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# Terminal 4 Source Control Decision Support Data Collection Work Plan

Prepared by

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## LIST OF ACRONYMS

| | |
|---|---|
| Apex | Apex Companies, LLC (formerly Ash Creek) |
| Ash Creek | Ash Creek Associates, Inc. |
| BBL | Blasland, Bouck & Lee |
| BMPs | Best Management Practices |
| City | City of Portland, Oregon |
| COPC | Constituent of Potential Concern |
| DEQ | Oregon Department of Environmental Quality |
| EE/CA | Engineering Evaluation/Cost Analysis |
| EPA | U.S. Environmental Protection Agency |
| JSCS | Joint Source Control Strategy |
| LWG | Lower Willamette Group |
| MSL | Mean Sea Level |
| MS4 | Municipal Separate Storm Sewer System |
| NPDES | National Pollutant Discharge Elimination System |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PCB | Polychlorinated Biphenyl |
| PHSS | Portland Harbor Superfund Site |
| Port | Port of Portland |
| RI | Remedial Investigation |
| SLVs | Screening Level Values |
| Stormfilter® | Stormfilter® Treatment System |
| SW DSR | Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities |
| SWE WP | Storm Water Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities |
| SWSCE | Storm Water Source Control Evaluation |
| FSPR | Field Sampling Procedures Report |
| T4 | Port Terminal 4 Slip 1 Upland Facility in Portland, Oregon |
| TSS | Total Suspended Solids |

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## 1.0 INTRODUCTION

This Work Plan presents the proposed efforts for additional data collection to support decisions related to the selection and design of Source Control Measures (SCMs) at the Port of Portland (Port) Terminal 4 Slip 1 Upland Facility in Portland, Oregon (T4). Implementation of SCMs[1] are required by the Oregon Department of Environmental Quality (DEQ) pursuant to the Terminal 4 Slip 1 Upland Facility – Voluntary Agreement for Remedial Investigation, Source Control Measures, and Feasibility Study (DEQ No. LQVC-NWR-03-18), December 4, 2003.

The rationale for collecting additional decision support data at Terminal 4 (T4) was presented to DEQ on December 8, 2014. As discussed in that meeting, the SCMs implemented to date at T4 including; storm drain clean outs, increased street sweeping frequency, catch basin inserts, and new media in the StormFilter vault have improved the overall stormwater quality at T4. The data currently available at T4, however, indicate that structural stormwater treatment controls will be needed to further reduce Polycyclic Aromatic Hydrocarbon (PAH) discharge loadings from the two T4 drainage basins of interest (L and M). To select effective treatment SCMs, additional information is needed on the forms and characteristics of the various PAH species in stormwater at T4. Also, there is insufficient information on the rainfall-runoff response in Basins L and M to confidently size and design treatment controls and predict their load reduction performance. Therefore, efforts proposed herein focus on the collection of additional data to support a detailed understanding of hydrology, hydraulics and PAH treatability at T4, which will lead to the ultimate selection and design of structural treatment controls and an assessment of PAH load contribution to the Portland Harbor. For this purpose various types of site-specific data will be collected including:

- Flow: Flow data will be collected on a continuous basis in conjunction with composite sampling and will allow for a more comprehensive understanding of T4 system response to storm events. This data will also allow for the calibration of a site-specific hydrologic/hydraulic model for detailed analyses including SCM selection and design.
- Precipitation: Precipitation data will be collected with an on-site gage to improve the understanding of T4 system hydrologic response to hydrologic events. This data will also allow for the calibration of a site-specific hydrologic/hydraulic model for detailed analyses and design that are flow dependent. This data will also aid in assessing the representativeness of nearby gages, which have a longer period of record to support these analyses.

[1] Note the terms "SCM" and "best management practice or BMP" are used interchangeably and may include both non-structural or operational activities (e.g., street sweeping) and structural treatment controls (e.g., swales, media filter vaults, etc.).

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- Water Quality: Various types of water quality data will be collected to further characterize site runoff quality and allow for more confident selection and design of SCMs. The types of water quality data proposed for collection include:
  - Whole Water: Stormwater samples will be collected over multiple events and analyzed for total, settleable, and dissolved pollutant fraction concentrations. In addition, rainwater samples will be collected to evaluate background PAH concentrations that result from atmospheric deposition.
  - Stormwater Solids: Solids present within stormwater runoff will be collected and analyzed for both grain size distribution and the pollutant concentration relationships for given particle size fractions. This information in addition to the column study data described below will be very helpful for assessing potential treatability by the various treatment SCMs being considered.
  - Treatability: Raw water passing through appropriately sized on-site columns filled with treatment media will be collected and analyzed for pollutant concentrations to provide a measure of expected performance using industry current media. Initial media will include the current StormFilter mix of zeolite, perlite and granular activated carbon. If this media is determined to be ineffective or if additional media are selected, additional treatability tests may be conducted.

Further discussion and the conceptual parallel path of additional system understanding and SCM assessment are provided in Appendix B. The monitoring period as referenced in this work plan is proposed to run from approximately late winter through spring 2015.

### 1.1 Document Organization

This document is organized as follows:

- Section 2 provides a brief background of T4, the stormwater drainage system, and a summary of the previous investigations.
- Section 3 presents the proposed 2015 data collection and subsequent efforts.
- Section 4 presents stormwater sampling procedures and analytical program.
- Section 5 presents the proposed reporting of data collection results.
- Section 6 lists references cited in the document.

All figures are presented at the end of this document.

## 2.0 BACKGROUND

This section briefly describes the current and past uses of T4, identifies the National Pollutant Discharge Elimination System (NPDES) permits that regulate the discharge of stormwater from

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the site, and summarizes historical stormwater sampling results and upland source control activities that have occurred to date in the areas draining to Slips 1 and 3. Primary source documents referenced herein are the Terminal 4 Slip 1 Remedial Investigation (RI) Report (Ash Creek/Newfields, 2007a), the Terminal 4 Early Action Characterization Report (BBL, 2004), and the Terminal 4 Early Action Engineering Evaluation/Cost Analysis (EE/CA; BBL, 2005). Operations and environmental maintenance records maintained by the Port were also reviewed. Proposed data collection efforts build upon those conducted by Apex described in the 2013 T4 Stormwater Source Control Measure Work Plan (Apex, 2013).

## 2.1 Facility Description

T4 occupies approximately 283 acres on the east bank of the lower Willamette River downstream from the St. Johns Bridge in north Portland, Oregon, between River Miles 4.1 and 4.6. The Slip 1 Upland Facility is approximately 98 acres. Of specific interest for the purpose of additional data collection and SCM efforts are Basins L and M covering 31.9 acres and 15.3 acres, respectively. Basin K (4.2 acres) is also proposed for additional data collection to further characterize TSS, arsenic and total PAHs.

The topography of the Slip 1 Upland Facility is relatively flat, with an elevation of approximately 30 feet above mean sea level (MSL). The land cover at T4 is a mixture of pervious open space, rail tracks, industrial buildings, and asphalt and concrete pavement.

Figures 1 and 2 show the vicinity and layout of T4 identifying the respective basins of interest and locations proposed for additional data collection to support SCM recommendations and design. A digital surface model of T4 generated from LiDAR collected in 2005 by the Puget Sound LiDAR Consortium has also been obtained and will be used for potential refinement of Port storm basins. Updated LiDAR is tentatively expected to be available in the late spring/early summer of 2015 and will be used to further define surface flow directions and support refinement of hydrologic/hydraulic modeling efforts used to assess, size, and design potential treatment measures. This information will also be used to further assess and confirm the tributary area of Basin K.

### 2.1.1 Current Facility Use

T4 has been designated as a marine facility since 1917 and currently includes operational uses such as ship loading/unloading; bulk cargo, liquid, and grain handling and storage; and general equipment and operational maintenance. Specific uses within the drainage basins of interest for 2015 data collection are noted below. Additional description of tenant and facility operations and uses are provided in the 2013 T4 Stormwater Source Control Measure Work Plan (Apex, 2013).

Kinder Morgan leases Pier 4 and its adjacent area for loading of soda ash onto ships at Berths 410 and 411. As part of planned expansion, Kinder Morgan will begin to construct a railcar scale to verify loading volumes in January 2015. Kinder Morgan has also indicated potential future modifications to stormwater infrastructure and interface with its on-site treatment system.

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Current and planned operations in the context of stormwater interface and drainage area separations will be an important consideration in the selection and design of T4 SCMs.

IRM leases the liquid bulk facility at Slip 1 for storing, handling, and distributing bulk liquid and granular products. Products handled by IRM have included caustic soda, non-organic fertilizer, magnesium chloride, lignin, lignon-sulfonate, molasses products, tallow, propylene glycol, and vegetable oil. Currently, IRM is handling ammonium sulfate, urea ammonium nitrate (UAN), lignin, propylene glycol, and occasional shipments of sulfate of potash. IRM uses Berth 408 to unload these products. IRM's leasehold area within Basin M is surrounded by secondary containment and does not contribute stormwater to the Basin M outfall. However, there are adjacent paved areas that IRM personnel use outside the secondary containment that contribute stormwater runoff to catch basins that drain to the outfall.

A portion of Basin K is included in the Kinder Morgan soda ash operations, as identified above (Basin K drainage primarily). The remainder of Basin K currently does not have industrial operations. Port Marine Facilities Maintenance (MFM) currently uses the gearlocker building located south of the Kinder Morgan facility for storage.

### 2.1.2 Historical Facility Use

Operations over the last century at T4 have included: loading, unloading, processing and storage of grain; cold storage; fumigation of cotton and food products; liquid storage (fertilizer, molasses, tallow, urea, caustic soda, and fats); container food freight; a gasoline station; salvage yard; operation of a break-bulk berth and fire boat moorage; and importing ore and ore concentrates, including alumina, bauxite, chromite, chrome ore, coal, ferro-phosphorous iron ore, manganese, lead concentrate, tricaphos, and zinc.

Additional details on historical operations and uses at T4 are provided in the EE/CA Work Plan (BBL, 2004) and EE/CA Report (BBL, May 2005) and the 2013 T4 Source Control Measure Work Plan (Apex, 2013).

## 2.2 Stormwater Permits

Stormwater discharges from T4 are permitted under the Port's Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 (for property and infrastructure owned by the Port) and Kinder Morgan's 1200-Z Industrial Stormwater Permit Facility No. 100025 (for infrastructure on Kinder Morgan's leasehold). Kinder Morgan is responsible for legal compliance under its operating agreements, including operational permits, implementation of a Spill Response Plan and a Stormwater Pollution Control Plan (SWPCP), and compliance with the Port's MS4 Discharge Permit. These permits authorize the release of stormwater to the river subject to specified terms and conditions and also require the implementation of BMPs. Kinder Morgan also holds an industrial pretreatment permit issued by the City of Portland Bureau of Environmental Services for direct discharge of treated process and industrial exposure water to the sanitary system. Noted in Kinder Morgan's SWPCP; a portion of site infrastructure has been

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outfitted with valves that hydraulically disconnect portions of the drainage network so that wash water and some surface runoff (e.g., stormwater) is routed to the onsite treatment system. Stormwater diverted to the onsite treatment system discharges to the City's sanitary system, thereby reducing the effective area tributary to the outfalls and the volume of runoff discharged to the Willamette River.

Proposed 2015 data collection efforts within Basin L are focused on continuous flow monitoring to characterize rainfall-response and on stormwater solids to characterize PAH treatability and transport. Any future modifications to stormwater infrastructure and management of stormwater within the Kinder Morgan leasehold will need to be considered as part of the selection and sizing of future structural SCMs (i.e., treatment) for Basin L. Further characterization of PAHs (control and treatability) may also provide additional understanding on how soda ash potentially effects pollutant concentrations and the ability to treat using conventional media.

## 2.3 Best Management Practices

The Port has implemented numerous BMPs (both structural and nonstructural) at T4 through various mechanisms, including tenant and licensee contracts, The Environmental Management System Program, continual improvement policy, and a Stormwater Master Plan. Additional details for current best management practices can be found in the Apex (2013) and previous work plans referenced herein. The Port has also conducted rehabilitation of the entrance road facility in 2013 and impervious surface removal as part of the first identified stormwater retrofit submitted under the current MS4 permit in Basin Q. Current structural BMP treatment within the areas of interest at T4 include a Contech StormFilter® treatment system (Stormfilter) installed in the conveyance system for Basin M in 2006. The media based system works primarily via filtration and adsorption while utilizing a self-backwashing, siphon-actuated design. Currently, a zeolite, perlite, and granulated activated carbon media mixture (ZPG™) is being used in the cartridges to specifically target sediment, PAHs, and heavy metals.

As part of the stormwater master plan effort conducted under the current MS4 permit, a site-specific water quality assessment was completed for T4 that included the development of a pollutant load model and identification of potential water quality retrofit projects within Basins L and M. This previous work is being built upon as part of the parallel path approach to evaluate SCMs for PAHs using existing data and data collected as part of this work plan.

## 2.4 Stormwater System and Drainage Basins

Prior to initiating the stormwater data collection program and subbasin sampling in 2014, storm infrastructure drawings were reviewed to clarify the existing storm drain systems and drainage basin characteristics present at T4, as detailed in the DEQ-approved *Storm Water Evaluation Work Plan* (SWE WP; Ash Creek/Newfields, 2007b).

In January 2015, storm drain system design information, as-builts, and Port GIS data were also reviewed to verify critical storm drain dimensions and invert elevations for the proposed data

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collection equipment. Updated information was also reviewed on the management of stormwater within Kinder Morgan's leasehold and particularly the installation of valves and pumps that divert stormwater away from the Basin L outfall. Prior to final monitoring equipment procurement, critical infrastructure components will be verified in the field by Port staff.

## 2.5 Summary of Stormwater-Related Previous Investigations

Previous investigations related to stormwater and SCMs at T4 are presented below in abbreviated chronological fashion. Additional descriptions of referenced efforts are provided in the 2013 T4 Source Control Measure Work Plan (Apex, 2013). Together, the previous data collection and SCM efforts within Basins L and M represent a highly valuable data set and form the basis for the path forward at T4. Following review of the efforts noted below, additional data needs were identified with respect to the ability to confidently assess, design and size appropriate SCM for the treatment of PAHs. Additional proposed data collection is intended to fill these gaps and develop a plan for the long term treatment and management of stormwater at T4. The goal is significant reduction of stormwater as a potential pathway for sediment recontamination.

- 2004-2006: Terminal 4 Removal Action Characterization and Recontamination Analysis

Removal Action Characterization included extensive sediment sampling to define contaminants of potential concern (COPC) in sediments of the river. The COPC identified for T4 sediments included metals, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate (DEHP), pesticides (DDT/DDD/DDE), and polychlorinated biphenyls (PCBs). A Recontamination Analysis, which included stormwater sampling, was deemed necessary to assess ongoing sources that could re-contaminate the river sediments following the removal action. The stormwater data gaps drove the proposal for additional stormwater sampling at T4 to better characterize specific areas and pollutant concentrations in runoff.

- 2006-2008: Stormwater and Stormwater Solids Sampling and Source Control Evaluation

A stormwater characterization program was initiated in December 2006, concurrent with a program conducted by the Lower Willamette Group (LWG) for the Portland Harbor Superfund Site (PHSS) Study Area under U.S. Environmental Protection Agency (EPA) oversight. The stormwater characterization program was conducted in general accordance with the DEQ-approved SWE WP dated June 2007, prepared by Ash Creek (Ash Creek/Newfields, 2007b), and the *Rationale for Basin Selection for Storm Water Sampling and Additional Information Requested* by DEQ in the memorandum from Ash Creek to the Port, dated February 26, 2007 (Ash Creek/Newfields, 2007c).

The purpose of the SWSCE was to assess what, if any, stormwater SCMs were needed at T4. The results of the subsequent source control evaluation were presented in the SWSCE Report, submitted to the DEQ on September 9, 2009 (Ash Creek, 2009c). The stormwater results from the T4 sampling were compared with the sampling results in the LWG dataset of other Portland Harbor sites. The SWSCE identified analytes detected in stormwater and stormwater solids in

T4 samples at concentrations elevated relative to samples collected from other LWG Portland Harbor sites. The majority of those exceedances were in the samples collected from Basins L and M. Therefore, the SWSCE report recommended cleanout of the stormwater conveyance lines for Basins L and M in an effort to remove legacy solids from the line.

- 2010: Stormwater Source Control Measures and Performance Monitoring

To remove legacy solids from the stormwater conveyance lines, cleanouts of the stormwater conveyance systems for Basins L and M were conducted in June 2010. Because Basins K and N were assumed to be similar to Basin L based on similar land uses, as noted in the SWE WP, the conveyance lines of Basins K and N were also cleaned out.

Following the cleanouts, three rounds of grab samples were collected between October 2010 and May 2011 from Basins L and M to evaluate the effectiveness of the line cleanouts. The results of the 2010-2011 stormwater sampling for Basins L and M showed that the stormwater line cleanouts successfully removed legacy solids from the conveyance lines. Observed TSS concentrations were significantly reduced in the post-cleanout samples (previously correlated with detected chemical concentrations) with outfall concentrations remaining significantly below the respective 1200-Z benchmark of 100 mg/L through 2014.

- 2010-2012: Screening Level Recontamination Analysis for Stormwater Basins L and M

The *Screening Level Recontamination Analysis for Storm Water Basins L and M* (Formation Environmental, 2012) was conducted following discussion with DEQ and EPA to provide another line of evidence to the results and information presented in the *Storm Water Source Control Completion Report* (Ash Creek, 2011). The results of the analysis indicated that recontamination of river sediments due to arsenic and PAHs in stormwater discharges from Basins L and M was not predicted. However, the DEQ and EPA expressed concerns about the assumptions and model parameters.

Additional data collected at T4 as described in this work plan may be useful in further assessing the likelihood for recontamination potential from stormwater given a more comprehensive understanding of stormwater discharge volumes and pollutant characteristics including dissolved fraction of PAHs and PAH affiliation for varying grain sizes.

- 2012-2013: Stormwater Source Control Measures and Performance Monitoring

Design parameters for the media filtration vault within Basin M were reviewed along with discussions with vendors on the applicable proprietary media mixes. Along with increased diversion to the treatment vault and a switch to ZPG media, two rounds of follow up composite samples were collected between October 2012 and February 2013 from Basins L and M.

- 2013-2014: Stormwater Source Control Measures and Performance Monitoring

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Additional storm infrastructure investigations including identification of missing components, observation on sediment accumulation and SCM efforts, including comprehensive sweeping and cleanout of the stormwater inlets was recently completed in Basin L (September 2013) and Basin M (October 2013). Following these activities sampling conducted by Apex in 2014 consisted of automated composite sampling, grab samples and flow monitoring within Basins L and M. Sampling was conducted for both targeted subbasin areas and at the outfalls for the respective basins. Sampling was conducted for two JSCS qualifying events and helped to further characterize PAH and arsenic concentrations in stormwater, particularly at the respective outfalls. Finally, Kinder Morgan conducted sweeping, cleanout of the stormwater inlets, replacement of catch basin inserts, and cleanouts of the stormwater conveyance systems for Basins L and K from February through April 2014.

## 3.0 PROPOSED 2015 DATA COLLECTION EFFORTS

This section summarizes the scope of work for the proposed data collection efforts at T4 in support of identification and further assessment of SCMs as well as potential structural treatment for Basins L and M at T4 (see Figure 1). Although not specifically identified as a target basin of interest, Basin K is also included due to its adjacent connection to Basin L and partial exposure to ongoing industrial operations and similar historical site activities. The scope of work was developed based on the review of the historical stormwater sampling program (including past work plans and SCM efforts) through 2014 along with an evaluation of current and available technologies and performance data in the context of stormwater BMPs and structural treatment design. The Port proposes to complete multiple types of data collection as part of this effort, including flow monitoring, water quality monitoring, atmospheric deposition, and treatability studies as described below. Figure 2 shows the monitoring locations discussed below. Figure 3 shows the typical set-up for a flow monitoring and water quality station.

### 3.1 Flow Monitoring

Continuous flow monitoring stations will be installed at two locations within the drainage system: Station A for Basin M and Station B for Basin L. The flow monitoring equipment will consist of a primary device, for which an empirical relationship between flow rate and stage (water level) has been established, and a secondary device to continuously monitor and log the stage. The secondary device may be used to trigger and/or disable an external water and sediment sampling device.

For Station A, a fiberglass weir insert has been selected as the primary device with a Bubbler Level Logger as a secondary device. The weir insert will be installed in the terminal pipe segment from Basin M through Manhole STSMH2589. Based on current knowledge of the storm drain network, there are no lateral connections downstream of the proposed installation location. The flow measurement will therefore be representative of outfall flow from Basin M. The Bubbler Level Logger will be installed in a surface mounted enclosure near Manhole STSMH2589. A dedicated power supply will be provided to the enclosure.

For Station B, a fiberglass weir insert has also been selected as a primary device with a Bubbler Level Logger as a secondary device. The weir insert will be installed in the 21" diameter pipe segment where it enters Manhole STSMH2607. There is a 10" lateral that conveys runoff from approximately three percent of Basin L that discharges downstream of the proposed location of the primary device. It is not practical to measure flows from this lateral pipe due to site and equipment constraints. The Bubbler Level Logger will be installed in a surface mounted enclosure near Manhole STSMH2607. A dedicated power supply will be provided to the enclosure.

### 3.2 Water Quality Sampling

Automated water quality sampling equipment will be installed both at Station A and Station B. The water quality sampling equipment will be capable of collecting composite water samples over several storm events while simultaneously collecting stormwater solids for particle size analyses.

The equipment selected for Stations A and B are similar, as depicted in Figure 3. A submersible pump will be placed in a sump near the primary flow device. The sump pump will help keep sediment in suspension and can be activated/deactivated by a flow, water level, a rainfall condition signal switch, or manually. The initial plan is to pace all monitoring based on flow. The discharge line from the sump pump will be connected to a flow meter equipped with a pulse output. The pulse output from that flow meter will trigger two separate metering pumps to extract a designated volume of sample from the source water. The metering pump output will be collected in large volume collection containers; a separate container for each metering pump's output. The resultant composite sample in each collection container will be proportional to the volume of water pumped by the sump pump over the course of the event or several events.

The metering pumps and collection vessels will be located in an above ground enclosure. A dedicated power supply will be provided to the enclosure. For the sump pump in Basin L to operate properly, a 6- to 8-inch deep sump will be created within the manhole. A baffle wall constructed from 2 x 6 lumber inserted in a 1 ½ -inch wide C-Channel mounting bracket will be installed in the manhole. A waterstop will be applied to the bottom and vertical sides of the baffle wall to create a watertight seal for the sump. It may be necessary to remove some of the grouting from the base of the manhole to accommodate the baffle and sump. For Basin M, the submersible pump will be placed in the existing sedimentation sump in the StormFilter ™ vault (STSVLT001016) which would avoid having to make any structural modifications to the downstream manhole.

Raw stormwater diverted to the collection vessels will be sampled according to the sampling event criteria described in Section 4.1 and analyzed for TSS, arsenic, and PAHs.

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Additional grab samples from Basin K will also be taken to further characterize PAH concentrations in stormwater and note any differences in adjacent basin characteristics. These data will be collected with grab sample techniques during storm events where field personnel are available on-site, which may or may not occur during a JSCS qualifying event. If a JSCS qualifying event sample is collected, it will be noted in the field data sheet and final data summary report (see Section 4.0 for description of the sampling criteria).

### 3.3 Stormwater Solids Sampling

In addition to water quality sampling, stormwater solids will be collected for grain size and sediment PAH concentration analyses. The solids will be collected using a 5 micron polypropylene felt filter bag installed in-line with the sump pump return line as depicted in Figure 3. A flow totalizer will measure the volume of water passing through the filter, and a pressure gauge will indicate if/when the filter bag needs to be replaced. A pressure relief valve will also be installed as a safety precaution. It is anticipated that stormwater solids from several storm events may need to be collected before an adequate mass of solids accumulates to conduct grain size analyses. Additional details of the stormwater solids sampling procedures are described in Appendix A.

### 3.4 Atmospheric Deposition

Given the ubiquitous nature of PAHs within the environment, including emissions from vehicles, industrial operations, and chimneys, atmospheric deposition of PAHs may be an important component of concentrations in stormwater runoff at T4. A lab-cleaned sample container will be located in Basin M near the other sampling equipment and allowed to fill over the period of several storm events to assess atmospheric deposition (wet and dry). Rainwater samples will be collected from the container at least twice during the monitoring period and submitted to a laboratory for analysis of low level PAHs.

### 3.5 Treatability Studies

The primary constituents exceeding the JSCS SLVs for both Basin M and Basin L outfall are PAHs, which are hydrophobic compounds typically associated with sediments. There are multiple passive treatment alternatives that can be used to remove bulk and suspended solids larger than 200 microns, but removing smaller particles may require additional sedimentation and filtration treatment processes. Most passive stormwater BMPs (gravity flow) are designed to settle, filter, and bind charged particles in the source water. These BMPs are typically designed with a design storage volume or design flow rate; volumes or flows in excess of these may not get adequate treatment. These BMPs can be employed singularly or combined in a "treatment train." Active stormwater BMPs (off-line with pumped flow) rely on some of the same mechanisms, but can achieve a higher effluent quality as the additional head provided by the pump allows for chemical addition, enhanced settling, finer filtration media, and longer contact times with sorption and ion exchanged media. Active treatment systems are often located above ground to facilitate maintenance. Lifecycle costs for passive treatment systems are generally

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much less than for active systems. If they can achieve the treatment objectives, passive BMPs are the preferred treatment option in most cases. The monitoring setup was designed to accommodate testing apparatus to aid in determining passive treatment options that may be effective for meeting the discharge goals. (Note: Passive treatment could include a pump to deliver water to a passive system). If no passive treatment system seems feasible, the monitoring equipment can be adapted to facilitate treatability studies for active treatment system components. The primary reason for using a dual metering pump configuration for sampling was to provide a treatment vs control experimental setup to support treatability testing.

The sampling apparatuses are purposefully designed to accommodate media-filled columns for flow through operation and testing. The metering pumps can be set to reliably pump 0.3 gpd to 85 gpd (an effective turndown ratio of 1:283). This pumping rate flexibility allows for small scale treatability testing that can still approximate the actual hydraulic and sediment loading that a full scale system might receive. Therefore, using the same equipment used for collecting samples, a small scale column study will be conducted simultaneously to evaluate the treatability of fine particulates and PAHs. A mixture of inert and adsorptive media, including both proprietary media mixes and granular activated carbon (GAC), may be used depending on the results of the data collection activities. Initial media proposed to be tested will include the current StormFilter mix of zeolite, perlite and granular activated carbon. By conducting the treatability testing in the field, the site conditions and water quality characteristics of the source water will be more representative than if conducted in a laboratory environment. The media columns will be sized appropriately for the expected hydraulic and pollutant loading rates. These columns will be located within the monitoring equipment enclosures of Basin L or M depending on final selected size, number and type for testing.

Treated water will be sampled from the large collection vessels similar to the control water quality samples as described below.

## 4.0 STORMWATER SAMPLING AND ANALYSIS

### 4.1 Sampling Event Criteria

Because the primary objective of additional data collection is to support the selection, design, and long-term maintenance of SCMs at T4, continuous monitoring is proposed to capture as many characteristic storm events as possible during the monitoring period regardless of whether an event is classified as a JSCS qualifying event or not. For reference, a JSCS qualifying event is defined by the following criteria (DEQ/EPA, 2005):

- If the sampling event was preceded by an antecedent dry period of at least 24 hours (as defined by less than 0.1 inch over the previous 24 hours);
- The minimum predicted rainfall volume was greater than 0.2 inch per event; and
- The storm event duration was at least 3 hours.

For this study, the above criteria will be used, if possible, to initiate flow monitoring and sampling equipment testing and calibration. After the equipment initiation, the first water quality sampling event from the collection vessels will be triggered when the vessels are at least one quarter full. After the initiation event, up to two long-term composite water quality sampling events would be targeted for Basins L and M; one sample in early spring and one in late spring, or when the vessels become approximately two-thirds full. As described in Section 3.3, accumulated solids sampling will occur when the filter bags begin to clog as indicated by an increase in pressure.

Rainfall data from an on-site rain gage installed as part of the additional data collection will be used for hydrologic model calibration and to validate a nearby rain gage with longer term data. The rain gage at Terminal 4 (maintained by the City of Portland Hydra Network) was abandoned in the summer of 2011, but was replaced by the Shipyard Rain Gage located at 8900 N. Sever Road less than a mile away. The rain gage lists the rainfall depth per hour (reported on a 1- to 3-hour time delay). The rain gage data are found at the following web address: http://or.water.usgs.gov/non-usgs/bes/shipyard.rain.

## 4.2 Stormwater Sampling Procedures

Stormwater samples will be obtained in accordance with the sections presented above and the Sampling and Analysis Plan (Appendix A).

## 4.3 Laboratory Analysis

The samples collected from the above activities will be submitted for the following chemical analyses on a standard turnaround time.

- Total PAHs by EPA Method 8270D-SIM (soil and water);
    - 8270D-SIM-low level for atmospheric deposition, at a minimum
- Total arsenic by EPA Method 1632;
- TSS by SM 2540D; and
- Grain Size by ASTM D 422

Whole water samples will be analyzed for total PAHs, total arsenic and TSS while stormwater solids samples will be analyzed for total PAHs and grain size distribution. In addition, water samples collected from the collection vessels will be analyzed for PAHs after laboratory filtration using 20 micron and 0.45 micron glass filter sizes. The 20 micron size has been selected as an approximate particle size with the potential to settle in a quiescent water column. The 0.45 micron size is the typical size dividing particulate and dissolved fractions.

Additional details are provided in the Sampling and Analysis Plan in Appendix A along with the target reporting limits.

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## 5.0 REPORTING

Reporting will consist of a Data Summary Report that will include:

- A discussion of field activities completed, sampling methods, and sampling procedures used;
- A summary of rainfall data including the total rainfall, total runoff, total sampled volume, and estimated percentage the targeted storm events captured and therefore characterized by the composite sampling;
- A tabular summary of the analytical results including a comparison to JSCS screening level values; and
- Analytical laboratory reports including a quality assurance review.

The data (both as discrete samples and statistical averages) will be presented and discussed.

## 6.0 SUMMARY AND NEXT STEPS

The data collection effort will provide critical information needed to assist with the selection and design of effective SCMs for T4. Flow data are needed to assist with treatment system sizing and to adequately estimate expected load reductions. Water quality and stormwater solids samples will improve the understanding of the characteristics and fate of PAHs. For example, the analytical results will include both total concentrations of the individual PAH compounds as well as fractional concentrations based on different particle sizes. These fractional concentrations will provide critical information on the treatability and transportability of PAHs. If the majority of the total PAHs are associated with larger particle sizes (> 20 µm) then the use of passive treatment technologies may be feasible. However, if the majority of the total PAHs are associated with very small particles (<20 µm) then more active treatment technologies may be needed. On the other hand, if the sampling data indicates the settleable fractions of the various PAHs are below the SLVs, the Port may propose a technology-based effluent limit based on the concentrations of PAHs associated with settleable solids since these are the PAHs with the highest potential to contribute to recontamination of the Portland Harbor. The atmospheric deposition samples will also provide an indication of background PAH concentrations that could also be used as an alternative effluent limit to the SLVs.

Following the preparation and submittal of the Data Summary Report, a preliminary hydrologic model for the site developed using EPA SWMM will be calibrated using the site precipitation and flow data. The model along with the collected data and other sources of treatment information will then be used to identify and evaluate SCM design alternatives with the ultimate goal of selecting an alternative that meets effluent quality objectives and is most compatible with site operations and constraints.

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## 7.0 REFERENCES


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Formation Environmental, 2012. *Screening Level Recontamination Analysis for Storm Water Basins L and M at Terminal 4, Port of Portland, Portland, Oregon.* April 2012.

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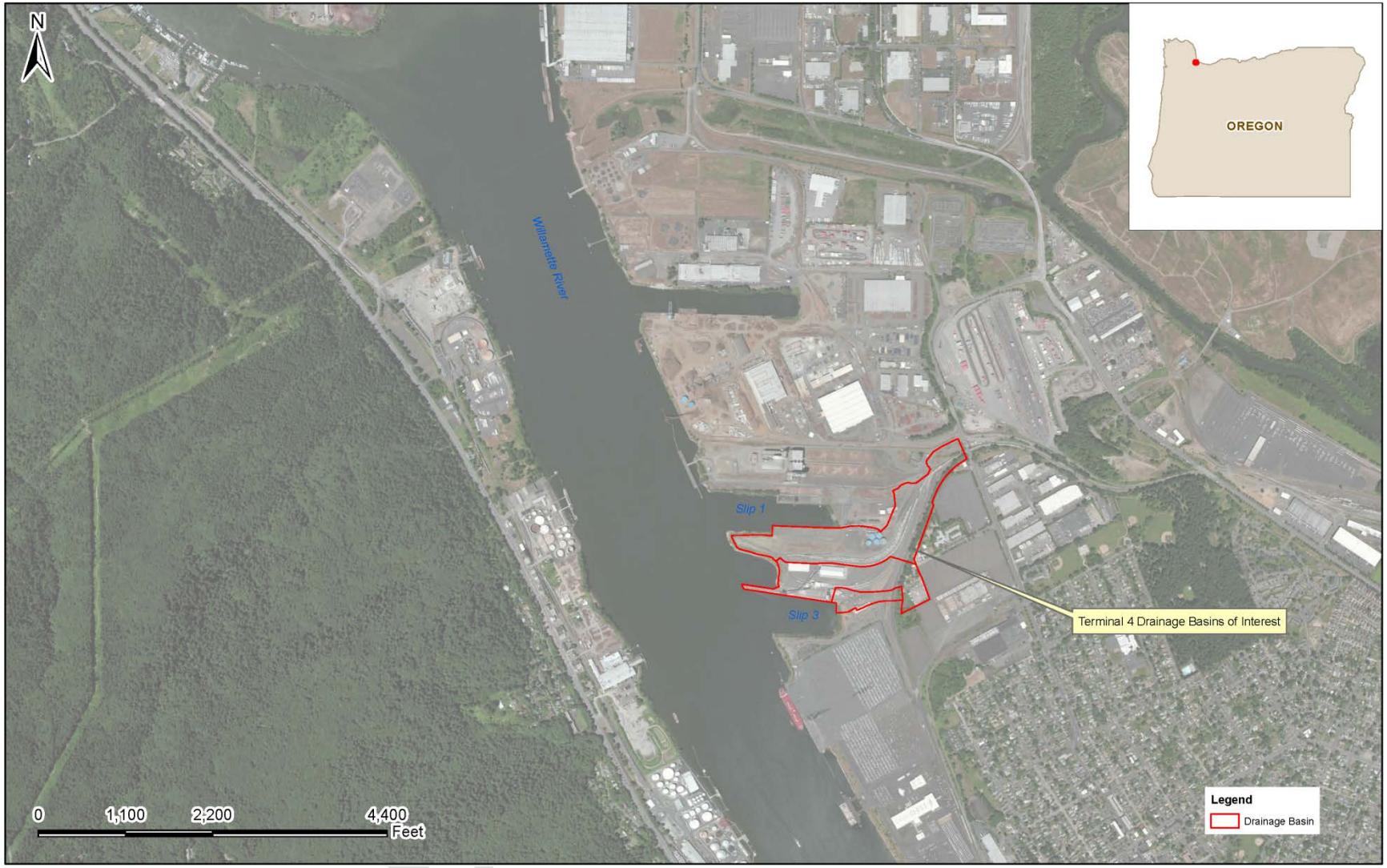


**Figure 1: T4 Basins of Interest Site Location**

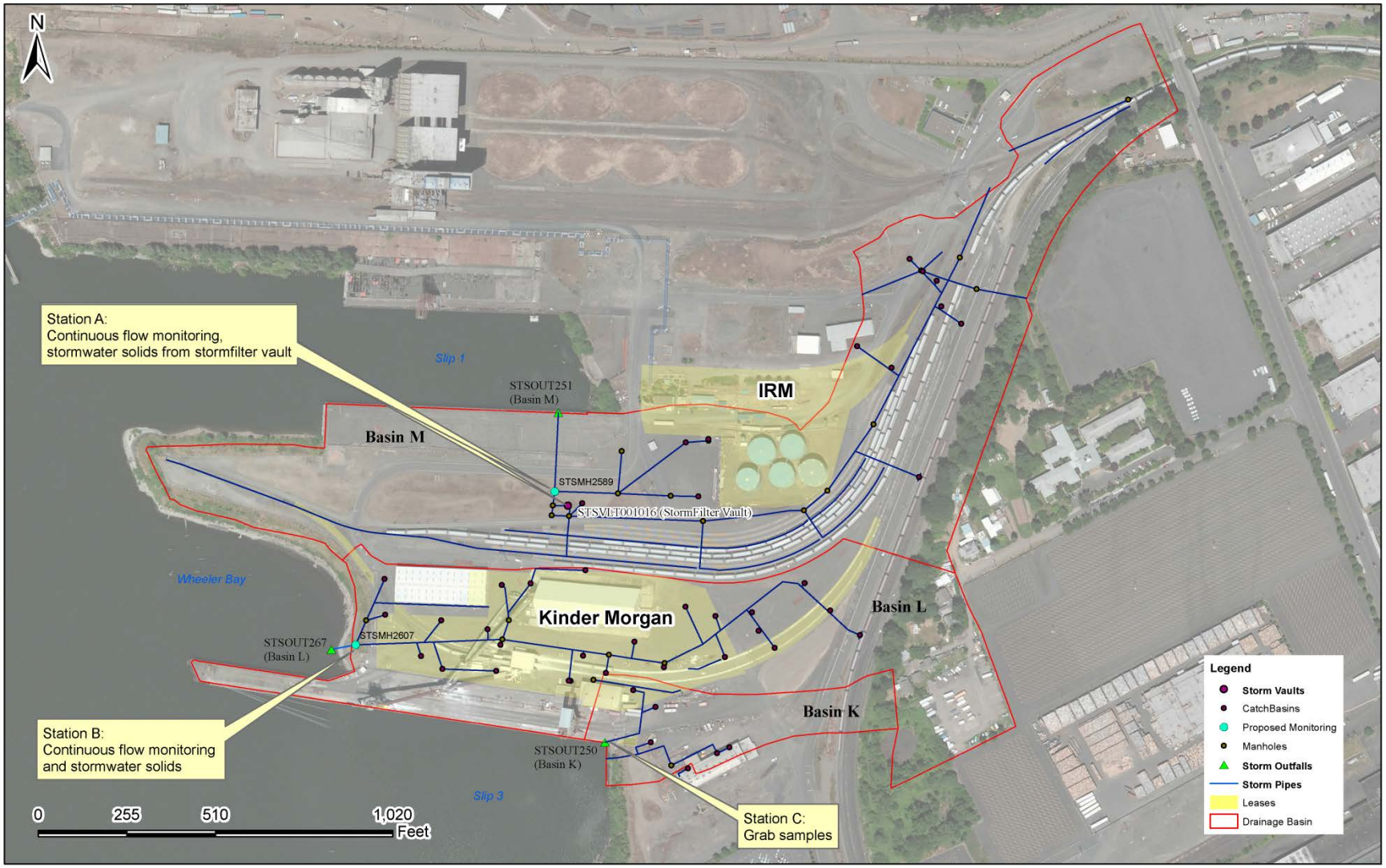


**Figure 2: Proposed Locations at T4 for 2015 Data Collection Efforts**

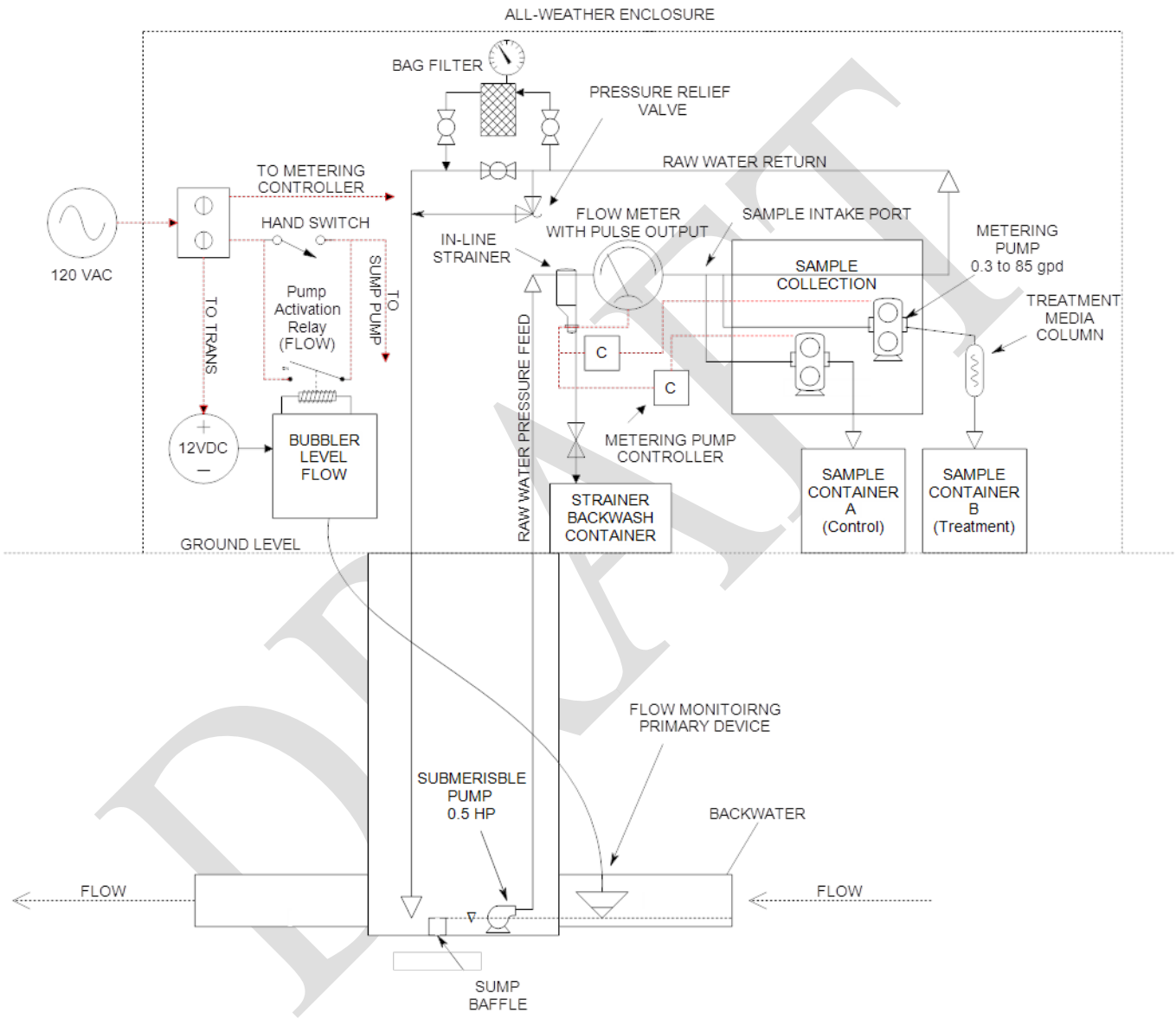


**Figure 3: Stormwater and Solids Sampling Schematic (Typ)**

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# APPENDIX A
## Sampling and Analysis Plan

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## 1.0 INTRODUCTION

This appendix presents the field and sampling procedures and the analytical testing program that will be used to complete the field and analytical work for this project. Quality assurance and quality control (QA/QC) procedures are also discussed in this appendix.

## 2.0 FIELD AND SAMPLING PROCEDURES

The scope of work (SOW) includes stormwater sampling (whole water and solids) and chemical analysis. The field sampling procedures include collection of grab and composite stormwater samples, filtered stormwater solids, sample management (i.e., containers, storage, and shipment), decontamination procedures, and handling of investigation-derived wastes (IDW).

### 2.1 Preparatory Activities

**Site Health and Safety Plan.** A Site-specific health and safety plan (HASP) will be prepared by each contractor conducting field activities in general accordance with the Occupational Safety and Health Act (OSHA) and the Oregon Administrative Rules (OAR). A copy of the HASP will be maintained on-site during the field activities.

### 2.2 Collection of Samples from Collection Vessels

In accordance with the work plan, Teflon-lined, 55-gallon collection vessels will be used to collect flow-weighted composite samples and atmospheric samples from an accumulation of rainfall events. Samples from the vessels will be collected a minimum of three times over the course of the study. Sample 1 will be withdrawn at completion of the equipment installation and calibration period and the collection vessels are at least one quarter full. Sample 2 will be collected mid-study or at conclusion of the storm event that results in one of the sample collection vessels becoming 2/3$^{rd}$ full (whichever comes first). Sample 3 will be collected near the end of the monitoring period or after one of the sample collection vessels become 2/3$^{rd}$ full (whichever comes first). This sampling schedule is subject to change depending on rainfall conditions and review of interim results. Unfiltered samples will be collected from the vessels using dedicated in-line booster pumps that discharge directly into 1-gallon laboratory-decontaminated containers for transport to the laboratory. A stainless steel paddle will be used to agitate the water in the collection vessels as the sample is withdrawn. The paddle will be decontaminated between use by rinsing in 1:100 Alconox ™ solution and wiping with a lint free wipe.

### 2.3 Collection of Stormwater Solids Samples from Filter Bags

In-line, 5 micron polypropylene filter bags will be used to collect stormwater solids. A pressure relief valve will be installed to allow bypass of the filter bags if the pressure exceeds 5 psi. When this occurs, or just prior, the filter bags with contained sediment will be removed from the filter bag housing and placed in labeled plastic bags. When replacing the filter bags during a storm event, or removing them at the end of an event, residual water in the filter bags will be allowed to gravity drain prior to placing in the plastic sample bag. Sample bags will be stored in a cooler lined with gel packs for transport to the laboratory for analysis. The laboratory will conduct grain size analyses and PAH analyses for up to 5 different grain size bins (e.g., discrete ranges of grain sizes). The selected bin sizes will depend on an initial evaluation of the particle size distribution as described in Section 3.0.

## 2.4 Collection of Grab Stormwater Samples

The unfiltered grab samples will be obtained from the outfall of Basin K for up to three events, which may or may not include JSCS qualifying events. A telescoping swing sampler with a pre-cleaned stainless steel cup will be used to collect the water samples. The water samples will be transferred into 1-gallon laboratory-decontaminated bulk sample containers for transport to the laboratory.

## 2.5 Sample Management

**Containers.** Clean sample containers and Ziploc bags will be provided by the analytical laboratory ready for sample collection.

**Labeling Requirements.** A sample label will be affixed to each sample container before sample collection. Containers will be marked with the project number, a sample number, date of collection, and the sampler's initials.

**Sample Storage and Shipment.** Samples will be stored in a cooler chilled with ice or blue ice to 4 degrees Celsius (°C). The cooler lid will be sealed with chain-of-custody seals. If necessary, the samples will be sent via overnight courier to the analytical laboratory for chemical analysis. Otherwise the containers will be transported to the laboratory. Chain of custody will be maintained and documented at all times.

## 2.6 Decontamination Procedures

**Personnel Decontamination.** Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP will identify the appropriate level of protection for the type of work and expected field conditions associated with this project. In general, clothing and other protective equipment can be removed from the investigation area. Field personnel should thoroughly wash their hands and faces at the end of each day and before taking any work breaks.

**Sampling Equipment Decontamination.** To prevent cross-contamination between sampling events, clean, dedicated sampling equipment will be used when possible for each sampling event and will be discarded after use. All hand work will be conducted with disposable nitrile gloves, which will be changed after handling each individual sample, as appropriate, and between sampling locations. Cleaning of non-disposable items will consist of washing in a detergent (Alconox®) solution, rinsing with tap water, followed by a deionized (DI) water rinse, and wiping with a clean lint-free disposable wipe.

## 2.7 Handling of Investigation-Derived Waste

Disposable items, such as sample tubing, gloves, protective coveralls (e.g., Tyvek®), paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal. After samples for laboratory analysis are collected from the stormwater collection vessels, the excess stormwater will be returned to the storm drain at the location it was collected.

# 3.0 ANALYTICAL TESTING PROGRAM

An analytical testing program will be performed to assess the chemical quality of samples collected as part of this project. Analytical laboratory QA/QC procedures are discussed in Section 4 of this appendix.

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The laboratory-supplied method reporting limits (MRLs) and method detection limits (MDLs) are presented in Table A-1 along with the JSCS screening levels (DEQ/EPA, 2005). Samples will be collected and handled using methods described in Section 2 of this appendix.

The contaminants of interest (COI) and respective analytical methods that are anticipated for this project include:

- Total polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270D-SIM;
- Total arsenic by EPA Method 1632; and
- Total suspended solids (TSS) by SM 2540D.
- Grain Size by ASTM D 422

### 3.1 Whole Water Samples

All whole water samples will be analyzed for TSS, total arsenic, and total PAHs. Additionally, for the whole water samples collected from Basins L and M, PAHs will also be analyzed after filtering in the laboratory using a 20 micron and 0.45 micron glass filter.

### 3.2 Stormwater Solids Samples

Upon receipt of stormwater solids samples, the filter bag and contained solids will be weighed wet and then dried and weighed again with and without the filter bag ring. The solids will then be prepared for grain size and PAH analyses. The number of PAH analyses by grain size will depend on the grain size distribution and the quantity of solids within each size bin. Therefore, during the first sampling event only grain size analyses will be conducted to characterize the mass of solids expected within the various grain sizes. During subsequent events, the laboratory will analyze PAHs for the entire mixed sample and for up to 5 grain sizes.

## 4.0 QUALITY ASSURANCE PROGRAM

### 4.1 Quality Assurance Objectives for Data Management

The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to assess the concentrations of PAHs, arsenic, and TSS. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody procedures (see Section 4.3).

MDLs and analytical results will be compared to action levels for each parameter in media of concern. The detection limits listed in Table A-1 are the expected MDLs and MRLs, based upon laboratory calculations and experience.

Specific QA objectives are as follows:

- Establish sampling techniques that will produce analytical data representative of the media (e.g., stormwater) being measured.

- Analyze a sufficient number of analytical duplicate samples to assess the performance of the analytical laboratory.
- Collect and analyze a sufficient number of blank samples to evaluate the potential for contamination from sampling equipment and techniques, and/or transportation.
- Analyze a sufficient number of blank, standard, duplicate, spiked, and check samples within the laboratory to evaluate results against numerical QA goals established for precision and accuracy.

Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

### 4.1.1 Precision

Precision is a measure of the reproducibility of data under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. For duplicate measurements, precision can be expressed as the relative percent difference (RPD). Field duplicates will not be collected. A 5-percent duplicate frequency will be carried out for laboratory samples.

### 4.1.2 Accuracy

Accuracy is the measure of error between the reported test results and the true sample concentration. True sample concentration is never known due to analytical limitations and error. Consequently, accuracy is inferred from the recovery data from spiked samples.

Because of difficulties with spiking samples in the field, the laboratory will spike samples. The laboratory shall perform sufficient spike samples of a similar matrix to allow the computation of the accuracy. For analyses of less than five samples, matrix spikes may be performed on a batch basis. Perfect accuracy is 100 percent recovery.

### 4.1.3 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration of the chemical parameters in the medium sampled. Sampling procedures—as well as sample-handling protocols for storage, preservation, and transportation—are designed to preserve the representativeness of the samples collected. Proper documentation will confirm that protocols are followed. This helps to assure sample identification and integrity.

Laboratory method blanks will be run in accordance with established laboratory protocols to ensure samples are not contaminated during sample preparation in the laboratory.

### 4.1.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. It is calculated as the number of valid data points achieved divided by the total number of data points requested by virtue of the study design. For this project, completeness objectives have been established at 95 percent.

### 4.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The objective of this QA program is to assure that all data developed during the investigation are comparable. Comparability of the data will be assured by using EPA-defined procedures which specify sample collection, handling, and analytical methods. The comparability of past data will be evaluated during the investigation (if possible) by assessing the techniques used for sample collection and analysis.

### 4.1.6 Documentation

Essentially, EPA Level III documentation will be generated during this investigation. This level of documentation is generally considered legally defensible and consists of the following:

- Holding times
- Trip blank data
- Field duplicate data
- Rinse blank data
- Laboratory method blank data
- Sample data
- Matrix/surrogate spike data
- Duplicate sample data

## 4.2 Sampling Procedures

Sampling procedures for stormwater are presented above in Section 2 of this appendix. These procedures are designed to ensure:

- Samples collected at the site are consistent with project objectives; and
- Samples are identified, handled, and transported in a manner that does not alter the representativeness of the data from the actual site conditions.

QA objectives for sample collection will be accomplished through a combination of the following items:

- **Trip Blank**. No trip blanks are planned for the stormwater sampling program as there are no planned analyses for volatile organic compounds (VOCs).
- **Rinse Blank Sample**. No rinse blanks are planned for the stormwater sampling program as there will be dedicated tubing and laboratory-supplied containers.
- **Duplicate Samples**. No field duplicates are planned for the stormwater sampling program.

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- **Laboratory QA**. Laboratory duplicate measurements will be carried out on at least 5 percent of laboratory samples. Analytical procedures will be evaluated using the protocols of the analytical laboratory. These protocols can be submitted upon request.

## 4.3 Sample and Document Custody Procedures

The various methods used to document field sample collection and laboratory operation are presented below.

### 4.3.1 Field Chain-of-Custody Procedures

Sample chain-of-custody refers to the process of tracking the possession of a sample from the time it is collected in the field through the laboratory analysis. A sample is considered to be under a person's custody if it is:

- In a person's physical possession;
- In view of the person after possession has been taken; or
- Secured by that person so no one can tamper with the sample, or secured by that person in an area restricted to authorized personnel.

A chain-of-custody form is used to record possession of a sample and to document analyses requested. Each time the sample bottles or samples are transferred between individuals, both the sender and receiver sign and date the chain-of-custody form. When a sample shipment is transported to the laboratory, a copy of the chain-of-custody form is included in the transport container (e.g., ice chest).

The chain-of-custody forms are used to record the following information:

- Sample identification number
- Sample collector's signature
- Date and time of collection
- Description of sample
- Analyses requested
- Shipper's name and address
- Receiver's name and address
- Signatures of persons involved in chain of custody

### 4.3.2 Laboratory Operations

The analytical laboratory has a system in place for documenting the following laboratory information:

- Calibration procedures
- Analytical procedures

- Computational procedures
- Quality control procedures
- Bench data
- Operating procedures or any changes to these procedures
- Laboratory notebook policy

Laboratory chain-of-custody procedures provide the following:

- Identification of the responsible party (sample custodian) authorized to sign for incoming field samples and a log consisting of sequential lab tracking numbers.
- Specification of laboratory sample custody procedures for sample handling, storage, and internal distribution for analysis.

### 4.3.3 Corrections to Documentation

Original data are recorded in field notes and on chain-of-custody forms using indelible ink. Documents will be retained even if they are illegible or contain inaccuracies that require correction.

If an error is made on a document, the individual making the entry will correct the document by crossing a line through the error, entering the correct information, and initialing and dating the correction. Any subsequent error discovered on a document is corrected, initialed, and dated by the person who made the entry.

## 4.4 Equipment Calibration Procedures and Frequency

Instruments and equipment used during this project will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by laboratory personnel fully trained in these procedures.

## 4.5 Analytical Procedures

Samples will be analyzed using essentially SW 846 analytical protocols for the parameters identified above in Section 2. Table A1 lists the data quality objectives for the proposed analytes including the target method detection limits (MRLs) and method reporting limits (MDLs).

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**Table A1 – Data Quality Objectives for Proposed Analytes**

| Analyte | Units | MDL | MRL | JSCS SLVs |
|---|---|---|---|---|
| ***Total Suspended Solids (TSS) by method SM2540 D – Water Samples*** | | | | |
| TSS | mg/L | 1 | 1 | -- |
| ***Metals by EPA method 1632 – Water Samples*** | | | | |
| Arsenic | µg/L | 0.003 | 0.02 | 0.045 |
| ***Polycyclic Aromatic Hydrocarbons by EPA method 8270D SIM – Water Samples*** | | | | |
| 2-Methylnaphthalene | µg/L | 0.0023 | 0.02 | 0.2 |
| Acenaphthene | µg/L | 0.0044 | 0.02 | 0.2 |
| Acenaphthylene | µg/L | 0.0034 | 0.02 | 0.2 |
| Anthracene | µg/L | 0.0036 | 0.02 | 0.2 |
| Benz(a)anthracene | µg/L | 0.0026 | 0.02 | 0.018 |
| Benzo(a)pyrene | µg/L | 0.0043 | 0.02 | 0.018 |
| Benzo(b)fluoranthene | µg/L | 0.0041 | 0.02 | 0.018 |
| Bnzo(g,h,i)perylene | µg/L | 0.0029 | 0.02 | 0.2 |
| Benzo(k)fluoranthene | µg/L | 0.003 | 0.02 | 0.018 |
| Chrysene | µg/L | 0.0034 | 0.02 | 0.018 |
| Dibenz(a,h)anthracene | µg/L | 0.0025 | 0.02 | 0.018 |
| Dibenzofuran | µg/L | 0.0093 | 0.02 | NA |
| Fluoranthene | µg/L | 0.01 | 0.02 | 0.2 |
| Fluorene | µg/L | 0.0038 | 0.02 | 0.2 |
| Indeno(1,2,3-cd)pyrene | µg/L | 0.0026 | 0.02 | 0.018 |
| Naphthalene | µg/L | 0.0038 | 0.02 | 0.2 |
| Phenanthrene | µg/L | 0.0050 | 0.02 | 0.2 |
| Pyrene | µg/L | 0.053 | 0.02 | 0.2 |
| ***Polycyclic Aromatic Hydrocarbons by EPA method 8270D SIM - Sediment*** | | | | |
| 2-Methylnaphthalene | µg/kg | 0.39 | 5 | 200 |
| Acenaphthene | µg/kg | 0.76 | 5 | 300 |
| Acenaphthylene | µg/kg | 0.59 | 5 | 200 |
| Anthracene | µg/kg | 0.58 | 5 | 845 |
| Benz(a)anthracene | µg/kg | 0.72 | 5 | 1,050 |
| Benzo(a)pyrene | µg/kg | 0.76 | 5 | 1,450 |
| Benzo(b)fluoranthene | µg/kg | 0.92 | 5 | NA |
| Bnzo(g,h,i)perylene | µg/kg | 0.85 | 5 | 300 |
| Benzo(k)fluoranthene | µg/kg | 0.87 | 5 | 13,000 |
| Chrysene | µg/kg | 0.8 | 5 | 1,290 |
| Dibenz(a,h)anthracene | µg/kg | 0.8 | 5 | 1,300 |
| Dibenzofuran | µg/kg | 0.63 | 5 | NA |
| Fluoranthene | µg/kg | 0.98 | 5 | 2,230 |
| Fluorene | µg/kg | 0.61 | 5 | 536 |
| Indeno(1,2,3-cd)pyrene | µg/kg | 0.87 | 5 | 100 |
| Naphthalene | µg/kg | 0.6 | 5 | 561 |
| Phenanthrene | µg/kg | 1.4 | 5 | 1,170 |
| Pyrene | µg/kg | 0.76 | 5 | 1,520 |

Notes:
1. NA = Not available or not applicable.
2. MDL = Method detection limit (MDL).
3. MRL = Method reporting limit (MRL).
4. JSCS = Screening levels from Portland Harbor Joint Source Control Strategy – Final (Table 3-1 Updated July 16, 2007). December 2005.

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## 4.6 Data Reduction, Validation, and Reporting

Reports generated in the field and laboratory will be included as an appendix to the draft and final versions of the Data Summary Report.

The task manager will assure validation of the analytical data. The laboratory generating analytical data for this project will be required to submit results that are supported by sufficient backup and QA/QC data to enable the reviewer to determine the quality of the data. Validity of the laboratory data will be determined based on the objectives outlined in Section 4.1 - Quality Assurance Objectives for Data Management. Data validity will also be determined based upon the sampling procedures and documentation outlined in Sections 4.2 and 4.3 of this Sampling and Analysis Plan (SAP). Upon completion of the review, the task manager will be responsible for assuring development of a QA/QC report on the analytical data. Data will be stored and maintained according to the standard procedures of the laboratory. The method of data reduction will be described in the final report.

## 4.7 Performance Audits

Performance audits are an integral part of an analytical laboratory's SOPs and are available upon request.

## 4.8 Corrective Actions

If the QC audit detects unacceptable conditions or data, the project manager will be responsible for developing and initiating corrective action. The task manager will be notified if the nonconformance is significant or requires special expertise. Corrective action may include the following:

- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data and acknowledging level of uncertainty or inaccuracy by flagging the data.

## 4.9 Quality Assurance Reports

The task manager will prepare a QA/QC evaluation of the data collected during the Site investigation field activities for inclusion in the final report. In addition to an opinion regarding the validity of the data, the QA/QC evaluation will address the following:

- Any adverse conditions or deviations from this SAP.
- Assessment of analytical data for precision, accuracy, and completeness.
- Significant QA problems and recommended solutions.
- Corrective actions taken for any problems previously identified.

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# APPENDIX B

## Conceptual Parallel Paths – Data Collection and SCM/Treatment Assessment

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## 1.0 INTRODUCTION

This appendix presents the conceptual path forward for the two parallel efforts proposed at the Port's Marine Terminal 4 (T4), additional decision support data collection to characterize the local stormwater system and SCM/treatment assessments. The parallel path approach was presented to DEQ on December 8, 2014 and forms the theoretical basis for the T4 Source Control Decision Support Data Collection Work Plan.

## 2.0 CONCEPTUAL PATH

Figure 1 below shows the conceptual paths proposed at T4 and how "parallel" paths or tracks are related to each other. Of primary interest in Track 1 is the further understanding of system hydraulics and observed response to characteristic storm events. With a more refined understanding of how respective drainage areas respond to storms, a site-calibrated hydraulic model could then be developed. This would allow for SCM/treatment measures to be assessed in greater detail and potentially sized for further investigations and design. Additional information on pollutant characteristics including (1) particle size fractions and strength (i.e., the relative ratio of weight per unit weight of sediment per relative size fraction) and (2) potentially pore-sized influence equilibrium concentrations are of specific interest in the context of effective treatment technologies and for the purpose of further SCM and structural treatment assessments (which are currently ongoing and will be updated as necessary following applicable data collection and analysis).

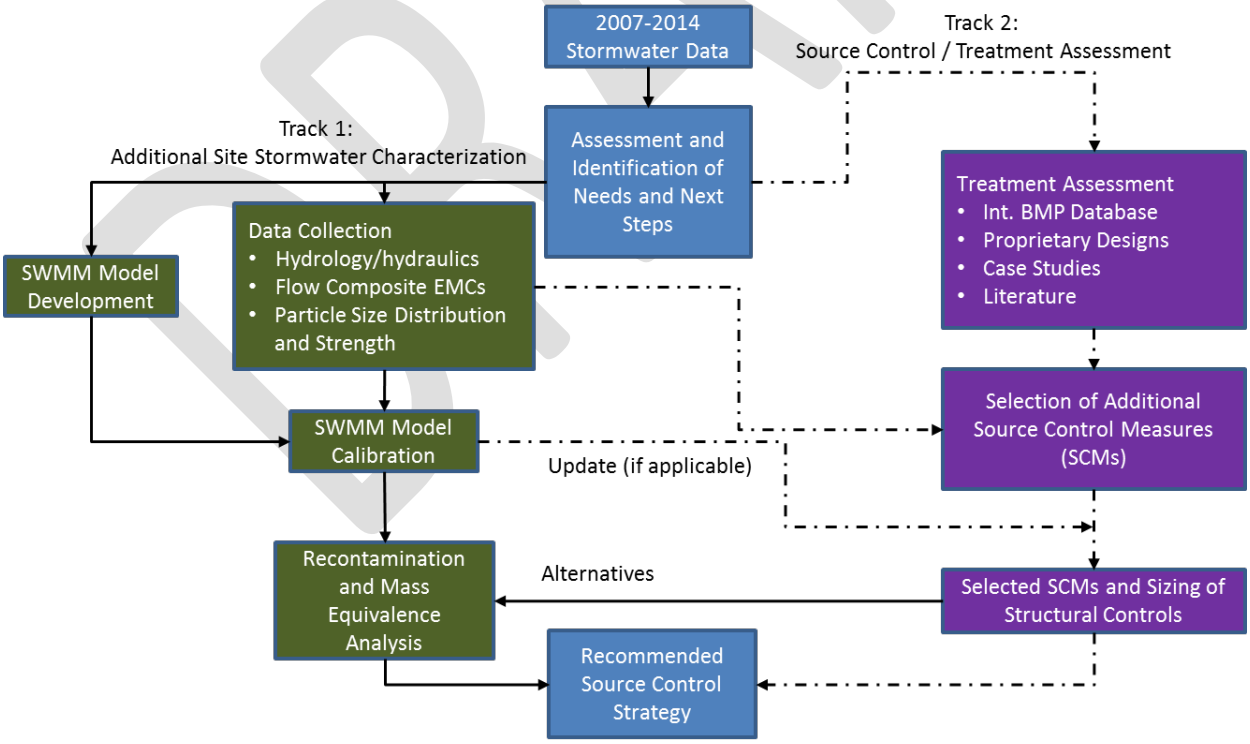


**Figure B-1: Conceptual Representation of the Parallel Paths or Tracks at T4.**

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Note here that “Recontamination and Mass Equivalence Analysis” is not meant to coincide with the technical approach guidelines for a “Recontamination Analysis” under DEQ guidelines, but rather a theoretical assessment of the potential for stormwater at T4, and specifically Basins L and M, to recontaminate receiving water sediment within the Willamette River based on known stormwater and environmental characteristics, observed site data and SCM/treatment alternatives assessed using up-to-date public and proprietary design information (e.g., best available technologies).

The goal of the parallel path approach is to outline and pursue an efficient path forward that utilizes previously conducted evaluations and data collection, while concurrently pushing ahead with ongoing SCM and structural treatment assessments resulting in a comprehensive source control strategy for the long term management of stormwater at T4.

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