Revised Additional Stormwater Source Control Measure Work Plan Terminal 4 Slip 1 Upland Facility Portland, Oregon

Prepared for:
Port of Portland

October 17, 2013
1267-12.007

APEX

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Acronyms and Abbreviations

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
Facilities	Terminal 4 Slip 1 and Slip 3 Uplands
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
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
SWMP	Storm Water Management Plan
SWSCE	Storm Water Source Control Evaluation
FSPR	Field Sampling Procedures Report
TSS	Total Suspended Solids

1.0 Introduction

This Work Plan presents the proposed additional Source Control Measures (SCMs) proposed at the Port of Portland (Port) Terminal 4 Slip 1 Upland Facility in Portland, Oregon (the Facility). The SCM activities are required by the Oregon Department of Environmental Quality (DEQ), pursuant to the following:

- 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.

1.1 Document Organization

This document is organized as follows:

- Section 2 provides a background of the Facility, stormwater drainage system, a summary of the previous investigations, and a summary of the 2013 field verification activities.
- Section 3 provides information on the stormwater permits, best management practices (BMPs), and stormwater controls.
- Section 4 presents a multiple lines of evidence evaluation of Basin M.
- Section 5 presents the proposed 2013 SCMs.
- Section 6 presents stormwater sampling program procedures and analytical program.
- Section 7 presents the proposed reporting.

2.0 Background

This section describes the Facility and storm drain system and summarizes historical stormwater sampling results, including information on Terminal 4 Slip 3 Upland Facility. Primary source documents 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), as well as operations and environmental maintenance records maintained by the Port.

2.1 Facility Description

Terminal 4 comprises approximately 283 acres on the east bank of the lower Willamette River and is 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 in area. Figures 1 and 2 show the vicinity and layout of the Slip 1 Facility, including the Slip 3 Facility.

The topography of the Slip 1 Uplands is relatively flat, with an elevation of approximately 30 feet above mean sea level (MSL). The ground surface of the Facility is predominantly paved with asphalt or concrete, with unpaved areas of generally gravel or grass. No surface water bodies are located on the Facility, but it is located adjacent to the Willamette River.

2.1.1 Current Facility Use

Terminal 4 has been designated as a marine facility since 1917 and is capable of ship loading and unloading and cargo handling and storage, and has equipment maintenance facilities. The terminal includes three berthing areas (Berths 401, 405, and 408) that are located in Slip 1. Activities at the Slip 1 Upland Facility include areas directly adjacent to Slip 3.

- Slip 1. The Port leases portions of Slip 1 to various industrial tenants. Current tenants include Cereal Food Processors, Inc. (Cereal Foods), Kinder Morgan Bulk Terminal (Kinder Morgan), and International Raw Materials, Ltd. (IRM).
  - Cereal Foods leases approximately 2.0 acres and associated structures at Slip 1 for a flouring mill.
  - Kinder Morgan leases Pier 4 and its adjacent area for loading of soda ash onto ships at Berths 410 and 411. In order to expand existing storage capacity to meet customer demand, Kinder Morgan plans to build a new storage dome with a 60,000-metric-ton capacity (to be located within an adjacent area currently occupied by the Port's Warehouse No. 4; Figure 3). In addition, Kinder Morgan also plans to construct a railcar scale to verify loading volumes. These activities are tentatively scheduled to begin in fall 2013.
  - 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, and uses Berth 408 to unload these products.
- Slip 3. A portion of the Slip 3 Uplands is included in the Kinder Morgan soda ash operations, as identified above. Port Marine Facilities Maintenance (MFM) currently uses the gearlocker building located on the Slip 3 Uplands for storage. In the future, Kinder Morgan will also use the gearlocker building and adjacent yard storage space. The remainder of Slip 3 is either used for parking associated with the Toyota Auto Storage Facility or is currently inactive.

Figure 3 shows the boundaries of the current leaseholds for Slip 1 and Slip 3 Facilities.

2.1.2 Historical Facility Use

The Port prepared a detailed discussion of the history of Terminal 4 (including the Facility) for the EE/CA Work Plan (BBL, 2004) and EE/CA Report (BBL, May 2005). Information on Slip 1 operations, former and current tenants, and substances currently or formerly handled at the Facility are detailed in Appendix A of the EE/CA and summarized below.

The Port acquired certain property and improvements within the Terminal 4 property from the City of Portland Commission of Public Docks (City CPD) effective January 1, 1971. The City CPD purchased the property in 1917 as part of the original 117.55-acre site for the St. Johns terminal. This included approximately 36 acres of submerged land around the former Gatton Slough, which entered the river near the head of Slip 1. Development of the terminal resulted in the filling of Gatton Slough and adjacent areas within the river, and excavation of Slip 1. In 1972, the Port purchased a strip of land along the northern property line from Broadway Holding Company in connection with the relocation of the grain berth to the face of current Berth 401 (Hart Crowser, 1991).

Operations at the Slip 1 Upland Facility during the City CPD's ownership (1917 to 1971) included: loading, unloading, and storage of grain; cold storage; fumigation of cotton and food products; liquid storage (fertilizer, molasses, tallow, urea, caustic soda, and fats); milling of grain into flour, 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 concentrate.

During the Port's ownership of the Slip 1 Upland Facility, tenant operations have generally included grain storage, milling grain, liquid bulk storage, pencil pitch handling, a soda ash handling facility, and storing and maintaining equipment for loading and unloading ships. The buildings at Pier 1 and Pier 2 have also been used for storage of impounded vehicles from a federal sting operation, architectural artifacts for a local historical group, importing live sheep, and for handling break-bulk cargoes such as steel coil and aluminum ingots.

2.2 Stormwater System and Drainage Basins

Prior to initiating the stormwater sampling program, storm drain drawings were reviewed to identify existing storm drain systems and the drainage basins contributing to the drainage systems present on the Facility as detailed in the DEQ-approved *Storm Water Evaluation Work Plan* (SWE WP; Ash Creek/Newfields, 2007b). Figure 4 shows the basins and drainage systems for the Facility, including the Slip 3 Facility (as presented on the most current Port base map).

2.3 Summary of Stormwater-Related Previous Investigations

2.3.1 Terminal 4 Removal Action Characterization and Recontamination Analysis

The Port completed a Removal Action for sediments at Terminal 4. As part of that process, a Removal Action Characterization was completed (BBL, 2004). Extensive sediment sampling was conducted to define contaminants of potential concern (COPC) in sediments of the river. The COPC identified for Terminal 4 sediments were metals, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate (DEHP), pesticides (DDT/DDD/DDE), and polychlorinated biphenyls (PCBs).

As part of the removal action, a Recontamination Analysis was deemed necessary to assess ongoing sources that could re-contaminate the river sediments following the removal action. The Recontamination Analysis included stormwater sampling. Analytical results from the initial stormwater solids sampling were presented and evaluated in the *Draft Recontamination Analysis Report* (BBL, 2006). The 2006 draft recontamination analysis provided the initial analysis approach to support the sediment cleanup design and identified stormwater data gaps that would need to be filled to support the final analysis. The stormwater data gaps identified included completion of additional stormwater sampling at Terminal 4 (see Section 2.3.2 for further information). Based on this additional stormwater characterization data and other considerations, a *Sediment Recontamination Analysis Approach Report*, prepared by Formation Environmental (Formation, 2010), was finalized and describes the proposed approach to assess the potential for recontamination of sediments within the Terminal 4 Removal Action area after actions have been implemented.

2.3.2 2006-2008 Stormwater and Stormwater Solids Sampling and Source Control Evaluation

A stormwater characterization program was initiated in December 2006 and included the winter/spring 2007 storm season and the fall 2007/winter 2008 storm season. 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 Terminal 4 stormwater characterization program was conducted concurrently with a stormwater characterization 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. Methods and procedures used in the LWG study were comparable to the Terminal 4 program so both data sets could be used to assess stormwater at the PHSS. Results from the LWG study have been provided to the EPA and partner agencies, and include the Terminal 4 results (LWG's Round 3A and 3B Upland Storm Water Sampling Data Report [September 2008]).

The scope of the sampling program consisted of:

- Stormwater sampling from drainage basin conveyance lines for Basins R, Q, M, L, and D. Three storm events satisfying sampling criteria were targeted for sampling during the winter/spring 2007 stormwater season. To meet LWG objectives, the scope was subsequently increased to include an additional fall 2007 stormwater event from Basins R, Q, M, L, and D, and three events from Basin D in fall 2007/winter 2008 for PCB analysis.
- Obtaining water level and velocity information from the stormwater drainage basin pipes where the composite samplers were deployed.
- Collecting stormwater solids samples for analysis from four drainage basin conveyance lines (Basins R, M, L, and D) using sediment traps. Sediment traps were deployed from January 2007 through February 2008 (sample bottles were removed from approximately June through August 2007, during the non-rainy season).

The scope and additional details of the sampling program was described in the *T4 Field Sampling Procedures Report* (FSPR; Ash Creek/Newfields, 2009a).

The results of the stormwater characterization were documented in the *Storm Water Data Summary Report*, Terminal 4 Slip 1 and Slip 3 Upland Facilities (SW DSR), dated March 2009 (Ash Creek, 2009b). The evaluation of the stormwater and stormwater solids sampling results was conducted in accordance with the Joint Source Control Strategy (JSCS) guidance (DEQ/EPA, 2007) and DEQ's Guidance for Evaluating the Stormwater Pathway at Upland Sites (DEQ, originally published in 2009; updated in 2010). The purpose of the SWSCE was to assess what, if any, stormwater SCMs were needed at the Facilities. 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 Terminal 4 sampling were compared with the sampling results in the LWG dataset of other Portland Harbor HI Sites. The SWSCE identified analytes detected in stormwater and stormwater solids in Terminal 4 samples at concentrations elevated relative to samples collected from other LWG Portland Harbor HI 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.

2.3.3 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.

The stormwater conveyance line cleanout SCMs were conducted in general accordance with the DEQ-approved SWSCE report. DEQ commented on the SWSCE in a letter dated December 14, 2009. A response to DEQ comments was submitted by the Port in a letter dated January 29, 2010. The DEQ approved the SWSCE and Port comments in a letter dated March 5, 2010.

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 stormwater SCMs and subsequent sampling were presented in the *Storm Water Source Control Completion Report* (Ash Creek, 2011). Also included in the report were the results of stormwater sampling conducted following tank demolition activities at the Facilities to assess whether the demolition activities impacted stormwater.

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. TSS concentrations were significantly reduced in the post-cleanout samples (previously correlated with detected chemical concentrations). Concentrations in stormwater from Basins L and M following the line cleanout were generally within the range of detected concentrations in other Portland Harbor Heavy Industrial (HI) sites.

The DEQ and EPA provided comments on the project report and requested additional information regarding the detected concentrations of arsenic and PAHs. The arsenic concentrations increased following the SCM with no known mechanism for the increase. The average concentration of PAHs increased slightly in Basin M following the SCM but decreased an order of magnitude in Basin L. The data collected during the Terminal 4 Slip 1 RI did not identify sources of arsenic or PAHs in surface soil in Basins L or M. In discussions on whether additional source controls or stormwater sampling would be needed, it was agreed that a screening level recontamination analysis would be performed to provide another line of evidence in the evaluation. The Terminal 4 site is unique in the Portland Harbor in that as part of a Removal Action process, on August 6, 2010, EPA approved a recontamination analysis approach (*Sediment Recontamination Approach*, Formation Environmental, 2010).

2.3.4 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 recontamination analysis calculations were conducted for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. These specific PAHs were chosen as they were measured at maximum concentrations over two hundred times the JSCS screening level in Basin L stormwater prior to the stormwater line cleanouts. These compounds were also the most elevated above screening levels in Basin M stormwater.

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.

2.3.5 2012-2013 Stormwater Source Control Measures and Performance Monitoring

The design parameters of the Basin M Stormfilter were reviewed, including discussions with the treatment system vendor. The volume of water directed to the treatment system was originally designed to coincide with the change in the drainage basin resulting from the 2006 Berth 408 Rail Yard Modernization Project. The height of the diversion wall in the conveyance line (on the bypass around the treatment system) was increased in 2012 to direct a greater volume of water to the treatment system.

Discussions with the Stormfilter vendor (ConTech) identified a potential issue with the treatment media. The media in use at that time in Basin M (CSF® Leaf Media) may have resulted in increases in PAHs downstream of the filters. The vendor is unsure if the type of media actually releases PAHs or if it is a matrix interference effect. ConTech's ZPG™ (zeolite, perlite, and GAC) StormFilter media was installed in place of the CSF® Leaf Media in the Basin M treatment system prior to the start of the wet season.

Following the SCMs, two rounds of composite samples were collected between October 2012 and February 2013 from Basins L and M. The results of the stormwater SCMs and subsequent sampling were presented in the *Storm Water Sampling Results Memorandum* (Ash Creek, 2013).

3.0 Stormwater Permits, BMPs, and Stormwater Controls

3.1 Stormwater Permits

Stormwater discharges from the Facilities are permitted under the Port's NPDES DEQ Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 (for infrastructure owned by the Port) and Kinder Morgan's individual NPDES Industrial Stormwater Permit No. 102446 (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.

3.2 Best Management Practices

The Port has implemented numerous BMPs at Terminal 4 as part of its tenant and licensee contracts, Environmental Management System Program, and continual improvement policy. The following is a list of BMPs that are specifically related to activities conducted at Terminal 4 under the Stormwater Management Plan (SWMP) for the NPDES MS4 permit:

- Covered storage, material, and maintenance areas to reduce stormwater contact area;
- Waste chemical handling, storage, and disposal procedures to prevent and control spills;
- Regular inspection, cleaning, and maintenance of all materials handling and storage areas and stormwater control measures, structures, catch basins and treatment facilities to prevent blocking, accumulations, and discharge of pollutants;
- Annual cleanout of catch basins;
- Deployment and regular maintenance (annual) of catch basin inserts in the following catch basins to prevent sediment loading (Figure 5 shows the location of catch basins with inserts):
  - Basin O – Nos. 5801, 6009, 6011, 6019, 6020, 6022, 6023, and 6024;
  - Basin N – Nos. 6014, 6015, and 6017 (monthly inspection); and
  - Basin Q – Nos. 5792, 6007, 6008, 6025, 6026, 6027, 6029, 6030, 6031, 6032, 6033, and 6034;
- Annual sweeping of impervious areas exposed to stormwater to remove any accumulated solids. Sweeping is completed by Port staff using a Port-owned Elgin Crosswind regenerative sweeper truck;
- During the Berth 408 Rail Yard Modernization Project, a passive stormwater collection system was installed consisting of rock filter areas and perforated high density polyethylene (HDPE) pipe. Stormwater is filtered by the rock areas prior to discharging to the perforated pipe, which connects to the stormwater system;
- Adherence to published guidance for limiting landscape maintenance impacts to stormwater;
- Implementation of a comprehensive Spill Response Program (including a reporting component that provides for immediate action to ensure appropriate and timely spill cleanup and reporting);
- Compliance with City of Portland Stormwater Manual for new development/redevelopment;
- Membership in the City's Regional Spill Committee and the Clean Rivers Cooperative, which are organizations committed to spill prevention and response, and the ongoing protection of maritime environments; and
- Administration of a training program for all affected personnel who play a role in the protection of stormwater.

Residuals from catch basin cleanout and street sweeping are managed by the Port MFM personnel. Waste residuals (e.g., catch basin cleanout and street sweeping debris) are collected by MFM and consolidated with similar waste streams from other Port facilities. These wastes are subsequently profiled for waste characterization to determine appropriate treatment or disposal.

Maintenance work on the stormwater conveyance system is conducted on a regular basis, including monthly inspections of stormwater filtration devices/features and annual maintenance and cleaning of catch basins and drain inlets (last comprehensive Facility cleanout conducted February 2013). In addition, annual sweeping is conducted on most of the impervious areas that are exposed to stormwater and accessible. Figure 6 shows the areas swept for the most recent sweeping event in August 2012.

The Port and its tenants implement the terms and conditions of their permits and report annually to the DEQ.

The Kinder Morgan SWPCP (Kinder Morgan, 2012) indicates the following tenant-specific BMPs:

- Debris and spilled cargo are cleaned up as necessary on a daily basis.
- Stormwater inlets are inspected monthly for debris and foreign matter and are routinely cleaned.
- Stormwater inlets located adjacent to machinery are equipped with shut-off valves to minimize the possibility of oil or other contaminants from entering the river during an emergency or from spills.

3.3 Stormwater Controls

Port. In addition to BMPs employed across the Facility, a ConTech Stormfilter® treatment system (Stormfilter) is installed in the conveyance system for Basin M (Figure 7). This system is inspected monthly. The Stormfilter was installed in 2006 as part of the Berth 408 Rail Yard Modernization Project. The Stormfilter is an underground, concrete vault (6 by 12 feet) which houses 11 cartridges. The CSF® Leaf Media cartridges were replaced with ZPG™ (zeolite, perlite, and GAC) media in the summer of 2012. The media works by trapping and adsorbing solids and the above pollutants. Storm runoff comes into the vault through an inlet pipe within the storm system; the vault fills via a flow spreader that disperses the water across the cartridges. The cartridges utilize siphon-actuated filtration. Once water reaches the top of the saturated filter, it drains the filtered water through the bottom of the cartridge and allows the filtered water to move out of the vault and to the outfall.

Stormwater is directed to the treatment vault by a diversion wall installed in a manhole in the conveyance line to the south of the treatment vault. Excess flow is diverted around the cartridges without treatment. The height of the diversion wall in the conveyance line (on the bypass around the treatment system) was increased in the summer of 2012 to direct a greater volume of water to the treatment system. Figure 7 shows the locations of the sampler, diversion wall, and Stormfilter vault.

Kinder Morgan. The following information is based on review of the Kinder Morgan SWPCP (Kinder Morgan 2012) and observations made during a facility tour with a Kinder Morgan on July 11, 2013 with Jeff Bean (Kinder Morgan, Assistant Terminal Manager).

Kinder Morgan operates the pre-treatment system to treat wash water prior to its disposal to the sanitary sewer (under a City permit). The pre-treatment system also treats a limited volume of stormwater from the Kinder Morgan leasehold. The collection system includes wash water used to steam clean machinery, pressure wash material handling equipment, and wash the pit area beneath the railcar unloading building. Stormwater is collected in two catch basins in the operations area (STSCB5816 and STSCB5824) and in containment pits located below the ship loader support structures. The captured stormwater is transferred by a series of sump pumps through 2-inch flexible hose to the settling basin located at the eastern end of the dock area. Additional storage capacity is provided by two aboveground storage tanks utilized (as needed) when stormwater is diverted to the treatment system during storm events or discharge to the sanitary sewer is suspended. The above-ground storage tanks are piped in parallel and prevent overflow of the settling basin during times of high flow. The storage tanks are discharged to the settling basin for treatment once the system has discharge capacity.

Effluent from the settling basin is pumped to an equilibration tank which is located inside the warehouse. From the equilibration tank, water discharge receives a metered injection of sulfuric acid for pH adjustment.

Following pH adjustment the water passes through an oil/water separator (OWS) before discharging to the City sanitary sewer. The discharge is equipped with a power actuated control valve connected to an in-stream Total Dissolved Solids (TDS) probe in order to maintain compliance with the discharge permit.

3.4 Summary of Master Plan Process

The Port is currently preparing a stormwater master plan. The master planning is not a regulatory requirement. The Port has chosen to go through this process for stormwater system asset management and to assist with the Port's MS4 permit requirements. The master plan process includes an evaluation of the following nine Port Facilities:

- Portland International Airport (PDX);
- Terminal 2;
- Terminal 4;
- Terminal 5;
- Terminal 6;
- Swan Island;
- Rivergate Industrial Park;
- Mock's Bottom Industrial Park; and
- The Navigation Base.

The scope of the master planning process varies by facility, with more intense studies/planning at airport and marine facilities.

The Port's MS4 permit requires the Port to develop and submit a stormwater retrofit plan by November 1, 2014 for Port facilities within the City of Portland urban services boundary. In addition, the Port is required to identify one stormwater quality improvement project by November 1, 2013 and to construct the project by January 30, 2016.

As part of the master plan effort, a water quality assessment is being conducted that includes modeling to estimate total suspended solids (TSS) loading in stormwater. The modeling results will be useful in future contaminant loading evaluations, if needed.

3.5 Entrance Road Rehabilitation Project

The Terminal 4 entrance road dates back to the early 1900s and is the primary entrance and exit for tenant employees and operational truck traffic. Between August and October 2013, the asphalt-concrete pavement will be replaced with Portland cement concrete. The project area consists of two and three lanes that accommodate flow around the security gate with and approximate length of 850 feet. A component of the project includes installation of proposed stormwater swales that discharge to an infiltration pond (Figure 5).

4.0 Proposed 2013 Source Control Measures

This section summarizes the scope of work for the SCMs for Basins L and M. The scope of work was developed based on the results of the historical stormwater sampling program and an evaluation of current and available BMPs. The Port proposes to complete multiple phases of activities per the following.

4.1 Phase I Activities

A comprehensive field verification effort was conducted in July 2013 to confirm stormwater structures were consistent with the Port's Terminal 4 stormwater system base map, qualitatively assess potential for solids loading to the system, and identify locations for sub-basin source sampling.

4.1.1 Basin L

Seven manholes and 26 inlets are presented on the Port's base map for Basin L. Four inlets were not located in the field (STSCB5789, STSCB5797, STSCB5809, and STSCB6052). The Port utility locate group completed a follow-up field visit and determined that STSCB5789, STSCB5797, and STSCB6052 were likely removed as part of historical construction projects. The Port confirmed that STSCB5809 was removed. Figure 8 was updated to indicate these findings.

Solids accumulation was observed in the field around numerous inlets in the paved areas on the Kinder Morgan leasehold. A comprehensive sweeping event and cleanout of the stormwater inlets was completed in September 2013.

4.1.2 Basin M

Thirteen manholes and 13 inlets are presented on the Port's base map for Basin M. Two additional inlets were located in the field (STS-SB-1 and STS-SB-2). Two inlets were not located in the field (STSCB5783 and STSCB6000). The Port utility locate group completed a follow-up field visit and determined that STSCB5783 was present but STSCB6000 could not be located. Figure 8 was updated to indicate these findings. Figures that present the paved surfaces have been updated based on additional field observations completed in October 2013.

A comprehensive sweeping event and cleanout of the stormwater inlets was completed in October 2013. Sweeping was completed on all paved surfaces within the basin with the exception of the Berth 408 area. Berth 408 has been condemned and consequently the area is fenced off and no access is allowed. Berth 408 drains directly to Slip 1 (i.e., not connected to the stormwater system).

4.1.3 Performance Monitoring

An initial round of performance sampling will be completed to evaluate the Phase I activities. A composite stormwater sample will be collected at the historical sample locations (Figure 8; Manholes STSMH2607 and STSMH2588). The composite sampling procedures and laboratory analytical methods are presented in Section 5.0. The sampling results will be discussed with DEQ. Additional composite sampling events would be completed to determine the continued effectiveness of this SCM.

4.2 Phase II Activities

The following Phase II activities will be completed if an improvement in water quality is not achieved following the Phase I activities.

Sub-Basin Source Sampling. To determine what additional SCMs may be effective, the Port needs to understand what area(s) are potentially contributing higher relative contaminant concentrations. This assessment will include one event where inline grab samples will be collected from selected upstream access points (i.e., manholes and cleanouts) and at the basin discharge. The proposed sampling locations are shown on Figure 8 and presented in the table below.

Basin L

Feature Type	Feature ID	Portion of Flow Sampled	Sample Type	Analytical Protocol	Rationale
Cleanout	CO-1	Inlet to Cleanout	Grab	Follow-Up Sample	Discrete rail branch of system.
Manhole	STSMH2606	Outlet from Manhole	Grab	Primary Sample	Downstream of rail area.
Manhole	STSMH2611	Outlet from Manhole	Grab	Follow-Up Sample	Downstream of STSMH2606; limited additional contribution.
Manhole	STSMH2613	Outlet from Manhole	Grab	Follow-Up Sample	Discrete branch of system.
Manhole	STSMH2614	Outlet from Manhole	Grab	Primary Sample	Approximate center of impervious area.
Manhole	STSMH2731	Outlet from Manhole	Grab	Follow-Up Sample	Discrete branch of system.
Manhole	STSMH2607	Outlet from Manhole	Flow Weighted Composite	Primary Sample	Location of historical outfall sampling.

Basin M

Feature Type	Feature ID	Portion of Flow Sampled	nalytical Protoc	Analytical Protocol	Rationale
Manhole	STSMH2718	Outlet from Manhole	Grab	Primary Sample	Downstream of rail area.
Manhole	STSMH2720	Outlet from Manhole	Grab	Follow-Up Sample	Downstream of STSMH2718.
Manhole	STSMH2732	Outlet from Rail Area	Grab	Follow-Up Sample	Downstream perforated portion of rail area.
Manhole	STSMH2729	Outlet from Rail Area	Grab	Follow-Up Sample	Downstream perforated portion of rail area.
Manhole	STSMH2729	Outlet from Manhole	Grab	Primary Sample	Upstream of treatment system.
Manhole	STSMH2588	Outlet from Manhole	Grab	Primary Sample	Downstream of segregated branch of system.
Manhole	STSMH2588	Outlet from Manhole	Flow Weighted Composite	Primary Sample	Discharge from treatment system, diversion, and STSMH2588 flow.

These sampling points were selected following the field verification completed in July 2013. The approximate sub-basins are shown on Figure 8. The follow-up samples noted above will be analyzed if appropriate based on the results of the primary analyses. The grab sampling procedures and laboratory analytical methods are presented in Section 6.0.

As part of the sampling activities, field parameters will be measured to estimate the flow volume. These parameters include the depth of the flow (to be collected using water sensing paste on a measuring tape) and flow velocity (to be collected using a digital flow meter). In addition, a composite sampler will record the total flow measurement at the outfall sampling location.

4.3 Phase III Activities

Based on the results of the sub-basin sampling one or more of the following Phase II activities will be proposed in communication with DEQ.

- Addition of inlet filters in the sub-basins determined to contribute higher relative loading. These locations will be determined based on the sub-basin sampling data.
- Increased sweeping of the impervious areas (if determined to contribute potential for mass loading).
- Reconfiguration of stormwater system to direct water to treatment swales.
- Replacement of grated-side inlets with filtered, perforated pipe similar to Basin M.

An initial round of performance sampling will be completed to evaluate the Phase III activities. A composite stormwater sample will be collected at the historical sample locations (Figure 8; Manholes STSMH2607 and STSMH2588). The composite sampling procedures and laboratory analytical methods are presented in Section 5.0.

5.0 Stormwater Sampling and Analysis

5.1 Sampling Event Criteria

Representative storm events will be sampled: A storm event will be considered representative consistent with the Storm Event Criteria and Selection outlined in the JSCS (DEQ/EPA, 2005), as follows:

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

The rain gauge at Terminal 4 (maintained by the City of Portland Hydra Network) was abandoned in the summer of 2011. The rain gauge at Swan Island will be used to determine if the sampling criteria are met. The rain gauge lists the rainfall depth per hour (reported on a 1- to 3-hour time delay). The rain gauge data are found at the following web address: http://or.water.usgs.gov/non-usgs/bes/swan_island_pump.rain.

5.2 Stormwater Sampling Procedures

Stormwater samples will be obtained in accordance with the Sampling and Analysis Plan (SAP; Appendix A).

5.2.1 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 8270-SIM;
- Total arsenic by EPA Method 1632; and
- TSS by SM 2540D.

Additional details are provided in SAP in Appendix A along with the target reporting limits.

6.0 Reporting

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

- A discussion of the BMPs implemented, field activities completed, sampling methods, and sampling procedures used;
- A summary of stormwater event data and conformance with storm event criteria;
- Composite sampler data including bottle numbers, aliquot sampling time, water level, velocity, flow rate, and total flow for each sampling event;
- A tabular summary of the analytical results and JSCS screening; and
- Analytical laboratory reports and a quality assurance review.

The data (both as discrete samples and statistical average) will be screened using the relevant JSCS screening levels and the stormwater curves for Portland Harbor sites.

7.0 References

Ash Creek/Newfields, 2007a. *Remedial Investigation Report, Terminal 4 Slip 1 Upland Facility.* August 2007.

Ash Creek/Newfields, 2007b. *Storm Water Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* June 2007.

Ash Creek/Newfields, 2007c. *Memorandum: Rationale for Basin Selection for Storm Water Sampling and Additional Information Requested by Oregon Department of Environmental Quality (DEQ), Portland, Oregon, ACA No. 1267.* February 26 2007.

Ash Creek/Newfields, 2009a. *Field Sampling Procedures Report, Storm Water Sampling Program, Terminal 4 Upland Facility.* February 2009.

Ash Creek/Newfields, 2009b. *Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* March 2009.

Ash Creek, 2009c. *Storm Water Source Control Evaluation, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* September 2009.

Ash Creek, 2011. *Storm Water Source Control Completion Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities,* Portland Oregon, September 28, 2011.

Ash Creek, 2013. *Storm Water Sampling Results Memorandum, Terminal 4 Slip 1 and Slip 3 Upland Facilities,* Portland Oregon, April 18, 2013.

Blasland, Bouck & Lee (BBL), 2004. *Terminal 4 Early Action Characterization Report.* September 17, 2004.

BBL, 2005. *Terminal 4 Early Action Engineering Evaluation/Cost Analysis (EE/CA).* May 2005.

BBL, 2006. *Appendix N – Terminal 4 Recontamination Analysis.* November 2006.

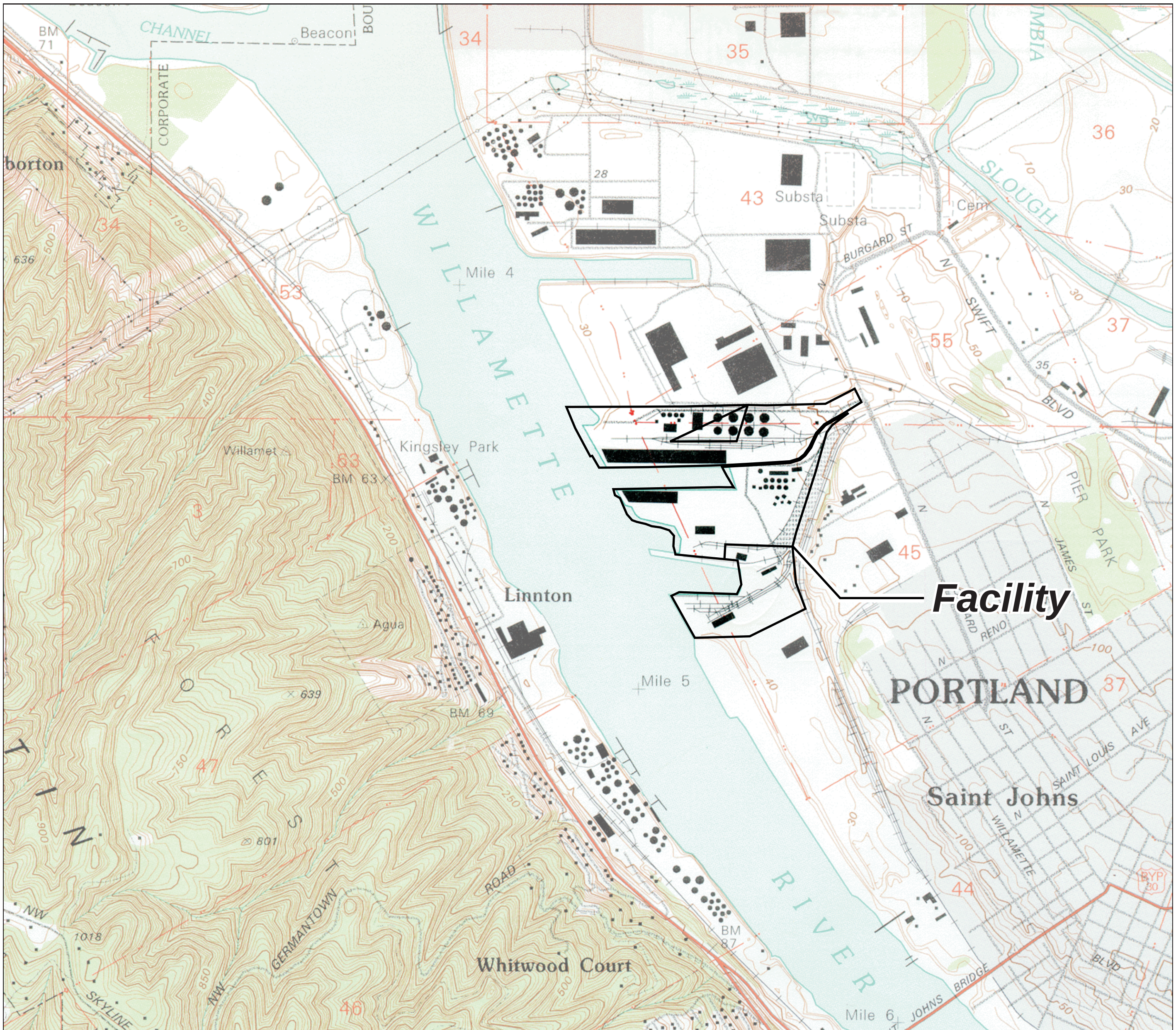
DEQ/EPA, 2005. *Portland Harbor Joint Source Control Strategy, Final.* December 2005 [Table 3-1, 7/16/07 Revision].

DEQ, 2010. *Guidance for Evaluating the Stormwater Pathway at Upland Sites.* January 2009, Updated October 2010.

Formation Environmental, 2010. *Final Sediment Recontamination Analysis Approach, Terminal 4 Removal Action, Port of Portland, Portland, Oregon.* August 12, 2010.

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

Kinder Morgan, 2012. *Stormwater Pollution Control Plan.* Prepared in Accordance with NPDES Permit No. 102446 issued by the Oregon Department of Environmental Quality. Kinder Morgan Bulk Terminals Inc. Bulk Terminal #4. 11040 N. Lombard. Portland, Oregon. December 11, 2012.



Base map prepared from the USGS 7.5-minute quadrangle of Linnton, Oregon, dated 1990.

N

0 2,000 4,000

Approximate Scale in Feet

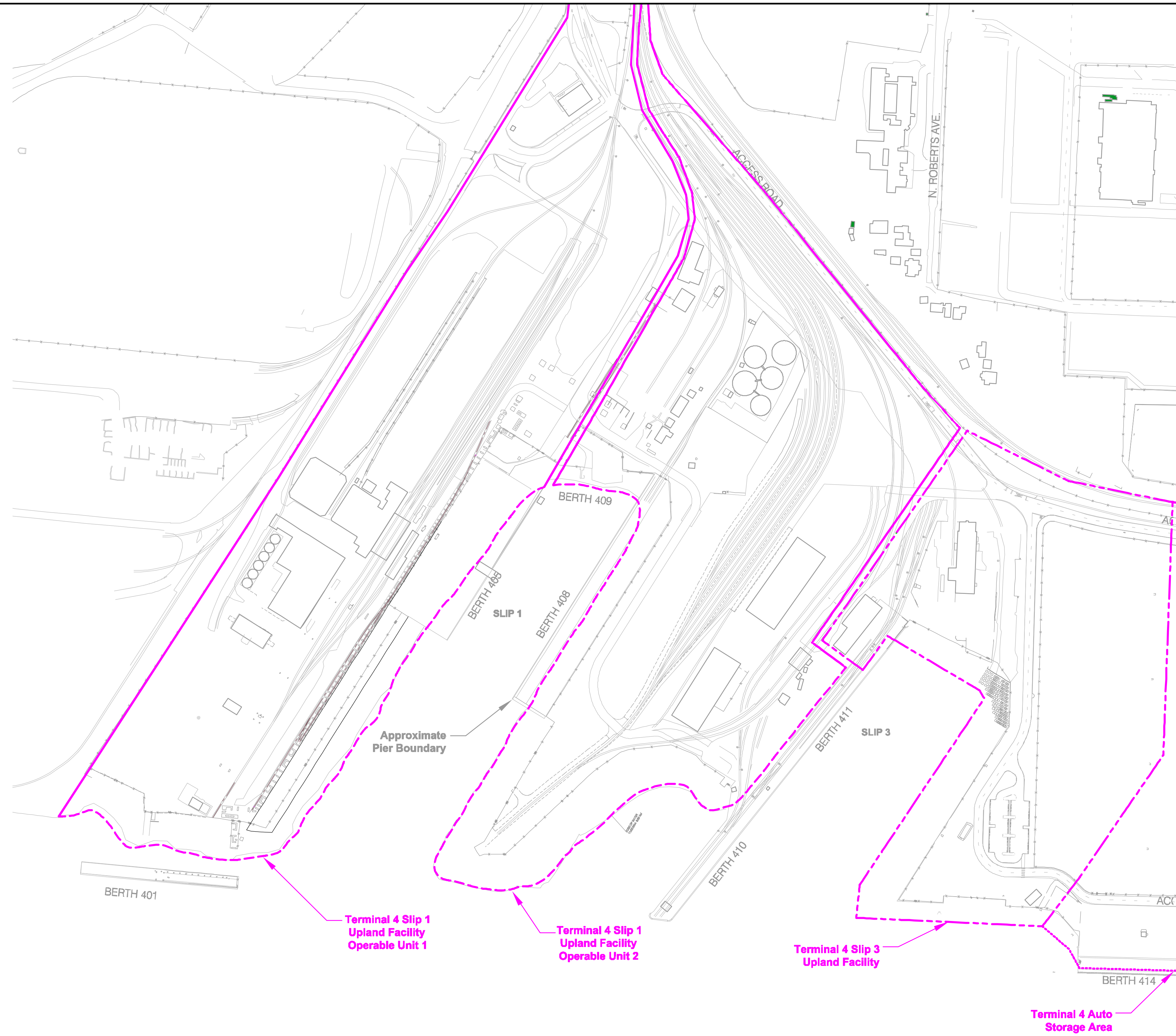
Facility Location Map

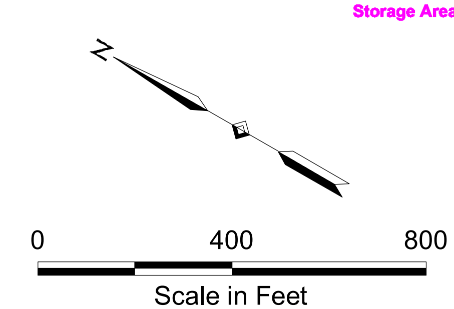
Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
October 2013		1





Legend:

- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area

NOTES:

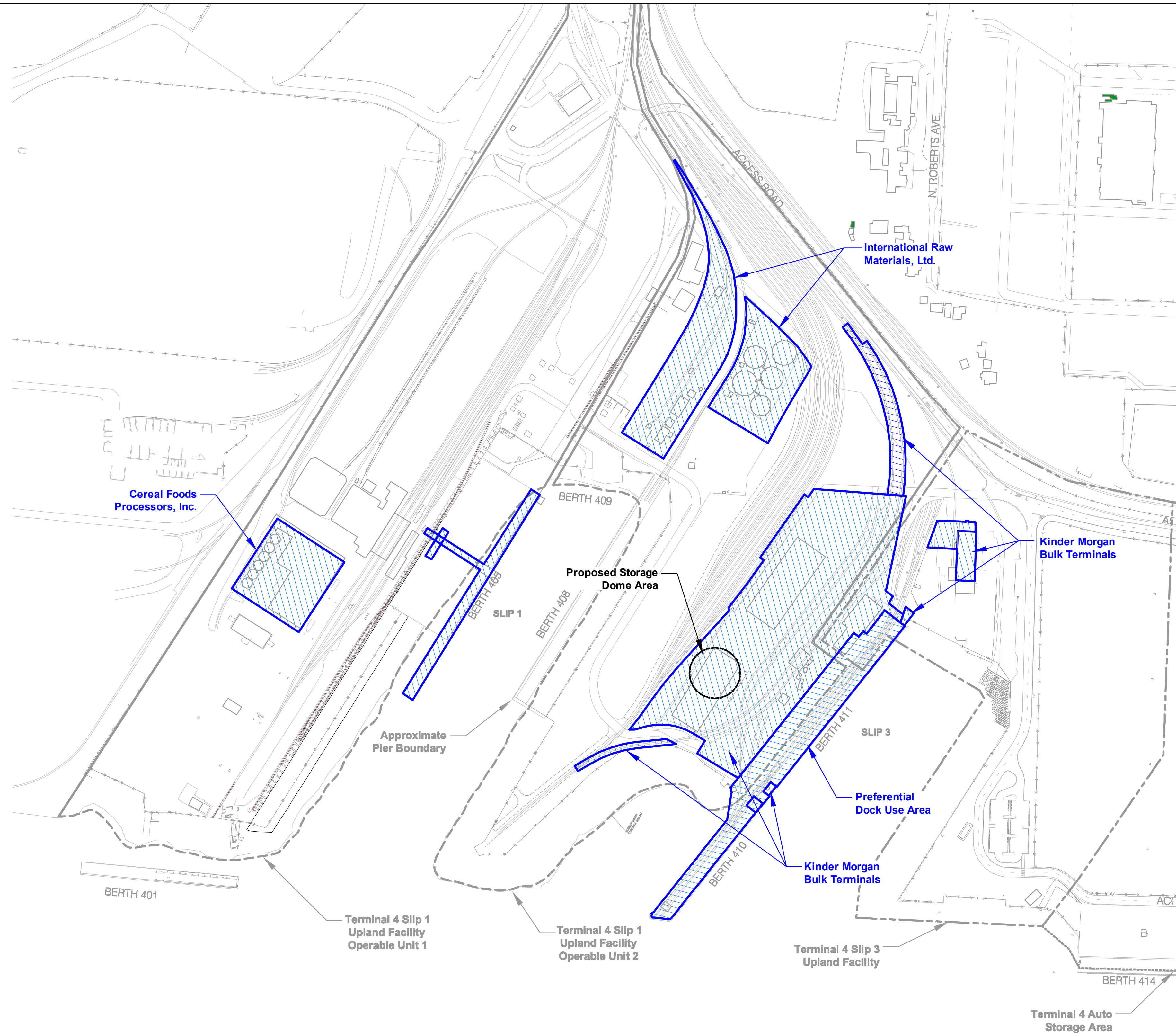
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

Facility Plan

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
October 2013		2



Legend:

- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 400 800

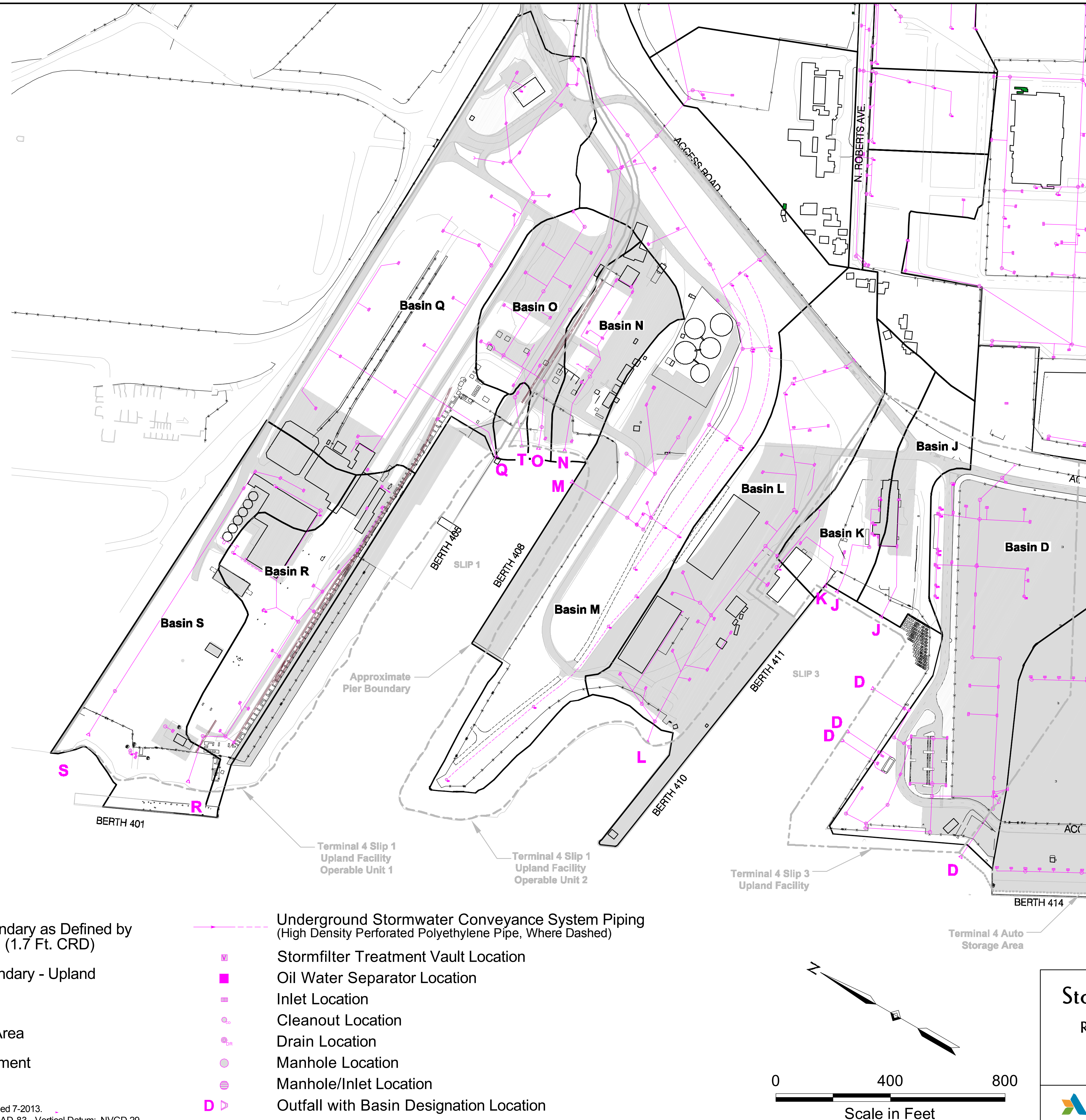
Scale in Feet

Leasehold Boundary Plan

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
October 2013		3



Legend:

- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Underground Stormwater Conveyance System Piping (High Density Perforated Polyethylene Pipe, Where Dashed)
- Stormfilter Treatment Vault Location
- Oil Water Separator Location
- Inlet Location
- Cleanout Location
- Drain Location
- Manhole Location
- Manhole/Inlet Location
- D Outfall with Basin Designation Location

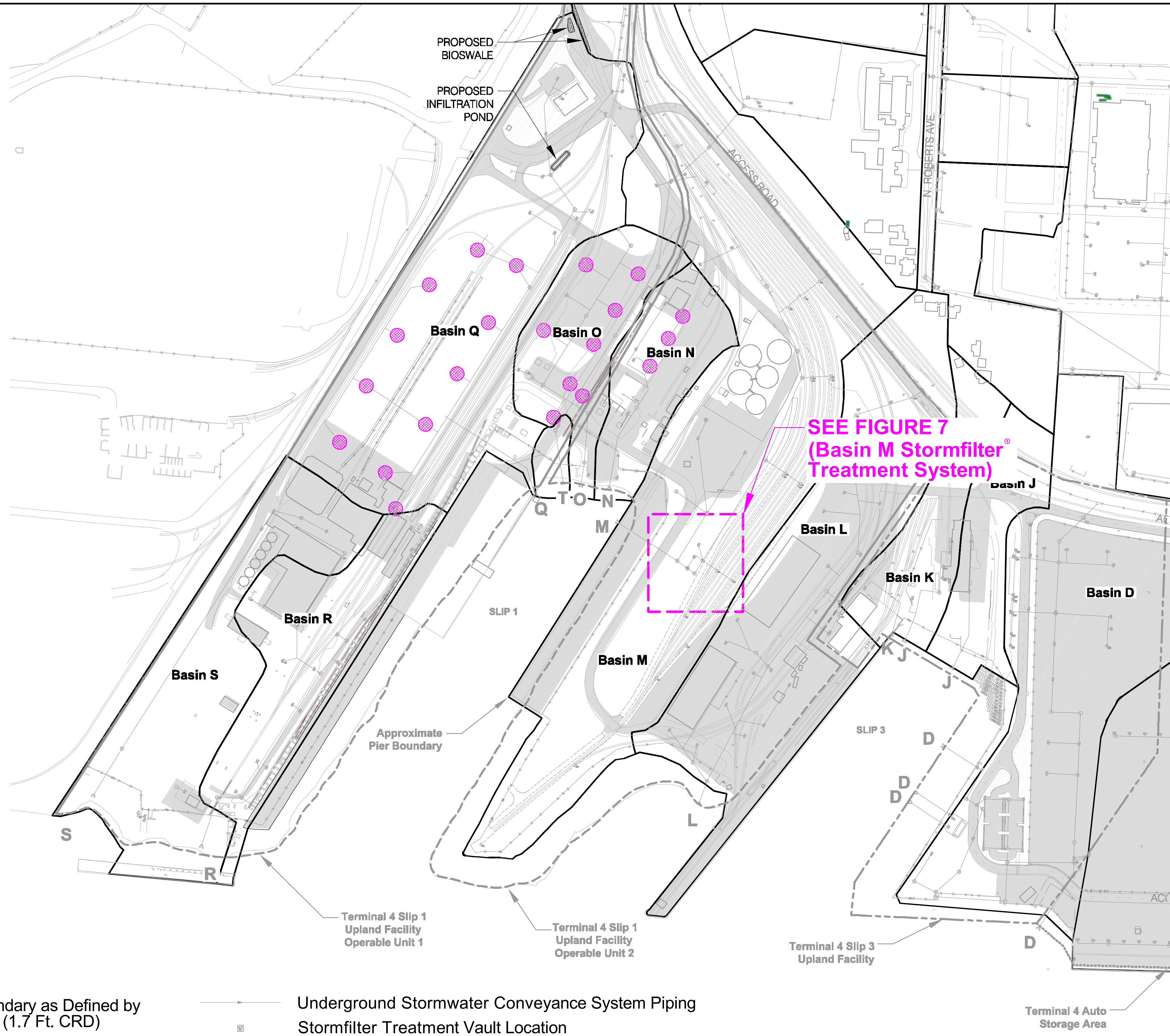
NOTES:
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

Storm Drain System and Drainage Basins

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number 1267
October 2013
Figure 4



Legend:

- Catch Basins with Inserts
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Underground Stormwater Conveyance System Piping
- Stormfilter Treatment Vault Location
- Oil Water Separator Location
- Inlet Location
- Cleanout Location
- Drain Location
- Manhole Location
- Manhole/Inlet Location
- D Outfall with Basin Designation Location

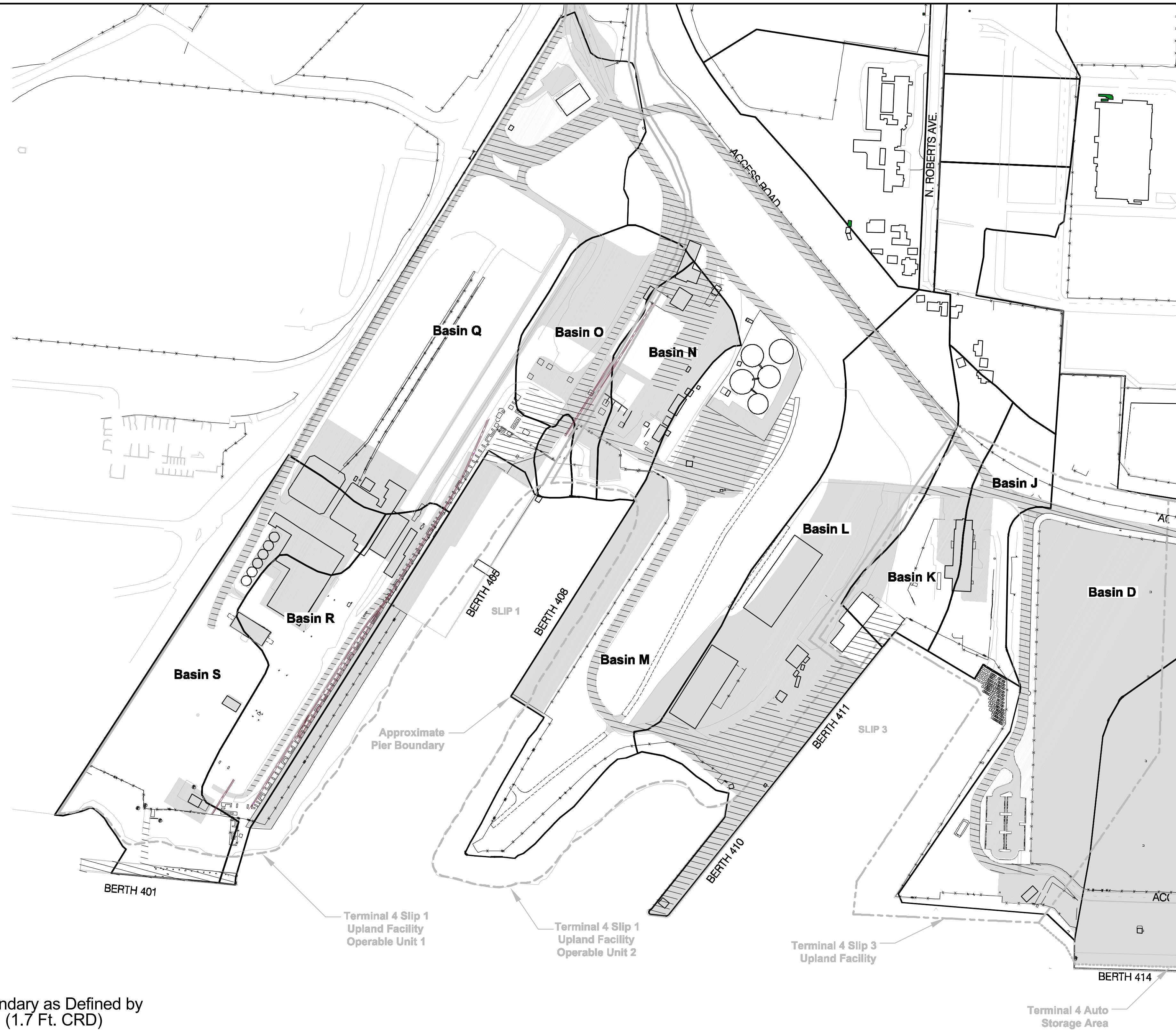
NOTES:
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

Stormwater Controls

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number 1267
October 2013
Figure 5



Legend:

- Sweep Area
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement

NOTES:
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

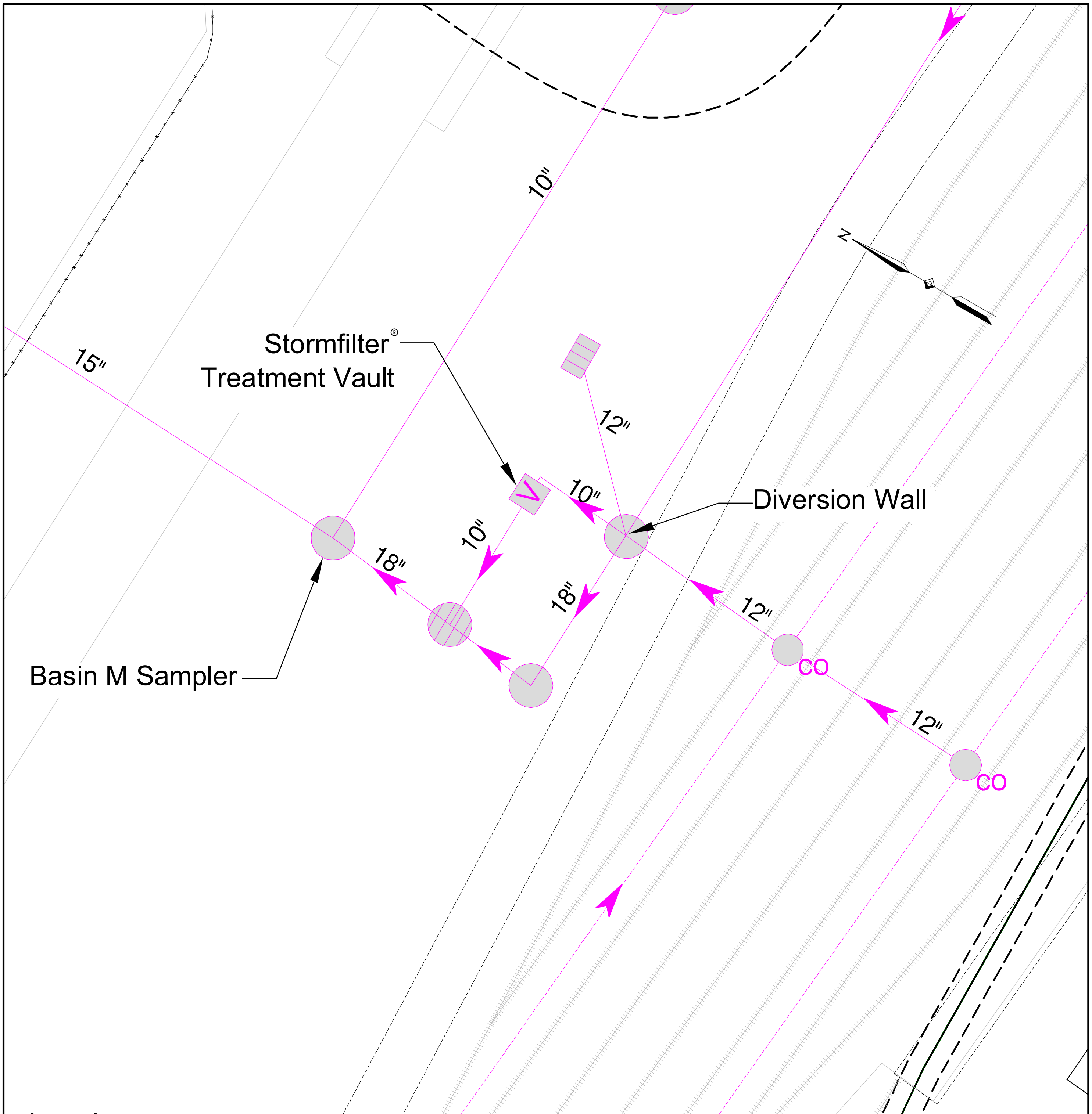
0 400 800
Scale in Feet

Terminal 4 2012 Sweeping

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
October 2013		6



Legend:

- Underground Storm Water Conveyance System Piping and Flow Direction
- V Stormfilter Treatment Vault Location
- Inlet Location
- CO Cleanout Location
- Manhole Location
- Manhole/Inlet Location

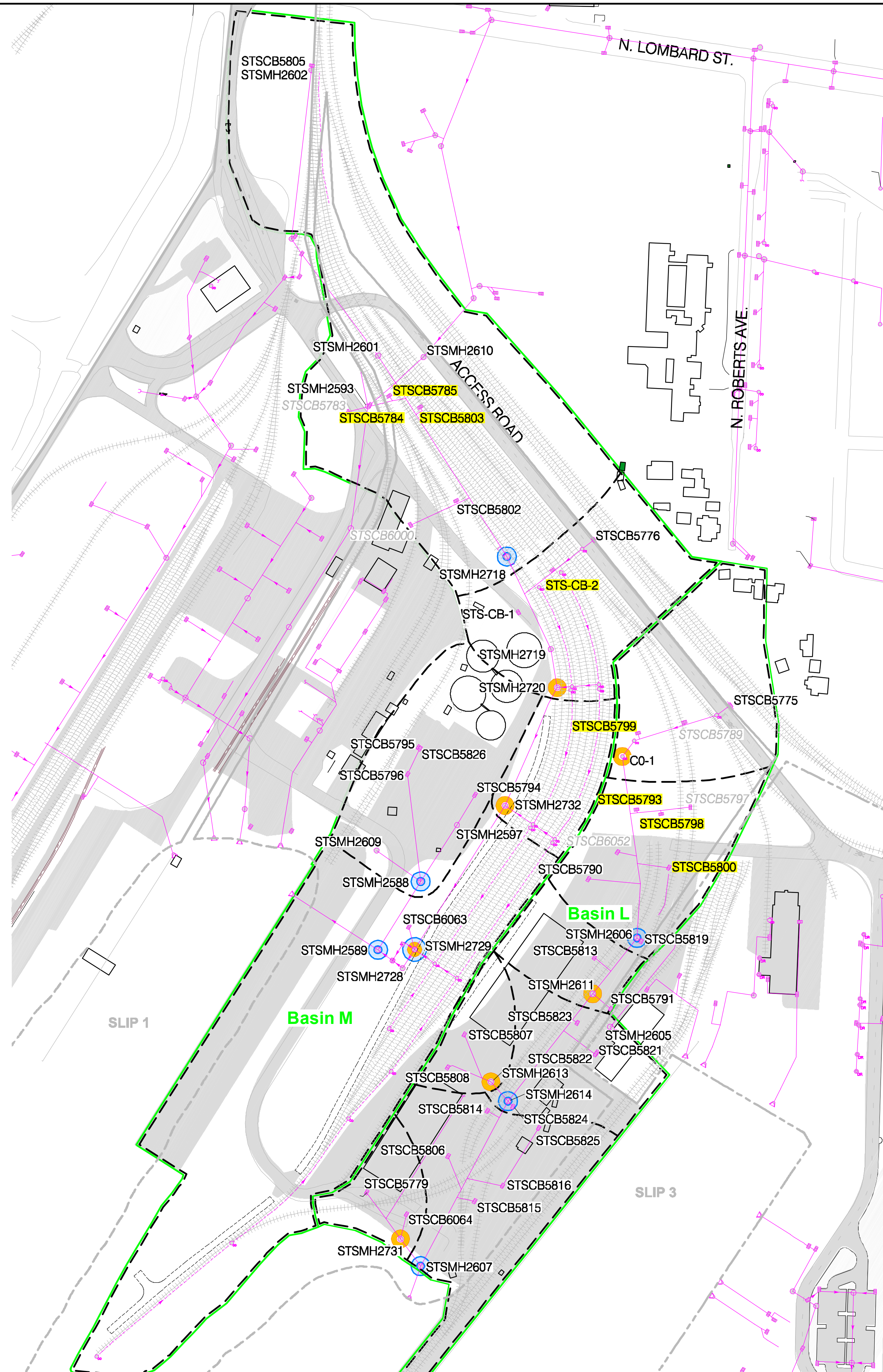
0 40 80
Scale in Feet

NOTES:
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.

Basin M Stormfilter® Treatment System

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number	1267	Figure 7
	October 2013		



N

Legend:

- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- Underground Stormwater Conveyance System Piping (High Density Perforated Polyethylene Pipe, Where Dashed)
- Stormfilter Treatment Vault Location
- Oil Water Separator Location
- STSCB5775 — Inlet Location and Identification (Basins L and M Only)
- C0-1 — Cleanout Location (Only Sampled Location is Identified)
- Drain Location
- STSMH2611 — Manhole Location and Identification (Basins L and M Only)
- Manhole/Inlet Location
- Proposed Sample Location (Sample and Analyze)
- Proposed Sample Location (Sample and Hold)
- Sub-Basin (Approximate)
- STSCB5799 — Inlet with Observed Side Grates Within Railroad Ballast
- STSCB5789 — Inlet Not Found

NOTES:
1. Base map prepared from Port of Portland AutoCAD file, provided 7-2013.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 300 600
Scale in Feet

Proposed Stormwater Sampling Locations and Approximate Sub-Basins

Revised Additional Source Control Measure Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX — Apex Companies, LLC, 3015 SW First Avenue, Portland, Oregon 97201	Project Number	1267	Figure 8
	October 2013		

Appendix A

Sampling and Analysis Plan

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 and chemical analysis. The field and sampling procedures include collection of grab and composite stormwater samples, 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 for the proposed 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 Grab Stormwater Samples

The unfiltered grab samples will be obtained in accordance with Standard Operating Procedure (SOP) 2.12. A telescoping swing sampler with a pre-cleaned stainless steel cup will be used to collect the water samples. The only exception is at location CO-1 (cleanout; see Figure 8 of Work Plan) where the necessary sample volume will be obtained using a peristaltic pump. The inlet tube will be weighted in order to keep the tubing in the flow. The water samples will be transferred into 1-gallon laboratory-decontaminated bulk sample containers for transport to the laboratory. The laboratory will transfer the samples into the respective sample containers for each analysis.

Field parameters will be measured in order to estimate the flow volume during sampling. These parameters include the depth of the flow (to be collected using water sensing paste on a measuring tape) and flow velocity (to be collected using a digital flow meter). In addition, a composite sampler will record the total flow measurement at the outfall sampling location (see Section 2.3).

2.3 Collection of Composite Stormwater Samples

Bulk stormwater samples will be collected as composite samples in accordance with Standard Operating Procedure T4-Composite. An automatic composite sampler will be set up with an area velocity flow meter that activates the sampling when there is flow in the pipe. The stormwater samplers will be installed in relatively low-traffic areas and consequently the samplers will likely be installed above ground (and covered with large wood boxes).

The samplers will be programmed to fill individual 1-gallon bottles one at a time. The first bottle would be filled when the target flow is reached. Then, based upon the average storm duration and intensity, the sampler will be programmed to fill the remaining bottles throughout the storm event. The collected stormwater from the four 1-gallon bottles will be composited and samples for chemical analysis will be collected from that composite. The stormwater samples will be obtained from the same manhole where sampling was historically conducted.

2.4 Sample Management

Containers. Clean sample containers 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. Sample 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, Apex Companies, LLC (Apex; formerly Ash Creek Associates) will transport the containers to the laboratory. Chain of custody will be maintained and documented at all times.

2.5 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. 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.

2.6 Handling of Investigation-Derived Waste

Disposable items, such as sample tubing, gloves, protective overalls (e.g., Tyvek®), paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

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.

The laboratory-supplied method reporting limits (MRLs) and method detection limits (MDLs) are presented in Table B-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 8270-SIM;
- Total arsenic by EPA Method 1632; and
- Total suspended solids (TSS) by SM 2540D.

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 B-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. The completeness goal is essentially that a sufficient amount of valid data be generated to meet the closure requirements.

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.
- **Laboratory QA.** Laboratory duplicate measurements will be carried out on at least 10 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 of this appendix.

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.

Table A-1 – Target Reporting Limits
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Analyte	Units	MDL	MRL	JSCS
Total Suspended Solids (TSS) by method SM2540 D				
TSS	mg/L	1	1	--
Metals (EPA Method 1632)				
Arsenic	ug/L	0.003	0.02	0.045
Polycyclic Aromatic Hydrocarbons (EPA Method 8270-SIM)				
Acenaphthene	ug/L	0.36	3.4	0.2
Acenaphthylene	ug/L	0.37	3.4	0.2
Anthracene	ug/L	0.29	3.4	0.2
Benz(a)anthracene	ug/L	0.34	3.4	0.018
Benzo(a)pyrene	ug/L	0.41	3.4	0.018
Benzo(b)fluoranthene	ug/L	0.25	3.4	0.018
Benzo(g,h,i)perylene	ug/L	0.36	3.4	0.2
Benzo(k)fluoranthene	ug/L	0.41	3.4	0.018
Chrysene	ug/L	0.65	3.4	0.018
Dibenz(a,h)anthracene	ug/L	0.45	3.4	0.018
Fluoranthene	ug/L	0.46	3.4	0.2
Fluorene	ug/L	0.42	3.4	0.2
Indeno(1,2,3-cd)pyrene	ug/L	0.44	3.4	0.018
Naphthalene	ug/L	0.71	3.4	0.2

Notes:
1. -- = 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.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining grab-type water samples from storm drains, outfalls, flumes or surface waters for physical and/or chemical analysis. For a grab sample a discrete aliquot is collected representing a specific location at a given time. This SOP does not include collection of samples with an automated sampler. Various types of methods are used to collect grab water samples including peristaltic pumps, telescoping samplers, or directly filling laboratory-supplied sample containers. This procedure is applicable during all Apex Companies, LLC (Apex) outfall water sampling activities.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Telescoping swing sampler; and/or peristaltic pump and tubing.
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: accessibility of sampling point, sampling depth, and flow rate. Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling method. The project sampling plan should define the specific requirements for collection of outfall water samples at a particular site.

Collection of Samples

- Record weather conditions at the time of sampling and last known rain fall event(s). Record and describe site conditions upon arrival and during sampling.
- Collect samples using the “Clean Hands/Dirty Hands” sampling technique. Operations involving direct contact with the sample bottle, sample bottle lid, sample suction tubing, and the transfer of the sample from the sample collection device to the sample bottle are handled by “clean hands”. “Dirty hands” is responsible for preparation of the sampler (except the sample container itself), operation of any machinery, and for all activities that do not involve handling items that have direct contact with the sample.
- The water sample can be collected directly by dipping a new laboratory supplied container (i.e. polyethylene, Teflon, or glass) into the water (just beneath the water surface) or under the flow path and filling. The liquid is then transferred to a laboratory supplied sample container. Be careful not to touch the sides of the vault, manhole, or outfall pipe.
- A telescoping swing sampler can be used if an extension is necessary to access the sample point. Attach a new laboratory supplied container (i.e. polyethylene, Teflon, or glass) to the sampler. This transfer device is used to transfer liquid from the sampling point to a sample bottle. Avoid using metal transfer devices for trace-metal analysis or plastic devices for sampling trace organics.
- A peristaltic pump with disposable tubing can be used to collect a water sample from a manhole. The downhole tubing can be attached to a telescoping sampling pole to provide better control. Lower the tubing downstream of any standing water and take care to avoid stirring up the sediment.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining automated composite water samples from storm drains, outfalls, flumes or surface waters for physical and/or chemical analysis. This SOP does not include collection of grab samples.

Bulk storm water samples will be collected as composite samples, which comprise a number of discrete individual samples of specific volumes taken at flow-weighted intervals. An automatic composite sampler will be set up with an area velocity flow meter that activates the sampling when there is flow in the pipe. The objective is to get a composite sample that represents the water quality over the longest practicable storm hydrograph. This procedure is applicable during Apex Companies, LLC (Apex) automated composite water sampling activities at Terminal 4.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Automated sampler (Teledyne-Isco Model 6712 or similar) equipped with four pre-cleaned 1-gallon glass collection vessels, a Teflon® screen, a Teflon® sampling tube, and an area/velocity (AV) type flow meter.
- RV/marine deep cycle 12 volt batteries.
- Stainless steel mounting brackets for flow sensor and sampling tube
- Wooden sampler cover (where necessary – varies by site)
- Mounting hardware to hang sampler in manhole (where necessary – varies by site)
- Field documentation materials (including flashlight)
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: accessibility of sampling point, sampling depth, and flow rate. Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling method. The project sampling plan should define the specific requirements for collection of outfall water samples at a particular site.

<u>Installation and Maintenance of Sampler</u>

- Program each sampler with the flow velocity for that specific pipe corresponding to the target rainfall event intensity. The Rational Method, in combination with Manning's equation and pipe geometry will be used to estimate flow velocity for the initial flow-weighting programming for the composite samplers. The Rational Method is a widely used method for estimating runoff of small drainage basins.[1] The Manning equation[2] and pipe geometry will be used to estimate the flow level and velocity expected in

[1] The rational method equation is: Q = kCiA where: Q – runoff flow; k – conversion constant; C - dimensionless runoff coefficient; i - rainfall intensity and A - catchment area.

[2] The Manning Equation was developed for uniform steady state flow in an open channel and is: $V = \frac{k}{n} R_h^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$ where:

V is the cross-sectional average velocity; *k* is a conversion constant *n* is the Manning coefficient of roughness; R_h is the hydraulic radius; *S* is the slope of the water surface. The discharge formula, $Q = AV$, can be used to manipulate Manning's equation to compute flow knowing limiting or actual flow velocity.

the storm water conveyance system within each basin based on the estimated runoff from a criteria storm.

- Program each sampler with the pipe diameter and the length of the suction sample line. Pre-program multiple sampling routines that include different proportional volume sampling rates so that an appropriate program can be selected based on the predicted magnitude of the storm.
- Field calibrate each sampler for water level and velocity readings.
- Program each sampler to fill individual 1-gallon glass collection vessels one at a time.
- Make sure that the sampler is above any high water level within the pipe or in a ground surface installation.
- Place the intake tubing with at least 2 inches of depth or greater for the intake. Use an anchor system or anchors to secure the tubing.
- All work requiring confined space entry will be performed by subcontractors with the necessary training.
- The glass collection vessels, screen, suction line, and pump tube will be decontaminated prior to installation. It is not anticipated that screens and intakes tubes will be removed for cleaning between sampling events. The sampler will be programmed to purge the intake tubes and silicon pump tubing several times before and after each stormwater sample is collected. Inspect tubing from the ground surface before each event. Inspect the downhole components before the start of each sampling season. If algae is growing in the intake tube, debris is blocking the tube, or any other gross contamination issues may exist, contaminated screens and intake tubes will be replaced with decontaminated screens and intake tubes decontaminated or replaced.

Collection of Samples

- Record weather conditions at the time of sampling and last known rain fall event(s). Record and describe site conditions upon arrival and during sampling.
- Collect samples using the “Clean Hands/Dirty Hands” sampling technique. Operations involving direct contact with the sample bottle, sample bottle lid, sample suction tubing, and the transfer of the sample from the sample collection device to the sample bottle are handled by “clean hands”. “Dirty hands” is responsible for preparation of the sampler (except the sample container itself), operation of any machinery, and for all activities that do not involve handling items that have direct contact with the sample.
- Cap the glass collection vessels and remove from the sampler.
- Submit samples to the laboratory under chain-of-custody protocols for compositing, filtration (as necessary), and analysis.