Appendix H Infrastructure Technical Report

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SOUTHEAST AREA SPECIFIC PLAN

INFRASTRUCTURE TECHNICAL REPORT FOR HYDROLOGY, SEWER, WATER, & WATER QUALITY

City of Long Beach
County of Los Angeles, California

Prepared For

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full circle thinking®

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APRIL 6, 2016

TABLE OF CONTENTS

1. INTRODUCTION & BACKGROUND 1
2. ENVIRONMENTAL SETTING 6
2.1 Hydrology 6
2.1.1 Watershed Setting and Existing Drainage Facilities 6
2.1.2 2005 City of Long Beach Master Plan of Drainage Update 11
2.1.3 Existing Floodplain Mapping 12
2.2 Sewer & Wastewater Infrastructure 15
2.2.1 Existing Sewer System and Facilities 15
2.2.2 Existing Sewer Flows per Planning Area 18
2.2.3 Existing Sewer Capacity Assessment 18
2.3 Water Distribution System 20
2.3.1 Existing Water System 20
2.3.2 Existing Water Demand 22
2.3.3 2010 Urban Water Management Plan and Recycled Water Master Plan 23
2.4 Water Quality 24
2.4.1 Regulatory Framework 24
2.4.2 Existing Surface Water Conditions 27
2.4.3 Existing Groundwater Conditions 28
3. THRESHOLDS OF SIGNIFICANCE 31
3.1 Hydrology & Water Quality Thresholds (CEQA Checklist Section IX) 31
3.2 Utilities and Service Systems Thresholds (CEQA Checklist Section XVII) 32
4. ENVIRONMENTAL IMPACTS 33
4.1 Hydrology 33
4.1.1 Proposed Drainage Conditions 33
4.1.2 Hydrology Impacts 34
4.2 Sewer & Wastewater Infrastructure 39
4.2.1 Proposed Wastewater System Flows per Land Use Designation 39
4.2.2 Proposed Sewer/Wastewater System 39
4.2.3 Sewer/Wastewater Impacts 43
4.3 Water Infrastructure 44
4.3.1 Proposed Water Demand per Land Use Designation 44
4.3.2 Proposed Water System 45
4.3.3 Water Impacts 48

4.4 Sea Level Rise 50
4.5 Water Quality 58
4.5.1 Construction Activities 58
4.5.2 Post-Construction Activities 60
4.5.3 Water Quality Impacts 62
5. CONCLUSION 64
6. REFERENCES 65
7. TECHNICAL APPENDICES 67

LIST OF FIGURES

Figure 1 SEASP Vicinity Map.....3
Figure 2 SEASP Aerial Extent with Key Features.....4
Figure 3 SEASP Proposed Zoning.....5
Figure 4 SEASP Existing Storm Drain Systems 9
Figure 5 Infrared Existing Impervious/Pervious Condition 10
Figure 6 SEASP Storm Drain Deficiency Map.....13
Figure 7 SEASP Area Flood Zone Map 14
Figure 8 SEASP Existing Sewer Systems 17
Figure 9 SEASP Existing Water Systems 21
Figure 10 San Gabriel River Watershed.....26
Figure 11 SEASP Proposed Storm Drain Recommended Improvements.....38
Figure 12 SEASP Proposed Sewer Demands 42
Figure 13 SEASP Proposed Water Demands 47
Figure 14 SEASP Proposed Water System Capacity.....49
Figure 15 Sea Level Rise – Spinaker Bay Existing Residential Area 53
Figure 16 Sea Level Rise – Best Western Hotel 54
Figure 17 Sea Level Rise – Marine Stadium Park 55
Figure 18 Sea Level Rise – Los Cerritos Wetland Restoration Area.....56
Figure 19 Sea Level Rise – Industrial Area.....57

LIST OF TABLES

Table 1 Existing Land Use Designations 1
Table 2 Southeast Area Project Summary 2
Table 3 Existing Drainage Facilities 8
Table 4 2005 Master Plan of Drainage Update Deficiencies 11
Table 5 Existing Sewer Facilities 16
Table 6 Existing Condition Average Daily Sewer Flows 18
Table 7 Existing Water Facilities 20
Table 8 Existing Condition Average Daily Water Demand 22
Table 9 TMDLs for Copper in the San Gabriel River Estuary 25
Table 10 Groundwater Quality Objectives for the Coastal Plain of Los Angeles West Coast Basin 29
Table 11 Water Quality Monitoring Data for West Coast Basin ID 42/13W-23D04S: Deepest sample at 1390 feet 30
Table 12 Water Quality Monitoring Data for West Coast Basin ID 42/13W-23D08S: Shallow sample at 430 feet 30
Table 13 Existing and Proposed Land Uses and Associated Runoff Coefficients 33
Table 14 Proposed Condition Average Daily Sewer Flows 39
Table 15 Proposed Condition Average Daily Water Demand 45

LIST OF APPENDICES

Appendix A Hydrology
Appendix B Sewer Demand Calculations
Appendix C Water Demand Calculations
Appendix D Sea Level Rise Modeling for SEASP Area

ACRONYMS & ABBREVIATIONS

ATS	Active Treatment System
BAT	Best Available Technology Economically Available
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practice
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CWA	Clean Water Act
d/D	Maximum Flow within Pipe Over Depth Ratio
DCV	Design Capture Volume
DU	Dwelling Units
EIR	Environmental Impact Report
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GCP	General Construction Permit
GIS	Geographic Information Systems
gpd	gallons per day
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LBWD	City of Long Beach Water Department
LF	Linear Feet
LID	Low Impact Development
MGD	Millions of Gallons per Day
MS4	Municipal Separate Storm Sewer Systems
MWD	Metropolitan Water District of Southern California
NAL	Numeric Action Levels
NEL	Numeric Effluent Limits
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PCH	Pacific Coast Highway
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
RWQCB	Regional Water Quality Control Board
SEASP	Southeast Area Specific Plan
SF	Square Feet

SFHA	Special Flood Hazard Area
SWPPP	Storm Water Pollution Prevention Program
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
UWMP	Urban Water Management Plan
WDR	Waste Discharge Requirement
WQO	Water Quality Objective
WRD	Water Replenishment District of Southern California

1. INTRODUCTION & BACKGROUND

The Southeast Area Specific Plan (SEASP) project site is located on the southeast edge of the City of Long Beach in Los Angeles County. The City of Long Beach is proposing the SEASP to establish a land use, development and implementation framework to encourage redevelopment of a 1,472 acre area of Long Beach to support residential uses, job creation, commercial and employment space, as well as hotel uses. The SEASP area consists of the area south of 7th Street, east of Bellflower Boulevard, east of the Long Beach Marine Stadium and Alamitos Bay docks, south of Colorado Street, and north and west of Long Beach's southern boundary.

The SEASP covers approximately 1,472 acres divided up into thirteen land use designations including Single Family Residential, Multi-Family Residential, Mobile Homes, Commercial-Neighborhood, Mixed Use Community Core, Mixed Use Marina, Industrial, Public, Open Space, Coastal Habitat, Wetlands, & Recreation, Channel/Marina/Waterway, Right-of-Way (ROW)/Caltrans and Dedicated ROW. This report will focus only on the areas that will incorporate land use changes which could result in impacts to existing infrastructure (storm drain, sewer and water).These include the Multi-Family Residential, Commercial-Neighborhood, Mixed Use Community Core, Mixed Use Marina, and Industrial land uses and encompass 505 acres of the total 1,472 acre specific plan boundary. These areas are currently within the zoning sphere of PD-1. The zoning will change to reflect the land use designations as specified above.

Table 1 Existing Land Use Designations

Land Use Designation	Acreage (ac.)	Subject to Land Use Change? (Y/N)
Single Family Residential	187	N
Multi-Family Residential	117	Y
Mobile Homes	33	N
Commercial-Neighborhood	9	Y
Mixed Use Community Core	72	Y
Mixed Use Marina	14	Y
Industrial	293	Y
Public	20	N
Open Space	75	N
Coastal Habitat, Wetlands, & Recreation	285	N
Channel/Marina/Waterway	162	N
Right-of-Way/Caltrans	15	N
Dedicated ROW	182	N

The Southeast Area Project will support approximately 9,520 dwelling units (DUs), 2.6 million square feet (sf) of commercial/employment and over 4,000 jobs. This represents an increase of approximately 5,439 DUs, 50 hotel rooms, approximately 574,000 sf of non-residential land uses and 560 jobs. Figure 1 and Figure 2 provide a vicinity map and an aerial over view of the SEASP.

Table 2 summarizes the various areas subject to land use changes, their acreage, and proposed land use. Figure 3 provides a summary of the proposed zoning.

Table 2 Southeast Area Project Summary

Land Use Designation	Acreage (ac)	Proposed Land Use Description
Multi-Family Residential	117	117 acres supporting an additional 129 DUs of multi-family residential homes.
Commercial - Neighborhood	9	9 acres supporting an additional 50,000 sf of commercial land uses.
Industrial	293	293 acres supporting an additional 35,000 sf of industrial land uses.
Mixed Use Community Core	72	72 acres to support various mixed land uses designations. These include an additional 4,860 condominium and apartment DUs, 270,860 sf of mixed land uses and 25 hotel rooms.
Mixed Use Marina	14	14 acres of to support various mixed land use designations. These include 450 condominium and apartment DUs, 217,880 sf of mixed use and 25 hotel rooms.
Total	**505**	9,518 Residential Units (increase of 5,439 units) 2.6 million sf of non-residential (increase of ~574,000 sf)

The City of Long Beach is seeking approval of a General Plan Amendment, the Southeast Area Specific Plan, the Zone Change and the Program Environmental Impact Report (EIR) Certification. In addition, the approval of an amendment to the City of Long Beach Local Coastal Program from the California Coastal Commission is required per the California Coastal Act as well as the approval of an encroachment permit by Caltrans for the roadway cross-section improvements along Pacific Coast Highway (PCH). As part of this California Environmental Quality Act (CEQA) process, infrastructure such as drainage, sewer, water systems and water quality that support the existing and proposed land uses will be analyzed at a level consistent with the program-level planning of an EIR. The land use changes have the potential to change impervious conditions, sewer/wastewater flow rates, water demands, and water quality impacts.

This report analyzes the proposed land use changes within the SEASP area and how these changes may impact the existing infrastructure that lies within or immediately downstream. For those areas where the land use changes may impact the existing infrastructure, measures will be identified to improve the infrastructure to support the proposed land uses. The analysis will include a review of the Master Plans of Drainage, Water, and Wastewater systems, as well as the existing drainage (storm drain systems), sewer systems, water systems, and water quality systems currently in place. For water quality, measures to reduce potential impacts to surface water as a result of post-construction operations will be addressed in this report. This includes structural Best Management Practices (BMPs) and Low Impact Development (LID) strategies for post-construction water quality protection. Additional details on water quality will occur during the site planning process through the City of Long Beach and the development of site-specific (e.g. project-specific) LID BMP Plans.

Figure 1

SEASP Vicinity Map

Specific Plan Boundary

Long Beach City Boundary

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0 1,850 3,700 7,400 Feet

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Figure 2

SEASP Aerial Extent with Key Features

Specific Plan Boundary

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0 600 1,200 2,400 Feet

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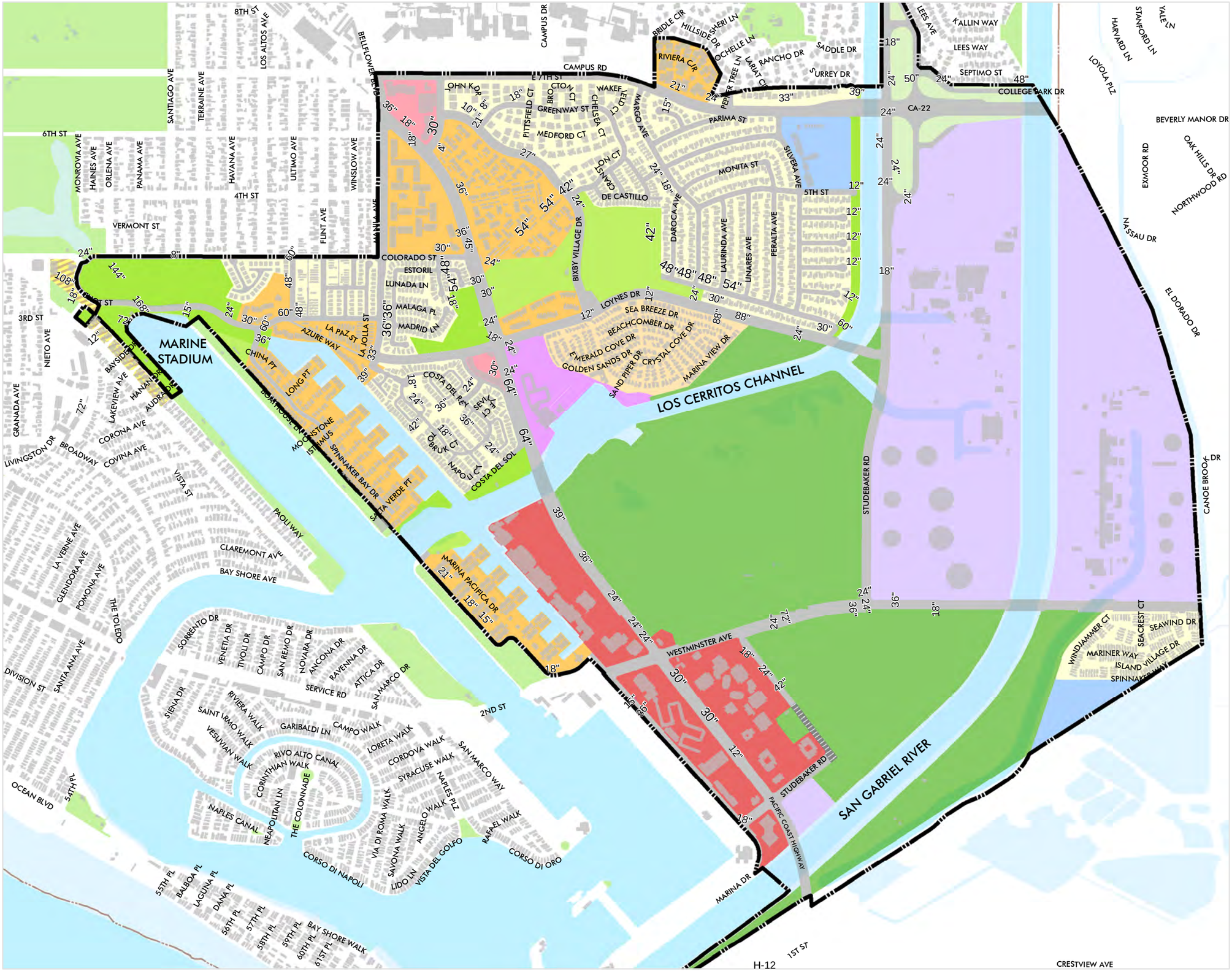
Figure 3

SEASP Proposed Zoning



- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

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0 600 1,200 2,400 Feet

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2. ENVIRONMENTAL SETTING

2.1 HYDROLOGY

The purpose of the hydrology evaluation is to evaluate the existing status of the storm drain system based on best available information (Master Plan of Drainage, specific studies within the project study area, etc.) and determine if the system can accommodate the proposed land use changes. Where applicable, storm drain system improvements will be identified to support the proposed land plan based on the most current Master Plan of Drainage. The analysis is based on information provided by the City of Long Beach and the Los Angeles County Department of Public Works.

2.1.1 Watershed Setting and Existing Drainage Facilities

The Southeast Area Project site resides within the San Gabriel River Watershed within Los Angeles County. Approximately 25 square miles of the 689 square-mile San Gabriel River watershed is located within the boundary of Long Beach. The San Gabriel River is a 58-mile long, largely concrete-lined channel that flows from the San Gabriel Mountains to the Pacific Ocean at Long Beach. Channel flows pass through different sections in the San Gabriel River, diverting from the riverbed into four different spreading grounds, held behind several rubber dams for controlled flow and ground water recharge, and controlled through 10 miles of concrete channel bottom from below Whittier Narrows Dam to past Coyote Creek. The lower part of the river flows through a concrete-lined channel in a heavily urbanized portion of the county before becoming a soft bottom channel once again near the ocean in the City of Long Beach[1].

The project site is located within the Los Cerritos Channel and Alamitos Bay Water Management Area (WMA) of the San Gabriel River watershed. The WMA is located between the Los Angeles and San Gabriel Rivers and drains to the same general area as the San Gabriel River. Alamitos Bay, located in the southeastern portion of the City of Long Beach (City) near the Los Angeles County/Orange County border, is connected directly to the Pacific Ocean. Alamitos Bay is composed of Marine Stadium, a recreation facility used for boating, water skiing, and jet skiing which is located outside the western portion of the SEASP boundary.

According to the City of Long Beach Stormwater Master Plan Update (2005), the entire project study area is located with major Basin #22 which includes numerous sub basins. Based on the GIS data and the Stormwater Master Plan, no storm drain pump stations exist within the project study area.

The Southeast Area study area is served by two primary flood control and drainage systems.

1) The City of Long Beach (City) operates and maintains a storm drain system including catch basins, storm drain pipes (primarily reinforced concrete pipe (RCP)) that range from 8" to 168" pipes within the study area.

[1] County of Los Angeles, Department of Public Works, San Gabriel River Watershed, http://dpw.lacounty.gov/wmd/watershed/sg/ accessed December 2, 2015.

2) Los Angeles County Flood Control District (LACFCD) operates and maintains flood control facilities including the larger systems primarily ranging from 18″ to 108″ within the study area.

The majority of the SEASP drainage areas discharges directly into the San Gabriel River, Marine Stadium and Los Cerritos Channel with a small drainage area discharging into City of Long Beach open space behind the existing retail development area along Pacific Coast Highway. A summary of the existing City and LACFCD facilities within the study area and brief descriptions are provided below.

- In the Multi-Family Residential land use designation, stormwater is collected by City owned 30″ and 39″ lines immediately south of Colorado Street and east of Pacific Coast Highway. These lines empty into an existing detention basin north of Loynes Drive and east of Pacific Coast Highway.

- The Commercial-Neighborhood land use designation discharges into City owned 18″ and 24″ pipes along Channel Drive and Pacific Coast Highway that continues to drain to the south ultimately draining to the existing detention basin north of Loynes Drive.

- The Industrial land use designation is served by both LACFCD and City storm drain lines. The northern portion of the Industrial area is served by a series of 18″ and 24″ City lines. The southern portion of the Industrial area along Westminster Avenue is served by a series of 18″, 24″ and 36″ LACFCD storm drain lines. Flows from this area discharge into either the San Gabriel River or Los Cerritos Channel.

- In the Mixed Use Marina, stormwater runoff is collected by LACFCD storm drain lines that range from 18″-64″ along Pacific Coast Highway and runoff is discharged to Los Cerritos Channel.

- The Mixed Use Community Core is served primarily by City lines with few LACFCD lines at the western portion of the land use designation. The northern portion of the Mixed Use Community Core discharges to City owned 24″ and 36″ storm drain lines and discharges into Los Cerritos Channel. The southwest portion of the Mixed Use Community Core connects to City storm drain lines that range in size from 15″ to 36″and drain into Marine Stadium (Alamitos Bay). The southeast portion of the Mixed Use Community Core connects to 18″ City lines and to 24″ and 42″ LACFCD storm drain lines and discharge into the open space areas (Los Cerritos Wetlands) east of the development.

In summary, all runoff from the Southeast Area study area ultimately discharges into Los Cerritos Channel, Alamitos Bay or the San Gabriel River before discharging into the Pacific Ocean. See Figure 4 existing storm drain facilities within the SEASP boundary.

Table 3 summarizes the impervious conditions as shown by Figure 5, the primary existing drainage facilities for each land use designation, and ownership (City or LACFCD). Impervious conditions were analyzed using GIS infrared tools which can detect pervious and impervious area at a high degree of accuracy.

Table 3 Existing Drainage Facilities

Land Use Designation	*Acreage*	*Existing Imperviousness*	*Existing Sewer Facilities*
Multi-Family Residential	117	62%	30″ & 39″ (City) Internal streets and Colorado Street
Commercial-Neighborhood	9	92%	18″ & 24″ (City) Pacific Coast Highway and Channel Drive
Industrial	293	91%	24″ (City) Studebaker 24″ (LACFCD) Studebaker and Westminster Avenue
Mixed Use Marina	14	92%	18″, 24″ & 64″ (LACFCD) Pacific Coast Highway
Mixed Use Community Core	72	90%	15″- 39″ (City) Internal streets and Pacific Coast Highway 24″ & 42″ (LACFCD) Internal Streets

Notes:
Source: City GIS Data obtained 2015

Figure 4

SEASP Existing Storm Drain Systems

- Catch Basins
- LACFCD Storm Drains
- City of Long Beach Storm Drains
- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

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0 600 1,200 2,400 Feet

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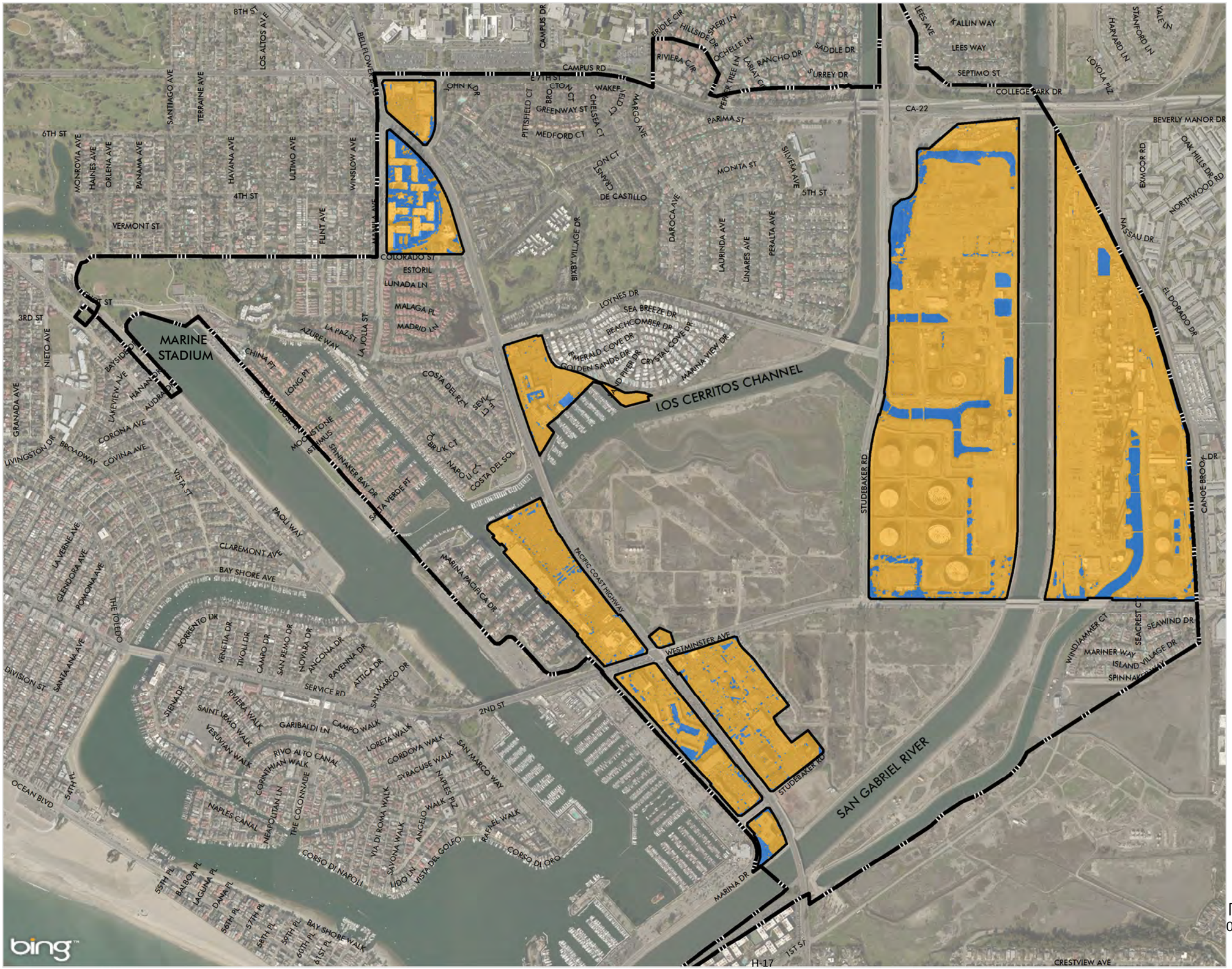
Figure 5

Infrared Existing Impervious/ Pervious Conditions



Impervious - 358.04 AC (90%)

Pervious - 40.89 AC (10%)

Specific Plan Boundary

City Boundary

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0 600 1,200 2,400 Feet

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2.1.2 2005 City of Long Beach Master Plan of Drainage Update

Long Beach Modeled Stormwater System

The City of Long Beach is divided into thirty (30) major drainage basins. Within each major basin, sub-basins are identified which are served by 36″ drainage pipes or larger. Sub-basins are further sub-divided into drainage areas contributing runoff to specific drainage nodes. The entire system is integrated into Geographic Information Systems (GIS) which provides the City a useful management tool for the operation and maintenance of the storm drain system.

As aforementioned, according to the City of Long Beach Stormwater Master Plan, the entire project study area is located with major Basin # 22 which includes numerous sub basins. In 2005, the Master Plan of Drainage was updated to evaluate the hydraulic capacity of the major storm drain systems within the various drainage basins of the City boundary including LACFCD facilities. The analysis included computation of the 10-year, 25-year and 50-year storm events and the capacity of the existing storm drain systems to determine where improvements are recommended. The analysis utilized a variety of information including invert elevations, ground surface elevations, length, slope, pipe size, type, drainage area and street conveyance capacity. The 10-year conveyance capacity was used as the threshold for determining if the existing drainage pipe needed upsizing. For example, if the 10-year peak flow discharge was determined to be 120 cfs and the capacity of the existing pipe was 100 cfs, the study identified the appropriate pipe size to accommodate 120 cfs. See Appendix A for Long Beach Modeled Stormwater System Maps 2, 3, 7 and 8 and the corresponding capacity evaluation calculations.

Within the Southeast Area Project, the 2005 Master Plan of Drainage Update identified seventeen segments with deficiency. Of the seventeen deficient segments, five segments are in areas subject to land use changes. An analysis of the remainder of the storm drain system within the study area was deemed sufficient under existing conditions to convey the 10-year event.

Table 4 summarizes the deficiencies within areas subject to land use change. It is likely that deficiencies within areas subject to land use changes will be improved during redevelopment to be able to handle associated potential increases in stormwater flows. Deficiencies outside of land use change areas will continue to be incorporated into capital improvement budgeting and prioritization.

Table 4 2005 Master Plan of Drainage Update Deficiencies

City of Long Beach Storm Drain Lines						
Segment ID	Pipe Size	Capacity	Total Pipe Length (LF)	10-year Peak Flow	Recommended Pipe Size	Location
220835	24″	43.9 cfs	315	44.0 cfs	30″	Commercial-Neighborhood
220805	39″	51.6 cfs	524	90.0 cfs	54″	Multi-Family Residential
220810	39″	65.7 cfs	443	81.0 cfs	48″	Multi-Family Residential

220015	24″ RCP	10.6 cfs	617	14 cfs	30″ RCP	Mixed Use Community Core

Los Angeles County Flood Control District Storm Drain Lines

Segment ID	Pipe Size	Capacity	Total Pipe Length (LF)	10-year Peak Flow	Recommended Pipe Size	Location
220710	64″ RCP	100.1 cfs	381	188 cfs	84″ RCP	Mixed Use Marina

See Figure 6 for a map of the noted deficiencies within the Southeast Area Project area as identified by the 2005 Master Pan of Drainage Update. The improvements identified in the Update have not been implemented by the City of Long Beach or Los Angeles County Flood Control District (LACFCD) and there are no current plans for implementation in the near future. Implementation of the project consistent with the approved land uses will provide the opportunity to improve a portion of the noted deficiencies.

2.1.3 Existing Floodplain Mapping

The National Flood Insurance Act (1968) established the National Flood Insurance Program, which is based on the minimal requirements for flood plain management and is designed to minimize flood damage within Special Flood Hazard Areas. The Federal Emergency Management Agency (FEMA) is the agency that administrates the National Flood Insurance Program. Special Flood Hazard Areas (SFHA) are defined as areas that have a 1 percent change of flooding within a given year, also referred to as the 100-year flood. Flood Insurance Rate Maps (FIRMs) were developed to identify areas of flood hazards within a community.

According to the Flood Zone determination covering the Southeast Area Project area, the majority of the project area lies outside the 100-year Flood Plain. Potential areas affected by a 100-year flood fall with FEMA Zone AE and include Spinnaker Bay, Marina Pacifica, Bay Harbor, Del Lago and minor portion of land north of Los Cerritos Channel southwest of Belmont Shore Mobile Estates. These same areas are also the most susceptible to sea level rise. Approximately 90 acres are potentially impacted by a 100-year event or less than 10% of the project study area.

Figure 6

SEASP Storm Drain Deficiency Map

- Catch Basins
- LACFCD Storm Drains
- City of Long Beach Storm Drains
- Storm Drain Deficiencies and Recommended Diameter Improvements (per 2005 MPD)
- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

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0 600 1,200 2,400 Feet

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Figure 7

SEASP Area Flood Zone Map

Specific Plan Boundary
Zone A
Zone AE
Zone X

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0 600 1,200 2,400 Feet

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2.2 SEWER & WASTEWATER INFRASTRUCTURE

The purpose of the sewer/wastewater evaluation is to determine if the existing sewer system can accommodate the proposed land use changes at the Specific Plan level. In order to determine that, an analysis of the existing sewer and water systems are required. The analysis is based on information provided by the City of Long Beach Water Department (LBWD) and the Los Angeles County Sanitation District (LACSD).

2.2.1 Existing Sewer System and Facilities

The sewer system that serves the 1,472-acre is extensive and includes a variety of pipe sizes ranging from 2″ to 27″ including numerous sewer force mains. There is approximately 103,345 linear feet (LF) of 8″ pipe or less, 14,400 LF of pipe ranging from 10″ - 12″, and 15,925 LF of sewer pipe 15″ or greater. The sewer system is operated and maintained by the City of Long Beach Water Department (LBWD) and the Los Angeles County Sanitation District (LACSD). Typically, the LBWD owns and operates sewer lines 15″ or smaller while LACSD owns and operates the lines 15″ or greater within the SEASP area. The primary sewer systems within SEASP include LACSD's sewer system draining northerly along PCH (15″ - 18″ VCP) and the sewer system (18″ - 21″ VCP) along Colorado St draining westerly.

Figure 8 provides a summary of the existing City of Long Beach and LACSD sewer system facilities within the study area and brief descriptions are provided below.

- The Multi-Family Residential land use designation is served by existing City and LACSD sewer lines. These include an 8″ City line which ultimately drains to an 18″ LACSD line along Colorado Street.

- The Commercial-Neighborhood land use designation is composed of a series of 8″ City lines along Channel Drive that run north to south and ultimately tie into the LACSD 18″ trunk line on Pacific Coast Highway.

- The Industrial land use designation is primarily served by private sewer systems.

- The Mixed Use Marina is served primarily by 8″ City lines. These lines ultimately discharge to an 18″ City line into the 15″ LACSD trunk line along Pacific Coast Highway.

- The Mixed Use Community Core is served by a combination of City and LACSD sewer facilities. City lines throughout the area range from 8″-12″ and ultimately tie into the 15″ LACSD trunk line along the southern portion of Pacific Coast Highway.

Table 5 summarizes the existing sewer facilities serving the Southeast Area Project and Figure 8 provide a summary of their locations based on the City's GIS data.

Table 5 Existing Sewer Facilities

Land Use Designation	*Acreage*	*Existing Sewer Facilities*
Multi-Family Residential	117	8″ (City) Internal streets 15″ (LACSD) along Colorado Street
Commercial-Neighborhood	9	8″ (City) Internal streets and Channel Drive
Industrial	293	Private systems (unknown)
Mixed Use Marina	14	8″ (City) Internal streets 18″ (City) Pacific Coast Highway
Mixed Use Community Core	72	8″-12″ (City) Internal streets 15″ (LACSD) Pacific Coast Highway

Notes:
Source: City GIS Data obtained 2015

Figure 8

SEASP Existing Sewer Systems

LACSD Sewer Mains

LBWD Sewer Mains (7" Diameter and Greater)

- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

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0 600 1,200 2,400 Feet

11/10/2015 COLB-04.0

2.2.2 Existing Sewer Flows per Planning Area

The City of Long Beach's 2010 Urban Water Management Plan (UWMP)[2] and LACSD provide sewer generation factors for estimating existing sewer flows based on existing land use. For each land use designation, sewer generation was estimated to provide a baseline condition and to allow for comparisons against proposed land use changes under the Southeast Area Project. Acreages of the existing development (i.e., residential, commercial, industrial, etc.) and number of dwelling units were utilized along with their corresponding flow factors to develop existing condition flow rates.

Table 6 provides a summary of the existing wastewater flows for each land use designation subject to change. Details are provided in Appendix B.

Table 6 Existing Condition Average Daily Sewer Flows

Land Use Designation	*Acreage*	*Number of Dwelling Units[2]*	*Non-Residential SF[1, 3]*	*Average Sewer Flow (GPD)[2]*
Multi-Family Residential	117	2,329	--	363,324
Commercial-Neighborhood	9	--	87,350	28,389
Industrial	293	--	1,110,711	222,142
Mixed Use Marina	14	--	5,395	25,191
Mixed Use Community Core	72	--	836,690	295,362
Total	**505**	**2,329**	**2,040,146**	**934,408**

1. Non-Residential includes commercial, retail and institutional land uses
2. Accounts for the existing 375 hotel rooms within the Mixed Use Community Core and Mixed Use Marina. Demand factors specific to hotel rooms were employed instead of non-residential square footage demand factors to avoid duplication.
3. Excludes existing SF for Public land uses (51,301 SF).

Notes:
GPD gallons per day SF square feet

Under the existing conditions, average daily sewer flows are estimated at 0.934 million gallons per day (MGD). Development of the existing condition average daily sewer flows will allow for comparison against the proposed land use average daily sewer flows in Section 4.2.1.

2.2.3 Existing Sewer Capacity Assessment

The Long Beach Water Department maintains a comprehensive hydraulic sewer model for the entire sewer system to help manage capacity, maintenance, capital improvement projects and many other benefits. The sewer model typically covers 12" lines and greater. The sheer extent and linear length of 8" lines or smaller within the City prohibits modeling such sizes from a cost

[2] Long Beach Water Department. 2010 Urban Water Management Plan (June, 2011).

benefit perspective. In addition, 8" lines are usually at the upstream end of the system whereas the larger lines (>12") are located further downstream where sewer flows confluence.
Based on these modeling parameters, the sewer model does not cover the areas within SEASP where significant land use changes are proposed. These areas of future redevelopment are served by a series of 8"and 10" lines that connect directly into LACSD trunk lines. Therefore, no existing sewer capacity for the City's sewer system within the project area exists. However, individual projects are required to provide flow monitoring and capacity assessments for any line intended for connection (typically 8") to the system.

LACSD frequently analyzes the existing conditions of the sewer system lift stations and evaluates the sewer system capacity through flow monitoring at key manholes throughout their service area. The analysis includes localized flow testing of the trunk lines to determine average flows, peak flows, peak demand times, deficiencies and other relevant factors within the existing system. Maximum peak flows were obtained from LACSD from a series of trunk lines within the land use change areas subject to land use changes (see Appendix B). Overall, the majority of the sewer system serving the Southeast Area Project is well within design capacity (< 0.5 d/D or <0.75 d/D dependent upon size) under existing conditions.

LACSD identified a few segments along the PCH corridor where maximum peak flows have exceeded the design criteria. Such findings do not warrant immediate replacement/upsizing but rather allows LACSD to effectively monitor these lines more closely. It also assists LACSD in identifying which sewer lines may require additional study once individual projects are proposed that may increase sewer demands. LACSD also has mechanisms in place that account for proposed sewer demand changes related to General Plans, Specific Plans and individual projects. This information is used to issue will-serve letters for individual projects and also helps LACSD determine when lines will need to be upsized in the future.

2.3 WATER DISTRIBUTION SYSTEM

The purpose of the water system evaluation is to describe and evaluate the existing status of the water distribution system and identify any known deficiencies or improvements required to support existing uses. The analysis is based on information provided by the City of Long Beach.

2.3.1 Existing Water System

The City of Long Beach is the water service provider and distributes water to the City's residents and businesses. LBWD receives water from three main sources: imported water from Metropolitan Water District (MWD), groundwater pumped and treated from city wells, and recycled water. LBWD operates the largest groundwater treatment plant in the United States and has the capability to treat up to 62.5 million gallons per day. MWD is Long Beach's wholesale supplier and the primary source of imported water originates from the Colorado River and the State Water Project.

Wastewater for reuse in Long Beach is treated to tertiary levels at the Long Beach Water Reclamation Plant which produces 18-25 MGD. The LBWD has been providing recycled water from the reclamation plant since the 1980s to customers in its service area. The LBWD has approximately 90 recycled water service connections. Within the SEASP boundary, there are currently two recycled water connections that serve Marina Vista Park and Rogers Mini Park which are located towards the northern SEASP boundary.

Under the existing conditions, the SEASP area is served by a variety of 4" to 20" water lines (e.g., cast iron, ductile iron, and asbestos cement) located in the public streets, alley ways, parks, and parking lots. A summary of the primary water lines within each land use area are provided below. See Figure 9 for locations of the existing water facilities.

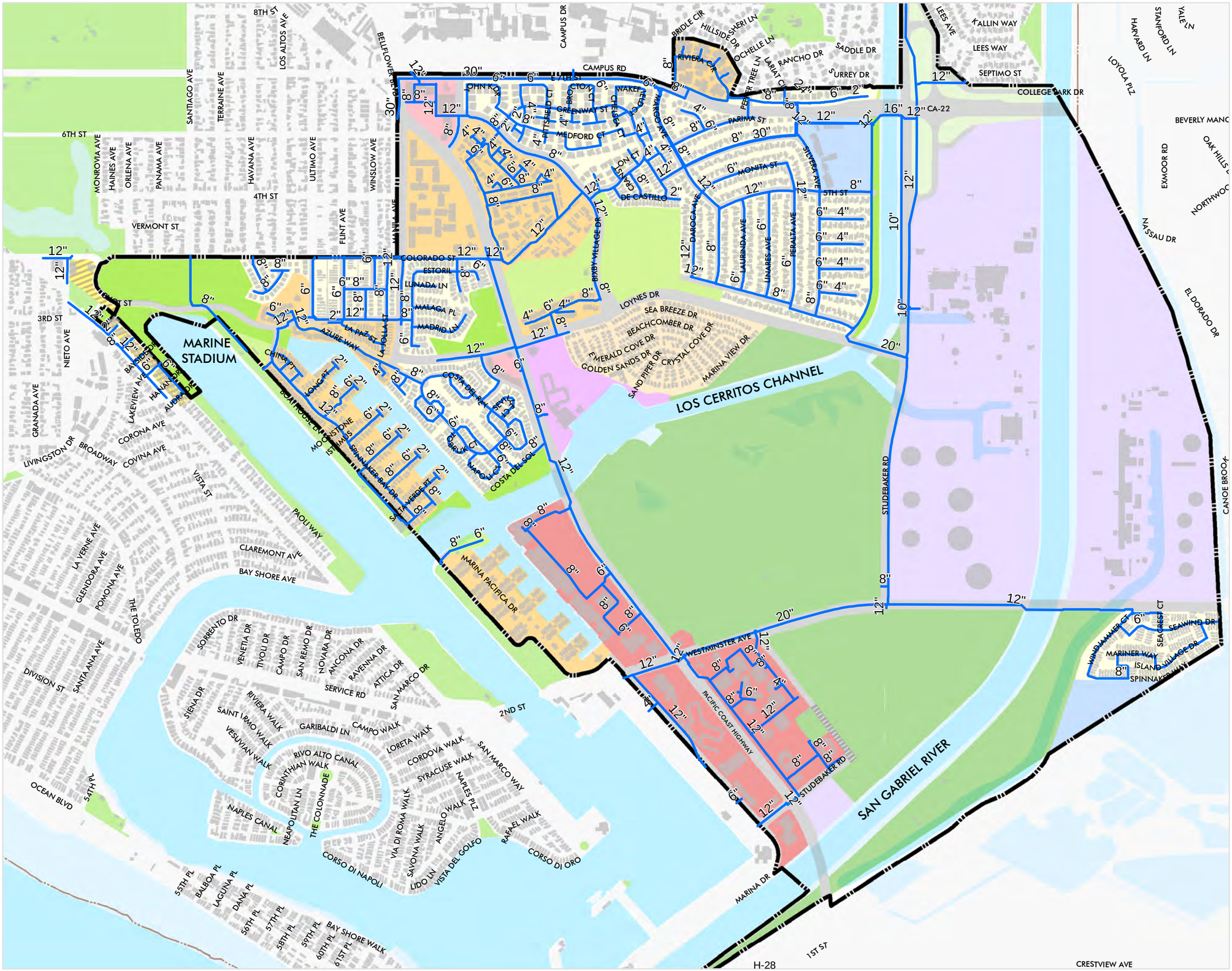
Table 7 Existing Water Facilities

Land Use Designation	*Acreage*	*Existing Water Facilities*
Multi-Family Residential	117	12" Colorado Street
Commercial-Neighborhood	9	8"-12" Internal streets 30": Bellflower Boulevard
Industrial	293	12" Studebaker Road 20" Loynes Drive
Mixed Use Marina	14	12": Loynes Drive 8": Pacific Coast Highway
Mixed Use Community Core	72	20": PCH
Total	**505**	4"-12" Internal streets 12": Pacific Coast Highway

Notes:
Source: City GIS Data obtained 2015

Figure 9

SEASP Existing Water Systems



- Water Mains
- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

FUSCOE ENGINEERING

0 600 1,200 2,400 Feet

11/10/2015 COLB-04.0

The LBWD Water Capital Improvement Plan includes an ongoing water line maintenance program to replace longstanding or deteriorated water pipes and continue its replacement of aging cast iron mains with ductile iron pipe. The criteria for replacing water mains are based on their age, flow, pressure and main break history. In the Southeast Area study area, there are no capacity issues and no planned capital improvements to the existing water system.

2.3.2 Existing Water Demand

For each land use area, water demand estimates were developed to provide a baseline condition and to allow for comparisons against proposed land use changes. Similar to the sewer/wastewater analysis, acreages of development (i.e., commercial, industrial, etc.) and number of dwelling units for existing and proposed conditions were utilized along with their corresponding flow factors to identify changes in water demand. The 2010 UWMP (June 2011) was used to calculate the most up to date water demands and supplemented by Los Angeles County data if specific land use water generation numbers were not available. Table 8 provides a summary of the existing conditions water demand for each land use designation area. The projected flows in Table 7 were compared with the City's water system model which is calibrated against measured flows and measured pressure collected throughout the water system. The estimated existing condition flows were consistent with the existing water model conditions. Detailed calculations are provided in Appendix C.

Table 8 Existing Condition Average Daily Water Demand

Land Use Designation	*Acreage*	*Number of Dwelling Units*	*Non-Residential SF[1, 3]*	*Average Water Demand (GPD)[2]*
Multi-Family Residential	117	2,329	--	519,775
Commercial-Neighborhood	9	--	87,350	17,470
Industrial	293	--	1,110,711	222,103
Mixed Use Marina	14	--	5,395	24,512
Mixed Use Community Core	72	--	836,690	190,750
Total	**505**	**2,329**	**2,040,146**	**974,610**

1. Non-Residential includes commercial, retail and institutional land uses
2. Accounts for the existing 375 hotel rooms within the Mixed Use Community Core and Mixed Use Marina. Demand factors specific to hotel rooms were employed instead of non-residential square footage demand factors to avoid duplication.
3. Excludes existing SF for Public land uses (51,301 SF).

Notes:
GPD gallons per day SF square feet

Under the existing conditions, average daily flows are estimated at 0.975 MGD. As part of the existing conditions analysis, LBWD analyzed their existing hydraulic water model specific to the Southeast Area Project area. The model did not identify any deficiencies related to fire flow issues or high velocities within or around the Southeast Area. In addition, no major water infrastructure improvements are planned for the area beyond the standard maintenance and replacement program currently being implemented.

2.3.3 2010 Urban Water Management Plan and Recycled Water Master Plan

The 2010 Urban Water Management Plan (UWMP) was produced as a result of an ongoing 5-year comprehensive planning process that produces reports every 5 years that estimate water supplies and demand for 25 years into the future. The 2010 UWMP evaluates the status of the existing water supply system, future growth conditions, and identifies opportunities to expand recycled water service areas.

In the 2010 Recycled Water Master Plan[3], LBWD has identified several potential customers that could benefit from an extension of recycled water infrastructure further south into the SEASP area. However, the recycled water supply is now 100% allocated to existing demands (LBWD direct communication, January 2016). Due to the lack of available recycled water supply and high costs associated with the construction of new infrastructure, it is currently not practical to implement recycled water within the SEASP area. In addition, there are no new plans to expand the regional recycled water supply production capabilities thus making it unlikely recycled water lines will be implemented in the near future. However, on-site water recycling systems and rain water harvest and reuse systems will be promoted and supported to reduce future water demands.

[3] Long Beach Water Department and Water Replenishment District of Southern California. Final Report – Recycled Water Master Plan (November 2010).

2.4 WATER QUALITY

2.4.1 Regulatory Framework

Basin Plan for the Los Angeles Region

In addition to its permitting programs, the State Water Resources Control Board (SWRCB), through its nine Regional Water Quality Control Boards (RWQCBs), developed Regional Water Quality Control Plans (or Basin Plans) that designate beneficial uses and water quality objectives for California's surface waters and groundwater basins, as mandated by both the CWA and the state's Porter-Cologne Water Quality Control Act. Water quality standards are thus established in these Basin Plans and provide the foundation for the regulatory programs implemented by the state. The Los Angeles RWQCB's Basin Plan, which covers the Southeast Area Project area, specifically designates beneficial uses for surface waters and ground waters, (ii) sets narrative and numerical objectives that must be met in order to protect the beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region.[4] In other words, the Los Angeles RWQCB Basin Plan provides all relevant information necessary to carry out federal mandates for the antidegradation policy, 303(d) listing of impaired waters, and related Total Maximum Daily Loads (TMDLs), and provides information relative to NPDES and Waste Discharge Requirement (WDR) permit limits.

Clean Water Act 303(d) List of Water Quality Limited Segments

Under Section 303(d) of the Clean Water Act (CWA), states are required to identify water bodies that do not meet their water quality standards. Once a water body has been listed as impaired, a Total Maximum Daily Load (TMDL) for the constituent of concern (pollutant) must be developed for that water body. A TMDL is an estimate of the daily load of pollutants that a water body may receive from point sources, non-point sources, and natural background conditions (including an appropriate margin of safety), without exceeding its water quality standard. Those facilities and activities that are discharging into the water body, collectively, must not exceed the TMDL.

Storm water runoff from the Southeast Area Project area ultimately discharges into the San Gabriel River Estuary to the west of the project site. The San Gabriel River Estuary ultimately outlets into the Pacific Ocean. According to the 2010 303(d) list of Water Quality Limited Segments published by the SWRCB, the San Gabriel River Estuary is listed as impaired for dissolved copper, dioxin, dissolved oxygen and nickel. See Figure 10 for the San Gabriel River Watershed.

Total Maximum Daily Loads (TMDLs)

Once a water body has been listed as impaired on the 303(d) list, a TMDL for the constituent of concern (pollutant) must be developed for that water body. A TMDL is an estimate of the daily load of pollutants that a water body may receive from point sources, non-point sources, and natural background conditions (including an appropriate margin of safety), without exceeding its water quality standard. Those facilities and activities that are discharging into the

[4] California Regional Water Quality Control Board, Los Angeles Region. (1994, June). *Water Quality Control Plan for the Los Angeles Region*. Retrieved July 7, 2014, from http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtm

water body, collectively, must not exceed the TMDL. In general terms, municipal, small (Municipal Separate Storm Sewer System) MS4, and other dischargers within each watershed are collectively responsible for meeting the required reductions and other TMDL requirements by the assigned deadline.

For the San Gabriel River Estuary, the Los Angeles RWQCB has adopted dry-weather TMDL for copper. The numeric target for copper in the estuary is based on the California Toxics Rule saltwater criteria because salinity in the estuary is greater than 10 parts per thousand at least 95% of the time. The San Gabriel River Estuary is also impaired for dioxin, dissolved oxygen and nickel; however, TMDLs have not yet been established for these three additional impairments[5].

Table 9 summarizes the numeric targets and loading capacities selected in order to meet the water quality objectives (WQOs) for the protection of beneficial uses in impaired waters as part of the TMDLs[6].

Table 9 TMDLs for Copper in the San Gabriel River Estuary

Reach	Chronic Saltwater Criteria (µg/L dissolved)	Chronic Conversion Factor	Numeric Target (µg/L total)
San Gabriel River Estuary	3.1	0.83	3.7

[5] 2012 Water Body Report for San Gabriel River Estuary. http://iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=CAR4051600020000229163853&p_cycle=2012&p_report_type=

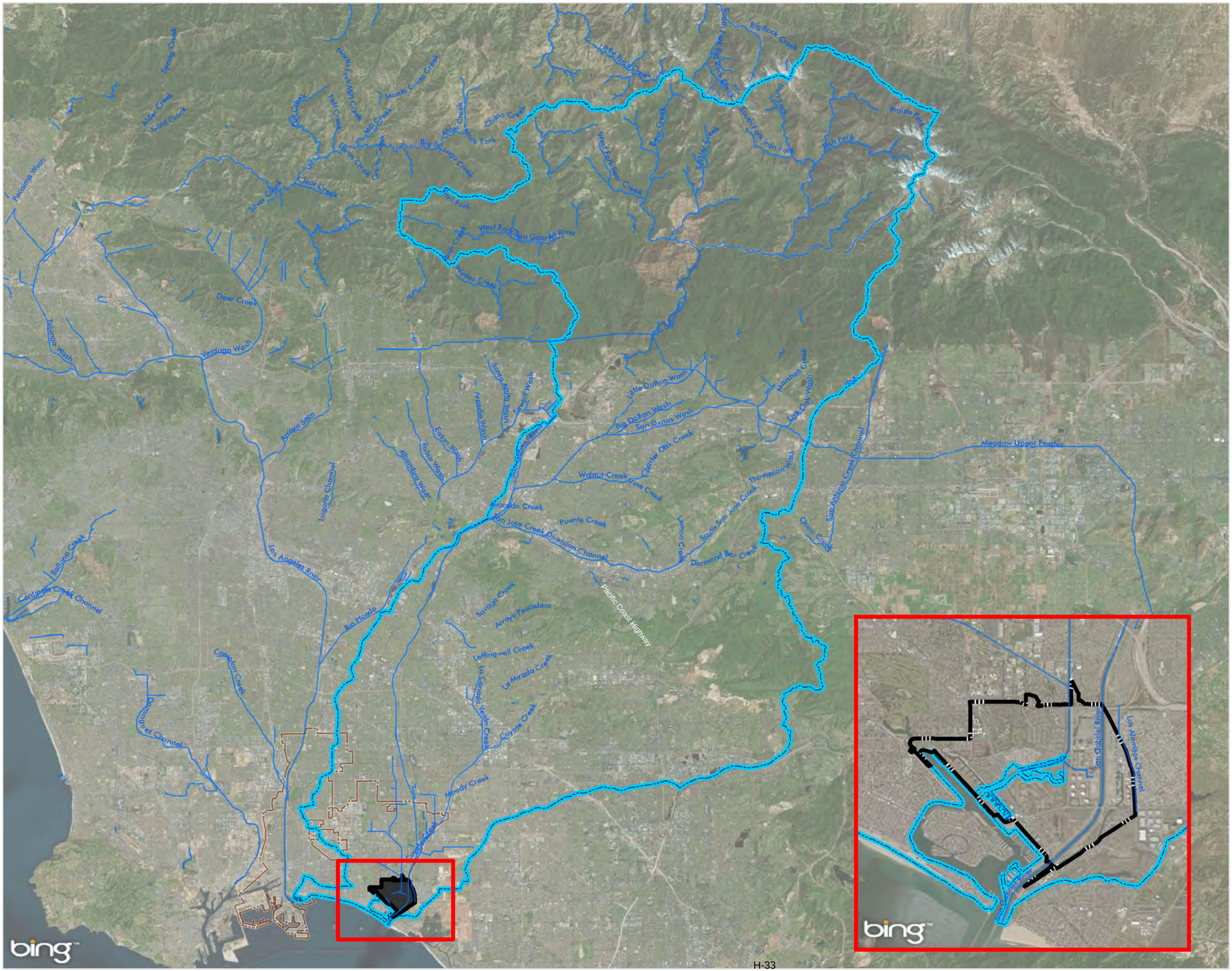
[6] Total Maximum Daily Loads for Metals and Selenium – San Gabriel River and Impaired Tributaries. United States Environmental Protection Agency. http://ofmpub.epa.gov/waters10/attains_impaired_waters.show_tmdl_document?p_tmdl_doc_blobs_id=60727

Figure 10

SEASP San Gabriel Watershed

Specific Plan Boundary

San Gabriel River Watershed



FUSCOE ENGINEERING

0 2.5 5 10 Miles

General Construction Permit and Storm Water Pollution Prevention Plans (SWPPPs)

The General Construction Permit (GCP), Order No. 2012-0006-DWQ, NPDES Permit No. CAS000002, last updated by the SWRCB in July 2012, regulates storm water and non-storm water discharges associated with construction activities disturbing 1 acre or greater of soil. Construction sites that qualify must submit a Notice of Intent (NOI) to gain permit coverage or otherwise be in violation of the CWA and California Water Code.

The GCP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for each individual construction project greater than or equal to 1 acre of disturbed soil area (regardless of the site's Risk Level). The SWPPP must list Best Management Practices (BMPs) that the discharger will use to control sediment and other pollutants in storm water and non-storm water runoff; the BMPs must meet the BAT and BCT performance standards. Additionally, the SWPPP must contain a visual monitoring inspection program; a chemical monitoring program for sediment and other "non-visible" pollutants to be implemented based on the Risk Level of the site, as well as inspection, reporting, training and record-keeping requirements. Section XVI of the GCP describes the elements that must be contained in a SWPPP.[7]

City of Long Beach MS4 Permit and Long Beach Stormwater Management Plan

In March 2014, the Los Angeles RWQCB re-issued the City of Long Beach MS4 Storm Water Permit as WDR Order R4-2014-0024 (NPDES Permit No. CAS004003). Pursuant to this MS4 Permit, the City is required to develop and implement Minimum Control Measures as part of a Stormwater Management Program. The Long Beach Stormwater Management Plan was last revised in August 2001 and was built upon Regional Board WDR Order No. 99-060.

In order to comply with the updated MS4 Permit, a "Low Impact Development (LID) Best Management Practices (BMP) Design Manual" was developed (2013) in advance of the final permit which details actions for compliance with the LID regulations adopted in City Ordinance No. ORD-10-035, such as land development policies pertaining to LID and hydromodification for new development and significant redevelopment projects. The use of LID Best Management Practices (BMPs) in project planning and design is to preserve a site's predevelopment hydrology by minimizing the loss of natural hydrologic processes such as infiltration, evapotranspiration, and runoff detention. LID BMPs try to offset these losses by introducing structural and non-structural design components that restore these water quality functions into the project's land plan.

2.4.2 Existing Surface Water Conditions

Regional Drainage

According to the State of the Watershed Report on Surface Water Quality for the San Gabriel River Watershed, the Southeast Area Project area is located within the lower portion of the watershed in the San Gabriel Estuary (see Figure 10).[8] Pollutants from dense clusters of

[7] California State Water Resources Control Board. (2008). Storm Water Program: Construction Program. Retrieved January 27, 2009, from http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml

[8] State of the Watershed – Report on Surface Water Quality – The San Gabriel River Watershed. California Regional Water Quality Control Board – Los Angeles Region. June 2000.

residential and commercial activities have impaired water quality in the middle and lower watershed. Tertiary effluent from several sewage treatment plants enters the river in its middle reaches (which is partially channelized) while two power generating stations discharge cooling water into the river's estuary. The watershed is also covered under two municipal storm water NPDES permits. Several landfills are also located in the watershed.

Beneficial Uses

The existing beneficial uses of San Gabriel River Estuary are:

- IND – Industrial Service Supply
- NAV – Navigation
- MAR – Marine Habitat
- WILD – Wildlife Habitat
- RARE – Rare, Threatened, or Endangered Species
- REC1 – Water Contact Recreation
- REC2 – Noncontact Water Recreation
- COMM – Commercial, and Sport Fishing
- EST – Estuarine Habitat
- MIGR – Fish Migration
- SPWN – Fish Spawning
- SHELL – Shellfish Harvesting

Water Quality Objectives

General water quality objectives have been prescribed for the upstream portions of San Gabriel River Watershed. However, site-specific objectives have not been determined for the reaches surrounding the SEASP project (San Gabriel River between Firestone Blvd and San Gabriel River Estuary). These areas are often impaired (by high levels of minerals) and there is not sufficient historic data to designate objectives based on natural background conditions.

2.4.3 Existing Groundwater Conditions

Regional Drainage

Geographically, the proposed project site is located within the southeast end of the Los Angeles West Coast Basin, which is one of five major groundwater basins in the Los Angeles River Watershed. The other four groundwater basins are San Fernando Basin, Raymond Basin, Main San Gabriel Basin, and the Central Basin. Much of the Los Angeles River Watershed is underlain with extensive clay layers and the most important spreading basins for groundwater recharge are in the San Fernando Basin, far to the northwest, where the underlying soils are permeable (Council for Watershed Health, 2012). Unlike the other four groundwater basins with notable spreading grounds, groundwater recharge for the West Coast Basin is primarily through direct injection, along with lateral flow from the adjacent Central Basin to the northeast.

In general, historical activities and practices have degraded groundwater quality in the County over the past century. Causes include seepage of fertilizers and pesticides into the subsurface from past agricultural uses, nitrogen and pathogenic bacteria from poorly sited and maintained

septic tanks, and various hazardous substances from leaking aboveground and underground storage tanks and industrial operations. Overdraft of groundwater from coastal aquifers in the first half of the 20th Century resulted in not only a decline in groundwater levels, but also the intrusion of seawater into the aquifers (Council for Watershed Health, 2012).

Beneficial Uses

The Basin Plan identifies Coastal Plain of Los Angeles West Coast Basin groundwater management zone in the Lower Los Angeles River as having four beneficial uses. They are:

- MUN – Municipal and Domestic Supply;
- AGR – Agricultural Supply;
- IND – Industrial Service Supply; and
- PROC – Industrial Process Supply.

Water Quality Objectives

Specific water quality objectives have been established for the Coastal Plain of Los Angles West Coast Basin to maintain its beneficial uses, and are summarized in Table 10.

Table 10 Groundwater Quality Objectives for the Coastal Plain of Los Angeles West Coast Basin

TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron (mg/L)
800	250	250	1.5

In addition to specific numeric water quality objectives, narrative objectives for all groundwaters in the Los Angeles Region also apply to the Coastal Plain of Los Angles West Coast Basin.[9] Narrative objectives have been established for the following constituents:

- Bacteria
- Nitrogen (nitrate, nitrite)
- Chemical constituents
- Mineral quality
- Radioactivity
- Taste and odor

Current Groundwater Quality Conditions

The Water Replenishment District of Southern California (WRD) conducts a Regional Groundwater Monitoring Program for the Central and West Coast groundwater basins. One of the monitoring wells in the program is about 1.3 miles west and 0.4 miles north from the northwest corner of Southeast Area and provides some information on the regional groundwater quality conditions. Well 42/13W-23D is an active WRD monitoring well that has been recording data since 2000. It has been sampled about 1-2 times per year at four depths ranging from 430 feet to 1390 feet below ground surface. The monitoring program does not include boron, one of the LA Basin Plan Groundwater Quality Objectives. Water quality

[9] California Regional Water Quality Control Board, Los Angeles Region. (1994, June). *Water Quality Control Plan for the Los Angeles Region*. Retrieved July 7, 2014, from http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtm

monitoring data from Well 42/13W-23D is shown in Table 11 and Table 12 at depths of 1390 feet and 430 feet, respectively.

Table 11 Water Quality Monitoring Data for West Coast Basin ID 42/13W-23D04S: Deepest sample at 1390 feet

Constituent	*No. of Events Sampled* [a]	*Range*	*Mean*	*Basin Plan Criteria*
Total Dissolved Solids (mg/L)	25	416 - 480	455	800
Sulfate (mg/L)	25	0-2.69	0.11	250
Chloride (mg/L)	25	15.8-19	17.6	250
Boron (mg/L)	-	-	-	-

Notes:
Bold typeface denotes exceedance of basin plan objective or outside tolerance limit.
a. Water Replenishment District Interactive Well Search application, accessed at http://gis.wrd.org/wrdmap/login.asp

Table 12 Water Quality Monitoring Data for West Coast Basin ID 42/13W-23D08S: Shallow sample at 430 feet

Constituent	*No. of Events Sampled* [a]	*Range*	*Mean*	*Basin Plan Criteria*
Total Dissolved Solids (mg/L)	25	**1380-3170**	**2067**	800
Sulfate (mg/L)	26	61-75	68.8	250
Chloride (mg/L)	25	**606-1000**	**871**	250
Boron (mg/L)	-	-	-	-

Notes:
Bold typeface denotes exceedance of basin plan objective or outside tolerance limit.
a. Water Replenishment District Interactive Well Search application, accessed at http://gis.wrd.org/wrdmap/login.asp

In general, exceedances of Basin Plan water quality objectives were observed consistently for total dissolved solids and chloride at the shallow observation well; no exceedances were observed at the deeper well.

3. THRESHOLDS OF SIGNIFICANCE

California Environmental Quality Act (CEQA) significance criteria are used to evaluate the degree of impact caused by a development project on environmental resources such as hydrology and water quality. According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would impact any of the items listed below.

3.1 HYDROLOGY & WATER QUALITY THRESHOLDS (CEQA CHECKLIST SECTION IX)

Would the Project:

A. Violate any water quality standards or waste discharge requirements?

B. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table? (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)

C. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or in a manner which would result in a substantial erosion or siltation on- or off-site?

D. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

E. Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?

F. Otherwise substantially degrade water quality?

G. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

H. Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

I. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

J. Be subject to inundation by seiche, tsunami, or mudflow?

Should the answers to these environmental factors prove to be a potentially significant impact, mitigation measures would be required to reduce those impacts to a less-than-significant threshold. Impact I was studied in the Initial Study and found to have a Less than Significant Impact. Therefore, no additional analyses will be provided for this impact. Impacts B, C, D, E, G, H and J are associated with hydrology and will be analyzed within Section 4.1.2 of this

report. Impacts A and F are associated with water quality and will be analyzed within Section 4.4.3.

3.2 UTILITIES AND SERVICE SYSTEMS THRESHOLDS (CEQA CHECKLIST SECTION XVII)

Would the Project:

A. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

B. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

C. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

D. Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

E. Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

F. Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

G. Comply with federal, state, and local statutes and regulations related to solid waste?

Should the answers to these environmental factors prove to be a potentially significant impact, mitigation measures would be required to reduce those impacts to a less-than-significant threshold. Impact G was studied in the Initial Study and found to have a Less than Significant Impact. Impacts A, B, and E are associated with sewer and wastewater systems and are analyzed within Section 4.2.3 of this report. Impact B is associated with water systems, and water impacts are analyzed in Section 4.3.3 of this report. Impact B is also associated with drainage systems and hydrology, and will be analyzed within Section 4.1.2 of this report along with Impact C.

Impacts D and F are associated with water supply assessment and solid waste disposal, and are not discussed in this report and are evaluated separately in the EIR.

4. ENVIRONMENTAL IMPACTS

The purpose of the proposed conditions evaluation is to determine potential impacts related to the proposed land use zoning associated with the Southeast Area Project. The proposed Specific Plan consists of land use changes that will largely increase intensify existing land uses including multi-family homes, commercial and mixed use. Based on the proposed land use changes, runoff is anticipated to decrease overall while sewer and water demands are anticipated to increase. Additional details are provided below for hydrology, sewer and water.

4.1 HYDROLOGY

The purpose of the proposed conditions evaluation is to evaluate impacts associated with the proposed land use changes at a program-level EIR, characterize changes as compared to the existing runoff conditions and identify where additional storm drain facilities are recommended to improve runoff conditions.

4.1.1 Proposed Drainage Conditions

In order to evaluate impacts to the existing storm drain system, a summary of proposed land use changes within each land use designation is required. Table 13 provides a breakdown of the major land use changes within each land use designation including the primary land uses that will be added within each area.

Table 13 Existing and Proposed Land Uses and Associated Runoff Coefficients

Land Use Designation	*Acreage*	*Existing Imperviousness*	*Proposed Land Use Changes*	*Proposed Imperviousness*
Multi-Family Residential	117	62%	+129 MFR DUs	70%
Commercial-Neighborhood	9	92%	+49,864 SF Commercial	88%
Industrial	293	91%	+35,000 SF of Industrial	88%
Mixed Use Marina	14	92%	+450 DUs +217,882 SF Mixed Use + 25 Hotel Rooms	85%
Mixed Use Community Core	72	90%	+4,860 DUs +270,860 SF Mixed Use +25 Hotel Rooms	85%

Notes:
[a] Source: City GIS Data obtained 2015
Based on minimum landscape requirements and LID requirements (includes self-treating areas)

Based on the relatively high existing impervious conditions as shown in Figure 5 and Table 13 and proposed land uses which generally are equal to or less than existing impervious conditions, project runoff is not anticipated to increase over existing conditions. The existing City and County storm drain systems are not anticipated to change as a result of the Southeast Area Project, thereby making the 2005 Master Plan of Drainage Update applicable to the proposed conditions. Figure 11 highlights all storm drain improvements as identified in the 2005 Master Plan Update. This will impact a variety of facilities within the Multi-Family Residential, Commercial-Neighborhood, and Mixed Use Community Core land use designations.

Storm Drain Improvement Requirements for Southeast Area Project Area

In order for the proposed Southeast Area Project to be implemented in a responsible manner on the existing storm drain system, the following improvements and conditions will be required:

- All individual projects will require site specific hydrology and hydraulic studies of the on-site and immediate off-site storm drain systems to determine capacity and integrity of the existing systems prior to approval by Long Beach Public Works.

- The five city storm drain improvements identified within the 2005 Master Plan Update will be required as individual projects within the approved Specific Plan impact these specific segments of storm drain. Cost sharing mechanisms may be incorporated if the improvements benefit multiple landowners.

- Conformance with site specific "allowable discharge rates" as identified by Los Angeles County Public Works which limits peak flow discharges as compared to existing conditions based on regional flood control constraints. Each individual project that connects to a LA County storm drain line may have to request the "allowable discharge rate" from Los Angeles County Public Works if there is potential impact to the storm drain line.

- Incorporation of LID BMPs within each project will be required to provide water quality treatment and runoff reduction and/or detention in accordance with local stormwater permit requirements. Implementation of LID will also serve to minimize increase in runoff and will reduce runoff as compared to existing conditions.

4.1.2 Hydrology Impacts

The following impact assessments are based on the significance criteria established in Section 3.1 for hydrology.

Impact B: Would the Project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Impact Analysis: Under the existing conditions, the Southeast Area Project site is entirely built out with a high impervious condition. During storm events, most runoff does not have the opportunity to infiltrate and recharge groundwater. Under the proposed condition, the combination of enhanced landscaping, self-treating areas for water quality treatment and permeable pavements for water efficiency are some examples of features that are required with new developments that will inevitably increase perviousness compared to existing conditions. Also, on-site storm drain systems will be upgraded to include water quality LID features which will likely increase infiltration opportunities and the amount of infiltration as compared to existing conditions. The project site does not rely directly on on-site groundwater supply sources and therefore will have no impact on the local groundwater table.

Impact C: Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or in a manner which would result in a substantial erosion or siltation on- or off-site?

Impact Analysis: Under the existing conditions and proposed conditions, drainage patterns will largely be maintained and will utilize the existing drainage facilities within the public right of way. Under the existing conditions, flows generally drain south and westerly into the existing streets and are collected by a series of catch basins and storm drain facilities owned and operated by the City of Long Beach and Los Angeles County Public Works. Ultimately the majority of flows discharge to water bodies subject to tidal influences (Marine Stadium, Alamitos Bay, Los Cerritos Channel) or the San Gabriel River. Such water bodies are not subject to substantial erosion or siltation based on their ability to receive large influxes of water while maintaining their channel stability.

A small portion of the project (Existing Market Place adjacent to PCH within the Mixed Use Community Core area) drains easterly towards the existing wetlands owned by the City of Long Beach. If large increases of runoff occurred to the existing wetlands, localized flooding and scour could occur near the discharge point. However, the drainage areas tributary to the existing wetlands are all built out with high impervious conditions (>90%) and any future project would likely result in lower impervious conditions and peak flow reductions based on landscaping and LID requirements.

One exception to this statement is the potential extension of Shopkeeper Road located within the Mixed Use Community Core. In the event Shopkeeper Road was extended southerly to Studebaker Road, design features consistent with the MS4 Permit would require volume and peak flow mitigation to match existing (pre-built) conditions. Hydromodification requirements would not apply based on the fact it would not drain into a riverine channel susceptible to hydromodification impacts.

Under the proposed condition, overall drainage patterns, flow rates and flow volumes will be maintained based on the high level of impervious condition under the existing condition and will not increase the opportunity to erosion or scour downstream. On-site storm drain systems will likely change with the individual project components but will still utilize the existing city and county facilities within the public right of way. Implementation of the project will not result in erosion or siltation on or off-site.

Impact D: Would the Project substantially alter the existing drainage pattern of the site, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

Impact Analysis: See Impact Assessment C for alteration of existing drainage patterns. The proposed project will not result in an increase of peak flow runoff or volume based on the redevelopment of the project area. The on-site storm drain systems will be designed to safely collect and convey the 10-year flood within the on-site storm drain system while protecting all proposed buildings, structures and public safety from the 50-year capital event. Further flow rate restrictions may apply based on site specific discharge limits issued by Los Angeles County Public Works which would serve to further reduce peak flows well below existing conditions. Impacts related to increases in rate and volume of runoff are less than significant.

In the event Shopkeeper Road was extended southerly to Studebaker Road, design measures would be incorporated to control surface runoff events that would reduce impacts related to flooding and water quality while maintaining conditions similar to existing runoff. Design measures could include bioswales, bioretention landscaping and permeable pavement to reduce runoff impacts.

Impact E: Would the Project create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?

Impact Analysis: The majority of the existing storm drain system is adequately sized to accommodate the existing and proposed condition runoff. Based on the 2005 Master Plan of Drainage Update, one County and four City storm drain improvements were identified. Implementation of the proposed upgrades for the City storm drain facilities would be tied to the redevelopment projects throughout the specific plan boundary. Implementation of the Los Angeles County storm drain deficiencies is not anticipated and impacts to the system will be controlled by "allowable peak flow discharges" issued by the County per individual project. These allowable discharges often result in a reduction of peak flow discharges as compared to existing conditions.

The project is not anticipated to produce substantial additional sources of polluted runoff based on the proposed water quality management strategy of infiltration and/or biotreatment. A full discussion of water quality impacts is provided in Impact Assessment A under Section 4.4.3 of this report.

Impact G: Would the Project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Impact Analysis: The proposed zoning changes and redevelopment areas that will include residential housing do not lie within the 100-year floodplain (refer to Section 2.1.3). Therefore, there are no impacts related to residential housing or proposed structures within the floodplain.

Impact H: Would the Project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Impact Analysis: See Impact Assessment G.

Impact J: Would the Project be subject to inundation by seiche, tsunami, or mudflow?

Impact Analysis: The Southeast Area Project is not located in an area susceptible to seichi or mudflows based on its downstream location in a highly developed watershed. Impacts caused by seiche or mudflows are considered less than significant.

The Project area is located within a tsunami zone as identified by Tsunami Inundation Map for Emergency Planning (Los Alamitos Quadrangle, Seal Beach Quadrangle, March 1, 2009) prepared by the CA Department of Conservation. Based on the project's location, tsunami awareness materials and preparedness materials should be included with all redevelopment project approvals such and be provided in lease agreements or disclosures during the escrow process.

Figure 11

SEASP Proposed Storm Drain Recommended Improvements

- Catch Basins
- LACFCD Storm Drains
- City of Long Beach Storm Drains
- Proposed Storm Drain Recommended Improvements
- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

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4.2 SEWER & WASTEWATER INFRASTRUCTURE

4.2.1 Proposed Wastewater System Flows per Land Use Designation

Under the proposed condition, sewer flows will increase significantly due to the increase in multi-family residential, commercial, and industrial uses. A total increase of 5,439 DUs, approximately 574,000 sf of non-residential uses are proposed under the ultimate build out condition. The projected flow rates also account for the increases in hotel rooms (50 rooms) throughout the Mixed Use Community Core and Mixed Use Marina. Using the same methodology as the existing conditions (Section 2.2.2), proposed sewer demand flows are provided below in Table 14. See Appendix B for additional details.

Table 14 Proposed Condition Average Daily Sewer Flows

Land Use Designation	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Proposed Average Daily Flow (GPD)[2]*	*Existing Average Daily Flow (GPD)*	*Change in Sewer Flows (GPD)*	*% Increase*
Multi-Family Residential	2,458	--	383,448	363,324	+20,124	+6%
Commercial-Neighborhood	--	137,214	44,595	28,389	+16,206	+57%
Industrial	--	1,145,711	229,142	222,142	+7,000	+3%
Mixed Use Marina	450	223,277	179,857	25,191	+154,667	+613%
Mixed Use Community Core	4,860	1,107,545	1,258,399	295,362	+963,037	+326%
Total	7,768	2,613,747	2,089,049	934,408	+1,161,033	+124%

1. Non-Residential includes commercial, retail and industrial land uses
2. Accounts for a total of 50 additional proposed hotel rooms within the Mixed Use Marina and the Mixed Use Community Core. Demand factors specific to hotel rooms were employed instead of non-residential square footage demand factors to avoid duplication.
3.

Notes:
GPD gallons per day SF square feet

Full implementation of the land use changes has the potential to increase sewer flows by 1.16 MGD within the project area. Figure 12 highlights areas that will experience increased sewer flows from land use changes. The increase in flows will be generally spread out among the Mixed Use Community Core and Mixed Use Marina, thereby potentially impacting numerous city sewer lines. In order to evaluate the impact of the proposed land uses, the County's sewer hydraulic flow analysis was reviewed and analyzed to account for the increases in sewer flows.

4.2.2 Proposed Sewer/Wastewater System

The majority of the proposed sewer increases will originate from the Mixed Use Community Core and the Mixed Use Marina proposed land uses. The existing sewer systems serving this

area are primarily 8″ and 10″ lines owned by LBWD. All flows end up in the LACSD owned sewer lines (15″ & 18″) along PCH which drain northerly towards Colorado Blvd. LBWD maintains a sewer system hydraulic model to evaluate capacities, future improvements and evaluating impacts of new projects. The model generally accounts for sewer lines 12″ and greater. Therefore, the model does not cover the subject areas subject to land use changes within SEASP. It is anticipated that several of the 8″ sewer lines serving the Mixed Use Community Core and the Mixed Use Marina will require upsizing to 10″ or 12″ lines dependent upon the size, density and location of the individual projects. The requirement to evaluate existing lines and determine if upsizing is required is covered in the LBWD Sewer Design Guidelines and described below.

All sanitary sewers shall be designed in accordance with certain design standards, Long Beach Water Department (LBWD) Rules and Regulations, and to accepted engineering principles. In all newly development areas and/or in all existing areas where new sanitary sewers are required, the design shall include the provisions that the sewer systems size and capacity can adequately accommodate the ultimate anticipated conditions.

Flow monitoring and sewer capacity study is required under certain scenarios. These include when a proposed development intensifies the land use from the existing development on the site or a proposed development requires a general plan amendment to a more intense use. Typically, the modeling of an "existing condition" scenario will be compared to an "existing condition with proposed development" scenario to determine any significant increases in sewer flows. The capacity study is to ensure the sewer system can accommodate a proposed development, and if not, help identify needed improvements required for the development. The developer is required to cover the costs associated with flow monitoring, sewer capacity study, and sewer modeling.[10]

The project applicant may need to make improvements to the sewer system at their own costs and request a reimbursement agreement to recover a portion of the costs from other developments that tie into the system and benefit from the improvements. These agreements typically run about 20 years and are not guaranteed to be paid in full.

In addition to impacts to the LBWD sewer system, impacts may occur to the LACSD trunk lines that provide regional sewer service. Maximum peak flow data was obtained from LACSD to evaluate long term impacts. LACSD trunk lines serving the site as the lines are designed to accommodate on average over 3.26 MGD and the maximum flow rates from 2007-2012 averaged approximately 1.15 MGD. The addition of the 1.16 MGD to the existing trunk lines would not increase the flows beyond the total design capacity of these larger trunk lines and implementation of the Project is not anticipated to impact the regional system or exceed planned treatment capacities at the waste water treatment plant.

However, numerous trunk lines provide sewer service within the areas subject to redevelopment and individual LACSD trunk lines could potentially be impacted. To prevent this from happening, LACSD has regional mechanisms and databases in place to track growth

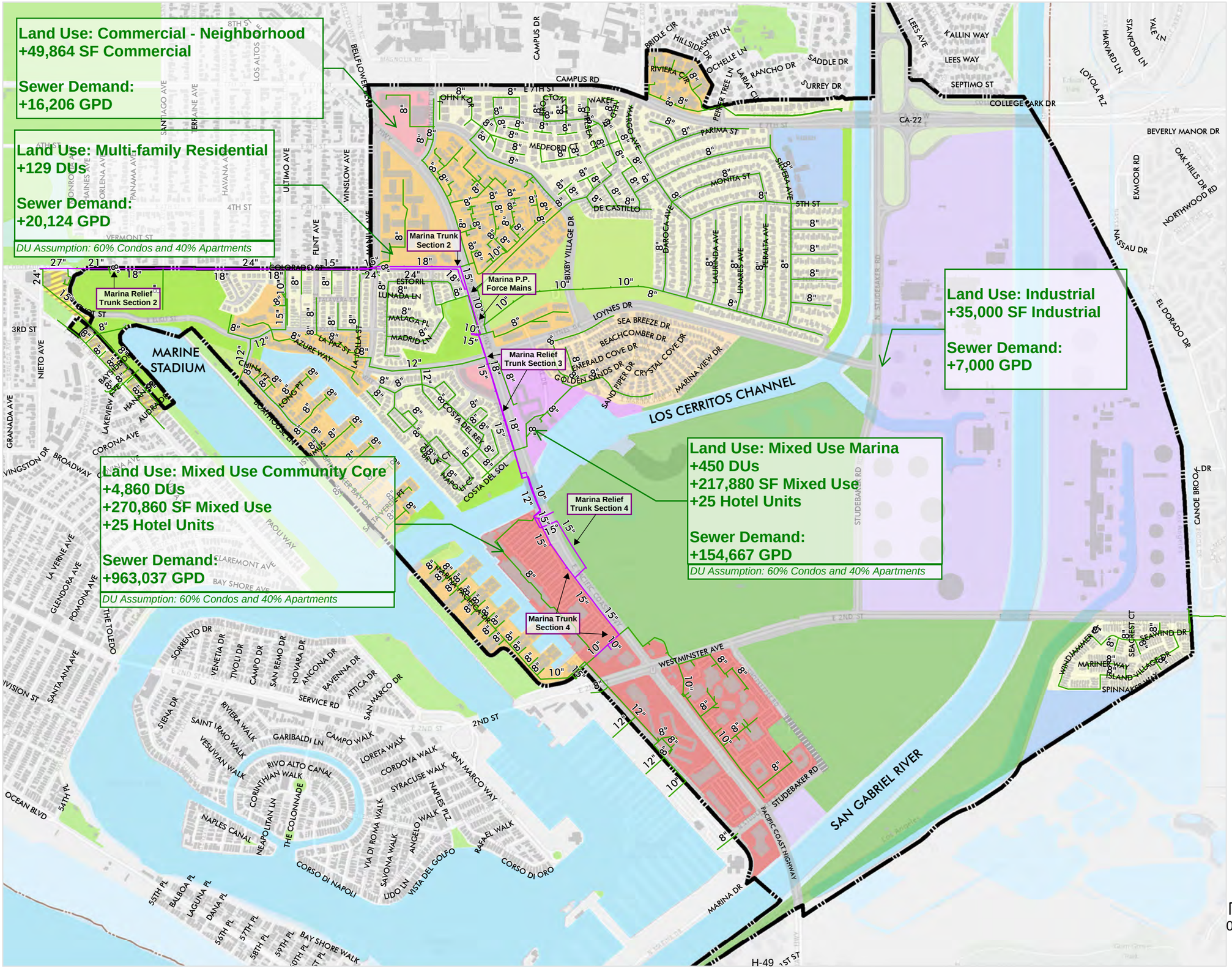
[10] Long Beach Water Department. Design Criteria for Sanitary Sewer Facilities. http://lbwater.org/sites/default/files/3.0%20Sanitary%20Sewer%20Design%20Criteria_v2.pdf accessed December 2015.

projections, changes in land use and flow monitors to determine if certain trunk lines may be impacted in the future. In addition, all site specific flow monitoring required by LBWD is provided to LACSD so they can track the capacity of the lines connecting with LACSD trunk lines within a certain region. Through this process, long term capacity is monitored closely to determine when trunk lines are nearing their design capacity (>0.75d/D). If LACSD identifies that over time, specific trunk lines are nearing their design capacity, the line will be added to their comprehensive Capital Improvement Project list for future upgrade.

If implementation of upgrades is required, conformance with the General Construction Permit for Linear Projects would be followed which serves to reduce the impacts of construction through the use of sediment and erosion based BMPs.

Figure12

SEASP Proposed Sewer Demands



LACSD Sewer Mains and Trunk Names

LBWD Sewer Mains (7" Diameter and Greater)

- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary

Sewer Demand Factors

Land Use	Demand Factor	Unit
Multi-family Housing[1]	156	GPD/DU*
Condominiums[1]	195	GPD/DU
Hotels/Motels	125	GPD/Unit
Industrial	200	GPD/ 1 thousand SF
Commercial/Office /Retail	325	GPD/ 1 thousand SF

Source: Los Angeles County Sanitation District

**Derived from LACSD "Table 1 - Loadings for Each Class of Land Use" assuming five units or more.*

[1] DU Assumption: 60% condominiums and 40% Apartments in Mixed Use Community Core and Mixed Use Marina

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4.2.3 Sewer/Wastewater Impacts

The following impact assessments are based on the significance criteria established in Section 3.2 for wastewater.

Impact A. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

Impact Analysis: The proposed land use changes associated with the Southeast Area Project including residential, commercial, industrial and mixed use and the increase in proposed sewer flows will not exceed the treatment requirements of the Los Angeles RWQCB. Therefore, no impacts related to treatment requirements are anticipated.

Impact B. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Impact Analysis: Long Beach Water Department requires that all projects must perform sewer flow tests for the particular line the projects intends to connect with to determine the existing capacity within the 8" and 10" lines within the project area. The flow tests will determine whether or not there is sufficient capacity to accommodate the proposed project. If existing flows plus the projected flows exceed the design criteria, the project applicant would be responsible for upsizing the existing sewer line they intend to connect to as part of their project.

The existing capacity of the regional wastewater system is currently heavily monitored by the LACSD. Implementation of the Southeast Area Project would not require upsizing of the LACSD treatment plant facilities as the trunk lines serving the site based on their total design capacity. The trunk lines serving the project area and surrounding area are designed to accommodate on average over 3.26 MGD. The maximum flow rates from the project area and surrounding area 2007-2012 averaged approximately 1.15 MGD. The addition of the 1.16 MGD to the existing trunk lines would not increase the flows beyond the total design capacity of these larger trunk lines nor would it exceed the design capacity of the wastewater treatment plant. For LACSD trunk lines which collect flows from the tributary LBWD sewer lines, the system can accommodate the entire SEASP growth projections. However, based on the large number of trunk lines serving the PCH corridor and Colorado Blvd within the project area, an individual trunk line may require upsizing as the full implementation of the SEASP project occurs over time. LACSD has a system in place to monitor and track trunk line capacity and anticipate upgrades in advance prior to systems reaching their maximum capacity.

If implementation of upgrades is required, conformance with the General Construction Permit for Linear Projects would be followed which serves to reduce the impacts of construction through the use of sediment and erosion based BMPs.

Impact E. Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

Impact Analysis: Implementation of the Southeast Area Project would not require upsizing of the LACSD treatment plant facilities as the trunk lines serving the site are designed to accommodate on average over 3.26 MGD. The maximum flow rates from 2007-2012 averaged approximately 1.15 MGD. The addition of the 1.16 MGD to the existing trunk lines would not increase the flows beyond the total design capacity of these larger trunk lines nor would it exceed the design capacity of the wastewater treatment plant.

There are a variety of LACSD trunk lines serving the SEASP project area including main lines and relief lines along PCH and Colorado Blvd. In total, there is sufficient capacity to accommodate the entire SEASP sewer increase projection. However, individual trunk lines may be impacted dependent upon the orientation and sewer loadings of the specific projects within SEASP. LACSD tracks and monitors the capacity of their trunk lines through flow tests and projected sewer flows. In the event a particular trunk line is identified as nearing design capacity over time, LACSD will include the particular line to its capital improvement project list. LACSD can also request that the SEASP projects modify their sewer alignment to tie into a different LBWD line that does not impact the specific LACSD trunk line. Through these requirements, LACSD can commit to providing sufficient sewer capacity for the proposed project and impacts related to sewer capacity are considered less than significant.

4.3 WATER INFRASTRUCTURE

4.3.1 Proposed Water Demand per Land Use Designation

Under the proposed condition, water demands will increase due to the increase in high-density residential and commercial, mixed use and industrial uses. A total increase of 5,439 DUs, approximately 574,000 sf of non-residential uses are proposed under the ultimate build out condition. The projected flow rates also account for the increases in hotel rooms (50 rooms) throughout the Mixed Use Marina and Mixed Use Community Core. Table 15 and Figure 13 show the changes in water demands based on the proposed land use changes for each land use area, using the same methodology as for the existing conditions. Detailed calculations and associated exhibits are included in Appendix C.

Table 15 Proposed Condition Average Daily Water Demand

Land Use Designation	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Proposed Water Demand (GPD)[2]*	*Existing Water Demand (GPD)*	*Change in Demand (GPD)*	*% Increase*
Multi-Family Residential	2,458	--	548,564	519,775	+28,790	+6%
Commercial-Neighborhood	--	137,214	27,438	17,470	+9,967	+57%
Industrial	--	1,145,711	229,102	222,103	+7,000	+3%
Mixed Use Marina	450	223,277	219,059	24,512	+194,547	+794%
Mixed Use Community Core	4,860	1,107,545	1,380,147	190,750	+1,189,397	+624%
Total	7,768	2,613,747	2,404,310	974,610	+1,429,700	+147%

1. Non-Residential includes commercial, retail and industrial land uses
2. Accounts for a total of 50 additional proposed hotel rooms within the Mixed Use Marina and the Mixed Use Community Core. Demand factors specific to hotel rooms were employed instead of non-residential square footage demand factors to avoid duplication.

Notes:
GPD gallons per day SF square feet

Full implementation of the land use changes has the potential to increase water demand by 1.43 MGD within the project area. The increase in flows are generally focused within the Mixed Use Community Core and Mixed Use Marina land use areas, thereby potentially impacting numerous city water lines within these areas.

4.3.2 Proposed Water System

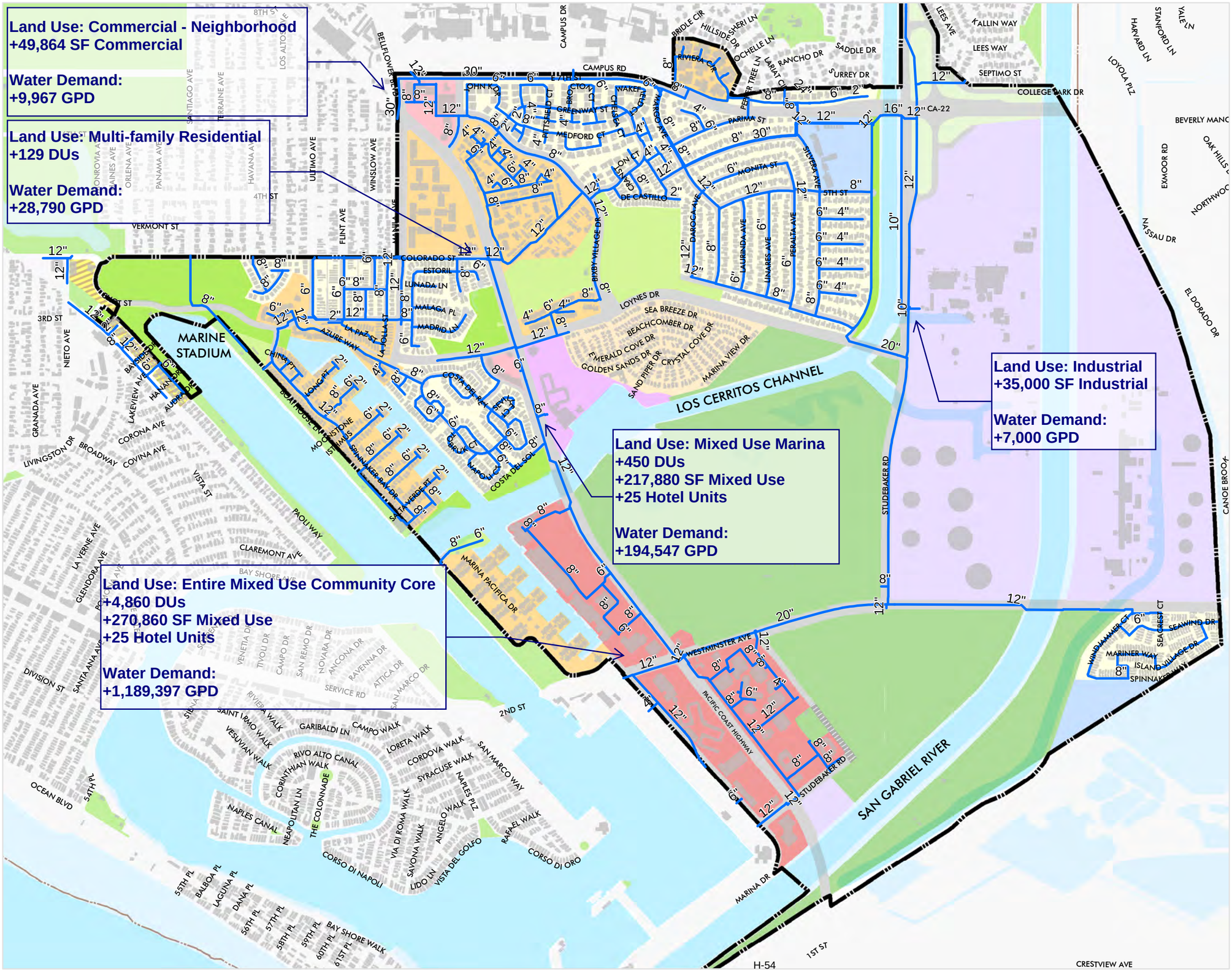
In order to evaluate the impact of the proposed land uses, the City's water hydraulic model was updated to account for the increases in water flows and verify fire flow pressures could be maintained with the proposed land use. Projected water demands plus estimated fire flow requirements based on the predominant land use were incorporated into the model to look at regional impacts.

The results indicated that water pressure remains between 60-80 psi on average and that flow velocities remain under the desired maximum velocity of 8.0 fps (see Figure 14). The results are provided in Appendix C. Based on these results, the existing water system has sufficient capacity and fire pressure to service the projected build out of the Southeast Area Project. No major infrastructure improvements are anticipated and the increases in water demand can be adequately served by the existing infrastructure. To confirm, each proposed project within SEASP will require fire flow pressure tests to confirm the findings of the City's hydraulic water model. In addition, routine maintenance and replacement of older water lines will continue throughout

the Southeast Area Project consistent with the Capital Improvement Program established by the Long Beach Water Department.

Figure 13

SEASP Proposed Water Demands



Water Mains
Single Family Residential
Mobile Homes
Multi-Family Residential
Commercial - Neighborhood
Mixed Use Community Core
Mixed Use Marina
Industrial
Public
Coastal Habitat, Wetlands & Recreation
Open Space/Recreation
Dedicated ROW (not built)
ROW/Caltrans
Channel, Marina & Waterway
Converting to Conventional Zoning
Specific Plan Boundary
City Boundary

Water Demand Factors

Land Use	Demand Factor	Unit
Multi-family Housing	223	GPD/DU
Hotels/Motels	125	GPD/Unit
Commercial/Office /Retail/Industrial	200	GPD/ 1 thousand SF

Source: Long Beach Water Department

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4.3.3 Water Impacts

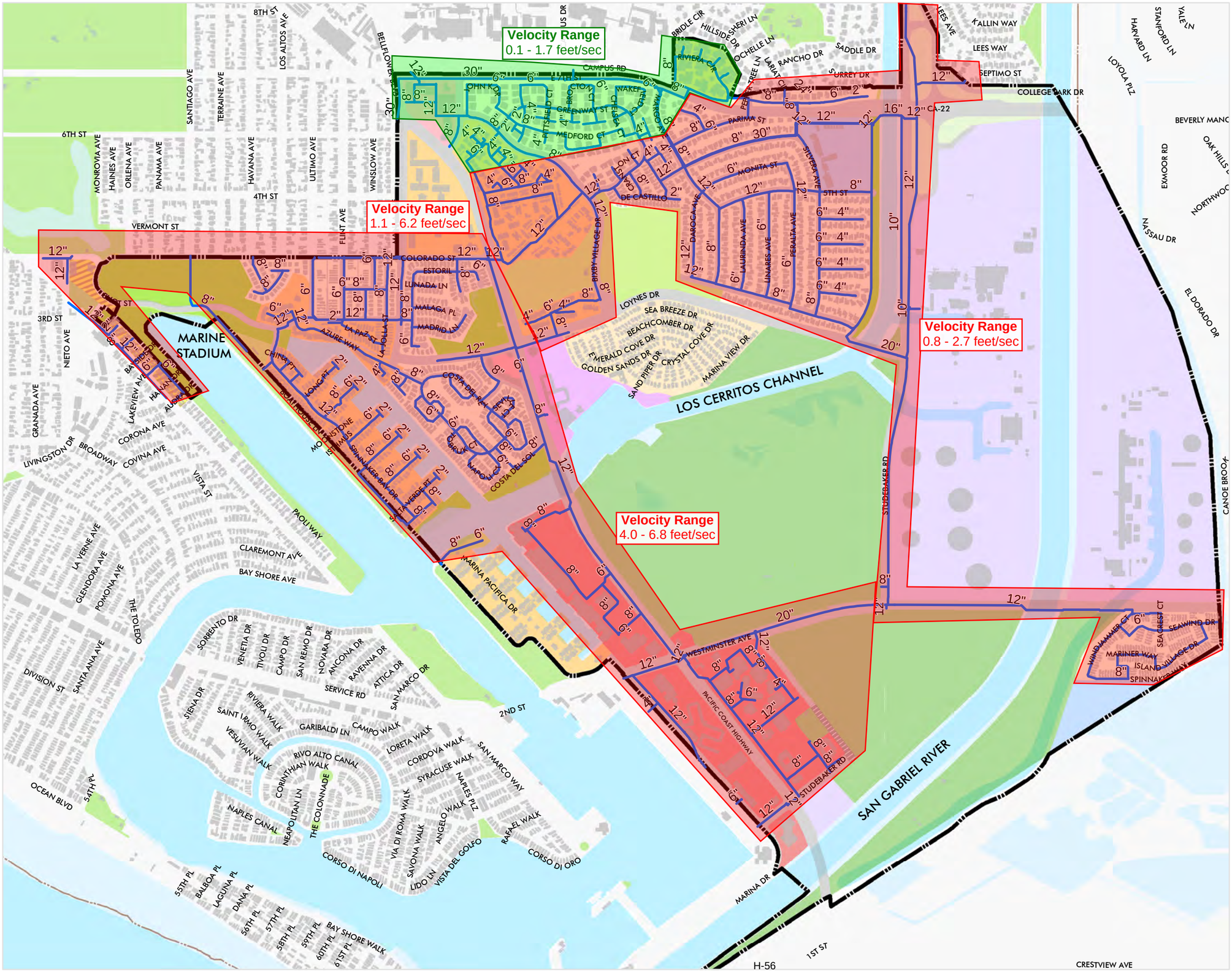
The following impact assessments are based on the significance criteria established in Section 3.2 for water systems.

Impact B Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Impact Analysis: Implementation of the project may require the construction of new on-site water lines to better serve the individual proposed projects based on their specific location and site orientation. However, as the existing and proposed water system capacity has been found to be sufficient within the Southeast Area Project, there is currently no anticipated need for the construction of new water lines within the public right of way or any expansions to the existing system. Based on the ability of the existing city water system to provide flows to the existing and proposed demands of SEASP, impacts related to water infrastructure are considered less than significant.

Figure 14

SEASP Proposed Water System Capacity



- Water Mains
- Single Family Residential
- Mobile Homes
- Multi-Family Residential
- Commercial - Neighborhood
- Mixed Use Community Core
- Mixed Use Marina
- Industrial
- Public
- Coastal Habitat, Wetlands & Recreation
- Open Space/Recreation
- Dedicated ROW (not built)
- ROW/Caltrans
- Channel, Marina & Waterway
- Converting to Conventional Zoning
- Specific Plan Boundary
- City Boundary
- Areas with an average 60-79 psi
- Areas with an average 40-59 psi

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4.4 SEA LEVEL RISE

Coastal Cities and associated General Plans, Local Coastal Programs & Specific Plans must address future sea level rise (SLR). In August 2015, the CA Coastal Commission unanimously approved their Sea Level Rise Policy Guidance document which provides guidance on how Cities should incorporate SLR into their planning efforts. The document identifies several objectives for Specific Plans including establishment of the following parameters:

- Projected SLR range for the proposed project;
- Determine how impacts from SLR may constraint the project site;
- Determine how the project may impact coastal resources, considering the influence of future SLR upon the landscape;
- Identify alternatives to avoid resource impacts and minimize risks; and
- Finalize project design and submit CDP.

A part of SEASP, Moffett & Nichol performed a site-specific SLR analysis for the SEASP study area (July 2015, Appendix D) which included the following parameters:

- Development of a numerical model to evaluate SLR under various conditions
- Establishment of three different SLR scenarios out to 2060 to cover the lifespan of the Southeast Area Specific Plan including existing conditions and two future conditions utilizing a median SLR projection (1.5 feet) and a high SLR projection (2.6 feet) consistent with the Policy Guidance document.
- Inundation maps for each scenario in GIS for future planning
- Consistency with the numerical model and SLR scenarios analyzed for the Los Cerritos Wetland Conceptual Restoration Plan (2014)

The analysis found that the majority of the SEASP area will be intact from projected SLR scenarios with the exception of a few developed areas including the following:

- Spinaker Bay within Marine Stadium
- Existing multi-family development in between Azul Way and Long Beach Bikeway Route 10 and Marine Stadium
- Jack Nichol Park adjacent to the Bay Harbor Residential Community.
- Parking lot of the Best Western Hotel
- Los Cerritos Wetland and adjoining undeveloped areas adjacent to the San Gabriel River

Each of these areas can expect to encounter minor flooding by 2060 when evaluating the high projection during dry and 50-year storm/future high tide conditions. In order to protect against future SLR, several strategies are available to the City and land owners.

City-wide SLR Strategies

The City of Long Beach is participating in multiple SLR studies with regional partners to understand the potential impacts across the City from various scenarios. As these studies are finalized and resiliency strategies are evaluated and approved, the City will be able to develop comprehensive SLR planning policies and infrastructure design requirements for the SLR impacts. These policies would be applicable to all future development and redevelopment. The strategies

would also help identify where long terms capital improvement project funds should be directed to protect existing infrastructure critical to basic services for the City and protection of life and property. For example, the City could adopt a standard bulkhead/seawall design and elevation that must be implemented for all applicable projects to accommodate future SLR scenarios.

SEASP SLR Strategies

In addition to a city-wide SLR strategy, resiliency strategies for areas within SEASP subject to SLR impacts are also required. For existing residential areas not anticipated for redevelopment such as Spinaker Bay, the existing bulkhead can be retrofitted or capped to a higher elevation to adjust for SLR (See Figure 15). As projects are approved through the Coastal Development Permit process by the CA Coastal Commission, raising of seawalls and bullkheads is becoming a standard condition. There are several options including complete replacement, capping of the existing wall to increase the elevation or implementation of a new wall in front of the existing wall. This process would slowly reduce impacts of SLR for Spinaker Bay and the existing multi-family off Azul Way as individual permits are approved.

For the Best Western Hotel, redevelopment of this property could include a shoreline management plan to account for future SLR (See Figure 16). Several options are available including raising the pad and parking lot elevations, retreat to accommodate SLR while allowing for a future parking structure to maintain existing parking, shore line protection or extension of the existing bulkhead serving the marina facility to the east.

For the Marine Stadium Park, Los Cerritos Wetland Restoration Area and portion of the Industrial land use designation, soft defense and retreat measures can be taken to accommodate future SLR (See Figure 17, Figure 18 and Figure 19). Such measures include establishment of habitat edge conditions or Low Impact Development features that can accommodate temporary flooding, removal of park features to higher elevations or re-grading of the park to re-contour for adaptive. Hard defenses such as seawalls or bulkheads may also be considered.

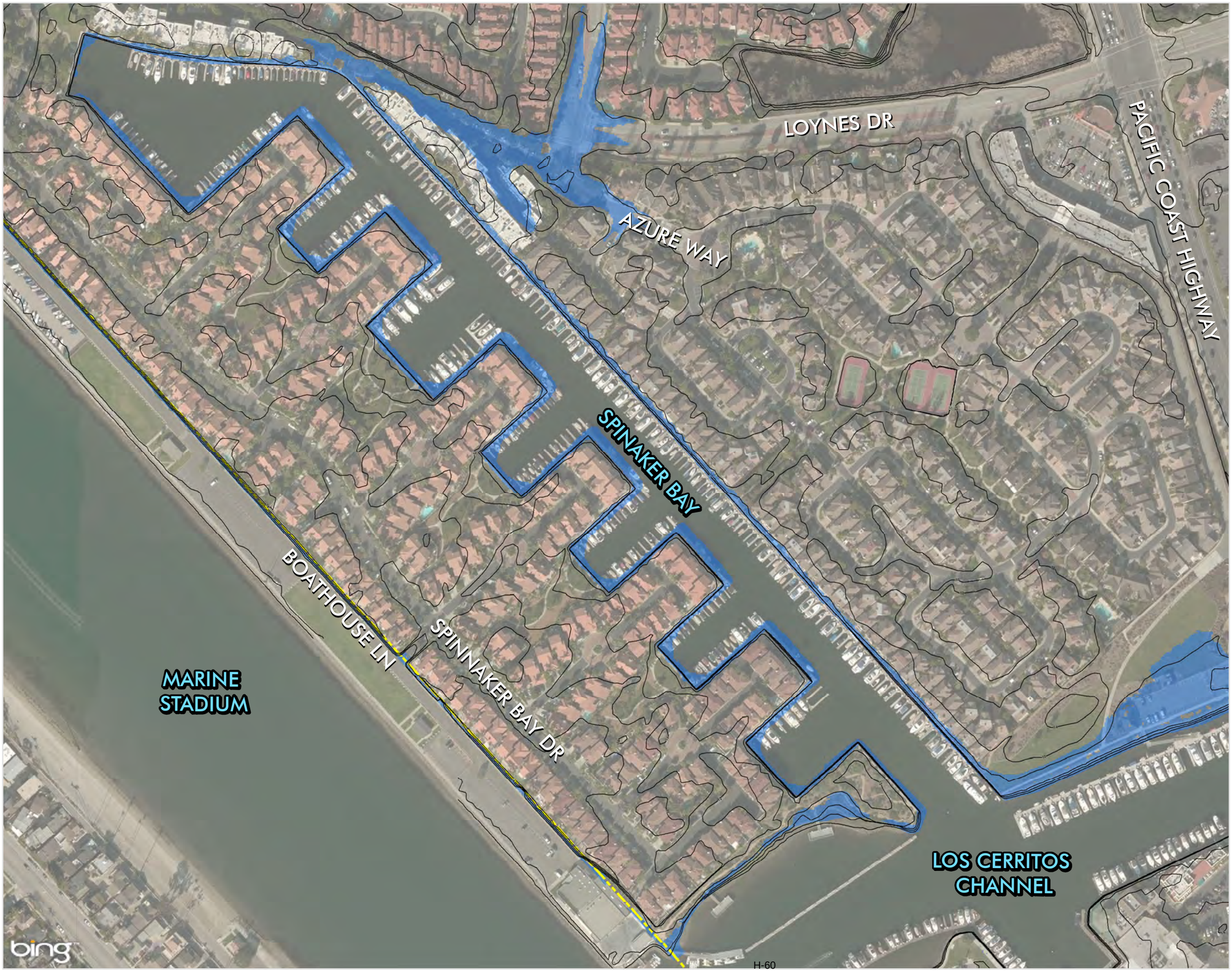
Los Cerritos Wetland Authority (LCWA) Conceptual Wetland Restoration Plan

An integral part of the SEASP project area is the Los Cerritos Wetlands which includes approximately 565 acres occupying the middle and southern portion of the project area. Approximately 200 acres are publically owned (170 by Los Cerritos Wetland Authority (LCWA), 34 acres by the City of Long Beach and 5 acres owned by the CA State Lands Commission). The remaining is partially owned by other interests. After a multi-year process with extensive outreach and public participation, the LCWA finalized the Conceptual Wetland Restoration Plan in August 2015 led by a local coastal engineering consultant, Moffatt & Nichol. The purpose of the report is to serve as a long-term road map on how to restore habitat and tidal functionality to the wetlands. Three main alternatives are presented including a minimum alternation (Alternative 1), moderate alteration (Alternative 2) and maximum alteration (Alternative 3). For each of these alternatives, SLR modeling was performed and was accounted for within the design of the alternatives restoration plans. As previously noted, the models used to evaluate SLR within the wetlands area were the same models and assumptions utilized for the SEASP evaluation for consistency. The SLR results identified that increases in SLR would increase the tidal range of the connected water bodies within the wetland area but would not adversely impact any existing

developed areas surrounding the wetlands. Impacts of SLR within the conceptual wetland restoration area to the surrounding development areas are considered less than significant.

Figure 15

Sea Level Rise – Spinaker Bay Existing Residential Area



SEASP Boundary

Inundation Area (SLR = 2.6ft)

2' Elevation Contours

Note: SEASP Areas Possible Inundated Under 2.6 Feet of Sea Level Rise, Wet Conditions (2060)

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0 130 260 520 Feet

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Figure 16

Sea Level Rise – Best Western Hotel

SEASP Boundary

Inundation Area (SLR = 2.6ft)

2' Elevation Contours

Note: SEASP Areas Possible Inundated Under 2.6 Feet of Sea Level Rise, Wet Conditions (2060)

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0 90 180 360 Feet

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Figure 17

Sea Level Rise – Marine Stadium Park

SEASP Boundary

Inundation Area (SLR = 2.6ft)

2' Elevation Contours

Note: SEASP Areas Possible Inundated Under 2.6 Feet of Sea Level Rise, Wet Conditions (2060)

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0 60 120 240 Feet

11/10/2015 COLB-04.0

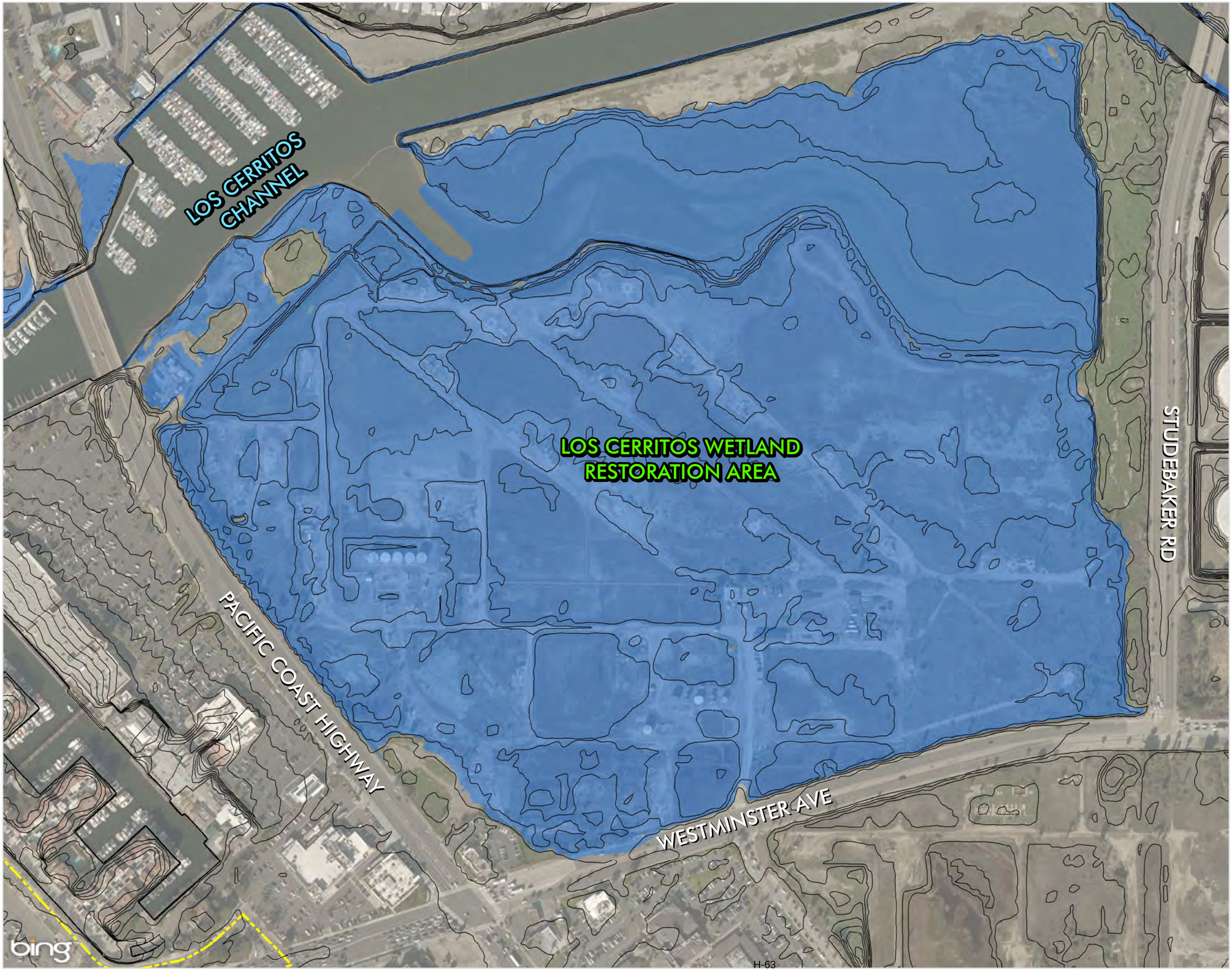

Figure 18

Sea Level Rise – Los Cerritos Wetland Restoration Area

SEASP Boundary

Inundation Area (SLR = 2.6ft)

2' Elevation Contours

Note: SEASP Areas Possible Inundated Under 2.6 Feet of Sea Level Rise, Wet Conditions (2060)

FUSCOE ENGINEERING

0 165 330 660 Feet

11/10/2015 COLB-04.0

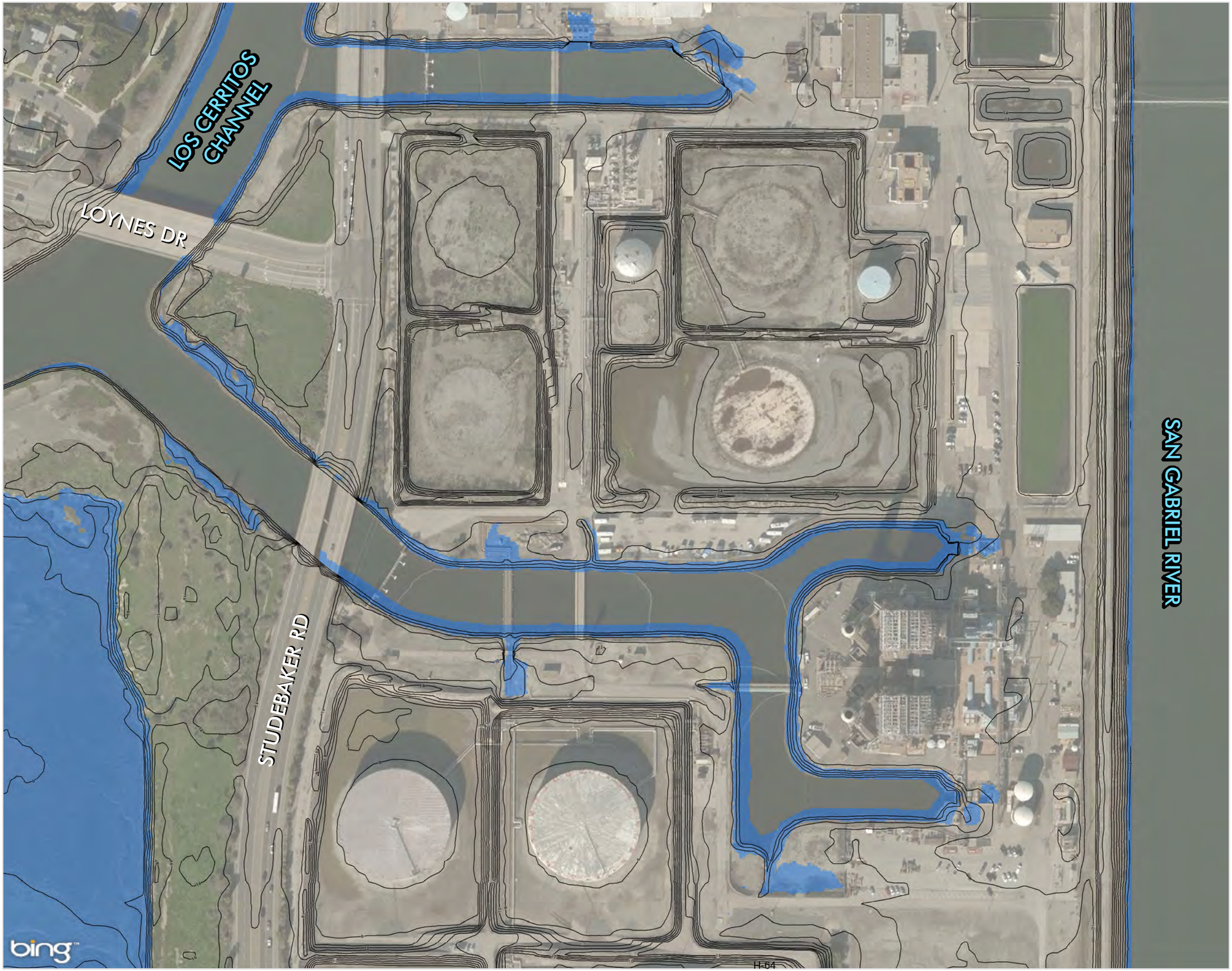

Figure 19

Sea Level Rise – Industrial Area

SEASP Boundary

Inundation Area (SLR = 2.6ft)

2' Elevation Contours

Note: SEASP Areas Possible Inundated Under 2.6 Feet of Sea Level Rise, Wet Conditions (2060)

FUSCOE ENGINEERING

0 100 200 400 Feet

11/10/2015 COLB-04.0

4.5 WATER QUALITY

4.5.1 Construction Activities

Clearing, grading, excavation and construction activities associated with the proposed project may impact water quality due to sheet erosion of exposed soils and subsequent deposition of particulates in local drainages. Grading activities, in particular, lead to exposed areas of loose soil, as well as sediment stockpiles, that are susceptible to uncontrolled sheet flow. Although erosion occurs naturally in the environment, primarily from weathering by water and wind action, improperly managed construction activities can lead to substantially accelerated rates of erosion that are considered detrimental to the environment.

General Construction Permit

Prior to the issuance of grading permits, the project applicants shall provide evidence that the development of the projects one acre or greater of soil disturbance shall comply with the most current General Construction Permit (GCP) and associated local National Pollutant Discharge Elimination System (NPDES) regulations to ensure that the potential for soil erosion is minimized on a project-by-project basis. In accordance with the updated GCP (Order No. 2009-0009-DWQ), the following Permit Registration Documents are required to be submitted to the SWRCB prior to commencement of construction activities:

- Notice of Intent (NOI)
- Risk Assessment (Standard or Site-Specific)
- Particle Size Analysis (if site-specific risk assessment is performed)
- Site Map
- SWPPP
- Post-Construction Water Balance Calculator (not required – project is covered under the Long Beach MS4 permit Order No. R4-2014-0024)
- Active Treatment System (ATS) Design Documentation (if ATS is determined necessary)
- Annual Fee & Certification

The updated GCP, Order No. 2009-0009-DWQ, uses a risk-based approach for controlling erosion and sediment discharges from construction sites, since the rates of erosion and sedimentation can vary from site to site depending on factors such as duration of construction activities, climate, topography, soil condition, and proximity to receiving water bodies. The updated GCP identifies three levels of risk with differing requirements, designated as Risk Levels 1, 2 and 3, with Risk Level 1 having the fewest permit requirements and Risk Level 3 having the most-stringent requirements.

Based on the Risk Level a project falls under, different sets of regulatory requirements are applied to the site. The main difference between Risk Levels 1, 2, and 3 are the numeric effluent standards. In Risk Level 1, there are no numeric effluent standard requirements, as it is considered a low Sediment Risk and low Receiving Water Risk. Instead, narrative effluent limits are prescribed. In Risk Level 2, Numeric Action Levels (NALs) of pH between 6.5-8.5 and turbidity below 250 NTU are prescribed in addition to the narrative effluent limitations found in

Risk Level 1 requirements. Should the NAL be exceeded during a storm event, the discharger is required to immediately determine the source associated with the exceedance and to implement corrective actions if necessary to mitigate the exceedance. Prior to December 2011, for a Risk Level 3 site, Numeric Effluent Limits (NELs) are applied in addition to the narrative and numeric effluent standards prescribed for a Risk Level 2 site. Risk Level 3 dischargers are subject to a pH Numeric Effluent Limit (NEL) of 6.0-9.0 and turbidity NEL of 500 NTU. Once an NEL is exceeded, the construction site is considered in violation of the GCP. Since December 2011, however, the Supreme Court issued a judgment and peremptory writ of mandate to remove requirements for NELs and to amend the GCP. Proposed revisions to the GCP requires Risk Level 3 dischargers to comply with Risk Level 2 requirements for NALs in addition to more rigorous monitoring requirements such as receiving water monitoring and in some cases bioassessment should NALs be exceeded.

Since the proposed Project is a Specific Plan in the City of Long Beach, a detailed, site-specific Risk Assessment cannot be performed at this time. However, since the project site resides in a watershed considered to be a low-risk receiving water body, it is anticipated that construction projects subject to the GCP will not be greater than Risk Level 2.

Construction Best Management Practices (BMPs)

In accordance with the existing and updated GCP, a construction SWPPP must be prepared and implemented at all construction projects with 1 acre or greater of soil disturbance, and revised as necessary, as administrative or physical conditions change. The SWPPP must be made available for review upon request, shall describe construction BMPs that address pollutant source reduction, and provide measures/controls necessary to mitigate potential pollutant sources. These include, but are not limited to: erosion controls, sediment controls, tracking controls, non-storm water management, materials & waste management, and good housekeeping practices.[11] The above-mentioned BMPs for construction activities are briefly discussed below.

Prior to commencement of construction activities within the Southeast Area Project area, the project-specific SWPPP(s) will be prepared in accordance with the site specific sediment risk analyses based on the grading plans, with erosion and sediment controls proposed for each phase of construction for the individual project. The phases of construction will define the maximum amount of soil disturbed, the appropriate sized sediment basins and other control measures to accommodate all active soil disturbance areas and the appropriate monitoring and sampling plans.

SWPPPs will require projects to plan BMPs for four general phases of construction: (1) grading and land development (e.g., mass grade & rough grade), (2) utility and road installation, (3) vertical construction, and (4) final stabilization and landscaping. Therefore, BMP implementation for new construction can be evaluated in this general context. Site specific details on individual BMPs will be dependent on the scope and breadth of each future project, which are not known at this time.

[11] California Stormwater Quality Association. (2003, January). *Stormwater Best Management Practices Handbook for New Development and Redevelopment*. Retrieved January 27, 2009, from http://www.cabmphandbooks.com

4.5.2 Post-Construction Activities

With the proposed land use changes, development of the Southeast Area Project may result in long-term impacts to the quality of storm water and urban runoff, subsequently impacting downstream water quality. It can potentially create new sources for runoff contamination through changing land uses. As a consequence, the Project may have the potential to increase the post-construction pollutant loadings of certain constituent pollutants associated with the proposed land uses and their associated features. Some common pollutants associated with mixed use redevelopment include bacteria/pathogens, metals, nutrients, oil/grease, sediment, organic compounds, trash/debris, oxygen demanding substances and pesticides.

To help prevent long-term impacts associated with land use changes and in accordance with the requirements of the City of Long Beach and its MS4 permit (Order No. R4-2014-0024), new development and significant redevelopment projects must incorporate LID/site design and source control BMPs to address post-construction storm water runoff management. In addition, projects that are identified as Priority Projects are required to implement site design/LID and source control BMPs applicable to their specific priority project categories, as well as implement treatment control BMPs where necessary. Selection of LID and additional treatment control BMPs is based on the pollutants of concern for the specific project site and the BMP's ability to effectively treat those pollutants, in consideration of site conditions and constraints. Further, projects must develop a project-specific LID Design Plans that describes the menu of BMPs chosen for the project, as well as include operation and maintenance requirements for all structural and any treatment control BMPs.

Since the Southeast Area Project does not include a specific or detailed development plan, project-specific LID Design Plans will not be developed for the project at this time. Future project-specific reports, preliminary and/or final, will be prepared consistent with the prevailing terms and conditions of the City's LID Ordinance (Ordinance No. ORD-2013-0024) and LID BMP Design Manual (2013) at the time of project application. Moreover, LID and water quality treatment solutions prescribed in project-specific reports shall be designed to support or enhance the regional BMPs and efforts implemented by the City as part of their City-wide efforts to improve water quality.

LID Design Approach

The overall approach to water quality treatment for the individual projects within the Southeast Area Project will include incorporation of site design/LID strategies and source control measures throughout the sites in a systematic manner that maximizes the use of LID features to provide treatment of storm water and reduce runoff. In accordance with the MS4 Permit for the City of Long Beach, the use of LID features will be consistent with the prescribed hierarchy of treatment provided in the Permit: infiltration, evapotranspiration, harvest/reuse and biotreatment. For those areas of the site where LID features are not feasible or do not meet the feasibility criteria, treatment control BMPs with biotreatment enhancement design features will be utilized to provide treatment. Where applicable, LID features will be analyzed to demonstrate their ability to treat portions of the required design capture volume (DCV) and reduce the size of downstream on-site treatment control BMPs.

Consistent with regulatory requirements and design guidelines for water quality protection, the following principles are being followed for the project and will be supported by construction level documents in the final LID Design Plans prior to grading permit(s) issuance by the City of Long Beach:

- Where feasible, LID features will be sized for water quality treatment credit according to local Regional Board sizing criteria as defined in the 2014 MS4 Permit for either flow-based or volume-based BMPs. There must be a significant effort to integrate LID techniques within the internal development areas (site design objectives), thereby providing treatment of low-flow runoff directly at the source and runoff reduction of small (i.e., more frequent) storm event runoff (first-flush). In most instances, LID features will be sized by volume-based analyses to demonstrate compliance with the required design capture volume for the project.
- Detailed field investigations, drainage calculations, grading, and BMP sizing to occur during the detailed design phase and future project-specific LIUD Design Plan documentation.
- Where feasible, LID features will be designed to infiltrate and/or reuse treated runoff on-site in accordance with feasibility criteria as defined in the 2013 LID BMP Design Manual (City of Long Beach Development Services)
- For those areas of the project where infiltration is not recommended or acceptable and harvest/reuse landscaping demands are insufficient, biotreatment LID features will be designed to treat runoff and discharge controlled effluent flows to downstream receiving waters.

Unlike flood control measures that are designed to handle peak storm flows, LID BMPs and treatment control BMPs are designed to retain, filter or treat more frequent, low-flow runoff or the "first-flush" runoff from storm events. In accordance with the 2014 MS4 Permit for the City of Long Beach, the LID BMPs shall be sized and designed to ensure on-site retention of the volume of runoff produced from a 24-hour 85th percentile storm event, as determined from the Los Angeles County's 85th Percentile Precipitation Map.[12] This is termed the "design capture volume", or DCV. The 85th Percentile for the northern half of the Southeast Area Project is 0.7" while the 85th Percentile event for the southern half of the project area is 0.6". The City's LID BMP Design Manual provides design criteria, hydrologic methods and calculations for combining use of infiltration, retention, and biofiltration BMPs to meet on-site volume retention requirements.

SEASP Water Quality Opportunities

Within the SEASP project area, there are opportunities for Low Impact Development features within the mixed use land uses. Mixed use projects tend to be higher density with limited at grade surface parking and often include parking structures that may include subterranean parking facilities. Although these are considered limitations, opportunities exist for LID integration within the common areas, landscape perimeters and subterranean locations. For example, a bioswale within the Whole Foods parking lot along PCH was incorporated to treat parking lot surface waters. Similar facilities could be incorporated within the proposed projects.

[12] Los Angeles County Department of Public Works Hydrology Map. http://dpw.lacounty.gov/wrd/hydrologygis/ (Accessed March 2015)

Incorporating storm water treatment within the proposed landscaping (i.e. biofiltration flow through planter) is potentially feasible based upon the proposed grading. In addition, proprietary biotreatment BMPs designed at the allowable flow-through rates may be suitable for certain projects or specific locations within projects. A centralized harvest and use cistern to capture rain water and reuse for landscaping and internal building demands (toilet flushing and laundry services) is also an option. With this option, recent technology has increased the viability of gray water systems which collect shower and sink water and then treat and disinfect to reusable standards. Gray water systems can be combined with storm water harvest and reuse systems to provide sustainable solutions to reducing potable water usage by reusing water more than once. Lastly, in certain area of SEASP project site, infiltration into deeper depths below the upper clay soils may be possible. However, the presence of shallow groundwater lenses would prohibit infiltration based solutions.

Opportunities also existing within the public right of way for those streets that may undergo re-design. Parkway planters provide opportunities for stormwater treatment and proprietary based biotreatment BMPs for roadway drainage.

Consistency with the State-wide Trash TMDL

As part of the state-wide mandate to reduce trash within receiving waters, the City of Long Beach and the SEASP project will be required to adhere to the requirements of the amended CA Trash Total Maximum Daily Load (TMDL) in July 2016. The requirements will include the installation and maintenance of trash screening devices at all public curb inlets, grate inlets and catch basin inlets. The trash screening devices must be approved by the local agency and consistent with the minimum standards of the Trash TMDL.

4.5.3 Water Quality Impacts

The impact assessments are based on the significance criteria established in Section 3 for water quality.

Impact A *Would the Project violate any water quality standards or waste discharge requirements?*

Impact Analysis: Construction activities related to the build-out of the Specific Plan would potentially result in soil erosion and temporary adverse impacts to surface water quality from construction materials and wastes if left unregulated or unmitigated.

Both State and Local regulations will effectively mitigate construction storm water runoff impacts from the build-out of the Southeast Area Specific Plan. The City of Long Beach Municipal Code requires standard erosion control practices to be implemented for all construction within the City. Additionally, construction sites will be required to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the requirements of the Statewide General Construction Permit and subject to the oversight of the Los Angeles Regional Water Quality Control Board. The SWPPP must include BMPs to reduce or eliminate erosion and sedimentation from soil disturbing activities, as well as proper materials and waste management. Implementation of these State and Local requirements would effectively protect projects from

violating any water quality standards or waste discharge requirements from construction activities.

In terms of post-construction related impacts, the incorporation of site design, LID features and BMPs as required under the City of Long Beach LID design requirements, the individual development and redevelopment projects within the Southeast Area Specific Plan will effectively retain or treat the 85th percentile 24-hour storm water runoff for pollutants such as bacteria, metals, nutrients, oil & grease, organics, pesticides, sediment, trash, and oxygen demanding substances prior to discharge off their property. As more and more properties within the Southeast Area Specific Plan area undergo redevelopment as part of the Specific Plan build-out, properties not containing any water quality BMPs will be replaced with project incorporating LID BMPs. Therefore, long-term surface water quality of runoff from the Southeast Area Specific Plan area would be expected to improve over existing conditions as more LID BMPs are implemented with the redevelopment projects throughout the project. This is considered an overall beneficial effect of the project.

Impact F Would the Project otherwise substantially degrade water quality?

Impact Analysis: As a result of the construction-related, site design, LID and source control BMPs, water quality exceedances are not anticipated and pollutant loads in Project runoff are not expected to adversely affect beneficial uses in downstream receiving waters, such as the Los Angeles River. See Impact Analysis to Impact A for additional details.

5. CONCLUSION

The proposed land use changes under the Southeast Area Project will increase the demand of potable water and sewer flows over existing conditions while largely maintaining existing runoff conditions. The report identifies a variety of storm drain improvements to improve existing condition runoff collection and improve conditions for the proposed land plan. In all cases, project specific analyses will be required during final design to evaluate individual storm drain, water and sewer facilities related to the individual projects to ensure impacts are less than significant.

Based on the existing built out condition and the proposed land use changes under the Southeast Area Project including the implementation of low impact development features, no substantial additional sources of pollutants or significant increases in Project runoff for the 85th percentile storm event are anticipated. Based on the findings of this technical study, the incorporation of site design/LID features, and infiltration/biotreatment BMPs as required under the MS4 Permit and local LID requirements, the individual projects will adequately reduce project related impacts to hydrology and water quality to a level less than significant.

6. REFERENCES

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7. TECHNICAL APPENDICES

Appendix A Hydrology

Appendix B Sewer Demand Calculations

Appendix C Water Demand Calculations

Appendix D Sea Level Rise Modeling for SEASP Area

APPENDIX A

HYDROLOGY

Conv. ID	Map Atlas No	Ownership		Elevations Ground	Elevations Invert	Existing Section Length (ft)	Slope	Man N	Size	Dge Area (acres)		Return Period (Years) 10	25	50	Capacity (cfs)	Replacement Size
Major Basin: 22																
220005	2	City	US	11.00	2.43	767	0.0010	0.013	36" Dia Pipe	14	Hydrology (cfs)	13.0	16.0	18.0	21.1	
	S5		DS	10.00	1.66						Depth in Street (ft)	-NA-	-NA-	-NA-		
220010	2	City	US	8.01	3.82	143	0.0097	0.013	30" Dia Pipe	14	Hydrology (cfs)	13.0	16.0	18.0	40.4	
	S5		DS	8.00	2.43						Depth in Street (ft)	-	-	-		
220015	3	City	US	7.69	5.17	617	0.0022	0.013	24" Dia Pipe	14	Hydrology (cfs)	14.0	17.0	19.0	10.6	30" Dia RCP
	S5		DS	8.00	3.82						Depth in Street (ft)	0.20	0.30	0.30		
220105	3	City	US	8.80	.58	151	0.0019	0.013	42" Dia Pipe	27	Hydrology (cfs)	25.0	30.0	34.0	43.3	
	T5		DS	8.70	.30						Depth in Street (ft)	-NA-	-NA-	-NA-		
220110	3	City	US	9.50	2.15	550	0.0019	0.013	36" Dia Pipe	12	Hydrology (cfs)	14.0	17.0	19.0	29.3	
	S5		DS	8.80	1.09						Depth in Street (ft)	-NA-	-NA-	-NA-		
220115	3	City	US	10.00	2.53	203	0.0019	0.013	33" Dia Pipe	12	Hydrology (cfs)	14.0	17.0	20.0	22.8	
	S5		DS	9.90	2.15						Depth in Street (ft)	-NA-	-NA-	-NA-		
220120	3	City	US	9.00	2.99	244	0.0019	0.013	30" Dia Pipe	12	Hydrology (cfs)	15.0	17.0	20.0	17.8	
	S5		DS	10.00	2.53						Depth in Street (ft)	-NA-	-NA-	-NA-		
220205	3	County	US	8.75	2.59	404	0.0050	0.013	24" Dia Pipe	15	Hydrology (cfs)	13.0	15.0	17.0	15.9	
	S5		DS	5.00	.58						Depth in Street (ft)	-NA-	-NA-	-NA-		
220305	7	City	US	13.10	1.26	452	0.0028	0.013	39" Dia Pipe	26	Hydrology (cfs)	25.0	30.0	34.0	43.4	
	S7		DS	9.50	.01						Depth in Street (ft)	-	-	-		
220310	7	City	US	9.20	3.27	685	0.0029	0.013	36" Dia Pipe	8	Hydrology (cfs)	9.0	11.0	12.0	36.1	
	S7		DS	13.10	1.26						Depth in Street (ft)	-	-	-		
220405	7	City	US	9.46	4.29	222	0.0112	0.013	42" Dia Pipe	35	Hydrology (cfs)	28.0	34.0	39.0	106.4	
	R8		DS	6.00	1.80						Depth in Street (ft)	-NA-	-NA-	-NA-		
220410	7	City	US	11.00	4.94	194	0.0010	0.013	36" Dia Pipe	19	Hydrology (cfs)	15.0	18.0	20.0	20.9	
	R8		DS	9.46	4.75						Depth in Street (ft)	-NA-	-NA-	-NA-		
220415	7	City	US	10.40	5.44	478	0.0011	0.013	36" Dia Pipe	3	Hydrology (cfs)	2.0	2.0	3.0	21.6	
	R8		DS	11.00	4.94						Depth in Street (ft)	-NA-	-NA-	-NA-		

Conv. ID	Map Atlas No	Ownership		Elevations Ground	Elevations Invert	Existing Section Length (ft)	Slope	Man N	Size	Dge Area (acres)		Return Period (Years) 10	25	50	Capacity (cfs)	Replacement Size
Major Basin: 22																
220420	7	City	US	10.46	6.96	375	0.0008	0.013	24" Dia Pipe	3	Hydrology (cfs)	2.0	3.0	3.0	6.4	
	R7		DS	5.00	6.66						Depth in Street (ft)	-	-	-		
220505	7	City	US	9.86	5.26	315	0.0010	0.013	36" Dia Pipe	8	Hydrology (cfs)	8.0	9.0	10.0	20.9	
	R8		DS	11.00	4.95						Depth in Street (ft)	-NA-	-NA-	-NA-		
220510	7	City	US	9.71	6.21	270	0.0035	0.013	24" Dia Pipe	8	Hydrology (cfs)	8.0	9.0	11.0	13.4	
	R8		DS	4.00	5.26						Depth in Street (ft)	-	-	-		
220605	7	City	US	9.59	5.45	532	0.0013	0.013	24" Dia Pipe	7	Hydrology (cfs)	7.0	8.0	10.0	8.2	
	R8		DS	6.00	4.75						Depth in Street (ft)	-	-	0.20		
220705	7	County	US	5.00	2.40	371	0.0011	0.015	5.33'H x 5.00'W Box	213	Hydrology (cfs)	188.0	228.0	265.0	102.7	5.33'H x 8.00'W Box
	R7		DS		2.00						Depth in Street (ft)	0.40	0.50	0.50		
220710	7	County	US	5.00	2.80	381	0.0011	0.013	64" Dia Pipe	213	Hydrology (cfs)	188.0	229.0	268.0	100.1	84" Dia RCP
	R8		DS	4.90	2.40						Depth in Street (ft)	1.00	1.20	1.30		
220715	7	County	US	4.00	3.51	288	0.0025	0.015	5.33'H x 5.00'W Box	213	Hydrology (cfs)	189.0	230.0	268.0	155.4	5.33'H x 6.00'W Box
	R8		DS	5.00	2.80						Depth in Street (ft)	0.40	0.50	0.60		
220720	7	County	US	2.00	4.01	475	0.0011	0.015	5.33'H x 5.00'W Box	186	Hydrology (cfs)	169.0	205.0	240.0	101.5	5.33'H x 7.50'W Box
	R8		DS	4.00	3.51						Depth in Street (ft)	0.50	0.60	0.60		
220725	7	City	US	25.80	11.50	1,103	0.0078	0.013	48" Dia Pipe	83	Hydrology (cfs)	74.0	89.0	104.0	126.5	
	R9		DS	5.90	2.93						Depth in Street (ft)	-NA-	-NA-	-NA-		
220730	7	City	US	24.40	12.50	727	0.0014	0.013	45" Dia Pipe	65	Hydrology (cfs)	61.0	73.0	85.0	44.8	54" Dia RCP
	R9		DS	25.80	11.50						Depth in Street (ft)	0.60	0.70	0.80		
220735	7	City	US	19.00	13.85	821	0.0016	0.013	27" Dia Pipe	33	Hydrology (cfs)	31.0	37.0	42.0	12.5	42" Dia RCP
	S10		DS	33.00	12.50						Depth in Street (ft)	0.30	0.30	0.40		
220805	7	City	US	10.52	4.98	524	0.0039	0.013	39" Dia Pipe	90	Hydrology (cfs)	90.0	108.0	126.0	51.6	54" Dia RCP
	R8		DS	5.90	2.93						Depth in Street (ft)	-NA-	-NA-	-NA-		
220810	7	City	US	18.40	7.79	443	0.0063	0.013	39" Dia Pipe	80	Hydrology (cfs)	81.0	98.0	114.0	65.7	48" Dia RCP
	R9		DS	10.52	4.98						Depth in Street (ft)	0.40	0.50	0.60		

Conv. ID	Map Atlas No	Ownership		Elevations Ground	Elevations Invert	Existing Section Length (ft)	Slope	Man N	Size	Dge Area (acres)		Return Period (Years) 10	25	50	Capacity (cfs)	Replacement Size
Major Basin: 22																
220815	7 R9	City	US	16.88	12.80	65	0.0246	0.013	36" Dia Pipe	61	Hydrology (cfs)	62.0	74.0	87.0	104.5	
			DS	18.40	11.20						Depth in Street (ft)	-NA-	-NA-	-NA-		
220820	7 R9	City	US	20.50	14.53	256	0.0068	0.013	45" Dia Pipe	61	Hydrology (cfs)	62.0	75.0	87.0	99.4	
			DS	16.88	12.80						Depth in Street (ft)	-	-	-		
220825	7 R9	City	US	50.00	42.00	764	0.0360	0.013	36" Dia Pipe	54	Hydrology (cfs)	56.0	67.0	78.0	126.4	
			DS	20.50	14.53						Depth in Street (ft)	-NA-	-NA-	-NA-		
220830	7 R10	City	US	50.80	44.00	351	0.0057	0.013	36" Dia Pipe	44	Hydrology (cfs)	44.0	52.0	61.0	50.3	
			DS	45.80	42.00						Depth in Street (ft)	-	0.20	0.30		
220835	7 R10	City	US	69.00	55.90	315	0.0378	0.013	24" Dia Pipe	44	Hydrology (cfs)	44.0	53.0	61.0	43.9	30" Dia RCP
			DS	51.00	44.00						Depth in Street (ft)	-	0.20	0.30		
220905	7 R10	City	US	63.00	39.51	1,179	0.0229	0.013	27" Dia Pipe	16	Hydrology (cfs)	22.0	26.0	30.0	46.8	
			DS	33.00	12.50						Depth in Street (ft)	-	-	-		
221005	7 R8	City	US	8.55	3.05	269	0.0036	0.013	39" Dia Pipe	24	Hydrology (cfs)	24.0	28.0	33.0	49.8	
			DS	6.40	2.07						Depth in Street (ft)	-	-	-		
221010	7 R8	City	US	7.00	3.19	38	0.0037	0.013	36" Dia Pipe	24	Hydrology (cfs)	24.0	28.0	33.0	40.3	
			DS	8.00	3.05						Depth in Street (ft)	-	-	-		
221015	7 R8	City	US	9.08	5.38	324	0.0068	0.013	33" Dia Pipe	24	Hydrology (cfs)	24.0	29.0	33.0	43.5	
			DS	7.00	3.19						Depth in Street (ft)	-	-	-		
221020	7 R8	City	US	10.00	6.01	194	0.0033	0.013	30" Dia Pipe	24	Hydrology (cfs)	24.0	29.0	33.0	23.4	36" Dia RCP
			DS	8.00	5.38						Depth in Street (ft)	0.10	0.20	0.30		
221025	7 R9	City	US	10.00	6.53	220	0.0024	0.013	24" Dia Pipe	24	Hydrology (cfs)	24.0	29.0	33.0	11.0	36" Dia RCP
			DS	9.90	6.01						Depth in Street (ft)	0.50	0.60	0.60		
221105	7 Q8	City	US	9.50	2.22	323	0.0022	0.013	60" Dia Pipe	52	Hydrology (cfs)	30.0	40.0	49.0	122.8	
			DS	10.00	1.50						Depth in Street (ft)	-	-	-		
221110	7 Q8	City	US	9.64	2.28	68	0.0009	0.013	60" Dia Pipe	39	Hydrology (cfs)	20.0	28.0	34.0	77.2	
			DS	9.50	2.22						Depth in Street (ft)	-	-	-		

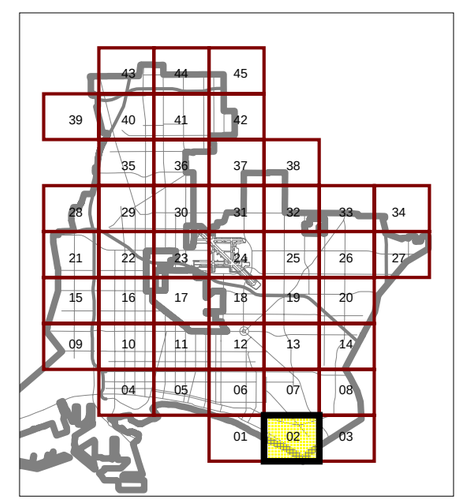
Conv. ID	Map Atlas No	Ownership		Elevations Ground	Elevations Invert	Existing Section Length (ft)	Slope	Man N	Size	Dge Area (acres)		Return Period (Years) 10	25	50	Capacity (cfs)	Replacement Size
Major Basin: 22																
221115	7	County	US	12.00	2.85	628	0.0009	0.013	48" Dia Pipe	39	Hydrology (cfs)	21.0	29.0	35.0	43.2	
	R9		DS	10.00	2.28						Depth in Street (ft)	-	-	-		
221120	7	County	US	17.00	3.12	289	0.0009	0.013	39" Dia Pipe	39	Hydrology (cfs)	21.0	29.0	35.0	25.2	
	R9		DS	12.00	2.85						Depth in Street (ft)	-	0.20	0.20		
221125	7	County	US	15.00	3.43	345	0.0009	0.013	24" Dia Pipe	39	Hydrology (cfs)	21.0	29.0	35.0	6.8	42" Dia RCP
	R9		DS	17.00	3.12						Depth in Street (ft)	0.30	0.40	0.40		
221205	7	City	US	9.50	2.23	29	0.0004	0.013	36" Dia Pipe	13	Hydrology (cfs)	12.0	15.0	17.0	12.5	
	Q8		DS	9.40	2.22						Depth in Street (ft)	-	0.20	0.20		
221305	8	City	US	8.30	3.08	195	0.0015	0.013	60" Dia Pipe	95	Hydrology (cfs)	67.0	88.0	102.0	102.1	
	T8		DS	9.00	3.38						Depth in Street (ft)	-	-	-		
221310	8	City	US	9.36	3.75	1,051	0.0065	0.013	42" Dia Pipe	95	Hydrology (cfs)	69.0	88.0	103.0	81.1	
	T8		DS	8.30	3.08						Depth in Street (ft)	-	0.30	0.60		
221315	8	City	US	9.60	4.04	283	0.0010	0.013	39" Dia Pipe	69	Hydrology (cfs)	47.0	59.0	70.0	26.0	54" Dia RCP
	S9		DS	9.36	3.76						Depth in Street (ft)	0.60	0.70	0.80		
221320	8	City	US	9.90	4.33	276	0.0010	0.013	36" Dia Pipe	62	Hydrology (cfs)	43.0	54.0	63.0	21.2	48" Dia RCP
	S9		DS	9.60	4.05						Depth in Street (ft)	0.50	0.60	0.70		
221325	7	City	US	9.00	4.55	234	0.0009	0.013	33" Dia Pipe	55	Hydrology (cfs)	41.0	50.0	58.0	16.2	48" Dia RCP
	S9		DS	8.90	4.33						Depth in Street (ft)	0.70	0.80	0.90		
221330	7	City	US	10.00	4.69	155	0.0009	0.013	30" Dia Pipe	55	Hydrology (cfs)	41.0	50.0	58.0	12.3	48" Dia RCP
	S9		DS	9.00	4.55						Depth in Street (ft)	0.40	0.50	0.50		
221335	7	City	US	16.00	5.82	1,197	0.0009	0.013	24" Dia Pipe	24	Hydrology (cfs)	24.0	28.0	32.0	6.9	42" Dia RCP
	S9		DS	10.00	4.69						Depth in Street (ft)	-NA-	-NA-	-NA-		
221405	8	City	US	8.00	5.35	171	0.0126	0.013	39" Dia Pipe	34	Hydrology (cfs)	34.0	41.0	48.0	92.6	
	T10		DS	6.00	3.20						Depth in Street (ft)	-	-	-		
221410	8	City	US	28.00	19.27	1,330	0.0105	0.013	33" Dia Pipe	34	Hydrology (cfs)	37.0	44.0	51.0	54.1	
	T10		DS	8.00	5.35						Depth in Street (ft)	-	-	-		

City of Long Beach Modeled Stormwater System

N

600' 0 600'

- Analysis Node
- 030105 Conveyance ID
- City Pipe/Box
- City Channel
- Roadway Surface Drainage
- County Pipe/Box
- County Channel
- Regional Drain
- Storage Basin
- 03 Major Basin
- 030105 Sub Basin
- SD01 Pump Station
- City Boundary



Drainage Map

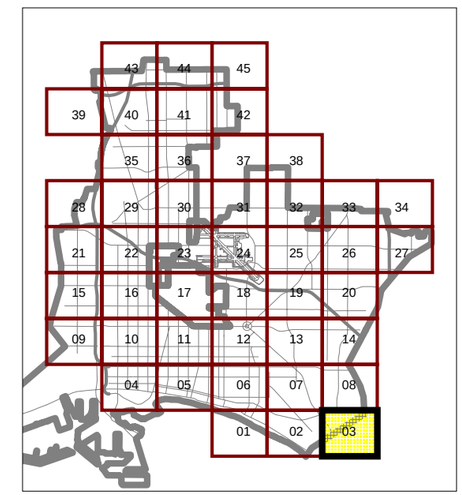
Map 02

City of Long Beach Modeled Stormwater System

N

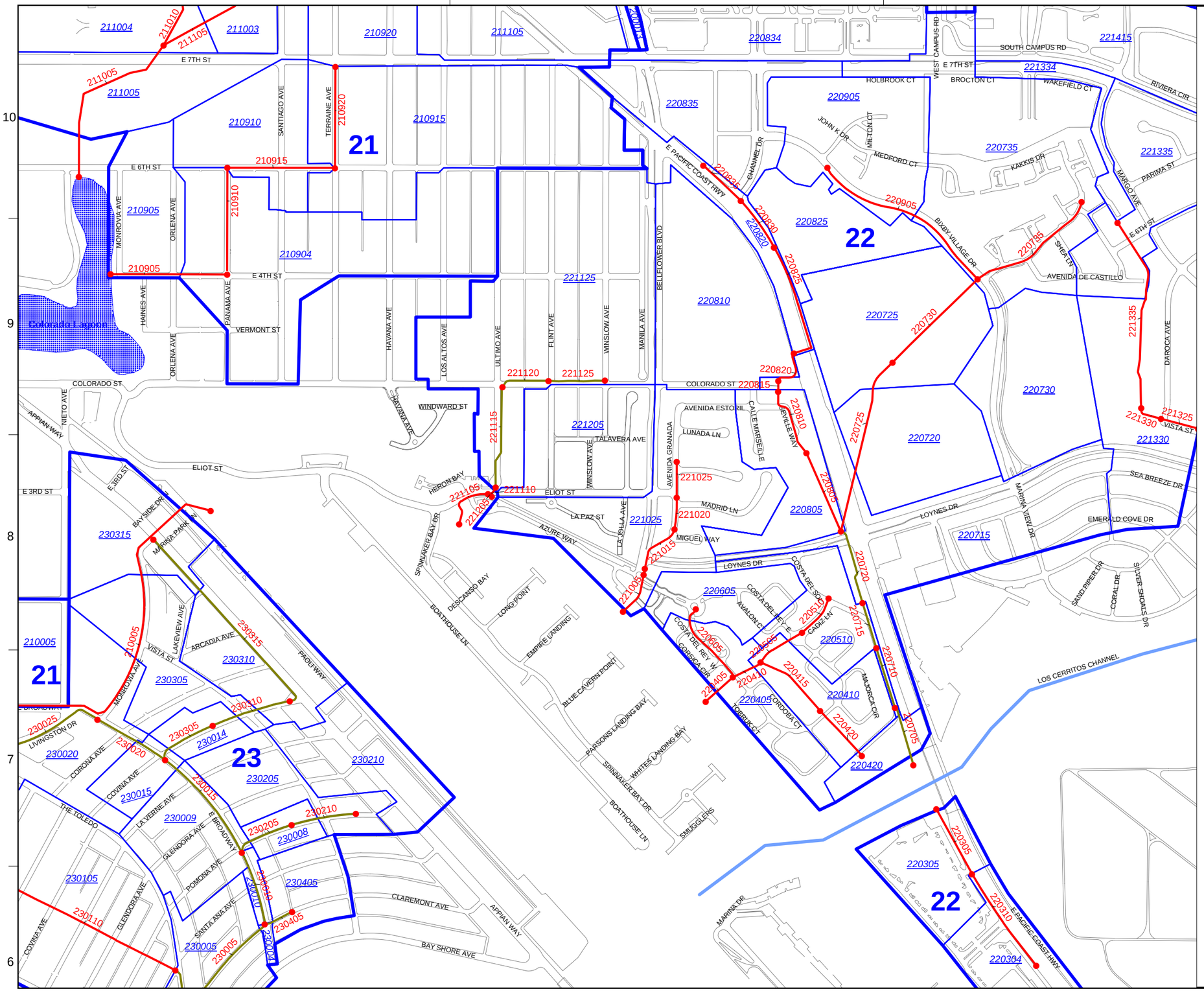
600' 0 600'

- Analysis Node
- 030105 Conveyance ID
- City Pipe/Box
- City Channel
- Roadway Surface Drainage
- County Pipe/Box
- County Channel
- Regional Drain
- Storage Basin
- 03 Major Basin
- 030105 Sub Basin
- SD01 Pump Station
- City Boundary



Drainage Map

Map 03

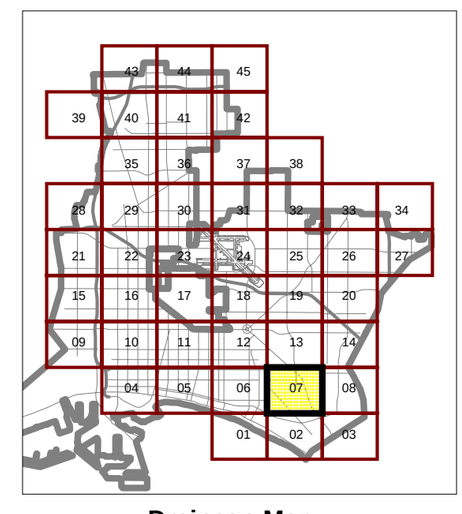


City of Long Beach Modeled Stormwater System

N

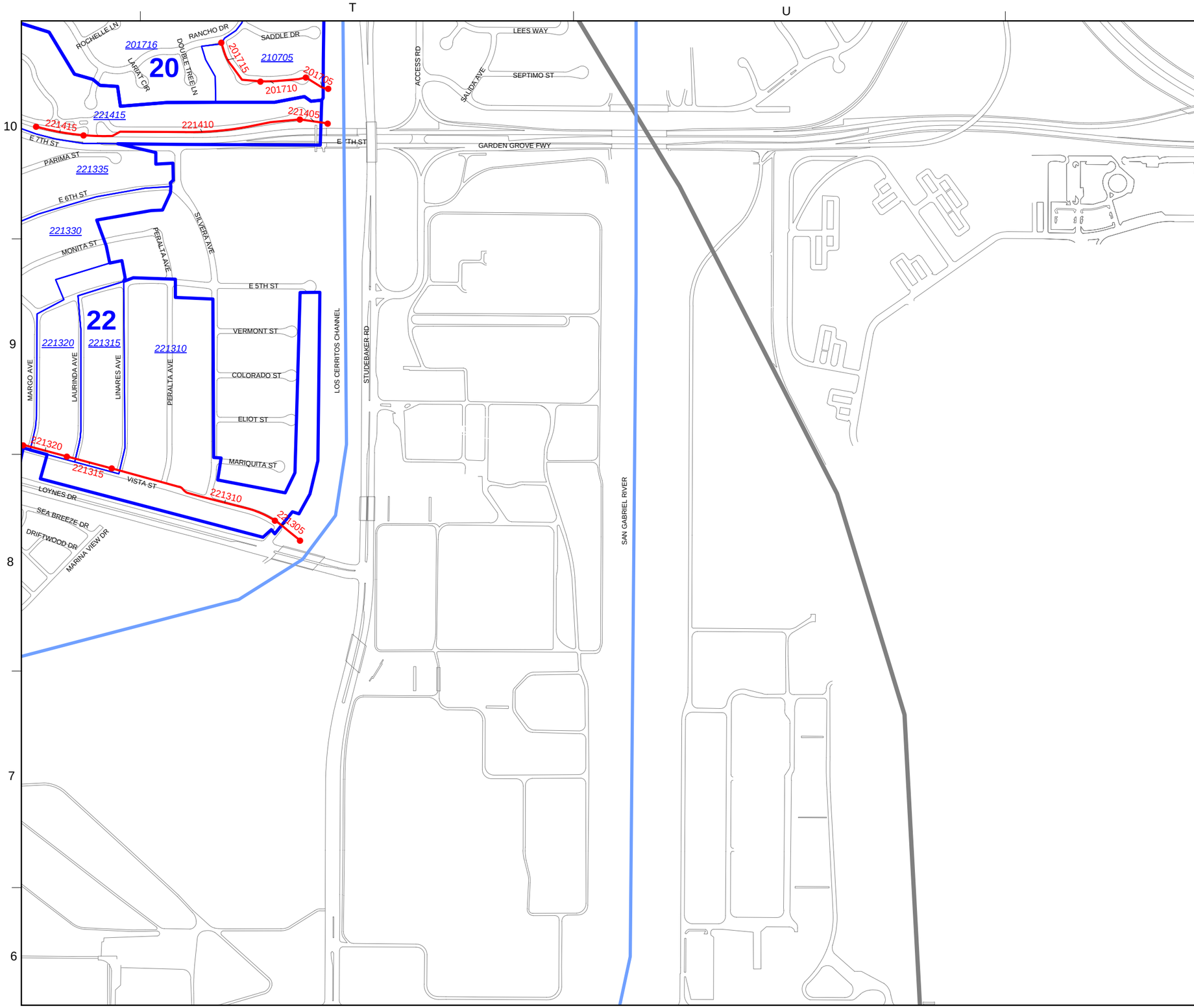
600' 0 600'

- Analysis Node
- 030105 Conveyance ID
- City Pipe/Box
- City Channel
- Roadway Surface Drainage
- County Pipe/Box
- County Channel
- Regional Drain
- Storage Basin
- 03 Major Basin
- 030105 Sub Basin
- SD01 Pump Station
- City Boundary



Drainage Map

Map 07

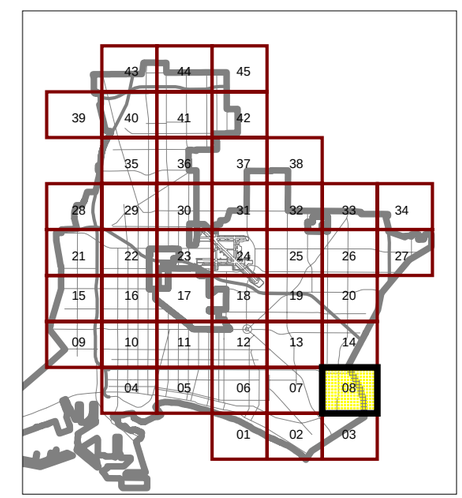


City of Long Beach Modeled Stormwater System

N

600' 0 600'

- Analysis Node
- 030105 Conveyance ID
- City Pipe/Box
- City Channel
- Roadway Surface Drainage
- County Pipe/Box
- County Channel
- Regional Drain
- Storage Basin
- 03 Major Basin
- 030105 Sub Basin
- SD01 Pump Station
- City Boundary



Drainage Map

Map 08

APPENDIX B

SEWER DEMAND CALCULATIONS

Long Beach SEASP Sewer Demand Analysis
April 6, 2016

Land Use	Existing Land Use		Proposed Land Use		Existing Sewer Demand	Proposed Sewer Demand	Increase in Sewer Demand	% Increase in Sewer Demand
	Square Feet	*Dwelling units*	*Square Feet*	*Dwelling units*	*GPD*	*GPD*	*GPD*	*%*
Commercial - Neighborhood	87,350		137,214		28,389.0	44,594.6	16,205.6	57%
Industrial	1,110,711		1,145,711		222,142.2	229,142.2	7,000.0	3%
Mixed Use Community Core	836,690		1,107,545.0	4,860.0	295,362.0	1,258,399.0	963,037.0	326%
Mixed Use Marina	5,395		223,277.0	450.0	25,190.5	179,857.0	154,666.5	614%
Multi-Family Res		2,329.0		2,458.0	363,324.0	383,448.0	20,124.0	6%
Totals	2,040,146.0	2,329.0	2,613,747.0	7,768.0	934,407.7	2,095,440.8	1,161,033.1	124%

Demand Factors:

Multi-Family Res: 156 GPD/DU

Condominiums: 195 GPD/DU

Hotels/Motels: 125 GPD/DU

Industial: 200 GPD/1,000 SF

Commercial/Mixed Use: 325 GPD/1,000 SF

TRUNK NAME	DIA.	USMH	DSMH	CAP (mgd)	PEAK	YEAR
Marina TS Section 4	9.48"	03 0498	03 0415	1.00	0.9	2007
Marina TS Section 4	15"	03 0415	03 0414	1.40	-	-
Marina TS Section 4	15"	03 0414	03 0413	1.40	0.9	2012
Marina TS Section 4	15"	03 0413	03 0412	1.30	-	-
Marina TS Section 4	15"	03 0412	03 0411	1.20	-	-
Marina TS Section 4	15"	03 0411	03 0553	1.30	0.8	2012
Marina TS Section 4	15"	03 0553	03 0410	1.40	0.7	2006
Marina TS Section 4	15"	03 0410	03 0409	1.60	-	-
Marina Relief TS Section 4	15"	03 0556	03 0555	1.50	-	-
Marina Relief TS Section 4	15"	03 0555	03 0554	1.60	0.6	2012
Marina Relief TS Section 4	15"	03 0554	03 0553	1.50	-	-
Marina Relief TS Section 4	15"	03 0553	03 0409	1.90	-	-
MARINA P.P. #2 FORCE MAIN #1	10"	03 0409	MARINA #	-	-	-
MARINA P.P. #2 FORCE MAIN #1	10"	03 0409	MARINA #	-	-	-
MARINA P.P. #2 EMERGENCY BYPASS	10"	03 0409	03 0589	-	-	-
MARINA P.P. #2 FORCE MAIN #1	10"	MARINA #	03 0589	-	-	-
MARINA P.P. #2 FORCE MAIN #2	10"	03 0589	03 MARINA	0.80	-	-
MARINA P.P. #2 FORCE MAIN #2	10"	03 MARINA	03 0522	0.90	-	-
MARINA P.P. #2 FORCE MAIN #2	12"	03 0522	03 0521	9.30	-	-
MARINA P.P. #2 FORCE MAIN #2	12"	03 0521	03 0520	0.40	-	-
MARINA P.P. #2 FORCE MAIN #2	12"	03 0520	03 0519	11.20	-	-
MARINA P.P. #2 FORCE MAIN #1	10"	03 0522	03 MARINA	-	-	-
MARINA P.P. #2 FORCE MAIN #1	10"	03 MARINA	03 0408	0.20	-	-
MARINA RELIEF TRUNK, SECTION 3	0	03 0408	03 0508	-	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0508	03 0507	5.80	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0507	03 0519	2.80	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0519	03 0506	2.60	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0506	03 0505	1.70	1.30	2012
MARINA RELIEF TRUNK, SECTION 3	18"	03 0505	03 0504	2.10	1.40	2006
MARINA RELIEF TRUNK, SECTION 3	18"	03 0504	03 0503	6.70	1.10	2012
MARINA RELIEF TRUNK, SECTION 3	18"	03 0503	03 0502	1.30	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0502	03 0501	2.10	-	-
MARINA RELIEF TRUNK, SECTION 3	18"	03 0501	03 0500	10.60	-	-
MARINA RELIEF TRUNK, SECTION 3	0	03 0500	03 0403	-	-	-
MARINA TRUNK, SECTION 3	14.34"	03 0403	03 0402	4.10	2.40	2006
MARINA P.P. #1 FORCE MAIN	10"	03 0402	MARINA #	-	-	-
MARINA P.P. #1 FORCE MAIN	10"	03 0402	MARINA #	-	-	-
MARINA P.P. #1 EMERGENCY BYPASS	10"	03 0402	03 0588	-	-	-
MARINA P.P. #1 FORCE MAIN	10"	MARINA #	03 0588	-	-	-
MARINA P.P. #1 FORCE MAIN	10"	03 0588	03 0584	1.10	out of service	
MARINA P.P. #1 FORCE MAIN RPLCMNT	12"	03 0588	03 0583	2.20	-	-

MARINA P.P. #1 FORCE MAIN #2	12"	03 0588	03 0583	2.40	out of service	

MARINA TRUNK, SECTION 2	15"	03 0584	03 0400	1.80	-	-
MARINA TRUNK, SECTION 2	18"	03 0400	03 0399	1.90	-	-
MARINA TRUNK, SECTION 2	18"	03 0399	03 0398	1.60	0.10	2012
MARINA TRUNK, SECTION 2	18"	03 0398	03 0397	2.20	-	-
MARINA TRUNK, SECTION 2	15"	03 0397	03 0396	5.60	-	-
MARINA TRUNK, SECTION 2	15"	03 0396	03 0395	1.90	-	-
MARINA TRUNK, SECTION 2	15"	03 0395	03 0394	1.90	-	-
MARINA TRUNK, SECTION 2	18"	03 0394	03 0393A	2.20	-	-
MARINA TRUNK, SECTION 2	18"	03 0393A	03 0586	2.20	-	-
MARINA TRUNK, SECTION 2	18"	03 0586	03 0393	1.30	-	-
MARINA TRUNK, SECTION 2	18"	03 0393	03 0585	2.00	-	-
MARINA TRUNK, SECTION 2	18"	03 0585	03 0392	2.00	-	-
MARINA TRUNK, SECTION 2	18"	03 0392	03 0391	2.50	-	-
MARINA TRUNK, SECTION 2	18"	03 0391	03 0390	1.50	-	-
MARINA TRUNK, SECTION 2	18"	03 0390	03 0389	1.90	-	-
MARINA TRUNK, SECTION 2	18"	03 0389	03 0382	1.20	0.6	2012
MARINA RELIEF TRUNK, SECTION 1B	18"	03 0382	03 0381	13.00	-	-

MARINA RELIEF TRUNK, SECTION 2	18"	03 0584	03 0583	2.80	-	-
MARINA RELIEF TRUNK, SECTION 2	18"	03 0583	03 0582	4.30	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0582	03 0581	3.70	0.50	2002
MARINA RELIEF TRUNK, SECTION 2	24"	03 0581	03 0580	3.80	2.10	2012
MARINA RELIEF TRUNK, SECTION 2	24"	03 0580	03 0579	6.30	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0579	03 0578	4.50	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0578	03 0577	4.50	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0577	03 0576	4.50	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0576	03 0575	5.30	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0575	03 0574	-	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0574	03 0573	4.80	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0573	03 0572	4.20	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0572	03 0571	4.50	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0571	03 MARINA	4.60	1.8	2012
MARINA RELIEF TRUNK, SECTION 2	24"	03 MARINA	03 0570	4.00	-	-

MARINA TRUNK, SECTION 2	12"	03 0388	03 MARINA	1.70	-	-
MARINA TRUNK, SECTION 1B	12"	03 0388	03 0387	2.90	-	-
MARINA RELIEF TRUNK, SECTION 1B	12"	03 0387	03 0570	1.10	-	-
MARINA RELIEF TRUNK, SECTION 2	24"	03 0570	03 0381	7.40	-	-

MARINA RELIEF TRUNK, SECTION 1B	21"	03 0381	03 0380	6.90	-	-
MARINA RELIEF TRUNK, SECTION 1B	27"	03 0380	03 0379	6.00	-	-
MARINA RELIEF TRUNK, SECTION 1B	27"	03 0379	03 0378	4.90	-	-
MARINA RELIEF TRUNK, SECTION 1B	27"	03 0378	03 0377	6.10	2.1	2012
MARINA RELIEF TRUNK, SECTION 1B	10"	03 0386	03 0385	0.20	-	-
MARINA RELIEF TRUNK, SECTION 1B	10"	03 0385	03 0379	3.90	-	-

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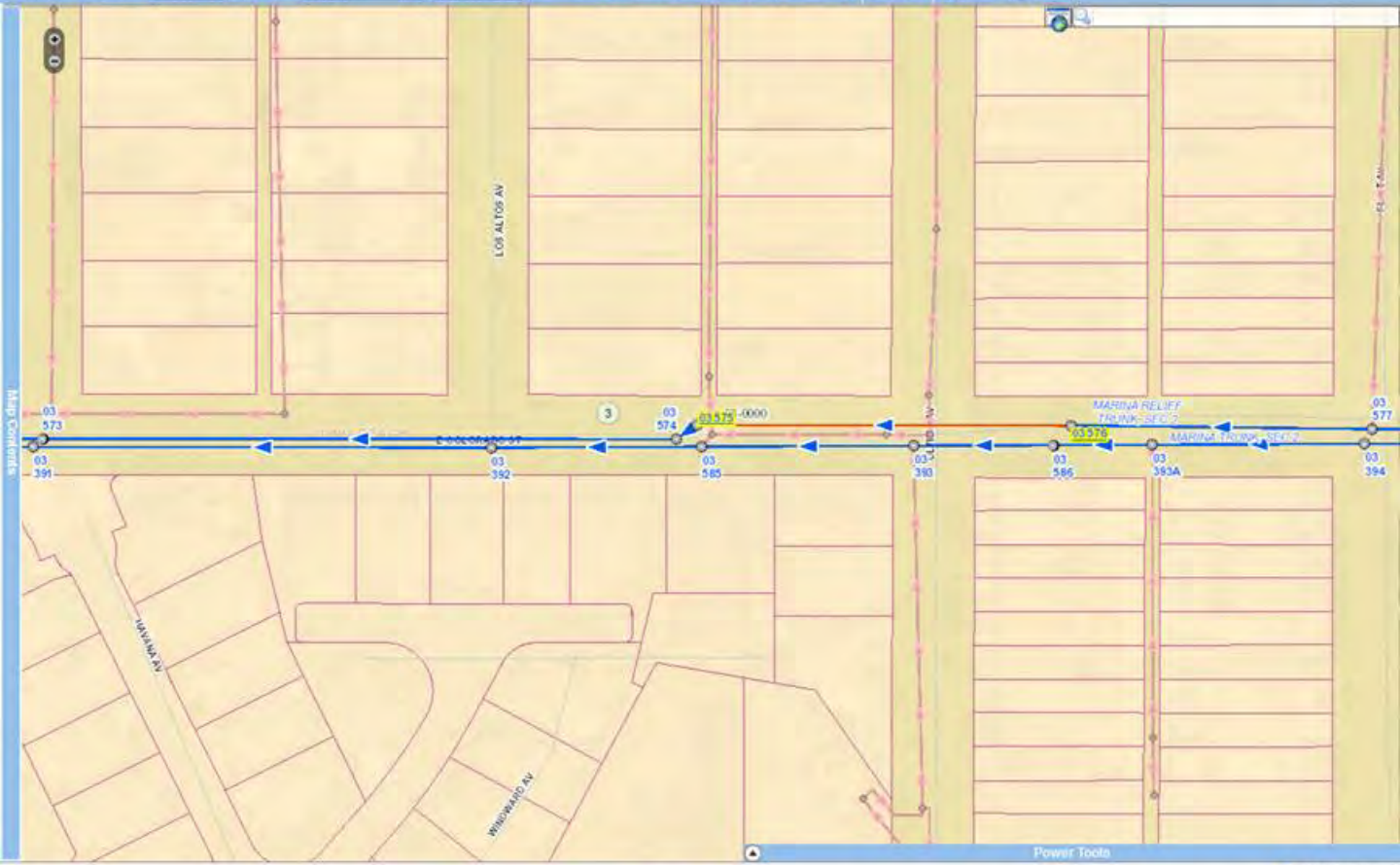

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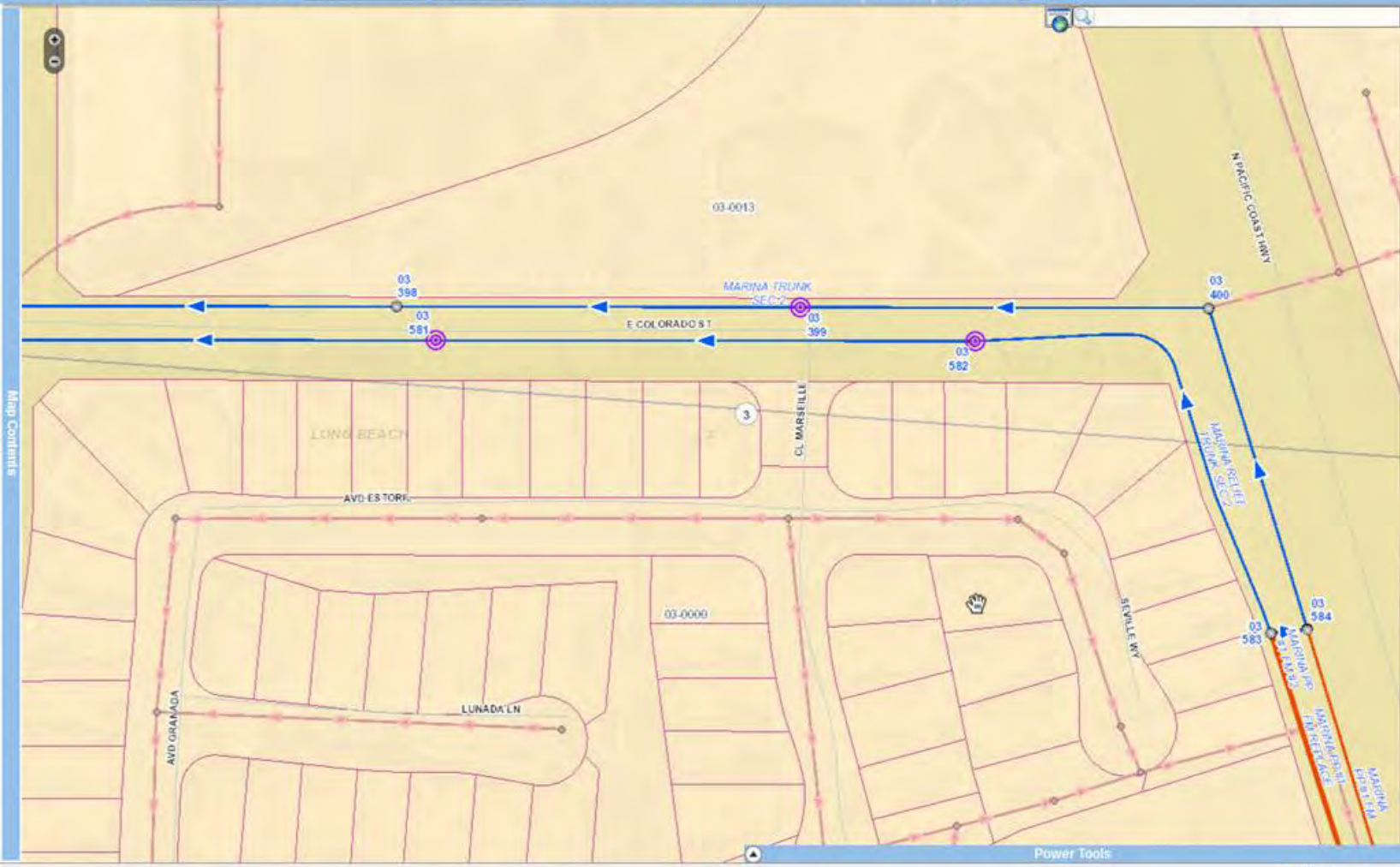

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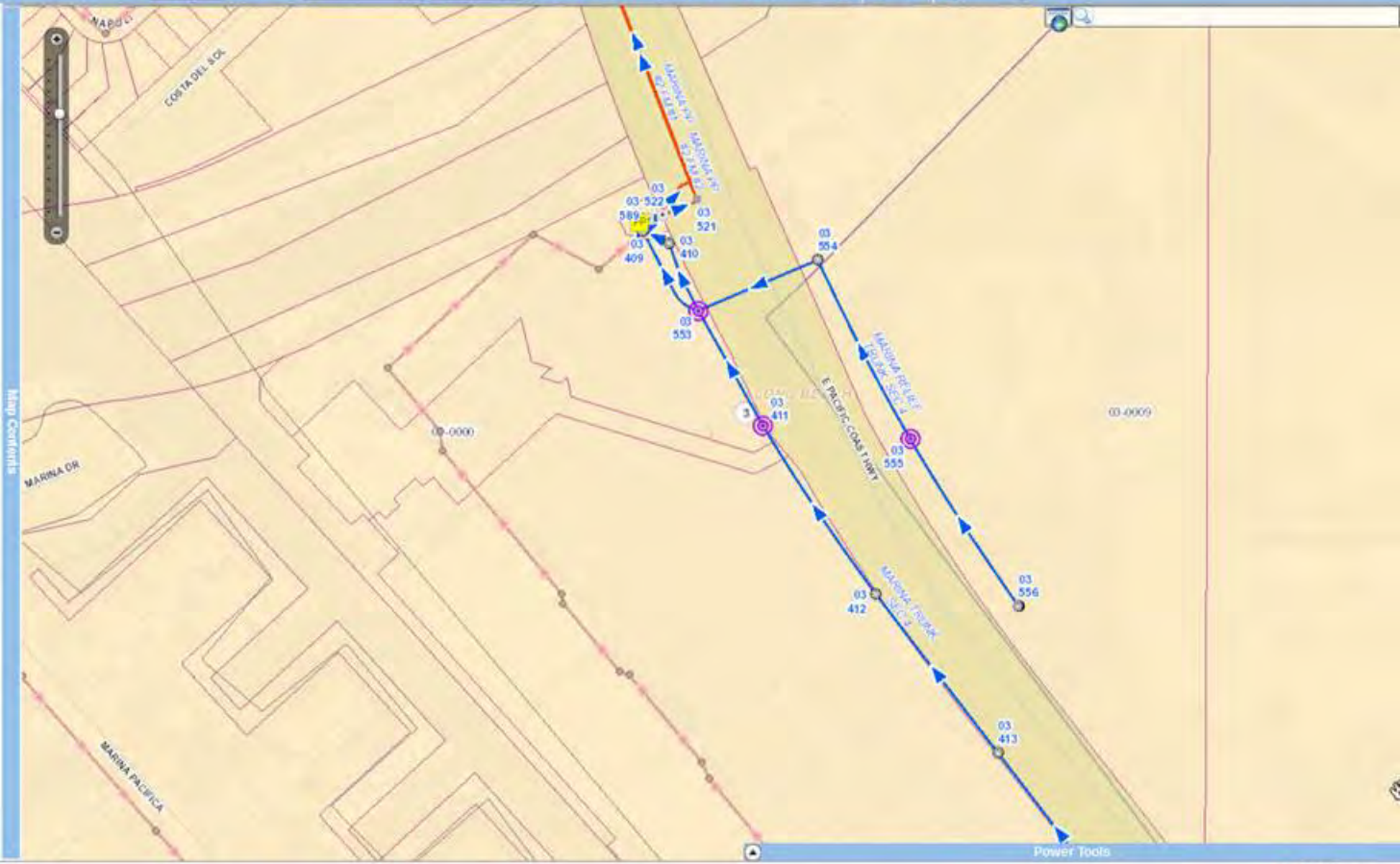

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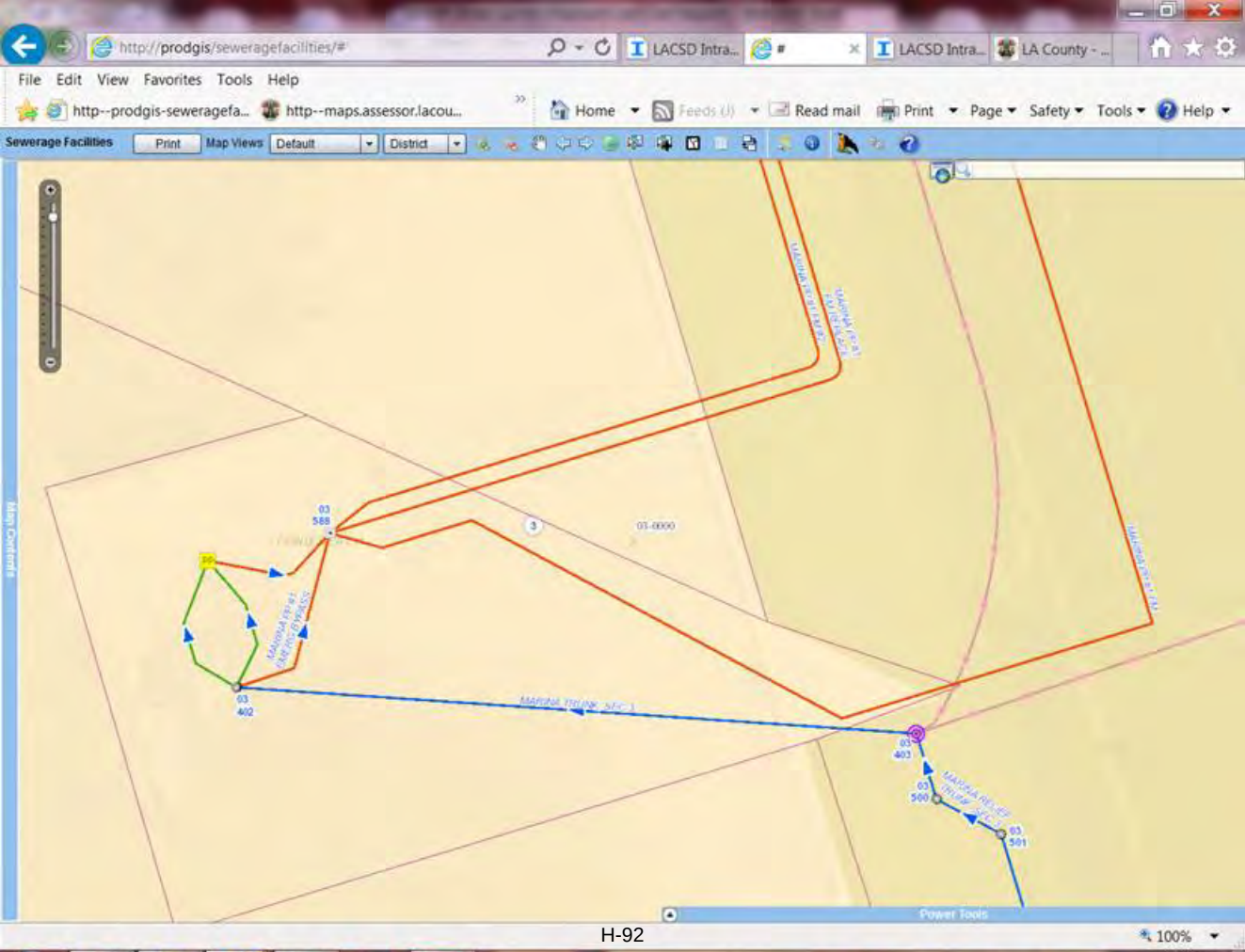
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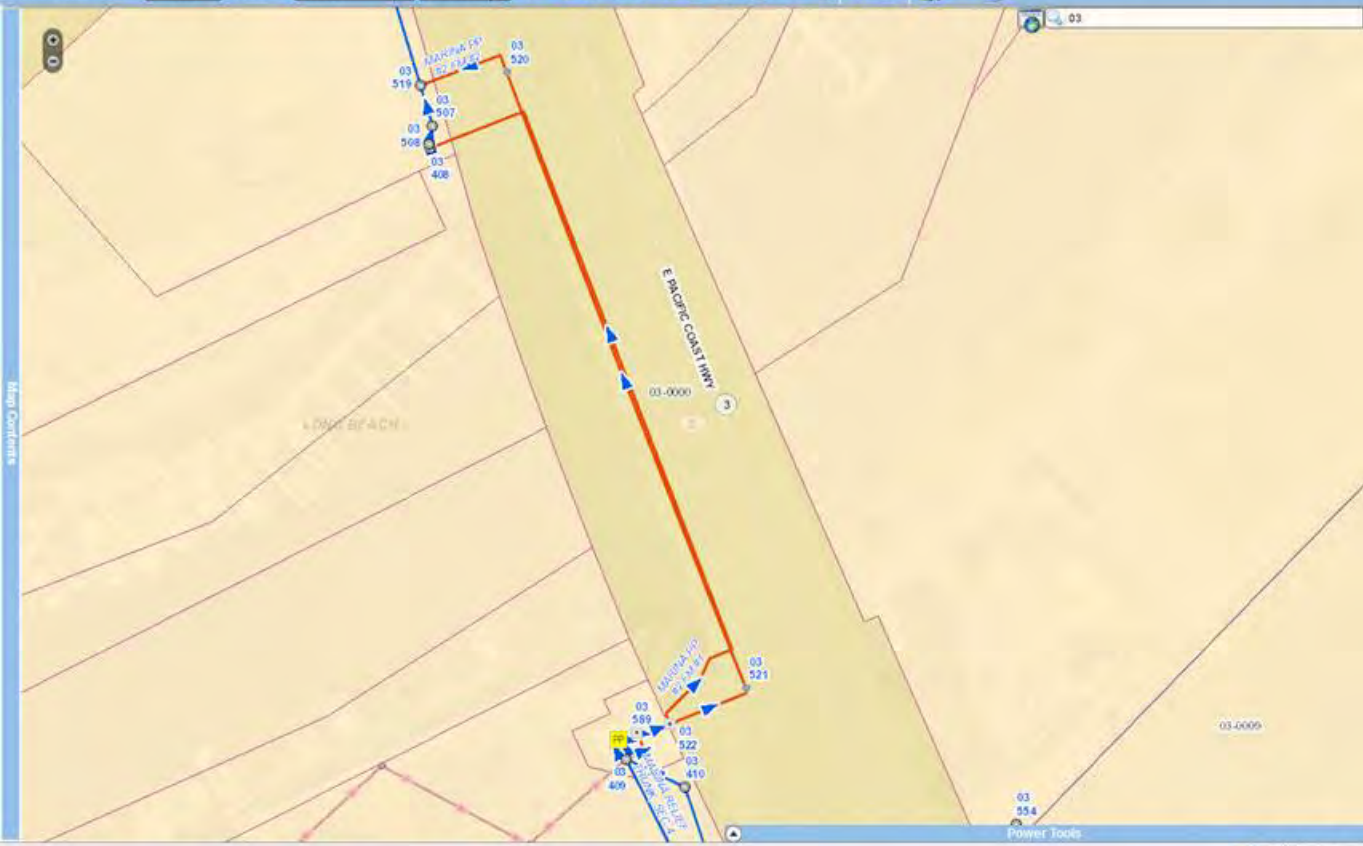

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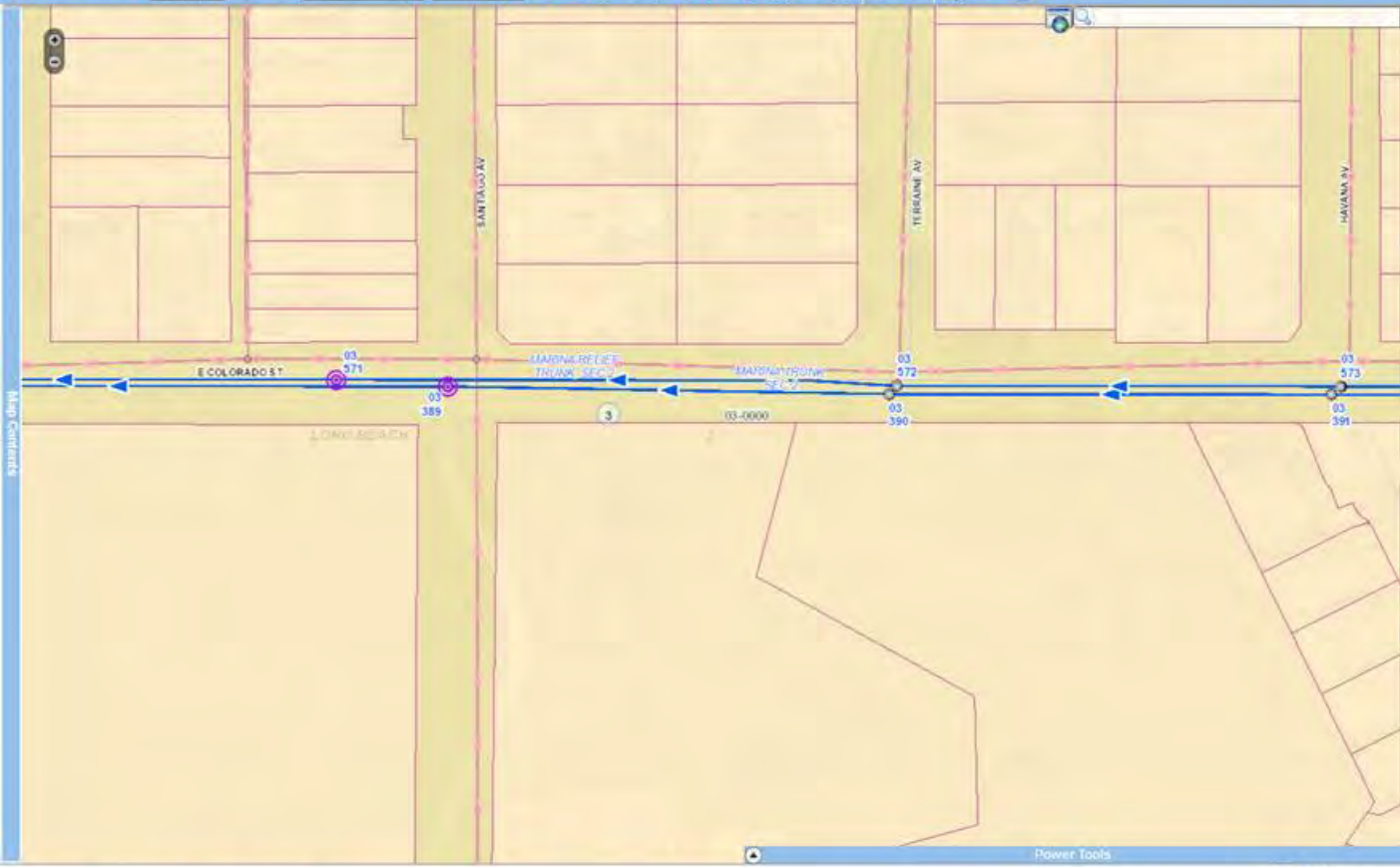

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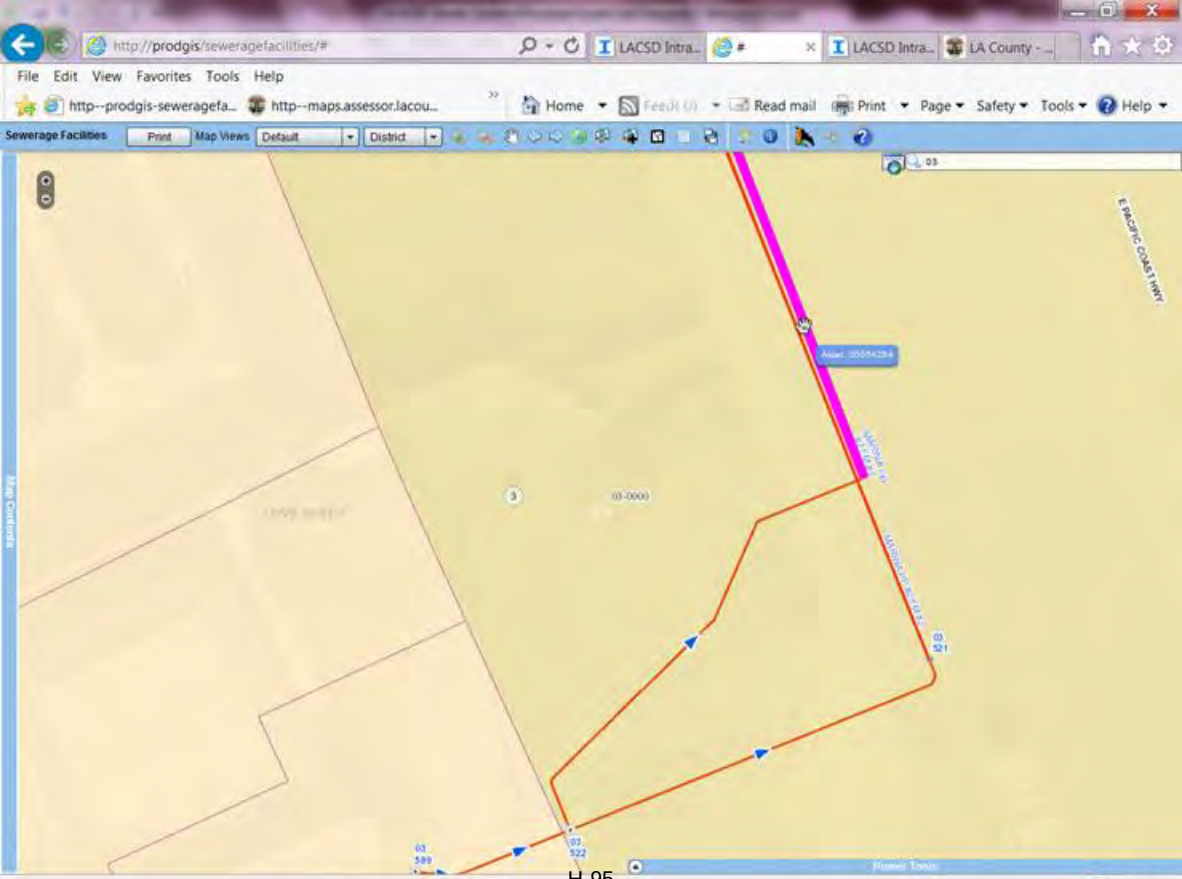
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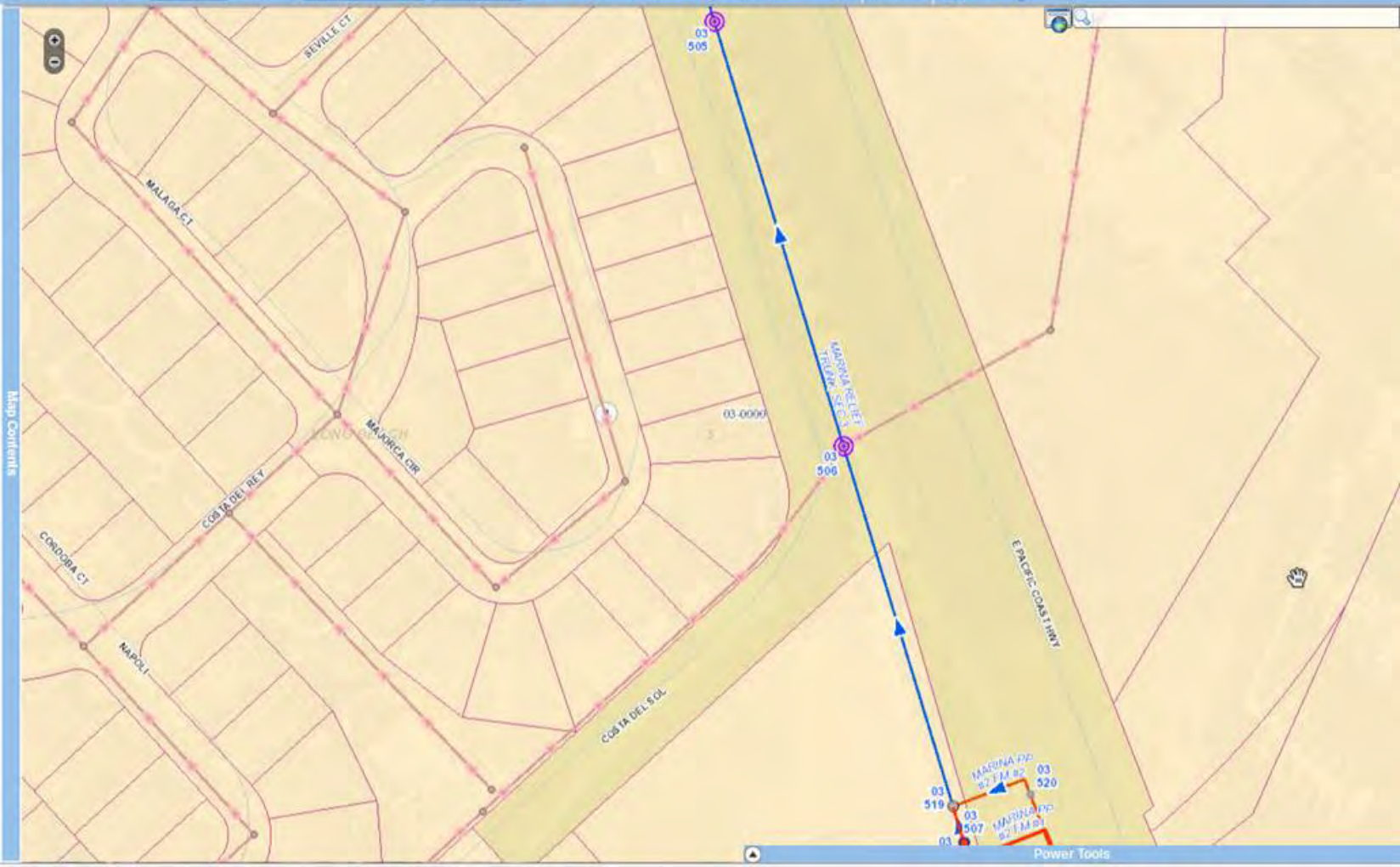

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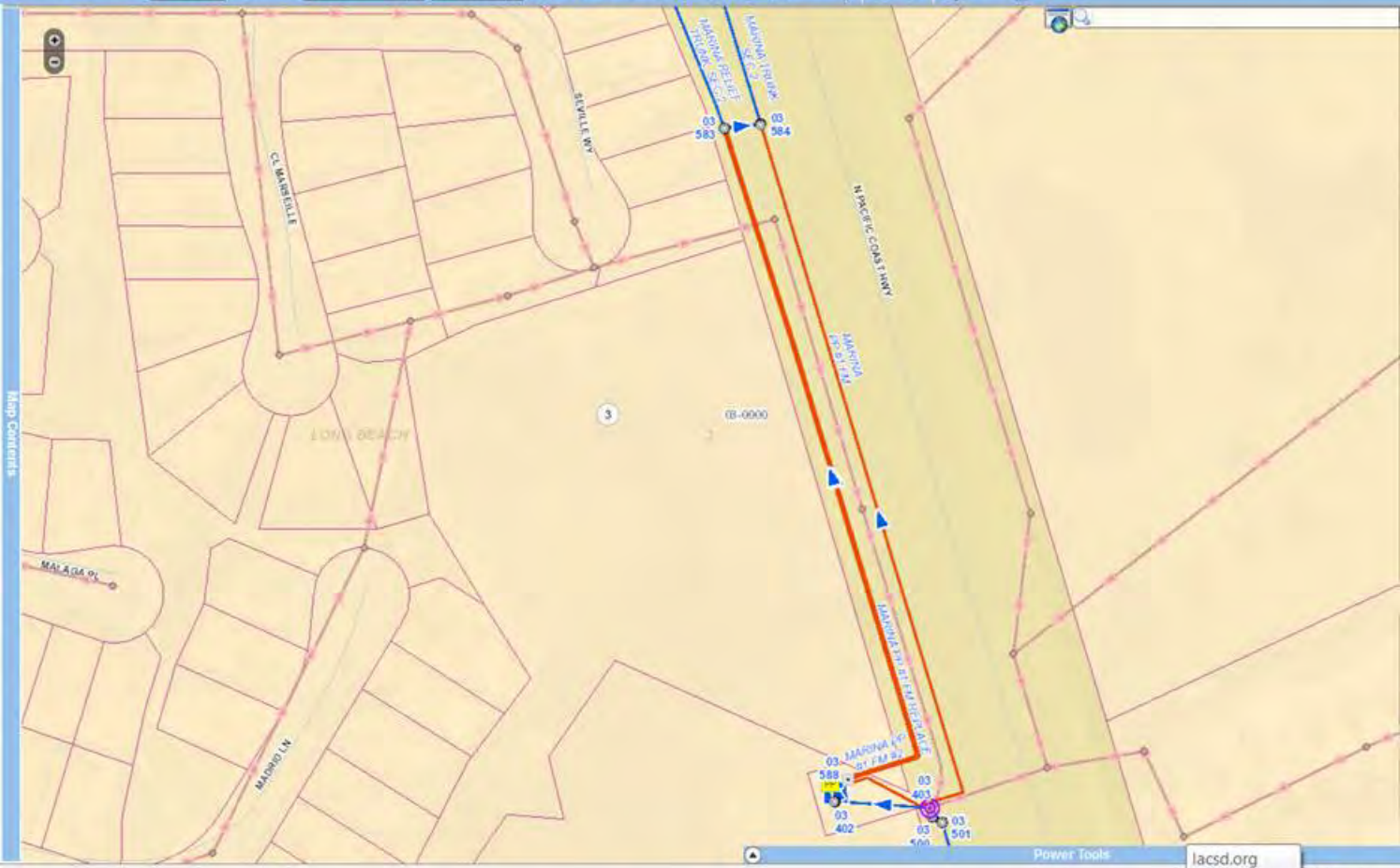

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APPENDIX C

WATER DEMAND CALCULATIONS

Long Beach SEASP Water Demand Analysis
April 6, 2016

Land Use	Existing Land Use		Proposed Land Use		Existing Water Demand	Proposed Water Demand	Increase in Water Demand	Percent Increase in Water Demand
	Square Feet	*Dwelling Units*	*Square Feet*	*Dwelling units*	*GPD*	*GPD*	*GPD*	*%*
Commercial - Neighborhood	87,350.0		137,214.0		17,470.0	27,438.0	9,968.0	57%
Industrial	1,110,711.0		1,145,711.0		222,103.1	229,101.9	6,998.8	3%
Multi-Family Res		2,329.0		2,458.0	519,774.6	548,564.2	28,789.6	6%
Mixed Use Community Core	836,690.0		1,107,545.0	4,860.0	190,750.0	1,380,147.0	1,189,397.0	624%
Mixed Use Marina	5,395.0		223,277.0	450.0	24,512.2	219,059.0	194,546.8	794%
Totals	2,040,146.0	2,329.0	2,613,747.0	7,768.0	974,609.9	2,404,310.0	1,429,700.1	147%

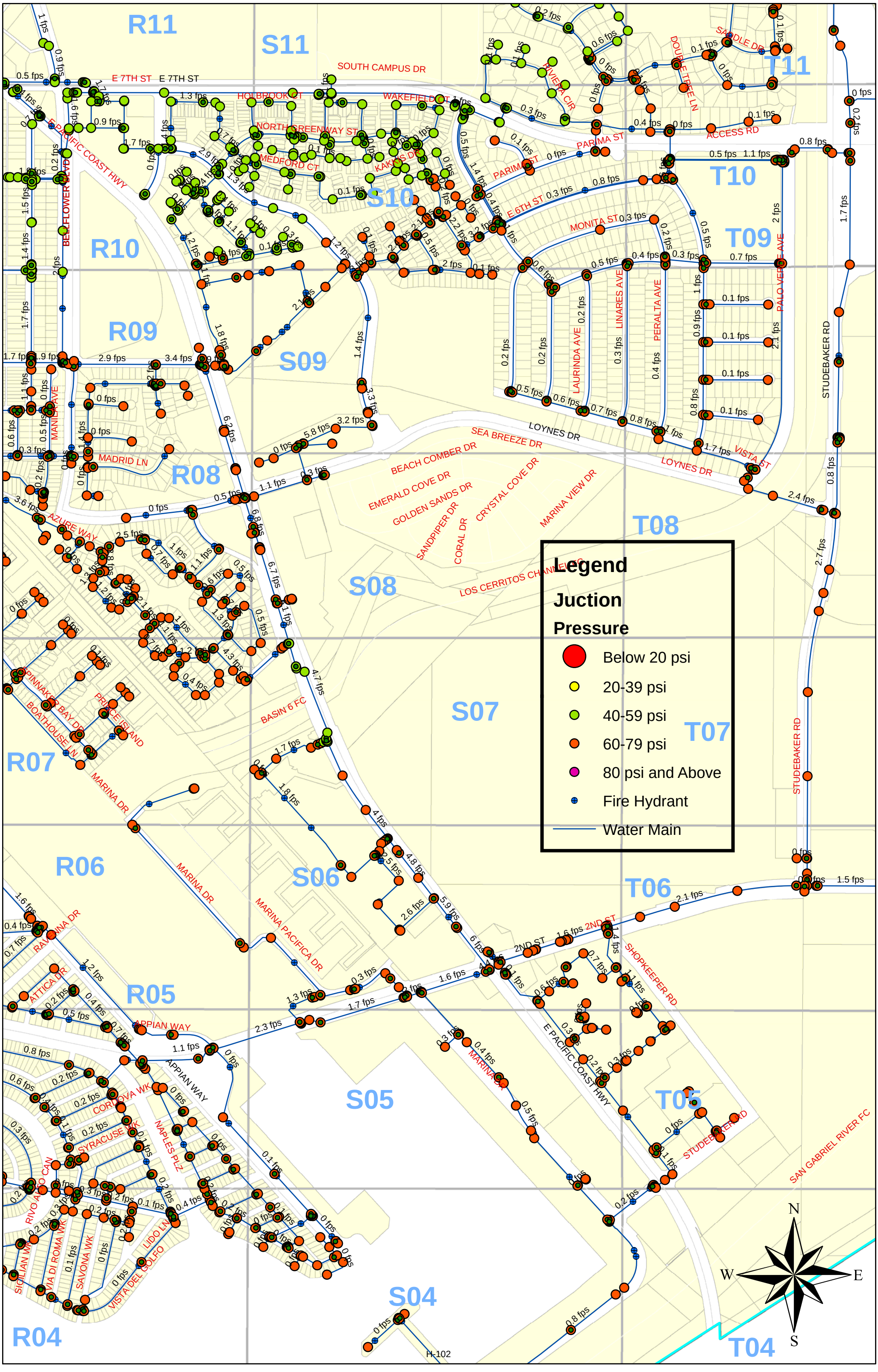
Demand Factors:

Multi-Family Res: 223 GPD/DU

Hotels/Motels: 125 GPD/DU

Industial: 200 GPD/1,000 SF

Commercial/Mixed Use: 200 GPD/1,000 SF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BEACH COMBER DR
EMERALD COVE DR
GOLDEN SANDS DR
SANDPIPER DR
CORAL DR
CRYSTAL COVE DR
MARINA VIEW DR
LOS CERRITOS CHANNEL FC
MANILA AVE
MADRID LN
AZURE WAY
SPINNAKER BAY DR
BOATHOUSE LN
PRICE ISLAND
BASIN 6 FC
MARINA DR
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APPENDIX D

SEA LEVEL RISE MODELING FOR SEASP AREA

moffatt & nichol

3780 Kilroy Airport Way, Suite 600
Long Beach, CA 90806

(562) 426-9551 ❖ Fax: (562) 424-7489
www.moffattnichol.com

Memorandum

To: Angela Reynolds, City of Long Beach

From: Chris Webb and Weixia Jin

Date: July 2, 2015

Subject: Sea Level Rise Modeling for SEADIP Area

Project: City SEADIP Project

1.0 INTRODUCTION

The City of Long Beach (the City) is updating their Local Coastal Program to address the Southeast Area Development Improvement Plan (SEADIP). As part of that work, the City needs to address sea level rise scenarios. The California Coastal Commission (CCC) provided guidance to the public for assessing sea level rise in planning (CCC, 2015). The City has retained Moffatt & Nichol (M&N) to apply this guidance to the SEADIP; specifically M&N was tasked to model the SEADIP Planning Area to predict areas that may be inundated by seawater under certain conditions. This document is a technical reference memorandum for use by the SEADIP planning team to consider in formulation of development actions into the future.

The CCC suggests that planning consider a range of sea level rise (SLR) scenarios. The City's planning document will address development actions out to year 2060. Therefore, sea level rise scenarios anticipated to potentially occur at that time horizon are considered in this SEADIP planning technical memo.

The SEADIP planning area is shown in Figure 1-1 on the following page. The area includes water bodies within all of Alamitos Bay and Marine Stadium, as well as portions of the Los Cerritos Channel and the San Gabriel River. Land areas border the water areas and include the Los Cerritos Wetlands, business areas along Pacific Coast Highway (PCH), residential areas north of Los Cerritos Channel both east and west of PCH, and the industrial areas straddling the San Gabriel River that include the AES and Haynes Power Plants.

Figure 1-1: SEADIP Planning Area

2.0 STUDY OVERVIEW

This study follows the scope of work agreed upon between the City and M&N on February 3, 2015. Specific tasks include:

1. **Expand the Existing Hydrodynamic Model Area to Cover All Potential Risk Areas:** In 2011, M&N developed a numerical model to simulate the waterways in this area as part of the Los Cerritos Wetlands Conceptual Restoration Plan (CRP) (Moffatt & Nichol, 2011). This task entails adding areas within the SEADIP Planning Area that may be vulnerable to future inundation and that were not included in the model for Los Cerritos Wetlands.
2. **Model Existing Conditions and Two Sea Level Rise Scenarios, One With and Without Stormflow:** Model existing conditions, two SLR scenarios for the dry season and one SLR scenario for the wet season to identify potential areas of inundation. The two SLR scenarios were identified based on the range of projected SLR for the year 2060; the two SLR values modeled are 1.5 feet (ft), a median projection, and 2.6 ft, a high projection. Both of these conditions shall be modeled for the dry season, while the high SLR projection of 2.6 ft shall also be modeled for the wet season. The wet season simulation will model the 50-year stormflow from the Colorado Lagoon, the Los Cerritos Channel and the San Gabriel River, occurring coincident with a future high tide.
3. **Prepare Maps of Inundation Areas:** Results of the study will be presented as digital maps of areas to possibly be inundated by the scenarios modeled using the ArcView Geographic Information System (GIS). The City can use these maps as an overlay file in the SEADIP Planning Project.

3.0 METHODS

The model developed for this study is a two-dimensional depth averaged finite element hydrodynamic numerical model referred to as RMA-2, a federally-developed and approved model for tidal and storm flows. The model provides data of water levels and water flow velocities over time and space, and can be efficiently applied to this planning task with high accuracy. A description of this model, as well as a rationale for its selection for this application, can be found in Moffatt & Nichol, 2011.

3.1 MODEL DOMAIN

The RMA2 model requires the hydraulic system to be represented by a network of nodal points defined by coordinates in the horizontal plane and by water depths; elements are

created by connecting these adjacent points to form areas. Nodes can be connected to form 1- and 2-dimensional elements, having two to four nodes. The resulting nodal/element network is commonly called a finite element mesh and provides a computerized representation of the basin geometry and bathymetry.

As stated in Section 2.0, the RMA2 model for this study was based on a similar model for the Los Cerritos Wetlands (Moffatt & Nichol, 2011). The domain of this model included the entire Alamitos Bay, Marine Stadium, Colorado Lagoon, several miles along the San Gabriel River and Los Cerritos Channel, and the nearshore ocean. The ocean boundary is approximately two miles from the shoreline; this distance was deemed to be sufficient to minimize boundary effects within the area of interest. The domain for this model can be seen in Figure 3-1; Moffatt & Nichol, 2011 contains a complete description of the model.

Figure 3-1. Finite Element Model for the Los Cerritos Wetlands Model (aerial image courtesy of Google Earth)

The Los Cerritos Wetlands model was expanded for this study to include land areas within the SEADIP that may be vulnerable to inundation. This process involved adding additional nodes, defined by their geospatial location and elevation. Elevation data were based on topographic data provided by the City (City of Long Beach, 2015). In addition, bathymetry in the San Gabriel River was updated based on as-built plans provided by U.S. Army Corps of Engineers (USACE, 1960).

The model domain and finite element mesh used for the SEADIP Planning Area SLR study can be seen in Figure 3-2; Figure 3-3 shows the same mesh in the vicinity of the SEADIP Planning Area.

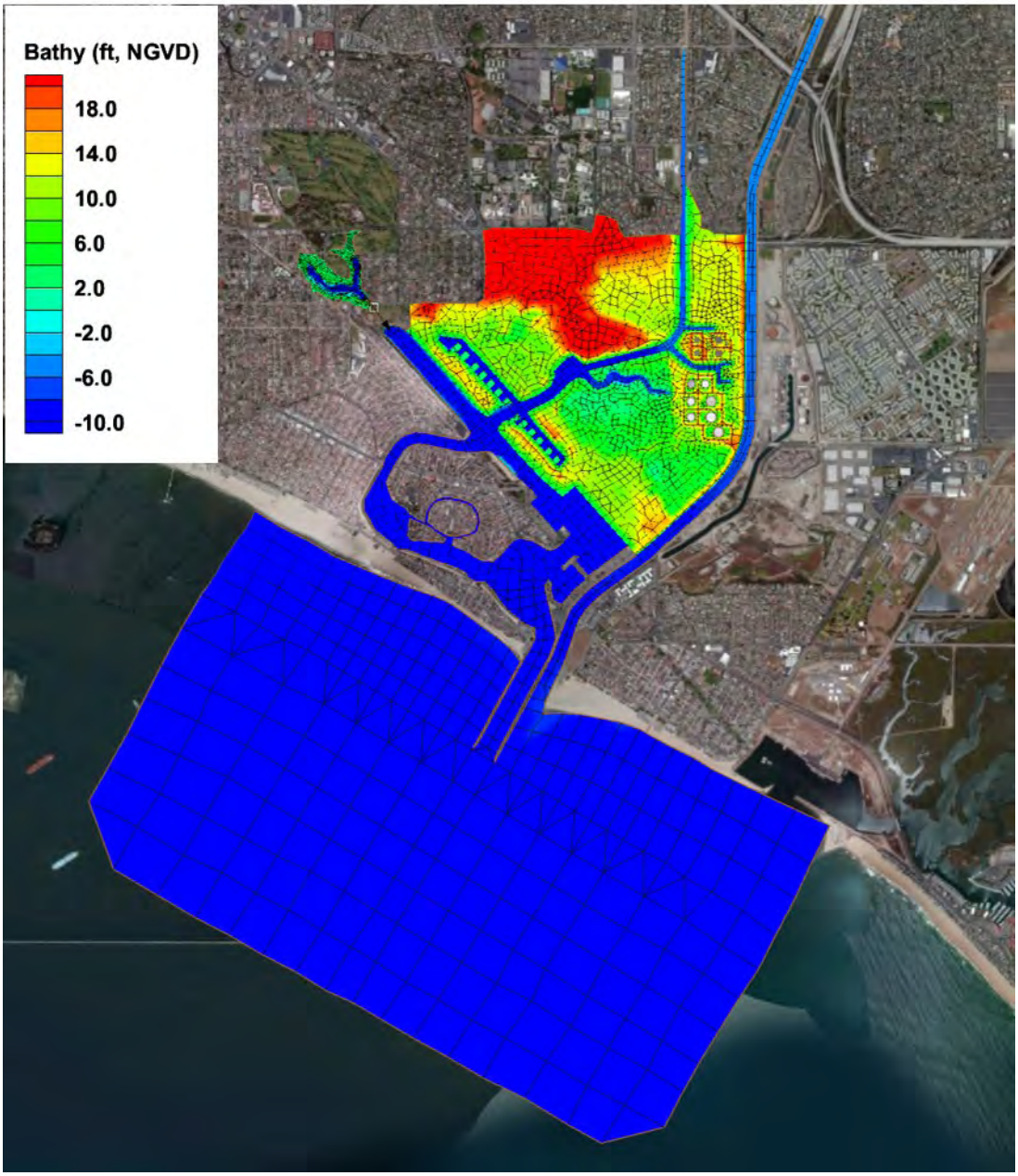

Figure 3-2. SEADIP SLR Study Model Domain and Finite Element Mesh

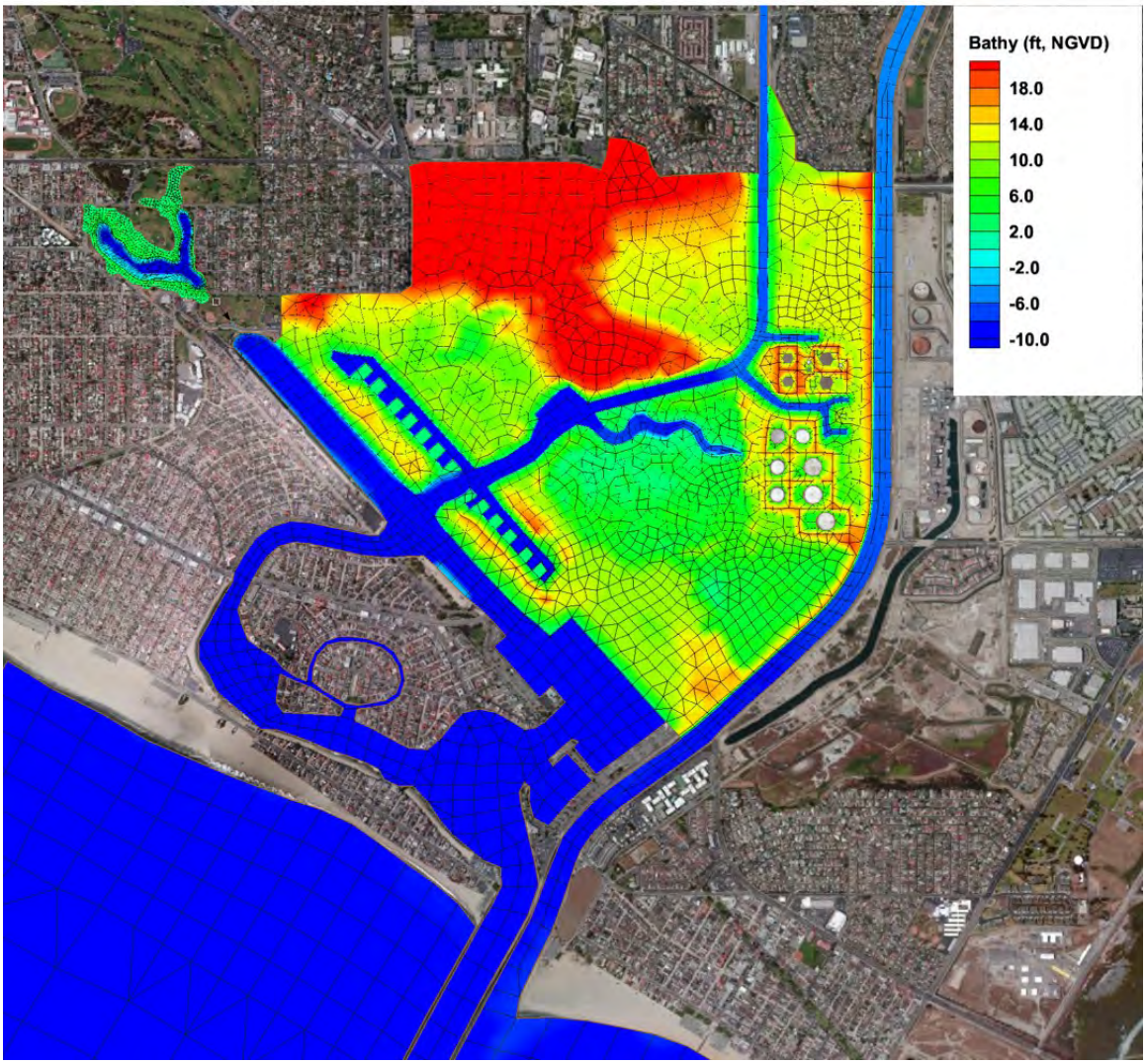

Figure 3-3. RMA2 Finite Element Mesh for the SEADIP Planning Area

3.2 BOUNDARY CONDITIONS

Boundary conditions are the inputs to the model. These include the tides, sea level rise, and storm event runoff. Dry season runoff is negligible in comparison to tidal and storm inputs to the wetlands and is not included in the two dry season simulations. Groundwater within the study area has a relatively high elevation, has been found to be saline and is strongly influenced by tidal movement (AECOM, 2011), however is not a relevant factor for hydraulic modeling of SLR impacts.

3.2.1 Tides

There are no official tide stations within Alamitos Bay; the nearest tide station administered by National Oceanic and Atmospheric Administration (NOAA) at Los

Angeles Outer Harbor (NOAA, 2004) was assumed to represent the ocean boundary tidal conditions. The diurnal tide range is approximately 5.49 ft from Mean Lower Low Water to Mean Higher High Water. Tidal data were analyzed to extract a two week period selected to represent typical spring tide conditions; this two week tidal record can be seen in Figure 3-4.

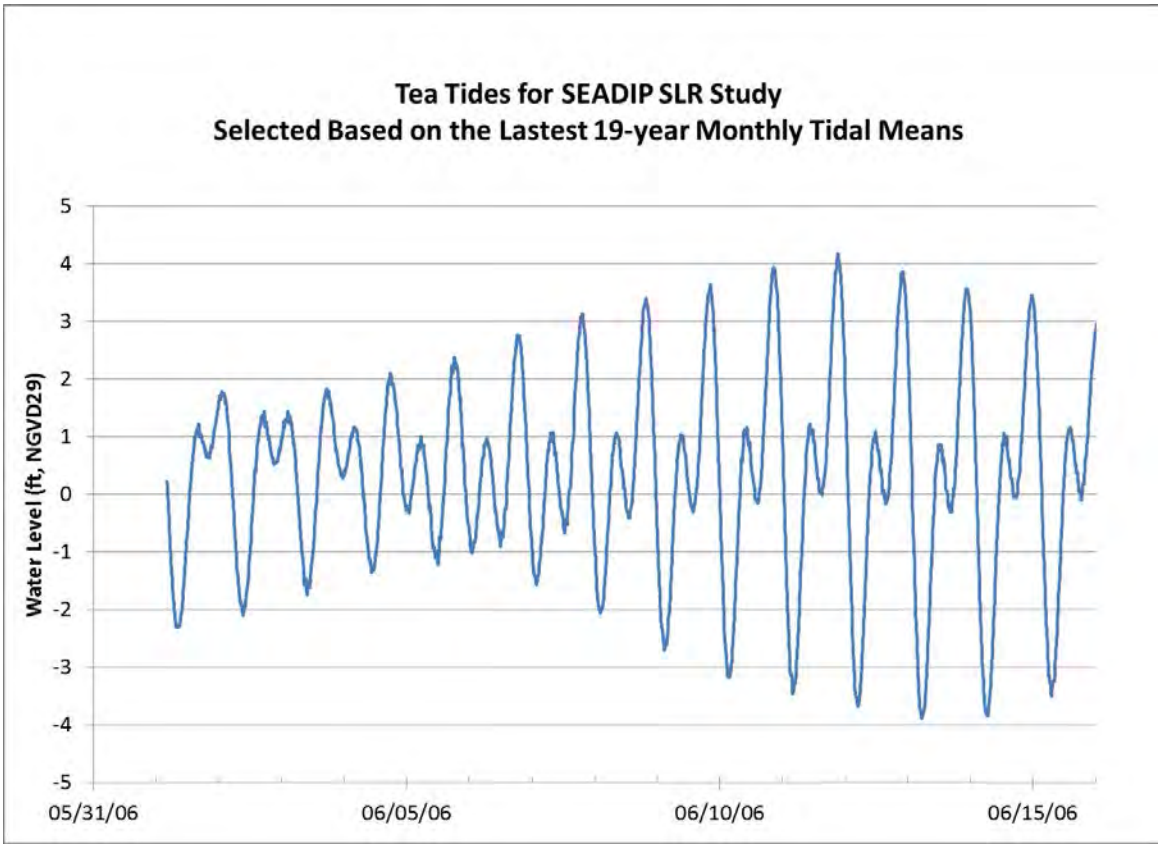

Figure 3-4. Typical Spring Tides

3.2.2 Sea Level Rise

As mentioned in Section 2.0, SLR values of 1.5 ft and 2.6 ft were simulated for this study. These values are based upon projections for 2060 contained in NRC, 2012 – generally considered the best available science for the region at the time of this memorandum. Data derived from the NRC report were used to project the range of potential SLR values at year 2060 to be 0.5 ft to 2.6 ft; thus, 1.5 ft represents a median SLR value and 2.6 ft represents an upper-end SLR scenario. Sea level rise was simulated by adding 1.5 ft and 2.6 ft to the ocean water levels used for modeling.

3.2.3 Storm Events

The wet season simulation considered simultaneously occurring 50-year stormflow in the San Gabriel River, the Los Cerritos Channel, and the Colorado Lagoon. The hydrograph for the San Gabriel River was derived from USACE, 1991; the hydrograph for the Los

Cerritos Channel was provided in Imaa, 2015, and the hydrograph of outflow from the Colorado Lagoon was provided in Everest International Consultants, Inc., 2007. The 50-year hydrographs for all of these sources can been seen in Figure 3-5.

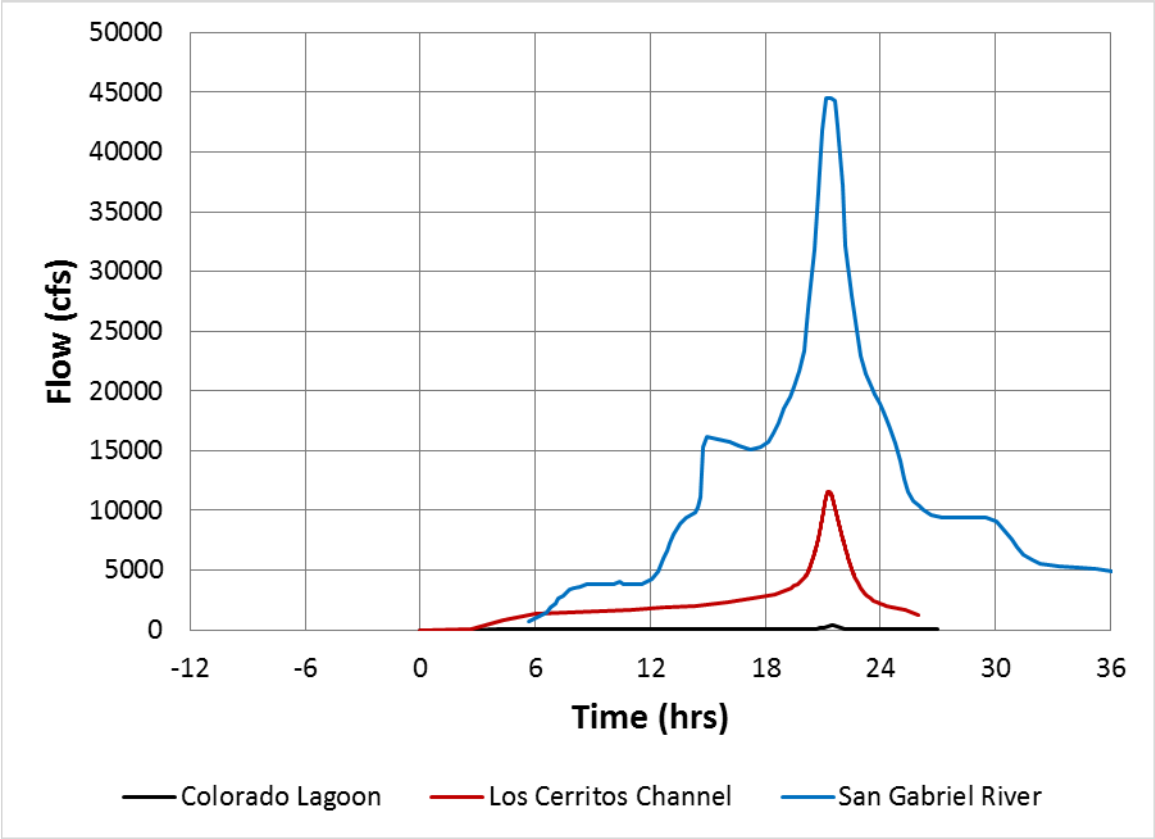

Figure 3-5. 50-year Hydrograph for the Colorado Lagoon, the Los Cerritos Channel, and the San Gabriel River

3.3 SIMULATIONS

Four simulations were performed for this study:

1. Simulation 1 represented existing tides without SLR during dry conditions;
2. Simulation 2 included 1.5 ft of SLR during dry conditions;
3. Simulation 3 included 2.5 ft of SLR during dry conditions, and
4. Simulation 4 included 2.5 ft of SLR and 50-year stormflow whose peak coincided with high tide.

Each simulation lasted approximately 48 hours. The first 12 hours served as a warm-up period and contained one high tide. The following 36 hours simulated 1.5 tidal cycles,

including the highest high tide shown in Figure 3-4. All simulations were performed using the NGVD29 vertical datum.

Figure 3-6 through Figure 3-9 show how a combination of the boundary conditions were applied to each simulation.

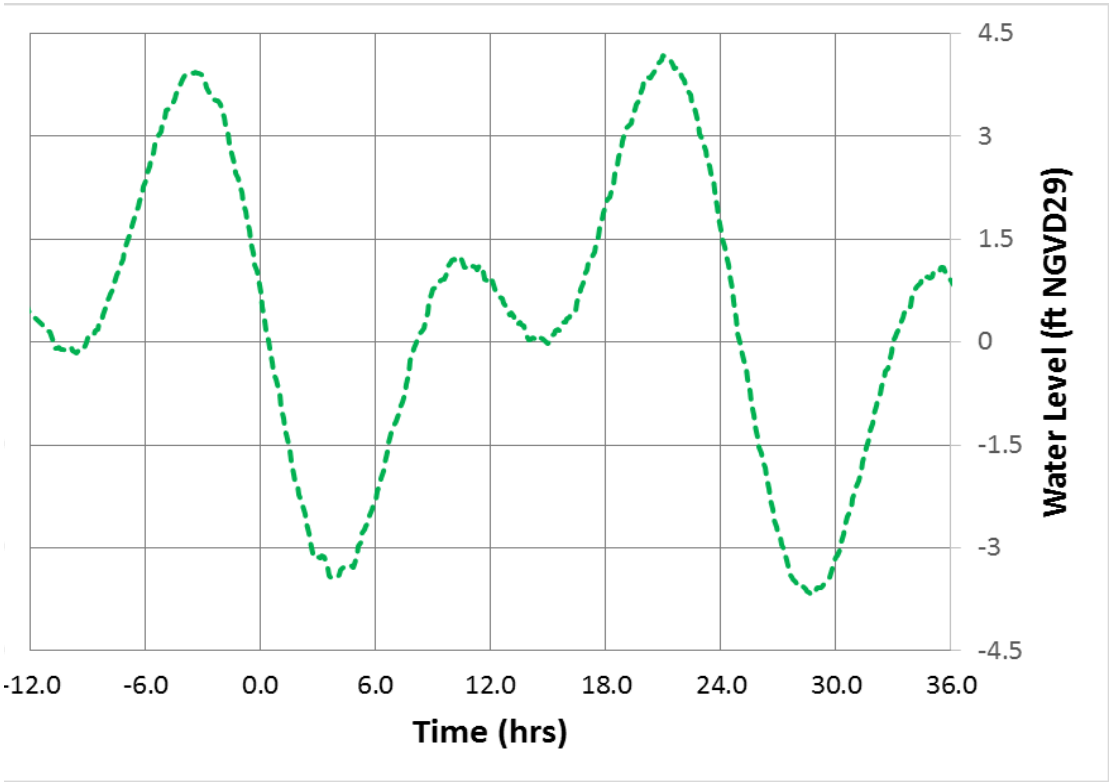

Figure 3-6. Simulation 1 Boundary Conditions

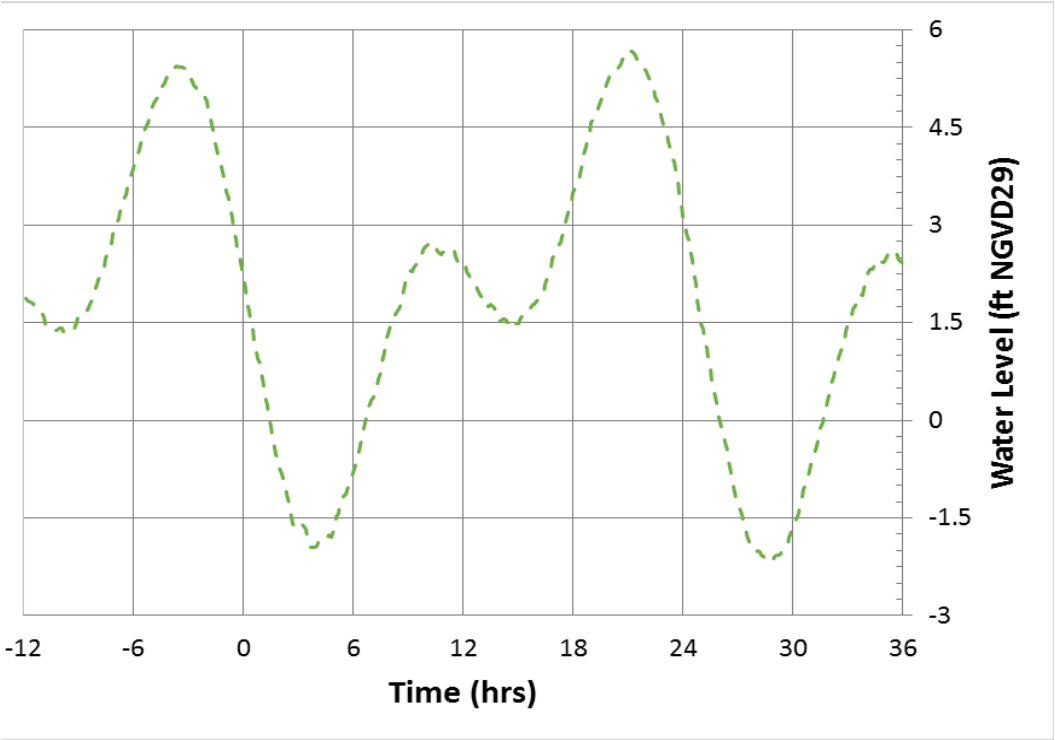

Figure 3-7. Simulation 2 Boundary Conditions

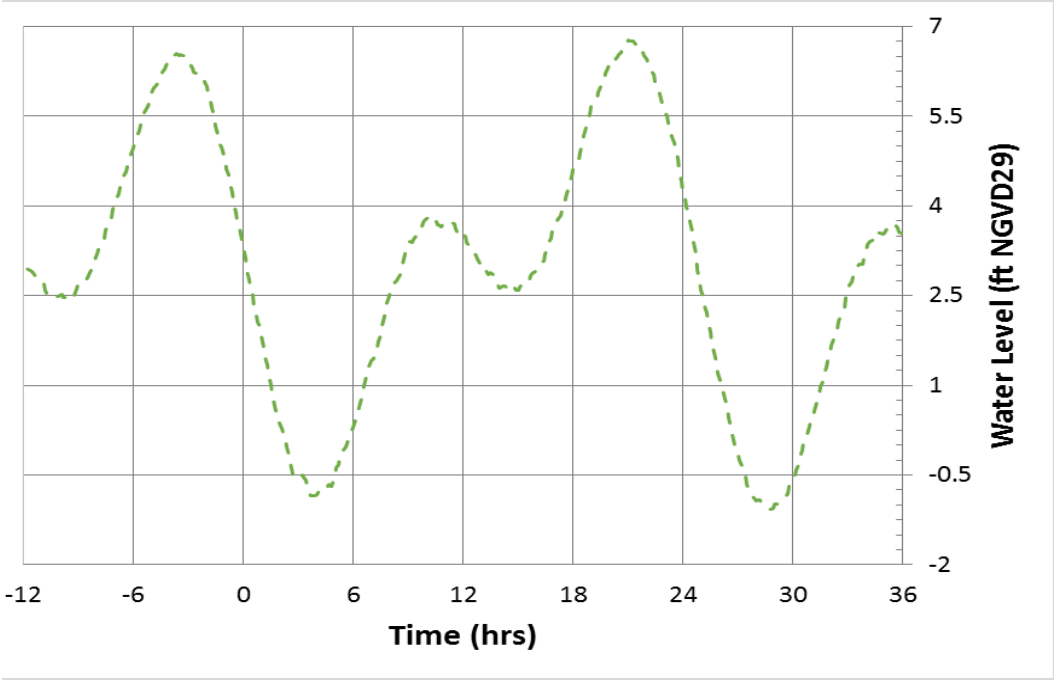

Figure 3-8. Simulation 3 Boundary Conditions

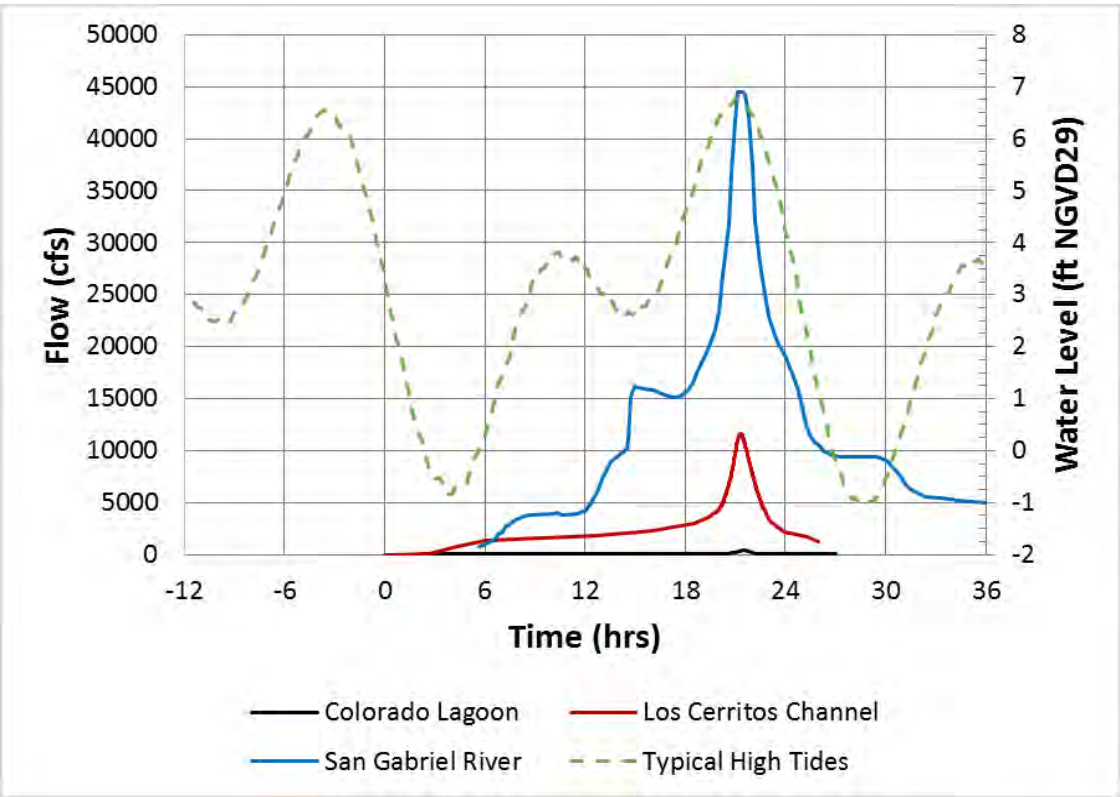

Figure 3-9. Simulation 4 Boundary Conditions

4.0 RESULTS

The results of this study include maps of areas within the SEADIP Planning Area that would possibly be inundated by the scenarios modeled; these maps can be seen in Figure 4-1 through Figure 4-4. Electronic versions (in ArcView Geographic Information System) are being provided to the City.

The area within the SEADIP boundary east of the San Gabriel River was modeled using a different method because it is connected to the River by culverts, and culvert flows are better approximated using a one-dimensional model. The area at that location is in use for industrial oil extraction, and two small wetlands exist. Water levels will rise at the wetlands by several feet during SLR conditions, and with SLR combined with a stormflow event. However, the portion of the site surrounding the wetlands is sufficient high that waters will be contained on-site within the wetlands and they would not expand significantly beyond their existing boundaries.

Areas to be affected with inundation by high water during the high-end sea level rise scenario analyzed herein (2.6 feet of sea level rise during dry weather) include the following sites:

- The PCH Club site east of Pacific Coast Highway (PCH) and north of Los Cerritos Channel;
- Jack Nichol Park west of PCH and north of Los Cerritos Channel;
- The intersection of Loynes Drive and Bellflower Boulevard;
- Azure Way and the Long Beach Bikeway route adjacent to Spinnaker Bay;
- East Elliot Street along the north end of Marine Stadium; and
- The west bound lanes of 2nd Street just east of PCH.

Recommendations for flood protection of these sites consist of evaluating the status of shoreline protection at each site and considering improvements, such as raising the elevation of the shoreline protection structure (e.g. seawall and/or rip-rap) along the perimeter of the adjacent water body. For example, the PCH Club site (the parking lot) may be able to be protected from flooding by raising the edge between land and water along the channel-side of the parking lot by at least one foot. The site is approximately 8.0 feet above North American Vertical Datum (NAVD, 1988) and high water is predicted to reach +9.0 feet NAVD in 2060 with high tide combined with a 50 year stormflow. Raising the entire parking lot may also be worth considering to more fully protect the site and eliminate seawater backing up through any storm drains, particularly for future predicted high waters subsequent in time to 2060. Figure 4-5 shows the condition of the existing shoreline along this location. Existing shore protection consists of large pieces of broken concrete dumped along the shore, with gunnite or grout poured over them. This type of material may be ineffective to adequately protect the shoreline during future predicted high waters. Figure 4-6 shows the elevation of the PCH Club site relative to surrounding areas, with predicted inundation areas outlined in red.

In addition, PCH south of Los Cerritos Channel is at an elevation of approximately +10 feet NAVD 88, so one foot of freeboard exists under the worst case high water scenario analyzed herein. Any increase in water levels above this scenario in the future may episodically threaten PCH in this area. Either raising PCH at this location or the privately-owned land area between PCH and the water may be viable options for the future.

Figure 4-1. SEADIP Planning Area Possibly Inundated Under Existing Conditions

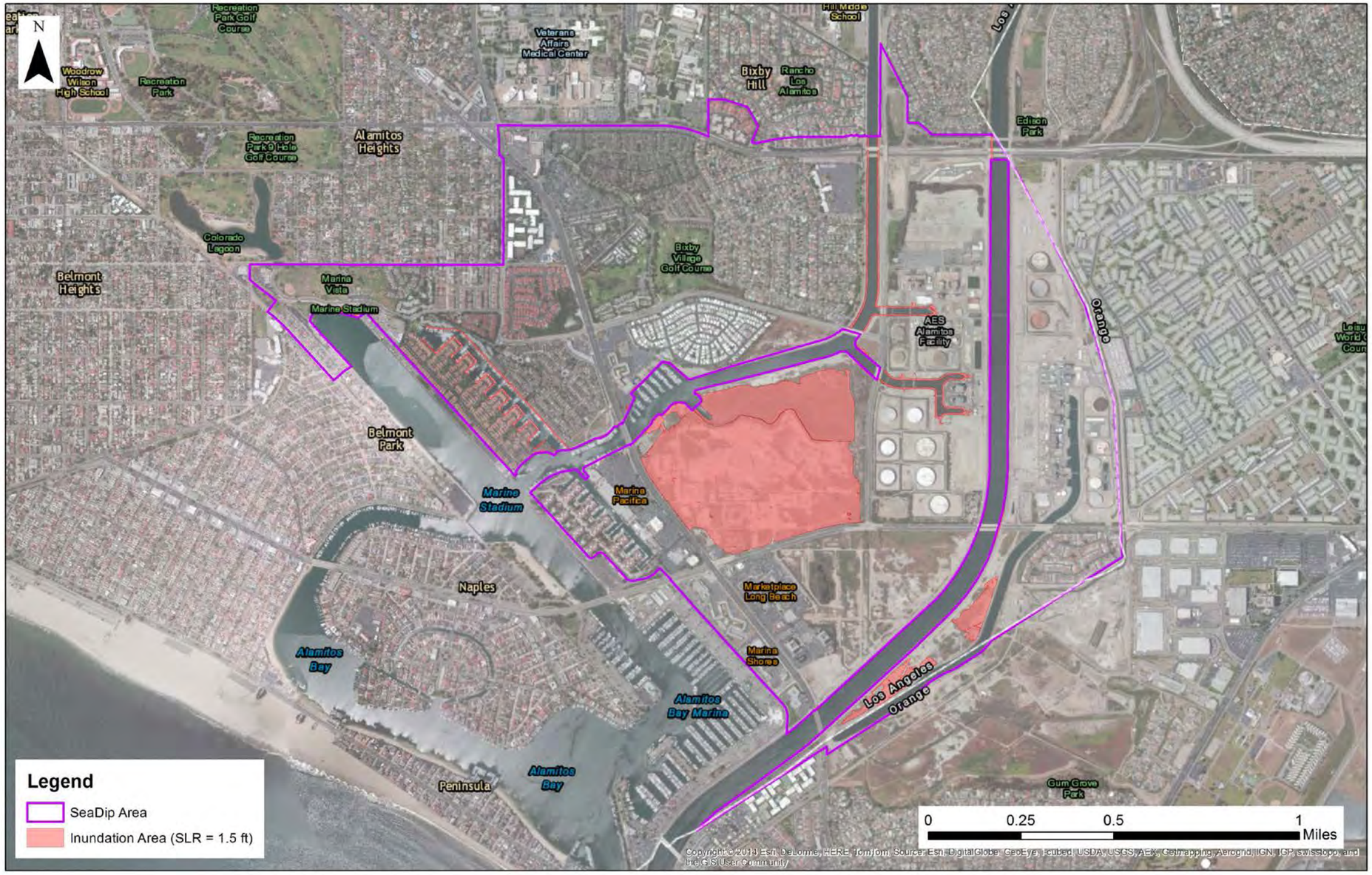

Figure 4-2. SEADIP Planning Area Possibly Inundated Under 1.5 Feet of Sea Level Rise, Dry Conditions

Figure 4-3. SEADIP Planning Areas Possibly Inundated Under 2.6 Feet of Sea Level Rise, Dry Conditions

Figure 4-4. SEADIP Planning Areas Possibly Inundated Under 2.6 Feet of Sea Level Rise and 50-Year Stormflow

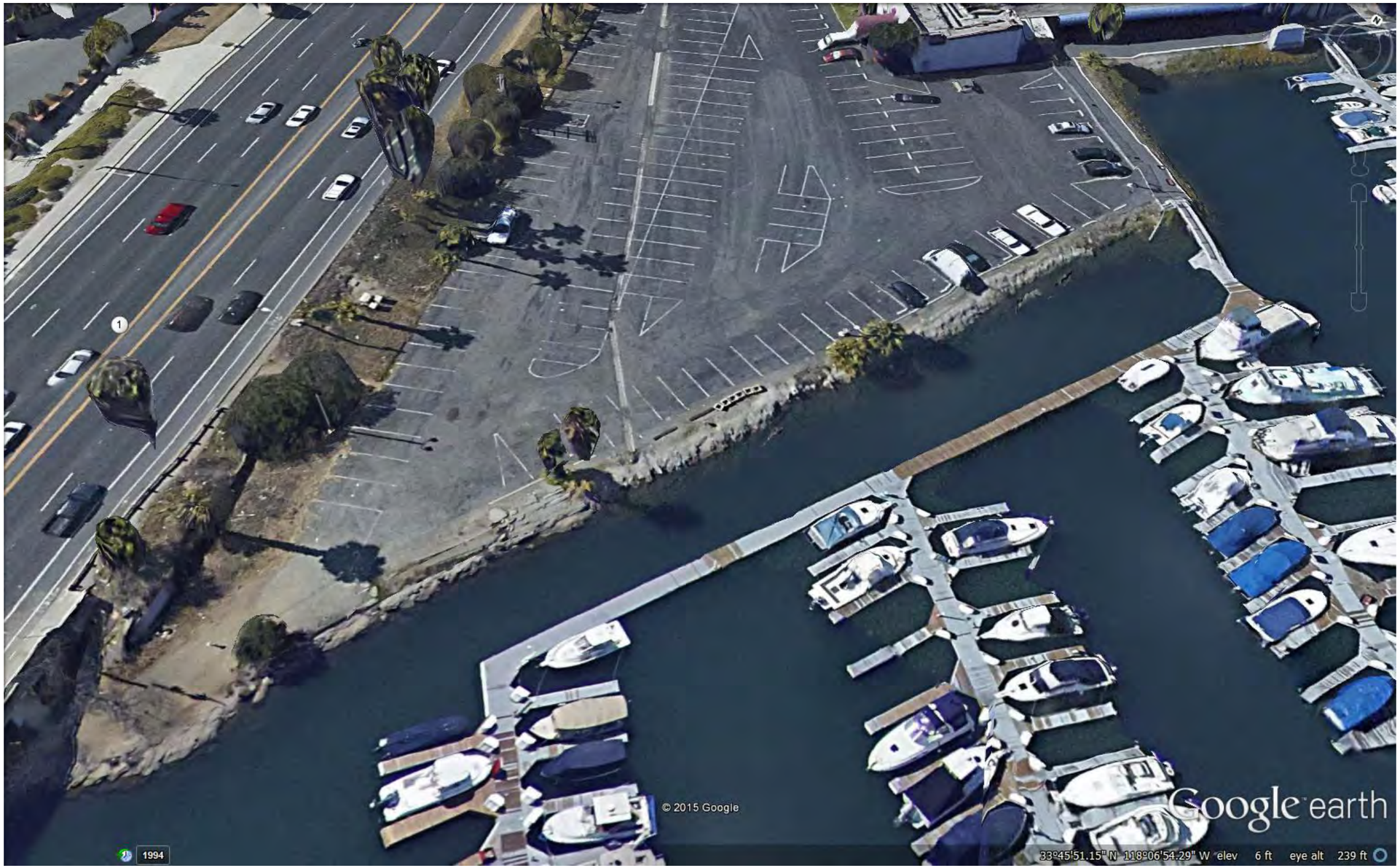

Figure 4-5. The Existing Shoreline Condition of the PCH Club Site (Parking Lot) Within the SEADIP Planning Area

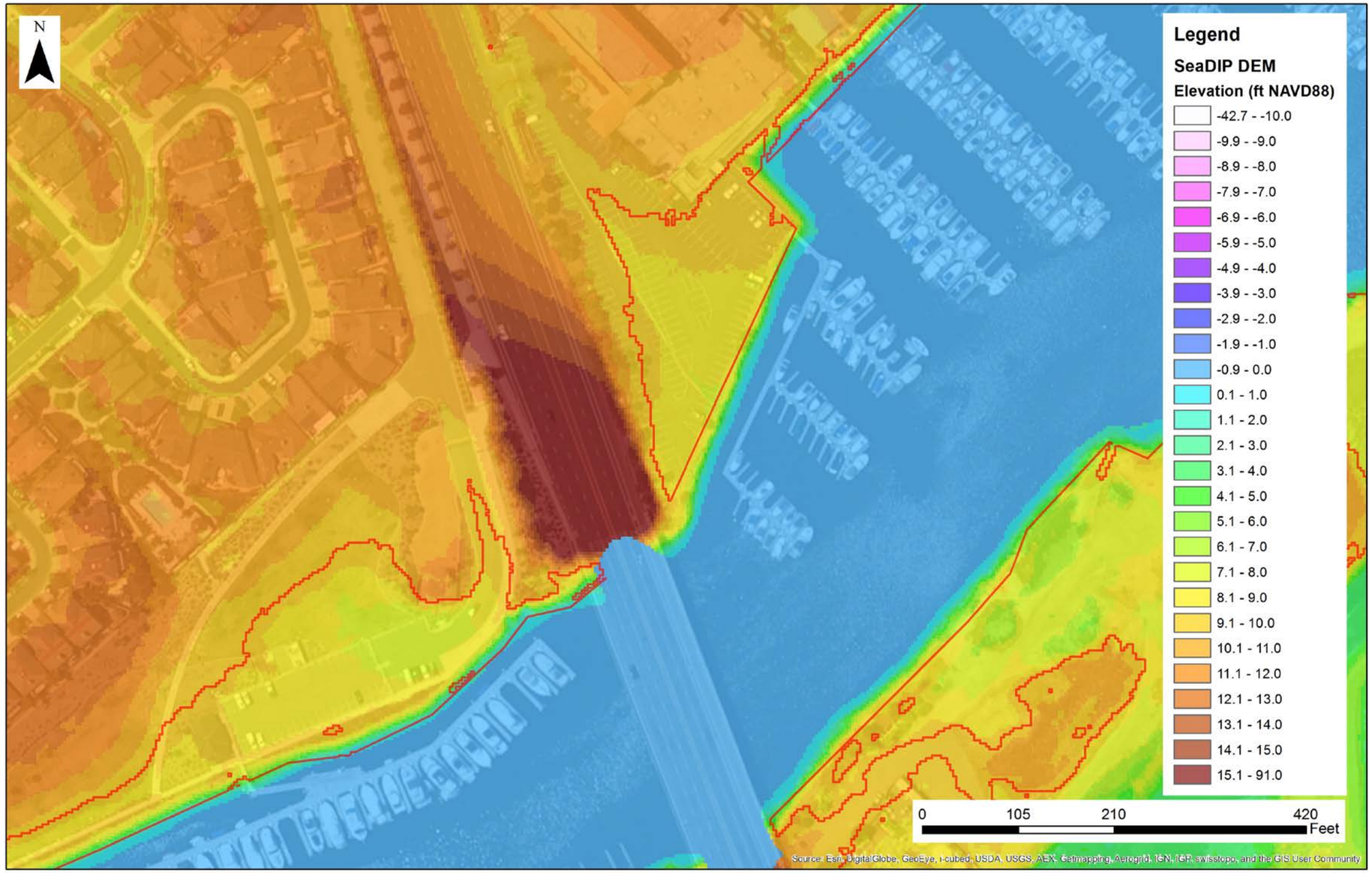

Figure 4-6. The Existing Elevation of the PCH Club Site With Predicted Inundation Areas Outlined in Red

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