

City of Long Beach Harbor Department Engineering Design Division



DESIGN CRITERIA MANUAL

January 2014



Port of
LONG BEACH
The Green Port



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Engineering Design Division

POLB DESIGN CRITERIA MANUAL

January 2014

Port of Long Beach

Director of Engineering Design

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Deputy Chief Harbor Engineer

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This version was approved by:

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PART O - OVERVIEW

This Design Criteria Manual is issued to assure consistent standardization in the performance of all Port of Long Beach (POLB) infrastructure work being performed, and in meeting the requirements of, and conforming to, the criteria set forth by POLB. This manual establishes the basic guidelines and minimum design criteria for design projects within the POLB infrastructure. Design of all POLB infrastructure projects shall conform to the latest version of the POLB Design Criteria that exists at the time of contract execution.

The guidelines in this manual will be updated on a continual basis to reflect changes in POLB practices and the revision dates are shown accordingly. It is the responsibility of the user to determine that the guidelines are current.

The use of this manual in no way releases the Engineer from liability, alleviates, or replaces the individual design Engineer's adherence to the profession's "standard of care" in the design. Facilities designed prior to the adoption of this manual are not necessarily subject to the current criteria.

O-01 INTRODUCTION

The Port of Long Beach is one of the busiest seaports in the world, and the second busiest seaport in the United States. It is the gateway for trade between the United States and Asia, and a critical component of the economy of the United States, generating billions of dollars in economic activity each year. POLB directly provides approximately 30,000 jobs in the City of Long Beach, and indirectly provides hundreds of thousands of more jobs throughout Southern California. The containers moved through POLB account for 33% of all containers moved through California, 25% of all containers moved through the western United States, and nearly 20% of all containers moved throughout the entire United States.

POLB is comprised of 3,400 acres of land, 10 piers and 80 berths. POLB is a landlord port that develops and leases shipping terminals to tenants. POLB provides and maintains the infrastructure to support the shipping activities.

O-02 TOPOGRAPHY AND CLIMATE

POLB ranges in surface elevation between 0 feet (sea level) and 30 feet above sea level. There is not a general slope of surface elevations, but rather high points and low points located throughout. Some of the lowest surface elevations are on Pier A within the City of Los Angeles property. Major freeways used to access POLB include the Long Beach (710) Freeway and the Terminal Island (103) Freeway. The Long Beach Freeway enters POLB from the north on Pier B where the Terminal Island Freeway enters POLB from the north on Pier A.

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Temperatures at POLB remain mild year-round, with warmer weather occurring in the summer months and colder weather occurring in the winter months. A monthly average low temperature occurs in December at 45 degrees Fahrenheit. A monthly average high temperature occurs in August at 85 degrees Fahrenheit. It is common for mornings to have low clouds and fog, and afternoons to be clear with cool breezes. There is an average of 36 rainy days per year, with a total average precipitation of 12.94 inches.



PART 1 DRAFTING, ELECTRICAL, RAILROAD, WHARF/STRUCTURAL

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PART 1 DRAFTING, ELECTRICAL, RAILROAD, WHARF/STRUCTURAL

Separate individual manuals have been developed for the following topics. Please refer to those manuals as stated herein, which can be found in the RFP/RFQ Section of the POLB Website:

<http://www.polb.com/economics/contractors/resources.asp>

To link to the documents directly, please see below:

A. Drafting

POLB CADD Standards Manual Ver. 1.4:

<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=9702>

B. Electrical

POLB Electrical Design Criteria:

<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=8331>

C. Railroad

POLB Railroad Design Criteria, April 13, 2011:

<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=8326>

D. Wharf/Structural

POLB Wharf Design Criteria Version 3.0:

<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=9481>

Port-wide Ground Motion Study:

<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=3196>



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PART 2 - CONTROL

The following general criteria are to be applied to the development of the horizontal and vertical controls required as part of the design and construction at the Port of Long Beach (POLB, Port).

2.01 BASE PLANS

POLB shall supply base map files from the Port's CAD and/or GIS Mapping Systems. Should the Engineer desire a base map and associated information contained in the Port's Mapping Systems, the Engineer shall submit to the Port's Project Manager an Electronic Data Request Form [form and outline enclosed]. The form, outline and samples are stored in the following EDRMS folder:

<http://edrms/webtop/drl/objectId/0b02417880150437>

The Engineer shall review Port files and other information services to locate, gather and review previous work and studies that relate to the Project Site, including surveys, geotechnical, utility potholes, soil, utility and existing facility drawings.

The Engineer shall verify information obtained from existing drawings, including those marked As-Built or Record Drawings. The Engineer shall perform site visits to visually inspect the site conditions to confirm the completeness of the Base Map. Relevant features that are missing, or features which appear to be incorrectly located or identified, shall be noted and reported to POLB's Project Manager. The Engineer shall provide field inspections to discover, verify and document existing conditions and features that affect the work, and that are visible or accessible from the ground surface, including, but not limited to, above- and below-ground utilities, rights-of-way, property boundaries, roadways, railways, easements, facilities, structures, any obstructions to construction, regulatory boundaries and local datum.

The Engineer shall evaluate whether the existing survey information is valid for design purposes. If additional survey information is desired, the Engineer shall mark on a Base Map the areas needing additional survey. Specific areas requiring a high degree, i.e., (0.01') of accuracy, shall be indicated.

The Engineer shall submit a Request for Surveying and Mapping Services Form to the Port Project Manager, with the Base Map attached, at least two weeks in advance of when the survey needs to be initiated. [form enclosed]

PART 2 - CONTROL

2.02 HORIZONTAL AND VERTICAL CONTROL

Horizontal Control: The Port of Long Beach (POLB, Port) CAD and GIS Mapping Systems use California State Plane NAD 1983 Zone 5, 2007 Epoch. The Engineer shall submit project plans with the above-referenced coordinate system when electronic files are downloaded into the Port's GIS and/or CAD Systems, so that they will be in the correct coordinate positions.

When stationing or coordinates are used in the Drawings, a Horizontal Datum must be stated on the Project Location and Index sheet using one of the following two formats:

A. Horizontal Datum

The horizontal data shown is based on North American Datum of 1983 (NAD'83) (2007 EPOCH) California Coordinate System of 1983 (CCS'83), Zone 5 in U.S. Survey Feet. Reference LBHD Map No. HD 10-1974.

B. Horizontal Datum

The horizontal data shown is based on North American Datum of 1983 (NAD'83) (1991.35 EPOCH) California Coordinate System of 1983 (CCS'83), Zone 5 in U.S. Survey Feet. Reference LBHD Map No. 8-395 and LBHD FB 3023.

When stationing or coordinates are used in the Drawings, a Drawing sheet providing survey control must be provided. This Drawing sheet shall show at least two monuments and provide a description of their character, coordinates in the project datum (if coordinates are used in the Drawings) and their stations and outs (if stations and outs are used in the Drawings). This Drawing sheet shall also restate the horizontal datum in the above format. Additional information may be added to this sheet, such as coordinates and stations for points where no monuments exist or future monuments are to be set, equations to other datum, curve data, and vertical control.

Example 2-1

PRIMARY HORIZONTAL CONTROL			
PT. #	NORTHING	EASTING	DESCRIPTION
GPS XXXX	XXXXXXXX.XX	XXXXXXXX.XX	Description of the Character and Location of the Monument
GPS YYYY	YYYYYYYY.YY	YYYYYYYY.YY	Description of the Character and Location of the Monument

Drawings must reference the survey field book number(s) and page(s) that established both the horizontal and vertical control used in preliminary surveys for the design of the project. While we recommend that only one datum be used in a project, if more than one datum is used this must be clearly stated in the Drawings.

Vertical Control: POLB currently uses National Geodetic Vertical Datum (NGVD29) Mean Lower Low Water (MLLW). The Engineer shall submit project plans with the above-referenced

PART 2 - CONTROL

vertical control so that when the electronic files are downloaded into the Port's system they will be at the correct elevation.

When elevations are used in Drawings, a Vertical Datum must be stated on the Project Location and Index sheet using the following format:

A. Vertical Datum

The vertical datum shown is based on National Geodetic Datum of 1929 (NGVD'29) (1924-1932 EPOCH), POLB <Month'YY> Adjustment, Mean Lower Low Water Elevation (MLLW) in feet.

This Drawing sheet shall show only one (1) primary benchmark monument and provide a description of their character and approximate coordinates in the project datum (if coordinates are used in the Drawings).

Example 2-2

PRIMARY VERTICAL CONTROL				
BM #	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM XXXX	XXXXXXXX	XXXXXXXX	X.XX'	Description of Benchmark Character and Location

POLB's Project Manager will provide the appropriate horizontal Bench Mark Datum and horizontal Control Survey Monuments to the Engineer for use in the project design. The Bench Mark Datum shall be included on the Project Title Sheet and the Survey Monuments depicted on the Projects Control Sheets or Construction Drawings.

Prior to final design, the Engineer shall obtain approval from POLB's Project Manager for any proposed project-specific control base lines, stationing and element location method.

On the Project Drawings, the Engineer shall show the critical dimensions and elevations that define the size, shape and location of all Project elements.

On the project plans, the Engineer shall correctly depict and identify all rights-of-way, property boundaries, lease lines and easements to ensure that Project elements will be designed and constructed on or within their appropriate locations.

With the Final Design submittal, the Engineer shall provide an ASCII File containing: Point Number, Station, Northing, Easting, Elevation and descriptions of all Curve Beginnings (BCS), Endings (ESC), Points of Intersection (PIS), as well as all horizontal alignment Angle Points and Structural Points essential for survey layout; numbers to be shown to two decimal points.

The ASCII File must contain six fields formatted with comma delimiters, as follows:

A. Point Number

B. Station



PART 2 - CONTROL

- C. Northing
- D. Easting
- E. Elevation
- F. Description

2.03 BENCH MARKS

The Engineer shall indicate on the Project Plans the location of Bench Marks. POLB's Survey Section shall provide the required locations to the Engineer.

2.04 CENTERLINE MONUMENTS

On the Project Plans, the Engineer shall indicate the location of Centerline Monuments. POLB's Survey Section shall provide the required locations to the Engineer.

2.05 GENERAL REQUIREMENTS

The Engineer is responsible for developing, unless previously established by POLB, the horizontal centerline for the Project. Coordinates for centerline intersections and other monumentation shall be provided on the Project Plans.

2.06 PROTECTION

On the Project Plans, the Engineer shall show the location of monumentation as provided by POLB's Survey Section. In the Project Documents, the Engineer shall indicate any requirements for the protection of monuments, as required by POLB's Survey Section.

Engineering Design / GIS Group - Data Release Form Outline

If you provide the following information, we can have someone from GIS or Drafting (Bob LePage) pre-fill the data release form and send it to you and/or your consultant:

1) The primary consultant firm name and contact name/email (primary consultant is responsible to provide the data to its subcontractors). Provide primary contact/email for agencies/companies (e.g. Southern California Edison, Oxy/Tidelands, etc.) that are either performing work or contracting work within the POLB service area; the agency/company is responsible to provide the data to its subcontractors.

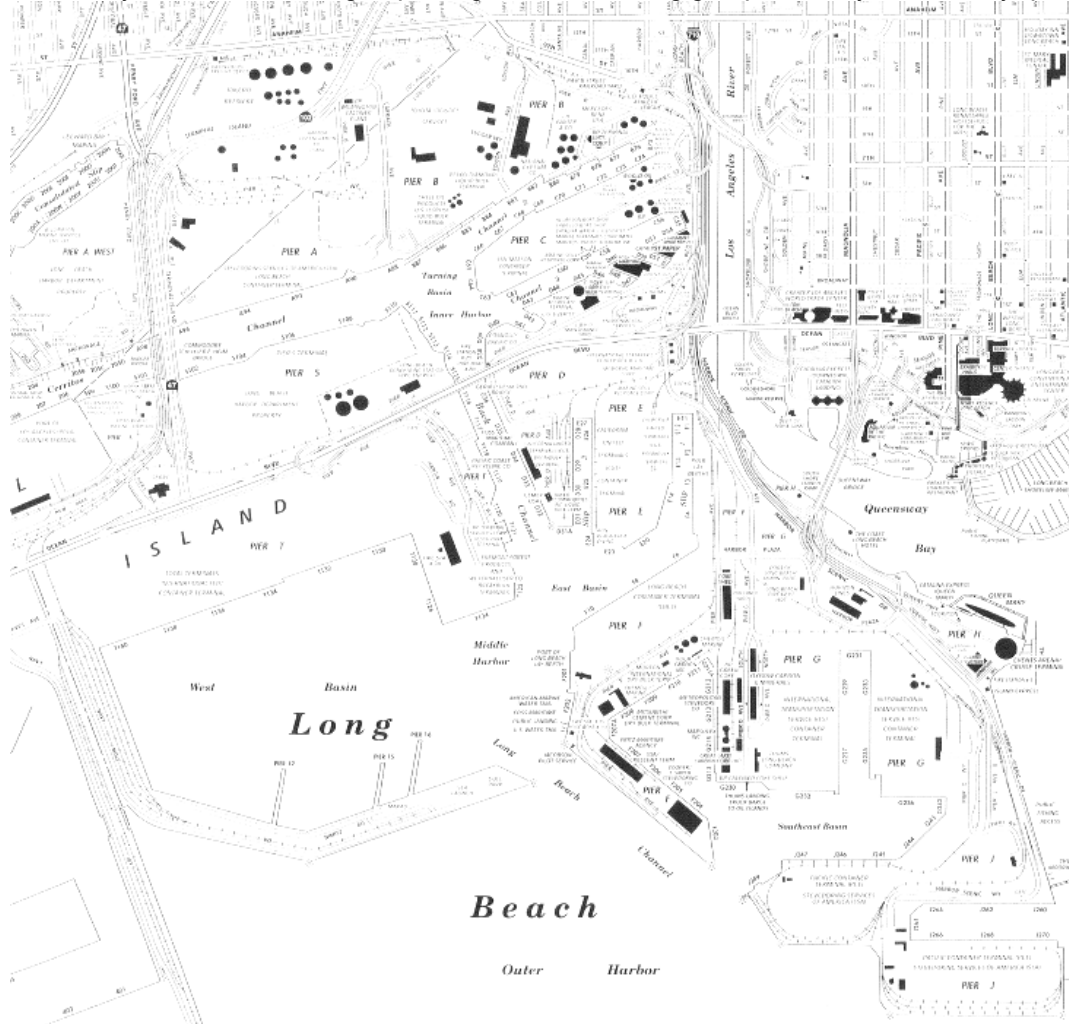
2) The POLB Project Name, Specification Number and POLB Project Manager

3) Files/data of interest:

- a. 2012 Base map detail file (i.e. road edge, buildings, etc.)
- b. 2012 Striping file
- c. 2012 Topo/contours file
- d. 2012 Aerial photo files
- e. Utility files
- f. GIS data (i.e. filegeodatabase, etc.)

4) Project extents (Use the map below to circle or highlight the project area). Keep in mind that our Director has given us instructions to only furnish the extents needed for the project instead of providing the data on a port wide basis; the exception would be for projects that cover the entire Port (i.e. master plans, port wide striping projects, etc.)

Also pre-filling the forms on POLB's end will ensure better organization and consistency by clearly indicating the files being provided, the file format and the coordinate system/datum. Once we receive the signed form, we will post the files to the Port's FTP site with instructions for downloading since the files can be rather large. Let Miguel Hernandez and/or anyone from the GIS group along with the Drafting group know if you have any questions.





ELECTRONIC DATA RELEASE FORM

The undersigned has requested the Port of Long Beach (POLB) provide the data specified on this form for the purpose specified below. The undersigned recognizes that the electronic storage, reproduction and retention of data has inherent risks. Various actions or conditions could degrade or corrupt the files or the data. These include:

1. Use of this data with any software other than ArcGIS desktop, version 10.1 or MicroStation V8i.
2. Copying or transmitting the data.
3. Modification of the files or the data.

The undersigned understands these risks and waives all claims against POLB that may result from degradation or corruption of the data.

The undersigned acknowledges that the data is the property of POLB and agrees not to use the data on other projects or provide this data to any other party. Any use of this data by the undersigned or others for a purpose other than that specified below is prohibited and will be at the user's sole risk.

The undersigned acknowledges that the data is provided in its existing form without any representation from POLB that it is accurate or complete or suitable for the purpose for which it will be used. The undersigned waives all claims against POLB relating to or resulting from the data, including all claims relating to or resulting from any errors, omissions or inaccuracies in the data.

Electronic Data Provided: _____

Coordinate System / Datum: _____

Project Name/ Project Manager /Primary Contact: _____

Location: _____

HD Spec No: _____

Intended Use of Data: _____

Requesting Company Name: _____

Company Representative Name / Title: _____

Address: _____

Phone: _____

The undersigned agrees to the terms and conditions of this release form.

Signed: _____ Date: _____

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PART 3 – STORM DRAIN

3.01 GENERAL DRAINAGE DESIGN CRITERIA

The following general drainage design criteria will be applied to all development design projects to assure consistent performance in meeting the requirements of the Port of Long Beach (POLB) Drainage Standards. This section establishes the basic guidelines and minimum design criteria for the design of storm drainage improvements within POLB in order to provide safe and low-maintenance facilities. Design of all POLB storm drainage shall conform to the latest version of POLB's Storm Drain Standard Plans, Stormwater Infrastructure Master Plan, and this manual. The design of a storm drain system in existing, developed areas shall meet these standards, even if the point of connection is inadequate and/or does not meet current drainage standards. During the design and construction of the project, the design Engineer shall take into account the existing drainage flow and any possible anticipated development flow of downstream or upstream properties.

A. DRAINAGE CALCULATIONS

Drainage Calculations: All drainage calculations shall be prepared in report format with applicable supporting documentation. At a minimum, the report shall include the following elements:

1. Executive Summary that includes elements from each major section of the report as defined below
2. The intent of the study, discussion of any potential issues, including proposed project, existing conditions & facilities
3. The applicable codes, standards, design criteria, conditions, permits, and/or assumptions
4. The analysis methodology and storm frequency
5. An analysis of the results
6. Conclusion and recommendation
7. An appendix including all back-up information (Drainage Area Map and Hydrology, Calculations, System Layout and Hydraulic Calculations)

The drainage report and calculations shall be signed and sealed by a Civil Engineer currently registered in the State of California. The calculations shall be complete and clearly presented indicating that the design standards have been met.

B. HYDROLOGY

Hydrology Calculations: The hydrology calculations shall be performed in accordance with the Los Angeles County Department of Public Works Hydrology and Sedimentation Manuals, current edition. The analysis shall be made using the Modified Rational Hydrology

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(MORA) Computer Program number F0601 or current program, unless otherwise specified or as approved by the Director of Engineering Design.

The following storm frequencies shall be used for design of storm drain systems on POLB property:

Storm Frequency	Design Criteria
10-year	All storm drain pipe and inlet structures located within a flow-by condition.
25-year	All storm drain inlet structures located within a sump condition.
50-year	All pump stations located within a sump condition.

The goal is to provide 100-year storm protection for any habitable structures, terminal buildings, or other structures of concern. All proposed storm drain system improvements shall be checked under a 100-year storm frequency to confirm that the extent of flooding remains within POLB property, does not increase existing flooding conditions, and does not encroach upon any habitable structures, terminal buildings, or other structures of concern as specified by the Director of Engineering Design.

Storm Run-off Calculations: A Hydrology Map shall be prepared for the tributary area to the proposed system, and shall include:

1. An outline of the contributing drainage area depicting the area's topography, existing drainage features and future development in the vicinity of the proposed project. The Hydrology Map shall be a topographic map of sufficient scale to show legible elevations, drainage patterns, and quantities of run-off. North arrow, scale, and legend shall be included on the Hydrology Map.
2. A plot of all existing and proposed storm drains in and adjacent to the drainage area noting size and material type.
3. Drainage sub-areas, acreage and computed run-off data.
4. The run-off information shall include the quantity of flow for the required design frequency, and the time of concentration above and below all junctions. All flows approaching, entering, and carried over from each catch basin shall be shown.
5. Proposed pipe sizes and catch basins as computed from the Hydraulic Design shall be added to the completed Hydrology Map or Preliminary Proposed Storm Drain Facility Exhibit.
6. Show Flood Hazard Zone designations, map panel number and effective date in accordance with the Flood Insurance Rate Maps (FIRM) published by FEMA.

PART 3 – STORM DRAIN

C. HYDRAULIC DESIGN

Computer Analysis: The following Hydraulic computational computer programs should be used to prepare the hydraulic analysis:

1. WSPG
2. XPWSPG
3. WSPGW
4. StormCad

Other computer analysis programs for pipe hydraulics may be used with prior approval by the Director of Engineering Design.

The design condition hydraulic grade line shall be no less than 12 inches below the surface drainage entrance to inlets and catch basins, and not less than 12 inches below the rim elevation of manholes or lowest surface opening of other structures.

Some of the procedures that should be included in the hydraulic computation are given below:

1. Identify all calculations by referring to the storm drain line number and its location.
2. Begin all hydraulic grade line calculations at the downstream end of a system and proceed upstream to the catch basin or other inlet facility.
3. Calculations must proceed from point to point in a logical, easy to follow analysis. Start with a beginning water surface which has been verified and double checked, and add losses in a systematic manner as they accrue along the pipeline. Sum these losses and show the hydraulic grade line and energy grade line elevations at critical points.
4. Show the hydraulic grade line and energy grade line plot on the storm drain improvement plans. Show all water surface elevations and the top of curb elevations at catch basins. In addition, all hydraulic elements (Q's, V_n , slopes, pipe sizes, invert elevations, and pertinent stationing) shall be shown on the plans.
5. At all junctions, show detail, including angles between the mainline storm drain and incoming laterals.
6. The minimum free board in catch basins shall be 12 inches below the flow line at the catch basin opening.
7. At changes of direction, a drop in flow line shall be installed equal to the velocity head times the ratio of angular change to 90 degrees, unless written approval is obtained from the Director of Engineering Design.

$$V^2/2g * A^\circ/90^\circ = \text{Head Loss}$$

PART 3 – STORM DRAIN

Outlet to the Harbor: When the storm drain system outlets to the harbor, the control water surface elevation for the hydraulic grade line at the outlet location shall equal the Mean Higher High Water (MHHW) elevation, currently 5.28 ft (NAVD 88) or lower.

D. DEWATERING

Active Dewatering is not allowed for storm drain construction. Reinforced Concrete Pipe with water tight joints is required in wet conditions. Bedding shall be in accordance with the Class “A” Bedding Alternative per POLB Standard Plan U-1. Pipe bedding shall be constructed by removal of wet, yielding or mucky material and replaced with sufficient $\frac{3}{4}$ ” crushed rock to correct the instability. Pipe construction in wet conditions shall only proceed with the approval of the Director of Engineering Design.

The contract documents are to reflect the areas of ground water contamination as determined by the soils investigation together with borings, soil characteristics and anticipated flow calculations. If ground water contamination is to be encountered, the designer may require tight sheeting or sheet pile cut-off walls for excavations in order to minimize the amount of ground water to be removed, treated or disposed of.

Prior to the start of excavation, the design Engineer shall require the Contractor to submit the operation plan with appropriate calculations for review.

Plans and specifications shall require the contractor to obtain a permit from the Regional Water Quality Control Board for work that is within the ground water table.

E. ALIGNMENT

Existing and proposed surface and sub-surface improvements shall be considered when setting horizontal and vertical storm drain pipe alignments. Possible soil and groundwater contamination areas shall be avoided whenever possible. Storm drain alignments outside of POLB right-of-way shall be contained within an easement a minimum of 10 feet wide with rights for POLB to maintain their facility. The design Engineer shall be responsible for preparing a legal description with layout sketch signed by a Licensed Surveyor registered in the State of California, preparing the easement dedication documents, obtaining all required signatures, and for recording the document with the Los Angeles County Recorder’s office in order to complete documentation.

F. SURFACE DRAINAGE

The minimum slope for asphalt shall be 1.2 percent.

The minimum slope for concrete gutters shall be 0.50 percent.

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The minimum slope for surfaces in container terminal backland for sheet flow shall be 1 percent with a maximum grade break of 2 percent, or as approved by the Director of Engineering Design.

To the maximum extent possible surface drainage is to be diverted away from terminal buildings.

In all cases, in the event a drainage inlet becomes plugged, the ponded water shall overflow away from buildings prior to reaching within 12 inches of the building floor elevations.

G. PIPE D-LOADS

Storm drain pipes subject to loads from container handling equipment shall be designed for 100 KIP wheel loads (140 psi) plus 25 KIP impact loads (125 KIP over a 5 square-foot area). Pipe D-loads shall be calculated considering dead loads determined by Masten's Equation and live loads by Boussinesq's Equation.

All other D-Loads shall be in accordance with the values listed in POLB Standard Plan D-39.

A minimum D-Load of 1750 shall be used for laterals.

H. REINFORCING IN CONCRETE DRAINAGE STRUCTURES

All new cast-in-place concrete drainage structures (i.e. manholes, catch basins, outfall structures, concrete collars, transition structures, etc.) shall be reinforced with epoxy-coated rebar having a minimum of 2 inches of concrete cover.

I. PORTLAND CEMENT IN CONCRETE DRAINAGE STRUCTURES

All new cast-in-place structures shall use ASTM C 150 Type V cement with less than 5% tricalcium aluminate (C3A) content, or Type II cement with less than 8% C3A when the sulfur trioxide (SO₃) content is less than 3%. Cement with a C3A content up to 10% may be used if the SO₃ content does not exceed 2.5%. The optimum concrete is 6 ½ to 7 ½ sacks of cement per cubic yard, and would have a water/cement ratio not to exceed 6 gallons per sack of cement. Maximum slump should not exceed 4 inches.

J. SUB-SURFACE DRAINAGE SYSTEM

1. Filter: A graded aggregate filter or filter cloth shall be provided to prevent soil grains from entering the drain.

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2. Perforated Pipe: Perforated pipe and fittings shall be PVC SDR 26 pipe in accordance with ASTM D-3034. The minimum diameter used shall be four (4) inches. Plastic, corrugated, smooth interior High Density Polyethylene (HDPE) pipe in accordance with AASHTO M 294 type S with Class 1 perforations may be used in lieu of PVC with prior written approval from the Director of Engineering Design.
3. Non-perforated Pipe: Non-perforated pipe with closed joints shall be used as a collector. The minimum diameter shall be 18 inches at a slope to provide minimum 2 foot per second velocity when flowing full. Where sufficient gradient is available, collectors shall be depressed below drains. When the pipe itself is half full, the pipe slope should achieve a 2 to 4 foot per second velocity. The minimum allowable pipe slope shall be 0.001. Cleanouts shall be provided at all major bends, at a maximum spacing of two hundred (200) feet, or as required by the latest edition of the Uniform Plumbing Code.
4. Outlets: Outlets shall be designed in such a manner so as to minimize surface water, tidal water, or groundwater from entering the drainage system.

3.02 DESIGN CRITERIA

A. PIPES

1. Reinforced concrete pipe (RCP) with rubber gasket joints shall be used for storm drain piping. Plastic, corrugated, smooth interior High Density Polyethylene (HDPE) pipe and pipe fittings in accordance with AASHTO M 294 having water tight joints meeting the requirements of ASTM 321 may be used with prior written approval of the Director of Engineering Design. Ductile Iron Pipe shall be used within the limits of all pump stations; piping may transition to the above specified material when the head is two feet or less above the top of pipe. Prior written approval from the Director of Engineering Design is required if any other alternate pipe materials are planned to be used.
2. Storm drain systems shall be designed for ease of maintenance by POLB staff. Director of Engineering Design shall approve all storm drain system alignment and access.
3. A minimum pipe size of 18 inches shall be used for all POLB-maintained storm drain, unless otherwise approved by the Director of Engineering Design.
4. The following "n" factors shall be used for RCP:
 - a. $n = 0.015$ for pipe 21-inch or smaller in diameter,
 - b. $n = 0.013$ for pipe 24-inch or larger in diameter.
5. Minimum velocity at full flow shall be 2 feet per second.

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6. A minimum radius of 22 1/2 feet, and/or multiples of 22 1/2 feet, shall be used for any horizontal bends in RCP horizontal layouts.
7. Slope anchors shall be provided when the slope exceeds 33%. Slope anchors shall be constructed at intervals in accordance with SPPWC Standard Plan 221-2.
8. Thick wall RCP with a minimum cover of 1 ½ inches over the reinforcing shall be used when the velocity exceeds 20 feet per second. Maximum velocity shall not exceed 45 feet per second.
9. A bedding detail is required for all types of pipe. POLB Standard Plan U-1 shall be used.
10. Concrete collars shall be used as required and in accordance with Public Works Construction (SSPWC) Standard Plan 380-4.
11. Concrete pipe support across trenches shall be in accordance with SPPWC Standard Plan 224-2.
12. Trench excavation and width requirements shall be in accordance with POLB Standard Plan U-1.
13. Junction structures shall be in accordance with SPPWC Standard Plans.
14. Transition structures shall be in accordance with SPPWC Standard Plans.
15. Care must be taken that the storm drain piping does not interfere with water services and sewer laterals. Vertical separation of 1 foot and Horizontal separation of 3 feet (OD to OD) is required unless written approval is obtained from the Director of Engineering Design. Sewer laterals crossing over storm drain lines are required to be encased in concrete or supported per SPPWC Standard Plan 224-1.
16. A minimum of 12 inches of separation must be maintained between storm drain piping and gas or high pressure water injection lines and oil lines.
17. Curved storm drain pipe alignments for RCP will not be allowed except for pipe sizes with an ID of 36 inches or larger, or unless written approval is obtained from the Director of Engineering Design.
18. The connection of storm drain pipe to an existing storm drain shall be in accordance with SPPWC Standard Plan 335-2.

B. STORM DRAIN MANHOLES

1. Manholes are required at the following locations unless otherwise approved by the Director of Engineering Design.
 - a. Beginning or ending of curves
 - b. At all changes of size
 - c. At all changes in type of pipe
 - d. At all changes of direction
 - e. At intersections of lines including inlet runs
 - f. As required for maintenance per spacing requirements below

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2. The maximum spacing of manholes shall be as follows:
 - a. For pipe 30" and smaller in diameter - 300'
 - b. For pipe 30" to 45" in diameter - 400'
 - c. For pipe over 45" in diameter - 500'
3. Manholes shall be constructed in accordance with SPPWC Standard Plans.
4. Catch basins shall be constructed in accordance with SPPWC Standard Plans.
5. If subjected to container equipment loading, manhole covers shall be designed for 100 KIP wheel loads plus 25 KIP impact loads. Neenah Foundry manhole cover R-3492-C or equal shall be used.
6. The use of grate-type catch basins shall not be allowed on public streets unless approved by the Director of Engineering Design.

C. INLETS

1. Hydraulic design of inlets shall be in accordance with criteria established by the Los Angeles County Department of Public Works.
2. The types of inlets to be used are depicted in the SPPWC Standards Plans 300-3 through 305-3. Construction of inlets shall be in accordance with the SPPWC Standard Plans unless otherwise approved by the Director of Engineering Design.
3. Where an inlet is located directly above the storm drain, the SPPWC Standard Plan 332-2 shall be used.
4. Inlets shall be located at the following points:
 - a. At all low points
 - b. At points where depth of flow in gutter exceeds 0.4 feet
 - c. At street intersections. (Wherever possible inlets shall not be located within the curb return.)
5. Along with street centerline stationing, the size, depth, and type of inlet shall be shown on the improvement plans.

D. OUTFALLS

1. The design of outlet structures shall be in accordance with Section B-4.9 in Los Angeles County Department of Public Works, Hydraulic Design Manual (Ref. 8). The design shall be submitted for approval by the Director of Engineering Design.
2. Flap gates should be used when the system is subject to backflow at high tide (to protect upstream property), where upstream property is below the tidal elevation.
3. Outlets passing through rock dikes, or those which are susceptible to differential settlement or alignment disturbance, shall be of monolithic construction.
4. On rock slopes which are subject to settlement, the designer should consider using pile-supported outlets.

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E. ABANDONMENT OF EXISTING FACILITIES

1. If existing culverts, pipes, or other facilities are abandoned or removed, provisions must be made for drainage.
2. If facilities are abandoned, it will be necessary to remove the existing drainage facility, backfill and re-compact, unless otherwise approved by the Director of Engineering Design.

F. PUMP STATIONS

The hydraulic design and operation of pump stations exclusive of discharge lines shall conform to criteria set forth in the Los Angeles County Department of Public Works Pump Station Design Manual.

Discharge lines shall be designed in accordance with criteria set forth in this document, specifically "Design Criteria - Pipes".

POLB will furnish or confirm the inflow hydrographs to be used in designing pump stations. Consultants shall use Los Angeles County Department of Public Works methods and standards in preparing inflow hydrographs for pump and wet well sizing.

G. STORM WATER PERMITS

The Contractor shall prepare Storm Water Pollution Prevention Plan (SWPPP) that identifies and commits to implementing Storm Water Pollution Prevention measures to reduce pollutants in storm water discharges from the project site during construction and after construction is completed.

The project documents shall provide for the construction or installation of Storm Water control measures as required by the requirements of conditions of other permitting agencies.

3.03 STORM DRAIN GENERAL NOTES (To be included on all Storm Drain Improvement Plans)

- A. All reinforced concrete structures must be 3,250 pounds per square inch in 28 days unless specified on the plans or as approved by the Director of Engineering Design. Type of Portland Cement Concrete will be shown on the plans or specifications.
- B. All pipe lengths are horizontal projections unless otherwise noted.
- C. For all trench and structure excavations, shoring shall be provided to satisfy all Cal/OSHA safety requirements.

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- D. Pipe construction in fill areas must be coordinated with the grading to ensure that, when the fill operation has been completed at grade, there is a minimum of two (2) feet of fill above the top of pipe.
- E. All work must be in conformance with POLB's Storm Drain Design Criteria, Standard Plans, and the Project Plans and Specifications.
- F. The Contractor must notify POLB's Engineer at least two (2) working days prior to commencement of any storm drain construction.
- G. All fills must be compacted to 90% relative compaction as determined by California Test Method No. 216, 1978 "Five Layer Method." All backfill must be free of vegetable matter.
- H. All surveying required for vertical or horizontal alignment will be provided, or as noted in the Project Specifications.
- I. All Reinforced Concrete Pipe shall be bedded in accordance with the Pipe Bedding Detail per POLB Standard Plan U-1.
- J. Contractor shall provide POLB's Engineer with verification of pipe D load testing and certification in writing from the Geotechnical Engineer that the storm drains' subgrade is of adequate strength to support the structures and any anticipated loads prior to placement of reinforced concrete pipe.
- K. Prior to the commencement of construction, the contractor shall obtain a permit from the State Division of Industrial Safety. A copy of the permit shall be kept on the job site at all times.
- L. The Contractor shall obtain a permit from the City of Long Beach Public Works Department for any encroachment necessary for construction outside of the Harbor District.

3.04 WATER QUALITY DESIGN CRITERIA

**Storm Water Management System (SWMS) Design Procedure
(Standard Operating Procedure for Environment Management System [EMS])**

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A. PERMITS REQUIRING STORM WATER MANAGEMENT SYSTEM (SWMS)

Design Engineer shall design storm water management systems in conformance with conditions specified on the following permits.

1. NPDES Permits

a. Industrial Permit-

State Water Resources Control Board (State Water Board)
Water Quality Order No. 97-03-Dwq
National Pollutant Discharge Elimination System (NPDES)
General Permit No. CAS000001 (General Permit)

b. Construction Permit-

State Water Resources Control Board (State Water Board)
Water Quality Order 99-08-Dwq
National Pollutant Discharge Elimination System (NPDES)
General Permit For
Storm Water Discharges Associated With
Construction Activity (General Permit)
General Permit No. CAS000002 (General Permit)

2. Harbor Department Permit- Issued by the Port of Long Beach Environmental Planning Division for each project.

B. PROJECTS REQUIRING PERMANENT BEST MANAGEMENT PRACTICES (BMPs)

1. POLB requires Design Engineers to implement appropriate structural or nonstructural BMPs on any project involving the collection and/or conveyance of storm water run-off.

2. Design Engineers shall examine projects independently and evaluate the site specific BMPs for each project.

3. Design Engineers shall use the following manual and handbook, latest version, as design guidelines:

a. A Manual for the Standard Urban Storm Water Mitigation Plan (SUSMP), Los Angeles County, http://ladpw.org/wmd/NPDES/SUSMP_MANUAL.pdf

b. California Stormwater Best Management Practice Handbooks, California Stormwater Quality Association (CASQA), <http://www.cabmphandbooks.com/>

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- c. LA SUSMP Manual will take precedence over CSBMP Handbooks.
- 4. Design Engineers shall prepare BMP Options and Ranking Tables
- 5. Annual Maintenance Cost Estimate shall be prepared.
- 6. Orphan areas include any undeveloped areas within 100 feet of project boundary without permanent storm water controls.
- 7. The property owner is responsible for continued storm water management on the project site if the construction storm water permit will remain active after completion of construction. Designers must provide long-term BMP's and a storm water operations and maintenance plan that will ensure compliance with all permit conditions after the construction contract is closed.
- 8. Maintenance of permanent BMPs outside of the terminals is the responsibility of the POLB Maintenance Division. Project Mangers/Project Engineers shall notify the Maintenance Division when maintenance responsibilities are transferred to them.

C. CONSTRUCTION PROJECTS REQUIRING STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- 1. Specifications shall include a provision for construction of SWPPP requirements and template, prepared by POLB Environmental Planning Division, for contractors to use and follow.
- 2. Follow the conditions specified in the Harbor Development Plan (HDP).

D. OPERATION AND MAINTENANCE (OEM)

Design Engineers shall prepare an O&M Manual as necessary.

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4.01 GENERAL CRITERIA

Design criteria and standards are used to ensure that new sewer facilities meet a certain requirement in order to maintain a properly-functioning sewer system. Design criteria are also used as the basis for determining if an element of the sewer system is deficient and requires improvement. Planning level criteria is used for future development projections and modeling.

Except where specifically noted, sewage collection and treatment shall comply with the following codes and standards:

- A. County Sanitation Districts of Los Angeles County
- B. City of Long Beach Municipal Code, Section 15*
- C. City of Long Beach Water Department (LBWD) Standard Drawings and Specifications*
- D. Standard Specifications for Public Works Construction (Green Book)
- E. City of Los Angeles Department of Public Works, Bureau of Engineering Manual, Part F**

* The LBWD standards apply to sewer installation in public and private property within the City of Long Beach, where LBWD operates and maintains the main line sewers. LBWD has acknowledged that POLB may use other materials and modifications of LBWD standards on POLB property.

** POLB owns and develops property located within the city limits of the City of Los Angeles.

Sewer design calculations and drawings shall be signed and sealed by a Civil Engineer registered in California.

4.02 DESIGN FACTORS

In general, sewer systems shall be designed for the estimated ultimate working population of the Tributary area and the maximum anticipated waste water flows from industrial, commercial and institutional uses.

In determining the required capacities of sanitary sewers, the following factors shall be considered:

- A. Peak sewage flows
- B. Additional sewage or wastewater flow from industrial facilities
- C. Ground water
- D. Depth of excavation
- E. Tributary sewer drainage basin
- F. Topography of area
- G. Pumping requirements

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4.03 DESIGN CRITERIA

A. COLLECTION SYSTEM DESIGN CRITERIA

Table 4-1 identifies the recommended collection system design criteria for future POLB design projects.

Table 4-1
Recommended Collection System Design Criteria

Parameter	Criteria	
d/D	<u>New Pipe</u>	<u>Existing Pipe</u>
12" and smaller	$d/D \leq 0.50$	$d/D \leq 0.75$
Greater than 12"	$d/D \leq 0.75$	$d/D \leq 0.90$
Velocity		
Minimum	2 ft/s	
Maximum	10 ft/s	
Minimum Slope		
8"	0.0040	
12"	0.0023	
$\geq 15"$	0.0015	

1. Sewer Pipe material shall be Vitrified Clay Pipe or Polyvinyl Chloride Pipe.
2. Sewer pipe, including mains and service laterals, installed in a traveled way shall have a minimum cover of five (5) feet from the finished surface. The pipe strength for all sewer pipes located in a roadway outside of a container terminal shall be based on an HS25 design vehicle load. The pipe strength for all sewer pipes located within a container terminal loading area shall be based on the load design criteria described under 8. Manhole structures and covers.
3. Service laterals shall have a minimum pipe diameter of four (4) inches, with a maximum slope of $\frac{1}{4}$ inch per foot, unless otherwise approved by the Director of Engineering Design.
4. Manholes shall be located at junction points, changes in horizontal and/or vertical alignment, changes in conduit size, and at the end of main lines, unless otherwise approved by the Director of Engineering Design.
5. Unless otherwise approved by the Director of Engineering Design, manholes shall be spaced at intervals no greater than three hundred (300) feet.
6. Drop Manholes – A drop connection shall be provided for a sewer entering a manhole at an elevation two (2) feet or more above the manhole invert. When the difference in elevation between the incoming sewer and the manhole invert is less than two (2) feet, the manhole invert shall be filleted and channeled to provide a

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smooth transition. The drop connection shall be constructed in accordance with the standard detail requirements for manhole installation.

7. A minimum of sixteen and one half (16.5) feet of overhead clearance shall be provided at all manholes.
8. Manhole structures and covers shall be designed for the loads imposed by container terminal vehicles and/or containers. The design calculations shall note the load design criteria of the current in-terminal vehicle, including wheel loads, tire pressure, tire contact dimensions and the centerline-to-centerline dimension of the two closest wheels on the front axle. (Example: Cat V925 Lift Truck, front axle of four wheels, each wheel with a maximum load of 57 kips, tire pressure 110 psi, each wheel contact over a 32-inch by 21-inch area, with wheels 28-inches apart.) An additional 10% impact load shall be used in the design. For roadways outside of the container terminal loading area, an HS25 vehicle load shall be used.

The depth-to-diameter ratio (d/D) has been identified for new and existing pipe. It is common practice to allow greater d/D values for existing pipe. However, any new pipe to be installed should adhere to the new pipe d/D criteria. The new pipe d/D criteria is consistent with industry-accepted d/D values for new pipe installations.

A minimum velocity of 2 ft/s (feet per second) in sewer systems is an industry standard. This velocity is the minimum “self-cleaning” velocity because it keeps solids from settling on the pipe invert. When velocities are less than 2 ft/s, an anaerobic condition can occur which leads to the formation of hydrogen sulfide gases. Hydrogen sulfide gas leads to corrosion of concrete manholes and other structures. A maximum velocity of 10 ft/s is also important to minimize excessive turbulence.

The minimum slope criteria, velocity criteria, and d/D criteria go hand-in-hand. The minimum slopes were set for the various pipe diameters based on the d/D criteria and the minimum velocity criteria. For example, the minimum slope criteria for a 15” pipe was determined using Manning’s equation with a d/D value of 0.75 and a velocity of 2 ft/s. Please note, these are absolute minimum slopes; sewers should be designed with steeper slopes whenever possible.

B. LIFT STATION DESIGN PARAMETERS

Lift station design parameters provide a set of standards and guidelines for future lift stations, or lift station rehabilitation and replacement projects. The parameters are consistent with the industry-accepted requirements of proper lift station design. Standards have been provided for the “smaller” lift stations in the system. These parameters do not apply to future large lift stations similar in size to SLS101, SLS104, and SLS1CO.

In the design of small lift stations, there are essentially two options:

1. Utilize a packaged pumping system
2. Individually-sourced pumps, valves, and piping

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The advantages of a packaged system include faster construction duration and a single point of responsibility for the entire pumping unit. The advantage of individually-sourced pumps, valves and piping is that each component can be individually customized, and there is more flexibility in the layout of the station

There are several manufacturers in the market that are providing reliable packaged systems to sewer agencies. The packaged lift stations reduce the consultants' design effort, and are easier for the Contractor to install. Packaged lift stations should be utilized whenever possible.

The lift station design parameters shown in Table 4-2 should be reviewed prior to the design of new lift stations. The parameters are meant to provide general guidelines for future designs, and shall be adapted based on the specific application.

Table 4-2
Lift Station Design Parameters

Pumps	• Shall be sized so design flow can be pumped with the largest pump out of service (typical configuration: 1 primary pump, 1 back-up pump) • Shall be sized to not create deficiency in downstream gravity pipelines (if possible) • Shall consider peak, average, and minimum flows
Cycle Time	• Minimum: 10 minutes • Maximum: 8 hours
Wet Well	• Shall avoid "back-up" into inlet pipelines when possible • Entire structure shall be protected from corrosion with protective lining
Valving	• All stations shall have a separate valve vault downstream of the pumps • Each discharge line shall have a check valve • Each pump shall be able to be isolated while keeping the other pump in service
Force Mains	• Each station shall have two force mains which are interconnected by valving • Each force main shall be capable of conveying the design flow at an acceptable velocity
SCADA	• All stations to be equipped for SCADA

1. The maximum run for two (2)-inch diameter forced main is one hundred (100) feet.

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2. Any use of forced main less than four (4) inches in diameter must have specific approval from the Director of Engineering Design.
3. The maximum run for four (4)-inch force main is unlimited, provided clean-outs are installed at one hundred (100) feet on center.
4. ABS is approved for sewer forced mains.
5. Sewer forced mains shall have clean-outs installed at spacing adequate to conform to the cleaning method and apparatus in use by POLB, or at locations which may be a clogging point, such as 90-degree bends.
6. These clean-outs shall be brought to grade where appropriate.
7. Coordination and approval by the Director of Engineering Design shall be obtained prior to final design of the forced main, clean-out and/or lift station.

In reference to the last item in Table 4-2, POLB SCADA Standards are included as Appendix H.

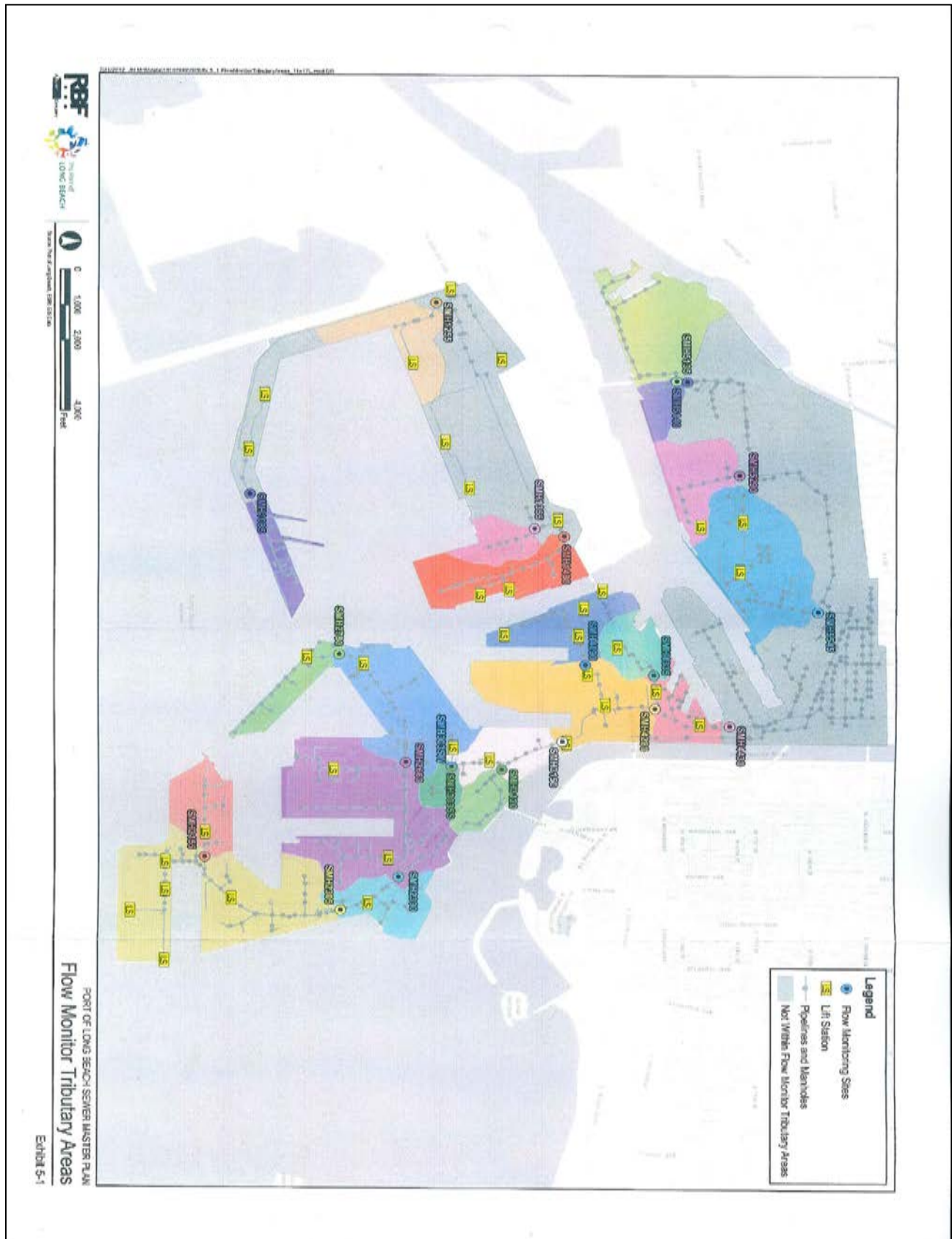
4.04 SEWERAGE REPORT

A Sewerage Report shall be prepared when a development requires the construction of a mainline sewer to serve the project.

The Engineer shall determine the adequacy of the existing sanitary sewer system to accommodate the proposed development. To substantiate the design of the sewer system, the following shall be addressed in the Sewerage Report:

- A. Area of project
- B. Adjacent and tributary areas outside project
- C. Surface contours/elevations as required by the Director of Engineering Design
- D. Line layout, profile, pipe size, slope and type of material
- E. Any non-domestic waste being introduced into the system, such as industrial process wastes, cooling waters, etc., and the types of pre-treatment devices to be provided
- F. Calculations showing predicted average and peak flows at major junction points, including flow coming from outside of the project area(s)
- G. Land use and building use factors used to predict flows
- H. Quantity of wastewater flow from areas such as container wash racks, terminal operations facilities, industrial facilities and large office buildings, etc.
- I. Design calculations, such as hydraulic design, trench design, pipe structural design, cost estimates, etc.

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4.05 PLANNING-LEVEL CRITERIA

Planning-level criteria is used primarily for future project projections and estimations. Planning-level criteria is often used for hydraulic modeling purposes for future projects. The planning-level criteria includes Manning’s Roughness “n”, sewer generation, diurnal curve, peak hour factor, and inflow and infiltration prediction.

A. MANNING’S ROUGHNESS “N”

The industry-standard Manning’s Roughness Coefficient “n” for new and properly-flowing concrete and vitrified clay pipe is 0.013. Based on the condition assessment of the pipelines, there are some pipes in good condition that flow properly. However there are also some pipes with settled debris that limit the flow capacity of the pipe. To account for this, it is recommended to use a Manning’s Roughness Coefficient “n” of 0.014. This value was used for all pipe in the hydraulic model analysis.

B. SEWER GENERATION COEFFICIENTS

Flow monitoring took place during the 14-day period of November 14, 2011 to November 27, 2011 and is summarized in Table 4-3.

There were a total of 27 sites installed, with only 21 sites recording flow. Six of the sites did not record flow because the line was blocked upstream or downstream, or the meter was located downstream from an area that is not currently occupied or generating wastewater.

Table 4-3
Flow Monitor Summary

#	Flow Monitor	Pier	Average flow ^[1]	
			gpm	gpd
1	SMH5135	A	11.1	15,998
2	SMH5140	A	22.6	32,544
3	SMH5290	A	1.6	2,290
4	SMH5545	B	18.6	26,726
5	SMH4430	C	354.2	510,048
6	SMH4280	D	282.2	406,426
7	SMH4335	D	23.6	33,998
8	SMH4090	E	14.2	20,376
9	SMH2780	F	10.8	15,509
10	SMH3150	F	283.5	408,240

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11	SMH2305	G	44.5	64,080
12	SMH2660	G	157.4	226,670
13	SMH3035S	G	9.6	13,795
14	SMH3035W	G	210.6	303,264
15	SMH3120	G	23.6	33,955
16	SMH2390	H	106.3	153,072
17	SMH2155	J	0.1	135
18	SMH1085	T	14.6	21,082
19	SMH1255	T	0.9	1,244
20	SMH1355	T	12.4	17,813
21	SMH1480	T	0.1	154

[1] 14-day average (November 14, 2011 to November 27, 2011)

The 21 sites that recorded flow were used as the basis for developing the sewage generation coefficients. A summary of the average flow over the 14-day period is shown in Table 4-3.

Once the average flows were determined for each of the flow monitors, the GIS Geodatabase was used to conduct the next steps of the analysis. During the next steps of this analysis, a tributary area was determined for each of the flow monitors. A tributary area is the area of land that is upstream of the flow monitor. The flow monitors at the most upstream points in the system had smaller tributary areas, while the monitors at the most downstream points in the system had very large tributary areas. The tributary areas for each of the flow monitors are shown in a later section in Exhibit 5-1. Please note, the tributary areas overlap each other, which can't necessarily be seen on Exhibit 5-1. For example, the tributary area for SMH4430 essentially includes all of South and Middle Harbor (Piers D, E, F, G, H, and J).

The aerial imagery was then used to determine all areas that were within an undeveloped tributary area. Some of the larger areas within the POLB that are currently not developed are on Pier S and Pier A.

The undeveloped tributary area was subtracted from the total tributary area to get a total developed tributary area for each flow monitor. The average flow (gpm) for each monitor and the developed tributary area for each monitor (acres) was used to get an average sewage flow coefficient for each monitor (gpm/ac). A summary of this analysis is shown on Table 4-4.

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Table 4-4
Sewage Flow Coefficient Summary

#	Flow Monitor	Pier	Average flow ^[1] (gpm)	Total Tributary Area (ac)	Developed Tributary Area (ac)	Average Flow Coefficient (gpm/ac)
1	SMH5135	A	11.1	113.3	70.5	0.158
2	SMH5140	A	22.6	114.0	71.2	0.317
3	SMH5290	A	1.6	59.2	59.2	0.027
4	SMH5545	B	18.6	172.9	172.9	0.107
5	SMH4430	C	354.2	1367.1	1306.1	0.271
6	SMH4280	D	282.2	1266.7	1212.8	0.233
7	SMH4335	D	23.6	65.2	58.0	0.407
8	SMH4090	E	14.2	75.1	75.1	0.188
9	SMH2780	F	10.8	48.0	48.0	0.224
10	SMH3150	F	283.5	1026.4	975.2	0.291
11	SMH2305	G	44.5	328.5	328.5	0.135
12	SMH2660	G	157.4	680.1	628.9	0.250
13	SMH3035S	G	9.6	19.5	19.5	0.491
14	SMH3035 W	G	210.6	890.5	839.3	0.251
15	SMH3120	G	23.6	48.5	48.5	0.486
16	SMH2390	H	106.3	398.6	398.6	0.267
17	SMH2155	J	0.1	78.8	78.8	0.001
18	SMH1085	T	14.6	45.9	44.3	0.330
19	SMH1255	T	0.9	44.6	44.6	0.019
20	SMH1355	T	12.4	49.4	49.4	0.251
21	SMH1480	T	0.1	118.0	118.0	0.001

[1] 14-day average (November 14, 2011 to November 27, 2011)

For practicality, the 21 individual sewage flow coefficients were consolidated for use in the model and for POLB's future use. An analysis of the individual sewage flow coefficients was conducted to determine the average of all coefficients, the weighted average of all flows and all tributary areas, and the median of all coefficients. It was determined that the median of all coefficients was the most appropriate value for system-wide flow estimation. A summary of the different factors considered is shown in Table 4-5.

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Table 4-5
Average Sewage Flow Coefficient Summary

Description	Coefficient
Mean of All Coefficients	0.224 gpm/ac
Mean of Totals (Sum of Flows / Sum of Trib Areas)	0.241 gpm/ac
Median of All Coefficients	0.250 gpm/ac
Mean of Coefficients with 5 Largest Tributary Areas	0.259 gpm/ac

For the purpose of estimating future flow, the median of all sewage flow coefficients, which is 0.250 gpm/ac, is recommended. This factor should also be used to estimate existing flow for areas where flow monitoring data isn't available.

C. DIURNAL CURVE

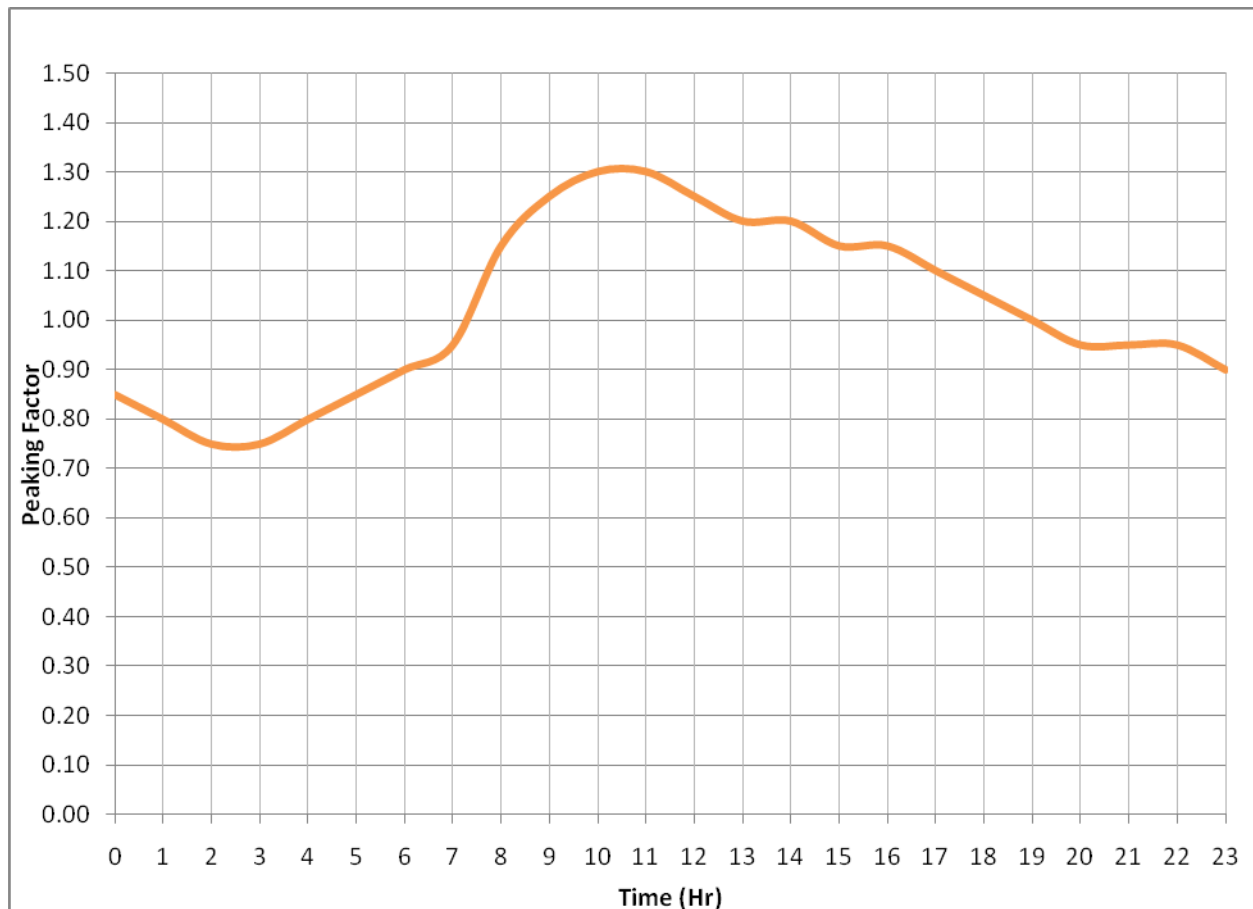
Diurnal curves represent the daily flow fluctuations within a sewer system. A diurnal curve is a plot of the hour-by-hour peaking factors. Each of the peaking factors is calculated by dividing the actual flow at that hour by the average daily flow. In a residential system there will often be peaking factors throughout the day as low as 0.2, such as in the middle of the night, or as high as 2.0 or higher, such as in the mornings when daily activity typically begins. Since POLB exhibits more of a 24-hour operation, the highs and lows of the diurnal curve will be less extreme.

To develop the diurnal curve for POLB, an individual diurnal curve was developed and plotted for each of the 21 flow monitors. It was observed that three of the monitors (SMH1085, SMH1480, and SMH2155) experienced times of no flow, then times of high flow. SMH1085 recorded flow from the Sea Launch facility and SMH1480 and SMH2155 were directly affected by lift station cycles. These three monitors were eliminated from the diurnal curve analysis because they would skew the results.

The remaining 18 diurnal curves were averaged to develop an overall diurnal curve for POLB. The true average of the 18 monitors captured the lows and highs, along with all the small ups and downs of the sewer pattern. This diurnal curve is shown in Figure 4-1.

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Figure 4-1
Diurnal Curve



It should be noted that the recommended diurnal curve represents closer to an average of the 18 flow monitors, and does not represent a “worst case scenario.” There were flow monitors that experienced peaking factors near 2.0, however these were from monitors that had smaller tributary areas. The average diurnal curve shown in Figure 4-1 has a peaking factor of 1.30. The average diurnal curve methodology is recommended because it represents the true conditions of the sewer system as a whole. If the diurnal curve had been developed based on the “worst case scenario” peaking factors, it would not have been representative of the system-wide diurnal pattern.

D. PEAK HOUR FACTOR

Hourly peaking factors are determined from the ratio of the hourly actual flow divided by the total daily average flow. It is recommended to use this peaking factor for future peak flow estimation.

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Applying the peak hour factor of 1.30 to the recommended sewage flow coefficient of 0.250 gpm/ac represents a peak estimated dry-day flow of 0.325 gpm/ac. The existing POLB design criteria estimated peak flow generation to be 2 times the average water demand of 0.246 gpm/ac, or 0.492 gpm/ac. Please note, the recommended values in this report are less than the existing POLB criteria, however the recommended values are from the result of a thorough flow monitoring study, and represent actual conditions in 2011. Since the peak hour factor was developed based on an averaging of flow data throughout the entire system, the factor will tend to be more accurate when applied to larger tributary areas. Smaller tributary areas have more pronounced maximum and minimum flows, which would result in greater peaking factors.

E. INFLOW AND INFILTRATION (WET WEATHER FLOW)

Inflow and Infiltration (I&I) is the amount of “non-sewage” flow entering a sewer system. Inflow is classified as water directly entering the system, i.e. through the manhole covers or direct storm drain connections. Infiltration is classified as water entering the system through seepage at pipe joints or fractures. For the purpose of analyzing I&I within the sewer system, flow monitoring was conducted, and is included in the Sewer Master Plan Report dated May 2013.

For the purposes of planning criteria, a wet weather factor of 1.16 gpm/MH shall be used. This factor is representative of an inflow-dominated storm response during six storm events across the two winters of flow monitoring, which saw system flows increase during storm events due to what was presumed to be water entering the sewer system through manhole covers. The factors developed for this project are appropriate for representing the wet weather conditions observed during the six storm events during the flow monitoring periods.

4.06 SUMMARY OF DESIGN AND PLANNING CRITERIA

Table 4-6 provides a summary of the design and planning criteria recommended for POLB. This criteria was used as part of the hydraulic model analysis and basis for recommendations in the CIP.

PART 4 – SANITARY SEWER

Table 4-6
Criteria Summary

Collection System Criteria		
d/D	New Pipe	Existing Pipe
12" and smaller	d/D ≤ 0.50	d/D ≤ 0.75
Greater than 12"	d/D ≤ 0.75	d/D ≤ 0.90
Velocity		
Minimum	2 ft/s	
Maximum	10 ft/s	
Minimum Slope		
8"	0.0040	
12"	0.0023	
≥ 15"	0.0015	
Lift Station Criteria		
Pumps	Shall be sized so design flow can be pumped with the largest pump out of service (typical configuration: 1 primary pump, 1 back-up pump) Shall be sized to not create deficiency in downstream gravity pipelines (if possible) shall consider peak, average, and minimum flows	
Cycle Time	Minimum: 10 minutes Maximum: 8 hours	
Wet Well	Shall never allow "back-up" into inlet pipelines Entire structure shall be protected from corrosion with protective lining	
Valving	All stations shall have a separate valve vault downstream of the pumps Each discharge line shall have a check valve Each pump shall be able to be isolated while keeping the other pump in service	
Force Mains	Each station shall have two force mains which are interconnected by valving Each force main shall be capable of conveying the design flow at an acceptable velocity	
SCADA	All stations to be equipped for SCADA	
Planning Level Criteria		
Manning's Roughness "n"	0.014	
Sewer Generation (Average Day)	0.250 gpm/ac	
Peak Hour Factor	1.3 x Average Day	
Wet Weather Factor (Inflow)	1.16 gpm/MH	

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5.01 GENERAL CRITERIA

The following general criteria are to be applied to the development of any water system design as part of the design and construction of a Port project.

Water system design and construction shall comply with the following codes and standards, except where specifically noted:

- A. Port of Long Beach Standard Drawings and Specifications
- B. Uniform Plumbing Code, latest edition, as adopted by the City of Long Beach Planning and Building Department
- C. Standard Specifications for Public Works Construction (Green Book), latest edition
- D. City of Long Beach Water Department (LBWD) Standard Drawings and Specifications*
- E. City of Los Angeles Department of Public Works, Bureau of Engineering Manual, and the Los Angeles City Plumbing and Fire Code**
- F. American Water Work Association (AWWA) Standards
- G. The regulations of the California State Department of Health Services, Title 17
- H. The regulations of the City of Long Beach Department of Health and Human Services
- I. The regulations of the City of Long Beach Fire Department, Fire Prevention Bureau
- J. The Manual of Standard Design Criteria, City of Long Beach

*The LBWD standards apply to water main and lateral installations in public streets and easements where LBWD operates and maintains the water mains. LBWD has acknowledged that the POLB may use other materials and modifications of LBWD standards on POLB property.

**The City of Los Angeles regulations apply to water main and lateral installations in public streets and easements where the POLB owns and develops property located within the city limits of the City of Los Angeles.

Water system design calculations and drawings shall be signed and sealed by a Civil Engineer registered in the state of California. The calculations shall be complete and clearly presented, and shall indicate that the design standards have been met.

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5.02 WATER FLOW DEMAND

Estimated water flow demands for future container terminal developments shall be based upon a projected average daily demand of 0.246 gpm per acre of land¹. A peaking factor of 1.72 for maximum day/average day demand¹ shall be used unless otherwise approved by the Director of Engineering Design.

5.03 FIRE FLOW DEMAND

The American Water Works Association defines the required fire flow as “the rate of water flow, at a residual pressure of 20 psi, and for a specified duration that is necessary to control a major fire in a specific structure”. Fire flow includes the required flows for fixed fire extinguishing systems, plus flows for manual fire streams applied by the City of Long Beach Fire Department. The required fire flows can be provided by the Municipal Water System, a private fire protection water supply system, or a combination of these systems.

In general, it is recommended that the fire flow demand for a typical container terminal be three thousand gallons per minute (3,000 gpm), with the consideration that the buildings are protected by sprinklers. Specific fire flow requirements for buildings and structures are provided in the Uniform Fire Code (UFC), which has been adopted by the City of Long Beach Fire Department. Although the UFC also requires that sufficient fire flows be provided for hazards other than buildings, the Code does not typically establish specific, minimum fire flows. Other nationally-recognized standards also require that adequate water supplies be provided for fire-fighting purposes, however, minimum flow requirements are also not typically specified in these standards.

Where specific information on the size and type of buildings anticipated is unavailable, and if the buildings are to be provided with automatic sprinklers, a fire flow of 1,500 gpm would be anticipated. If buildings are not protected with sprinklers, fire flows of up to 4,500 gpm could be anticipated. Flammable and combustible liquid installations may require fire flows as high as 7,500 gpm or greater.

To put these requirements for fire flows into better perspective, it should be noted that typical municipal fire department pumping apparatus are provided with pumps rated at between 1,000 and 2,000 gpm. A single, 2-1/2 inch manual hose line will flow at an approximate rate of 250 gpm, while a typical aerial master stream device can flow at the rate of 1,000 gpm. Flow demands for building sprinkler systems range from approximately 500 gpm, including hose stream flow requirements, to upwards of 1,500 gpm, depending upon the types of hazards protected.

¹ Technical Memorandum W.2 Revision B, Port of Long Beach, Terminal Island Water Master Plans, Water System Demands, Black & Veatch Corporation, May 2000.

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Fire flow requirements are typically based upon the size of buildings and the hazards presented by the buildings or other facilities provided on an individual property. In some cases, high-hazard facilities may dictate high fire flow requirements. It may be considered unreasonable to size a Municipal Water Supply system to provide these higher required fire flows, and may be more reasonable to require the facility with the high fire flows and to provide on-site water supplies and distribution facilities in which to accommodate them.

On the other hand, for large or high-value facilities, in-house risk management programs often call for providing on-site fire protection water supplies completely redundant of Municipal Water Supplies. According to this risk management approach, the Municipal Water Supply is not under the control of the facility, and, therefore, cannot be individually relied upon to serve the perpetual fire protection needs of the facility.

The actual determination of the required fire flow shall be approved by the Long Beach Fire Department, Bureau of Fire Prevention.

5.04 HYDRAULIC ANALYSIS

In general, the water distribution network for a container terminal should be designed based on peak flows derived from the estimated water demands with, in addition, a fire flow of 3,000 gpm at the fire hydrant farthest away from the point of connection to the City Water Main.

5.05 DESIGN FACTORS

In determining the required capacities and pipe sizes of the water distribution network, the following factors shall be considered:

- A. Peak water demand.
- B. Fire flow demand.
- C. During normal conditions, a minimum of 55 psi in the POLB system, which includes a minimum pressure of 40 psi, plus a 15 psi loss through a backflow preventer device and meter.
- D. During fire flow conditions, a minimum of 35 psi in the POLB system, which includes a minimum pressure of 20 psi, plus a 15 psi loss through a backflow preventer device and meter.
- E. Roughness coefficients are 100 for the existing pipes, and 130 for new pipes.

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- F. A peaking factor of 1.72 for the average day demand to maximum daily demand ($MD/AD = 1.72$).
- G. A peaking factor of 3.6 for the average day demand to maximum hourly demand ($MH/AD = 3.6$).
- H. Estimated existing and future water demands for the development.
- I. The water demand for each building shall be evaluated individually based on the Uniform Plumbing Code (UPC) and building use.

The computer analysis of water system design may be used with prior approval from the Director of Engineering Design.

5.06 DESIGN AND GENERAL REQUIREMENTS

- A. All water mains 4-inches and above on POLB property shall be PVC Pressure Class 200, DR14 pipe and gate valves, unless otherwise authorized by the Director of Engineering Design.
- B. All water mains in public streets and easements maintained by the LBWD shall be Ductile Iron Pipe and have gate valves for lines less than twelve (12) inches in diameter, and butterfly valves for lines twelve (12) inches in diameter and larger.
- C. Water lines shall have a minimum cover of four (4) feet.
- D. Backflow preventers for water systems shall be of a reduced pressure type approved by the City of Long Beach Department of Health and Human Services, and meters shall be a type approved by the Long Beach Water Department.
- E. To accommodate the proposed development, the Engineer shall determine the adequacy of the existing water system.
- F. All fire hydrants shall have a 2-1/2 inch auxiliary, top-mounted outlet.
- G. Mechanical joint fittings are allowed on PVC systems, but not on Ductile Iron Pipe systems.
- H. Tapping sleeves shall be stainless steel.

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5.07 SUMMARY OF DESIGN CRITERIA

Table 5-1

Criteria or Standard	Value/Requirements
<i>Water System Operating Pressures</i>	
Water System Minimum Operating Pressure	40 pounds per square inch (psi) under normal operating conditions, including peak-hour demands 20 psi during fire-flow events
Water System Maximum Operating Pressure	80 psi under all operating conditions
<i>Pipeline Hydraulics</i>	
Maximum Pipeline Flow Velocity	8 feet per second under all operating conditions for existing water pipelines, not including fire flows. For new pipelines, the velocity shall not exceed 5 feet/second. This latter criterion shall be used for hydraulic modeling of new pipelines. Under fire-flow conditions, the pipeline velocity shall not exceed 15 feet/second.
Maximum Pipeline Headloss	7.5 feet per 1,000 feet for pipelines up to 16 inches in diameter. 5 feet per 1,000 feet for pipelines greater than 16 inches in diameter.
<i>Pipeline Sizes, Materials and Appurtenances</i>	
Minimum Pipe Size	6 inches for looped and dead-end pipes. Existing 4-inch dead-end pipes are acceptable, provided a 2-inch blow-off is provided near the end of the pipeline.
Asbestos Cement Pipe/Fittings	Allowed only for existing pipelines on a case-by-case basis, and with special conditions agreed to by both parties. Visible or acoustically-detected leaks are not acceptable.
Ductile Iron Pipe/Fittings	Acceptable material for existing pipelines. Visible or acoustically-detected leaks are not acceptable.
PVC Pipe	Existing water system PVC pipes will be allowed only on a case-by-case basis, and with special conditions agreed to by both parties, provided the pipe conforms to AWWA C900 standards.

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	Visible or acoustically-detected leaks are not acceptable.
Pipeline Valves	
Minimum Valve Size	4 inches in diameter.
Gate Valves	For valves 4 to 36 inches in size, the valves shall be the same size as the pipeline where the valve is installed.
Butterfly Valves	Acceptable as system isolation valves in sizes from 4 inches to 12 inches.
Valve Water Main Spacing Requirements	Acceptable as system isolation valves in sizes larger than 12 inches.
	High-density areas = 500 feet
	Transmission mains = 5,280 feet
	Arteries and secondary distribution mains – 1,320 feet
	Combination transmission/distribution mains – 2,640 feet
	Where deemed necessary for system operation.
Fire Flows	
Fire-Flow Requirements	The following criteria are based on the POLB Design Guidance Manual requirements: 1,500 gallons per minute (gpm) for a 2-hour duration for all buildings 500 square feet (SF) or less. 1,500 gpm for a 2-hour duration for all buildings equipped with fire sprinklers and container terminal areas. 3,000 gpm for a 3-hour duration for all typical container terminals, assuming that all buildings in excess of 500 square feet in area equipped with fire sprinklers. 4,500 gpm for a 4-hour duration for all non-sprinklered buildings in excess of 500 SF. 7,500 gpm for a 7-hour duration in all terminal areas and buildings where flammable or combustible materials are stored.

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<i>Fire Hydrants</i>	
Fire Hydrant Type	Wet-barrel. Commercial/Industrial 1-2 ½ x 2-4.
Minimum Hydrant Size	6 inches in diameter.
Maximum Hydrant Spacing	Commercial and industrial areas = 300 feet.
Hydrant Locations	At intersections, middle of blocks (where flows exceed 1,300 gpm), at the end of dead-end streets, on the prolongation of the beginning of curve, or as approved by the fire department.
<i>Water Meters</i>	
Allowable Types	5/8 inch to 2 inches = Positive Displacement Nuating Disc type. 2 inches to 6 inches – Turbine (Class II) 8 inches to 12 inches = Turbine (Class I)
Minimum Water Meter Size	¾ inch
Meter Service Requirements	Each building or tenant area under separate ownership shall have a water meter service.
Water Meter Laterals	Copper only. No PVC, galvanized or other types of pipe.
<i>Back Flow Prevention Devices ^(a)</i>	
Allowable Types	Double-check and reduced-pressure devices.
Allowable Device Sizes	½ inch to 10 inches.
<i>Air/Vacuum Relief Valves and Blow-Off Assemblies</i>	
Installation Requirements	Combination air release/vacuum valves are to be installed at all pipeline high points. Blow-off assemblies are to be installed at all pipeline low points and dead-end pipelines. Minimum size = 2 inches.
<i>Non-Revenue Water Loss ^(b)</i>	
Water System Losses & Goal	Existing system losses not greater than 10%.

Notes:

^(a) Backflow prevention device criteria are for commercial connections.

All backflow prevention devices shall be of the approved types by the Los Angeles County Department of Public Health and the University of Southern California *Foundation for Cross-Connection Control and Hydraulic Research* programs.

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- (b) Non-Revenue Water Loss = Water delivered to the POLB water system through the LBWD master meters (water delivered to POLB tenants + water used for water quality flushing + other quantifiable water losses). Other quantifiable water losses are water losses due to uses such as landscape irrigation and damage to water system assets that can be estimated based on reasonable assumptions and known or published information. For asset damage, the water loss can be estimated based on the time to effectuate repairs, and an estimate of the water loss flow rate from the damaged asset over the period of time required to make the repair.

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PART 6 - UTILITIES

6.01 GENERAL CRITERIA

The following general criteria are to be applied to the development of plans for new utilities, relocation of utilities, and temporary utility services as part of the design and construction of a Port project.

The Project Manager may be required to become directly involved with a third-party utility coordination effort to help the utility understand the Port's priorities.

The Engineer shall prepare a substructure plan showing all utilities, pipelines and structures within and adjacent to the project site. The plans shall indicate ownership, and shall be verified by the Agency or private owners or operators. The Engineer shall provide the necessary coordination for the timely relocation or reconstruction of existing third party utilities.

The Engineer shall resolve interferences between existing utilities and any utility requirements of the project without loss of function, through coordination with agencies and entities which may have data or information on existing conditions including potential obstructions. The Engineer shall obtain any required approval necessary to construct adjacent to and/or over/under their utilities/facilities, and shall coordinate project design to avoid damages.

Where utility relocation or reconstruction will be done by the utility concerned and not by the Port contractor, the Engineer shall coordinate with the utility company to receive a commitment for construction with a schedule appropriate to the Engineer's estimate of when the work must be performed by the utility, such that the construction by the utility will not adversely affect the Port or the Port Contractor. With respect to this provision, utilities include, but are not limited to: Southern California Edison; Long Beach Gas and Oil Department; Long Beach Water Department (Water and Sewer); Los Angeles County Sanitation Districts; City of Los Angeles Department of Water and Power; Verizon; THUMS; TOPKO; private oil companies including: Arco; Shell; Golden West; PetroDiamond; Oxy; Aera Energy; ChemOil; TOSCO; Southern California Gas Company; Equilon; and others; the Burlington Northern Santa Fe Railroad; Union Pacific Railroad; Pacific Harbor Line Railroad; City of Los Angeles Department of Public Works (Sewers); and others.

For any utilities located outside the project area that are affected by the project, the Engineer shall provide engineering services to identify and coordinate their removal or re-routing.

The Engineer shall design any utilities or facilities necessary to support the Project to meet the Port's insurance and risk management requirements. The Project Manager will coordinate with the Port's Risk Management Division, as required.

The Engineer shall investigate, quantify, contact and verify with the applicable utility company that there is sufficient availability of additional utility capacity as may be required for the project.

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Any temporary service requirements for maintaining Port operation(s) during construction shall be identified. Any implementation plan shall be drafted describing when and how to initiate and maintain any such service.

The Engineer shall coordinate the temporary service requirements with the affected utilities. A final, temporary utility services plan shall be submitted to, and approved by the Port. This plan shall indicate work to be performed by contract, by utility owner and by Port personnel. The Engineer shall document submittals to and responses from utility companies, and shall provide assistance to the Project Manager in the preparation of permit applications and in obtaining agreements.

The Engineer shall maintain a written log of all contacts with the utility companies, and shall include such log in the Monthly Status Report.

6.02 DESIGN CRITERIA

All work not included in these guidelines shall conform to the latest edition and amendments of the Standard Specifications for Public Works Construction (SSPWC).

The Engineer shall incorporate the appropriate criteria within the project design and all documentation.

A. CODES AND STANDARDS

The Engineer shall design and conduct work in compliance with all applicable Federal, State and local laws, codes and regulations. The Engineer shall design in accordance with POLB Design Criteria and current applicable codes, standards and regulations.

It is the Engineer's sole responsibility to determine the applicable and appropriate codes and standards that apply to the work. Prior to the start of the design, the Engineer shall contact applicable government agencies to verify that he/she is using their current code(s), standard(s) and regulation(s).

B. PUBLIC SAFETY

The Engineer shall specify such precautions as are necessary to protect all workers engaged in the performance of the work, provide safe passage to and from adjacent areas that may be affected by the work, and protect the public from hazardous conditions, per applicable sections of the California Occupational Safety and Health Act (Cal-OSHA).

The requirements shall comply with the provisions of Subsections 7-10, "Public Conveyance and Safety" of the SSPWC, latest edition, and all subsequent supplements.

PART 6 - UTILITIES

C. TRAFFIC CONTROL

Refer to Part 7 (Streets & Highways), Section 7.22 (Traffic Control) of this Manual.

D. PIPE LAYING

Each pipe shall have a firm and uniform bearing over its entire length.

All pipelines not otherwise specifically provided for shall be constructed of materials which are new, or in such a condition as will ensure satisfactory service and durability in accordance with the purpose of the intended use, and as approved by the Director of Engineering Design.

Upon completion, approved above-ground pipeline installations shall be painted and maintained in a neat and orderly manner, and the immediate area shall be kept free of debris. Guard posts may be necessary in some areas.

E. PAVEMENT REMOVAL

All asphaltic concrete paving shall be neatly cut, outlining the width of the trench. The removed asphaltic concrete and unsuitable excavated material shall not be placed in the backfill, but shall be promptly disposed of.

F. EARTHWORK FOR PIPELINES

Trench excavation and width requirements shall be in accordance with POLB Standard Plan U-1.

1. Excavation

Excavation shall include the removal of all liquid waste and material of any nature that interferes with the construction work. Subgrade shall be the exterior bottom of the pipe. Where the ground on which the pipe or appurtenant structure is to be constructed is composed of soft or spongy material, such material shall be removed and replaced with good, sound earth, sand or gravel, which shall be compacted to not less than ninety percent (90%) relative compaction.

If the bottom of the excavation is found to consist of rock or any material that by reason of its' hardness cannot readily be excavated to a true subgrade, the rock or hard material shall be removed for at least three (3) inches below subgrade, and the excavation refilled to subgrade with good, sound earth, sand or gravel, which shall be compacted as previously stated.

In addition, should unidentified utilities (i.e. pipes, conduits, casings, etc.) be encountered during excavation, the Engineer shall research and identify the unknown condition and determine the required corrective actions to be taken in order to complete the work.

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Excavations for pulling operations and repair of the pipelines shall be confined to a right-of-way five (5) feet on either side of the center of the pipelines.

Excavations shall be made in a manner that will minimize damage to vegetation encountered in the course of the work. Plants in the way of excavation shall be removed and replaced once the work is complete.

2. Trenches

The pipe shall be laid in an open trench unless tunneling is required. No trench shall be excavated more than three hundred (300) feet in advance of the construction, or left unfilled for more than four hundred (400) feet in the rear thereof, unless approved by the Director of Engineering Design. Testing and As-Built survey of pipelines shall be performed before any backfill is allowed.

Where trenches must cross roadways that are in use, the Engineer shall make provision for trench crossings, either by means of backfills or temporary plating, to permit passage of at least one (1) lane of traffic in each direction, and additional lanes if traffic conditions require, as approved by POLB's Traffic Engineer.

Pipelines under existing railroad tracks shall be installed in a pipe casing per the requirement of the SSPWC and POLB Railroad Design Criteria, and is subject to approval by the Director of Engineering Design and the railroad operator.

3. Minimum Width

The minimum width of excavation for pipes in trenches and tunnels shall be the exterior diameter of the pipe, on each side of the pipe, plus the following:

- a. Twelve (12) inches for pipe with bells or collars
- b. Eight (8) inches for pipe without bells or collars

For conduits formed in place in the trench, the minimum width of excavation shall be the external horizontal dimension of the structure. The minimum width under any circumstances shall be twenty four (24) inches, unless otherwise authorized by the Director of Engineering Design.

When required, the trench width may be increased a sufficient amount to permit the placement of sheeting.

4. Maximum Width

The maximum width of excavation for all pipes shall be not more than twenty four (24) inches greater than the exterior diameter of the pipe, up to a point six (6) inches above the top of the pipe, except that it may be widened enough to place sheeting, where required.

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If maximum trench width is exceeded, Engineer-approved additional bedding of high-strength pipe shall be provided, at no additional cost to the Port.

5. Manholes and Other Structures

The excavation for all manholes and other structures shall be sufficient to leave at least six (6) inches in the clear between the outer surface of the structure and the embankment or timber which may be used to protect it. In suitable soil, the excavation may serve as the exterior form for concrete structures, provided the excavation is neatly made at least one (1) inch wider per side than specified, and that fallen dirt and rock is removed prior to placement of concrete.

6. Excavation Shoring

Where an excavation or trench is five (5) feet or more in depth, an acceptable, detailed plan for worker protection from the hazard of caving ground shall be developed. This plan shall show the design of shoring, bracing, sloping and other necessary provisions. If such a plan varies from the shoring system standards established by the Construction Safety Orders of the State of California Division of Industrial Safety, the design shall be prepared, stamped and signed by a current California Registered Civil or Structural Engineer. No shoring, sloping or protective system less effective may be used in such an excavation. No excavation shall commence until said detailed design has been approved by the Director of Engineering Design. The shoring design shall provide for nearby railroad loading and clearance requirements.

G. TRENCHING RAILROAD (When jacking is not required)

Refer to POLB Railroad Design Criteria, April 13, 2011.

H. GROUNDWATER

For trenches placed below the groundwater table in contaminated or possible future contaminated areas, the granular trench bedding shall be sealed with concrete slurry at approximately six hundred (600) feet on center to prevent the movement of contaminated water.

I. BEDDING AND PIPE LAYING

Bedding and pipe laying shall be in accordance with SSPWC 306-1.2, "Installation of Pipe", and Port of Long Beach Standard Plan U-1.

J. BACKFILL AND DENSIFICATION

Backfill of trenches shall be done in accordance with Section 306-1.3 "Backfill and Densification" of the latest edition of the SSPWC. The top three (3) feet shall be compacted to ninety five percent (95%), as determined by field density tests. Testing and As-Built survey of pipelines shall be performed before any backfill is allowed.

PART 6 - UTILITIES

K. PIPELINE TEST

Testing of pipelines shall be in accordance with SSPWC 306-1.4, “Testing Pipelines”, unless otherwise specified.

L. RESTORATION OF SURFACES AND IMPROVEMENTS

Upon approval of pipeline testing and backfill completion, the paved surfaces and ground areas shall be restored in a satisfactory manner and per POLB Standard Plan U-4. All surface improvements damaged or removed shall be reconstructed to the same dimensions. In asphalt/concrete-paved areas, a temporary patch shall be placed with a minimum of twelve (12) inches of compacted base rock and two (2) inches of temporary plant mix in the upper fourteen (14) inches of the trench, or replace to the existing dimensions, whichever is greater. The plant mix surfacing shall be maintained in good traffic condition, smooth and free from bumps and depressions. Prior to placement of plant mixture, the edge of the trench pavement shall be neatly cut to a minimum depth of two (2) inches back from the edge of excavation to sound material. The strip of existing pavement delineated by the saw cut and the edge of excavation shall be left in place until permanent resurfacing is performed, at which time it shall be removed along with the plant mix surfacing. After settlement has taken place, the temporary plant mix, trimmed pavement and the upper four-inch (4”) thickness of base rock shall be removed, adjacent edges of asphaltic concrete pavement shall be cleaned and coated with hot asphalt cement, and replaced with i-kind asphaltic concrete pavement Class B or C1, PG64-10, as specified in SSPWC Subsections 203-6, “Asphalt Concrete”, and 302-5, “Asphalt Concrete Pavement” to a neat and even grade with the existing pavement. In areas where only dirt or base rock exist, the replacement shall be in kind after compacting the backfill material. (Refer to Standard Plan U-1)

The material shall be of such nature and quality that when watered and rolled during the process of paving or base construction, it will thoroughly compact throughout with a hard, unyielding surface, and will not become soft or unstable when saturated with water. All base rock shall be capable of being compacted to at least ninety-five percent (95%) relative density.

M. PIPELINE REMOVAL & ABANDONMENT

In the case of pipelines, the Director of Engineering Design monitors construction projects and requires submittal of As-Built drawings for mapping purposes. The Director of Engineering Design establishes conditions for pipeline removal within the Harbor District. No pipelines shall be abandoned in place without prior written consent from the Director of Engineering Design and the Director of Planning.

Stipulations when pipelines or facilities are removed or abandoned:

1. Prior to removal or abandonment of pipelines, pipelines shall be cleaned in a manner that removes all residue materials. All residue removed from the pipeline, along with

PART 6 - UTILITIES

- any materials used in the cleaning process, shall be contained. All residues and cleaning materials shall be disposed of in accordance with applicable laws and regulations.
2. If the pipeline is removed, excavation, backfill and resurfacing shall be done in accordance with the provisions of these guidelines.
 3. Within POLB's jurisdiction, abandonment of utility lines or pipelines should include the removal of those lines entirely. Exceptions to the general rule of removal consist of abandonment in place, if:
 - a. The line is excessively deep; generally greater than seven (7) feet of cover
 - b. The removal of the line will entail excessive or expensive removal of surface improvements
 - c. The line to be removed is known to pass through a contaminated area; this alone may not be a basis for leaving the line in place
 - d. The removal will cause other inconvenience or excessive expense to POLB
 - e. Any pipeline to be abandoned shall be cleaned and filled with mud-jack material throughout the entire abandoned portion, and both ends of the line plugged. The mud-jack material shall be approved by the Director of Engineering Design.

Design Lookup on 07/11/13 02:05 PM
County: LOS ANGELES Place: LONG BEACH
Grids: 0795A06 0795B06

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MAPREQUESTS@SCE.COM

UVZLAKWD
UTILIQUEST FOR VERIZON - LAKEWOOD

(714)375-6760

XOM03
EXXON MOBIL PIPELINE CO
TERI SHINDE
12851 E 166TH ST
CERRITOS, CA 90703
(310)212-1794



SAMPLE

October 31, 2013

Mr. Rob Streed
BP Pipeline Company/BP West Coast Products, LLC
4 Centerpointe Drive, Room 4-382
La Palma, CA 90623

Re: Utility Information Confirmation Request
Pico Avenue Street Improvement from Pier D St. to Pier E. St.
CWO HA1384, Specification HD-S2471

Dear Mr. Streed:

The Port of Long Beach (Port) is currently preparing designs, plans and specifications to widen and reconstruct the pavement at the following location:

Pico Avenue - Between Pier D Avenue and Pier E Street

The Project will include adding one lane on the west side of Pico as well as reconstruction of the existing pavement section. The enclosed location map includes our GIS record of utilities in the Project area, and is enclosed for your reference (also available in PDF via email). The Port is requesting confirmation of your facility's existence, the location, and depth and size of your utilities in the roadway area, which is indicated by the yellow boundary on the location map. This project is planned to advertise for bid in early 2014.

A Utility Notice Reply Form is enclosed for your use and return. Unless otherwise stated in writing, failure to provide a written response to this Utility Information Confirmation Request will be taken by the Port and the City of Long Beach (City) as if your company does not own or operate any utilities/facilities in the Project area. Furthermore, any impacts on the existing utilities/facilities by either the Port or its contractor(s), and/or impacts on the project and possible subsequent damages/delay claims shall be the responsibility of the facility owner, should it be determined that the facilities in question are in fact owned by your company.

The Port is also requesting information regarding your company's future plans to relocate, repair, replace, or abandon any of the existing utilities within the next five years. The Port has recently adopted the City's policy of placing a five year moratorium on all newly reconstructed streets.

Utility Information Confirmation Request
Pico Avenue Street Improvement from Pier D St. to Pier E. St.
CWO HA1384, Specification HD-S2471
October 31, 2013
Page -2-

SAMPLE

The final due date for a written response to this letter is December 2, 2013. We would like to resolve all potential impacts on the design and construction of this project as soon as possible. Your cooperation is highly appreciated.

Any questions regarding the request should be directed to Ursula Goings by phone at (562) 283-7865, fax (562) 901-1729 or by e-mail at ursula.goings@polb.com

Sincerely,

Neil D. Morrison, P.E.
Director of Engineering Design

NDM/ug

Attachment: Location Map
Utility Notice Reply Form

**Port of Long Beach
Utility Notification Log
(Updated 1/15/14)**

Sample

File Copy

**Project: NORTH HARBOR STREET
REHABILITATION**

Underground Service Alert (USA) (800) 227-2600

Company/Address	Utility Location Requests		Preliminary Notice & Two Sets of Plans		Final Notice & One Set of Plans	Remarks
	Date Mailed	Date Returned	Date Mailed	Date Returned	Date Mailed	
TESORO Mr. Rob Streed 6 Centerpointe Drive, STE 500 La Palma, CA 90623 (714) 228-6526	09/17/13 via UPS	10/07/13				United Postal Service delivered the Plans from TESORO on 10/11/13.
Chevron JAMES DUPREE 16301 Trojan Way La Mirada, CA 90638 (714) 936-6019	10/04/13 via e-mail	10/15/13				AI Super responded that Chevron does not Have facility at our project site.
City of Los Angeles BUREAU OF STREET LIGHTING Mr. Marc Bacierto 1149 S Broadway #200 Los Angeles, CA 90015 (213) 847-1552	09/17/13 via FedEx	10/22/13 via us postage				Lilia Mendoza informed us that City of Los Angeles has no facilities at our project site.
COPH PHILIPS 66 PIPELINES, LLC BILL ORR 1580 E BATTLES RD SANTA MARIA, CA 93454 (805) 925-1468	09/17/13 via UPS	10/21/13 via mail				Leo Martinez submitted the facilities plan for our project site.
Chemoil Refining Corporations Mr. Randy Turek 2365 E. Sepulveda Blvd Long Beach, CA 90810 (562) 883-1905	09/17/13 via ups	10/02/13				Rundy submitted plans for their Pipe Lines On 10/02/13
Crimson Pipeline LP Mr. Ernie Castellon 3780 Kilroy Airport Way, Suite 400 Long Beach, CA 90806 (562)285-4117 (562)233-2436	09/17/13 via ups	10/10/13				They submitted plan for their facilities But it is not detailed enough to know exactly Where it is located. They also want to be Notified during construction so they can mark up their pipes location.
LA County Sanitation District Sewer Design Section Head Mr. Jon Ganz						Joe sent e-mail to Regina @psomas.Regina Informed us they don't have facilities at our project site.
LA Department of Water and Power/Joint Locating Underground Substructure Design Mr. Richard Kussman 111 N. Hope Street, Room 813 Los Angeles, CA 90012 (213) 367-2659	09/17/13 via ups					They did not respond both to mail and e-mails.
OXY Long Beach (which includes both Thums Long Beach & Tidelands Oil Production) Adam Donald 111 West Ocean Blvd., Suite 800 Long Beach, CA 90802 (562) 624-3204	09/17/13 via ups	09/27/13				Adam Donald submitted Plans for their Facilities and also informed us Utility Notification For Thums Long Beach & Tidelands Oil Should be send to him w/ Oxy Long Beach Address.

MCI Verizon Business Dean Boyers 2400 N Glenville Richardson, TX 75082 (972) 729-6322	09/17/13 via ups					They did not respond both to mail and e-mails.
Exxon Mobil Pipeline Co Ms. Teri Shinde 12851 E 166th Street Cerritos, CA 90703 310-212-1794	09/17/13 via ups	10/21/13 Via ups				ExxonMobil has facility at the project site and they submitted their plan.
Oil Operations, Inc. Elizabeth Jordan 2852 Gundry Avenue Signal Hill, CA 90755 (562)988-3534	09/17/13 via ups	10/10/13				James L. Stive responded that Facilities within the proposed job limits are not affected at this time.
Plains All American Pipeline Joe Matteo 5900 Cherry Avenue Long Beach, CA 90805 (562) 728-2368	09/17/13 via ups	09/30/13				Paula Bawden notified us that they don't have Facility at the project site.
Petro-Diamond Terminal Company Pat Kennedy 1920 Luger Way Long Beach, CA 90813 (562) 435-8365 x116	09/17/13 via ups	10/01/13				They notified us they don't have facilities at the Project site.
Paramount Petroleum Corp Mr. Stephen Peyton 14700 Downey Avenue Paramount, CA 90723 (562) 531-2060 x2751 (562) 577-1389 ©	09/17/13 via ups					They did not respond both to mail and e-mails.
QWEST SUE BEAM 700 W. MINERAL AVE LITTLETON, CO 80120 (303)707-6892 Elene.beam@qwest.com	09/17/13 via ups					They did not respond both to mail and e-mails.
Ribost Terminal, LLC Mr. John Dougherty 1405 Pier C Street Long Beach, CA 90813 (562) 432-1737	09/17/13 via ups	11/14/13 via e-mail				They notified us they don't have facilities at the Project site.
SC Edison Transmission/Distribution Mr. Mike Alkhoutoff 2800 E. Willow Street Long Beach, CA 90806 (714) 917-9899	09/17/13 via ups	10/07/13 via ups				Kim Gurule submitted Edison's facilities at The project site.
SC Gas Phil Jenkins 701 N Bullis Road Compton, CA 90221	09/17/13 via ups	12/03/13				Skip Babbitt notified us that they don't have facilities at the Project site.
Valero Refinery Mr. Bill Myers 2402 E Anaheim Street Wilmington, CA 90744 (562) 491-6753	09/17/13 via ups	10/23/13 Usp				Mark Snyder submitted their facility Map on 10/23/13.
City of Long Beach Gas & Oil Mr. Steve Bateman 2400 E Spring Street Long Beach, CA 90806 (562) 570-2034	09/17/13 via ups	10/30/13 Via mail				Aaron Perkins responded that City of Long Beach Gas & Oil has facilities at t our project site.
City of Long Beach Water Mr. Dennis Santos 1800 E Wardlow Road Long Beach, CA 90807 (562) 570-2381	9/17/13 via ups					They did not respond both to mail and e-mails.
City of Long Beach Lights Mr. David Roberts 2400 E Spring Street, Bldg 560 Long Beach, CA 90806	09/17/13 via ups					They did not respond both to mail and e-mails.

(562) 570-2766						
Verizon-Lakewood (714)375-6760	09/26/13 via ups	10/04/13 via ups				Verizon submitted plan for their facility at Project site.



PART 7 – STREETS & HIGHWAYS

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PART 7 – STREETS & HIGHWAYS

The Engineer shall design the streets and highways in accordance with the Port of Long Beach Design Criteria and Standards, Standard Specifications for Public Works Construction, and the Caltrans' Design Manual.

The Consultant shall examine existing traffic data for project streets and highways.

Seventy to eighty percent (70%-80%) of the traffic in the Port is truck traffic, and must be taken into consideration in all aspects of design and operations of roadways within the Port.

7.01 GEOMETRICS

The Engineer shall utilize Caltrans and AASHTO standards, applied to reflect the existing and proposed heavy truck movements determined for the specific project. Streets shall be designed to accommodate Surface Transportation Assistance Act (STAA) vehicles with a fifty-three (53)-foot container, unless otherwise authorized by the Director of Engineering Design. (Reference the Surface Transportation Assistance Act of 1982)

7.02 CURVES

Curves in the roadway can present special challenges to motorists, which, in turn, may require special traffic control devices. Curves may require curve warning (W1, W2, W3, W4, or W5) signs. Where the design speed of the curve is greater than the speed limit and street lighting is provided, then curve warning signage is not necessary; otherwise it should be provided. Where the speed of the curve is less than the speed limit, then the curve warning signs should be supplemented with advisory speed (W6) signs. Curves with a central angle of ninety (90) degrees or greater should be posted with W4 signs.

For curves where the difference between the design speed and speed limit is ten (10) miles per hour or greater, W57 or W81 signage should be installed. W57 signs should be used for relatively short lengths or curves, and should be installed singly facing head-on traffic. W81 signs should be used to emphasize longer curves, and should be spaced so that a minimum of three (3) are in view throughout the curve.

For the location and type of signage to use, refer to CAMUTCD Sections 2C.06-2C.15.

7.03 TRUCK TURNING RADIUS

The Engineer shall consider appropriate truck turning radii for the design of intersections and lane width on curved streets.

PART 7 – STREETS & HIGHWAYS

7.04 CURB RETURN RADII

The minimum curb return radii at street intersections shall be not less than twenty five (25) feet. If there is extensive truck traffic, turning radii shall be designed to accommodate the STAA vehicles, or as directed by the Traffic Engineer.

7.05 LANE WIDTH

The Engineer shall design the street lane widths to be consistent with the volume of truck traffic, turning movements, and as approved by the Traffic Engineer.

7.06 SHOULDER WIDTH

Shoulders and sidewalks shall provide adequate locations for mounting traffic signs, normally a minimum width of five (5) feet.

The following shoulder widths shall be used for the respective roadway configurations:

2 lane (40') minimum road width	8' shoulder/sidewalk
4 lane, truck DDHV under 200	2' shoulder/sidewalk
4 lane, truck DDHV under 200-400	4' shoulder/sidewalk
4 lane, truck DDHV over 400	8' shoulder/sidewalk

If space for adequate shoulders is not available, then provide a wider shoulder on one side of the road.

7.07 SIDEWALK WIDTH

The Engineer shall design the striping in accordance with these standards and appropriate American Disability Act (ADA) requirements. Please refer to the current version of Caltrans Design Information Bulletin 82-05, or the ADA website: www.access-board.gov.

The sidewalk width shall be designed to accommodate both utility poles and wheelchairs. A signal pole may have a base plate as large as two (2) square feet. The setback for a signal pole is two feet, six inches (2', 6") from the face of the pole to the face of the curb, and may have a base plate as large as two (2) squared feet; the minimum clear width for a wheelchair is three (3) feet.

PART 7 – STREETS & HIGHWAYS

7.08 VERTICAL CLEARANCE

The Engineer shall design roadway projects to provide the required vertical clearance of sixteen feet, six inches (16'-6") under an overpass bridge, or as approved by the Director of Engineering Design.

7.09 DESIGN SPEED

Freeways and Expressways	55 mph minimum
Arterials	40 mph
Collectors	30 mph

7.10 PAVEMENT DESIGN

The Traffic Index to be used in the pavement and geometric design of streets shall be coordinated with the Traffic Engineer, and shall reflect projected truck traffic from terminals serviced by the street, as well as future expansion into backland areas. Note that the Caltrans Highway Design Manual recommends a minimum Traffic Index of 12 for ramps in Port areas, and a minimum Traffic Index of 8 for the design of collector streets.

As a minimum, the street structural paving shall be designed to withstand Caltrans HS-25 loadings. If the street is in the backland and container loading occurs regularly, then increased structural paving will be required. If it is considered to be a possibility that the roadway may be incorporated into a terminal area in the future, the pavement design shall be in accordance with terminal equipment loading.

Pavement design shall be in accordance with Caltrans design guidelines for flexible pavements. Design calculations shall be approved by the Director of Engineering Design. For Terminal Backlands Pavement, see Part 8 of this manual, Terminal Planning & Design.

Paving, consisting of Sub-base, Base and Surface Course, shall be designed for the loads and repetitions anticipated over the life of the intended section. For locations with potentially high rutting, the concrete may be used in lieu of asphalt. Bridges and road sections shall be designed to accommodate HS-25 vehicle loading.

To manage the roadway surface condition more efficiently, POLB has developed a Pavement Management System (PMS) that assists in identifying short-term and long-term Capital Improvement Projects (CIP) for upgrading and maintaining the existing roadway network. The

PART 7 – STREETS & HIGHWAYS

objective of the system is to proactively monitor and improve the streets, minimizing the maintenance costs and keeping the streets in optimal operating condition. The system covers all public streets within the Harbor District, excluding the facilities in the terminals. All streets are divided by sections based on the pavement type and age, field inspected and given a score referred to as the Pavement Condition Index (PCI). The program recommends multi-year improvement plans to elevate and sustain the streets to the target condition of a certain PCI.

For any pavement reconstruction, pavement life cycle analysis shall be conducted prior to pavement design. A Geotechnical Report shall be prepared as part of the life cycle analysis. New pavement sections should be recommended while incorporating sustainable paving alternatives, such as Geogrid and rubberized paving materials. Per the POLB Environmental Waste Testing Guidelines, the existing subgrade, consisting of the upper six (6) inches, must be tested for hazardous materials.

7.11 NATIONAL HIGHWAY SYSTEM

Federally-funded improvements on the National Highway System (NHS) must be designed to AASHTO Standards. The following roadways within the POLB have been identified by Caltrans as being on the NHS:

- A. Ocean Blvd on Terminal Island, exiting Gerald Desmond Bridge, ramps to Pico Ave
- B. Pico Ave from Ocean Blvd to North 9th Street and Pier B Street
- C. 9th St / 10th St between Pico Ave and Santa Fe Ave
- D. Santa Fe Ave between 9th St and Anaheim St
- E. Anaheim St between 0.05 miles West of 9th Street and Santa Fe Avenue
- F. Harbor Scenic Drive between the southern terminus of the 710 Fwy and 0.3 miles south of Harbor Plaza
- G. Long Beach Fwy (710 Fwy)

For roads in the NHS, the Design Criteria are listed in the Caltrans Local Assistance Procedures Manual, Chapter 11.

7.12 STRIPING & CHANNELIZATION

The primary function of striping and channelization is to delineate the intended operation and desired travel paths as clearly as possible.

PART 7 – STREETS & HIGHWAYS

Materials used for channelization include:

- A. Raised curb or berm for medians and islands
- B. Raised ceramic and reflective pavement markers
- C. Delineator posts
- D. Painted striping
- E. Permanent and detour-grade pavement marking tape; and
- F. Alkyd-based thermoplastic striping

The Engineer shall provide for the use of alkyd-type thermal plastic pavement markings on roadway projects unless otherwise directed by POLB's Traffic Engineer. Pavement markings shall be designed in accordance with the California Manual on Uniform Traffic Control Devices (CAMUTCD), Caltrans Standard Plans, and Caltrans Standard Specifications.

Raised triangular separator islands are desirable in order to confine an intersection that otherwise would be excessively large. Raised median islands can be used to prohibit left turns, separate opposing flows and provide landscaping opportunities. However, at signalized intersections they can create negatively-offset left turns with restricted visibility. The approach nose of a raised separator island should be marked with reflective white paint. The nose of a raised median island may be marked with reflective yellow paint and/or a Type Q marker if there is no R7 sign. The type Q marker will spring back when hit, thus reducing the burden of maintenance.

Raised ceramic pavement markers may be selectively used where striping requires excessive maintenance. Raised reflective pavement markers may be selectively used where modern street lighting does not exist, however, they shall not be used to delineate right-edge lines.

Flexible delineator posts can be used to delineate the edge of roadway that lacks conventional curbs and modern street lighting.

Painted striping should be used only for detours, or as an interim measure pending alkyd-based thermoplastic striping.

Permanent pavement marking tape may be used to replace short sections of striping that have been removed due to major street excavations. Detour-grade pavement marking tape may be used to cover existing striping and to delineate detour striping for periods of six (6) months or less.

7.13 STRIPING ON NARROW ROADWAYS

Instead of a skip centerline, a double yellow centerline should be provided, as follows:

- A. Where horizontal or vertical alignment limits sight distance below that which is appropriate for the design speed;

PART 7 – STREETS & HIGHWAYS

- B. Within one hundred (100) to two hundred (200) feet of a stop sign, traffic signal or marked crosswalk;
- C. Within one hundred (100) to two hundred (200) feet of a taper, and along the length of the taper.

A double yellow centerline or partial passing centerline shall be provided instead of a skip centerline where two (2) or more lanes are striped in one (1) direction, with one (1) lane in the other direction.

Where a partial passing centerline is used, the skip yellow stripe shall be for the direction with one (1) lane.

A double yellow centerline, raised median island or left turn channelization shall be provided where there is one street with two (2) or more lanes in each direction.

7.14 LEFT-TURN CHANNELIZATION

Left-turn channelization is the most effective tool for improving traffic operation and reducing accidents, such as rear-end, side-swipe, head-on and left-turn types. It is delineated by the two (2)-way left-turn lane, the (unidirectional) left-turn pocket, and the striped median. Generally, it is desirable to operate with at least two (2) lanes in each direction and left-turn channelization (five (5)-lane operation). Where continuous channelization is not feasible due to width restrictions, efforts should be made to install left-turn pockets at signaled intersections, or, alternatively, to restrict them. Generally, a five (5)-lane operation has been shown to operate more smoothly than a six (6)-lane operation without channelization. A three (3)-lane operation has been shown to operate more smoothly than a two (2)-lane off-peak/four (4)-lane peak operation where there is fronting development.

When a street is being reviewed for stripping improvements, the designers of the stripping and channelization need to consider the benefits noted above. Multiple left-turn lanes require special design considerations at standard intersections (i.e. two (2)-way streets, four (4) legs and right angle alignment). They present challenges to left-turn motorists in seeing opposing through traffic and pedestrians in the receptive leg of the intersection. Accordingly, dual left turn lanes at standard intersections shall have protected left turn phasing. A left through lane adjacent to a left-turn presents the same challenges. In addition, this operation can result in lane blockage as left turn motorists wait for gaps in opposing traffic. This operation should be phased separately from that for pedestrians.

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7.15 RIGHT-TURN CHANNELIZATION

All right-turn lanes should be “shadowed” on the far side of intersections. Shadowing for a right turn lane includes an un-delineated curb lane, reduced roadway width, and a raised island or striped island on the departure side. A receptive through lane on the far side of an intersection directly opposite a right-turn lane can result in disrespect or misuse of the turn lane.

Raised islands or other raised barriers for divergences or right-turn lanes should be preceded by painted gores, which should be preceded by barrier lines. In trap lane situations, the barrier line is preceded by lane drop striping, which is preceded by standard lane lines. This hierarchy of striping helps to alert motorists of changing conditions.

Multiple right-turn lanes require special design considerations. Dual right-turn lanes and right plus right-through lanes present challenges to motorists in seeing pedestrians in the receptive leg of the intersection. Accordingly, separate phasing for right turns and conflicting pedestrian movements should be considered, and the dual turn should be evaluated as to necessity.

Channelized right turns having raised triangular islands that separate them from adjacent lanes under traffic signal control can have several types of control. Generally, they are controlled by R1-2 (Yield) signs. However, where the approach speeds are ten (10) mph or below, visibility is restricted, or pedestrian volume is high, R-1 (Stop) sign control is used. Where there is sufficient longitudinal distance for acceleration, a W59 (Merge) sign is posted on the receptive leg of the intersection, and a W54 (Pedestrian Crossing) sign is posted at the diagonal-marked crosswalk near the middle of the raised island. Where the channelized right turn forms a continuous added lane on the receptive leg of the intersection, a W60 (Added Lane) sign is posted, along with a W54 sign as described above. W11 (Lane Drop) signs are not used for channelized right turns.

7.16 INTERSECTION STRIPING

Striping is generally discontinuous through intersections. However, multiple turn lanes, curves, tapers or offsets at or near intersections require supplemental delineation in order to reduce the probability of side-swipe or head-on accidents. Continuous (unbroken) striping through intersections is not generally used for this purpose, as it would eliminate an important clue relating to intersection presence. Accordingly, short lengths of broken lines, known as “cat tracks” are used within intersections.

7.17 MARKED CROSSWALKS

- A. Marked crosswalks shall be installed where:
 - 1. Pedestrians are allowed to cross at signalized intersections
 - 2. A pedestrian crossing is necessary, but a legal, un-marked crosswalk does not otherwise exist.

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- B. They may be installed at a location where:
 - 1. Pedestrian crossings are frequent and the warning devices associated with the marked crosswalk will so advise motorists
 - 2. It is desired to advise pedestrians of a preferred crossing
 - 3. It is desired to channelize pedestrians to a single crossing
- C. Marked crosswalks shall be aligned so that they meet two criteria:
 - 1. There is a buffer zone between the edge of the marked crosswalk and the adjacent lane of parallel traffic
 - 2. The area between the middle of the curb return and the point of intersection of the crosswalk lines is not so great so as to inadvertently invite the pedestrian to wait in the street.

7.18 PAVEMENT MARKINGS, LEGENDS & SYMBOLS

The size and shape of pavement markings, legends and symbols shall be consistent with those shown in the CAMUTCD and Caltrans Standard Plans, or as specified by POLB's Traffic Engineer.

At the first location with stop sign control along a route preceded by two (2) or more traffic signals, "Stop" pavement messages should be installed at the limit lines, and advance "Stop Ahead" pavement messages and signing should be installed on the approaches to supplements R1 and W17 signage. These same traffic control devices should be used on approaches with angle parking.

"Wait Here" pavement messages should be installed in conjunction with the limit lines where:

- A. The stopping point is not at the marked crosswalk
- B. Pedestrian crossings are prohibited and the intersection has an unusual alignment such as a skew
- C. Pedestrian crossings are prohibited and the approach speeds are forty (40) mph or greater, so as to improve target value

Pavement arrows are installed at the beginning of turn and optional turn lanes. They are also installed mid-length within long turn lanes.

"Keep Clear" pavement messages supplement regulatory signs, such as R65, R66 and R90 signs. Otherwise, they are advisory and unenforceable.

7.19 GUIDE SIGNS

The intent, placement, color and shape of guide signs within the Port are to be in accordance with standards as shown in the Port Guide Sign Program (see HD8-384 and subsequent



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drawings). They shall be consistent with Caltrans guidelines and the existing Port Guide Sign Program.

The Pier Gateway-type guide sign shall be placed after most road turnoffs. Their purpose is to assure that traffic is going in the right direction.

7.20 TRAFFIC SIGNALS

All signals within POLB are maintained by the City of Long Beach Public Works Department and/or Caltrans. All signal designs and modifications must conform to the City of Long Beach and/or Caltrans standards (See the Electrical Section of these Standards).

For the following signals, the signal timing is controlled by Caltrans:

- A. Ocean Blvd/SR 47
- B. Ocean Blvd/Pier S Ave
- C. I-710/Pier B St/9th St

7.21 COMMUNICATION LINES

A two-inch (2") diameter conduit for proposed or future communication lines shall be included in the design of new or reconstructed streets. Prior to inclusion of the conduit in the project plans, the alignment location shall be approved by the Director of Engineering Design.

7.22 TRAFFIC CONTROL

Project roadway plans must contain a Traffic Control Plan that is approved by POLB's Traffic Engineer.

As part of the Harbor Development Permit procedures, prior to any construction that requires temporary roadway closures within POLB's Right-of-Way, the project owner shall submit a traffic control plan. This plan must be reviewed and deemed acceptable by POLB's Traffic Engineer prior to any work performed, and must be prepared according to the requirements in the 2012 California Manual on Uniform Traffic Control Devices (CAMUTCD). The traffic control plan shall be signed and sealed (wet-stamped) by a current State of California registered Traffic Engineer. However, with prior approval from POLB's Traffic Engineer, a plan prepared under the supervision of a Civil Engineer may be acceptable.

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In order to minimize the number of reviews and expedite the approval process, it is recommended that the design engineer preparing the plans begin the process with a conceptual plan to be reviewed by POLB's Traffic Engineer. This will allow the design engineer to be made aware of any unusual traffic conditions or concerns within the construction area.

The design engineer must conduct a field investigation prior to preparing Traffic Control Plans, and attach a minimum of two pictures of the site showing any street name signs and speed limit signs in the vicinity. Vertical and Horizontal sight distances impacted by the closure must be examined and deemed to meet the AASHTO street design guidelines. When closure affects an intersection, the CA Legal (Caltrans) truck turning templates or equivalent must be applied for all turning movements.

The traffic control plans should be prepared using POLB standards at the time. They should be drawn to scale 1" = 40' or that which has been determined by POLB's Traffic Engineer. All first submittals should be "full size" 22"x34" or 24"x36". Copies of POLB Basemaps are available by contacting Robert Lepage (562-283-7873) or via email at robert.lepage@polb.com.

The contents of the traffic control plan should include the following, but are not limited to:

- A. Project Vicinity Map (no scale required) and POLB's **Traffic Control General Notes** on first sheet.
- B. Legend, sign chart, HDP #, north arrow, sheet numbers and scale on all sheets.
- C. Clearly demarcate all existing stripes and markings to remain, to be removed, and all proposed striping and markings for each construction stage. Show appropriate Caltrans stripe detail numbers to be used.
- D. Show dimensions of the existing striping. Cross sections may be used to clearly illustrate lane width.
- E. Show total roadway width at the start and end of the taper, the length, lateral shift and/or the slope of the taper, and the design speed.
- F. Show dimensions (length and width) and locations of work area of each phase using nearby fixed objects as reference. Label and dimension the beginning and end of a taper and buffer zone.
- G. Show dimensions of travel lane width, shoulder width, sidewalk of each phase, and the overall roadway or bridge width along the length of the area to be affected by the traffic control.
- H. Show location of existing pedestrian paths and pedestrian detour route of each stage of construction.
- I. Clearly show the locations of existing signs (including speed limit signs) as well as the proposed signs for each construction stage.
- J. Clearly identify locations of arrow boards and CMS signs with messages to be displayed.
- K. If K-rail is required, clearly identify location of crash cushions at the beginning of K-rail and where K-rail deflection is more than required 10:1. Indicate array type per Caltrans standard plans.

Multiple stages may be shown on a same sheet if the work will be performed concurrently, otherwise only one stage of work shall be shown.

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The following notes shall be on the Traffic Control Plans:

- A. The contractor performing work in a public street is responsible for installing and maintaining the traffic control devices as shown herein, as well as any such additional traffic control devices that may be required to ensure the safe movement of traffic and pedestrians through or around the work area, and maximum protection and safety to construction workers.
- B. At least ten (10) working days in advance of implementing any construction detour or lane closure, the Contractor shall notify the Traffic Engineer for the Port of Long Beach at (562) 283-7881, and e-mail to trafficcontrol@polb.com, for approval.
- C. The Port of Long Beach reserves the right to observe the implementation of traffic control plans and to make any changes if necessary, or to direct the contractor to make any necessary change warranted by field conditions. Any changes shall supersede the previously-submitted plans.
- D. This plan reflects typical traffic control plans. Prior to work commencing, special application of sections of this plan, with starting and ending dates of each stage of work, must be individually accepted by the Traffic Engineer for the Port of Long Beach.
- E. All traffic control devices and their installations shall conform to 2010 State of California Standard Specifications, 2012 CAMUTCD and 2010 Caltrans' Standard Plans, or latest edition of these materials.
- F. If used at nighttime, all delineators or cones shall be equipped with reflective bands.
- G. Any vehicle path being modified longer than two weeks shall be painted, not marked by cones or delineators.
- H. Unless K-rails are placed along the open trench, barricades with flashing beacons shall be placed at each end of any open excavation and at intervals of not more than fifty feet (50') along such open trench, until the excavation is entirely backfilled and resurfaced.
- I. Maintain five feet (5') minimum clearance between work zone and the edge of the adjacent travel lane.
- J. By the end of the workday, or when the work area is unmanned, any open trench and/or excavation shall be back-filled or covered with steel plates with anti-skip marks.
- K. Except when K-rail is used, a five foot (5') minimum clearance must be maintained between any open trench (excavation) and Edge of Travelled Way.
- L. All traffic control devices shall be kept in their proper positions at all times, and shall be repaired, replaced, or cleaned as necessary to maintain their functions and continuity.
- M. Prior to any change in the traffic pattern, all conflicting stripes, pavement markings and legends shall be completely removed by grinding or other methods approved by the Traffic Engineer.
- N. Contractor shall provide flaggers as deemed necessary. Flaggers shall be trained per requirements specified in the 2012 CAMUTCD, chapter 6E.
- O. In each lane that is closed, place additional "LANE CLOSED" (C30 (CA)) signs and/or "OPEN TRENCH" (C27(CA)) signs at least 150-foot intervals throughout extended work areas.
- P. All temporary traffic control devices shall be removed following completion of each construction stage, and permanent traffic control devices shall be restored by the contractor upon completion of the project.

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- Q. If necessary, Contractor may cover all existing speed limit signs and replace with C17(CA) (XX MPH Road Work Speed Limit Sign) during construction.
- R. At the end of each work day, Contractor shall replace and/or repair all damaged striping with temporary striping or raised pavement markers.
- S. Contractor shall maintain safe pedestrian access at all times.
- T. Contractor shall cover or remove all conflicting signs. These signs shall be restored once the project has been completed.
- U. If uneven pavement occurred during construction, the Contractor shall post uneven pavement signs. The contractor shall ramp vertical pavement offsets of one inch (1”) or more with asphalt for smooth transition.
- V. For any traffic signal adjustment, contact Traffic Operations, City of Long Beach at (562) 570-3263, at least ten (10) working days in advance.
- W. Work hours of this project: ____ a.m. to ____ p.m., Monday through Friday. Duration of this project is: ____ working days, and is to be broken down by construction phases.

7.23 STREET LIGHTING

The Engineer shall provide street lighting design and plans in accordance with the requirements and standards provided in the Electrical section of these guidelines.

Street lighting system shall be controlled by Photocell.

7.24 FIRE PROTECTION

If required, the Engineer shall provide the design and plans for fire hydrant assemblies. The Engineer shall utilize the criteria and standards in the Water section of these guidelines. Plans and supporting documentation shall be provided for review and approval by the Long Beach Fire Department and if the project is outside of the Harbor District, the Long Beach Water Department.

7.25 STREET FENCING

The Engineer shall design the street fencing to be set back to provide adequate site distance for driveway egress, and to allow for the placement of traffic signage.

Street and highway fencing shall be eight-foot (8') high chain link with three (3) strands of barbed wire atop the chain link fencing. Posts shall be embedded in three-foot (3') deep concrete bases. (See Standard Plans for Public Works Construction).

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7.26 STREET LANDSCAPE/IRRIGATION

The Engineer shall design all street improvement plans to include provisions for landscaping in accordance with Part 10 of this manual.

Any landscape plan shall be approved by the Director of Engineering Design.

Trees whose diameter could possibly grow to a diameter larger than four (4) inches should not be planted closer than nine (9) feet from the edge of the way of travel. The Engineer shall take into consideration all aspects of driver safety in their landscape design.

7.27 AGENCY PARKING LOTS

With input from POLB, the Engineer shall determine the number of parking spaces required for agency parking lots, as well as project ingress and egress requirements and locations. The Engineer shall prepare alternative layouts to assist in the selection of a preferred alternative.

A. PAVING

Unless otherwise directed by the Director of Engineering Design, asphalt concrete pavement shall be used for agency parking lots and their access.

A minimum Traffic Index of five (5) is required for auto parking areas, while a minimum Traffic Index of six (6) is required for truck parking areas. Consult with POLB's Traffic Engineer for final Traffic Index, loading and other requirements for the paving design.

Minimum pavement section will be 3" AC on 6" CMB.

B. STRIPING

Striping plans, parking lot layout and geometrics require approval by POLB's Traffic Engineer and the City of Long Beach Fire Department.

Unless otherwise directed, parking stalls shall be nine (9) feet wide. When space permits, parking stalls may be separated by double white lines eighteen (18) inches on center.

When possible, the Engineer shall minimize the use of "compact only" stalls. The placement of "compact only" and handicapped stalls will require approval by the Port of Long Beach Traffic Engineer.

C. WHEEL STOPS

Unless otherwise directed, the Engineer shall limit the use of wheel stops in the parking lot design. Wheel stops should be used to avoid damage to walls, buildings, fences and above-grade facilities.

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D. MEDIANS

Paved or landscaped medians may be required as a part of the parking lot project plans.

Median surface treatment and landscaping shall be designed while taking into consideration pedestrian circulation, obstruction to parked vehicles and sight requirements.

E. SECURITY

With input from POLB, or as directed by the Director of Engineering Design, the engineer shall provide for installation of, or provision for, future security systems.

These systems may include fencing, gates, lighting, guard booths, communications, traffic ingress and egress control devices, closed circuit TV (CCTV) surveillance and recording systems, fence breach detection systems and motion detectors.

F. SIGNAGE

The Engineer shall provide the design and layout of informational and directional signage to the satisfaction of the Port of Long Beach Traffic Engineer, and in compliance with these standards, ADA requirements and the City of Long Beach Municipal Code.



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The following general criteria are provided to assist in the development design of the Backlands element of a Port of Long Beach (POLB, Port) Terminal Project. Much of this section deals with providing guidelines towards the development of the Conceptual Plan for the project. Following completion and approval of the Conceptual Plan, the Engineer shall use the standards provided herein, as well as within other sections of POLB Standard Plans and Design Criteria Manual, in the preparation of the Project Plans.

8.01 TERMINAL PLANNING

A. GENERAL CRITERIA

Elements of a terminal consist of a wharf, backlands, on-dock rail yards, gate and support buildings. Terminal planning has to address these elements, as well as off-site access facilities, for efficient ingress and egress.

Basic to the start of the development process is the gathering of information. Information on lease boundaries are available from the Port, and can be provided to the Engineer by the Port's Project Manager.

The Port generally provides for the site Geotechnical Investigation, determines the need for, and provides for any remediation requirements. The Engineer should fully review this information with the Port's Project Manager.

With the data research underway or completed, the Engineer shall prepare base plans for development of the terminal concepts. These base plans are to be used to develop several conceptual alternatives. Generally three will be expected, however, the number shall be decided mutually by the Engineer and his team members.

To accurately define project goals and requirements, several meetings may be required of the Project Team. If the Project Site, or a portion of the Site, is an operating terminal or facility that must remain in service, additional requirements must be identified for the conceptual plans in regards to the development of construction phasing.

1. Possible goals for the Port may include:
 - a. Ensure efficient access
 - b. Enable efficient and economical future site expansion
 - c. Provide terminal layout and fixed facilities adaptable to future Tenants or operations

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- d. Minimize or eliminate off-site access roadway queues
 - e. Identify infrastructure conditions and required improvements
 - f. Maintain project and adjacent operations during construction
2. Possible requirements of the Tenants may include:
- a. Ability to meet projected operation capacity
 - b. Maximize land useage
 - c. Minimize truck turn-around time
 - d. Maximize density and throughput without sacrificing efficiency
 - e. Ensure automation at industry standards or above
 - f. Provide efficient gate complex designed for economical, future expansion, if necessary

The conceptual plans and estimates shall be developed, reviewed and revised as necessary, to a degree where one alternative can be identified as the Preferred Alternative.

To accomplish these goals and requirements, an interactive process by the project team begins with the selection of a Preferred Alternative. The culmination of this intensive effort will be in the form of a Project Design Criteria Manual.

The Project Design Criteria Manual will be reviewed by the tenant and shall be presented to the Port for acceptance and approval.

The Project Design Criteria Manual, included in the Project Design Documents, shall address all elements of the Terminal. The criteria and standards to be followed in the design of individual elements are included in this section, or elsewhere in this manual.

The following is the general criteria for the Master Planning of the major terminal components, which includes wharf, backlands layout, gate and fixed facilities:

1. WHARF

The size and number of berths may be fixed due to location constraints and adjacent developments. The determination of the initial wharf size and possible future wharf expansion shall be made by the Port. The number and capacity of wharf cranes to be provided will be determined by the Port and tenant.

Using tenant-supplied data on anticipated ship schedules and lift counts, the Engineer shall analyze, by approved model methods, the demand for dock cranes, berths, working

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track and container storage capacity. The results of this effort will allow for balanced allocation of land resources.

Design criteria and standards to be used in the wharf development are referenced in POLB Wharf Design Criteria.

2. BACKLANDS LAYOUT

Working in close concert with the Port and tenant, the Engineer shall develop several layout alternatives. These alternatives shall address the tenants' requirements, operation plans, results of model analysis, as well as flexibility for expansion and possible future changes in tenants and operations.

Storage areas for the various storage types shall be determined by computer analysis utilizing input on dock and intermodal crane productivity, operating schedules, ship loads and intermodal loads.

The resulting area requirements shall be modified for the proposed tenant operations, and utilized in the preparation of the backlands layout alternatives.

The resulting layout alternatives shall reflect the size and locations of various storage types, receiving and delivery gates, buildings and other ancillary facilities and functions.

3. GATE

The Engineer shall develop a gate complex in conjunction with the Terminal layout. A computer simulation model shall be utilized for the proposed gate operation plan and based upon the projected peak day load arrival pattern.

The number of stations and queue lengths shall be determined, and a layout provided, which would prevent excessive queues during operating hours. The design shall consider possible expansion requirements, to be provided both economically and efficiently.

4. FIXED FACILITIES

Concurrent with the site planning effort, the Engineering Design team shall conduct the building planning process. The design team shall work toward developing criteria and alternative proposals for the design of permanent structures and buildings that will be needed to support the proposed terminal operation.

Based upon research of similar terminal facilities, tenant requirements, staff interviews and site visits, a list of required buildings with their room descriptions, square footage requirements and other operational considerations shall be developed. When approved, the information shall be used to develop building block diagrams for each building.

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The back-up data and building block diagrams, when approved, shall be used to develop conceptual floor plans for each building. These floor plans shall be developed responding to functional requirements, placement in the site, and Terminal function interaction and internal circulation. Systems shall be coordinated to ensure compatibility and shall maximize the potential of each building for materials chosen, structural and mechanical systems, environmental and energy considerations.

Building footprints will be incorporated into the various backlands layout alternatives. Placement of the buildings shall take into consideration access, circulation, interference with terminal functions and compatibility with terminal expansion, as well as possible change in further operations.

The Engineer shall conduct a computer simulation model and planning study to analyze the performance of alternate terminal layout efficiency for equipment utilization and truck traffic circulation. Following a careful review of the results of the analysis, an agreed-upon, preferred alternative will be selected.

The selected alternative will be reviewed, refined and modified, as necessary, until its inclusion in the Project Basis of Design (BOD). If required by the project, phase construction drawings that address the Port and Tenant requirements shall be prepared.

Once completed, the Engineer shall present the Project Master Plan with the back-up data used in the design of the conceptual plan. The manual shall also address all of the individual elements of the plan in sufficient detail as to provide the BOD for the project construction documents. Probable construction costs will be developed for project approval and funding.

8.02 GRADING

The Engineer shall design terminal improvements utilizing the following criteria, unless otherwise directed by, or as approved by, the Director of Engineering Design.

The grading shall be designed for the proposed terminal operation, to include flexibility for future operations. Design constraints affecting terminal grading are based upon the requirement that all areas of the terminal be capable of supporting wheeled and top-handler operations.

In general, grades should not exceed 1%. Additionally, contour lines should be parallel to the wharf, which should also be parallel to the long axis of grounded containers.

Unless otherwise authorized, the minimum design flowline slope shall be 0.7% for asphalt, and 0.25% for concrete.

Maximum grade break shall be 2.0%.



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All pavement grades shall be designed to meet or take into consideration the existing grades in adjacent, developed backlands without creating ponding conditions.

Since much of the Port property is adjacent to the ocean, and subject to a high ground water table and tidal action, the Engineer shall take the following into consideration:

- A. Limited placement of substructures within the groundwater table
- B. The tidal action within substructures, like storm drain systems, which outlet into the harbor
- C. The desirable elevation for final grade shall be elevation 15 M.L.L.W. (Mean Lower Low Water) Minimum elevation shall be 12 M.L.L.W

Existing catch basins on the proposed grounded storage areas will be relocated. To accommodate top handlers, all underground structures shall be designed for 150 psi on a 460 sq. in. footprint.

In general, all drainage shall be directed away from railroad tracks and structures.

The Engineer may be required to obtain a grading permit from the City of Long Beach Building and Safety Department.

8.03 PAVING

A soil report indicating R-values and unified soils classification is necessary to design structural pavement sections.

Pavement shall be asphalt concrete or Portland Cement concrete designed for the traffic patterns, repetitions and maximum equipment loads anticipated for the terminal. Generally, the pieces of yard equipment that control the design are the very large top picks or reach stackers that are used for container stacking. The Engineer shall obtain the pavement loading criteria for the equipment they intend to use from the tenant.

Unless otherwise authorized or approved, pavement subject to container loading equipment shall be designed for 100 KIP wheel loads (20KIP/Sq. Ft.), plus 25% impact loads.

Most of the container terminal shall be paved with asphalt concrete. Portland Cement concrete may be specified in special-use and high-use areas.

Traffic type and loading shall be identified for each part of the site.

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8.04 STRIPING

Striping criteria for the design of streets and highways serving a Terminal Backlands Project is provided in Part 7 – Streets & Highways section of this manual.

Paint is the preferred medium for striping within terminals.

Collector roadways shall be striped, providing lane widths to accommodate the intended equipment use. Collector roadways, when adjacent to the motor legs of RTGs or the back of wheeled storage, shall be lined with Jersey barriers. Concrete barriers shall also be used where the roadway straddles light poles or other obstructions.

The Engineer shall submit striping, fencing and fire hydrant layout plans to the Long Beach Fire Department for review and approval.

Layout of container yard storage areas and circulation lanes shall be based upon input from the Port and the tenant.

Unless otherwise directed by the Port, or approved tenant requirements, the Engineer shall design container storage striping in accordance with the following criteria and standards:

- A. 4-inch wide, white paint striping shall be used for designation of all chassis and stacked container spaces.
- B. Chassis stalls shall be 8 feet wide with 2-foot wide spaces between stalls.
- C. Stacked container spots shall be 8 feet wide with 16-inch spaces between container spots, and 20 feet long and 2-foot spaces between container spots.
- D. Painted numbers and letters used to designate chassis stalls and stacked container spots shall be 3 feet high, and white.

For additional details on container storage, see the Container Storage standards in this section. [Part 8 – Terminal Planning & Design, 8.10 Container Storage]

8.05 SIGNAGE

Signing within terminals shall avoid using the colors yellow and red, except for warning and STOP, YIELD and WRONG WAY signs.

Row signs shall be 23 feet high, have 2-foot high letters and numbers painted on metal sheeting, and be protected by steel pipe bollards or concrete barrier rail.

The Engineer shall obtain information from the tenant to address the tenants' proposed operation in consideration with the design of the terminal signage plan.

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Buildings should each be designated by a letter mounted near the top of the building, and on the roof for Police Department use, as approved by POLB's Traffic Engineer, the Fire Department and the City of Long Beach Zoning Code.

Off-site signage shall be designed in accordance with the standards of POLB's Traffic Engineer and the existing Port Guide Sign Program.

8.06 FENCING

Terminal perimeter fence shall be 8-foot high chain link with three strands of barbed wire atop the fence, in accordance with Standard Plans for Public Works Construction, and shall include a ¾-inch thick steel wire rope running longitudinally at approximately 3 feet above the ground surface. Fence components shall be galvanized.

Posts shall be embedded in 3-foot deep concrete bases. Pavement underlying the fence may be required to extend a minimum of 2 feet beyond the fence.

Fencing along the streets should be set back to provide an adequate sight distance for driveway egress, and to allow for placement of traffic signage.

All perimeter chain link access gates shall also incorporate crash gates, composed of heavy structural pipe or tubing, with locking devices and a Long Beach Fire Department-approved Knox box.

Interior fencing shall be as required by the Tenant's operations, parking lot layouts and security and employee access requirements.

Fence and gate criteria and standards shall be in accordance with this manual, or the Tenant's requirements, as approved by the Director of Engineering Design.

Fencing plans shall be reviewed and approved by POLB's Traffic Engineer, and may require submittal to the Long Beach Fire Department for approval.

8.07 SECURITY

The primary terminal security shall be provided by chain link fence topped with 3 strands of barbed wire; see Fencing in this section [Part 8 – Terminal Planning & Design, Fencing 8.06]. Because of possible vehicle intrusion exposure, the Port may require that the fence be set atop a continuous, precast concrete barrier in lieu of the use of a ¾-inch steel wire rope running longitudinally above the ground. In which case, the chain link fabric above the concrete barrier shall be 5 foot, 4 inches high, so that the resultant distance from the pavement to the top of fabric shall be at least 8 foot, 0 inches.

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Vehicle access gates shall have security stations manned, as required, to monitor pedestrian and vehicle access to the terminal.

In addition to the fence and gate system, a closed-circuit TV (CCTV) surveillance and recording system may be required to mitigate the risk created by perimeter fence lines exposed for long durations.

The Engineer shall use the POLB Electrical Design Criteria for the design of electrical security systems.

8.08 [NOT USED]

8.09 PRIVATELY OWNED VEHICLE PARKING LOTS

The size, configuration, location and access for tenant parking shall be determined in the Terminal Planning process.

The Engineer shall ensure that each parking lot has internal circulation.

The design shall incorporate standard parking stalls of 9 feet by 19 feet, unless otherwise approved by the Director of Engineering Design. The Engineer shall minimize the use of “compact only” stalls. Handicap stalls shall be provided in compliance with the State of California Architectural Barriers Law Requirements. The type and location shall be as approved by POLB’s Traffic Engineer.

Wheel stops in parking lots should only be used to avoid damage to walls, buildings, fences or other structures.

Raised parking row medians between parking rows are preferred, rather than the use of wheel stops.

Parking lot landscaping shall be contained within raised curbs. Landscaping that would be an obstruction to pedestrian circulation should be avoided. See Part 10 - Landscape & Irrigation section of this manual.

The Engineer shall design the parking lot pavement for the anticipated load conditions and expected life, and based upon the soil investigation and related recommendations. The minimum pavement section for areas not subject to heavy loading shall be 3 inches of asphalt concrete on 6 inches of aggregate base.

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8.10 CONTAINER STORAGE

A. GROUNDED RTG STORAGE

The grounded storage areas should be striped with container spots 20 feet long by 8 feet wide. The end-to-end clearance between containers shall be 2 feet, and the side-to-side clearance shall be 1 foot, 4 inches. At minimum, the corners of each spot shall be striped. A typical grounded striping plan is presented in POLB Standard Plan BK-5.

B. WHEELED AND REEFER CONTAINER STORAGE

Wheeled storage striping slots shall be 10 feet wide and 40 feet, 0 inches from the face of the wheel stop to the edge of the stripe adjacent to the aisle. A typical wheeled storage striping plan is presented in POLB Standard Plan BK-2. Herringbone wheeled storage striping shall be at a 60° angle. Where slots are against a barrier, a 5 foot clearance shall be provided. Aisles serving chassis parking areas shall be a 65 foot minimum.

Reefer receptacles shall be mounted in low-profile concrete pedestals not more than 13 inches high. The pedestals should be designed to support a loaded truck's maximum wheel load without failure. Each pedestal should hold four reefer receptacles, two facing one way and two facing the opposite way. The pedestals should be located about every 20 feet along the centerline of the space between bumper blocks in reefer-wheeled rows so as to maximize the reach of the cords.

Power conduit should be located in the future wheeled reefer storage locations.

The Engineer shall design an electronic reefer monitoring system, or make provision for a future system that shall include conduit between the reefer storage areas and the maintenance and repair building. Such systems typically use the power conductors for data transmission. The tenant shall determine the specific system required.

The reefer monitoring system shall report the following to a computer located in the Maintenance and Repair Building:

1. Reefer unit operating status
2. Power consumption
3. Reefer internal temperature
4. Malfunctions

The system may use the power conductors for data transmission. Malfunctions shall set off an audible alarm and flashing light at the Maintenance and Repair Building.

PART 8 – TERMINAL PLANNING AND DESIGN

C. GROUNDED EMPTY STORAGE

The grounded empty storage areas should be striped for container spots 20 feet long by 8 feet wide. The end-to-end clearance between containers shall be 2 feet, and the side-to-side clearance shall be 2 inches. At a minimum, the limits of the storage width by 20 feet length should be striped. The minimum working aisle width between storage stacks shall be 65 feet. A suggested grounded empty striping plan is presented in POLB Standard Plan BK-6.

D. CORRELATION OF PAVING JOINTS AND STORAGE STRIPING

In order to facilitate a pavement maintenance program, the paving joints should be located near the centerline of containers in the RTG grounded storage area. The paving joints are based upon the assumption that the pavement section in the storage area is different from the RTG runways. Transverse paving joints should be located 22 feet on center across the entire yard. This is based on the assumption that the planned pavement section for transverse aisles between the storage will support the gantrying of unloaded RTGs, and that runways will not be required.

8.11 MISCELLANEOUS STRUCTURES

Prior to 50% Design submittal, the Engineer shall have sufficient soil data in the vicinity of his proposed structures, for his use in developing the structural calculations and plans.

Paint and protective coating systems shall be specified for the resistance and durability capabilities for a saltwater marine environment.

Manhole and vault structures and covers, as well as other structures which may be subject to container equipment loading, shall be designed for 100 KIP wheel loads plus 25 KIP impact loads.

Concrete in the Port shall be designed to incorporate the hazards of weather and moisture encountered in the marine environment. It is important to maintain a water/cement ratio of 0.40, and a minimum cover of three (3) inches over the reinforcing steel. If the structure is over or near the water, a special evaluation should be done to check chloride infiltration. This evaluation must consider the expected life of the structure, the minimum cover over the steel, the rate of chloride attack and the protection afforded by any corrosion inhibitor additive used.

The Engineer shall request and receive approval by the Director of Engineering Design before providing for the use of epoxy-coated bar reinforcement and wire reinforcement.

If the Geotechnical Investigation Report indicates the possibility of unsuitable material being present under the structure foundations, the Engineer shall so indicate on the plans and require over-excavation and replacement by aggregate base.

PART 8 – TERMINAL PLANNING AND DESIGN

Design Criteria for various structures shall be as follows:

A. LIGHT POLES

Light pole foundations shall be designed for the location-specific soil pressure from the Geotechnical Investigation Report, or 1,000 psf.

Design wind loads shall be in accordance with the Uniform Building Code requirements using height gust factors.

B. DOLLY STRIPS

Portland Cement concrete dolly strips shall be provided in chassis parking areas for chassis landing legs to be placed upon. The dolly strips shall be designed for the same equipment loads as the container yard equipment, since that equipment may traverse the strips when chassis are not using the space.

C. RTG RUNWAYS

6-foot wide reinforced concrete runways shall be provided in container stacking areas served by Rubber-Tired Gantry cranes (RTG). The Engineer shall obtain from the tenant the geometric and wheel loading data for the RTG equipment they intend to use, and will design the runways for that equipment.

8.12 WATER

The Engineer shall design water systems for the terminal project in accordance with the approved project conceptual plans, unless otherwise authorized by the Director of Engineering Design.

In addition to the design criteria and standards in Part 5 - Water section of this manual, the Engineer shall design the system in accordance with the following criteria and guidelines:

- A. To the maximum extent possible, fire hydrants shall be located adjacent to the light poles, and protected by the bollards surrounding the light poles. See POLB Standard Plan E-210.
- B. Fire hydrants shall be located so that a 350-foot long fire hose attached to a hydrant and pulled by a fire truck is able to reach at least one side of every container storage area.
- C. Placement of backflow preventers shall comply with City of Long Beach Water Department standards.

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- D. Generally, connection to a fire hydrant lateral should be avoided. If connection must be made, the fire hydrant lateral must be a minimum of an 8-inch diameter.
- E. For new waterline improvements where fire hydrants are to be placed, the fire hydrant and valving that are in line to the mainline are to be bid as one (normally called fire hydrant assembly). In addition to the water valves adjacent to the fire hydrant, this assembly shall include any gate valves required in the run from the mainline.
- F. Water meters shall be placed in the location, and to the size, approved by the Maintenance Division and if the project is outside of the Harbor District, the City of Long Beach Water Department.
- G. Water line material shall be ductile iron unless otherwise approved by the Director of Engineering Design. ABS, PVC and HDPE have been approved for use within the terminals.
- H. Water systems providing fire hydrants require approval of the Long Beach Fire Department.

8.13 GAS

Natural gas service to the Port is provided by Long Beach Gas & Oil (LBGO). The design of gas mains and services shall be based on the standards and specifications of LBGO.

Unless otherwise authorized, gas mains shall be of steel pipe and house connections of either steel or polyethylene pipe.

All natural gas meters shall be located as a result of coordination with the Port, tenant and LBGO.

The Engineer shall fully coordinate his design with the Port, and shall submit plans and specifications for the gas main installations to the Port and LBGO for review and approval.



PART 9 – UNDERGROUND/ABOVE GROUND STORAGE TANKS

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PART 9 – UNDERGROUND/ABOVE GROUND STORAGE TANKS

Fuel storage tanks shall be designed to meet the applicable requirements of the current Uniform Fire Code (UFC).

The Engineer shall locate above-ground storage tanks in accordance with the following clearance requirements, the UFC, or as directed by the Long Beach Fire Department:

- A. Minimum distance from property/lease line: 50 feet
- B. Minimum distance from nearest building: 25 feet
- C. Minimum distance between tanks: 25 feet

The Engineer shall provide for an automatic gauging system for detecting leaks.

Underground tanks located in areas where they may become buoyant due to a rise in the water table, or in areas which are subject to flooding, shall be anchored in a manner which will prevent their floating and/or unsafe movement.

A tank foundation shall be at least one (1) foot thick and structurally designed for the intended load. It shall have sufficient mass to counterweigh the full buoyant forces on the tank when submerged and empty.

Underground tanks shall be located so that:

- A. They are not less than one (1) foot from a wall, basement or pit
- B. They are not less than three (3) feet from the property line
- C. They are at least one (1) foot apart
- D. Loads carried by existing building foundations and supports cannot be transmitted to the tank
- E. The amount of maneuvering necessary for the tank truck making the product delivery to reach the fill openings is minimized
- F. Where subjected to vehicular or other superimposed loads, they are installed at least four (4) feet below the lowest grade, or covered with at least eighteen (18) inches of non-corrosive inert material (e.g., clean sand or pea gravel) well tamped in place, plus six (6) inches of reinforced concrete slab that extends two (2) feet beyond the extremity of the tank.
- G. Where there is no vehicular traffic, they are installed not less than two (2) feet below the lowest grade



PART 9 – UNDERGROUND/ABOVE GROUND STORAGE TANKS

- H. The tank truck making the product delivery will not:
 - 1. Be on a public right-of-way
 - 2. Block motorists' view of roadways
 - 3. Impede the flow of vehicles or pedestrians
- I. They are set on a firm bottom foundation of at least twelve (12) inches of non-corrosive inert backfill material, such as clean sand or pea gravel, well tamped in place on the top, sides and ends of the tank.

Tanks which have remote fill shall be equipped with automatic closing devices installed in the fill line to prevent filling the tank more than 95%, plus an audible alarm to sound when 90% full.

- A. Tanks requiring a vapor recovery system shall have a vent pipe with a nominal inside diameter of not less than two (2) inches
- B. Vent pipes shall have the capacity to prevent back pressure from building up to 2.5 psig
- C. Vent pipe shall terminate at:
 - 1. No less than eighteen (18) inches above the highest point of the building roof when that point is within fifteen (15) feet of the pipe termination
 - 2. Twelve (12) feet above adjacent ground level or floor deck
 - 3. No less than ten (10) feet from a building opening
- D. In cases of one fill only, vent pipe shall be not less than 1-1/4 inch in diameter
- E. A semi-horizontal run (1/4-inch fall per one (1) foot of horizontal run) should be considered

Tanks shall be provided with approved spill and overflow prevention equipment.

For the possibility of an oil and fuel spill that may run to catch basin locations, the Engineer shall design the catch basin to be fitted with a valve system, which would normally be kept closed to stop spills from entering the system and traveling to the water. The valves would be opened prior to rain events.

All service openings at ground level or above, or leading to the primary tank or secondary containment, shall be:

- A. Designed so as to be liquid tight, not allowing any drainage or contamination to accidentally enter through the opening



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- B. Installed a minimum of one (1) inch above adjacent ground level
- C. A minimum of four (4) inches in diameter; probes must be serviceable

The tank and all associated pipes and equipment shall be compatible with methanol in accordance with AQMD Rule 1170.

The Engineer shall conduct a site analysis, the results of which will influence the selection of materials for parts and fittings, as well as the location of the underground/above ground tank. The site analysis shall include:

- A. Characterizing the corrosivity and stability of the soil at the selected site
- B. Evaluating the site's specific needs for ground water protection
- C. Locating and identifying nearby structures, such as utility lines, sewer lines, etc.
- D. Every new facility shall be designed and constructed with secondary containment; double-wall tank and double-wall pipes
- E. Concrete vaulting shall not be used to provide secondary containment for tanks or lines due to the vaulting's propensity for cracking and structural degradation as a result of aggressive soil conditions and geological shifts
- F. Dispensing devices shall be listed by an organization acceptable to the City of Long Beach Building and Safety Department, the; "authority having jurisdiction"
- G. The dispensing device shall be mounted and bolted on a concrete island and protected against collision damage. Installation shall be in accordance with the manufacturer's instructions
- H. Hose lengths at service stations shall not exceed eighteen (18) feet, and shall be "listed"
- I. A dispensing area shall be located at street level, with no dispenser located more than fifty (50) feet from the vehicle exit to, or entrance from, the outside of the building
- J. Fiberglass-reinforced plastic pipes shall not be used above ground
- K. Fiberglass-reinforced plastic pipes used underground in tank installation shall be U.L.-approved and stamped with the U.L. seal
- L. Flexible joints shall be provided in lines at points where the piping connects with the tanks, and where the piping ends at the pump islands and vent risers



PART 9 – UNDERGROUND/ABOVE GROUND STORAGE TANKS

The Engineer shall submit plans, details, specifications and manufacturers product data to the Long Beach Fire Department, Long Beach Department of Building and Safety, and POLB for reviews, approvals and permitting prior to the 50% Design submittal.

For wash-down facilities where the collection point of the facility is exposed to rainwater runoff, a rainwater diverter must be installed to the City of Long Beach Water Department and Regional Water Quality requirements. This diverter would allow the diversion of the waste flow, normally to the sewer, to be diverted to the storm drain after a specified amount of rainfall. The reset must be automated.



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PART 10 – LANDSCAPE & IRRIGATION

10.01 INTRODUCTION

The following criteria establishes standards for the unification and improved appearance of all public right-of-ways, tenant areas and other areas accessible to the public within the Harbor District, and the following criteria are to be applied to the development of the landscape as a part of the design and construction of a Port project.

Unity is based upon establishing a limited general plant palette, derived from a combination of successful existing material and proposed plant material with a high resistance to wind, salt and pollution. Decorative and low-maintenance characteristics are also primary criteria.

Unity is further reinforced by subdividing the plant palette into unique groupings to be used only within prototypical areas throughout the Port or Harbor District. Each grouping combines large scale trees and shrubs that are appropriate for the physical parameters and primary function of the prototypical area. Secondary plants provide a smooth transition to neighboring areas.

Improved appearance will be derived from the installation of plant materials appropriate to the harbor area's microclimate. An important attribute of these plants is the ability to thrive even with reduced maintenance. Long-range benefits include: a unification of the various phased projects over the next few years, a standard landscape edge providing both a directional backdrop and screen, and a separation of both tenant and recreational uses from the industrial harbor areas.

Please see the POLB Standard Plan L-1 for Landscape Element Map, and concepts for planting areas designated on the map. Tenant area landscape and irrigation maintenance requirements are also included in the standard plan.

Refer to the POLB Sustainable Landscape Palettes for the latest recommendations for sustainable landscaping practices and plant palettes.

10.02 GOALS

The purpose of this section is to provide Engineers, Contractors and POLB staff with landscape design/implementation criteria for tenant and Port-operated facilities for the following:

- A. Enhance visual perception of the Harbor District
- B. Minimize service and maintenance by the standardization of materials and flora
- C. Provide uniformity of landscape treatment and compatibility with the surrounding environment and adjoining buildings
- D. Facilitate the execution of landscape activities in the Harbor District to meet the needs of the Port and surrounding community

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10.03 PROTOTYPICAL DESIGN ELEMENTS

The design elements are distinctive plant groupings that can be arranged in a number of sequences to unite the various routes experienced by a visitor traveling to the harbor by automobile from the surrounding areas. The elements are divided into four basic types:

- A. Nodes: Decision points in the roadways such as intersections
- B. Edges: Long, narrow areas generally referred to as the “right-of-way”
- C. Slopes: Edges with modifications to accommodate changes in elevation
- D. Areas: Surrounding headquarters, offices, recreational elements and their respective parking areas

Each basic element is further subdivided, as described below.

A. NODES

- 1. Gateway: The first intersection (Node) a visitor experiences upon exiting the freeway, crossing a bridge ramp, or otherwise entering the harbor area. The planting and arrangement is large, formal and supported by walls and other distinctive features to signal an arrival at the Harbor District.
- 2. Intersection: A break in the street and/or linear planting. Formal trees provide drivers with an advanced indication of an intersection while traveling among large trucks.
- 3. Major Medians: Larger islands used to separate traffic with planting. These range from formal tree rows to simple stone set flush with the top of the curb, depending on the type of traffic and adjacent usage.
- 4. Minor Medians: Traffic islands less than four (4) feet in width to be filled with masonry units.

B. EDGES

- 1. Major Screens: Linear planting areas. These areas should have enough width to allow staggered plant layouts and still provide landscape visual buffer between roadways and harbor industrial areas.
- 2. Minor Screens: Very narrow, linear areas. These areas should have room for a hedge row type of layout.

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3. Buffer Areas: Small, intermediate areas exposed to the public between individual lease lots or along the rights-of-way, which do not fall into other guideline categories.

C. SLOPES

1. Harbor Scenic Drive Edge: A dual-purpose element that will block the harbor foreground along the west edge of Harbor Scenic Drive and soften the distant harbor elements from downtown Long Beach. This will be achieved with low shrub massing and skyline trees.
2. Bridge and Ramp Slopes: A dual-purpose element that will soften vertical structures and provide a transition to the flat plane of the harbor dock level.
3. Interior Lease Area Slopes: An element that will provide screening for the elevated portions of the interior and stabilize unpaved slopes.

D. AREAS

1. Tenant Improvement Areas: Portions of leased areas that are visible from the right-of-way, and areas of high employee use, such as entries and lunch or break areas.
2. Public Areas: Open public gathering areas related to sport fishing and harbor viewing areas.

E. TRANSITION ELEMENTS

Each design element plant list has designated the plant species to be used to cross the boundary between element areas. The transition plant is normally the smallest of particular category and should be used in the foreground to link the plant groupings of the adjacent element areas.

F. TYPICAL SCENARIO (Refer to the POLB Standard Plan L-1)

A visitor traveling south on Route 710 and exiting onto Ocean Boulevard would first arrive at a formal gateway, and then proceed along either Ocean Boulevard or Pico Avenue, with screening along the edges between secondary intersections, and punctuated by tall, formal tree groupings. Continuing south on Pico Avenue, a backdrop would be provided along the east edge by major and minor screens along Harbor Scenic Drive. These backdrops will link openings at tenant areas where the tenant element and the interior slope elements would screen the working part of the harbor view.

A visitor arriving southbound on Route 710 and continuing south on Harbor Scenic Drive, or crossing the Queensway Bridge, would experience the combined existing commercial and Harbor Scenic Drive theme at a major gateway/median entry just east of the harbor.

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10.04 DESIGN CRITERIA

The Port of Long Beach Engineering Design Division/Maintenance Division will use these guidelines to evaluate proposed landscaping plans in conjunction with Harbor Development Permit Conditions.

A. LANDSCAPE MASSING

1. Consistent with long-range POLB programs (Port coordination)
2. Provides buffers between utility areas and public areas
3. Supports visibility for safety and sign recognition, plus operational clearance (sight lines, signage and truck radius overlays to be shown on the site plan; note vertical clearance to be maintained)
4. Compatible with site lighting (major lights to be located on plan)
5. Smooth transition to adjacent property and public right-of-way
6. Provide appropriate shelter from prevailing winds
7. Accent structures and public entries

B. SPECIFIC PLANT MATERIAL SELECTION

1. Define major plant groupings and demonstrate their primary locations on the site plan
2. Consistent with the POLB Standard Plans
3. Layout anticipates wind and provides mutual protection
4. Suitable for site-specific soil (attach soil test)
5. Optional plant materials to be tolerant of industrial pollution, wind-born salt and brackish groundwater, high in drought-resistance and low in necessary maintenance (see Salt Tolerant list for recommendations, POLB Standard Plan L-13)

C. AREAS TO BE LANDSCAPED

All facilities should provide landscape treatment for the following areas:

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1. Areas lying between the property line and the perimeter fence/wall, especially areas which abut and extend along the public right-of-way
2. Open areas surrounding and within buildings (i.e. adjacent to or within the maximum building footprint), which includes areas such as courts, patios, outdoor restrooms, employee rest areas, ingress/egress areas, front internal service drives, etc.
3. Areas within and adjacent to parking lots, especially entries, exits and ends of parking rows
4. Areas not otherwise covered by paving/buildings or that are specially designated for purposes other than landscape development
5. Any visually-offensive areas such as storage, refuse or laydown sites

D. WIND

1. Windbreaks and Screening Configurations: Landscape designs should assist in alleviating the problem of airborne dust and sand by using windbreaks and screening configurations (e.g. walls, berms, mounds, trees, large plantings) where appropriate
2. Ground Areas: To reduce the problem of blowing and erosion of sand and dust:
 - a. Ground areas should be covered (ratio of trees, shrubs, ground cover and grass in extensively landscaped areas must be reviewed by the Landscape Architect).
 - b. A 3-inch layer of composted green waste should be used between shrubs where ground cover is not used.
 - c. A layer of 8- to 12-inch diameter river run granite stones, grouted or ungrouted depending on application and location, may be used to cover places not covered with paving, shrubs or grass, or in lieu of other ground cover plantings or hardscape material. The use of such material requires approval from the Director of Engineering Design.

E. GLARE/HEAT REDUCTION

1. Shade: Landscaped areas shall respect orientation principles which maximize the potential for shade and reduction of glare. As an example, efforts should be made to maximize shade in car parking areas by planting trees on a grid layout to promote the development of a closed canopy.

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2. Heat Reduction: Materials and constructed elements exposed to direct sunlight should be selected to minimize conduction and convection heat gains. Due to temperature variations, ample expansion and control joints for all landscape pavements/structures are required. Large, uninterrupted expanses of pavement should be avoided, where possible.

F. SOILS

Soils are a governing condition at POLB. In the Pico Corridor area soils can usually be amended or leached. In some terminal areas where waste disposal has occurred over time and operations have left the soil unsuitable for plant growth, replacement is sometimes required.

For bidding purposes, and in association with design development, agronomic soils testing shall be performed. Testing can be performed by a laboratory such as Wallace Laboratories, El Segundo, California (310-315-0116). Recommendations from this testing shall be included in the specifications and/or Appendix for Contractor reference.

NOTE: This does not alleviate the Contractor from further testing during the construction process.

G. DEFINITION OF “CLASS A TOPSOIL”

1. General

Topsoil shall be free of roots, clods, stones larger than one (1) inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.

Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil. Total pore space content on a volume/volume basis shall be at least 15% when moisture is present at field capacity. Soil shall have a field capacity of at least 15% by weight.

2. Gradation Limits

Soil shall be a loam or sandy loam. The definition of soil texture shall be the USDA classification scheme.

3. Permeability Rate

Hydraulic conductivity rate shall be not less than one (1) inch per hour, and no more than twenty (20) inches per hour when tested in accordance with the USDA Handbook Number 60, method 34b, or other approved methods.

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4. Fertility

The range of the essential elemental concentration in soil shall be as follows:

	Ammonium Bicarbonate/DTPA Extraction Parts per Million (mg/kilogram) Dry Weight Basis
Phosphorus	2-40
Potassium	40-220
Iron	2-35
Manganese	0.3-6
Zinc	0.6-8
Copper	0.1-5
Boron	0.2-1
Magnesium	50-150
Sodium	0-100
Sulfur	25-500
Molybdenum	0.1-30

5. Acidity

The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0-7.9.

6. Salinity

The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60)¹ shall be 0.5-2.0 dS/m (Decisiemens per centimeters). If calcium and sulfate ions both exceed 20 milliequivalents per liter in the saturation extract, the maximum salinity shall be 4.0 dS/m.

7. Chloride

The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

8. Boron

The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

¹ USDA Handbook Number 60. Diagnosis and Improvement, Saline and Alkali Soils. Issued February 1954, reviewed and approved for reprinting August 1969. United States Department of Agriculture, U.S. Government Printing Office, Washington, D.C., Stock Number 001-000-00763-7, Catalog Number A 1.76-60.

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9. Sodium Adsorption Ration (SAR)

The maximum SAR shall be 6 measured (Method 20b, USDA Handbook Number 60).

10. Soil Organic Matter Contents

Sufficient soil organic matter shall be present to impart good physical soil properties, but not be excessive to cause toxicity or excessive reduction in the volume of soil due to decomposition of organic matter.

11. Calcium Carbonate Content

Free calcium carbonate (limestone) shall not be present.

12. Heavy Metals

The maximum permissible elemental concentration in the soil shall not exceed the following:

	Ammonium Bicarbonate/DTPA Extraction Parts per Million (mg/kilogram) Dry Weight Basis
Arsenic	2
Cadmium	2
Chromium	10
Cobalt	2
Lead	30
Mercury	1
Nickel	5
Selenium	3
Silver	0.5
Vanadium	3

If the soil pH is between 6.0 and 7.0, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

13. Phytotoxic Constituent, Herbicides, Hydrocarbons, etc.

Germination and growth of plants shall not be restricted more than 10% compared to standard controls. Standard controls shall be both monocots and dicots. Total petroleum hydrocarbons shall not exceed 100-mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons

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(benzene, toluene, xylene and ethylbenzene) shall not exceed 2-mg/kg dry soil measured per EPA Methods No. 8020.

H. PLANTING MATERIALS

1. Selection

Planting materials shall be selected from the Harbor Department-approved Plant and Materials list (available in the POLB Standard Plans) and be compatible with zone 24, per the current edition of Sunset's Western Garden Book (seaside conditions). In addition, all plant selection, size and number, as well as site storage, installation and maintenance, shall conform to the sections of the drawings and specifications which govern landscape materials in public areas.

2. Planting Emphasis

Plantings should emphasize the use of broad-leaved evergreen trees (flowering where possible), palm trees and shrubs. Deciduous trees may be utilized, but consideration should be given to leaf drop and structural form. Grey/green leaf plants should be de-emphasized, except where needed for contrast and/or accent purposes. High-impact landscape (e.g., trees, palms, colorful accent plant materials) should be considered in areas frequented by the public.

3. Hydroseeding

Hydromulched seed material may be considered. However, the specified plant species considered for hydroseeding must be reviewed and approved by the Director of Engineering Design. Irrigation or watering will be required to support growth.

4. In Parking Lots

Trees should be used throughout a parking lot to break up the "sea of asphalt" effect. Canopy trees should be used between rows, with accent or contrasting types of trees at row ends.

I. FERTILIZERS

Both mineral and organic fertilizers are essential to meet pre-planting specifications.

J. USE OF ACCENT PLANTING

Design efforts should utilize accent planting techniques for those sites requiring any of the following:

1. The modulation of large, open-space areas

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2. The delineation of major points of orientation
3. The provision of legibility (e.g., the denotation of landmarks)
4. The accentuation of the built environment

K. USE OF CLIMBING PLANTS AND VINES

Climbing plants and vines, trained on pergolas, fences, walls and other structures should assist in providing:

1. Flowering color
2. Overhead shade
3. Cover for unsightly objects
4. Green, leafy walls (clinging vines are not to be placed on building walls)
5. A deterrent to graffiti

L. USE OF GRASSED AREAS

If practical, grassed areas should be considered in:

1. Courtyards, public gathering places and areas surrounding pedestrian walkways
2. Front yard areas
3. Front ingress/egress areas and medians, where appropriate

M. USE OF BERMS

Berms (earth mounds) should be incorporated into the landscape design wherever possible, as they can:

1. Modulate flat terrain
2. Assist in reducing noise, wind, dust and visual pollution
3. Assist where soil lifts are required
4. Exaggerate and highlight landscape

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N. ALKALINE GROUNDWATER

1. Soil Lifts: Imported soil lifts (mounds) should be considered to raise the rootball zones above the alkaline groundwater table.
2. Capillary Break: Intensely-planted areas may need a capillary break (layer of subgrade drainage gravel with a separator and perforated agriculture drain tiles) to divert alkaline groundwater.
3. Salt-Tolerant Plants: Salt-tolerant plants should be considered where the local elevation is low and close to the groundwater.

O. UNOBSTRUCTED VISION

In all instances, landscape designs shall ensure that plantings do not obstruct motorists' field of vision. Shrubs should not grow above three (3) feet, and trees should not hang lower than nine (9) feet from the ground within fifty (50) feet of an intersection. See POLB Standard Plans L-14 and L-15.

P. PARKING LOT LANDSCAPE DESIGN

1. Shrub Spacing/Effect: Shrubs should be spaced so that they can grow to their natural size without overlapping. They should be offset to give a natural growth effect and minimize pruning (hedging and row effects are undesirable).
2. Use of Continuous Planting Strips: These strips are not acceptable between parking rows where they may be in conflict with natural pedestrian circulation patterns.
3. Use of Raised Medians: Where raised medians are used in lieu of wheel stops, all designs (landscape, hardscape and irrigation) should work together to minimize maintenance and damage from vehicle overhang/drippage.
4. Curbs and Islands: All parking lot surface landscape should be surrounded with a six (6) inch curb for protection; islands should have radii to be compatible with vehicular circulation patterns.

Q. AREAS DESIGNATED FOR FUTURE EXPANSION

Any areas reserved for future expansion should be provided with appropriate landscape screening, complimentary to surrounding or adjacent landscape schemes, along street frontages.

The Preliminary Planting Plan is to be submitted to the Director of Engineering Design and Maintenance early in the design phase to provide maximum benefit in coordination of all parts of the site for design and efficiency in the final result.

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Civil and Hardscape Review Items:

1. All property/lease line and easements located on all appropriate plans
2. Handicapped and general safety issues addressed
3. Sight drainage and waste water properly contained
4. All walls and fences located

R. PLANTING REVIEW ITEMS

1. Soil analysis and corresponding soil preparation schedule
2. Planting legend, including botanical and common names, container sizes and minimum plant structure. POLB Standard Plans establish minimum sizes.
3. Provide yearly maintenance schedule for users to use in obtaining long-term maintenance.

S. FINAL SITE REVIEW AND CERTIFICATION

Provide As-Built record set on mylar before final turn-over of the project.

10.05 GENERAL LANDSCAPE MAINTENANCE GUIDELINES

A. BASIC MAINTENANCE REQUIREMENTS

Tenant areas not otherwise part of POLB's maintenance program should provide the following, basic landscape maintenance services:

1. Tenant areas shall be kept neat and tidy at all times.
2. All debris/trash accumulated as a result of maintenance operations shall be removed from the site.
3. All landscaped areas shall be adequately watered and fertilized to maintain plant materials in a thriving condition.
4. Trees shall be groomed, as required, to control form and size. Dead or low-hanging branches shall be removed. Misdirected branches and branches against buildings shall also be removed.
5. Dead or missing shrubbery or groundcover shall be replaced.

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6. All walkways shall be kept clear of debris from the maintenance operations, erosion, run-off from storms, irrigation and windblown debris.
7. Maintenance shall occur weekly.
8. All irrigation systems shall be maintained in working order.
9. Tenant or Tenant's representative shall make annual inspections of landscaped areas and file with POLB a written report of observations and recommendations. The report shall include a full inspection of irrigation systems for both operation and coverage.
10. All drainage lines and catch basins shall be cleaned as needed.
11. All parking areas shall be kept free of debris.

10.06 IRRIGATION

The following criteria are to be applied to the development of the irrigation as a part of the design and construction of a Port project.

A. INTRODUCTION

The following criteria establish standards for the design and installation of irrigation systems to support landscaping in public right-of-ways, tenant areas and other areas accessible to the public within the Harbor District.

This section is to provide the following:

1. Irrigation systems to provide the appropriate coverage and water amounts to maintain existing or proposed landscaping.
2. Minimize service and maintenance by the standardization of materials and equipment.

B. CONCEPT DESIGN

It is the intent of these guidelines to implement State Water Conservation Ordinance AB325, and to provide irrigation equipment compatible with a future conversion to reclaimed water, as it becomes available. The intent of introducing a reclaimed water system is to reduce irrigation cost and ensure the ability to maintain the landscape during periods of drought.

Site landscape designs organize plant material into compatible hydrozones for irrigation valving. Planting areas relate to efficient irrigation head layout for uniform infiltration, and prevent overspray onto unplanted areas.

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As operation times are established, irrigation schedules shall take into consideration the hours of facility operation and seasonal wind.

Designer shall consider using drip systems including drip lines where it is applicable.

Central control irrigation system shall be used such as the Calsense ET2000e or equivalent.

C. DESIGN CRITERIA

POLB will use these guidelines to evaluate proposed irrigation plans in conjunction with Harbor Development Permit conditions. Irrigation plans and documentation should not be started until approval by the Director of Engineering Design of the Landscape Preliminary Design has been completed and returned to the Engineer. Approval is based upon compliance with the overall purpose and intent of the plans.

1. General Irrigation Estimations and Design Factors:
 - a. Describe basic hydrozones and type of irrigation system
 - b. Describe automatic controls and system override features
 - c. Provide gross AB325 summary estimate
 - d. Establish point of connections for water and electricity for review
2. Irrigation and Utility Review Items:
 - a. Domestic water and electricity points of connection
 - b. Future reclaimed water provisions detailed and required separations noted to accommodate future tie-in
 - c. Completed AB325 irrigation calculations and tables
 - d. Controller scheduling chart
 - e. Critical system hydraulic calculations
 - f. Pressure and flow at valve at highest elevation
 - g. Pressure and flow at valve at lowest elevation
 - h. Valve with highest gallons per minute (GPM) and gallons per hour (GPH)
 - i. Valve with lowest GPM and GPH

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- j. Calculation sheet indicating valve sequence number, total GPM/GPH, elevation of valve, water meter and highest irrigation head or emitter, total friction loss through all irrigation equipment and piping, operating PSI of irrigation head or emitter, and residual PSI.