = Few	W = Weak
F = Fine	Second letter	Second letter	M = Moderate
Gr = Gravelly	F = Fine	F = Fine	S = strong
V = Very	M = Medium	M = Medium	
X = Extremely	C = Coarse	L = Large	
Co = Cobbly		Third letter	

(* C in front of LS or SL stands for Coarse)	F = Faint D = Distinct P = Prominent	Second letter represents the size of the structural unit F = Fine M = Medium C = Coarse Third letter group represents the shape of the structural unit SAB = subangular blocky AB = angular blocky G = granular Pl = platy

Stream Type = stream type: as defined in WAC 222-16-030, Water Typing System. These typing were established in cooperation between the Dept. of Natural Resources, the Dept. of Fisheries, the Dept. of Wildlife, the Dept. of Ecology, and in consultation with affected Indian tribes. The results are available across the counter at DNR Map and Photo Sales. The current stream type definitions are as follows (paraphrased from the WAC code descriptions):

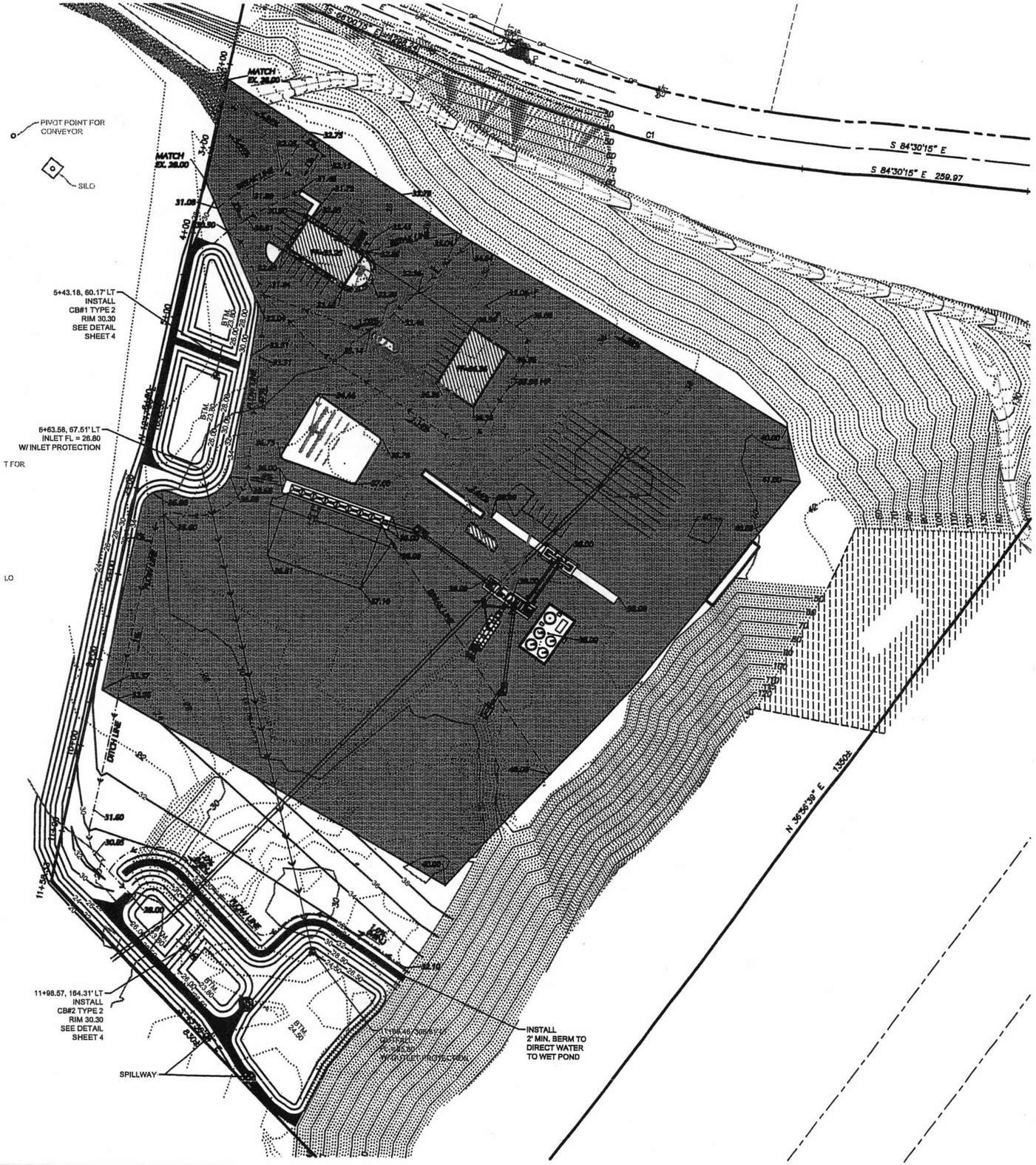
Stream Type	Typical characteristics
1	All shorelines of the state, as defined under RCW 90.58, within their ordinary high water mark, excepting their associated wetlands. Generally, these include all rivers, lakes greater than 20 acres, and perennial streams downstream of the point of greater than 20 cfs flow. These are generally considered to be fish-bearing waters.
2	These are not Type 1 waters, but do have high fish, wildlife, or human use values. They include segments of natural waters and their associated wetlands which: (a) are diverted for domestic use by more than 100 residential or camping units...; (b) are within any campground with greater than 30 camping units...; (c) are used by substantial numbers of anadromous or resident game fish for spawning, rearing or migration, such as those having a defined channel width of 20 feet or greater and a gradient of less than 4%, or lakes, ponds or impoundments with greater than 1 acre of surface area at seasonal low water. (d) are used by salmonid for off-channel habitat, usually critical for juvenile survival, such as those areas connected to a slmonid bearing stream and accessible at some time of the year and having an access drainage area with less than 5% gradient.
3	These are not Type 1 or 2 waters, but have moderate to slight fish, wildlife, or human use values. They include segments of natural waters and their associated wetlands which: (a) are diverted for domestic use by more than 10 residential or camping units...; (b) are used by significant numbers of anadromous fish for spawning, rearing or migration, such as those having a defined channel width of 5 feet or greater and a gradient of less than 12% and not upstream of a falls of more than 10 vertical feet. (c) are used by significant numbers of resident game fish, such as those having a defined channel width of 10 feet or greater, a summer low flow of greater than 0.3CFS, and a gradient of less than 12%, and ponds or impoundments with greater than 0.5 acre of surface area at seasonal low water. (d) are highly significant for protection of downstream water quality, such as tributaries that contribute more than 20% of the flow to a Type 1 or 2 water...
4	These are not Type 1, 2, or 3 waters, but are considered important for protection of downstream water quality. These are not fish-bearing streams, but have a defined channel and are either intermittent drainages, or are perennial streams in unreachable portions of a drainage. These waters continue upstream until the channel becomes less than 2 feet wide.
5	These are not Type 1, 2, 3, or 4 waters, but include streams with or without well-defined channels, areas of perennial or intermittent seepage, ponds, natural sinks and drainageways having short periods of spring or storm run off.

Appendix 6
Vicinity Map



LAKESIDE INDUSTRIES
VICINITY MAP

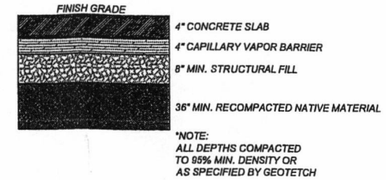
APPENDIX B – Drainage Exhibit



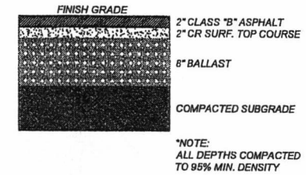
60 30 0 60 120
SCALE: 1" = 60'

NE 1/4 SEC. 17, TWP. 18N, RGE. 1E., W.M.

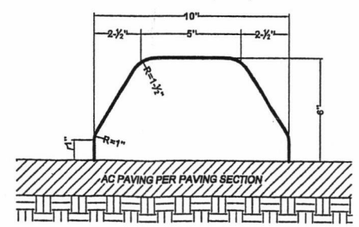
VERTICAL DATUM
THURSTON COUNTY
CONTROL POINT #863
SURFACE MONUMENT WITH 2" BRASS CAP
OLD PACIFIC HWY MON P.C. STA.848+04.80
CENTER ROAD 0.24 MILE SW DURGIN RD &
0.35 MILES NE RESERVATION RD
NGVD 29 ELEV.=23.56



BUILDING PAD DETAIL
N.T.S.



ONSITE PAVEMENT SECTION
N.T.S.



ONSITE EXTRUDED CONCRETE CURB DETAIL
NTS

ACCEPTED AS NOTED
THURSTON COUNTY ROADS & TRANSPORTATION SVS.
DEVELOPMENT REVIEW SECTION

BY: _____

ACCEPTANCE DATE: _____

EXPIRES 2 YEARS FROM ACCEPTANCE DATE

DESIGNED BY: EBA
DRAWN BY: JLO
CHECKED BY:
DATE: JULY 2005
SCALE: H 1" = 60'
V

STEVEN D. HATTON
STATE OF WASHINGTON
24183
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 11-27-05

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
1840 BARNES BOULEVARD S W
TUMWATER, WA 98512
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:

LAKESIDE ASPHALT PLANT

HOLROYD GRAVEL PIT
THURSTON COUNTY, WA
GRADING / DRAINAGE PLAN

AGENCY NO. _____
SHEET: 3 OF 10
INDEX: 04-19Grading.dwg
JOB: 04-190

APPENDIX C – Hydraulic Calculations

Developed Condition							
Infiltration Pond #	Sub-Basin	Proposed Impervious Roofs	Impervious P-lots	Total Impervious	Pervious	Total Area trib. to pond	% IMP
1	A	13,600 SF	237,340 SF	250,940 SF	72,337 SF	323277 SF	77.62%
1	B		139,154 SF	139,154 SF	131,865 SF	271019 SF	51.34%
		13,600 SF	376,494 SF	390,094 SF	204,202 SF	594,296 SF	
1	A	0.31 Acres	5.45 Acres	5.76 Acres	1.66 Acres	7.42 Acres	77.62%
1	B	0.00 Acres	3.19 Acres	3.19 Acres	3.03 Acres	6.22 Acres	51.34%
		0.31 Acres	8.64 Acres	8.96 Acres	4.69 Acres	13.64 Acres	65.64%

Trapezoidal Basin

Required Volume

Total area	13.64	ac
Percent Impervious	65.64%	
Vol./pervious	1571	CF/ac
Vol./Impervious	4714	CF/ac
Infiltration Rate	12.00	in/hr

Volumes at 4 in/hr infiltration rate

VOLUME REQ.	49,580	cf
VOLUME REQ. (from HYDRA)	19,501	cf

Elevation (ft)	water surface area (sf)	Infiltration Rate (cfs)	Volume (cf)			
24.50	23,230	6.453	Area for infiltration rate calculation			
24.50	28,556	6.453	Area for volume calc.			
25.00	28,981	6.453	14,384			
25.50	29,406	6.453	43,364			
26.00	29,831	6.453	58,171			
26.50	30,257	6.453	73,188			
27.00	30,682	6.453	88,415			
27.50	31,107	6.453	103,851			
28.00	31,532	6.453	119,495			
28.50	31,957	6.453	135,346			
28.50	31,957	6.453	135,346			

C:\HYDRA\CMD\04-190C.CMD 9:57 6-Oct-105

Lakeside Industries Site Plan 25 year 24 hour Event

*** POND

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	100	24	98.00	0.0040	2.00	-0.17	0.0	12.4	4.85	12.40	0
			97.60		2.40		0.0	0.0	0.75		

Lateral length= 100 Upstream length= 100

C:\HYDRA\CMD\04-190T.CMD 10:36 6-Oct-105

Lakeside Industries Site Plan 25 year 24 hour Event

*** POND Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	100	15	98.00	0.0040	2.00	0.65	0.0	3.2	3.46	3.22	0
			97.60		2.40		0.0	0.0	0.71		

Lateral length= 100 Upstream length= 100

C:\HYDRA\CMD\04-190I.CMD 13:30 14-Oct-105

Lakeside Industries Site Plan 100 year 24 hour Event

*** POND Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	1	24	182.83	0.0041	4.17	2.00	0.0	15.5	5.17	15.51	0
			182.83		4.17		0.0	0.0	0.89		

*** POND Reservoir

Link	Invert Up/Dn	Maximum Flow Values	San	Inf	Sto	Mis	Design	Cost
2	182.83	Discharge :	0.00	0.00	6.45	0.00	6.45	0
	181.83	Stored :	0	0	19501	0	19501	
		Incoming :	0.00	0.00	15.51	0.00	15.51	

Lateral length= 1 Upstream length= 1

```
Status of DEFAULTS at start of run. ( * May be reset by SET)
  |
  |  Command file : C:\HYDRA\CMD\04-190T.CMD
  |  Input units are read as                 : USA
  |* Output sent to display                  : Detailed
  |* Output sent to printer                  : Off
  |* Output sent to file                     : Detailed
  |  Paper width in inches                   : 8.000
  |  String to reset printer                 : 27 38 108 54 68 27 38 107
51 83
  |  String to set printer to compressed     : 21 27 38 107 50 83
  |  String to set printer to 8 lines/inch   : 8 27 38 108 56 68
  |  Name of printer                         : Hewlett-Packard, ThinkJet,
HP mode
  |  Print heading at top of page            : False
  |
  |  Number of steps in hydrograph           : 96
  |  Step length in minutes                  : 15
  |  Significant flow in hydrograph          : 0.010
  |* Maximum plot value                      : Selected by HYDRA
  |  Type of hydrographic plot               : Compact
  |
  |  Sanitary flow by                        : Peaking Factor
  |  Delay to start of actual storm          : 0.00
  |  Rational Method computations            : Off
  |  SCS computations                        : Santa Barbara
  |  Continuous simulation computations      : Off
  |
  |* Maximum d/D for pipe design/analysis    : 0.900
  |* Match point position on pipe            : 0.00 or Invert
  |* Number of allowable diam drops          : 999
  |* Mimimum drop thru manhole               : 0.000
  |  Routing technique                       : Quick
  |
  |* Calculate sanitary flows                : True
  |* Calculate infiltration flows            : True
  |* Calculate storm flows                   : True
  |* Calculate misc flows                    : True
  |
  |  Listing of acceptable diameters (Changed by the PCO command):
  |      4     6     8    10    12    15    18    21    24    27    30
  |     33    36    39    42    45    48    54    60    66    72    78
  |     84    90    96   102   108   114   120   132
  +-------------------------------------------------------------------

   1: JOB Lakeside Industries Site Plan 25 year 24 hour Event
   2: REM HGA #04-190
   3:
   4: TOT 1.79
                                    Total rainfall :       1.79 Inches


   5: FIL tc6.INC
------START OF SUB-FILE------
   1: HYE 15 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.02 0.02 0.02 0.03
+
   2:     0.04 0.04 0.04 0.05 0.05 0.05 0.06 0.06 0.06 0.06 0.06 0.08
0.08
          0.08+
   3:     0.15 0.08 0.20 0.29 0.76 0.06 0.18 0.18 0.13 0.13 0.19 0.15
0.11
```

```
          0.09 0.15+
   4:     0.11 0.12 0.09 0.09 0.09 0.09 0.08 0.08 0.08 0.08 0.10 0.10
0.10+
   5:     0.10 0.10 0.09 0.08 0.08 0.08 0.06 0.06 0.06 0.06 0.06 0.06
0.06+
   6:     0.05 0.05 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04+
   7:     0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04+
   8:     0.04 0.04 0.04
                                        Step time :      15.00 Minutes
                     Total in original hyetograph :       1.79 Inches
       Total volume rain in production hyetograph :       1.79 Inches
                                 Maximum intensity :       0.76 Inches/Hr

   9: RET
------ END OF SUB-FILE ------
   6:
   7: PDA 0.012 8 2 2 2 0.004

                                       Mannings n :       0.0120
                                 Minimum diameter :       8.00 Inches
                                    Minimum depth :       2.00 Feet
                                    Minimum cover :       2.00 Feet
                                 Minimum velocity :       2.00 Feet/Sec
                                    Minimum slope :       0.00400
                                 Maximum diameter :     132.00 Inches


   8:
   9: NEW POND
  10: REM CALCULATE THE RUNOFF
  11: SCS 12.55 .7136 98 86 25

            Total rainfall falling on impervious :   58191.32 CuFt
                                Impervious runoff :   50388.04 CuFt
                           Portion off impervious :      86.59 %

         Peak CFS rainfall falling on impervious :       6.85 CuFt/Sec
                 Peak CFS runoff from impervious :       2.99 CuFt/Sec
                   Equivalant "C" off impervious :       0.44

               Total rainfall falling on pervious :   23354.81 CuFt
                                   Pervious runoff :    8892.02 CuFt
                              Portion off pervious :      38.07 %

           Peak CFS rainfall falling on pervious :       2.75 CuFt/Sec
                   Peak CFS runoff from pervious :       0.23 CuFt/Sec
                     Equivalant "C" off pervious :       0.0830

                Total rainfall falling on segment :   81546.13 CuFt
                                Total segment runoff :   59280.06 CuFt
                                 Portion off segment :      72.70 %

            Peak CFS rainfall falling on segment :       9.60 CuFt/Sec
                    Peak CFS runoff from segment :       3.22 CuFt/Sec
                      Equivalant "C" off segment :       0.33

  12: INL 99
  13: PIP 100 100 100 98 97.6
                                            Length :     100.00 Feet
```

```
                    Ground elevation up :      100.00 Feet
                  Ground elevation down :      100.00 Feet
                    Invert elevation up :       98.00 Feet
                  Invert elevation down :       97.60 Feet
                          Lump sum cost :        0.00 Dollars
                              ManningsN :        0.01200
                           Link number :         1
          Average daily sanitary flow :         0.000 CuFt/Sec
                   Storm flow (no SF) :         3.216 Cuft/Sec
             Design flow including SF :         3.216 Cuft/Sec
                           Combined SF :         1.000

                       Design diameter :        15.00 Inches
                        Invert elev up :        98.00 Feet
                      Invert elev down :        97.60 Feet
                                 Slope :         0.00400
                 Depth of fluid in pipe :        10.65 Inches
                                   d/D :         0.710
                  Partial flow velocity :        3.458 Feet/Sec

  14:
  15:
  16: END
------ S U M M A R Y   O F   A N A L Y S I S ------

                 Run number on command file :       1
                            Number of links :       1
                     Number of hydrographs :       28
                  Total sanitary population :       0
                        Total sanitary area :       0.00 Acres
                           Total storm area :       12.55 Acres
                            Number of pumps :       0
                       Number of reservoirs :       0
            Number of diversion structures :        0
                           Number of inlets :       1
                        Length of new pipe :      100.00 Feet
                   Length of existing pipe :        0.00 Feet
                         Length of channel :        0.00 Feet
                          Length of gutter :        0.00 Feet
                 Length of transport units :        0.00 Feet
                   Length of pressure pipe :        0.00 Feet
```

```
Status of DEFAULTS at start of run. ( * May be reset by SET)
  |
  |  Command file : C:\HYDRA\CMD\04-190C.CMD
  |  Input units are read as                  : USA
  |* Output sent to display                   : Detailed
  |* Output sent to printer                   : Off
  |* Output sent to file                      : Detailed
  |  Paper width in inches                    : 8.000
  |  String to reset printer                  : 27 38 108 54 68 27 38 107
51 83
  |  String to set printer to compressed      : 21 27 38 107 50 83
  |  String to set printer to 8 lines/inch    : 8 27 38 108 56 68
  |  Name of printer                          : Hewlett-Packard, ThinkJet,
HP mode
  |  Print heading at top of page             : False
  |
  |  Number of steps in hydrograph            : 144
  |  Step length in minutes                   : 10
  |  Significant flow in hydrograph           : 0.010
  |* Maximum plot value                       : Selected by HYDRA
  |  Type of hydrographic plot                : Compact
  |
  |  Sanitary flow by                         : Peaking Factor
  |  Delay to start of actual storm           : 0.00
  |  Rational Method computations             : Off
  |  SCS computations                         : Santa Barbara
  |  Continuous simulation computations       : Off
  |
  |* Maximum d/D for pipe design/analysis     : 0.900
  |* Match point position on pipe             : 0.00 or Invert
  |* Number of allowable diam drops           : 999
  |* Mimimum drop thru manhole                : 0.000
  |  Routing technique                        : Quick
  |
  |* Calculate sanitary flows                 : True
  |* Calculate infiltration flows             : True
  |* Calculate storm flows                    : True
  |* Calculate misc flows                     : True
  |
  |  Listing of acceptable diameters (Changed by the PCO command):
  |      4     6     8    10    12    15    18    21    24    27    30
  |     33    36    39    42    45    48    54    60    66    72    78
  |     84    90    96   102   108   114   120   132
  +-------------------------------------------------------------------------

   1: JOB Lakeside Industries Site Plan 25 year 24 hour Event
   2: REM HGA #04-190
   3:
   4: TOT 5.1
                                    Total rainfall :       5.10 Inches


   5: FIL tc25.INC
------START OF SUB-FILE------
   1: HYE 15   0.110   0.110   0.110   0.110   0.110   0.122   0.143
0.14
          3   0.143   +
   2:         0.143   0.184   0.202   0.202   0.202   0.224   0.224
0.236
            0.236   +
   3:         0.263   0.263   0.276   0.276   0.277   0.277   0.291
```

```
0.291
                0.370   +
   4:            0.370   0.302   0.793   2.052   0.487   0.183   0.366
0.316
                0.348   +
   5:            0.345   0.242   0.215   0.215   0.215   0.215   0.237
0.284
                0.220   +
   6:            0.240   0.242   0.242   0.242   0.286   0.247   0.247
0.227
                0.227   +
   7:            0.227   0.227   0.227   0.227   0.144   0.144   0.138
0.138
                0.138   +
   8:            0.138   0.138   0.138   0.119   0.119   0.110   0.110
0.110
                0.110   +
   9:            0.110   0.110   0.110   0.110   0.110   0.110   0.110
0.110
                0.110   +
  10:            0.110   0.110   0.110   0.110   0.110   0.110   0.110
0.110
                0.098   +
  11:            0.098   0.098   0.098   0.098   0.098   0.098
                        +
  12:       RET
                                          Step time :      15.00 Minutes
                        Total in original hyetograph :       5.10 Inches
          Adjusting hyetograph from 15.00 minutes to 10.00 minutes
       Total volume rain in production hyetograph :       5.10 Inches
                                   Maximum intensity :       2.05 Inches/Hr

------ END OF SUB-FILE ------
   6:
   7: PDA 0.012 8 2 2 2 0.004

                                        Mannings n :       0.0120
                                  Minimum diameter :       8.00 Inches
                                     Minimum depth :       2.00 Feet
                                     Minimum cover :       2.00 Feet
                                  Minimum velocity :       2.00 Feet/Sec
                                     Minimum slope :       0.00400
                                  Maximum diameter :     132.00 Inches


   8:
   9: NEW POND
  10: REM CALCULATE THE RUNOFF
  11: SCS 12.55 .7136 98 86 25

             Total rainfall falling on impervious :  165796.50 CuFt
                                   Impervious runoff :  156764.63 CuFt
                          Portion off impervious :      94.55 %

          Peak CFS rainfall falling on impervious :      18.53 CuFt/Sec
                  Peak CFS runoff from impervious :       9.63 CuFt/Sec
                    Equivalant "C" off impervious :       0.52

               Total rainfall falling on pervious :   66541.65 CuFt
                                     Pervious runoff :   45955.64 CuFt
                            Portion off pervious :      69.06 %
```

```
          Peak CFS rainfall falling on pervious :       7.44 CuFt/Sec
                  Peak CFS runoff from pervious :       2.87 CuFt/Sec
                    Equivalant "C" off pervious :       0.39

             Total rainfall falling on segment :  232338.15 CuFt
                           Total segment runoff :  202720.27 CuFt
                            Portion off segment :      87.25 %

           Peak CFS rainfall falling on segment :      25.97 CuFt/Sec
                   Peak CFS runoff from segment :      12.50 CuFt/Sec
                     Equivalant "C" off segment :       0.48

 12: INL 99
 13: PIP 100 100 100 98 97.6
                                          Length :     100.00 Feet
                              Ground elevation up :     100.00 Feet
                            Ground elevation down :     100.00 Feet
                              Invert elevation up :      98.00 Feet
                            Invert elevation down :      97.60 Feet
                                    Lump sum cost :       0.00 Dollars
                                        ManningsN :       0.01200
                                     Link number :       1
                     Average daily sanitary flow :       0.000 CuFt/Sec
                              Storm flow (no SF) :      12.496 Cuft/Sec
                         Design flow including SF :      12.496 Cuft/Sec
                                      Combined SF :       1.000

                                 Design diameter :      24.00 Inches
                                  Invert elev up :      98.00 Feet
                                Invert elev down :      97.60 Feet
                                           Slope :       0.00400
                            Depth of fluid in pipe :      18.24 Inches
                                             d/D :       0.760
                            Partial flow velocity :       4.880 Feet/Sec

 14:
 15:
 16: END
------ S U M M A R Y   O F   A N A L Y S I S ------

                        Run number on command file :       3
                                  Number of links :       1
                            Number of hydrographs :      28
                       Total sanitary population :       0
                             Total sanitary area :       0.00 Acres
                                Total storm area :      12.55 Acres
                                 Number of pumps :       0
                            Number of reservoirs :       0
                   Number of diversion structures :       0
                                Number of inlets :       1
                             Length of new pipe :     100.00 Feet
                          Length of existing pipe :       0.00 Feet
                               Length of channel :       0.00 Feet
                                Length of gutter :       0.00 Feet
                         Length of transport units :       0.00 Feet
                           Length of pressure pipe :       0.00 Feet
```

```
Status of DEFAULTS at start of run. ( * May be reset by SET)
  |
  |  Command file : C:\HYDRA\CMD\04-190I.CMD
  |  Input units are read as                  : USA
  |* Output sent to display                   : Detailed
  |* Output sent to printer                   : Off
  |* Output sent to file                      : Detailed
  |  Paper width in inches                    : 8.000
  |  String to reset printer                  : 27 38 108 54 68 27 38 107
51 83
  |  String to set printer to compressed      : 21 27 38 107 50 83
  |  String to set printer to 8 lines/inch    : 8 27 38 108 56 68
  |  Name of printer                          : Hewlett-Packard, ThinkJet,
HP mode
  |  Print heading at top of page             : False
  |
  |  Number of steps in hydrograph            : 144
  |  Step length in minutes                   : 10
  |  Significant flow in hydrograph           : 0.010
  |* Maximum plot value                       : Selected by HYDRA
  |  Type of hydrographic plot                : Compact
  |
  |  Sanitary flow by                         : Peaking Factor
  |  Delay to start of actual storm           : 0.00
  |  Rational Method computations             : Off
  |  SCS computations                         : Santa Barbara
  |  Continuous simulation computations       : Off
  |
  |* Maximum d/D for pipe design/analysis     : 0.900
  |* Match point position on pipe             : 0.00 or Invert
  |* Number of allowable diam drops           : 999
  |* Mimimum drop thru manhole                : 0.000
  |  Routing technique                        : Quick
  |
  |* Calculate sanitary flows                 : True
  |* Calculate infiltration flows             : True
  |* Calculate storm flows                    : True
  |* Calculate misc flows                     : True
  |
  |  Listing of acceptable diameters (Changed by the PCO command):
  |      4     6     8    10    12    15    18    21    24    27    30
  |     33    36    39    42    45    48    54    60    66    72    78
  |     84    90    96   102   108   114   120   132
  +-------------------------------------------------------------------

   1: JOB Lakeside Industries Site Plan 100 year 24 hour Event
   2: REM HGA #04-190
   3:
   4: TOT 6.15
                                    Total rainfall :       6.15 Inches


   5: FIL tc100.INC
------START OF SUB-FILE------
   1: HYE 15   0.091  0.091  0.091  0.091  0.091  0.091  0.106  0.123
0.12
          3  0.123+
   2:      0.159  0.159  0.159  0.159  0.176  0.202  0.212  0.212  0.236
0
          .236+
   3:      0.248  0.279  0.308  0.308  0.323  0.323  0.412  0.412  0.373
```

```
0
          .373+
   4:      0.971  2.514  0.553  0.367  0.508  0.391  0.389  0.539  0.579
0
          .333+
   5:      0.449  0.466  0.292  0.292  0.272  0.272  0.272  0.272  0.272
0
          .272+
   6:      0.234  0.234  0.215  0.237  0.241  0.259  0.259  0.259  0.237
0
          .237+
   7:      0.227  0.227  0.208  0.189  0.189  0.189  0.164  0.164  0.151
0
          .151+
   8:      0.151  0.151  0.151  0.151  0.151  0.151  0.151  0.151  0.151
0
          .151+
   9:      0.151  0.151  0.151  0.151  0.151  0.151  0.151  0.151  0.151
0
          .136+
  10:      0.136  0.136  0.121  0.121  0.121  0.121
                                        Step time :      15.00 Minutes
                     Total in original hyetograph :       6.15 Inches
          Adjusting hyetograph from 15.00 minutes to 10.00 minutes
       Total volume rain in production hyetograph :       6.15 Inches
                                Maximum intensity :       2.51 Inches/Hr

  11: RET
------ END OF SUB-FILE ------
   6:
   7: PDA 0.012 8 2 2 2 0.004

                                       Mannings n :       0.0120
                                 Minimum diameter :       8.00 Inches
                                    Minimum depth :       2.00 Feet
                                    Minimum cover :       2.00 Feet
                                 Minimum velocity :       2.00 Feet/Sec
                                    Minimum slope :       0.00400
                                 Maximum diameter :     132.00 Inches


   8:
   9: NEW POND
  10: REM CALCULATE THE RUNOFF
  11: SCS 12.55 .7136 98 86 25

            Total rainfall falling on impervious :  199931.08 CuFt
                                Impervious runoff :  190525.91 CuFt
                          Portion off impervious :      95.30 %

         Peak CFS rainfall falling on impervious :      22.70 CuFt/Sec
                 Peak CFS runoff from impervious :      11.87 CuFt/Sec
                   Equivalant "C" off impervious :       0.52

              Total rainfall falling on pervious :   80241.40 CuFt
                                  Pervious runoff :   58759.22 CuFt
                            Portion off pervious :      73.23 %

           Peak CFS rainfall falling on pervious :       9.11 CuFt/Sec
                   Peak CFS runoff from pervious :       3.65 CuFt/Sec
                     Equivalant "C" off pervious :       0.40
```

```
                Total rainfall falling on segment :  280172.47 CuFt
                            Total segment runoff :  249285.14 CuFt
                             Portion off segment :      88.98 %

            Peak CFS rainfall falling on segment :      31.82 CuFt/Sec
                    Peak CFS runoff from segment :      15.51 CuFt/Sec
                      Equivalant "C" off segment :       0.49

 12: INL 99
 13: PIP 1 187 187
                                          Length :       1.00 Feet
                              Ground elevation up :     187.00 Feet
                            Ground elevation down :     187.00 Feet
                                     Lump sum cost :       0.00 Dollars
                                         ManningsN :       0.01200
                                       Link number :       1
                     Average daily sanitary flow :       0.000 CuFt/Sec
                              Storm flow (no SF) :      15.512 Cuft/Sec
                         Design flow including SF :      15.512 Cuft/Sec
                                      Combined SF :       1.000

                                   Design diameter :      24.00 Inches
                                     Invert elev up :     182.83 Feet
                                   Invert elev down :     182.83 Feet
                                              Slope :       0.00407
                            Depth of fluid in pipe :      21.36 Inches
                                               d/D :       0.890
                             Partial flow velocity :       5.169 Feet/Sec

 14:
 15: RES -1 0/0.00 1000/6.453 500000/6.453 1000000/6.453 2000000/6.453

      Number of points on Volume/Discharge curve :       5
                 Maximum capacity of reservoir : 2000000.00 CuFt
                              Outlet elevation :      -1.00 Feet
                                    Link number :       2
                     Average daily sanitary flow :       0.000 CuFt/Sec
                              Storm flow (no SF) :      15.512 Cuft/Sec
                         Design flow including SF :      15.512 Cuft/Sec
                                      Combined SF :       1.000

Diversion hydrographs :
          I - Incoming hydrograph in CFS
                  X - Exit hydrograph in CFS
                          V - Volume of Reservoir in CuFt
                              divided by 1000
                            0.00      5.00      10.00      15.00
20.00
  Time                      +---------+---------+---------+---------+
     0    0.00    0.00    0.00 |         |         |         |         |
    10    0.00    0.00    0.00 |         |         |         |         |
    20    0.00    0.00    0.00 |         |         |         |         |
    30    0.00    0.00    0.00 |         |         |         |         |
    40    0.06    0.05    0.01 |         |         |         |         |
    50    0.12    0.11    0.01 |         |         |         |         |
    60    0.18    0.17    0.02 |         |         |         |         |
    70    0.24    0.23    0.02 |         |         |         |         |
    80    0.30    0.29    0.03 |         |         |         |         |
    90    0.36    0.36    0.03 |         |         |         |         |
   100    0.43    0.42    0.04 |         |         |         |         |
```

```
110     0.49     0.48     0.05 |          |          |          |          |
120     0.61     0.59     0.06 |          |          |          |          |
130     0.67     0.66     0.06 |          |          |          |          |
140     0.73     0.72     0.07 |          |          |          |          |
150     0.79     0.78     0.08 |*         |          |          |          |
160     0.91     0.89     0.09 |*         |          |          |          |
170     0.97     0.96     0.09 |*         |          |          |          |
180     1.03     1.02     0.10 |*         |          |          |          |
190     1.09     1.09     0.10 |*         |          |          |          |
200     1.16     1.15     0.11 |*         |          |          |          |
210     1.22     1.21     0.12 |*         |          |          |          |
220     1.34     1.32     0.13 | *        |          |          |          |
230     1.46     1.44     0.14 | *        |          |          |          |
240     1.58     1.56     0.15 | *        |          |          |          |
250     1.70     1.68     0.16 | *        |          |          |          |
260     1.76     1.75     0.17 |  *       |          |          |          |
270     1.89     1.87     0.18 |  *       |          |          |          |
280     2.01     1.99     0.19 |  *       |          |          |          |
290     2.13     2.11     0.20 |  *       |          |          |          |
300     2.19     2.18     0.21 |  *       |          |          |          |
310     2.31     2.29     0.22 |   *      |          |          |          |
320     2.49     2.47     0.24 |   *      |          |          |          |
330     2.62     2.60     0.25 |   *      |          |          |          |
340     2.86     2.82     0.27 |    *     |          |          |          |
350     2.98     2.96     0.28 |    *     |          |          |          |
360     3.10     3.08     0.29 |    *     |          |          |          |
370     3.22     3.20     0.31 |    *     |          |          |          |
380     3.28     3.28     0.31 |     *    |          |          |          |
390     3.53     3.49     0.33 |     *    |          |          |          |
400     3.89     3.84     0.37 |      *   |          |          |          |
410     4.08     4.05     0.39 |      *   |          |          |          |
420     4.20     4.18     0.40 |      *   |          |          |          |
430     4.20     4.20     0.40 |      *   |          |          |          |
440     4.20     4.20     0.40 |      *   |          |          |          |
450     5.35     5.17     0.51 |        XI|          |          |          |
460     8.82     6.45     1.93 |  V       | X    I   |          |          |
470    14.17     6.45     6.56 |          | *        |       I  |          |
480    15.51     6.45    11.99 |          | X        |  V       I          |
490    12.35     6.45    15.53 |          | X        |   I      V          |
500     9.92     6.45    17.61 |          | X      I|          |   V      |
510     8.33     6.45    18.74 |          | X   I    |          |     V    |
520     7.48     6.45    19.36 |          | X I      |          |       V  |
530     6.69     6.45    19.50 |          | *        |          |       V  |
540     6.02     6.45    19.24 |          |IX        |          |      V   |
550     5.72     6.45    18.80 |         I X        |          |      V   |
560     5.84     6.45    18.43 |         |IX        |          |     V    |
570     6.14     6.45    18.25 |         |IX        |          |    V     |
580     6.20     6.45    18.10 |         |IX        |          |    V     |
590     5.72     6.45    17.66 |         I X        |          |   V      |
600     5.41     6.45    17.04 |         I X        |          |  V       |
610     5.47     6.45    16.45 |         I X        |          | V        |
620     5.54     6.45    15.90 |         I X        |          |V         |
630     5.23     6.45    15.17 |        I| X        |        V|          |
640     4.68     6.45    14.11 |       I | X        |      V  |          |
650     4.32     6.45    12.82 |       I | X        |    V    |          |
660     4.02     6.45    11.36 |      I  | X        | V       |          |
670     3.77     6.45     9.75 |      I  | X      V|          |          |
680     3.65     6.45     8.07 |     I   | X  V     |          |          |
690     3.53     6.45     6.32 |     I   | *        |          |          |
700     3.47     6.45     4.53 |     I V | X        |          |          |
710     3.41     6.45     2.70 |   V I   | X        |          |          |
```

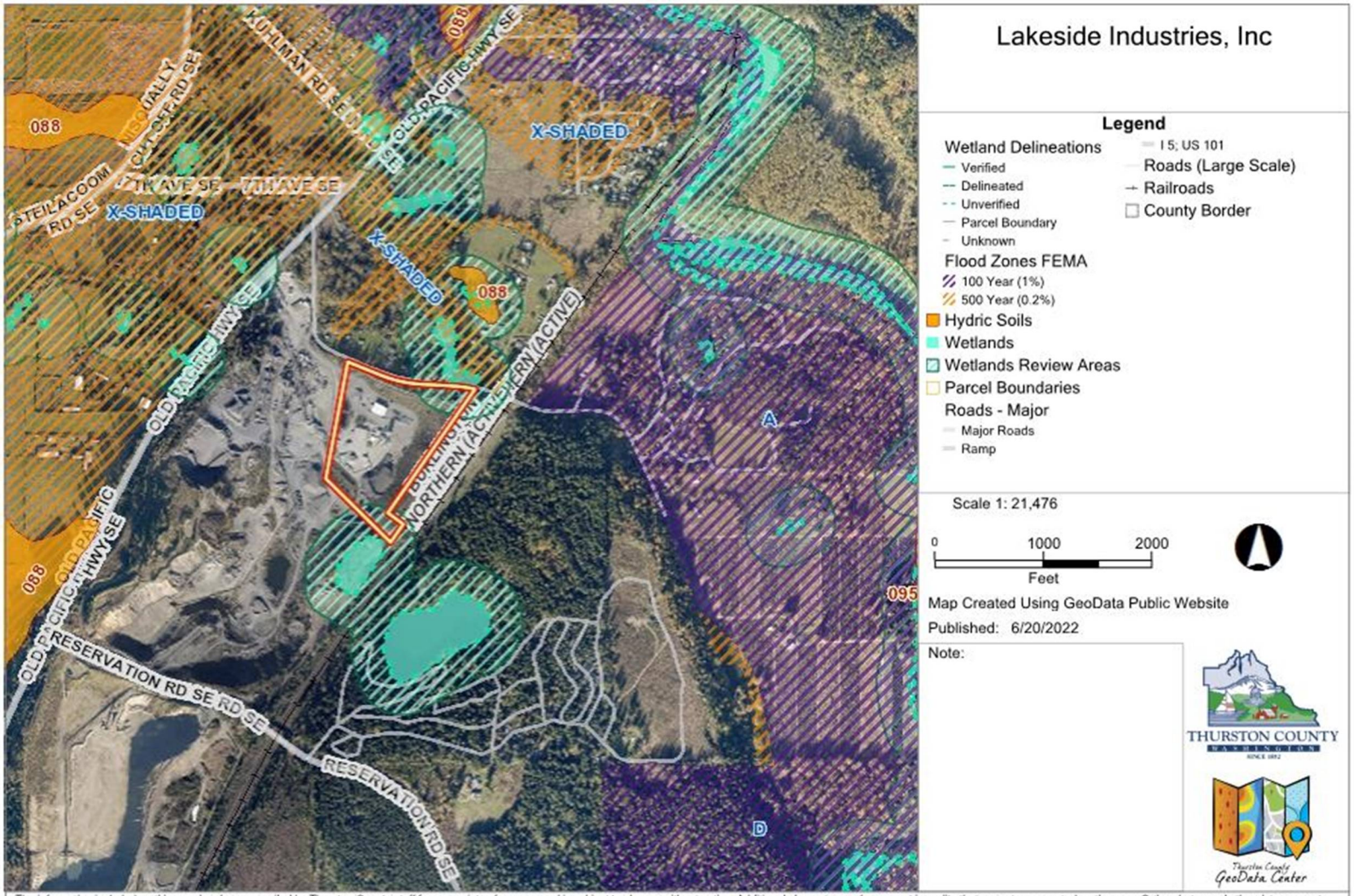
720	3.41	6.45	0.87	V I X
730	3.41	4.31	0.33	I X
740	3.35	3.36	0.32	*
750	3.29	3.29	0.31	*
760	3.16	3.18	0.30	*
770	3.04	3.06	0.29	*
780	2.98	2.99	0.28	*
790	2.86	2.88	0.27	*
800	2.86	2.86	0.27	*
810	2.92	2.91	0.28	*
820	2.92	2.92	0.28	*
830	2.98	2.97	0.28	*
840	3.10	3.08	0.29	*
850	3.10	3.10	0.29	*
860	3.16	3.15	0.30	*
870	3.10	3.11	0.29	*
880	3.04	3.05	0.29	*
890	3.04	3.04	0.29	*
900	2.98	2.99	0.28	*
910	2.92	2.93	0.28	*
920	2.86	2.87	0.27	*
930	2.80	2.81	0.27	*
940	2.74	2.75	0.26	*
950	2.62	2.64	0.25	*
960	2.49	2.51	0.24	*
970	2.43	2.44	0.23	*
980	2.43	2.43	0.23	*
990	2.37	2.38	0.23	*
1000	2.25	2.27	0.21	*
1010	2.19	2.20	0.21	*
1020	2.13	2.14	0.20	*
1030	2.01	2.03	0.00	*
1040	1.95	1.96	0.00	*
1050	1.95	1.95	0.00	*
1060	1.95	1.95	0.00	*
1070	1.89	1.90	0.00	*
1080	1.89	1.89	0.00	*
1090	1.89	1.89	0.00	*
1100	1.89	1.89	0.00	*
1110	1.89	1.89	0.00	*
1120	1.89	1.89	0.00	*
1130	1.89	1.89	0.00	*
1140	1.89	1.89	0.00	*
1150	1.89	1.89	0.00	*
1160	1.89	1.89	0.00	*
1170	1.89	1.89	0.00	*
1180	1.89	1.89	0.00	*
1190	1.89	1.89	0.00	*
1200	1.89	1.89	0.00	*
1210	1.89	1.89	0.00	*
1220	1.89	1.89	0.00	*
1230	1.89	1.89	0.00	*
1240	1.89	1.89	0.00	*
1250	1.89	1.89	0.00	*
1260	1.89	1.89	0.00	*
1270	1.89	1.89	0.00	*
1280	1.89	1.89	0.00	*
1290	1.89	1.89	0.00	*
1300	1.89	1.89	0.00	*
1310	1.89	1.89	0.00	*
1320	1.89	1.89	0.00	*

```
  1330    1.89    1.89    0.00 |  *      |         |         |         |
  1340    1.83    1.83    0.00 |  *      |         |         |         |
  1350    1.76    1.77    0.00 |  *      |         |         |         |
  1360    1.76    1.76    0.00 |  *      |         |         |         |
  1370    1.70    1.71    0.00 | *       |         |         |         |
  1380    1.70    1.70    0.00 | *       |         |         |         |
  1390    1.64    1.65    0.00 | *       |         |         |         |
  1400    1.58    1.59    0.00 | *       |         |         |         |
  1410    1.58    1.58    0.00 | *       |         |         |         |
  1420    1.52    1.53    0.00 | *       |         |         |         |
  1430    0.00    0.24    0.00 |         |         |         |         |
  Time                           +---------+---------+---------+---------+
                                0.00      5.00     10.00     15.00
20.00


  16:
  17: END
------ S U M M A R Y   O F   A N A L Y S I S ------

                        Run number on command file :       4
                                   Number of links :       2
                             Number of hydrographs :      37
                         Total sanitary population :       0
                               Total sanitary area :       0.00 Acres
                                  Total storm area :      12.55 Acres
                                   Number of pumps :       0
                               Number of reservoirs :       1
                     Number of diversion structures :       0
                                  Number of inlets :       1
                                Length of new pipe :       1.00 Feet
                           Length of existing pipe :       0.00 Feet
                                 Length of channel :       0.00 Feet
                                  Length of gutter :       0.00 Feet
                         Length of transport units :       0.00 Feet
                           Length of pressure pipe :       0.00 Feet
```

Thurston County Wetland Map (GIS)



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FEMA Flood Hazard Map

National Flood Hazard Layer FIRMette

Legend

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

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

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/20/2022 at 7:30 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Resource Protection Well Map

Figure 1.
Current Groundwater Monitoring Locations, Lakeside Durgin Road Plant

From July 11, 2022 Technical Memorandum prepared by Parametrix for Lakeside Industries, Inc. under job number 555-1857-002 (11.02)