Port of Tacoma

Stormwater Management Guidance Manual

March 2015

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Port of Tacoma
Stormwater Management Guidance Manual

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Acronyms and Abbreviations

AKART	"all known, available, and reasonable methods of prevention, control and treatment"
BMPs	Best Management Practices
Ecology	Washington State Department of Ecology
ISGP	Industrial Stormwater General Permit
LID	Low Impact Development
MR	minimum requirements
MS4	municipal separate storm sewer systems
NPDES	National Pollutant Discharge Elimination System
PSP	Puget Sound Partnership
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TAPE	Technology Assessment Protocol-Ecology
TSS	Total Suspended Solids

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1.0 Introduction

1.1 Purpose and Need for this Document

The Port of Tacoma (Port) constructs, operates, and maintains stormwater facilities on Port-owned properties on the Tacoma Tideflats and parts of unincorporated Pierce County. The Port is required to reduce the discharge of pollutants, protect water quality, and meet the requirements of the Clean Water Act as mandated through the National Pollutant Discharge Elimination System (NPDES) permit. In the state of Washington, the NPDES permit is issued by the Washington State Department of Ecology (Ecology) for municipal separate storm sewer systems (MS4). The responsibilities for meeting the NPDES requirements for addressing new development and redevelopment activities on Port-owned properties has, in the past been coordinated through plan review conducted by the City of Tacoma. The purpose of this manual is to allow the Port to assume the responsibilities from the City of Tacoma for stormwater plan review for Port-related projects. It is also intended to allow the Port to tailor stormwater requirements to accommodate the unique industrial activities and physical setting of the Port properties.

This Port of Tacoma Stormwater Management Guidance Manual is intended to complement the City of Tacoma Stormwater Management Manual and other Ecology-approved stormwater management manuals.

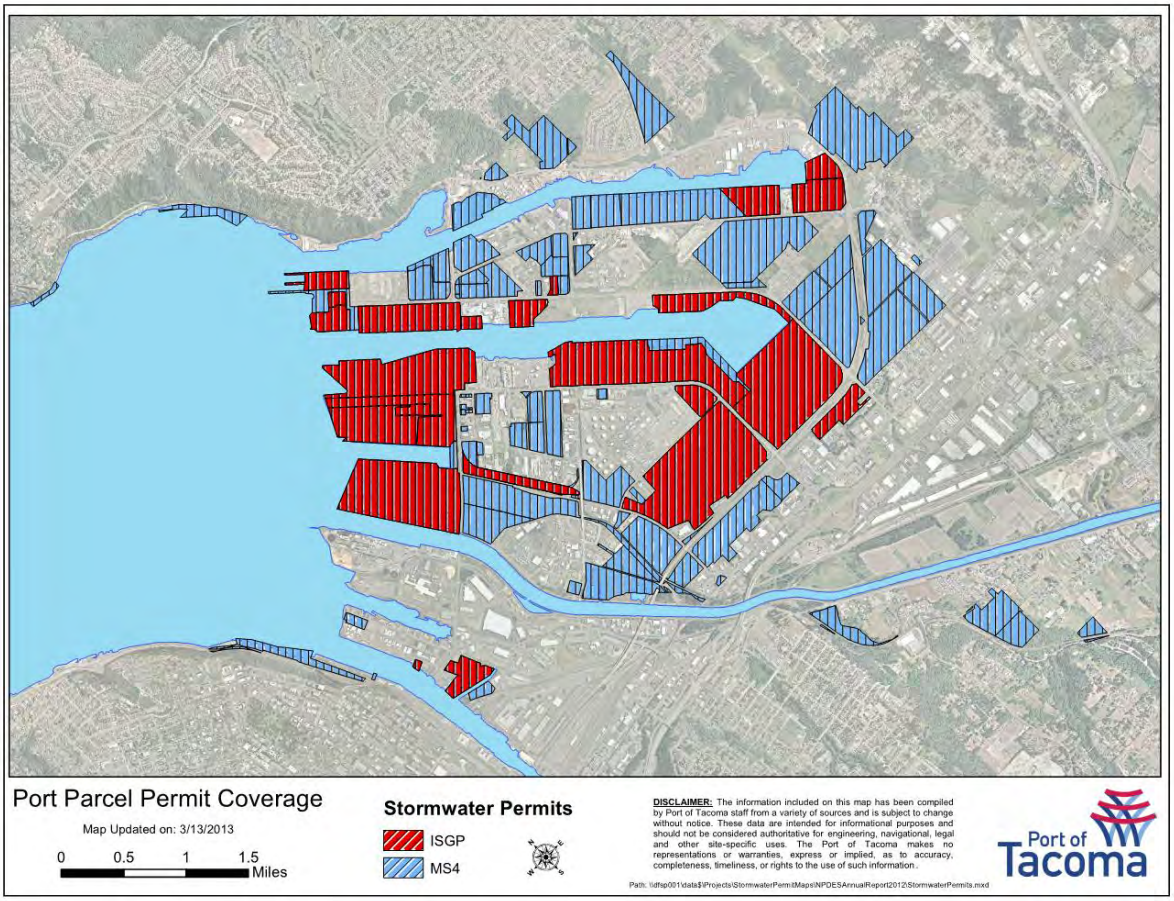
1.2 Regulatory Framework

Stormwater originating on Port-owned properties is regulated under the Clean Water Act by a NPDES permit issued by Ecology. The Port is identified as a secondary permittee under the Phase 1 Municipal Stormwater permit (MS4). Under the NPDES permit, the Port is responsible for complying with applicable requirements for the municipal separate storm sewers it owns or operates, including tenant-occupied properties.

The current NPDES permit was issued August 1, 2013 and will be valid until July 31, 2018. Under the permit, the Port is required to follow all conditions except S5 (Stormwater Management Program) and S6.D (Stormwater Management Program for Secondary Permittees). Instead, the Port is required to comply with S1-S4, S7-S9, and specifically with S6.E, Stormwater Management Program for the Port of Seattle and Port of Tacoma. Condition S6.E defines the actions and activities the Port is required to conduct to meet their NPDES requirements. The Port has been actively implementing their permit-mandated stormwater management program since the issuance of the first permit in 2007.

Portions of Port properties are also covered under the Industrial Stormwater General Permit (ISGP) as required for certain industrial activities. The Port currently manages ISGPs for several individual tenants and port-operated terminals, some of whom have been through Level 3 corrective actions. Other tenants manage their own ISGPs. Permit coverage for individual parcels on Port-owned properties is shown on **Figure 1**.

Figure 1. Permit Coverage for Port-Owned Projects



Note: current map versions can be downloaded from the Port's website

1.3 Definitions as Applied to Port Projects

The following definitions are provided to clarify terminology as applied to Port projects. These definitions are intended to supplement the definitions contained in other Ecology-approved manuals, or, in some cases replace those definitions.

Water quality treatment – treatment required for Port properties is based on the outcome of the Best Management Practice (BMP) selection process, which will meet the minimum Ecology requirements for treatment.

Road-related projects – all roadways and paved surfaces on Port properties are considered areas of vehicle movement. There are no roadways subject to the road-related thresholds defined in the Ecology manual.

Development and redevelopment – development is the conversion of vegetated land to other uses including buildings, other structures, or the creation of hard (impervious) surfaces. Redevelopment is the replacement or expansion of development (buildings and/or hard surfaces) on already developed land. Projects on Port-owned properties are primarily considered redevelopment since the area is already developed for industrial uses.

Activity-based requirements – stormwater treatment requirements that are triggered by changing activities or land use (i.e. changing a parking area to a log yard) that would result in a potential change in pollutant sources and loading from the site. This applies specifically when a site does not have pollution controls or treatment in place to address pollution-generating activities from the new activity. Activity-based requirements are specific to the Port and are not included in the Ecology manual and NPDES Phase 1 permit.

Tenant Improvements – improvements, alterations or other changes on Port property that are facilitated, contracted and financed by the Tenant that would not be considered ordinary maintenance or repairs. A Tenant Improvement request initiates the stormwater review process.

1.4 Website Resources

Additional resources for stormwater activities at the Port are available on the Port of Tacoma website. This website provides the most recent updates to maps, forms, and stormwater policies that are referred to in this manual.

http://portoftacoma.com/community/environment/water-quality

2.0 Stormwater Requirements for Port Properties

2.1 Background

The Port of Tacoma Stormwater Management Guidance Manual addresses runoff originating from Port-owned properties. The Port owns approximately 2,600 acres of land, including 2,500 acres located on the Tacoma Tideflats and 106 acres in unincorporated Pierce County. Stormwater infrastructure on the Tacoma Tideflats includes approximately 1,700 catchbasins and 130 outfalls.

Section S6.E.5 of the Port's MS4 NPDES permit requires that the Port comply with regulations of local jurisdictions governing post-construction stormwater mitigation measures, including the technical requirements for new development and redevelopment specified in Appendix 1 of the Phase 1 NPDES permit. It is also required to coordinate with local jurisdictions regarding projects that discharge runoff into interconnected MS4s.

Stormwater originating on Port-owned properties and flowing through Port-maintained infrastructure is to be mitigated under the conditions of the Port's NPDES permit as supplemented by the Port's Stormwater Management Guidance Manual. For these projects, the Port will be responsible for reviewing and approving the stormwater site plans associated with the proposed improvement.

Stormwater originating on Port-owned properties and flowing into the stormwater infrastructure maintained by an adjoining jurisdiction will also be mitigated under the conditions of the Port's NPDES permit as supplemented by the Port's Stormwater Management Guidance Manual. These projects will require the review and approval of both the Port and the other responsible jurisdiction.

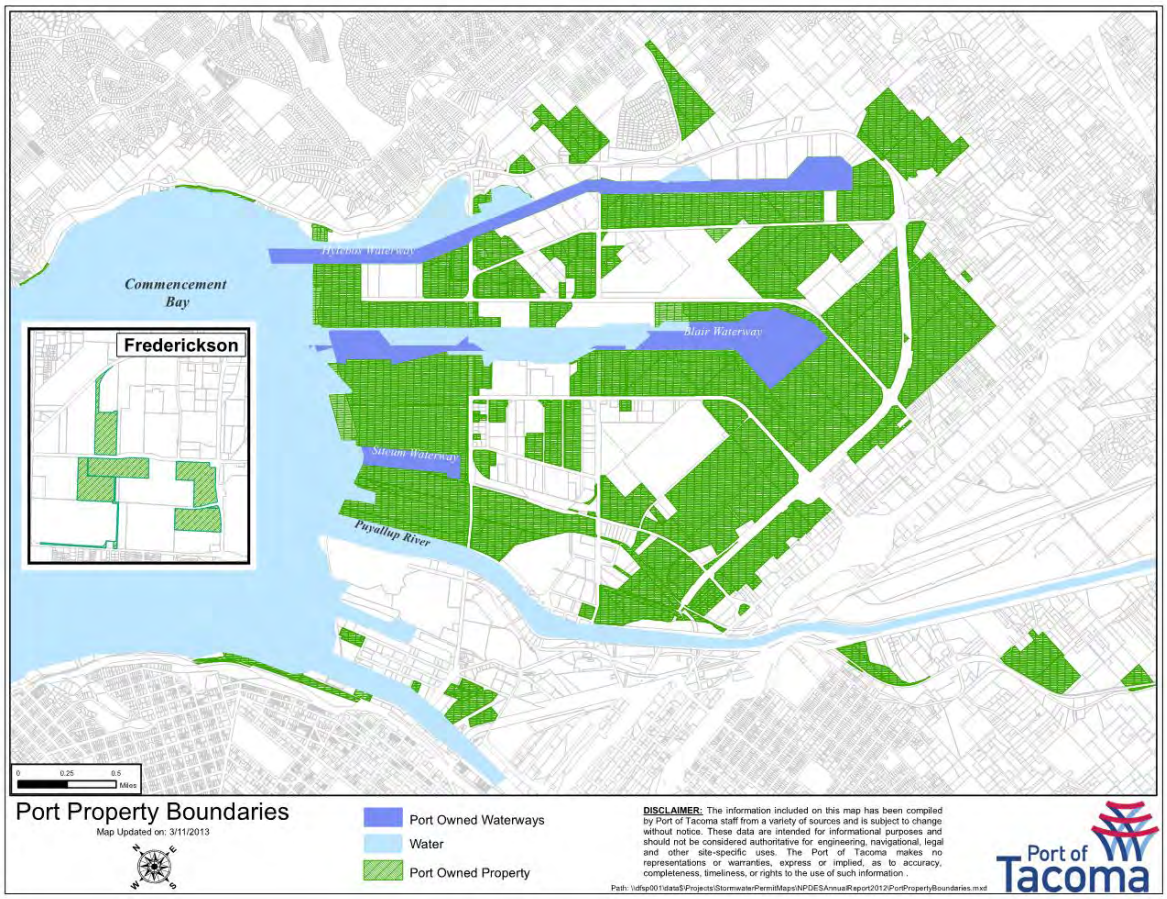
Most of the Port properties are located on the Tacoma Tideflats and will require coordination with the City of Tacoma. The Port and the City have entered into an interlocal agreement to define coordination required between the two jurisdictions for stormwater mitigation on new and redevelopment projects. A copy of the agreement defining the roles and responsibilities for the Port and City is included in Appendix A.

Projects can occur in areas adjoining jurisdictions other than the City of Tacoma, such as the City of Fife and Pierce County. Under those circumstances, the project-related requirements will need to be coordinated with those jurisdictions.

2.2 Where Port Requirements are Applied

Port-owned properties where the Port's Stormwater Management Guidance Manual is to be applied are shown in **Figure 2**. It should be noted that within the Port-owned properties there are parcels already covered by ISGPs (**Figure 1**). The requirements described within this guidance manual do not replace existing requirements of ISGPs.

Figure 2. Port-Owned Properties



Note: current map versions can be downloaded from the Port's website

2.3 Requirements for Development and Redevelopment

Port projects are primarily considered "Redevelopment" since most sites have 35% or more impervious surfaces. The requirements for Development and Redevelopment as defined by the Ecology Manual and the permit requirements are development based. The various minimum requirements (MR) for stormwater mitigation are triggered when certain thresholds are exceeded. The thresholds used for the Port of Tacoma meet and, in some cases, exceed Ecology's threshold requirements, as described below. The Port's minimum requirements are described in detail in Section 2.5, **Table 1**.

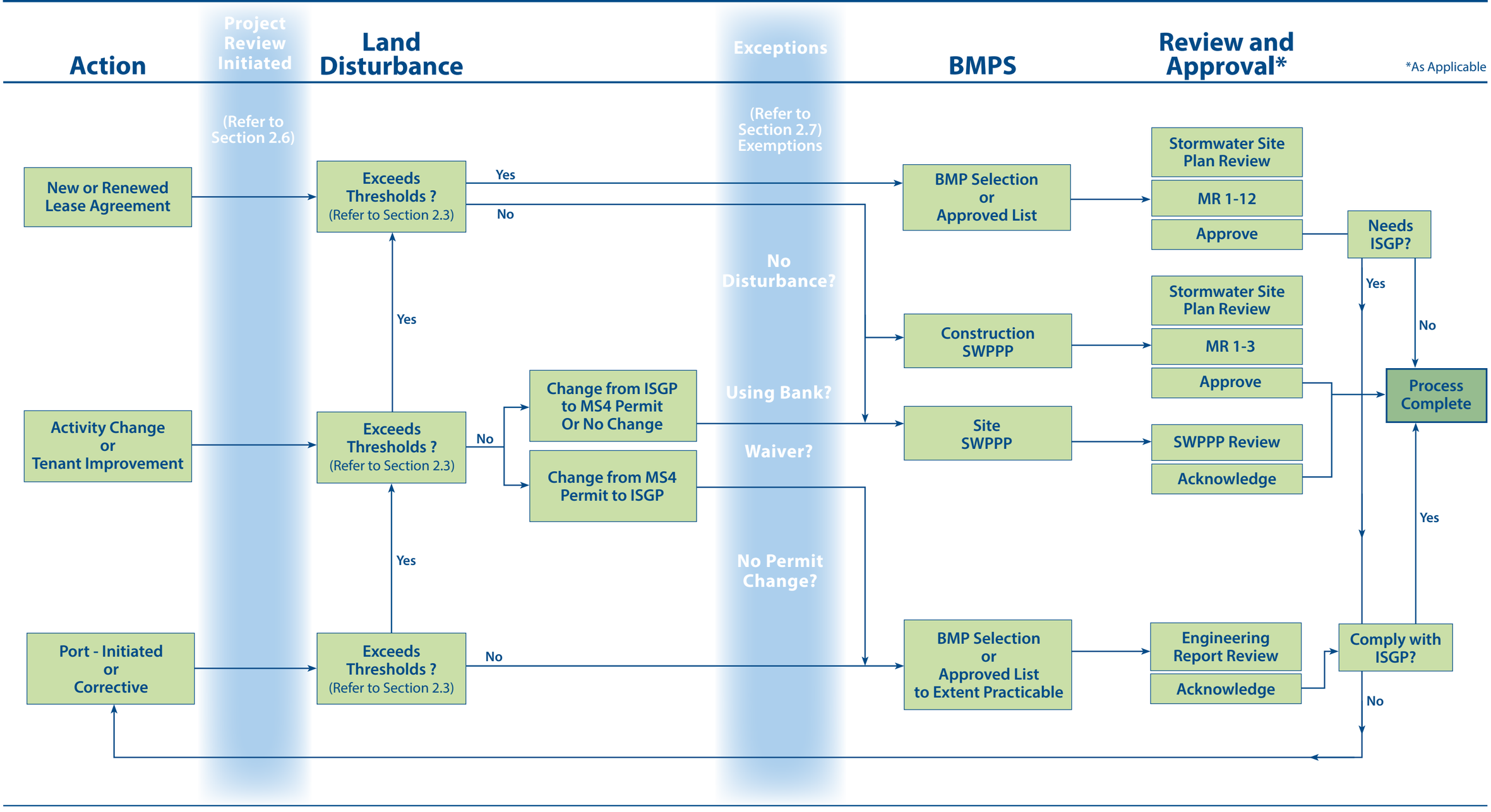
- If the total of new, replaced, or new plus replaced impervious surfaces total 2,000 square feet or more **OR** the project disturbs 7,000 square feet or more of land – minimum requirements (MR) 1-5, and 11 are required. If not, only MR 2 (Construction Stormwater Pollution Prevention) is needed along with a quantitative off-site analysis (MR11).
- If the total of new plus replaced impervious surface is greater than 5,000 square feet, **OR** the project converts ¾ acres or more of native vegetation to landscaped areas, review MR 1 through 12 and comply as necessary for new, replaced and converted surfaces.

2.4 Activity-based Requirements

The Port of Tacoma has included an activity-based requirement to address projects that can increase pollutant loading without triggering the disturbance-based thresholds included in the Ecology manual and permit requirements. Activity-based requirements are triggered when a tenant proposes to change the use in an unmitigated area to an activity that could increase pollutant loading. An example is converting an unused paved area to vehicle storage (a minor change) or a log yard (a major change). Either case could trigger activity-based requirements if the change resulted in increased pollutant loading from that parcel.

An activity-based requirement is triggered when a tenant seeks to obtain a lease agreement that includes a change in land use or activity. At that time the tenant must submit the Tenant Improvement Request with the Project Request Checklist for Stormwater (Appendix B) that describes and addresses the proposed change in land use or activity. The tenant and Port will coordinate to determine to what extent MR 3, 5, and 6 need to be implemented. The flow chart in **Figure 3** provides visual guidance for determining applicable requirements.

ACTION AND REVIEW DECISIONS



MS4: Municipal Separate Storm Sewer System
ISGP: Industrial Stormwater General Permit

FIGURE 3. Action and Review Decisions
Refer to Section 2.6

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2.5 Minimum Requirements for Port Projects

The minimum requirements triggered by disturbance thresholds or activity-based requirements are presented in **Table 1**. The MRs are a compilation of those in the Ecology manual and permit requirements as well as the additional MRs that the City of Tacoma has included in their manual. Additional information regarding selected MRs for Port projects is included below.

The Port may allow the minimum requirements to be applied on an equivalent area within Port-controlled properties if it is impractical or infeasible to mitigate on-site. An equivalent area is one with the same runoff characteristics (if flow control is required) and pollution-generating characteristics. The Port of Tacoma Engineering Department will review and approve proposed equivalent areas.

Table 1. Minimum Stormwater Requirements for Port Projects.

Requirement	Application to Port Projects
MR-1 Preparation of Stormwater Site Plan (Ecology/City of Tacoma)	Requirements as described in the City of Tacoma manual apply on Port projects. Additional submittal requirements for Port projects are described in Section 2.5.1. The Port of Tacoma Engineering Department will review submitted site plans.
MR-2 Construction Stormwater Pollution Prevention (Ecology/City of Tacoma)	Requirements as described in the City of Tacoma manual apply on Port projects. The Port typically acquires the Construction Stormwater NPDES permit prior to construction and develops the initial construction Stormwater Pollution Prevention Plan (SWPPP). The contractor is given the option of creating their own SWPPP or adopting the Port SWPPP.
MR-3 Source Control of Pollution (Ecology/City of Tacoma)	Requirements as described in the City of Tacoma manual apply on Port projects. The Port also requires avoiding the use of galvanized steel and other pollution-generating products or materials. Properties under ISGPs also have source control requirements.
MR-4 Preservation of Natural Drainage Systems and Outfalls (Ecology/City of Tacoma)	Does not apply. Port properties are drained by storm drains or ditches leading to outfalls. There are no "natural drainage systems." Redirecting runoff between outfalls may be possible on a case by case basis if there is sufficient capacity in the drainage system and the diversion is compatible with environmental regulations.
MR-5 Onsite Stormwater Management (Ecology/City of Tacoma)	Applicable to the extent required by the discharge location and activity. Port properties predominately discharge directly to tidally influenced waters, and on-site stormwater management practices are used primarily for runoff treatment rather than runoff reduction. Guidelines regarding the use of On-site Stormwater Management for Port projects is described below in Section 2.5.2 and is further defined in Chapter 3.
MR-6 Runoff Treatment (Ecology/City of Tacoma)	Water quality treatment is required for Port projects exceeding the thresholds. The Port has identified acceptable structural BMPs that can be considered (identified in Chapter 4). In addition, the Port is in the process of establishing a water quality treatment bank whereby mitigation required for a particular redevelopment project can be applied, in kind, to retrofit another site as designated by the Port. Additional information concerning Water Quality Treatment requirements for Port projects are described below in Section 2.5.3 and Chapter 4.
MR-7 Flow Control (Ecology/City of Tacoma)	Flow control, for streambank erosion protection, generally does not apply to Port projects. Runoff generated within the Tacoma Tideflats is collected by man-made conveyance and directed to outfalls discharging to receiving waters that are flow-control exempt. The Port does own some properties in outlying areas where flow-control could be required. In flow-control areas, the project proponent must follow the requirements of the local jurisdiction.
MR-8 Wetlands Protection (Ecology/City of Tacoma)	There are habitat and wetland mitigation sites that require protection. Port projects in the vicinity of these sites should review the site's mitigation plan to determine what measures could be required to protect these areas.
MR-9 Basin/Watershed Planning	No longer listed as a MR by Tacoma or Ecology. This is a placeholder for future planning efforts and does not apply on Port projects at this time. Port sub-basins draining to individual outfalls are subsets of larger basins that fall outside of Port jurisdiction. A Basin Plan can be used to tailor requirements for the entire area and develop a comprehensive plan for

Requirement	Application to Port Projects
	implementing water quality controls.
MR-10 Operation and Maintenance (City of Tacoma/MR9 in Ecology)	Requirements as defined in the Port's MS4 permit or as described in the City of Tacoma manual apply on Port projects. For proprietary systems, operation and maintenance will be based on the manufacturer's recommendations.
MR 11 Offsite Analysis and Mitigation (City of Tacoma)	Not listed as a MR by Ecology. Modified for application to Port projects. Port properties are typically located where groundwater is tidally influenced and discharge directly to tidally influenced waters. The Port requires offsite analyses but does not necessarily require mitigation. Capacity issues are dealt with on a case by case basis. The procedures to follow for offsite analysis and mitigation on Port projects are described below in Section 2.5.4.
MR 12 Activity-based Treatment Requirement (New-added for Port of Tacoma)	The activity-based treatment requirement by the Port of Tacoma provides a means to implement necessary water quality treatment if a change in land use or activity can increase pollutant loadings. This requirement will be initiated through the submission of a Tenant Improvement Request and the Project Request Checklist for Stormwater (Appendix B) as a condition of the lease agreement for the subject property. Negotiation between the tenant and the Port could result in the site being retrofitted for treatment, suitable off-site treatment of an equivalent area or participation in the retrofit banking program being developed by the Port.

The following provides additional information for selected minimum requirements. The information is presented with background information, specific directions on what is required for projects on Port properties, and supplemental guidelines that provide additional direction on meeting the requirement.

2.5.1 Stormwater Site Plans

Background

All projects meeting the thresholds are required to submit a Stormwater Site Plan to document existing and post-developed conditions of the site, including proposed stormwater facilities and supporting analyses. The Stormwater Site Plan documents proposed changes and provides a mechanism for the Port to keep track of changes on Port properties. Port tenants provide stormwater management under their respective leases. The Port maintains a database to make sure stormwater requirements are being met, as the condition of each lease stipulates.

Requirements for Projects on Port Properties

The Stormwater Site Plan is used during the planning of projects and serves as the final documentation of what site changes and corresponding mitigation was completed for the project. The Port requires that a preliminary site plan be prepared and submitted at the initial project scoping meeting held with the Port (see section 2.6 for required meetings with the Port). The Preliminary Stormwater Site Plan shall describe the proposed project, quantify expected changes in stormwater runoff, and identify the type size and location of proposed stormwater facilities. Stormwater treatment at the Port is expected to begin with source control activities such as good housekeeping and proper material selection. Runoff shall be treated first with on-site Low Impact Development (LID) treatment methods (discussed in Chapter 3). Any areas that cannot be treated with LID will be treated with conventional BMPs (discussed in Chapter 4). Submittal of the Preliminary Stormwater Site Plan at the initial project scoping meeting will allow the Port to provide comments and perhaps suggest alternative mitigation approaches that could be beneficial to both the Port and the project proponent.

Once the project is completed, the project proponent shall submit a Final Stormwater Site Plan that includes the analyses and design of the project. Information provided in the Final Stormwater Site Plan will be entered into the Port's database for stormwater facilities.

A checklist to be followed in preparing Stormwater Site Plans is provided in Appendix B. In addition to the information on this checklist, the Port requires the following.

Chapter 1. Project Overview – Coordinate with the Port to confirm permits required and any site-specific conditions on the site or adjacent parcels that could influence the project.

Chapter 2. Existing Condition Summary – Coordinate with the Port to obtain site-specific data for the proposed project site. Provide a site map that identifies the upstream area(s) draining to the site. Include any stormwater inventory data collected as a part of the project. A broad view of stormwater inventory data available from the Port is shown in **Figure 4**. Updates to this information, at a larger scale, are kept current on the Port's webpages at the following URL.

[*Port to provide URL*]

Chapter 3. Offsite Analyses – Conduct qualitative and quantitative analyses to document potential off-site changes that could result from the project. Investigate the downstream drainage system (up to ¼ mile downstream from the site) to identify the existing drainage system leading to Port outfalls. The project proponent should coordinate with the Port to obtain drainage system inventory data that may be available and if needed, conduct field survey to supplement the existing databases. Any field survey data collected as a part of the site development shall be coordinated with Port GIS and provided to the Port in an electronic format so that it can be added to the Port GIS database. Note that the requirements for off-site analyses are further described in Section 2.5.4 "Offsite Analyses and Mitigation" in this manual.

Chapter 4. Permanent Stormwater Control Plan – Provide all of the information used to select, size, and locate the permanent stormwater control measures including source control, LID, and BMPs for the site. The Port also requires that the project proponent submit any water quality data that may have been collected to verify performance of the selected BMP (See Chapter 4).

Chapter 5. Discussion of Minimum Requirements – This chapter shall include all of the relevant information pertaining to thresholds, applicable requirements, site hydrology, water quality treatment, and conveyance design as specified in the City of Tacoma manual (Section 4.1, Chapter 4, Volume 1).

Other submittal requirements appended to the Stormwater Site Plan are as follows:

- **Operation and Maintenance Plan –** Describe the long-term operation and maintenance needs for the LID and BMPs to be installed on site and provide estimates for annual operations and maintenance costs.
- **Construction Stormwater Pollution Prevention Plan –** The Port typically acquires the Construction Stormwater NPDES permit prior to construction and develops the initial SWPPP. The contractor is given the option of creating their own SWPPP or adopting the Port SWPPP.

Supplemental Guidelines

The Preliminary Stormwater Site Plan is based on a design that is approximately 30 percent complete. It should provide enough information to assess current conditions, identify changes in stormwater expected from the project, and have enough design detail to be able to confirm that there are no constraints that could prevent the proposed stormwater design from being constructed as planned.

2.5.2 Source Control of Pollutants

Background

The Ecology manual and permit requirements require source control of pollutants. The intent is to reduce pollutant sources at the source by preventing stormwater from coming into contact with pollutant sources.

Requirements for Projects on Port Properties

Apply source control BMPs as specified in the Ecology manual and permit requirements. The Port also requires the selective use of building materials to reduce pollutant sources. All capital improvement projects such as terminals, roadway, railroad, and infrastructure improvements, must minimize uncoated galvanized steel surface as a means to prevent surface and ground water pollution caused by zinc and other pollutants leaching from galvanized surfaces. All of the Port's new terminal leases will preclude the use of uncoated galvanized metal on exposed equipment and structural surfaces.

Supplemental Guidelines

By reference, the Port adopts the City of Tacoma's galvanized steel surface coating requirement. The following excerpt is the requirement of the City of Tacoma: "*Any galvanized materials shall have an inert, non-leachable finish, such as a baked enamel, fluorocarbon paint (such as Kynar or Hylar), factory-applied epoxy, pure aluminum, or asphalt coating. Acrylic paint, polyester paint, field-applied, and Galvalume coatings are not acceptable*."

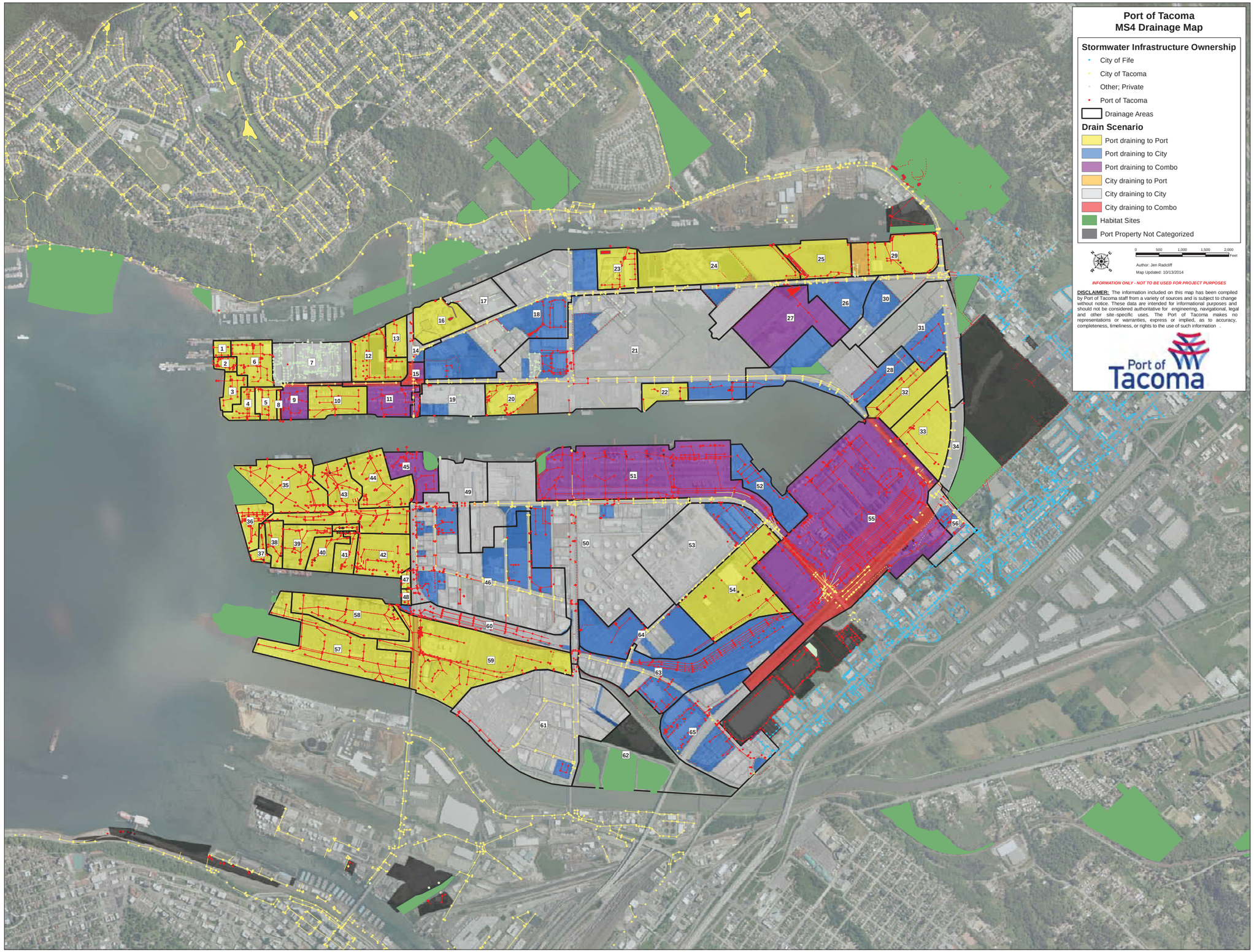
Avoid using uncoated galvanized steel for building roofs, siding, gutters, downspouts and other materials that convey stormwater. Submit material specifications for the above mentioned building components along with the City of Tacoma Fill and Grade Permit application if required.

Select alternative materials such as aluminum, stainless steel, and plastic or coated metal in lieu of galvanized steel on exposed surfaces. Select painted metal instead of galvanized metal for ventilator covers, ductwork, and other surfaces. Substitute alternative materials, such as vinyl-covered chain-link fences for galvanized chain-link fences. All galvanized steel posts, cross bars, and gates will be painted or coated.

Where unavoidable, the use of uncoated galvanized steel is acceptable in the moving part(s) of fixed or mobile equipment. These unavoidable uses include, but are not limited to, cargo handling equipment, movable ramps, and cables on the cranes.

Exceptions to the "no galvanized material" policy will be made on a case-by-case basis. The project proponent should provide information to, and obtain approval by the Chief Facilities Development Officer.

Figure 4



Document Path: L:\Projects\StormwaterPermitMaps\StormwaterDataFromContractor\DrainagebyJurisdictionJR.mxd

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2.5.3 On-site Stormwater Management

Background

The Ecology manual and permit requirements specify that projects employ onsite stormwater management practices "where feasible and appropriate." The intent is to infiltrate, disperse, and retain runoff onsite to the maximum extent feasible without causing flooding, erosion, water quality, or groundwater impacts. Specific LID BMPs required include roof downspout control, dispersion, soil quality, and tree retention/transplanting. The objective is to "reduce the amount of disruption to the natural hydrologic characteristics of the site."

Port properties are typically low lying, highly altered lands near sea level having limited "natural" hydrologic characteristics. Implementation of on-site stormwater management practices are limited by industrial uses, the occasional presence of contaminated soils, and groundwater elevations that are influenced by tides. Nevertheless, onsite Stormwater practices can serve a role in runoff treatment and are required to the extent practicable.

Requirements for Projects on Port Properties

Chapter 3 of this manual describes and defines potential LID techniques that the Port requires and those the Port prefers as alternatives to be used at the Port when feasible. Only those techniques described in Chapter 3 should be used on Port properties. The Port may decide to use other methods if applicable to the unique circumstances at the Port and they do not need to be defined as LID in order to be used. Methods that are prohibited or conditional are also identified in Chapter 3.

Applicable LID techniques must be designed in accordance with the design criteria in the City of Tacoma manual or a manual deemed equivalent to the Ecology Manual.

Supplemental Guidelines

The use of LID techniques at the Port is highly influenced by specific activities that are conducted on Port properties. In addition, some properties are subject to industrial stormwater permits and have advanced treatment systems that effectively manage water quality and preclude the use of LID.

Much of the Port properties are on the Tacoma Tideflats and may be situated on unsuitable fill material and/or are subject to high groundwater conditions. In addition, there are contaminated soils that must be avoided. Specific site conditions that limit the use of LID are identified in Chapter 3.

2.5.4 Water Quality Treatment

Background

Ecology requirements specify that all pollution-generating surfaces exceeding State-set thresholds be treated for water quality. These requirements are for structural treatment BMPs that will be in addition to source controls. Under the MS4 permit, the Port is required to use the Ecology Manual (or an equivalent manual such as the City of Tacoma manual) as All Known and Available Reasonable Prevention Control and Treatment (AKART) and select BMPs from it for projects exceeding the thresholds. By applying activity based triggers, the Port meets and exceeds these requirements.

Requirements for Projects on Port Properties

For projects under Port jurisdiction, treatment will be required for all pollution-generating surfaces that either exceed Ecology disturbance thresholds or trigger the Port's activity-based requirements. It is important to note that the Port considers all impervious surfaces as pollution generating. Applicable BMPs must be designed in accordance with the design criteria in the City of Tacoma manual or a manual deemed equivalent to the Ecology Manual.

The Port has prepared a process to select Port preferred BMPs that meet multiple needs. Chapter 4 describes the process and lists appropriate BMPs to use on Port projects. BMPs that are currently accepted by Ecology (and presumed effective for treatment) are further categorized in consideration of compatibility with Port activities and the physical setting of much of the Port properties. Categories include Preferred, Conditionally Allowed, and Not Applicable for use on Port properties. Preferred and Conditionally Allowed BMPs are listed below, based on the screening process described in Chapter 4 and Appendix D. Updates to this list can be found on the Port's website.

http://portoftacoma.com/community/environment/water-quality

- **Preferred BMPS** – selected based on best reliability, operation and maintenance considerations, and cost effectiveness.
    - Bioretention cells (T7.30)
    - Bioretention swales (T7.30)
    - Bioretention Planter boxes (T7.30)
    - Compost-amended vegetated filter strips (T7.40)
    - Basic biofiltration swale (T9.10)
    - Basic filter strip (T9.40)
- **Conditionally Allowed** – generally not preferred due to poor performance, incompatible site constraints, and/or high costs (see Chapter 4 and Appendix D for more detail). May be allowed by the Port if proof of concept is demonstrated.
    - Basic Sand Filter Basin (T8.10)
    - Large Sand Filter Basin (T8.11)
    - Sand Filter Vault (T8.20)
    - Linear Sand Filter (T8.30)
    - Media Filter drain (T8.40)
    - Wet biofiltration swale (T9.20)
    - Continuous inflow biofiltration swale (T9.30)
    - Compost-amended biofiltration swale
    - Filterra ™
    - Aqua-Filter ™ systems
    - BayFilter ™
    - Modular Wetland System – Linear
    - FloClear ™

- StormFilter ™
- UrbanGreen ™ Biofilter
- Up-flo ™ Filter
- ecoStorm Plus ™
- FloGard ™ Perk Filter
- Jellyfish ™ Filter
- Aquip™

Supplemental Guidelines

The Port may, on occasion, allow the use of new BMPs that have not been approved through the Technology Assessment Protocol-Ecology (TAPE) process. Under these circumstances, the developer is expected to conduct on-site testing of the proposed technology in order to demonstrate that it will meet Port required performance standards (described in Appendix D), before being approved by the Port for use. Data collected will need to be submitted to the Port as a percent-exceedance curve to demonstrate performance. The process for demonstrating performance is discussed further in Section 4.3 and Appendix D. Collected data will be submitted as a part of the Stormwater Site Plan.

BMPs will be maintained in accordance with the maintenance standards included in the Ecology-approved manual or by conditions specified in the ISGP. Exceptions may occur based on documented facility experience or as recommended by device manufacturers for proprietary systems.

Retrofit Treatment Program (future proposal)

The Port may develop a retrofit program open to developer participation in the future. It is recognized that providing treatment for small redevelopment sites that are part of a larger parcel may not always be practical. The retrofit program would direct stormwater treatment on a more comprehensive, cost-effective manner in an effort to optimize treatment. To participate, water quality treatment must be provided to an equivalent area (flow and pollution characteristics) at another retrofit site selected or managed by the Port.

The retrofit site would be part of a retrofit banking program, whereby water quality retrofits have already been constructed in advance of redevelopment requirements. New redevelopment projects would then be allowed to “buy in” to the bank, provided the treatment requirements do not exceed the cumulative retrofits that have already been credited to the banked site.

2.5.5 Offsite Analysis and Mitigation

Background

The City of Tacoma requires an offsite analysis for projects that discharge stormwater offsite. The analysis is to be provided as a part of the Stormwater Site Plan and Report. Included is a Qualitative Analysis (Section 3.4.11.1 of the City of Tacoma Stormwater Management Manual) required for all projects and a Quantitative Analysis (Section 3.4.11.2 of the City of Tacoma Stormwater Management Manual) if flow control thresholds are met (Section 3.4.7.2 of the City of Tacoma Stormwater Management Manual) or the project is “deemed to need additional downstream information.”

The City of Tacoma manual includes an "Infrastructure Protection Requirement" (Section 3.4.7.4 of the City of Tacoma Stormwater Management Manual) intended to mitigate stormwater impacts from projects that meet the flow control thresholds but are not required to meet the Standard Requirement to provide flow control (Section 3.4.7.3 of the City of Tacoma Stormwater Management Manual). Under the Infrastructure Protection Requirement, flow control or offsite conveyance improvements can be required to address capacity concerns.

Port properties are comprised of predominately impervious surfaces that are served by stormwater infrastructure discharging to existing outfalls. Localized flooding can occur at times during peak runoff events coupled with high tides. However, flooding is not considered a problem unless there is infrastructure damage or interruption of operations.

Requirements for Projects on Port Properties

For projects under Port jurisdiction, offsite analyses are to be completed for all projects in accordance with the City of Tacoma manual (Section 3.4.11), following the method of analysis described to satisfy minimum requirement 11. The applicant can rely on inventory data provided by the Port and/or available at the City of Tacoma to the extent practicable. The qualitative analysis is to be documented in the Stormwater Site Plan and Report.

Supplemental Guidelines

Off-site analyses can be supported by Port inventory data for storm drains leading to existing outfalls. The project proponent should contact the Port to obtain relevant data.

The project proponent should coordinate directly with Port staff to determine if there are any known capacity problems in the downstream system that need to be considered. Off-site mitigation is not required unless the Port determines that changes in runoff can aggravate an existing drainage problem. It is anticipated that most projects will not trigger off-site mitigation requirements – based on the Port's knowledge of current conditions.

2.6 Process to Follow for Port Projects

The Port requires a submittal and review process designed to help facilitate project development that is consistent with Port and permit requirements as well as tenant's needs. For projects meeting the thresholds, the process involves the following steps:

1. **Project Request** – The project request is initiated at the Port through a new or renewed lease agreement, or through a Tenant Improvement request. At this point the proponent should check with the Port to confirm jurisdictional responsibilities and obtain guidance and information such as the Port Stormwater Management Guidance Manual and available drainage infrastructure data.
2. **Pre-Application Meeting** – The project proponent then develops a preliminary 30 percent design that is based on the project thresholds and the associated requirements. The design is documented as the Draft Stormwater Site Plan and submitted to the Port for review in advance of the Pre-Application Meeting. The Project Pre-Application Checklist for Stormwater in Appendix B must be used in preparing the site plan with acknowledgment that this is at the 30 percent design level. The Pre-Application Meeting is held with the project proponent and Port

staff to review the proposed project and determine if requirements as proposed are being met and/or if there are alternative mitigation opportunities that provide greater benefit and are more cost effective. An example is off-site mitigation for an equivalent area or participation in the stormwater treatment banking offered by the Port.

3. **Final Submittal** – The project proponent completes the proposed design following the Stormwater Site Plan checklist in Appendix B. The Final Stormwater Site Plan and supporting information defined in Section 2.5.1 is then submitted to the Port for approval.

For projects meeting the activity-based requirements, the proponent will submit a site SWPPP as a condition of the lease associated with a change in activity or land use. The Port will either confirm the site SWPPP as submitted or determine if other more cost-effective measures are available. The Port of Tacoma's site SWPPP template can be downloaded from the Port's website.

http://portoftacoma.com/community/environment/water-quality

2.7 Exceptions to the Minimum Requirements

Exceptions to the minimum requirements are granted for the following Port activities even though the action described could meet the definition of new development or redevelopment.

- Pavement maintenance as described in the Appendix 1 of the NPDES permit and the City of Tacoma manual.
- Building demolition projects are exempt from all of the Minimum Requirements except MR 2, Construction Stormwater Pollution Prevention.
- Underground utility projects are exempt from all of the Minimum Requirements except MR 2, Construction Stormwater Pollution Prevention.
- Activities that are being implemented as part of a state or federally approved clean-up plan.

Exceptions to the minimum requirements may also be requested following the guidance provided in Section 3.5.1 of the City of Tacoma manual. The decision to grant an exception is at the discretion of the Port and may also require concurrence with the City of Tacoma.

3.0 LID Selection Based on Feasibility

3.1 Introduction

LID[1] in stormwater management is an approach where the impacts of creating impervious surfaces (which increase runoff and pollutants) are controlled by minimizing pollutant creation, dispersing or infiltrating runoff, collecting and "treating" runoff near its source, or reusing the excess runoff created. By reducing the overall impact at or near the source, the potential risks of poor end-of-pipe system performance can be minimized. In addition, these methods lend themselves to efficient and multiple uses of the land (i.e., landscaped areas can also serve as stormwater areas).

Ecology requires municipalities under the Phase 1 and Phase 2 Municipal General NPDES permits to use LID principals and BMPs "where feasible." In addition, the Port Stormwater Management Plan (SWMP) affirms the need for "…an LID use policy for new/redevelopment projects."

This chapter describes and defines potential LID techniques that are *required* or *allowed* at the Port for specific Port operations *when feasible*. These Port-preferred techniques have been assessed and are considered feasible for application in a marine port setting when appropriate physical conditions are present. Not all techniques approved by Ecology (Ecology 2012) or described in the LID guidance manual for Puget Sound (Puget Sound Partnership [PSP] 2012) should be considered LID at the Port. Only the techniques described in this guidance document should be used on Port property. However, there are provisions whereby the Port of Tacoma can decide to use other stormwater control methods if applicable to the unique circumstances at the Port, and they do not need to be defined as LID to be used. An exception to using LID on Port properties is when a stormwater control system is already in place and is fully controlling/treating stormwater. In this case, additional LID applications would be impracticable (i.e., applying two systems to a site is inappropriate).

LID techniques are applied to minimize, reduce, or control impacts to stormwater flows and stormwater quality. At the Port, flow control is almost never needed because adjacent waterways (Commencement Bay, the Puyallup River, and tidally influenced ditches) are flow control-exempt receiving waters. Consequently, LID techniques applied to the Port are nearly always applied for stormwater quality and not flow control, even though the benefits are generally greater when applied to flow control.

The feasibility assessment described in this chapter is structured around evaluating physical and operational considerations for applying LID. Although there are additional techniques in the "LID toolbox," this guidance limits the feasibility assessment to device selection and effective impervious area reduction methods described below. Site design approaches, material selection, and soil amendments, in addition to flow control and effective impervious surface minimization techniques such as using minimal excavation, downspout infiltration, reverse slope sidewalks, and vegetation preservation, are not evaluated for feasibility at the Port because they are rarely considered on redevelopment sites . The Port's expectation is that site designers will always be working toward minimizing stormwater impacts that need mitigation and that efficient site design, reduced impervious surfaces, and good site layouts that facilitate near-source stormwater controls are the norm.

[1] LID also refers to 'low impact design' in some jurisdictions and the terms are interchangeable.

In addition, cost feasibility is not included as a step in the evaluation. However, it is incumbent on the designer to consider cost feasibility or impracticability as part of the individual assessments for LID techniques.

3.2 Definition of LID

Stormwater control guidance for structural LID is provided by Ecology (Ecology 2012) in Volume 5 of the Stormwater Manual, and by the PSP in Section 6 of the LID Manual (PSP 2012). These Western Washington preferred methods were evaluated by the Port of Tacoma and assessed for feasibility of use on Port property. The following is a list of those methods that were found feasible and are preferred by the Port. The reference number for each method in the Ecology manual and PSP guidance document is shown in parentheses.

- Bioretention (5.14A, 5.14B; 6.1)
- Permeable pavement (5.15; 6.3)
- Planter boxes and trees (5.16; 6.4)
- Downspout treatment (n/a; n/a)
- Vegetated roofs (5.17; 6.5)
- Rainwater collection and use (5.20; 6.7)
- Dispersion (5.11, 5.12, 5.30; n/a)

Additional techniques included in the guidance documents that are not evaluated for feasibility (as they are not applicable) at the Port include:

- Amended soil (5.13; 6.2)
- Better site design (5.41; n/a)

One issue with LID and its application is the large number of potentially similar techniques that are not actually LID. This gray area comes about from different naming conventions, methods that are functionally equivalent in performance but are arguably not LID, supposed techniques that are labeled LID but in fact have few characteristics in common with actual LID, and seemingly similar techniques that have very different feasibility considerations. For this reason, **Table 2**, which focuses on structural controls, provides the naming convention that will be used, a definition and description of the method, other names commonly used, and a list of what is not included in the category to provide further clarity. The following LID techniques, as defined below, are further evaluated later in this document for feasible use at the Port. Additional methods can be proposed, but their equivalence to the techniques in **Table 2** must be demonstrated.

Table 2. LID Techniques for Use at the Port (Structural Controls)

Ecology (5)	PSP (6)	LID Name	Defined	Also known as and including	Description	What it isn't
5.14A & 5.14 B	6.1	Bioretention	Shallow depressions with soil media and plants for pollution removal discharging only to the ground or an underdrain	Rain gardens, bioretention swales, Bioretention planters	Shallow depressions accepting stormwater from small areas; include a soil media and plants to support pollution removal; with or without an underdrain; includes flow-through systems with shallow slopes but equivalent soil and subsurface conditions.	Dry wells; infiltration systems that collect stormwater from an area larger than six times the bioretention area
5.15	6.3	Permeable Pavement	Pavements that allow infiltration through the section, discharging only to the ground or an underdrain	Porous asphalt pavement, pervious concrete, permeable interlocking pavements and pavers, grid systems (geotextile or concrete)	Hard surfaces for vehicular and pedestrian movement or storage with openings or permeable aggregate that allows stormwater to pass through and be temporarily stored in the subgrade until it can infiltrate into the ground or discharge through an underdrain.	Gravel or aggregate surfaces
5.16	6.4	Planter Boxes and Trees	Confined planters and landscape trees with water storage and filtering capabilities	Filterra bioretention, Silva cells	Contained soil structures, boxes, grids, or cells are designed to support plant and tree growth in confined areas. They are similar to bioretention but differentiated mainly by rigid structure, scale (very local drainage area), and discrete planting (often a single tree). May or may not include soil filtering design or underdrains like bioretention.	Bioretention, above grade planters, or other similar systems such as downspout control, stormwater-irrigated planting areas, or media filters
		Downspout Treatment	Portable or movable above-ground structures or boxes for treating roof runoff that contain soil or media filtration layers and underdrains connected to conveyance systems	Splash Boxx; Grattix boxes; downspout filters; downspout planters, planter boxes	"Bioretention in a box" systems to target treatment of roof runoff without the capital cost of installing permanent systems, allowing for mobility and flexibility, with an opportunity for experimentation and adaptive management.	Bioretention, rain gardens, media filters

Ecology (5)	PSP (6)	LID Name	Defined	Also known as and including	Description	What it isn't
5.17	6.5	Vegetated Roofs	Thin layer of soil with vegetation constructed on conventional flat or sloped roofs to minimize contaminated roof runoff entering stormwater system	Ecoroofs, green roofs, rooftop gardens, living walls	Thin layer of soil with suitable vegetation constructed on conventional flat or sloped roofs to minimize contaminated roof runoff entering stormwater system. Is not designed or intended to meet a flow control design or a water quality design storm as roof tops are not pollution-generating activities but are potential sources.	Flow attenuation, bioretention, planter boxes, media filters, or downspout treatment
5.20	6.7	Rainwater collection and use	Collecting stormwater for small-scale non-potable uses, generally limited to landscape irrigation	Cisterns, rainwater harvesting	Collecting and storing stormwater from rooftops and other impervious surfaces for irrigation.	Flow reservoirs, stormwater treatment systems
5.11, 5.12, 5.30		Flow dispersion	Discharge of sheet flow or concentrated flow into a designed vegetated or soil-amended area	Filter strips, sheet flow dispersion	Keeping flow dispersed and unconcentrated or dispersing concentrated flow into a prepared vegetated or soil-amended area.	Infiltration, rain gardens, bioretention swales

Other potential LID methods, which will not be assessed for feasibility, are described in **Table 3** and can be applied if appropriate.

Table 3. Other LID Techniques That Could be Considered at the Port

Name	Defined	Description	What it isn't
Amended soil	Amending disturbed soil to improve abstraction and infiltration	Adding compost and soil rework of disturbed, compacted, or fill soils to improve infiltration characteristics and reduce runoff	Filter strips or dispersion
Better site design	Site design that reduces impervious surfaces, integrates more LID techniques, reduces concentrated flows, disperses stormwater treatment facilities, and controls pollution sources	Site design that reduces impervious surfaces, integrates more LID techniques, reduces concentrated flows, disperses stormwater treatment facilities, and controls pollution sources	Structural source control
Material selection	Using materials that are low sources of pollution in stormwater or minimizing use of materials that result in stormwater pollutants	Using materials that are low sources of pollution in stormwater or minimizing use of materials that result in stormwater pollutants	Good housekeeping, tenant education, spill containment, structural source control

3.3 Port Activities

LID feasibility at ports is highly influenced by the specific activities that are typically conducted on Port property. Some properties are industrial and subject to industrial stormwater permits may use advanced treatment systems that effectively manage water quality and preclude the use of LID. **Table 4** describes typical land uses at ports and the pollution-generating activities associated with each land use for consideration when applying LID.

Table 4. Port Activities and Land Uses

Land Use	Activities	Pollution-generating activities
Container terminals	Loading, unloading, movement, transfer, and storage of containers; includes automobile unloading	Vehicle movement; metals leaching from equipment; spills and maintenance; container leaks; roofs
Break Bulk terminals	Loading, unloading, movement, transfer, and storage of goods and containers	Vehicle movement; metals leaching from equipment; spills and maintenance; outdoor storage of finished goods and products; roofs
Dry bulk terminals	Loading, unloading, movement, transfer, and storage of goods, typically stockpiled in the open	Vehicle movement; metals leaching from equipment; spills and maintenance; outdoor storage of finished and unfinished goods and products; roofs

Land Use	Activities	Pollution-generating activities
Log yards	Loading, unloading, de-barking, moving, transferring, and storage of logs and wood products, typically stockpiled in the open	Vehicle movement; chemicals leaching from equipment and product; spills and maintenance; outdoor storage of finished and unfinished goods and products; heavy debris loads
Aggregate or outdoor material storage areas	Loading, unloading, movement, transfer, and storage of aggregate, rock, soil, scrap metal, etc., typically stockpiled in the open	Vehicle movement; chemicals leaching from equipment and product; spills and maintenance; outdoor storage of finished and unfinished goods and products; heavy sediment and debris loads
Maintenance areas	Repair, maintenance, parking, and fueling of vehicles	Vehicle movement; chemicals leaching from equipment and product; leaks and spills
Access Roads	Movement of trucks, automobiles, and buses on public roadways	Vehicle movement; tire and brake wear; leaks and spills; atmospheric deposition of exhaust; de-icing and sanding
Vehicle movement areas	Movement of trucks and automobiles on private roadways	Vehicle movement; tire and brake wear; leaks and spills; atmospheric deposition of pollutants
Parking (fleet and larger) lots	Movement and storage of trucks and automobiles, sometimes on a large scale with new cars	Vehicle movement; tire and brake wear; atmospheric deposition
Buildings/Roofs	All buildings (over 500 square foot footprint) with any type of roofing material and internal use and including gutters and collected drainage	Leaching metals from treated or untreated roofs; atmospheric deposition
Rail	Rail yards and track ballast	No concentrated stormwater
Other	Includes all other activities and areas at the Port, including pervious areas (considered non-pollution-generating), small roofs, sidewalks and pedestrian trails with collected drainage, open space and landscaping, parks and mitigation sites, and all other areas not included in the activities described above; also includes areas with no surface discharge or diverted to sanitary sewer	Varies depending on activity to minimal for non-pollution-generating activities and surfaces

3.4 LID Feasibility Assessment

LID is normally a preferred and beneficial approach and should be carefully considered as a first step to stormwater treatment. However, technical and operational limitations can render the use of LID infeasible under specific circumstances. The following sections describe circumstances when LID is appropriate, and circumstances and reasons for when it is not feasible.

The LID technique list (**Table 2**) has been evaluated in conjunction with the Port activities list (**Table 4**) to determine potential LID techniques for use at the Port. This evaluation is summarized in **Figure 5**, which provides a detailed decision matrix for evaluating and determining LID applications for any specific project.

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	Prohibited	Conditional	Port Required	Port Allowed
Container, Break Bulk, And Dry Bulk Terminals	• Permeable Pavement • Flow Dispersion	• Planters And Tree Boxes • Rainwater Collection And Use		Bioretention
Log Yards	• Bioretention • Permeable Pavement • Planter Boxes • Flow Dispersion	Rainwater Collection And Use		
Maintenance	• Permeable Pavement • Rainwater Collection And Use • Flow Dispersion	Bioretention		Planters And Tree Boxes
Public Roads and Vehicle Movement	Permeable Pavement			• Flow Dispersion • Bioretention • Planters And Tree Boxes
Outdoor Raw Materials Storage	• Bioretention • Permeable Pavement • Planter Boxes • Flow Dispersion	Rainwater Collection And Use		
Parking			Bioretention	• Permeable Pavement • Planters And Tree Boxes • Rainwater Collection And Use • Flow Dispersion
Buildings/ Roofs		• Bioretention • Planters And Tree Boxes • Flow Dispersion	• Vegetated Roofs • Downspout Treatment	Rainwater Collection And Use
Rail	LID Not Used			
Landscape	LID Not Used			
Other				

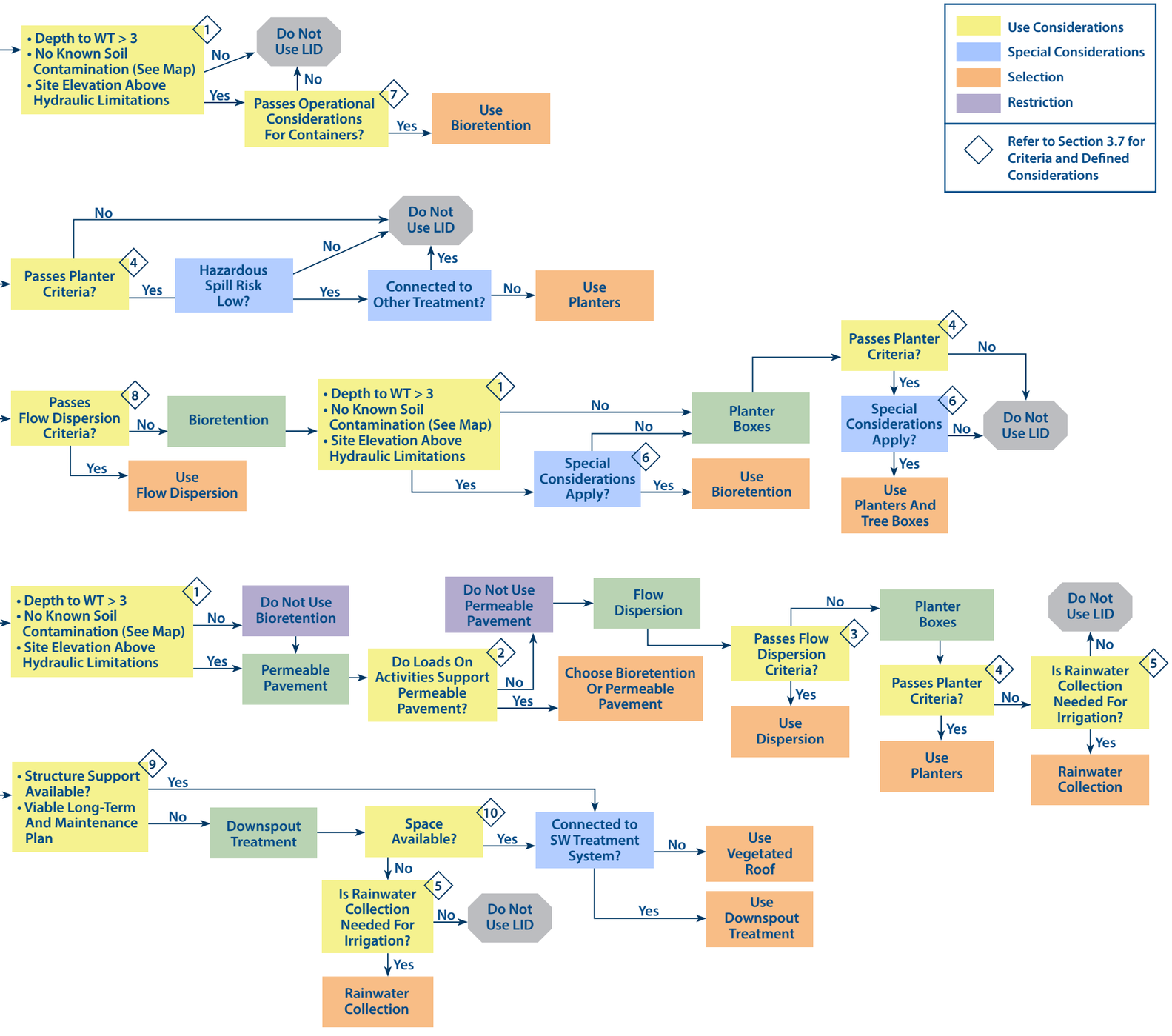

FIGURE 5. Decision Assessment for Evaluating LID Feasibility

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The decision assessment matrix in **Figure 5** indicates under what circumstances specific LID techniques are required and allowed by the Port. There is also a category of LID techniques that the Port prefers not to use, but can be considered if the unique circumstances of a site warrant. For further clarity, the categories of use from **Figure 5** are described below:

"Prohibited" – The Port will not allow the use of these LID methods for the activities specified.

"Conditional" – This category is for LID methods that the Port prefers not to use generally because the specified activities preclude them. However, if the applicant has special circumstances, they can have a method approved for their site through coordination with the Port.

"Port Required" – LID methods in this category must be used for the specified activities, provided appropriate physical conditions exist.

"Port Allowed" – LID methods in this category must also be considered and used where possible if the LID methods under "Must Use" prove infeasible.

Table 5 is a summary of LID use by Port activity. Unique circumstances can and do arise; the user should consider if reasonably equivalent conditions or uses exist and if **Table 5** or **Figure 5** are appropriate for stormwater control decisions. Section 3.8 Exceptions and Special Circumstances below includes a discussion of how unique circumstances should be evaluated.

3.5 Technical Limitations

The primary technical limitations encountered on Port properties are high groundwater and the presence of contaminated soils. Using LID in areas with high groundwater or hydraulic limitations can be considered, but only when there are no other alternatives available (LID or non-LID). In these cases, it must also be demonstrated that the system will remain functional under high water conditions. All in-ground systems (e.g., bioretention, planter boxes, and pervious pavement) that discharge into the ground or have underdrains are subject to the limitations described in Section 3.7.

Installing treatment systems in areas with contaminated soil is possible with impermeable barriers. However, under these circumstances such systems are no longer considered LID. **Figure 6** shows location across the Port that are designated groundwater remediation sites, those that have an engineered cap, and those that are known but may not yet be addressed.

Properties where activities have regular and routine potential debris loads (e.g., log yards), regular potential sediment loads (e.g., aggregate storage, concrete yards, soil storage, outdoor industrial activities), or intermittent sediment loads (winter sanding or anti-icing) should not use LID as part of the treatment system, or should include a solids removal protocol as part of a treatment train.

Table 5. LID use Considerations by Port Activity or Land Use

	Container Terminals	Break Bulk Terminals	Dry Bulk Terminals	Log Yards	Aggregate or Outdoor Material Storage	Maintenance	Public Roads	Vehicle Movement	Parking	Buildings / Roofs	Rail[1]
Bioretention	PA	PA	PA	P (debris)	P (sediment)	C	PA	PA	PR	C	n/a
Permeable Pavement	P (loads)	P (loads)	P (loads)	P (loads)	P (loads)	P (loads)	P (loads)	P (loads)	PA	n/a	n/a
Planter Boxes and Trees	C	C	C	P (debris)	P (sediment)	PA	PA	PA	PA	C	n/a
Downspout Treatment	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	PR	n/a
Vegetated Roofs	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	PR	n/a
Rainwater collection and use	PA	PA	PA	C	C	P (quality)	PA	PA	PA	PA	n/a
Flow dispersion	P (space)	P (space)	P (space)	P (space)	P (space)	P (quality)	PA	PA	PA	C	n/a

[1] Rail stormwater is considered dispersed and uncollected, therefore LID and similar BMPs cannot be applied.

PR - Port Required

PA - Port Allowed

C - Conditional

P - Prohibited

n/a Not applicable

General reason why the technique is not feasible:

- (loads) means the potential weight load of vehicles would exceed the normal performance range of the method
- (sediment) means that high sediment loads are usually associated with this activity that would be incompatible with normal operation and effective performance of this method
- (debris) means that there are normally high levels of debris associated with this activity that would be incompatible with normal operation and effective performance of this method
- (space) means that this method is space-intensive and may not be compatible with land use
- (quality) means that good water quality is needed for this use and not normally found with this activity

NOTES (Port # refers to Port parcel number):

1. Port #1A petroleum and solvents in groundwater and soil. Possible USTs.
2. Port #1B Earley Business Center; localized petroleum hydrocarbon contamination in soil and groundwater, and buried debris in southwest area that may require disposal as a Waste. 2013 Agreed Order to complete necessary cleanup.
3. Port #2 (northwest side) petroleum hydrocarbons in soil and groundwater. Port is conducting RI/FS under agreed order. Chlorinated solvents are also present and are addressed by Occidental as part of their cleanup.
4. Port #4 Ecology listed site; metals in soil.
5. Port #12 may contain arsenic-laden wood debris.
6. Port #14 arsenic in soil, undergoing excavation and offsite disposal. SPLP results indicate leaching to groundwater is not a pathway of concern.
7. Port #15 soils containing slag and woodwaste have been capped under an Ecology order on consent. Disturbance of the capped materials will require Ecology concurrence. PCP contamination within former sawmill area. Port and former tenant will enter into an agreed order with Ecology for RI/FS.
8. Port #25 soils containing slag and woodwaste have been capped under an Ecology consent decree. Soil and groundwater contamination are present beneath the cap limits. Disturbance of the capped materials will require Ecology concurrence.
9. Port #27 former slip filled with sediments from the Mouth of Hylebos Superfund Cleanup. Disturbance of capped materials requires EPA concurrence.
10. Port #27, former Petroleum Terminal. Soil and groundwater contain petroleum. Areas of highly contaminated soil and groundwater are shown. Ecology will require cleanup under an administrative order.
11. Port #27, former Wood Treatment Operation. Soil and groundwater contain creosote. Areas of highly contaminated soil and groundwater are shown. Ecology will require cleanup under an administrative order.
12. Port #27 removal of Pier 4 TBT-contaminated sediments planned under EPA Administrative Order on Consent. Historical contamination is present at former Time Oil and former wood treating facility.
13. Port #30 soils containing slag and woodwaste have been capped under an Ecology consent decree. Soil and groundwater contamination are present beneath the cap limits. Disturbance of the capped materials will require Ecology concurrence. Port #87 deed restriction on land use; metals in soil.
14. Port #33, Port #36A, Port #37A, Port #37D, Port #38, Port #70 and Port #78 are the site of a former City of Tacoma landfill.
15. Port #34 shallow soils contain petroleum and required remediation to be conducted by tenant.
16. Port #41 former waterway filled with sediments from the Sitcum Waterway Superfund Cleanup. Disturbance of capped materials requires EPA concurrence.
17. Port #47 soils containing slag and woodwaste have been capped under an Ecology consent decree. Soil and groundwater contamination are present beneath the cap limits. Disturbance of the capped materials will require Ecology concurrence.
18. Port #69 soil and groundwater contain petroleum and require long term monitoring.
19. Port #76 subject to Ecology order to identify a remedy for arsenic and other metals in soil and groundwater.
20. Port #77 will be subject to a consent decree to implement groundwater monitoring in accordance with the cleanup action plan. Areas of buried sludge and soil and groundwater contamination are shown.
21. Port #86 soils containing slag and woodwaste have been capped under an Ecology consent decree. Soil and groundwater contamination are present beneath the cap limits. Disturbance of the capped materials will require Ecology concurrence.
22. Port #88 southwest area cleaned up; site delisted; awaiting appeal judgment on final legal settlement with trust.
23. Port #91 soil and groundwater contain chlorinated solvents and required remediation to be conducted by former owner. PCBs on building and in soil.
24. Port #95 and Port #111 petroleum, solvents and other contamination associated with the Taylor Alexander Fill Area (TAFA). The approximate extent of contaminated fill is shown. Ecology has named TAFA Potentially Liable Parties and will require cleanup under an administrative order.
25. Port #96 may contain arsenic and remnant petroleum hydrocarbons in soil and groundwater.
26. Port #97 is adjacent to the Superlon facility to the north and may be affected by arsenic contamination at the border. Wood waste is present at ground surface following vacation by the tenant.
27. Port #99 is subject to two Ecology orders to identify a remedy for arsenic, other metals and solvents in soil and groundwater. Areas of highly contaminated soil and groundwater are shown.
28. Port #103 metals, PCBs, and high pH in groundwater near shoreline. Additional investigation needed to determine whether cleanup is required.
29. Port #114 metals and petroleum in fill soils and shallow groundwater. The stormwater ditch along the southern margin of the property has been filled with sodium silicate solids.
30. Port #115 sediments adjacent to pier contain metals that required remediation to be conducted by tenant under Ecology order, and high pH at southeast end of property.
31. Port #119 Ecology listed site; petroleum in soil and groundwater.
32. Mouth of the Hylebos is subject to a Consent Decree for monitoring potential recontamination following cleanup under EPA's Superfund Program. Performing parties are the Port of Tacoma and Occidental Petroleum. Notices required for all abutting leases.
33. Head of the Hylebos is subject to a Consent Decree for monitoring potential recontamination following cleanup under EPA's Superfund Program. Performing parties are the Port of Tacoma and General Metals. A portion of the Head of the Hylebos is also subject to an unrelated Ecology cleanup effort; performing parties include Weyerhaeuser, Louisiana-Pacific and Manke Lumber Company.
34. Occidental groundwater solvent (PCE, TCE, VC) and alkalinity plume. Hazardous Waste (caustic) and solvent vapors may be present in this area. The investigation and cleanup are being managed jointly by EPA under Superfund and by Ecology under MTCA and RCRA. Ground disturbance and leases on adjacent Port-owned properties requires advanced notice and consultation with EPA and Ecology.

REMEDIATION SITES

- Remediation Site
- Engineered Cap
- Known Area of Impact
- Possible Underground Storage Tanks
- Water
- Non-Port-owned Property

Port of Tacoma

Map Updated on: 11/3/2014

Head of the Hylebos
Mouth of the Hylebos
Blair Waterway
Commencement Bay
Puyallup River
Sitcum Waterway
Marine View Drive
Taylor Way
Alexander Avenue
Occidental
Earley Business Center
Totem Ocean Trailer Express Terminal
Husky Terminal
Terminal 4
P4 Gate
North Intermodal Rail Yard
Olympic Container Terminal
Terminal 7
APM Terminals
Exit Gate
South Intermodal Rail Yard
Pacific Rail Services (PRS) Yard
Milwaukee Way
Thorne Rd
Port of Tacoma Rd
Lincoln Ave
Tribal Ownership
BLAIR TERMINAL
WASHINGTON UNITED TERMINALS (WUT)
PIERCE COUNTY TERMINAL
Pierce County Terminal Gate
Pierce County Intermodal Rail Yard
Bonneville Power Administration (BPA)
BPA
Tacoma Power Substation
MARSHALL AVENUE AUTO FACILITY
Marshall Avenue
AWC
Auto Loading
Tacoma Rail Yard
Up Yard
54th Ave E
Fife Exit 137
Fife Exit 136
Pacific Hwy East
Pioneer Way
Transcontinental Rail Service
Burlington Northern Santa Fe Railroad
To Downtown Tacoma
Portland Ave
Marc St
East 16th
Stewart St
South Intermodal Support
East 11th ST
Lincoln Ave
99
5
509

Figure 6

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3.6 Operational Considerations

Several unique operational limitations at the Port can render LID infeasible. When a site has the following circumstances, the application of LID must be considered carefully.

Available Space – Port operations require large and specialized equipment that need significant space to safely operate.

Traffic – Ports are dominated by truck and rail traffic with unique travel and access considerations such as turning radii and the barring of heavy loads.

Proximity to Water – Ports require proximity, structures, and equipment in and over water. Also, there is limited available space for these unique water-based activities that must be optimized.

Operational – Ports often have large-scale outdoor activities and material storage that come into contact with stormwater with high sediment loads (aggregate), organic debris (logs and wood products), vehicle storage (car and machinery offloading), repair (ship yards), and finished and raw material storage and transfer, which require specialized controls and treatment.

Rail – Rail yards are typically constructed on ballast, which limits stormwater collection and makes standard stormwater control approaches infeasible to apply.

Industrial Treatment Systems – Some industrial sites have sophisticated stormwater treatment systems for controlling and treating industrial stormwater. Appling LID for treatment on these sites often does not provide additional benefits, though use as a source control measures should still be applied if feasible.

3.7 Criteria and Detailed Considerations

The following are criteria, considerations, and special circumstances that are common at ports and should be adhered to closely to ensure that LID methods are feasible for a specific site and function as intended. In addition to the criteria emphasized here, all LID design criteria listed by Ecology (2012) and the PSP (2012) for LID should be followed. This list should be used in conjunction with **Figure 5** to evaluate LID feasibility for a given site.

1. Bioretention must meet all of the following technical requirements to be used at the Port (adapted from PSP)
    - Depth to seasonal groundwater more than 3 feet AND bottom of facility is above Mean Higher High Water elevation.
    - Not located in an area of known contamination (see **Figure 6**)
    - Site elevation (at lowest drainage point) is higher than hydraulic flow line at high tides.
2. Permeable Pavement Criteria
    - There can be no use, storage, or transfer of hazardous materials over permeable pavement
    - Vehicle speeds must be less than 20 miles per hour
    - There must be no heavy vehicle traffic (such as trucks, pickers, or container transports) or parking

- No maintenance can be conducted or other activities with the potential for hazardous material spills

3. Flow Dispersion Criteria
    - May not be used on driving surfaces, emergency parking, or areas used as truck recovery zones
    - May not be used in limited areas that can be used for other purposes
    - Drainage areas must be less than 75 feet in length
    - May not be used in areas where drainage flows to non-Port property or has limited or poor downstream drainage
4. Planters and Tree Box Criteria
    - Hydraulic criteria for bioretention is met (see 1 above)
    - Compatible with safe vehicle movement and operations: minimum clearance from road at full tree height of 25 feet; meet sight distance criteria
    - Not used in road right-of-way
5. Rainwater Collection Criteria
    - There must be an application or use for the water on site (i.e., dust control, fire suppression, etc.)
    - Stormwater can be directed to planting areas as irrigation
6. Special Considerations
    - The site can be reasonably protected from damage by truck and heavy equipment traffic
7. Operational Considerations for Container Areas
    - Require continuous and connected paved areas with no breaks – LID systems cannot divide continuous and connected paved areas
    - LID systems cannot restrict turning radii of mobile equipment
8. Flow Dispersion Criteria – Roads (Same as 3)
    - Subject to truck recovery zone, driving surface, or emergency parking
    - May not be used in limited areas that can be used for other purposes
    - Greater than 75-foot drainage surface
    - Collection drains to non-Port property or has limited or poor downstream drainage
9. Vegetated Roof Criteria
    - The building must have sufficient structural support for application. If structural support is inadequate, improvements to the roof or building <u>are not</u> required to support the LID – the LID should not be used
    - Minimum 3-inch depth of soil

- Roof slope less than 20 percent
- Long-term maintenance is Port responsibility

10. Space Considerations
    - Space is available for typical ‘stormwater box’ device with minimal operation disruption
    - The device can be accessed easily and routinely for maintenance and replacement

3.8 Exceptions and Special Circumstances

The guidance above assumes typical circumstances for Port operations. It is not possible to consider all of the potential activities and needed stormwater controls. If a site exhibits exceptional circumstances, the guidance provided here can still be applied. It is suggested that the user consider the intent of this approach and look for equivalences, variances, and other processes as a basis to discuss exceptions. It is recommended that application of LID on a site be confirmed during the pre-application meeting with Port staff.

If site conditions indicate that a LID technique is prohibited, or another technique not included here could be applicable, the designer must coordinate with Port staff to obtain approval of alternate applications (see Section 4.3).

4.0 BMP Selection

4.1 Introduction

Stormwater under the MS4 Permit is regulated through the Port's permit that includes specific program performance measures for the Port to maintain compliance with its permit. The Permit requires the Port to use the Ecology Manual as AKART and select BMPs from it when new development or redevelopment occurs, using a presumptive compliance approach. Sites at the Port under the ISGP are required to conduct effluent monitoring and to carry out corrective actions when results fail benchmarks. BMPs selected under either permit program become legacies of the Port's stormwater system, and regulations continue to change with each permit renewal. Consequently, the Port has prepared a list of BMPs that meet multiple needs:

- Best-value performance based on highest typical expected effluent and best capital, life-cycle, operations value to achieve presumptive goals;
- Best-reduction performance to treat expected influent from Port-specific sites to achieve the technical maximum extent practicable;
- Preferred operations and maintenance needs and cost, and most reliable performance over the life of the system; and
- Near-term or temporary compliance need or replica of an approved BMP that meets Port operational and space constraints.

The list of BMPs highlights methods from the Ecology Manual that are preferred by the Port. In order to provide greater flexibility in selecting BMPs, the Port also provides a list of BMPs that have limitations on Port properties, but can be used if specific conditions are met. The final portion of the list describes BMPs that the Port prefers not to use.

The approach used in preparing the BMP selection list is based on typical past performance effluent results, limiting physical conditions typical for Port properties, and relative cost information. Details of this screening approach are available in Appendix D.

4.2 Preferred BMP List

When selecting BMPs for installation on Port property, the following list should be considered carefully. Conditionally Allowed treatment methods must be approved by the Port following the approval process described in Section 6. Special considerations for this approval are included in the list below. Updated versions of this list can be found on the Port's website.

http://portoftacoma.com/community/environment/water-quality

Preferred Treatment Methods:

Bioretention – Bioretention systems are effective at pollutant removal, particularly zinc. In addition, they are often well suited to spatial limitations on Port properties. However, underdrains may be necessary if high groundwater prevents infiltration.

Ecology-approved BMPs using this treatment method:

- Bioretention Cells, Swales, and Planter Boxes (T7.30)
- Compost-Amended Vegetated Filter Strips (T7.40)

Basic Biofiltration Swales – Biofiltration swales are particularly efficient at removing zinc and Total Suspended Solids (TSS) from stormwater, and are also well suited to the spatial limitations on Port properties.

Ecology-approved BMPs using this treatment method:

- Basic Biofiltration Swale (T9.10)

Basic Filter Strips – Basic Filter Strips are particularly efficient at removing zinc from stormwater and are also well suited to the spatial limitations on Port properties.

Ecology-approved BMPs using this treatment method:

- Basic Filter Strips (T9.40)

Conditionally Allowed Treatment Methods:

Sand Filters – Sand filtration works well for removing pollutants, particularly zinc. However, many sand filter systems rely on either infiltration or sufficient gradient to move water through the filter. Some sand filter basins are also too large to be practical on Port properties.
Special Considerations for approval: the proponent must demonstrate adequate site conditions for sand filters, but does not need to provide a percent exceedance curve (see Appendix D).

Ecology-approved BMPs using this treatment method:

- Basic Sand Filter Basin (T8.10)
- Large Sand Filter Basin (T8.11)
- Sand Filter Vault (T8.20)
- Linear Sand Filter (T8.30)

Media Filters – Similar to sand filters, media filters often need sufficient gradients to move water through the filter. Media filtration may be suitable for application on Port property, but must be approved by the Port.
Special Considerations for approval: the proponent must demonstrate adequate site conditions and provide a percent-exceedance curve (see Appendix D) to demonstrate the performance of the proposed media.

Ecology-approved BMPs using this treatment method:

- Media Filter Drain (T8.40)

Wet Biofiltration Swales – Similar to basic biofiltration swales, wet biofiltration swales are efficient at removing TSS, though less efficient when it comes to metals. Swales in general can easily be fit to a variety of unique site conditions.
Special Considerations for approval: the proponent must provide a percent-exceedance curve (see Appendix D) demonstrating effective treatment for copper and zinc.

Ecology-approved BMPs using this treatment method:

- Wet Biofiltration Swale (T9.20)
- Continuous Inflow Biofiltration Swale (T9.30)

Manufactured Devices – While manufactured devices work well in the unique environment at the Port, they are statistically less effective at removing pollutants and should be used only when other systems prove impractical.
Special Considerations for approval: the proponent must provide a percent-exceedance curve (see Appendix D) for the specific manufactured device proposed.

Ecology-approved emerging technologies:

- Filterra ™
- Aqua-Filter ™ Systems
- BayFilter ™
- MWS-Linear Modular Wetland
- FlocClear ™
- StormFilter ™
- UrbanGreen ™ Biofilter
- Up-Flo ™ Filter
- ecoStorm ™ Plus
- FloGard ™ Perk Filter
- Jellyfish Filter
- Aquip ™
- Compost Amended Biofiltration Swale

Methods Not Applicable to Port Properties:

Infiltration – Although infiltration systems are affective at removing pollutants, they are generally ineffective at the Port due to high groundwater, contaminated soil, and space constraints.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Infiltration Basins (T7.10)
- Infiltration Trenches (T7.20)

Wetponds – Wetponds are only moderately effective at removing stormwater pollutants. The largest deterrent against using wetponds is the size and need for sufficient gradient that is generally difficult to accommodate on Port properties.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Wet Ponds (T10.10)

Wet Vaults – Wet vaults are relatively inefficient for pollutant removal. In addition, wet vaults typically need sufficient gradient drops that are unsuited to Port properties.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Wet Vaults (T10.20)

Constructed Stormwater Wetlands – Although wetland facilities show excellent effectiveness at removing pollutants, their typically large size is prohibitive to use at the Port.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Stormwater Treatment Wetlands (T10.30)

4.3 Approving Other BMPs

Treatment method preferences listed above are based on general performance and typical site conditions. It is assumed that the majority of development and redevelopment projects can accommodate the preferred BMPs. However, it is acknowledged that some sites will have circumstances and conditions that won't accommodate the preferred BMPs and may require other options. The project proponent can propose the use of other BMPs by demonstrating performance and application of the proposed BMP.

For approval by the Port, performance must be demonstrated using the exceedence curve approach described in Appendix D, and a site plan must be provided to demonstrate applicability to the property constraints. The percent-exceedence curve should be prepared using effluent data from the proposed BMP. It is recommended that there be at least 10 data points to construct a curve. Data can be used from existing studies such as those in the International Stormwater BMP Database, studies conducted by the manufacturer, or other studies conducted using the same device/technology. If existing data is unavailable, proponents can conduct an off-site study to obtain data.

A spreadsheet tool for generating this type of curve can be found on the Port of Tacoma website at the link below.

http://portoftacoma.com/community/environment/water-quality

Water Quality Performance Standard

The resulting effluent percent-exceedance curve for the proposed BMP must demonstrate a minimum of 80 percent below the benchmark for at least two of the following constituents: total copper, total zinc, total suspended solids.

The exceedance curve must be submitted to the Port along with a site plan that demonstrates the size, location, and constraints for the proposed BMP. The Port will make a determination as to whether the BMP will be allowed on the site.

5.0 References

Puget Sound Partnership (PSP), Washington State University Extension. 2012. *Low Impact Development Technical Guidance Manual for Puget Sound*. Publication No. PSP 2012-3. December.

Washington State Department of Ecology (Ecology). 2012. *Stormwater Management Manual for Western Washington.* Publication No. 12-10-030. August.

Websites

International Stormwater BMP Database. http://www.bmpdatabase.org/

GLOSSARY

Activity-based Requirements – stormwater treatment requirements that are triggered by changes in land use that are likely to result in an increase in pollutant loading for unmitigated sites. Activity-based requirements would normally not be triggered by the disturbance thresholds in the Ecology manual and NPDES requirements.

All Known and Available Reasonable Treatments (AKART) – the most current methods that can be reasonably required for preventing, controlling, or abating the pollutants associated with stormwater discharge.

Best Management Practices (BMPs) – approved physical, structural, and/or managerial practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Demonstrative compliance approach – an approach to stormwater compliance that puts the burden of proof on the project proponent to demonstrate that the project will not adversely impact water quality.

Development and redevelopment –development is the conversion of vegetated land to other uses including buildings, other structures, or the creation of hard (impervious) surfaces. Redevelopment is the replacement or expansion of development (buildings and/or hard surfaces) on already developed land. Projects on Port-owned properties are primarily considered redevelopment since the area is already developed for industrial uses.

Equivalent Area – an area, other than the project area, that has the same runoff characteristics (if flow control is required) and pollution-generating characteristics. With approval, treating an equivalent area can be done in lieu of treating a project area directly.

Level 3 Corrective Actions – facilities under the Industrial Stormwater General Permit are required to monitor discharges quarterly. If water quality samples do not meet benchmark values, corrective actions are required. A level 3 corrective action is applied when benchmarks are not met for three quarters during a calendar year. In this case, stormwater treatment must be improved until compliance with the permit conditions is achieved.

Low Impact Development (LID) – an approach to stormwater treatment that manages stormwater as close to its source as possible. LID is considered an on-site approach to stormwater management and treatment.

Minimum Requirements – the Department of Ecology has set minimum requirements for stormwater management applicable to new development and redeveloped sites. Depending on the type and size of a project, different combinations of the minimum requirements apply.

Municipal Separate Storm Sewer Systems (MS4) – an acronym used in the NPDES permit issued to owners and operators of regulated small municipal separate storm sewer systems. This acronym is also sometimes used to refer to the municipal stormwater permit itself “MS4 Permit.”

On-site Stormwater Management – BMPs that serve to infiltrate, disperse, and retain stormwater on-site.

Percent-exceedance curve – a chart derived by data that shows the odds (percent chance) that a specific value is going to be exceeded. The Port of Tacoma uses percent-exceedance curves to determine the percent chance that stormwater may exceed benchmark values.

Presumptive compliance approach – an approach to stormwater compliance that, using best available science, presumes the effectiveness of treatment when treatment is based on the use of Ecology-approved BMPs. The approach is based on the idea that all stormwater runoff from developed sites is similar and that all approved treatment technology is capable of treating that "typical" stormwater and is presumed to be achieving appropriate standards.

Retrofit Banking Program – a Program planned for development at the Port of Tacoma that would allow smaller development projects to meet their stormwater treatment requirements by purchasing banked credits from previous retrofit projects completed on other Port properties.

Road-related Projects – all roadways and paved surfaces on Port properties are considered as areas of vehicle movement. There are no roadways to be interpreted as subject to the road-related thresholds defined in the Ecology manual.

Secondary Permittee – an operator of a regulated small MS4 that is not a city, town, or county. Secondary permittees include special purpose districts such as the Port of Tacoma.

Source Control – stormwater treatment methods that attempt to prevent pollution from entering stormwater. Examples of source controls used at the Port are good housekeeping measures such as sweeping, covering stock piles, and using non-pollutant-generating building materials.

Stormwater Pollution Prevention Plan (SWPPP) – a documented plan to implement measures to identify, prevent, and control the discharge of contaminated stormwater. Construction SWPPPs are required during project construction to prevent soil erosion and sediment transport. Site SWPPPs are required for stormwater control and treatment during day-to-day operation of a facility.

Tenant Improvements – improvements, alterations or other changes on Port property that are facilitated, contracted and financed by the Tenant that would not be considered ordinary maintenance or repairs. A Tenant Improvement request initiates the stormwater review process.

Water Quality Treatment – treatment required for Port properties is based on the outcome of the Best Management Practice (BMP) selection process, which will meet the minimum Ecology requirements for treatment.

APPENDIX A

Interlocal Agreement between the Port of Tacoma and the City of Tacoma

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INTERLOCAL AGREEMENT
BY AND BETWEEN THE PORT OF TACOMA and THE CITY OF TACOMA
FOR
Mutual Cooperation & Support Regarding Agency Storm Water Management

The Port of Tacoma, a port district organized under the laws of the State of Washington (hereafter, "Port") and the City of Tacoma, a municipal corporation (hereafter, "City"), collectively "the Parties" enter into this Interlocal Agreement ("Agreement") pursuant to the Interlocal Cooperation Act (Chapter 39.34 RCW).

RECITALS

WHEREAS the Parties have a common interest in the proper management of surface water runoff (stormwater) to protect the water quality of Commencement Bay, its waterways and other receiving waters in and around the City and Port.

WHEREAS the Port of Tacoma and the City each have a responsibility to comply with their respective requirements set forth in the NPDES Phase I Municipal Stormwater Permit (MS4 Permit), issued by the Department of Ecology.

WHEREAS the Parties recognize there is a mutual benefit in cooperating and coordinating the integration of certain MS4 permit program elements to ensure better water quality in Commencement Bay, its waterways and other receiving waters, and have a shared interest in exploring ways to create efficiencies and cost savings with regard to stormwater management.

NOW, THEREFORE, in consideration of the mutual promises, benefits and obligations hereinafter set forth, the Parties agree as follows:

TERMS OF AGREEMENT

A. PURPOSE

The purpose of this agreement is to provide a cooperative framework for coordination by the Parties to eliminate barriers to compliance with the terms of their respective Phase I stormwater permit, which is allowed under Special Condition S3.B. of the MS4 Permit, and is in the public interest. In accordance with Special Condition S3.B., each party remains responsible for their permit compliance, and this Agreement does not transfer such responsibility.

Cooperation is mutually beneficial because each party benefits by a coordinated approach that targets the reduction of pollutants in municipal stormwater to the maximum extent practicable within two independently owned and operated municipal stormwater systems.

B. COORDINATION

The Port's Environmental Director and the City's Director or Interim Director of the Environmental Services Department will coordinate all activities included herein unless otherwise noted.

C. ROLES AND RESPONSIBILITIES

1. The Port will:

a. Fulfill all requirements, terms and conditions that are applicable in the Port's Phase I permit for the municipal separate storm sewers it owns and operates.

b. At no cost to the City, grant access to Port properties discharging to the City's storm-water system covered by its MS4 permit allowing City staff to map, provide spill/emergency response, and inspect, the City's storm water system in accordance with Port policies and Department of Homeland Security Rules and Regulations, including ensuring a TWIC-compliant escort is readily available for City personnel access.

c. Implement internal review for compliance with the Port's permit requirements for Port development/redevelopment projects that only discharge to Port-owned storm system covered under its MS4 Permit,. Upon request, the City's Environmental Services Department is available for consultation regarding applicable stormwater-related requirements for such projects in accordance with Section B.7 in Exhibit A, which is incorporated by reference into and made part of this Agreement.

d. Comply with the City of Tacoma Surface Water Management Manual and Tacoma Municipal Code 12.08 or as otherwise amended for Port development and redevelopment projects that discharge surface or stormwater to the City of Tacoma's MS4 storm sewers.

e. Compensate the City for certain storm water services as set forth in Exhibit A, when the Port has requested such services and the City has provided a written scope and cost estimate prior to performing work, provided however, the requirement for a written estimate is waived when imminent harm may occur to the environment without immediate response. In such cases, verbal authorization from the Port will suffice.

f. Coordinate internal effort and assist City staff to ensure timely completion of the action elements in this Agreement.

2. The City will:

a. Implement the requirements that are applicable in the City's MS4 Permit for the separate municipal storm sewers it owns and operates.

b. Provide a courtesy stormwater review by Environmental Services, in conjunction with other required project reviews for Port projects that discharge to Port-owned MS4 infrastructure.

c. Implement the adopted Ordinance No. 13450, passed by the City Council on February 5, 2013, which added TMC 12.08.500 A.3, as may be amended by the City Council, which has the effect of reducing surface water fees for Port properties/tax parcels that do not flow through the City's municipal stormwater system but discharge directly through and from Port properties/tax parcels to receiving waters.

d. Implement Ordinance No. 13450, passed by the City Council on February 5, 2013, which added TMC 12.08.500 A.2, as may be amended by the City Council, which has the effect of reducing surface water fees for undeveloped Port- owned "open space" upland properties that are not planned for future development and can be demonstrated to provide a water quality benefit.

e. Meet annually with the Port to discuss maintenance of City-owned drainage ways (e.g., vegetation and sediment removal) and conveyance structures located within the Port District to assess whether such drainage ways or conveyance structures are causing property damage. Such review shall include identifying necessary infrastructure improvements and maintenance actions of the outfall structure and tidegate system for those parts of the drainage ways that are part of the City's storm-water system to address flooding of Port properties and portions of Milwaukee Avenue. (See, MS4 permit S5.C.9.e.) Infrastructure improvements and needed maintenance actions shall be subject to available funding, work prioritization by the City and, in the case of shared infrastructure, obtaining access and/or cost sharing agreements for such work.

f. At no cost to the Port, grant Port staff access to City infrastructure which discharges to the Port's storm-water system to map, provide spill/emergency response, inspect and perform other related activities in accordance with City policies.

g. Provide consultation regarding applicable stormwater-related requirements for Port projects and provide other stormwater-related services to the Port as set forth in Exhibit A.

h. Meet annually or as otherwise requested by the Port and/or City to discuss stormwater ordinance modification proposals , if any, deemed necessary by either party to support their business objectives and the successful implementation of their respective MS4 permit programs.

D. GENERAL PROVISIONS

1. Effective Date. This Agreement shall be effective upon approval by both the Tacoma City Council and the Port Commission, and execution by all signatories below. The Agreement shall remain in effect for a period of five (5) years unless terminated sooner by either party for convenience.

2. No Real Property Transfers. No ownership of real property will transfer as a result of this Agreement.

3. Financial Obligations. Except for payment of stormwater-related services the City provides the Port upon Port request as set forth in Exhibit A, each Party is responsible to finance the obligations it agrees to undertake as a result of this Agreement.

4. Contacts. Each of the parties shall designate from its respective staff a contact person with responsibility for administration of the terms of this Agreement.

5. Limitation of Agreement. This Agreement does not relieve either party of any obligation or responsibility imposed upon it by law, including the obligations set forth in each Parties' respective MS4 Permit.

6. Timing. The requirements of this Agreement shall be carried out in a timely manner according to a schedule negotiated by the parties.

7. Incorporation Clause. This Agreement constitutes the complete and final agreement of the Parties, replaces and supersedes all oral and/or written proposals and agreements heretofore made by the Parties on the subject matter, and may be modified only by a writing signed by the Parties hereto.

8. Filing/Posting. In accordance with Chapter 39.34 RCW, a copy of this Agreement shall be recorded in the Office of the Pierce County Auditor or posted by each Party on their web site.

9. Record Retention. All project records shall be retained in accordance with each party's document retention schedule and available for review or audit by the other party during the term of this Agreement.

10. Disputes. The designated representatives herein shall use their best efforts to resolve disputes between the Parties. If the designated representatives

are unable to resolve a dispute, then the responsible Project Directors for each Party shall review the matter and attempt to resolve it. If the Project Directors are unable to resolve the dispute, the matter shall be reviewed by the Department Director or Chief Executive Officer of each Party or his or her designee. The Parties agree to exhaust each of these procedural steps before seeking to resolve disputes in a court of law or any other forum.

11. Indemnification. The City shall defend, indemnify and hold the Port, its officers, elected officials, employees and agents harmless from and against any and all costs, claims, demands, suits, actions, judgments, an/or awards of damages (collectively "Claims") resulting from this Agreement, which arise due to the Fault of the City, and persons acting on its behalf. This Agreement does not transfer to, or make the City responsible for any of the Port's MS4 Permit compliance obligations, and any Claims based on such compliance obligations are not covered by this paragraph.

The Port shall defend, indemnify and hold the City, its officers, elected officials, employees and agents harmless from and against any and all Claims resulting from this Agreement, which arise due to the Fault of the Port, and persons acting on its behalf, including any claims that arise due to the City's inability to perform because of access restrictions imposed by Port Security. This Agreement does not transfer to, or make the Port responsible for any of the City's MS4 Permit compliance obligations, and any Claims based on such compliance obligations are not covered by this paragraph. The term "Fault" as it is used in this Paragraph shall be defined according to RCW 4.22.015. This Indemnification section shall survive the termination of this Agreement.

APPROVED BY the Commissioners of the Port of Tacoma, State of Washington and signed in authentication thereof the 25th day of July 2013.

Signature authorized by the Tacoma City Council pursuant to Resolution No. _____ on the ___ day of ___, 2013

PORT OF TACOMA:

By DON MEYER, Chair,
Port of Tacoma Commissioners

CITY OF TACOMA

T.C. Broadnax (Date)
City Manager

ATTEST:

Michael P. Slevin, III, P.E. (Date)
Director,
Environmental Services Department

7.26.13

John Wolfe, (Date)
Chief Executive Officer

Deborah Dahlstrom (Date)
Risk Manager

ATTEST:

Doris Sorum, City Clerk

APPROVED AS TO FORM:

Carolyn Lake, Port General Counsel

APPROVED AS TO FORM:

Deputy City Attorney

EXHIBIT A

The Port may request the City to provide the following stormwater-related services as set forth in this Exhibit A.

A. City Laboratory Services.

If requested by the Port, the City agrees to provide certain analytical services at its Environmental Services Department Laboratory ("City Laboratory") for the parameters listed and analytical costs quoted in the attached document titled "Laboratory Analytical Services Quotation." The City may periodically update this document either to add or delete parameters and/or to update cost quotes for analytical services, and provide the Port with a copy of the same, upon request. The Port is responsible for requesting whether there are updated cost quotes at the time they seek analytical services from the City. The Port's costs for City Laboratory services shall be in accordance with and equal to the City's "Laboratory Analytical Services Quotation" in effect at the time analytical services are requested by the Port.

1. The laboratory cost quotes are for samples provided by the Port to the City Laboratory in an "analysis ready" format. The term "analysis ready" means the samples have been collected, stored and managed in accordance with an approved Quality Assurance Project Plan (QAPP") by persons trained and qualified to perform such sampling activities. The Port shall make every effort to assure the samples delivered to the City Laboratory are in an "analysis ready" format.

2. The cost quotes in the "Laboratory Analytical Services Quotation" do not cover any costs the City may incur to make a sample "analysis ready", which shall be the Port's responsibility to pay. The City will provide the Port an estimate in writing of such costs before incurring any such costs and receive approval for the estimated costs in writing.

3. Prior to requesting City Laboratory services, the Port shall: (i) provide the City with a copy of its QAPP at no cost; and (ii) schedule a meeting between the City Laboratory staff and Port's sampling personnel to discuss the QAPP and expectations for the analytical work. Each party shall bear its own costs associated with the effort described in this paragraph.

B. Other City NPDES Stormwater Permit - Related Services.

1. Smoke Testing Pipe Infrastructure. Upon request, the City may "smoke-test" the Port's storm pipes (or sanitary pipes within the Port District) to detect illicit connections and illicit discharges to the Port's municipal stormwater system ("MS4 System"), per the cost schedule set forth in Section C below.

2. GIS Database Information. City generated Geographic Information Services (GIS) information, and other stormwater-related records shall be made available to the Port upon request in accordance with the Public Records Act, Chapter 42.56 RCW. City-generated draft GIS mapping information of stormwater facilities and conveyance systems on properties within the Port district that discharge to the City's stormwater drainage system shall be provided to the Port for its review and comment prior to the City finalizing such information. If requested, the City may assist the Port with GIS mapping services for properties that drain to the Port's stormwater drainage system per the cost schedule set forth in Section C below. GIS layers depicting the Port's stormwater drainage system may be maintained and used by the City for mapping purposes subject to regulatory restrictions imposed by the United States Department of Homeland Security and Port policies implementing such regulations.

3. Source Control/Business Inspections. If requested, the City may assist the Port with stormwater source control inspections at businesses that drain to the Port's stormwater drainage system, per the cost schedule set forth in Section C below. Samples collected during such inspections shall be the Port's responsibility to manage and analyze in accordance with its QAPP.

4. Spill-Related Emergency Response. At the Port's written request, provide and/or assist the Port with spill-related emergency response services after regular business hours for spills and releases of oil or hazardous substances originating from Port properties in accordance with the cost schedule set forth in Section C below. Personnel costs shall be adjusted to be equal to the City's overtime rate for spill response assistance after 5 PM Monday through Friday, and anytime during a weekend or holiday. City assistance with spill coordination and cleanup activities shall continue until an authorized Port representative arrives or until the cleanup or response action is completed, whichever is earlier. The Port and City shall coordinate each agency's spill response process and procedures and work to achieve as much consistency as possible. The Port shall ensure that Port Security provides the City with timely access to Port properties for spill response purposes.

5. Use of City Decant Facility. (*Tentative*)[1]

Upon request, and if authorized by the City's Conditional Solid Waste Handling Permit, the Port may use the City's Decant Facility to "off-load" its vactor truck decant material at such time(s) as may be approved by the City. Such material shall conform to any material specifications imposed by the City, and the City reserves the right to reject loads for non-conformance with its specifications. The Port's cost to use the Decant Facility is set forth below in Section C. The Port

[1] This condition is marked "tentative" because the City's Conditional Solid Waste Handling Permit issued by the Tacoma - Pierce County Health Department currently authorizes the City to accept City-generated process educator and street sweeping wastes only.

shall maintain any generator responsibility it may have under federal and state laws for any decant material the Port off-loads at the City's Decant Facility.

6. Training Services.

The City will provide periodic notice to the Port about any scheduled "internal" stormwater management-related training provided by City staff. Port personnel may attend such training at the same cost charged for City employees. The Port may also request the City to provide separate training to Port staff regarding stormwater best management practices. The scope, timing, cost and duration of such training shall be determined by the City in coordination with the Port. If the City offers training provided by an outside consultant or other provider, then Port staff may attend such training at the same cost per attendee as the City pays, provided there is no objection by the training provider.

7. Development/Redevelopment Consultations.

Depending on the scope and extent of the development/redevelopment consultation undertaken in accordance with Section C.1.c. of this Agreement, the City may charge the Port for such consultation. Such charge shall be discussed with the Port in advance of the consultation. The City will provide a written estimate of charges for this activity and the Port will approve it in writing prior to any work being performed.

C. Costs for Non-Laboratory City Services.

Personnel Costs.

The non-overtime hourly rate for the City personnel providing the services described in Section B of this Exhibit is as follows:

	Billing Rate
• Senior Environmental Specialist:	$71.66 per hour
• Senior Source Control Representative	$61.70 per hour
• Source Control Representative	$57.14 per hour
• Professional Engineer	Applicable Rate[2]

Overtime work shall be charged at the City's overtime rate. The above-listed hourly rates may be periodically updated by the City to reflect City Council-authorized changes in compensation for each of the job classifications listed. The Port is responsible for requesting whether there are updated cost quotes at the time they seek analytical services from the City. For services referenced herein where the Port has agreed to pay City costs, the Port shall pay the non-overtime

[2] The term "Applicable Rate" means the hourly rate of the City-employed Professional Engineer providing the service requested by the Port.

hourly (and overtime) rate in effect at the time a City service is provided to the Port. Provided however, if the work requested by the Port is of a non-emergent nature which is the type of work that typically can be completed during normal working hours, unlike a spill event, for example, then the City shall charge the Port the non-overtime hourly rate.

Loaned Equipment.

The City may lend the Port smoke-testing equipment, or other equipment at a cost agreed to by the parties, which shall be documented in writing prior to the equipment loan occurring.

Cost to Use City Decant Facility (*Tentative*)

The Port may use the City's Decant Facility on a "per load" basis at a cost that reimburses the City's labor and facility operation costs to manage and dispose of the Port's load of vactor waste material. The Port's cost shall be quoted in writing at the time the Port requests use of the City's Decant Facility.

Other Costs and Expenses.

For services referenced herein where the Port has agreed to pay City costs, materials, fuel, and supplies used by the City to accomplish the services provided in Section B of this Exhibit A shall be charged at the City's cost. For those portions of services referenced herein where the Port has agreed to pay City costs, the City may also assess a charge for use of its vehicles and equipment to accomplish the work covered under this section to cover depreciation and "wear and tear" of such vehicles and equipment.

D. Payment.

Invoices shall be accompanied with supporting data showing:

a) Written summary of work performed for the period of the invoice;
b) Staff charges by name, discipline, date of service, description of task and hourly rate;
c) Costs for equipment, supplies or other expenses;
d) Any markups, overhead of other fees comprising the total cost;
e) A copy of any consultant agreement and invoice will also be provided when applicable.

All invoices shall be mailed "Attention: Contracts Department". Invoices may be emailed to cpinvoices@portoftacoma.com. The email must include the required supporting documentation. Incomplete or improperly prepared invoices will be returned for correction without processing or payment.

City agrees to submit timely invoices when the work is complete, unless a specific service requested by the Port takes longer than 60 days to complete, in which case the Port may ask the City to provide an invoice after the 60th day.

The Port agrees to pay all undisputed costs incurred for laboratory and non-laboratory services arising under this Exhibit A within thirty (30) calendar days of receiving a properly documented invoice from the City.

###

APPENDIX B

Port of Tacoma Checklists / Forms

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Project Pre-Application Checklist for Stormwater

The following checklist ensures that preliminary stormwater-related information has been reviewed as part of the initiation of any new project. The proponent should provide the following information to the Port as preparation for the Pre-Application meeting for any development or redevelopment of Port property.

- ☐ Project name
- ☐ Project location – site address, and parcel number
- ☐ Owner – name, address, phone, and email
- ☐ Engineer representative – name, address, phone, and email
- ☐ Type of stormwater permit (MS4 or IGSP)
- ☐ Brief project description including the following:
  - ☐ Current and proposed condition, use and activity
  - ☐ Size of parcel
  - ☐ Receiving water
- ☐ Schedule from review process to construction completion
- ☐ Describe, discuss, and identify the following for the project site in its existing condition:
  - ☐ Topography
  - ☐ Land use and ground cover
  - ☐ Natural and man-made drainage patterns
  - ☐ Any known historic drainage problems such as flooding, erosion, etc.
  - ☐ Existing utilities (storm, water, sewer)
  - ☐ Existing fuel tanks or other sources of hazardous materials
- ☐ Identify difficult site conditions.
- ☐ Show drainage path on Port of Tacoma drainage infrastructure map identifying the following:
  - ☐ Catchment area delineated by outfall to receiving water or offsite discharge
  - ☐ Port and/or City drainage conveyance and outfall(s)
  - ☐ Ultimate receiving water
- ☐ Identify soil conditions including the following:
  - ☐ Groundwater elevation
  - ☐ Location of test pits
  - ☐ Infiltration rates (where applicable)
  - ☐ Location of contaminated soils; show site on Port of Tacoma contaminate soils map
- ☐ Identify existing and proposed use and activities, with general locations of each activity shown. Use the categories shown in Chapter 3, Table 4 of the Port's Stormwater Management Guidance Manual.
- ☐ Determine the following information for the onsite discharge area:
  - ☐ Total Project Area (ft^2)
  - ☐ Existing Impervious (ft^2)

- ☐ Existing Pervious (ft^2)
- ☐ Amount of new impervious (ft^2)[1]
- ☐ Amount of replaced impervious (ft^2)
- ☐ Amount of new plus replaced impervious (ft^2)
- ☐ Impervious surfaces to Pervious Surface (ft^2)
- ☐ Amount of Land Disturbed (ft^2)
- ☐ Amount of Land Undisturbed (ft^2)

☐ Apply flow chart from Figure 3 of the Port's Stormwater Management Guidance Manual with decision path clearly marked and supported.

☐ State conclusions from decision and flow chart(s).

☐ If water quality treatment is required, provide treatment type.

- ☐ Describe source control methods to be used onsite (Section 2.5.2).
- ☐ Describe LID applications (Sections 2.5.3 and 3.0). Include LID selection flow chart (Figure 6 of the Port's Stormwater Management Guidance Manual) with decision path clearly marked and supported.
- ☐ Describe BMP selection (Sections 2.5.4 and 4.0). If the BMP is Conditionally Allowed or a new technology, provide supporting information to justify use on this project site.

☐ Provide information supporting exceptions or special considerations.

☐ Other information as necessary to fully describe the existing site and its surroundings.

[1] Note: all impervious area is assumed pollution generating by the Port.

Port of Tacoma Stormwater Site Plan Checklist

The following checklist ensures that all necessary details are provided in the project Stormwater Site Plan (SSP) when submitted to the Port for review. See section 2.5.1 of the Port of Tacoma Stormwater Management Guidance Manual for an overview of SSP requirements.

Chapter 1. Project Overview

The project overview must provide a general description of the project including the existing condition of the site, the proposed developed condition of the site, the site area, and the extent of improvements.

- ☐ Project name
- ☐ Project location – site address, and parcel number
- ☐ Owner – name, address, phone, and email
- ☐ Engineer representative – name, address, phone, and email
- ☐ Type of stormwater permit (MS4 or IGSP)
- ☐ Brief project description including the following:
  - ☐ Current and proposed condition, use and activity
  - ☐ Size of parcel
  - ☐ Receiving water
- ☐ Schedule from review process to construction completion

Chapter 2. Existing Condition Summary

The Existing Condition Summary is intended to provide a complete understanding of the project site in its existing condition and must be based on thorough site research and investigation.

- ☐ Describe, discuss, and identify the following for the project site in its existing condition:
  - ☐ Topography
  - ☐ Land use and ground cover
  - ☐ Natural and man-made drainage patterns
  - ☐ Any known historic drainage problems such as flooding, erosion, etc.
  - ☐ Existing utilities (storm, water, sewer)
  - ☐ Existing fuel tanks or other sources of hazardous materials
- ☐ Identify difficult site conditions.
- ☐ Identify any specific requirements included in a basin plan for the area.
- ☐ Include a grading plan.
- ☐ Show drainage path on Port of Tacoma drainage infrastructure map identifying the following:
  - ☐ Catchment area delineated by outfall to receiving water or offsite discharge
  - ☐ Port and/or City drainage conveyance and outfall(s)
  - ☐ Ultimate receiving water
- ☐ Include a soil report that identifies the following (soil report should be contained as an appendix to the SSP):

- ☐ Groundwater elevation
- ☐ Location of test pits
- ☐ Infiltration rates (where applicable)
- ☐ Location of contaminated soils; show site on Port of Tacoma contaminate soils map

☐ Other information as necessary to fully describe the existing site and its surroundings.

Chapter 3. Offsite Analysis

The Port requires a qualitative discussion of the offsite upstream and downstream system for all projects. The qualitative analysis shall extend downstream for the entire flow path, from the project site to the receiving water, or up to ¼ mile, whichever is less. Upon review of this analysis, the Port may require a qualitative analysis farther downstream, mitigation measures deemed adequate to address any identified problems, or a quantitative analysis, depending on the proposed design of the onsite drainage facilities and the presence of existing or predicted flooding, erosion, or water quality problems.

☐ Provide and verify the following via site visits and other available information:

- ☐ Verify drainage areas
- ☐ Identify drainage conveyance shared with adjoining properties
- ☐ Identify existing/potential constrictions or capacity deficiencies in the drainage system
- ☐ Identify existing/potential flooding problems
- ☐ Verify information on pipe sizes, channel characteristics, and drainage structures
- ☐ Verify discharge location

Chapter 4. Permanent Stormwater Control Plan

Provide the information used to select size and locate permanent stormwater control LID and BMPs for the project site. Previous stormwater report may be referenced. The Stormwater Control Plan shall contain the following sections, as applicable:

Section 1 – Discharge Areas and Applicable Requirements for Treatment

Complete the following steps in order to determine the applicable Minimum Requirements.

☐ Provide a map showing the onsite discharge area for the project.

☐ Identify existing and proposed use and activities, with general locations of each activity shown. Use the categories shown in Chapter 3, Table 4 of the Port's Stormwater Management Guidance Manual.

☐ Determine the following information for the onsite discharge area:

- ☐ Total Project Area (ft^2)
- ☐ Existing Impervious (ft^2)
- ☐ Existing Pervious (ft^2)
- ☐ Amount of new impervious (ft^2)[1]
- ☐ Amount of replaced impervious (ft^2)
- ☐ Amount of new plus replaced impervious (ft^2)
- ☐ Impervious surfaces to Pervious Surface (ft^2)

[1] Note: all impervious area is assumed pollution generating by the Port.

- ☐ Amount of Land Disturbed (ft^2)
- ☐ Amount of Land Undisturbed (ft^2)

Section 2 – Existing Site Hydrology

Describe in as much detail as possible the existing site hydrology.

- ☐ Provide a list of assumptions and site parameters for the existing condition.
- ☐ Identify all sub-drainages within, or flowing through, the site. Use consistent labeling for all sub-drainages throughout figures, calculations, and text.
- ☐ For each sub-drainage, identify current land-use, acreage, and hydrologic soil group for modeling.
- ☐ Provide a basin map drawn to scale showing the following:
  - ☐ Delineation and acreage of areas contributing runon to the site, including land use type
  - ☐ Delineation and acreage of areas contributing runoff from the site, including land use type
  - ☐ The location of basin discharge and ultimate discharge
  - ☐ The limits of development
- ☐ Summarize output data from the existing condition models. For WWHM models, provide model files electronically. Do not provide printouts of WWHM model outputs.
- ☐ Provide other information as necessary to provide a detailed description of the drainages and sub-drainages affected by the project.

Section 3 – Proposed Site Hydrology

Describe in as much detail as possible the proposed site hydrology.

- ☐ Provide a list of assumptions and site parameters for the proposed condition.
- ☐ Identify all sub-drainages within, or flowing through, the site. Use consistent labeling for all sub-drainages throughout figures, calculations, and text. If drainage boundaries are modified by the project, clearly show the new boundaries on the map.
- ☐ For each sub-drainage, identify current land-use, acreage, and hydrologic soil group for modeling.
- ☐ Provide a basin map drawn to scale showing the following:
  - ☐ Delineation and acreage of areas contributing runoff from the site, including land use type
  - ☐ The location of basin discharge and ultimate discharge
  - ☐ The limits of development
- ☐ Summarize output data from the proposed condition models. For WWHM models, provide model files electronically. Do not provide printouts of WWHM model outputs.
- ☐ Provide other information as necessary to provide a detailed description of the drainages and sub-drainages affected by the project.

Section 4 – Performance Goals and Standards

Use the information obtained for Chapter 4, Section 1 of the SSP to complete this section.

- ☐ Apply flow chart from Figure 3 of the Port's Stormwater Management Guidance Manual with decision path clearly marked and supported.

- ☐ State conclusions from decision and flow chart(s).
- ☐ If water quality treatment is required, provide treatment type.

Section 5 – Water Quality System

The water quality treatment system should consist of source control methods, LID applications, and treatment BMPs that will be used on site.

- ☐ Describe source control methods to be used onsite.
- ☐ Describe LID applications. Include LID selection flow chart (Figure 6 of the Port's Stormwater Management Guidance Manual) with decision path clearly marked and supported.
- ☐ Describe BMP selection. If the BMP is Conditionally Allowed or a new technology, provide supporting information to justify use on this project site.
- ☐ Identify the sizing method(s) for both LID and BMP facilities as necessary.
- ☐ Summarize model results. Include an explanation of all assumptions made, equations used, etc.
- ☐ For each treatment method used, include size, type, and characteristics of treatment facility and appurtenances.
- ☐ Provide a drawing of the treatment facilities and their appurtenances, including:
    - ☐ Dimensions
    - ☐ Inlet/outlet sizes and elevations
    - ☐ Location and sizes of bypass
    - ☐ Location of the facilities on the project site
    - ☐ Appurtenances/fittings
- ☐ Calculations for the water quality design storm and facility sizing calculations must be included in Appendix D of the SSP. Provide all WWHM files electronically. Do not provide printouts of WWHM model outputs.
- ☐ Where appropriate, include manufacturer's specifications in Appendix E of the SSP.
- ☐ Provide information supporting exceptions or special considerations.

Section 7 –Conveyance System Analysis and Design

- ☐ Provide a site plan showing the conveyance system including:
    - ☐ Existing conveyance system components including all pipes, culverts, channels, swales, catch basins, manholes, etc. Include sizes, types, and slopes of all components.
    - ☐ Proposed conveyance system components including all pipes, culverts, channels, swales, catch basins, manholes, etc. Include sizes, types, and slopes of all components.
    - ☐ Invert elevations of all proposed and existing components.
    - ☐ All crossing information to ensure vertical and horizontal separation (this may require a profile view).
- ☐ Describe capacities, design flows, and velocities for each reach.
- ☐ Include conveyance calculations in Appendix D of the SSP.
- ☐ Other information as necessary to fully describe the existing and proposed conveyance system.

Chapter 5. Discussion of Minimum Requirements

Chapter 5 is intended as a checklist for the applicant and reviewer to verify that the applicable Minimum Requirements have been met within the project submittal.

- ☐ List the Minimum Requirements that apply to the project.
- ☐ Discuss how the project satisfies each Minimum Requirement.

Appendices

- ☐ Appendix A – Operations and Maintenance Plan for all stormwater systems
- ☐ Appendix B – Construction Stormwater Pollution Prevention Plan
- ☐ Appendix C – Submittal Requirements Checklist (a copy of the checklist shall be submitted as part of the SSP)
- ☐ Appendix D – Hydraulic Analysis/Calculations
- ☐ Appendix E – Other reports, as required

Required Drawings

Project drawings shall be provided and include the following as applicable for the project.

11" by 17" drawings must be included in the SSP Report.

- ☐ The first sheet or cover sheet shall include:
  - ☐ Name, address, email, and telephone number of the applicant, agent or owner
  - ☐ Name, address, email, and telephone number of the person preparing the plans
  - ☐ Name, address, email, and telephone number of the Project Engineer
  - ☐ Applicable Permit Numbers
  - ☐ North arrow
  - ☐ Vicinity Map showing project boundaries and of sufficient clarity to locate the property
  - ☐ Parcel numbers and legal description of the project site
  - ☐ Property boundaries, dimensions, and area (in square feet or acres)
  - ☐ Datum for the project
  - ☐ Legend, if symbols are used that are not labeled in the plan
- ☐ At least one sheet must contain a plan view of the entire project site. In the event the project site is sufficiently large that detailed drainage plans on any given sheet do not encompass the entire project site, then the sheet containing the plan view of the entire site must serve as an index to subsequent detailed plan sheets.
- ☐ All sheets shall contain a scale and north arrow.
- ☐ The overall plan view shall be no smaller than 1"=100'. Recommended scales for individual sheets are 1"=20' (Horizontal); 1"=5' or 1"=10' (Vertical).
- ☐ Cross sections shall be provided for stormwater facilities.
- ☐ Existing Site Information Including:

- ☐ Existing topography for the site and extending 50’ beyond project boundaries. Existing topography for adjacent rights-of-way for the full width of right-of-way.
    - ☐ Contours at a maximum 5’ vertical elevation intervals
    - ☐ Engineered designs require field verification of contours (field survey)
    - ☐ Depending on the site, a standalone topographic survey sheet may be required
- ☐ Existing lot boundaries, right of way boundaries, tracts, and easements. Documentation of easements may be required.
- ☐ Existing structures, including all structures within 50 feet of project boundaries, including:
    - ☐ All impervious surfaces such as roads, parking lots, vehicle movement areas, buildings, walkways, etc.
    - ☐ Existing structures to be removed
    - ☐ Existing storage tanks (above and below ground)
    - ☐ Existing oil water separators, grease interceptors, or other pretreatment facilities
- ☐ Existing site access points.
- ☐ Existing utilities including:
    - ☐ Any franchised utilities located above or below ground
    - ☐ Drainage facilities, which transport surface water onto, across, or from the project site
        - ☐ Invert or flow line elevation of existing drainage pipes, culverts, and channels
        - ☐ Rim elevations of any existing conveyance structures (catch basins, manholes, etc.)
    - ☐ Invert elevations for connections to existing public utilities

- ☐ Proposed site information, including:
    - ☐ Finished grade contours for the site showing catch points to existing topography at the limits of grading.
        - ☐ Contours at a maximum 5’ vertical elevation intervals
        - ☐ Engineered designs require field verification of contours (field survey)
        - ☐ Depending on the site, a standalone topographic survey sheet may be required
    - ☐ Contours, spot elevations, and flow arrows to clearly indicate how driveways, parking areas, and other impervious surfaces will be graded.
    - ☐ Proposed lot boundaries, right-of-way boundaries, tracts, and easements. Documentation of easements may be required.
    - ☐ Proposed structures including:
        - ☐ Proposed storage tanks (above and below ground)
        - ☐ Location and details for oil water separators, grease interceptors, or other pretreatment facilities
        - ☐ Proposed impervious surfaces such as roads, parking lots, vehicle movement areas, buildings, walkways, etc.

- ☐ Proposed drainage structures, including all flow control and water quality devices. Details shall be provided for all proposed drainage structures for which there is insufficient information on the plan view.

- ☐ Proposed utilities including:
  - ☐ Exact line and grade of all proposed utilities at crossings with other utilities
  - ☐ Any franchised utilities located above or below ground
  - ☐ Drainage facilities, which transport surface water onto, across, or from the project site
    - ☐ Invert or flow line elevation of proposed drainage pipes, culverts, and channels
    - ☐ Rim elevations of any proposed conveyance structures (catch basins, manholes, etc.)
  - ☐ Invert elevations for connections to existing public utilities

- ☐ Plan views of drainage conveyance facilities for which there is no accompanying profile view shall include the following information: pipe sizes, pipe types and materials, lengths of runs, pipe slope and exact locations of pipes or channels, structure identifier (e.g. catch basin/manhole number), type of structure (e.g. Type 2 CB), exact location of structures (e.g. station and offset, or dimensioning), invert elevations in/out of structures, and top elevations of structures. Notes and/or labels shall be included referencing details, cross-sections, profiles, etc.

- ☐ In existing and proposed rights-of-way, drainage conveyance facilities shall be shown in profile view. Profile views shall include:
  - ☐ Existing and finished grades
  - ☐ Proposed drainage pipes, channels and structures
  - ☐ Existing underground utilities where such utilities cross proposed drainage facilities
  - ☐ Profile views shall include the following information: pipe sizes, pipe types and materials, lengths of runs, gradient and exact locations of pipes or channels, structure identifier (e.g. catch basin/manhole number), type of structure (e.g. Type 2 CB), exact location of structures (e.g. station and offset, or dimensioning), invert elevations in/out of structures, and top elevations of structures. Plan and profile view shown on the same sheet shall be aligned, duplicate information should be avoided for plan and profile views on the same sheet.

- ☐ Location of and details associated with all stormwater mitigation facilities
- ☐ Stormwater Standard Notes (only include those applicable to the project)

Temporary Erosion and Sediment Drawings

The Temporary Erosion and Sedimentation Drawings shall include the following information, at a minimum.

- ☐ Vicinity map with roads and waters of the state within one mile of site
- ☐ Address, Parcel Number, and Street names
- ☐ Erosion and Sediment Control Notes
- ☐ Name, address, and 24-hour contact telephone number(s) of the designated emergency contact person

- ☐ Name, address, and phone number of the Certified Erosion and Sediment Control Lead (CESCL), as applicable
- ☐ Name, address, telephone number, and email address of the project owner and the Project Engineer
- ☐ Detailed listing of the construction sequence
- ☐ Detailed listing of the phasing of any erosion and sediment control work
- ☐ Legal description of subject property
- ☐ North Arrow
- ☐ Areas of potential erosion problems
- ☐ Existing and proposed contours
- ☐ Drainage basins and direction of flow for individual drainage areas
- ☐ Label final grade contours and identify developed condition drainage basins
- ☐ Delineation of areas that are to be cleared and graded
- ☐ All cut and fill slopes indicating top and bottom of slope catch lines
- ☐ Soil types, together with the location of any soil test pits or infiltration test sites
- ☐ Location of stockpiles, haul roads, and disposal sites
- ☐ Locations for swales, interceptor trenches, or ditches
- ☐ All temporary and permanent drainage pipes, ditches, or cutoff trenches required for erosion and sediment control
- ☐ Provide minimum slope and cover for all temporary pipes or call out pipe inverts
- ☐ Show grades, dimensions, and direction of flow in all ditches, swales, culverts, and pipes
- ☐ Details for by passing offsite runoff around disturbed areas
- ☐ Locations and outlets of any dewatering systems
- ☐ Locations of all existing and proposed channels, swales, or drainage pipes which either convey offsite stormwater through or route stormwater around the construction area
- ☐ Locations of all ESC facilities with dimensions and details as appropriate
- ☐ When sedimentation ponds and traps are proposed, at least one cross section detail shall be shown
- ☐ Any BMPs used that are not referenced in the Ecology Manual shall be explained and illustrated with detailed drawings
- ☐ Locations of BMPs to be used for the control of pollutants other than sediment, e.g. concrete wash water
- ☐ Water quality sampling locations to be used for monitoring water quality on the construction site, if applicable
- ☐ Description of inspection reporting responsibility, documentation, and filing

APPENDIX C

Port of Tacoma
Stormwater Pollution Prevention Plan Template

The SWPPP Template can be downloaded from the Port website at the following URL

http://portoftacoma.com/community/environment/water-quality

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APPENDIX D

Stormwater Treatment Selection Approach

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Introduction

The following describes an approach to selecting BMPs based on typical past performance effluent results and predicting effluent quality based on influent and expected reduction based on past performance. The combined approach is used to provide a short list of preferred BMPs. From this list, BMPs can be selected with the additional considerations of preferred cost-value, operations and maintenance, and capital/ life-cycle costs.

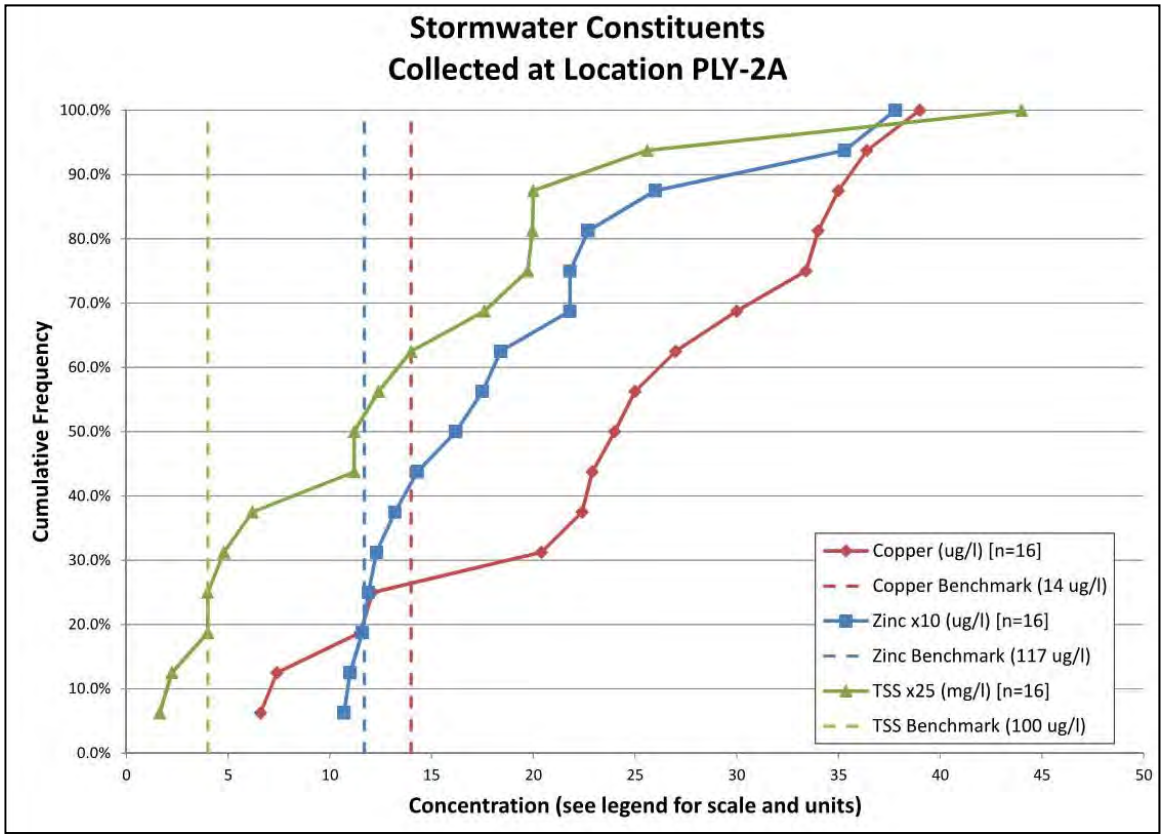
Performance

The presumptive approach to stormwater treatment uses a premise that all urban stormwater is "typical" or within a normal range of usual constituents that can be removed using the standard BMPs found in a stormwater manual. The engineer preparing a site design and evaluating a viable stormwater management system does not usually consider specific stormwater influent characteristics when selecting treatment. Often, the selection is made only considering site constraints, the local stormwater "culture" or manual requirements (e.g. enhanced versus basic) that suggest certain BMPs perform better than others, or personal preferences and familiarity with certain systems. When considering BMPs at Ports and the changing regulatory environment that is edging toward demonstrative compliance, there is a growing need to consider influent water quality in the selection process. Stormwater influent characterization can inform the selection process; become a baseline for predicting outcomes; and direct other control decisions such as source controls, treatment trains, and constituent-specific treatment.

Stormwater Characterization Using Percent-Exceedence Curves

Stormwater runoff quality from a site can be highly variable. A single site can have metal concentrations vary by one or more orders of magnitude. **Figure 1** shows the variation in stormwater constituents from the PLY-2A site at the Port over just 16 samples. Sites often vary greatly in the frequency at which they have extreme values (low or high). For this reason, the frequency at which concentrations occur or exceed target values is critical in identifying the level of treatment needed to address the risk of exceeding or the probability of attaining a target level. **Percent-exceedence/ attainment curves**, as demonstrated in **Figure 1**, are useful tools for characterizing and displaying water quality data. These curves characterize influent or effluent for a specific site, a group of similar sites, an activity type, the Port as a whole, an industry, etc. They can also be used to characterize effluent from a BMP or family of similar BMPs and reveal performance expectations and the potential frequency of effluent concentrations.

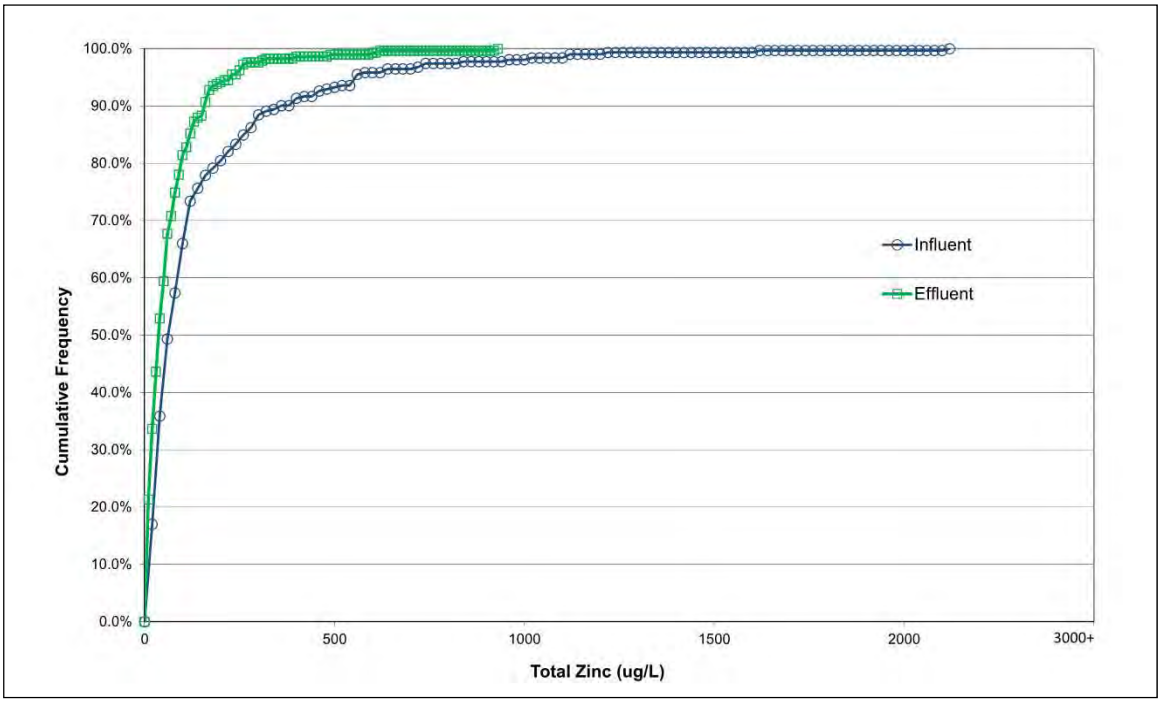
Figure 1. Percent-exceedence/attainment of total copper, total zinc, and TSS at the PLY-2A site, Port of Tacoma.



Percent-exceedence curves are prepared using existing available water quality data for a particular constituent. A value of **cumulative percent** is calculated for each concentration value and the results are plotted (see **Figure 1**). The x-axis represents the **constituent concentration**. The y-axis represents the percent of the water quality values that are less than a selected concentration and, inversely, the percent of values that are greater than the selected concentration. Using these percent-exceedence values and the frequency at which they are collected, one can estimate the likelihood and frequency at which a value could be exceeded. For example, **Figure 1** shows a percent-exceedence curve for total copper at the PLY-2A site. The benchmark for copper is 14 micrograms per liter. Following the line from the benchmark value on the x-axis up to the curve intercept, then left to the y-axis, we find that roughly 26 percent of the data points or collected sample values were lower than the benchmark. Consequently, 74 percent of the collected sample values were greater than the benchmark. The percent-exceedence curves provide a reasonable characterization of existing water quality. These curves can also be used to characterize BMP performance and assess future predicted concentration frequency at a site.

The International Stormwater BMP Database (ISBD) (Wright Water Engineers and Geosyntec Consultants 2013) uses similar curves to characterize influent and effluent concentration from different devices, and provides the data for which BMP performance percent-exceedence curves can be prepared. An example percent-exceedence curve showing the influent and effluent for total zinc from all Detention Basin BMPs for which data are available is shown on **Figure 2**. Use of these curves has become the standard for characterizing stormwater at the Port and evaluating expected BMP performance, which will inform the BMP selection process, as described below.

Figure 2. Percent-Exceedence curves for total zinc from Detention Basin BMPs.



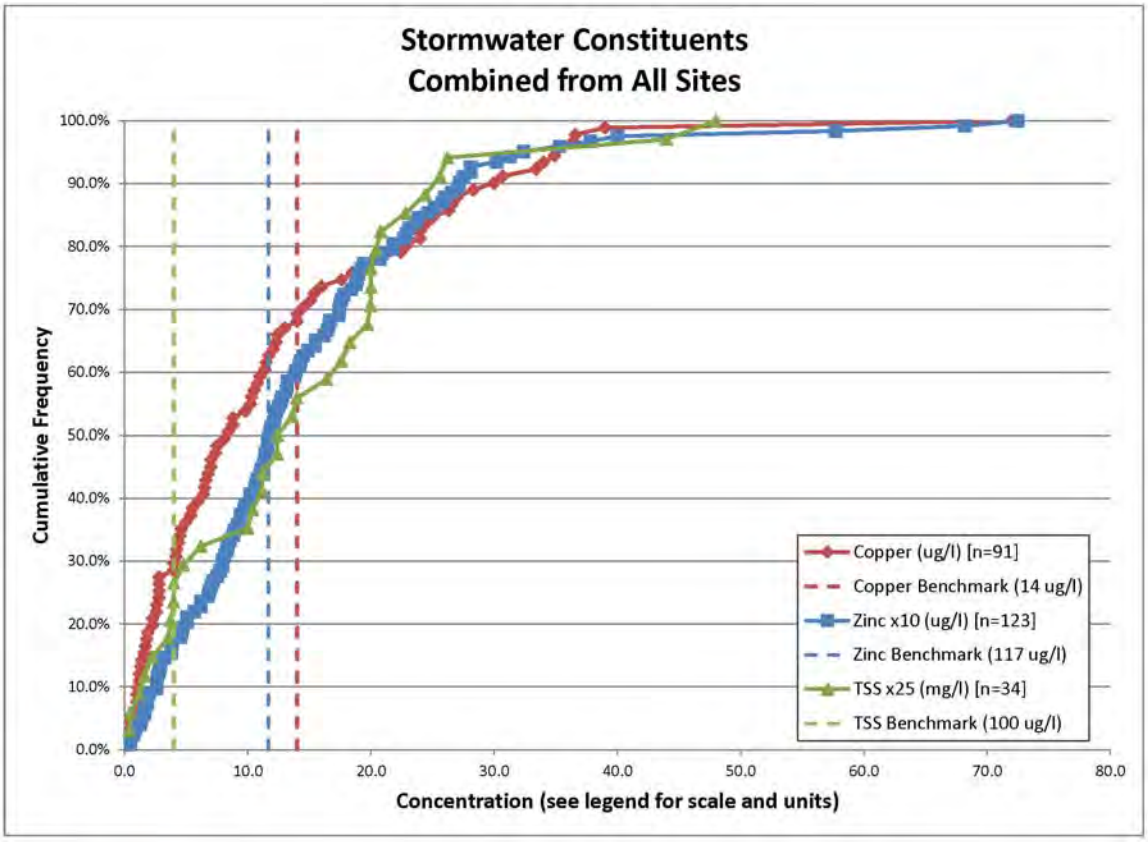
Source: ISDB

Standard curves have been prepared using all of the available data from the Port sampling sites as listed in **Table 1**. As additional data is collected, site or activity-specific curves can be added for use when data are not available. In addition, if a specific device is being considered, the influent curve from the ISBD can be compared to Port data or used as a guide for "typical stormwater" seen by other stormwater programs that will expect similar performance if the selected BMP is used.[2] The curve for representative stormwater at the Port of Tacoma is shown on **Figure 3**.

Table 1. Sampling sites used to generate "standard curves" for Zinc.

Site Name	Samples Collected
NIM	16
SIM	15
OCT	18
EB01	9
MF3	14
MF8	17
A1	18
A2	16
Total	**123**

Figure 3. "Typical" percent-exceedence curves for zinc, copper, TSS, and turbidity at Port of Tacoma sites.



[2] Effluent results are expected to be similar and independent of influent concentrations, notably at lower concentrations.

Treatment Approaches

Evaluation of BMPs and their acceptance for inclusion in stormwater manuals has often been a result of expected ability to reduce pollutant concentration by a certain percentage (often 80 percent). This is achieved by sampling influent and effluent and comparing the difference. While this provided reasonable consistency in evaluating BMPs, it was not a meaningful predictor of actual performance over a broad range of conditions. For example, high influent concentrations can be easier to treat so comparing effluent to influent produces a high rate of removal. But, lower influent concentrations often resulted in lower reduction percentages (and apparent missed performance), even if the resulting effluent concentrations were lower than targets. In contrast, when effluent alone is compared to benchmark targets, many BMPs are found to have a minimum effluent concentration that could be achieved regardless of the influent concentration.

In response to these findings, the approach of evaluating BMP performance by comparing measured effluent results is used here. The more frequently a BMP achieves effluent targets, the more it is preferred over those that don't. This approach can provide a meaningful differentiator between BMP types or at least show a potential for better performance even if the differences are not statistically significant.

The Ecology Manual provides a list of available and approved BMPs shown on **Table 2** (Ecology 2012). A placeholder for experimental BMPs that are not fully vetted through Ecology is also included on this list. The compared list of Ecology BMPs and ISBD groups is shown on **Table 2**. When evaluating typical effluent, the ISBD data for the corresponding Ecology BMP should be used. If the Ecology BMP is not included in the database, other BMP-specific performance data can be used or the standard reduction analysis should be used.

Table 2. List of potential BMPs and corresponding ISBD categories.

Available Stormwater Treatment BMPs (Ecology Manual)	ISBD Categories
Infiltration	
Infiltration Basins (BMP T7.10)	Infiltration
Infiltration Trenches (BMP T7.20)	Infiltration
Bioretention	
Bioretention Cells, Swales, and Planter Boxes (BMP T7.30)	Bioretention
Compost-Amended Vegetated Filter Strips (BMP T7.40)	Bioretention
Filtration Treatment Facilities	
Basic Sand Filter Basin (BMP T8.10)	Sand Filters
Large Sand Filter Basin (BMP T8.11)	Sand Filters
Sand Filter Vault (BMP T8.20)	Sand Filters
Linear Sand Filter (BMP T8.30)	Sand Filters
Media Filter Drain (BMP T8.40)	Media Filters
Biofiltration Treatment Facilities	
Basic Biofiltration Swale (BMP T9.10)	Basic Biofiltration Swale
Wet Biofiltration Swale (BMP T9.20)	Wet Biofiltration Swale
Continuous Inflow Biofiltration Swale (BMP T9.30)	Wet Biofiltration Swale
Basic Filter Strip (BMP T9.40)	Basic Filter Strips

Available Stormwater Treatment BMPs (Ecology Manual)	ISBD Categories
Wetpool Facilities	
Wet Pond (BMP T10.10)	Wet Ponds
Wetvault (BMP T10.20)	Wet Vaults
Stormwater Treatment Wetlands (BMP T10.30)	Wetlands
Oil and Water Separators	
API (Baffle type) Separator Bay	n/a
Coalescing Plate (CP) Separator Bay	n/a
Emerging Technologies Approved by Ecology (approved for Basic and Enhanced Treatment)	
Filterra	Media Filter
Aqua-Filter Systems	Manufactured Devices
BayFilter	Manufactured Devices
MWS-Linear Modular Wetland	Manufactured Devices
FlocClear (GULD and CULD)	Manufactured Devices
StormFilter	Media Filter
UrbanGreen Biofilter	Media Filter
Up-Flo Filter	Media Filter
ecoStorm Plus	Media Filter
FloGard Perk Filter	Media Filter
Jellyfish Filter	Manufactured Devices
Aquip	Manufactured Devices
Media Filter Drain (updated by WSDOT)	Media Filters
Compost Amended Biofiltration Swale	Media Filters
Experimental Technologies	
High Filtration Rate Bioretention Planter Boxes	Bioretention

The ISBD has provided effluent performance data for the BMP categories listed above. **Figures 4a, 4b, and 4c** show the expected exceedence-frequency of effluent for the BMP categories shown for copper, zinc, and TSS respectively. For this effort, an evaluation of the statistical difference between each set of performance values has not been completed. It is important to note that the expected effluent from these broad groups of devices, even in a single category, can vary widely. However, a review of confidence intervals indicates that this data is reasonably representative of the performance for each treatment type.

Figure 4a. Effluent percent-exceedence frequency curves for Copper (Source: ISBD).

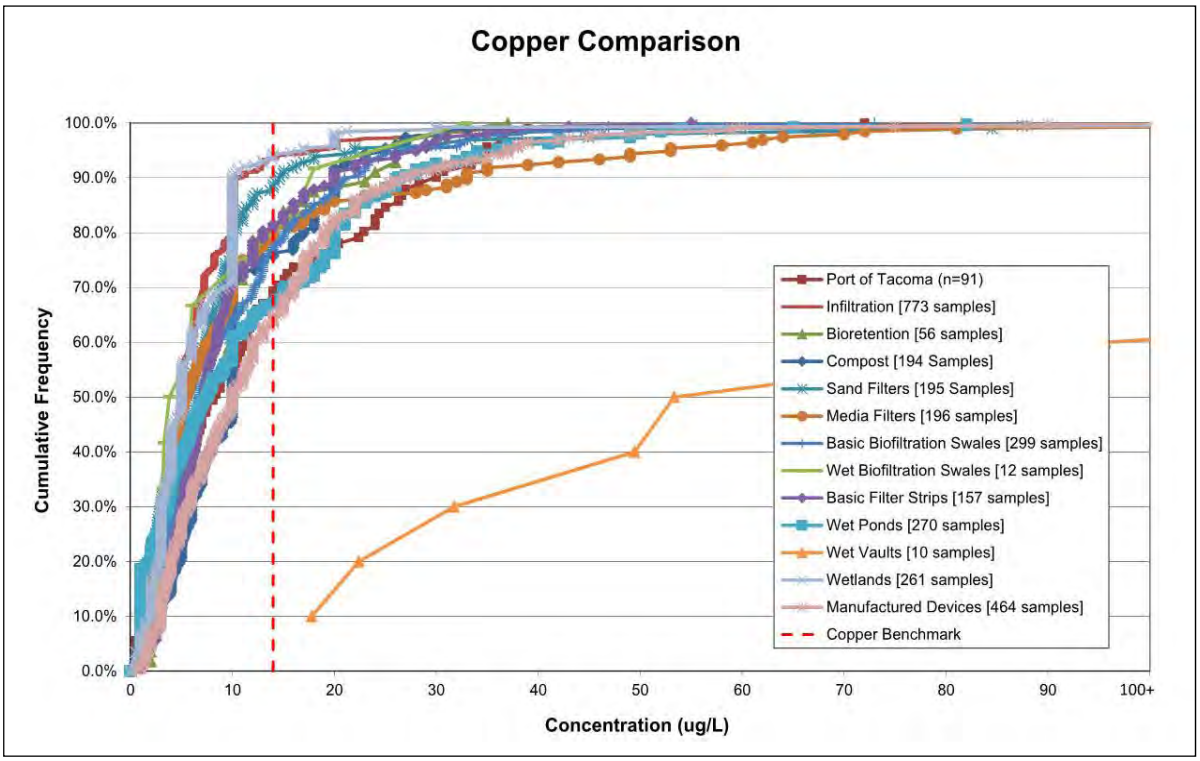


Figure 4b. Effluent percent-exceedence frequency curves for Copper (Source: ISBD).

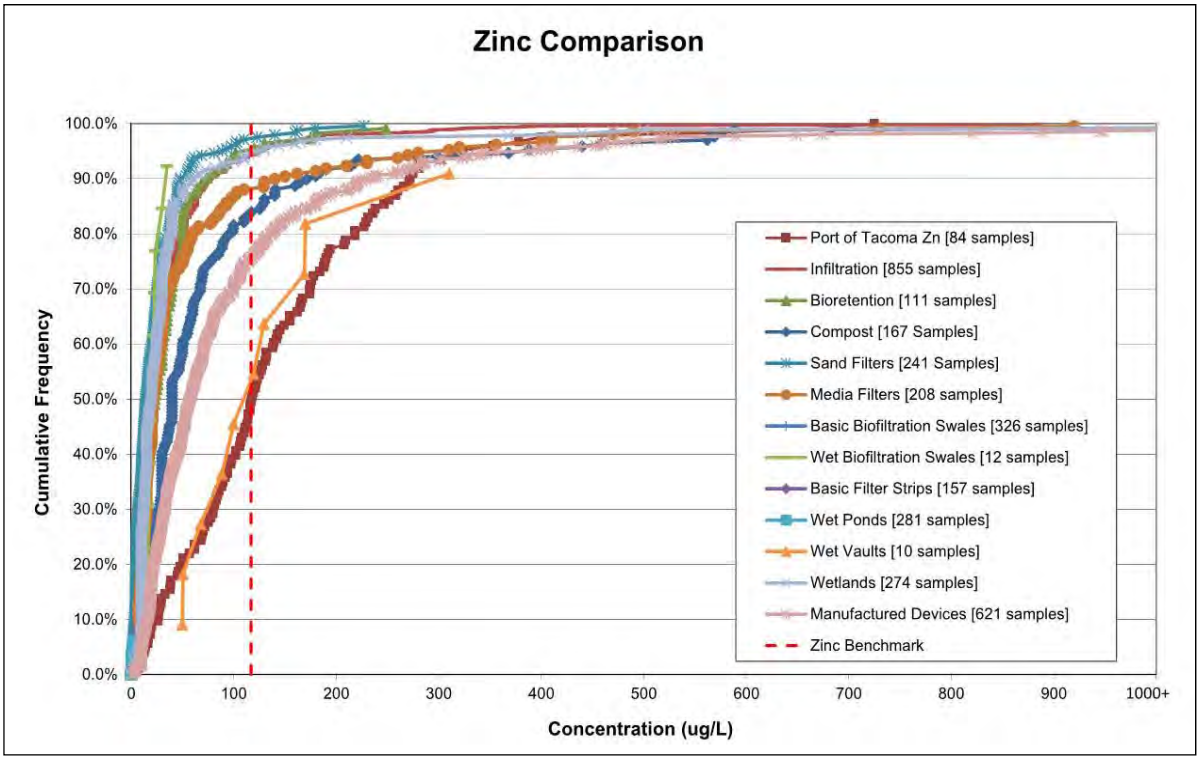
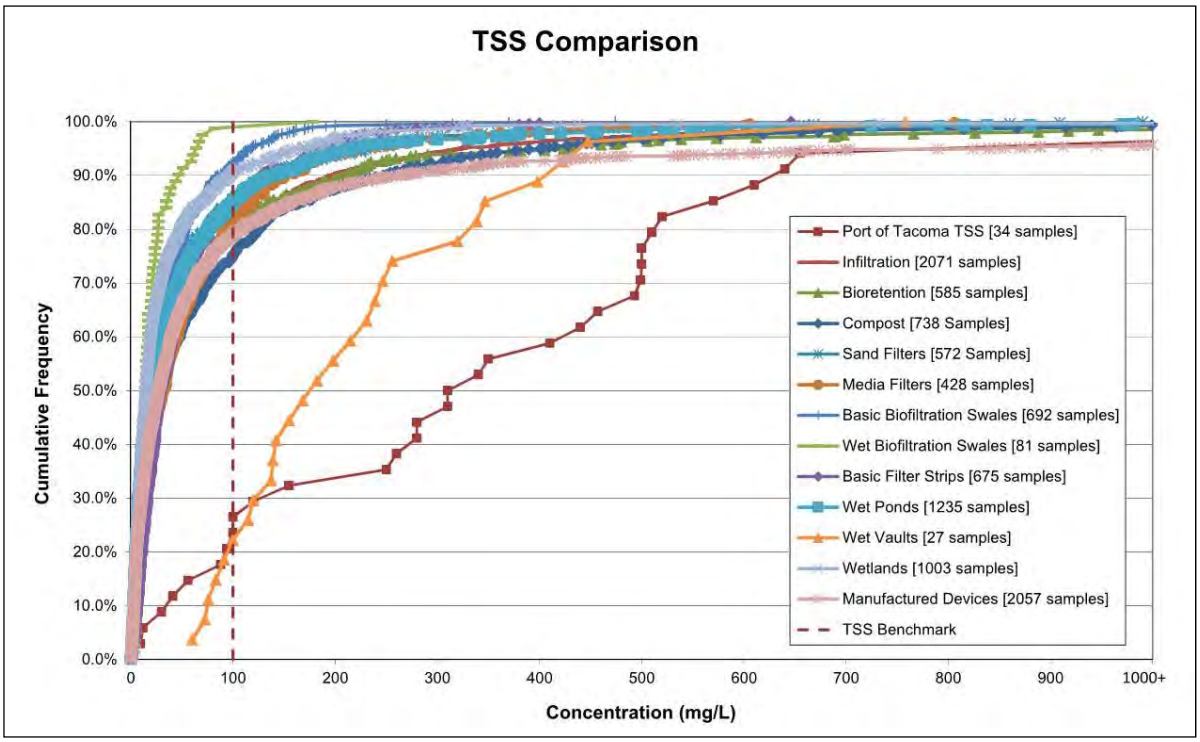


Figure 4c. Effluent percent-exceedence frequency curves for Copper (Source: ISBD).



To distinguish performance levels, the treatment types were categorized according to the frequency of achieving benchmarks. Those with median effluent concentrations achieving benchmarks greater than 90 percent of the time were ranked with a value of 2; those achieving benchmarks between 80 to 90 percent of the time were ranked with a value of 1; and those below 80 percent were ranked at 0 (See **Table 3**). This ranking was completed for the three primary pollutants of concern at the Port; copper, zinc, and TSS. A summation of these ranks provides an evaluation of which BMPs are Preferred (P), Conditionally Preferred (CP), and Not Preferred (NP) at the Port based only on effluent performance.

This evaluation should be considered a screening analysis to find preferences and evaluate the relative likelihood of achieving targets. Both Preferred and Conditionally Preferred BMPs from **Table 3** are further evaluated based on typical Port environments in Section 3. Further evaluation is also expected on the part of the designer based on cost, operations and maintenance, and expected life-cycles as discussed in Section 4. Not Preferred devices will require site-specific analysis, test results, unique site conditions, and Port approval to be reconsidered.

Table 3. Effluent approach BMP selection results.

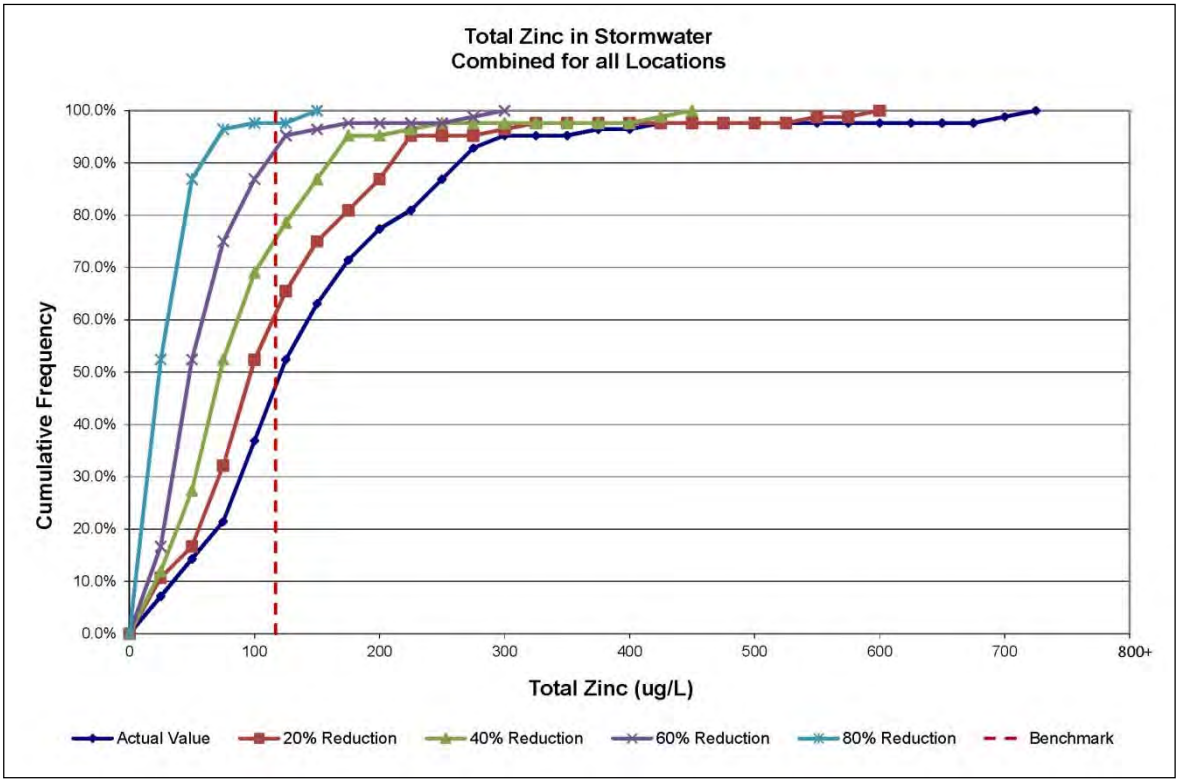
BMP	Copper Effluent Performance	Zinc Effluent Performance	TSS Effluent Performance	Total	Result
Infiltration	2	2	0	4	P
Bioretention	1	2	1	4	P
Sand Filters	1	2	1	4	P
Media Filters	1	1	1	3	CP
Basic Biofiltration Swale	0	2	2	4	P
Wet Biofiltration Swale	0	0	2	2	CP
Basic Filter Strips	1	2	1	4	P
Wetponds	0	1	1	2	NP
Wet Vaults	0	0	0	0	NP
Wetlands	2	2	2	6	P
Manufactured Devices	0	0	0	0	NP

Predicting Effluent Quality Using Removal Rates

Stormwater discharge data are now often available for specific outfalls, from a collection of sites with similar land use and activities, or from a combination of activities and locations representing "urban" or "industrial" stormwater. These data can be characterized as described above by their relative frequency of concentration levels. If removal or reduction of stormwater constituents is to be estimated or predicted, the expected effluent needs to be characterized and attainment frequency estimated.

Post-treatment concentrations can be estimated by evaluating past performance of similar devices, applying concentration reduction percentages to site water quality data, and preparing a predicted exceedence curve. If no device-specific percent reduction data are available, a constant rate of reduction can be applied. This approach is conservative (the reduction can be underpredicted) because higher concentrations of influent typically have higher removal rates (percentage reductions) than low concentrations. **Figure 5** shows the results of a constant percentage reduction on "typical combined Port stormwater." For example, a 40 percent reduction of all influent values would be needed to achieve between 70 and 80 percent benchmark attainment and a 60 percent reduction would be needed to achieve between 90 and 100 percent attainment.

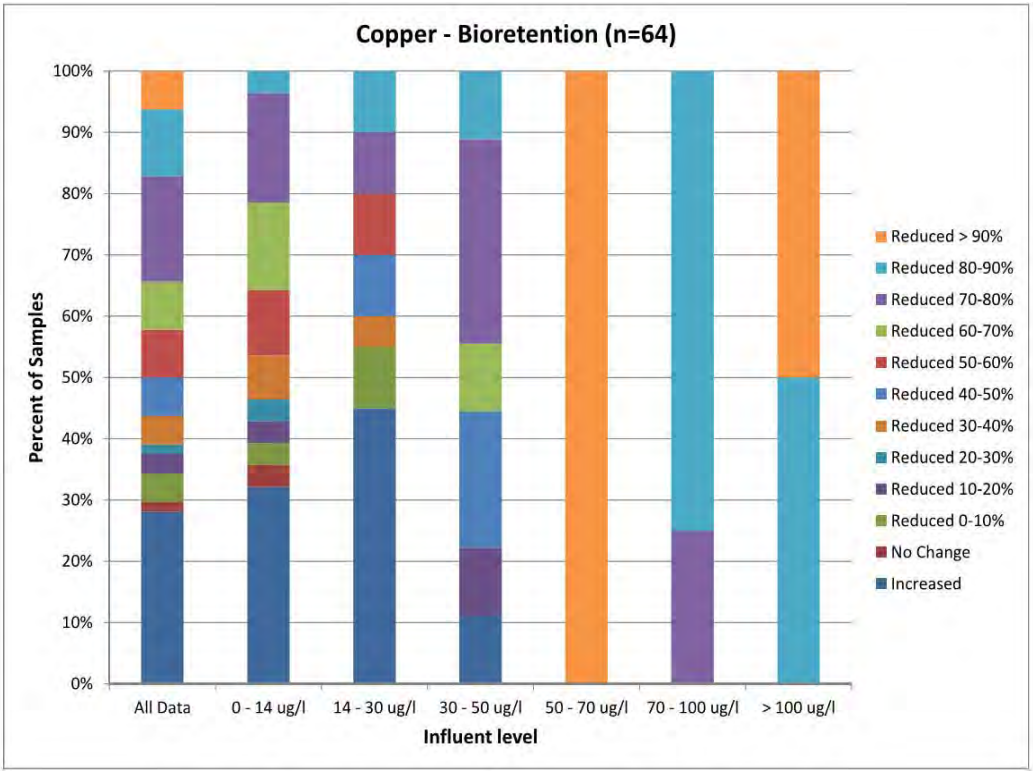
Figure 5. Uniform influent reduction for zinc for the Port of Tacoma combined data.



The ISBD provides paired influent and effluent results for the same family of treatment devices listed above. Using these data, typical reduction rates dependent on influent can be estimated. The paired data in the ISBD was used to determine the percent of the pairs in which the effluent had a higher value than influent (increased), there was no change, or it decreased by increments of generally 10 percent. This was determined for each of the Port's pollutants of concern (copper, zinc, and TSS) for each device. The results for copper removal for bioretention, sand filters, and basic filter strips are shown in **Figures 6a, 6b, and 6c**.

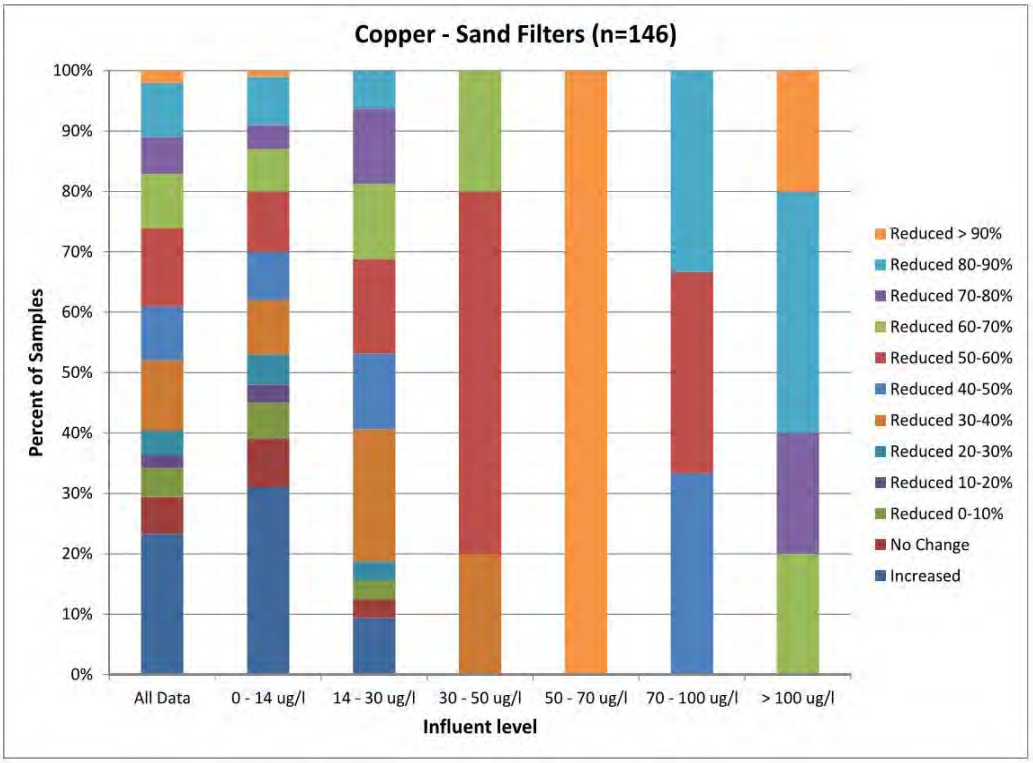
Figures 6a, 6b, and 6c show a range of influent levels and the resulting reduction percentage frequency. The bar graphs show the frequency of influent values that show an expected amount of reduction. For example, when the influent was between 30 and 50 ug/l and a bioretention device was used, copper in the effluent for about 11 percent of the paired samples increased, about 11 percent had no change, about 22 percent decreased between 40 and 50 percent, about 11 percent decreased between 60 and 70 percent, about 33 percent decreased between 70 and 80 percent, and about 11 percent decreased between 80 and 90 percent. These data can be used to predict pollutant reduction levels across varying influent concentrations. For example, if the influent concentration is between 14 and 30 micrograms/liter, the third bar on the graph would be used to predict removal rates. Using these variable reduction rates is more representative of actual BMP performance that varies with influent concentration.

Figure 6a. Biorention treatment of copper at different influent concentration ranges.



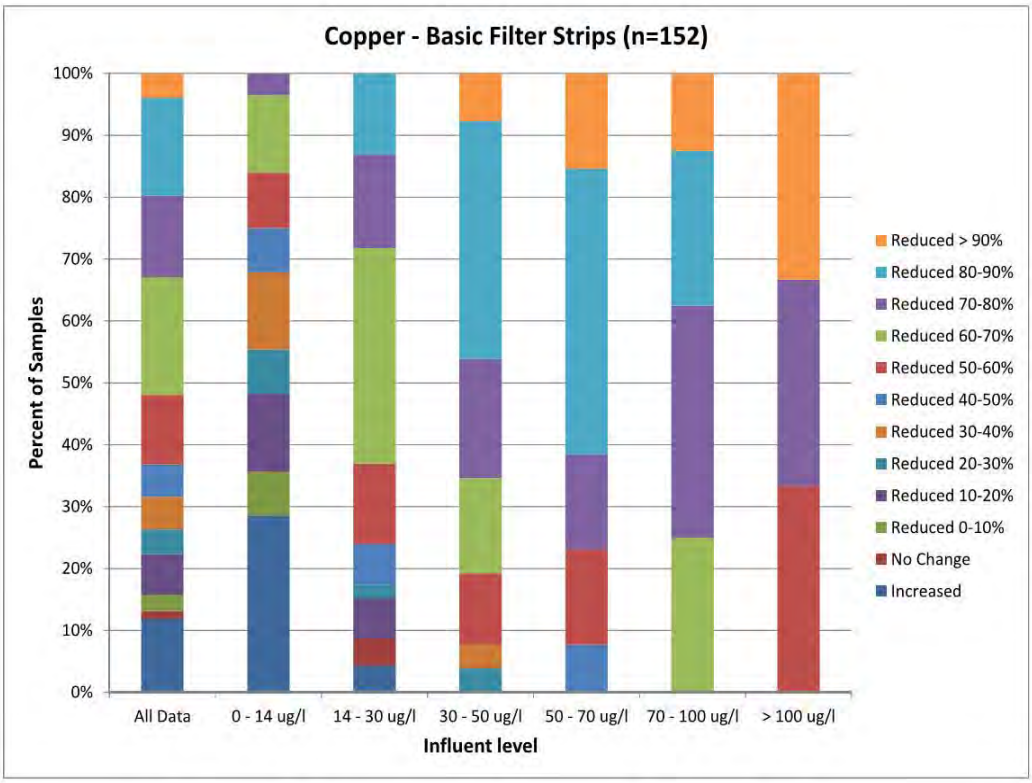
Source: ISBD

Figure 6b. Sand filter treatment of copper at different influent concentration ranges.



Source: ISBD

Figure 6c. basic filter strips treatment of copper at different influent concentration ranges.



Source: ISBD

As the bar graphs demonstrate, there is a large range of potential reduction for each of the influent ranges. Two reduction estimates were used to predict future effluent: the 25th percentile (**Figure 7a**) and the median (**Figure 7b**). The 25th percentile means that 75 percent of the paired data had a reduction rate equaling or better than the lowest 25 percent of the reduction rates. The median means that half of the pairs had a lower reduction rate and half had a higher reduction rate. The intercept of the 25th percentile with the bar graph reduction rate was used. If the intercept range is a 40-50 percent reduction, a 45 percent reduction was used. **Figures 7a and 7b** show a predicted effluent percent-exceedence curve applying the variable copper reduction rates to the Port's "typical" stormwater.

The results of the effluent prediction (**Figures 4a, 4b, and 4c**) and the variable reduction methods (**Figures 7a and 7b**) are then reviewed together to estimate expected performance after applying the BMP. For example, the effluent exceedence curve for the basic filter stipe on **Figure 4a** shows about 80 percent compliance, as does the variable effluent reduction curve on **Figure 7a**. The bioretention effluent curves (**Figure 4a**) show between 75 and 80 percent compliance rates, while the variable reduction curve (**Figure 7b**) shows about 80 percent compliance. The proposed attainment of the benchmark at the 75 percent exceedence or higher is a minimum performance criterion for all effluent and removal predictions. All of the preferred BMPs selected in the screening process are expected to achieve the performance target applying the median or 25th percentile reduction rates.

Figure 7a. Variable influent reduction for the Port of Tacoma combined data – 25th percentile reduction rate.

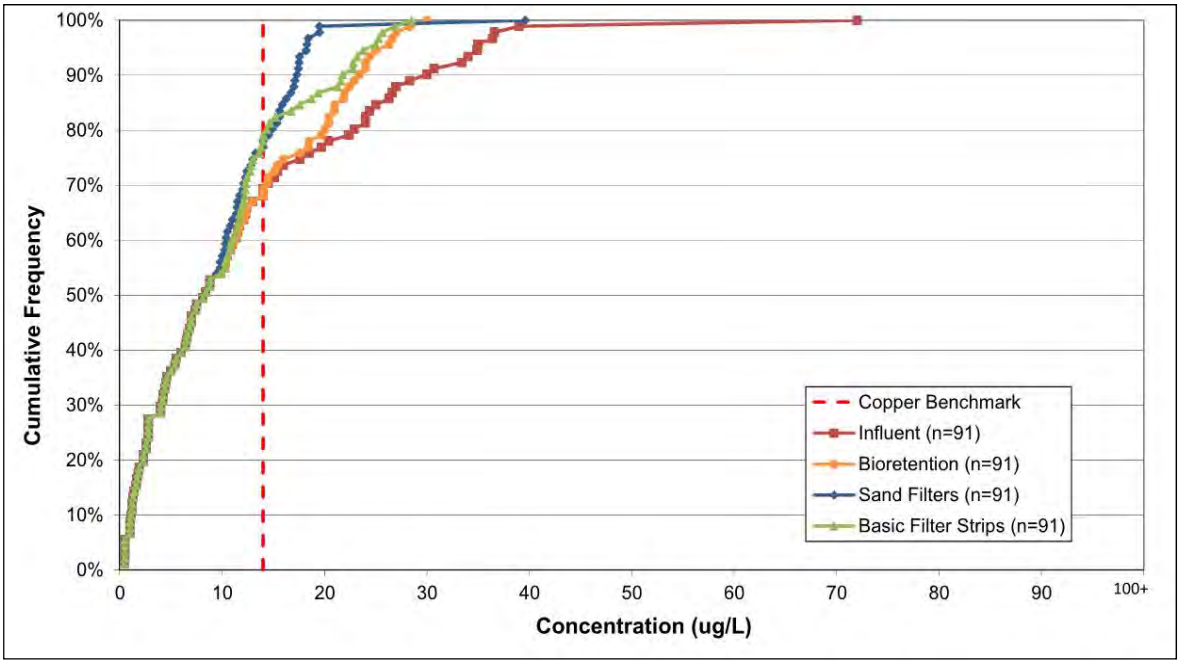
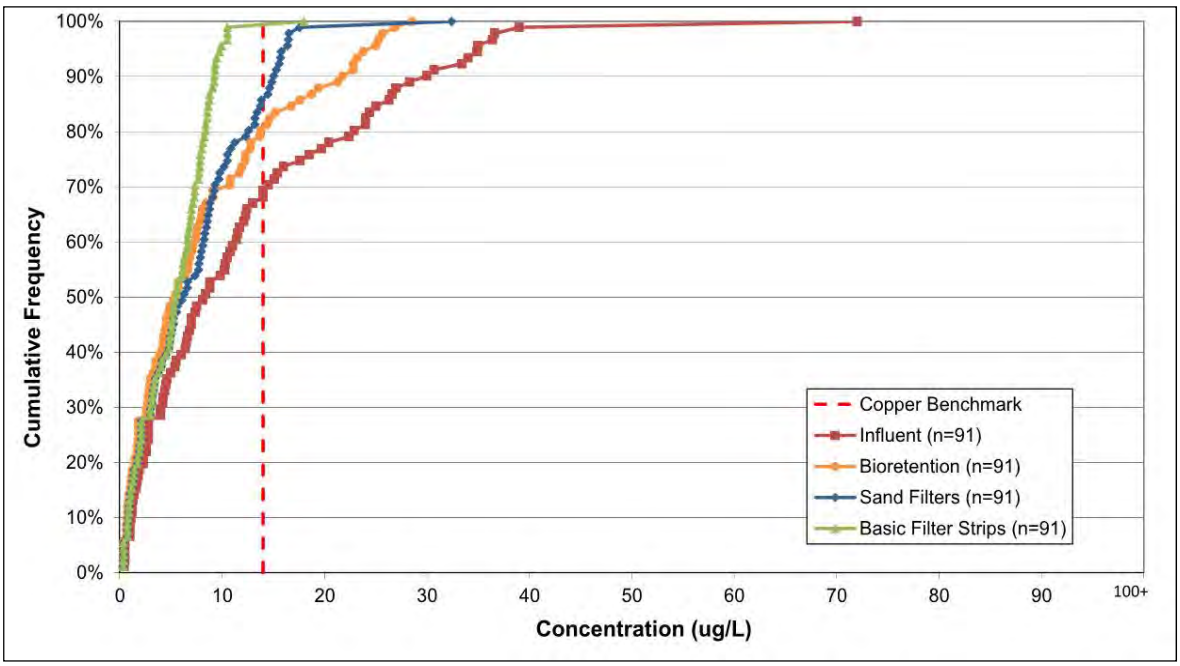


Figure 7b. Variable influent reduction for the Port of Tacoma combined data – median reduction rate.



Conditions Unique to Ports

The process described above demonstrates an approach to selecting BMPs using performance criteria and examples found at the Port. This process only narrows the list of all BMPs to preferred BMPs based on performance. BMPs in the Conditional or Not Preferred lists can be evaluated more closely to determine specific conditions or locations where these could be effectively applied.

Shallow Groundwater

The Port of Tacoma is located adjacent to Commencement Bay in Puget Sound. Because this water body is at sea level and experiences tidal fluctuation, groundwater under most Port properties is very shallow. Shallow groundwater generally precludes the use of BMPs that rely on infiltration as a means of discharge.

Low Gradient

The Port as a whole is a low gradient transition zone from upland to the Puget Sound. The majority of Port properties are relatively flat, which presents challenges for drainage. BMPs that can function in low gradient environments are preferred. BMPs such as underground vaults and some manufactured devices that rely on sufficient gradients have only limited uses at the Port.

Port Activities/Operations

Many of the unique activities common on Port properties require considerable land area. Examples of these activities include container terminals that need space for loading, unloading, moving, and storing cargo containers; dry bulk terminals that need space for loading, unloading, moving, and storing dry bulk good; and log yards that use space for loading, unloading, moving, and storing logs and wood products, among other activities. BMPs that occupy large spaces are not preferred for use on Port properties.

Table 4 summarizes Preferred, Conditionally Preferred, and Not Preferred BMPs at the Port based on the unique physical conditions and activities at the Port.

The retrofitting process for sites not being redeveloped will have additional site limitations because existing drainage systems will be in place and site reconfiguration opportunities are limited or constrained. It is anticipated that a broader palette of BMPs may be needed or applied and performance considerations may not dictate the decisions.

Table 4. BMP preference based on unique Port conditions.

BMP	Groundwater	Gradient	Port Activities	Result
Infiltration	X		X	NP
Bioretention	C			CP
Sand Filters		C		CP
Media Filters		C		CP
Basic Biofiltration Swale				P
Wet Biofiltration Swale				P
Basic Filter Strips				P
Wetponds		X	X	NP
Wet Vaults		X		NP
Wetlands			X	NP
Manufactured Devices				P

X – unlikely to work on Port property
C – could work conditionally

Cost Considerations

The next step in the selection process involves evaluating the devices for value. Value means the capital, operations and maintenance, and life cycle/replacement cost when compared to performance. Capital costs include the cost to design, acquire, construct, and activate the proposed BMPs. Operations include the additional cost of operating a non-passive system; and maintenance includes cost, ease, and system reliability when maintenance is not performed. Also considered is the life-cycle or replacement cost—how many years can the system be fully operational and perform reliably before the entire system needs replacement. These costs are discussed in the following sections.

Cost for stormwater BMPs can vary widely depending on specific site conditions, constraints and limitations, targeted pollutant, pollutant loading, and treatment area. It is difficult to pre-determine which form of stormwater treatment will cost the least/most without a site-specific comparative analysis. The selection of BMPs for stormwater treatment is typically made by the project proponent and their design professional with many factors entering into this decision. The following information is intended to inform these decisions during site planning.

Capital Costs

The base capital costs refer primarily to the cost of designing and constructing the BMP. This may include the cost of geotechnical testing and permitting. The cost of BMP construction varies widely and depends largely on site conditions, treatment area, and soil conditions. The cost of land acquisition is generally an important factor in municipal areas. At ports, the unique character of waterfront land and port operations make the land more ‘valuable’ and a scarce resource.

The evaluation of performance in Section 3 above is based on treatment methods. BMPs based on the same treatment methods should be considered equivalent for cost, which means that a more costly

BMP in the same class would not be considered a better treatment choice and the additional cost is not justified.

Operation and Maintenance Cost

The Port is in a unique position as a landowner subject to the MS4 Permit or the ISGP, as a landlord with limited involvement in the day-to-day upkeep of the majority of its land (and stormwater treatment facilities), and as an overseer of the MS4 and ISGP requirements. Because it has been placed in this multifaceted position of stormwater policy-making and compliance, it is in the Port's best interest that the stormwater BMPs put in place throughout the Port function as intended consistently. It is at considerable expense, both of development dollars and regulatory oversight, that stormwater BMPs are put into place and then are wasted when maintenance is not carried out.

To add some certainty that ongoing stormwater treatment will be effective, it is necessary to select BMPs with the following considerations in mind:

1. Does maintenance take specialized equipment?
2. How sensitive to maintenance is the treatment efficacy of the system?
3. What is the estimated maintenance frequency required?

A wet pond that has been filled with sediment requires hiring a backhoe and/or excavator along with a dump truck to excavate and clean the pond back down to design grades. A plugged sand filter will require a vactor truck or backhoe to replace the media in question. On the other hand, a biofiltration swale must simply be mowed at the same time as the other onsite grass requiring no specialized equipment.

Some BMPs, such as sand filters or infiltration systems, are highly sensitive to maintenance and will cease to function, or actually make effluent concentrations higher, if not properly maintained. With other BMPs, such as compost-amended biofiltration swales or media filter drains, the efficacy of the system will drop off without maintenance, but the treatment reduction is not drastic when maintenance is not occurring.

Maintenance frequency is an important part of the equation. Depending on the influent pollutants, some BMPs require very frequent cleaning and changing of media; others can go for years without having any significant work performed.

Table 5 summarizes these factors for the stormwater treatment BMPs contained in the manual—excluding emerging technologies and oil water separators. Based on the combination of the three factors, a status of Preferred (P), Conditionally Preferred (CP), and Not Preferred (NP) has been assigned to each BMP.

Table 5. Comparison of operation and maintenance factors for comparing BMPs.

	Specialized Equipment Required? (Y/N)	Sensitivity to Maitenance (High/Low)	Estimated Maintenance Frequency Required	Preferred (P) Conditionally Preferred (CP) Not Preferred (NP)
Infiltration				
Infiltration Basins	Y	H	1-2 years	CP
Infiltration Trenches	Y	H	1-2 years	CP
Bioretention				
Bioretention Cells	N	L	2 weeks - 2 months	P
Bioretention Swales	N	L	2 weeks - 2 months	P
Bioretention Planter Boxes	N	L	2 weeks - 2 months	P
Compost-Amended Vegetated Filter Strips	N	L	2 weeks - 2 months	P
Filtration Treatment Facilities				
Basic Sand filter Basin	Y	H	6 months	NP
Large Sand Filter Basin	Y	H	6 months	NP
Sand Filter Vault	Y	H	6 months	NP
Linear Sand Filter	Y	H	6 months	NP
Media Filter Drain	N	L	1-4 weeks (summer)	P
Biofiltration Treatment Facilities				
Basic Biofiltration Swale	N	L	1-4 weeks (summer)	P
Wet Biofiltration Swale	N	L	1-4 weeks (summer)	P
Continuous Inflow Biofiltration Swale	N	L	1-4 weeks (summer)	P
Basic Filter Strip	N	L	1-4 weeks (summer)	P
Wetpool Facilities				
Wet Pond	Y	L	2 years	CP
Wetvault	Y	L	2 years	CP
Stormwater Treatment Wetlands	Y	L	2 years	CP

Frequently, the cost of operation and maintenance are expressed as a percentage of the construction cost. For examples, see the section on case studies below.

Life Cycle Cost

Most cost estimates of BMPs focus on capital cost and maintenance. However, to accurately gauge cost-effectiveness or efficiency of these systems, it is critical to consider costs over the entire life of the project. A BMP that is relatively inexpensive, but needs to be replaced every few years, is not necessarily less expensive than a BMP that has high capital costs, but will remain functional for several decades.

BMP Cost Studies

Many studies have been conducted in an attempt to summarize the cost of BMPs. These studies attempt to provide cost estimates useful for site planning.

Puget Sound Stormwater BMP Cost Database

One study for comparing the costs for wet ponds and bioretention in the Puget Sound area is the Puget Sound Stormwater BMP Cost Database (Herrera Environmental Consultants 2011). To apply the data effectively for a cost comparison analysis, it was converted into a cost-to-treat per-acre.

For the purposes of this comparison, a 90 percent impervious cover and 10 percent till lawn cover was assumed in the Western Washington Hydrology Model Version 3 to determine a water quality volume for a wet pond treating one acre of developed area; the Pierce County BMP Sizing Calculator was used to estimate the square footage of a bioretention cell treating the same basin. The following average prices for construction were determined (**Table 6**):

Table 6. Average construction costs per treated basin area.

Stormwater BMP	Facility Size per Basin Acre	Facility Unit	Average Construction Cost /Unit from Database	Cost/Acre
Bioretention	788	SF	$ 30.55	$ 24,069.20
Wet Pond	4447	CF	$ 7.97	$ 35,446.38

The study above had a limited number of respondents in other BMP categories, but the methodology can be applied to other BMPs to develop comparative costs. For the purpose of this cost analysis, estimated cost per-acre to treat that is within 20 percent of the median cost should be considered within an acceptable, equivalent cost range.

Structural Stormwater Best Management Practices in North Carolina

This study, conducted by North Carolina State University (2003), provides a good comparison of the various BMP categories and the way that basin size relates to construction cost for each type of BMP (**Table 7**). While the actual magnitude of the cost data may be out of date and based on a different construction market, the comparative cost for each BMP is informative. **Table 8** shows the relative cost factors and treatment area for a 20-acre watershed basin at 100 percent impervious. The cost per acre of land is $100,000. The median value plus 20 percent would be considered equivalent.

Table 7. Summary of construction cost curves, maintenance cost curves, and required surface area for stormwater BMPs in North Carolina.

	Wet ponds	Stormwater wetlands	Sand filters	Bioretention in clay soils	Bioretention in sand soils
Construction cost	$C=13{,}909X^{0.672}$	$C=3{,}852X^{0.464}$	$C=47{,}888X^{0.882}$	$C=10{,}162X^{1.088}$	$C=2{,}861X^{0.438}$
20-year maintenance cost	$C=9{,}202X^{0.269}$	$C=4{,}502X^{0.153}$	$C=10{,}556X^{0.534}$	$C=3{,}437X^{0.152}$	$C=3{,}437X^{0.152}$
Required surface area of BMP in acres					
Residential development					
Piedmont (CN 80-90)	SA=0.015X	SA=0.02X		SA=0.025X	SA=0.025X
Coastal Plain (CN 65-75)	SA=0.0075X	SA=0.01X		SA=0.015X	SA=0.015X
Highly impervious area with CN 80	SA=0.02X	SA=0.03		SA=0.03X	SA=0.03X
100% impervious area (CN 100)	SA=0.05X	SA=0.065X	SA=0.017X	SA=0.07X	SA=0.07X

C=cost in $; X=size of watershed in acres; SA=surface area of BMP in acres Source: Wossink and Hunt (2003)

Table 8. Cost factor comparison analysis.

BMP Type	Size of Watershed (ac)	Surface Area of BMP (ac)	Area Cost	Construction Cost	20-year Maintenance Cost	Total Cost Factor
Wetponds	20	1.0	$100,000	$104,133	$20,600	$224,733
Stormwater Wetlands	20	1.3	$130,000	$16,420	$7,120	$153,540
Sand Filters	20	0.3	$30,000	$672,566	$52,269	$754,835
Bioretention, poor soils	20	1.4	$140,000	$264,545	$5,419	$409,964
Bioretention, good soils	20	1.4	$140,000	$10,625	$5,419	$156,044

Bold = Median, median plus 20 percent, and lower

University of New Hampshire, Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management (Houle, et.al 2013)

The purpose of this study was to examine cost comparisons of LID BMPs to conventional BMPs. The study provides information on maintenance activities and costs for a range of stormwater management strategies used for both conventional BMPs and LID techniques. The summary of the cost information they examined is provided in **Table 9**.

Table 9. UNHSC SCM Installation and Maintenance Cost Data, with Normalization per Hectare of Impervious Area Treated (Houle, et.al 2013).

Parameter	Vegetated Swale	Wet Pond	Dry Pond	Sand Filter	Gravel Wetland	Bioretention	Porous Asphalt
Original Capital Cost ($)	29,700	33,400	33,400	30,900	55,600	53,300	53,900
Inflated 2012 capital cost ($)	36,200	40,700	40,700	37,700	67,800	63,200	65,700
Maintenance-capital cost comparision (year)[a]	15.9	5.2	6.6	5.2	12.2	12.8	24.6
Personnel (h/year)	23.5	69.2	59.3	70.4	53.6	51.1	14.8
Personnel ($/year)	2,030	7,560	5,880	6,940	5,280	4,670	939
Materials ($/year)	247	272	272	272	272	272	0
Subcontractor Cost ($/year)	0	0	0	0	0	0	1,730
Annual O&M Cost ($/year)	2,280	7,830	6,150	7,210	5,550	4,940	2,670
Annual maintenance/capital cost (%)	6	19	15	19	8	8	4

[a]Number of years at which amortized maintenance costs equal capital construction cost.

This study concludes that, "LID systems, compared to conventional pond systems, do not have greater annual maintenance costs and, in most cases, have lower marginal maintenance burdens (as measured by cost and personnel hours) and higher water quality treatment capabilities as a function of pollutant removal performance."

BMP Construction and Maintenance Cost Commissioned by the Minnesota Pollution Control Agency (Barr 2011)

This study examined multiple construction project and other studies to compile a list of cost and design information. The data sources varied considerably in where and when they occurred. To compare these data the information was normalized for 2010 Minnesota costs. The summary of averages is presented in **Table 10** as cost per water quality volume treated.

Table 10. Average costs for BMP construction and maintenance.

	Construction Cost		Annual Maintenance Cost	
BMP	Number of BMPs	Average Cost Per Water Quality Volume/ft3	Number of BMPs	Average Cost Per Water Quality Volume/ft3
Bioretention Basins	11	$ 15	8	$ 1.25
Biofiltration Basins	2	$ 58	0	no data
Large Wet Detention Basins (treats < 100,000 ft3)	5	$ 2	4	$ 0.07
Small Detention Basins (treats > 10,000 ft3)	3	$ 145	0	no data
Constructed Wetland	4	$ 1	0	no data
Infiltration Trenches	8	$ 11	8	$ 0.39
Infiltration Basins	6	$ 21	6	no data
Underground Infiltration	8	$ 213	4	$ 1.26
Pervious Pavement	7	$ 16	0	no data

Preferred BMP List

Preference of BMPs at the Port considers the BMPs statistical pollutant removal performance (**Table 3**), the applicability of the BMP to the unique conditions on Port properties (**Table 4**), and to some degree the long term cost and reliability of the system. Under these considerations treatment methods have been segregated into those that are preferred by the Port (first choice), conditionally preferred by the Port (second choice), and those that should not be considered for use on Port properties.

When selecting BMPs for installation on Port property, the following list should be considered carefully. Conditionally preferred treatment methods must be approved by the Port following the approval process described in Section 6. Special considerations for this approval are included in the list below.

Preferred Treatment Methods:

Bioretention – Bioretention systems are effective at pollutant removal, particularly zinc. In addition, they are often well suited to spatial limitations on Port properties. However, under drains may be necessary if high groundwater prevents infiltration.

Ecology-approved BMPs using this treatment method:

- Bioretention Cells, Swales, and Planter Boxes (T7.30)
- Compost-Amended Vegetated Filter Strips (T7.40)

Basic Biofiltration Swales – Biofiltration swales are particularly efficient at removing zinc and TSS from stormwater, and are also well suited to the spatial limitations on Port properties.

Ecology-approved BMPs using this treatment method:

- Basic Biofiltration Swale (T9.10)

Basic Filter Strips – Basic Filter Strips are particularly efficient at removing zinc from stormwater and are also well suited to the spatial limitations on Port properties.

Ecology approved BMPs using this treatment method:

- Basic Filter Strips (T9.40)

Conditionally Allowed Treatment Methods:

Sand Filters – Sand filtration works well for removing pollutants, particularly zinc. However, many sand filter systems rely on either infiltration or sufficient gradient to move water through the filter.
Special Considerations for approval: the proponent must demonstrate adequate site conditions for sand filters, but does not need to provide a percent exceedance curve.

Ecology-approved BMPs using this treatment method:

- Basic Sand Filter Basin (T8.10)
- Large Sand Filter Basin (T8.11)
- Sand Filter Vault (T8.20)
- Linear Sand Filter (T8.30)

Media Filters – Similar to sand filters, media filters often need sufficient gradients to move water through the filter. Media filtration may be suitable for application on Port property, but must be approved by the Port.
Special Considerations for approval: the proponent must demonstrate adequate site conditions and provide a percent-exceedance curve to demonstrate the performance of the proposed media.

Ecology-approved BMPs using this treatment method:

- Media Filter Drain (T8.40)

Wet Biofiltration Swales – Similar to basic biofiltration swales, wet biofiltration swales are efficient at removing TSS, though less efficient when it comes to metals. Swales in general can easily be fit to a variety of unique site conditions.
Special Considerations for approval: the proponent must provide a percent-exceedance curve demonstrating effective treatment for copper and zinc.

Ecology-approved BMPs using this treatment method:

- Wet Biofiltration Swale (T9.20)
- Continuous Inflow Biofiltration Swale (T9.30)

Manufactured Devices – While manufactured devices work well in the unique environment at the Port, they are statistically less effective at removing pollutants and should be used only when other systems prove impractical.

Special Considerations for approval: the proponent must provide a percent-exceedance curve for the specific manufactured device proposed.

Ecology-approved emerging technologies:

- Filterra
- Aqua-Filter Systems
- BayFilter
- MWS-Linear Modular Wetland
- FlocClear (GULD and CULD)
- StormFilter
- UrbanGreen Biofilter
- Up-Flo Filter
- ecoStorm Plus
- FloGard Perk Filter
- Jellyfish Filter
- Aquip
- Compost Amended Biofiltration Swale

Methods Not Applicable to Port Properties:

Infiltration – Although infiltration systems are affective at removing pollutants, they are generally ineffective at the Port due to high groundwater and space constraints.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Infiltration Basins (T7.10)
- Infiltration Trenches (T7.20)

Wetponds – Wetponds are only moderately effective at removing stormwater pollutants. The largest deterrent against using wetponds is the size and need for sufficient gradient that is generally difficult to accommodate on Port properties.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Wet Ponds (T10.10)

Wet Vaults – Wet vaults are relatively inefficient for pollutant removal. In addition, wet vaults typically need sufficient gradient drops that are unsuited to Port properties.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Wet Vaults (T10.20)

Stormwater Treatment Wetlands – Although wetlands show excellent effectiveness at removing pollutants, their typically large size is prohibitive to use at the Port.

Ecology-approved BMPs using this treatment method not adaptable to Port properties:

- Stormwater Treatment Wetlands (T10.30)

References

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