Port of Kalama

Port of Kalama Marina Improvements

Stormwater Site Plan Report

June 2015

WE Job No. 1371A

wallis engineering

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I. Project Overview

The Port of Kalama Marina Improvements Project constitutes the development of approximately 3.4 Acres. The proposed project includes parking lot paving, pathways, sidewalks, and rain gardens.

The project is based within the City of Kalama. The City of Kalama stormwater standards are based upon the 1992 Stormwater Management Manual for the Puget Sound Basin and the following stormwater design reflects the requirements of this manual. However, we are basing our stormwater design on the 2005 Manual.

See Appendix A for details of existing and proposed site plan. The following design represents how the project will address minimum requirements #1 through #5:

II. Site Plan

Minimum Requirement #1 – Preparation of Stormwater Site Plans

1. Existing Conditions

Existing Drainage - The project site currently discharges overland to the Columbia River. There are two clogged catchbasins within the project boundaries.

Site Soils - The Port of Kalama marina was constructed with dredge sand material in 1963. The sand was derived from the US Army Corp of Engineers' channelizing efforts within the adjacent Columbia River. The soils consist mainly of Pilchuck loamy fine sand. A site soil map was obtained from the NRCS website, see Appendix B for additional details.

An infiltration report was prepared by Columbia West Engineering in March 2014. See Appendix C for full report and figures. The following information relative to the stormwater design is contained within this report:

> **Groundwater:** "Groundwater was not encountered within the subsurface exploration and is anticipated to coincide with the elevation of the Columbia River. Seasonal and dam-release river level and tidal fluctuations within the nearby Columbia River may influence local groundwater conditions. Groundwater levels are also often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Structures and drainage design should be planned accordingly."

Stormwater Infiltration Rate Estimates: "Seven infiltration tests were conducted at the site at depths of 2 to 5.5 feet below original ground surface. The single-ring, falling head infiltration test method was used. Tests were conducted by filling the apparatus with water, allowing the soil sample to saturate, and recording time and drop measurements at regular intervals. Using Darcy's Law for saturated flow in homogeneous media, the coefficient of permeability was then calculated to develop estimated infiltration rates. Estimated infiltration rates have been reported without application of a factor of safety… the infiltration tests were conducted at various depths in poorly graded sand (SP) soils. The tested infiltration rates ranged from 17 to 74 inches per hour."

"Columbia West provides the following recommendations for design and construction of the proposed stormwater management systems in the northern and southern study areas:

- Infiltration facilities should be protected from erosion, especially during construction. Improperly designed or constructed systems may become fouled or plugged with mud or micaceous sediment.
- If infiltration is considered, excavation and preparation of stormwater disposal facilities should be closely monitored by a geotechnical engineer and an appropriate factor of safety should be applied to the infiltration rates provided in Table 1 prior to use in design calculations. An emergency overflow discharge point should be provided.
- Due to variations in fill materials encountered at the site, as well as seasonally fluctuating groundwater conditions, infiltration rates are anticipated to vary throughout the site. Therefore, infiltration rates should be verified by additional testing during construction when subgrade soils are exposed. All subgrade soils should be observed by the geotechnical engineer to verify soil index properties pertaining to infiltration are similar to those at the tested locations.
- The elevation of the groundwater table is likely to have significant impact upon soil infiltration rates. The potential for reduced infiltration or partially submerged systems during flood events should be understood.
- Site soil conditions and localized infiltration capability may be highly variable. Limited one-day infiltration testing may not be an accurate predictor of long-term, post-developed system performance for sites with complex and highly variable soils. It should be understood that the systems may require additional infiltration capacity if future conditions indicate the systems are not functioning according to original tested and designed parameters.
- This Infiltration Testing Results Report does not address potential geotechnical issues related to the effects of stormwater infiltration adjacent to site slopes. Columbia West understands that slope stability has been addressed by a separate consultant in a site specific report."

Slope Analysis - GeoDesign, Inc. performed slope stability analysis for this project. See Appendix D for the full report. GeoDesign, Inc. assumes that the proposed stormwater infiltration would raise groundwater levels by 5 feet over the normal groundwater level. The analysis indicates a 5.6 percent reduction in the slope safety factor, which the geotechnical engineer deems as acceptable.

Floodplains – The project site is within a FEMA flood zone C and surrounded by the Columbia River, which is in Zone A7. Zone C indicates an area of minimal flooding. Zone A7 is a 100-year flood area with known base flood elevations. The FEMA floodmap for the project area can be found in Appendix E.

2. **Permanent Stormwater Control Plan**
   A Permanent Stormwater Control Plan for this project can be found in Appendix A.

3. **Off-site Analysis**
   All discharges proceed to the Columbia River. Runoff to the site currently discharges to catch basins located in the center of the parking areas. The catch basins then discharge to the Columbia via culverts. This system will be removed and replaced with infiltrating rain gardens. No new outfalls or discharges are anticipated, off-site analysis is not required for this site.

4. **Applicable Minimum Requirements**
   Per Figure 2.3 of the Stormwater Management Manual of Western Washington (SMMWW), the value of the proposed improvements do not exceed 50% of the assessed value of the existing site improvements, therefore it is assumed that the project will be required to address only minimum requirements #1 through #5 (see Figure 2.3 of the SMMWW in Appendix F). The assessed value of the existing property was obtained from the County GIS assessor parcel data and is $5,028,810 (included as Appendix G). The value of the proposed improvements are estimated to be $1,144,137 according to J.D. Walsh & Associates. The estimate of proposed improvements is included in Appendix H.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention (SWPP)

The Construction Stormwater Pollution Prevention (SWPP) for this project can be found in Appendix I.

A large parcel erosion and sediment control plan addressing the ESC minimum requirements has been prepared and included in this report as Appendix J.

Minimum Requirement #3 – Source Control of Pollution

The project site will operate as a parking lot. Applicable BMPs for Landscaping and Lawn/Vegetation Management, Maintenance of Stormwater Drainage and Treatment Systems, Parking and Storage of Vehicles and Equipment, and Roof/ Building Drains and Manufacturing and Commercial Buildings are anticipated. The site operator will follow the BMPs for Landscaping and Lawn/Vegetation Management, Maintenance of

Stormwater Drainage and Treatment Systems, Parking and Storage of Vehicles and Equipment, and Roof/ Building Drains and Manufacturing and Commercial Buildings as necessary.

See below for BMP details for Landscaping and Lawn/Vegetation Management:

Description of Pollutant Sources: Landscaping can include grading, soil transfer, vegetation removal, pesticide and fertilizer applications, and watering. Stormwater contaminants include toxic organic compounds, heavy metals, oils, total suspended solids, coliform bacteria, fertilizers, and pesticides.

Lawn and vegetation management can include control of objectionable weeds, insects, mold, bacteria and other pests with chemical pesticides and is conducted commercially at commercial, industrial, and residential sites. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; sap stain and insect control on lumber and logs; rooftop moss removal; killing nuisance rodents; fungicide application to patio decks, and residential lawn/plant care. Toxic pesticides such as pentachlorophenol, carbamates, and organometallics can be released to the environment by leaching and dripping from treated parts, container leaks, product misuse, and outside storage of pesticide contaminated materials and equipment. Poor management of the vegetation and poor application of pesticides or fertilizers can cause appreciable stormwater contamination.

Pollutant Control Approach: Control of fertilizer and pesticide applications, soil erosion, and site debris to prevent contamination of stormwater.

Develop and implement an Integrated Pest Management Plan (IPM) and use pesticides only as a last resort. If pesticides/herbicides are used they must be carefully applied in accordance with label instructions on U.S. Environmental Protection Agency (EPA) registered materials.

Maintain appropriate vegetation, with proper fertilizer application where practicable, to control erosion and the discharge of stormwater pollutants. Where practicable grow plant species appropriate for the site, or adjust the soil properties of the subject site to grow desired plant species.

Applicable Operational BMPs for Landscaping:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Do not dispose of collected vegetation into waterways or storm drainage systems.

Recommended Additional Operational BMPs for Landscaping:

- Conduct mulch-mowing whenever practicable

- Dispose of grass clippings, leaves, sticks, or other collected vegetation, by composting, if feasible.
- Use mulch or other erosion control measures when soils are exposed for more than one week during the dry season or two days during the rainy season.
- If oil or other chemicals are handled, store and maintain appropriate oil and chemical spill cleanup materials in readily accessible locations. Ensure that employees are familiar with proper spill cleanup procedures.
- Till fertilizers into the soil rather than dumping or broadcasting onto the surface. Determine the proper fertilizer application for the types of soil and vegetation encountered.
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Use manual and/or mechanical methods of vegetation removal rather than applying herbicides, where practical.

Applicable Operational BMPs for the Use of Pesticides:

- Develop and implement an IPM (See section on IPM at end of BMP) and use pesticides only as a last resort.
- Implement a pesticide-use plan and include at a minimum: a list of selected pesticides and their specific uses; brands, formulations, application methods and quantities to be used; equipment use and maintenance procedures; safety, storage, and disposal methods; and monitoring, record keeping, and public notice procedures. All procedures shall conform to the requirements of Chapter 17.21 RCW and Chapter 16-228 WAC (Appendix IV-D R.7).
- Choose the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. The pesticide should readily degrade in the environment and/or have properties that strongly bind it to the soil. Any pest control used should be conducted at the life stage when the pest is most vulnerable. For example, if it is necessary to use a Bacillus thuringiens is application to control tent caterpillars, it must be applied before the caterpillars cocoon or it will be ineffective. Any method used should be site-specific and not used wholesale over a wide area.
- Apply the pesticide according to label directions. Under no conditions shall pesticides be applied in quantities that exceed manufacturer's instructions.
- Mix the pesticides and clean the application equipment in an area where accidental spills will not
- Store pesticides in enclosed areas or in covered impervious containment. Ensure that pesticide contaminated stormwater or spills/leaks of pesticides are not discharged to storm drains. Do not hose down the paved areas to a storm drain or conveyance ditch. Store and maintain appropriate spill cleanup materials in a location known to all near the storage area.
- Clean up any spilled pesticides and ensure that the pesticide contaminated waste materials are kept in designated covered and contained areas.

- The pesticide application equipment must be capable of immediate shutoff in the event of an emergency.
- Do not spray pesticides within 100 feet of open waters including wetlands, ponds, and streams, sloughs and any drainage ditch or channel that leads to open water except when approved by Ecology or the local jurisdiction. All sensitive areas including wells, creeks and wetlands must be flagged prior to spraying.
- As required by the local government or by Ecology, complete public posting of the area to be sprayed prior to the application.
- Spray applications should only be conducted during weather conditions as specified in the label direction and applicable local and state regulations. Do not apply during rain or immediately before expected rain.

Recommended Additional Operational BMPs for the use of pesticides:

- Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal.
- Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes. The following are three possible mechanisms for disease control by compost addition (USEPA Publication 530-F-9-044):

    1. Successful competition for nutrients by antibiotic production;
    2. Successful predation against pathogens by beneficial microorganism; and
    3. Activation of disease-resistant genes in plants by composts.

Installing an amended soil/landscape system can preserve both the plant system and the soil system more effectively. This type of approach provides a soil/landscape system with adequate depth, permeability, and organic matter to sustain itself and continue working as an effective stormwater infiltration system and a sustainable nutrient cycle.

- Once a pesticide is applied, its effectiveness should be evaluated for possible improvement. Records should be kept showing the applicability and inapplicability of the pesticides considered.
- An annual evaluation procedure should be developed including a review of the effectiveness of pesticide applications, impact on buffers and sensitive areas (including potable wells), public concerns, and recent toxicological information on pesticides used/proposed for use. If individual or public potable wells are located in the proximity of commercial pesticide applications contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary.
- Rinseate from equipment cleaning and/or triple-rinsing of pesticide containers should be used as product or recycled into product.
- The application equipment used should be capable of immediate shutoff in the event of an emergency.

For more information, contact the WSU Extension Home-Assist Program, (253) 445-4556, or Bio-Integral Resource Center (BIRC), P.O. Box 7414, Berkeley, CA.94707, or the Washington Department of Ecology to obtain "Hazardous Waste Pesticides" (Publication #89-41); and/or EPA to obtain a publication entitled "Suspended, Canceled and Restricted Pesticides" which lists all restricted pesticides and the specific uses that are allowed. Valuable information from these sources may also be available on the internet.

Applicable Operational BMPs for Vegetation Management:

- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can substantially improve the permeability of the soil, the disease and drought resistance of the vegetation, and reduce fertilizer demand. This reduces the demand for fertilizers, herbicides, and pesticides. Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. If natural plant debris and mulch are returned to the soil, this system can continue recycling nutrients indefinitely.
- Select the appropriate turfgrass mixture for your climate and soil type. Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects. They do not, however, repel root-feeding lawn pests such as Crane Fly larvae, and are toxic to ruminants such as cattle and sheep. The fungus causes no known adverse effects to the host plant or to humans. Endophytic grasses are commercially available and can be used in areas such as parks or golf courses where grazing does not occur. The local Cooperative Extension office can offer advice on which types of grass are best suited to the area and soil type.
- Use the following seeding and planting BMPs, or equivalent BMPs to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: Temporary Seeding, Mulching and Matting, Clear Plastic Covering, Permanent Seeding and Planting, and Sodding as described in Volume II).
- Selection of desired plant species can be made by adjusting the soil properties of the subject site. For example, a constructed wetland can be designed to resist the invasion of reed canary grass by layering specific strata of organic matters (e.g., compost forest product residuals) and creating a mildly acidic pH and carbon-rich soil medium. Consult a soil restoration specialist for site-specific conditions.
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Aeration should be conducted while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than ¾-inch deep.
- Mowing is a stress-creating activity for turfgrass. When grass is mowed too short its productivity is decreased and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease prone and more

reliant on outside means such as pesticides, fertilizers and irrigation to remain healthy. Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.

Irrigation:

- The depth from which a plant normally extracts water depends on the rooting depth of the plant. Appropriately irrigated lawn grasses normally root in the top 6 to 12 inches of soil; lawns irrigated on a daily basis often root only in the top 1 inch of soil. Improper irrigation can encourage pest problems, leach nutrients, and make a lawn completely dependent on artificial watering. The amount of water applied depends on the normal rooting depth of the turfgrass species used, the available water holding capacity of the soil, and the efficiency of the irrigation system. Consult with the local water utility, Conservation District, or Cooperative Extension office to help determine optimum irrigation practices.

Fertilizer Management:

- Turfgrass is most responsive to nitrogen fertilization, followed by potassium and phosphorus. Fertilization needs vary by site depending on plant, soil and climatic conditions. Evaluation of soil nutrient levels through regular testing ensures the best possible efficiency and economy of fertilization. For details on soils testing, contact the local Conservation District or Cooperative Extension Service.
- Fertilizers should be applied in amounts appropriate for the target vegetation and at the time of year that minimizes losses to surface and ground waters. Do not fertilize during a drought or when the soil is dry. Alternatively, do not apply fertilizers within three days prior to predicted rainfall. The longer the period between fertilizer application and either rainfall or irrigation, the less fertilizer runoff occurs.
- Use slow release fertilizers such as methylene urea, IDBU, or resin coated fertilizers when appropriate, generally in the spring. Use of slow release fertilizers is especially important in areas with sandy or gravelly soils.
- Time the fertilizer application to periods of maximum plant uptake. Generally fall and spring applications are recommended, although WSU turf specialists recommend four fertilizer applications per year.
- Properly trained persons should apply all fertilizers. At commercial and industrial facilities fertilizers should not be applied to grass swales, filter strips, or buffer areas that drain to sensitive water bodies unless approved by the local jurisdiction.

Integrated Pest Management

An IPM program might consist of the following steps:
Step 1: Correctly identify problem pests and understand their life cycle
Step 2: Establish tolerance thresholds for pests.
Step 3: Monitor to detect and prevent pest problems.

Step 4: Modify the maintenance program to promote healthy plants and discourage pests.
Step 5: Use cultural, physical, mechanical or biological controls first if pests exceed the tolerance thresholds.
Step 6: Evaluate and record the effectiveness of the control and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

See below for BMP details for Maintenance of Stormwater Drainage and Treatment Systems:

Description of Pollutant Sources: Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil and water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in Volume V. Roadside catch basins can remove from 5 to 15 percent of the pollutants present in stormwater. When catch basins are about 60 percent full of sediment, they cease removing sediments. Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

Pollutant Control Approach: Provide maintenance and cleaning of debris, sediments, and oil from stormwater collection, conveyance, and treatment systems to obtain proper operation.

Applicable Operational BMPs:
Maintain stormwater treatment facilities according to the O & M procedures presented in Section 4.6 of Volume V in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine whether improvements in O & M are needed.
- Promptly repair any deterioration threatening the structural integrity of the facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure that storm sewer capacities are not exceeded and that heavy sediment discharges to the sewer system are prevented.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to a local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT Type 1L basins) may have as little as 12 inches sediment storage below the invert. These catch basins will need more frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.

- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catchbasin.
- Post warning signs; “Dump No Waste - Drains to Ground Water,” “Streams,” “Lakes,” or emboss on or adjacent to all storm drain inlets *where practical*.
- Disposal of sediments and liquids from the catch basins must comply with “Recommendations for Management of Street Wastes” described in Appendix IV-G of this volume.

Additional Applicable BMPs: Select additional applicable BMPs from this chapter depending on the pollutant sources and activities conducted at the facility. Those BMPs include:

- BMPs for Soil Erosion and Sediment Control at Industrial Sites
- BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers
- BMPs for Spills of Oil and Hazardous Substances
- BMPs for Illicit Connections to Storm Drains
- BMPs for Urban Streets.

See below for BMP details for Parking and Storage of Vehicles and Equipment:

Description of Pollutant Sources: Public and commercial parking lots such as retail store, fleet vehicle (including rent-a-car lots and car dealerships), equipment sale and rental parking lots, and parking lot driveways, can be sources of toxic hydrocarbons and other organic compounds, oils and greases, metals, and suspended solids caused by the parked vehicles.

Pollutant Control Approach: If the parking lot is a **high-use site** as defined below, provide appropriate oil removal equipment for the contaminated stormwater runoff.

Applicable Operational BMPs:

- If washing of a parking lot is conducted, discharge the washwater to a sanitary sewer, if allowed by the local sewer authority, or other approved wastewater treatment system, or collect it for off-site disposal.
- Do not hose down the area to a storm drain or to a receiving water. Sweep parking lots, storage areas, and driveways, regularly to collect dirt, waste, and debris.

Applicable Treatment BMPs: An oil removal system such as an API or CP oil and water separator, catch basin filter, or equivalent BMP, approved by the local jurisdiction, is applicable for parking lots meeting the threshold vehicle traffic intensity level of a *high-use site.*

Vehicle High-Use Sites

Establishments subject to a vehicle high-use intensity have been determined to be significant sources of oil contamination of stormwater. Examples of potential high use areas include customer parking lots at fast food stores, grocery stores, taverns, restaurants, large shopping malls, discount warehouse stores, quick-lube shops, and banks.

If the PGIS for a high-use site exceeds 5,000 square feet in a threshold discharge area, and oil control BMP from the Oil Control Menu is necessary. A high-use site at a commercial or industrial establishment has one of the following characteristics: (Gaus/King County, 1994)

- Is subject to an expected average daily vehicle traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area: or
- Is subject to storage of a fleet of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.).

See below for BMP details for Roof/Building Drains at Manufacturing and Commercial Buildings:

Description of Pollutant Sources: Stormwater runoff from roofs and sides of manufacturing and commercial buildings can be sources of pollutants caused by leaching of roofing materials, building vents, and other air emission sources. Vapors and entrained liquid and solid droplets/particles have been identified as potential pollutants in roof/building runoff. Metals, solvents, acidic/alkaline pH, BOD, and organics, are some of the pollutant constituents identified.

Pollutant Control Approach: Evaluate the potential sources of stormwater pollutants and apply source control BMPs where feasible.

Applicable Operational Source Control BMPs:

- If leachates and/or emissions from buildings are suspected sources of stormwater pollutants, then sample and analyze the stormwater draining from the building.
- If a roof/building stormwater pollutant source is identified, implement appropriate source control measures such as air pollution control equipment, selection of materials, operational changes, material recycle, process changes, etc.

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

The site currently drains through existing culverts to the Columbia River from catch basins located within the center of the parking bays. The proposed drainage plan intends to remove the catch basins and infiltrate all stormwater runoff onsite.

No new outfalls to the Columbia River are proposed with this development. This site plan will not cause a significant adverse impact to the Columbia River, any downstream properties, or salmonids. The drainage plan will improve the existing drainage system and reduce pollution to the Columbia River.

Minimum Requirement #5 – On-site Stormwater Management

The total project impacts are over 149,595sf. This area is 100% impervious in existing condition. See table for breakdown of impacted areas below:

Impervious and Pervious area breakdown			
Areas	Existing Conditions	Proposed Conditions	
		Treated in proposed conditions	Untreated in proposed conditions
Impervious Area (paved)	145,777 sf	102,808 sf	19,467 sf
Impervious Area (roof)	3,818 sf	3,818 sf	0 sf
Pervious Area	0 sf	23,502 sf	0 sf
Subtotals	149,595 sf	130,128 sf	19,467 sf
Totals	149,595 sf	149,595 sf	

There are areas noted above as impervious and untreated in proposed conditions. These areas consist of the boat ramp and perimeter sidewalks. Collection and treatment facilities for these areas was not feasible and these areas will discharge directly into the Columbia.

This site plan is anticipated to reduce the amount of disruption of the natural hydrologic characteristics of the site**.** Infiltration will take place using rain gardens. Overflow due to peak flows will be directed to drywells under the rain gardens. This design meets Site Suitability Criteria for Section 3.3.7 of Volume 3 of the 2005 SMMWW:

- The site will be primarily used as a parking lot which is an allowable purpose for an infiltration facility.
- The site is not in or near groundwater protection areas or high vehicle traffic areas. Though the rain gardens will be less than 50 feet from the top of streambank slopes greater than 15%, GeoDesign, Inc. in their slope stability analysis report (see Appendix D) assures that the integrity of the streambanks will not be compromised by the infiltration through the rain gardens. (SSC-1 to SSC - 3)
- The 91st percentile, 24-hour runoff volume (indicated by WWHM or MGS Flood) can infiltrate through the infiltration basin surface within 48 hours. The long term infiltration rate was assumed to be 2 in/hr. This can be calculated using a horizontal projection of the infiltration basin mid-depth dimensions and the estimated long-term infiltration rate. (SSC-4)
- The base of the infiltration basins is greater than 5 feet above the seasonal high-water mark, bedrock, and other low permeability layer. Columbia West did not encounter groundwater or bedrock in any of their borings, which ranged from approximately 8 to 12 feet in depth. Per ACOE data (See Appendix N), the seasonal high water mark for the Columbia in this location is approximate at elevation 12.3, the lowest base of our facilities will be at elevation 21.0. (SSC-5)
- We will be importing suitable soil material for the rain gardens, according to the requirements in SSC-6.
- The slope stability analysis performed by GeoDesign, Inc. (see Appendix D) determined that the slope of the streambank will maintain its integrity, under the

assumption that the proposed system will raise the groundwater table 5 feet above the existing level (SSC-7).

Hydrologic Analysis –
Per Vol III, Ch. 2, Design Storm described in Vol I, Appendix I-B of the 2005 manual, the SBUH method is an acceptable method of analysis and will be used to determine the runoff treatment flows. HydroCAD was used to calculate the flows for the project site. These calculations were made under the assumption that the rain gardens act as one basin because the runoff will be equally distributed to the rain gardens. The rain gardens are designed as flow through planters and any excess flow entering one rain garden will be transferred to the next along proposed concrete gutters. See Appendix K for HydroCAD project report.

The total surface area of rain gardens was 10,627sf and the total storage capacity was 7,188cf. The storage area was calculated assuming a void ratio of 40% in the underlying 1.5' of biofiltraion soils.

The isopluvial maps used to determine the 2, 10, and 100-year storm precipitation can be found in Appendix L.

Washington State Department of Ecology Listed 303(d) Water Body. The project site is adjacent to the Columbia River, which is on the Washington State Department of Ecology 303(d) list of impaired water bodies. The parameters identified by the Washington State Department of Ecology as concerns near our project area are Temperature, Total Dissolved Gas, Dioxin, PCB, Dieldrin, 4,4'-DDE, and Bis(2-Ethylhexyl) Phthalate. The project site is not currently a source for these parameters, nor will it be post-construction.

III. Other Permits

The following permits are applicable to this project:
SEPA
City of Kalama Grading Permit
City of Kalama Critical Areas Permit
City of Kalama Shorelines Substantial Development Permit
Washington State Department (WDOE) Stormwater Construction General Permit

IV. Erosion and Sediment Control Plan

A large parcel erosion and sediment control plan addressing the ESC minimum requirements has been prepared and included in this report as Appendix J.

V. Bond Quantities Worksheet

Adequate funding is available at the Port of Kalama to complete the project as designed. No additional bonding is anticipated.

VI. Maintenance and Operations Manual

An Operation and Maintenance manual for stormwater facilities is included in Appendix M.

VII. References

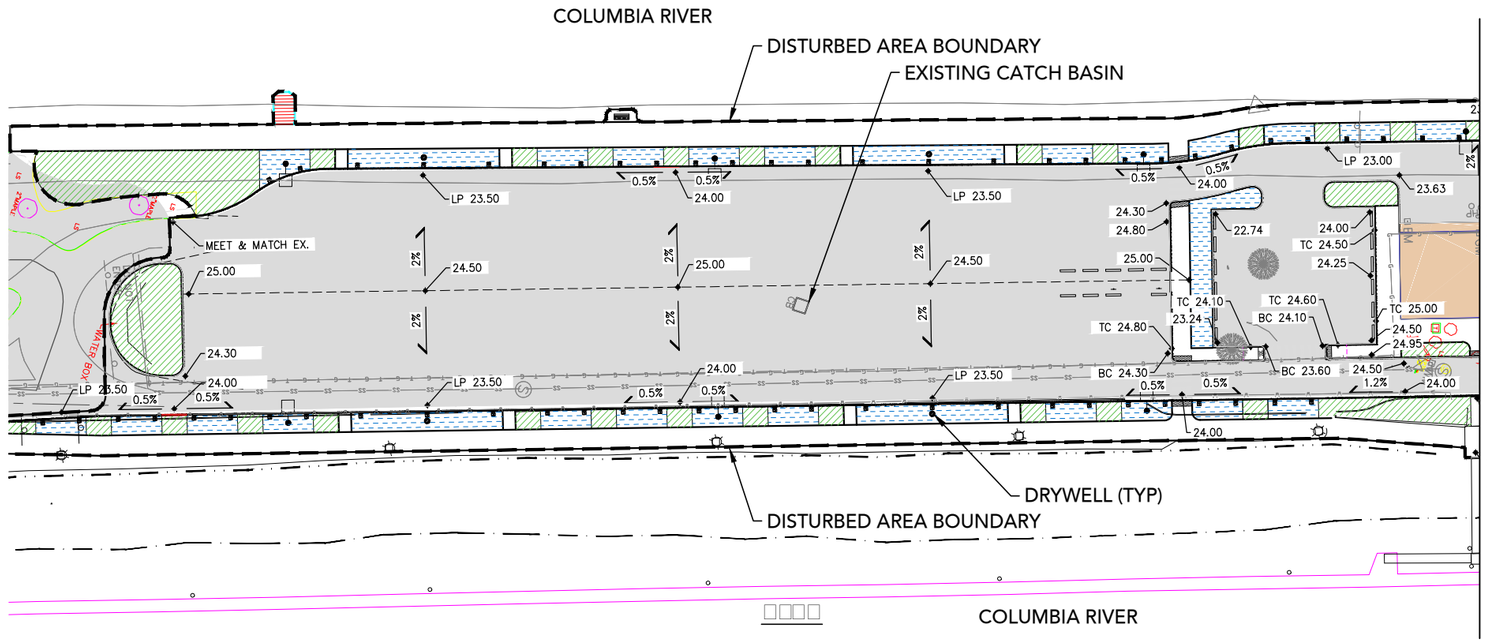
1. United States Department of Agriculture, Natural Resources Conservation Service. "Web Soil Survey." http://websoilsurvey.nrcs.usda.gov/app/

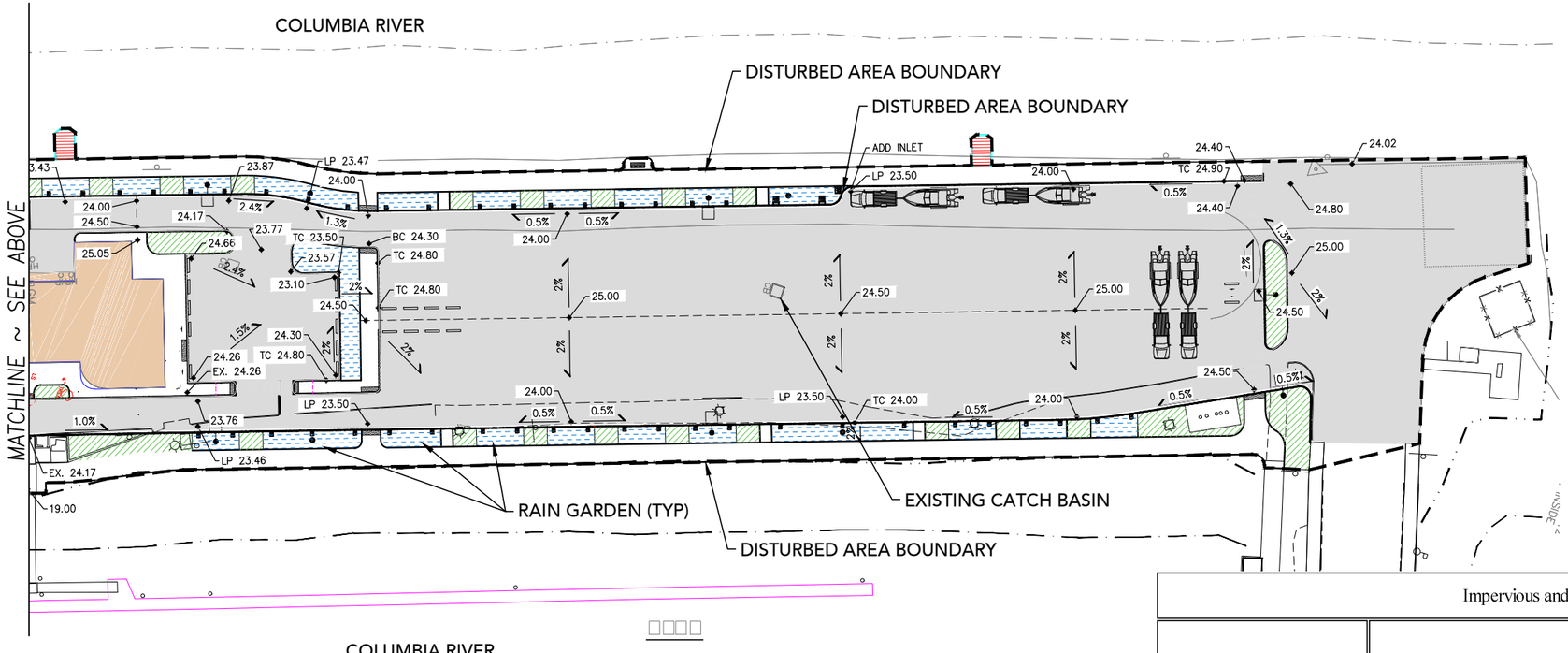
2. Washington State Department of Ecology's "Stormwater Management Manual for the Puget Sound Basin", February 1992.

3. Washington State Department of Ecology's "Stormwater Management Manual for Western Washington," February 2005.

TECHNICAL APPENDIX

A. Permanent Stormwater Control Plan





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NO.	REVISION	BY	DATE

DESIGNED BY: DB
DRAWN BY: CK
REV: DB

ONE INCH AT FULL SCALE
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

PERMANENT STORMWATER CONTROL PLAN

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DATE: 05/2014
PROJECT NO: 1371A

PHASE I
TRAIL AND PARKING IMPROVEMENTS

Port of Kalama

DRAWING NO:
C1
1 OF 1

Impervious and Pervious area breakdown

Areas	Existing Conditions (sf)	Proposed Conditions	
		Treated in proposed conditions (sf)	Untreated in proposed conditions (sf)
Impervious Area (paved)	145,777	102,808	19,467
Impervious Area (roof)	3,818	3,818	0
Pervious Area	0	23,502	0
Subtotals	149,595	130,128	19,467
Totals	149,595	149,595	