Appendix G
Hydrology Technical Report

ESA

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3RD AND PACIFIC
HYDROLOGY AND WATER QUALITY TECHNICAL REPORT
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1. INTRODUCTION

1.1. PROJECT DESCRIPTION

The 3rd and Pacific project is a mixed-use development consisting of 345 residential units and 14,437 square feet of retail commercial space (Project). The development proposes two buildings, a 23-story high rise building at the south end of the site, and an 8-story building at the north end of the property (Project Site). Both buildings offer ground floor retail, with apartments rising above. A proposed pedestrian-focused paseo reenvisions the existing alley and energizes the space between the two buildings. Parking for the site will be provided via two levels of underground parking for each building. The north building also has one level of parking at grade, and a second-floor parking level. The high rise building features four additional parking levels above the ground floor, extending from the second through fifth floors.

1.2. SCOPE OF WORK

This report provides a description of the existing surface water hydrology, surface water quality, groundwater level, and groundwater quality at the Project Site. In addition, the report includes an analysis of the Project's potential impacts related to surface water hydrology, surface water quality, groundwater level, and groundwater quality.

2. REGULATORY FRAMEWORK

2.1. SURFACE WATER HYDROLOGY

County of Los Angeles Hydrology Manual

The City of Long Beach refers to the Los Angeles County (County) Department of Public Works Hydrology Manual as its basis of design for storm drainage facilities. The Hydrology Manual requires that a storm drain conveyance system be designed for a 25-year storm event and that the combined capacity of a storm drain and street flow system accommodate flow from a 50-year storm event. Areas with sump conditions are required to have a storm drain conveyance system capable of conveying flow from a 50-year storm event.[1] The County also limits the allowable discharge into existing storm drain facilities based on the municipal separate storm sewer systems (MS4) Permit, which is enforced on all new developments that discharge directly into the County's storm drain system. Any proposed drainage improvements of County owned storm drain facilities such as catch basins and storm drain lines require approval/review from the County Flood Control District department.

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[1] Los Angeles County Department of Public Works Hydrology Manual, January 2006, http://ladpw.org/wrd/publication/index.cfm, accessed November 29, 2018.

City of Long Beach

Any proposed drainage improvements within the public right of way or any other property owned by, to be owned by, or under the control of the City requires the review and approval by the City of Long Beach Public Works Department.

2.2. SURFACE WATER QUALITY

Clean Water Act

The Clean Water Act was first introduced in 1948 as the Water Pollution Control Act. The Clean Water Act authorizes Federal, state, and local entities to cooperatively create comprehensive programs for eliminating or reducing the pollution of state waters and tributaries. The primary goals of the Clean Water Act are to restore and maintain the chemical, physical, and biological integrity of the nation's waters and to make all surface waters fishable and swimmable. As such, the Clean Water Act forms the basic national framework for the management of water quality and the control of pollutant discharges. The Clean Water Act also sets forth a number of objectives in order to achieve the above-mentioned goals. These objectives include regulating pollutant and toxic pollutant discharges; providing for water quality that protects and fosters the propagation of fish, shellfish and wildlife; developing waste treatment management plans; and developing and implementing programs for the control of non-point sources of pollution.[2]

Since its introduction, major amendments to the Clean Water Act have been enacted (e.g., 1961, 1966, 1970, 1972, 1977, and 1987). Amendments enacted in 1970 created the U.S. Environmental Protection Agency (USEPA), while amendments enacted in 1972 deemed the discharge of pollutants into waters of the United States from any point source unlawful unless authorized by a USEPA National Pollutant Discharge Elimination System (NPDES) permit. Amendments enacted in 1977 mandated development of a "Best Management Practices" Program at the state level and provided the Water Pollution Control Act with the common name of "Clean Water Act," which is universally used today. Amendments enacted in 1987 required the USEPA to create specific requirements for discharges.

In response to the 1987 amendments to the Clean Water Act and as part of Phase I of its NPDES permit program, the USEPA began requiring NPDES permits for: (1) municipal separate storm sewer systems (MS4) generally serving, or located in, incorporated cities with 100,000 or more people (referred to as municipal permits); (2) 11 specific categories of industrial activity (including landfills); and (3) construction activity that disturbs five acres or more of land. Phase II of the USEPA's NPDES permit program, which went into effect in early 2003, extended the requirements for NPDES permits to: (1) numerous small

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[2] Non-point sources of pollution are carried through the environment via elements such as wind, rain, or stormwater and are generated by diffuse land use activities (such as runoff from streets and sidewalks or agricultural activities) rather than from an identifiable or discrete facility.

municipal separate storm sewer systems,[3] (2) construction sites of one to five acres, and (3) industrial facilities owned or operated by small municipal separate storm sewer systems. The NPDES permit program is typically administered by individual authorized states.

In 2008, the USEPA published draft Effluent Limitation Guidelines (ELGs) for the construction and development industry. On December 1, 2009 the EPA finalized its 2008 Effluent Guidelines Program Plan.

In California, the NPDES stormwater permitting program is administered by the State Water Resources Control Board (SWRCB). The SWRCB was created by the Legislature in 1967. The joint authority of water distribution and water quality protection allows the Board to provide protection for the State's waters, through its nine Regional Water Quality Control Boards (RWQCBs). The RWQCBs develop and enforce water quality objectives and implement plans that will best protect California's waters, acknowledging areas of different climate, topography, geology, and hydrology. The RWQCBs develop "basin plans" for their hydrologic areas, issue waste discharge requirements, enforce action against stormwater discharge violators, and monitor water quality.[4]

Federal Anti-Degradation Policy

The Federal Anti-degradation Policy (40 Code of Federal Regulations 131.12) requires states to develop statewide anti-degradation policies and identify methods for implementing them. Pursuant to the Code of Federal Regulations (CFR), state anti-degradation policies and implementation methods shall, at a minimum, protect and maintain (1) existing in-stream water uses; (2) existing water quality, where the quality of the waters exceeds levels necessary to support existing beneficial uses, unless the state finds that allowing lower water quality is necessary to accommodate economic and social development in the area; and (3) water quality in waters considered an outstanding national resource.

California Porter-Cologne Act

The Porter-Cologne Water Quality Control Act established the legal and regulatory framework for California's water quality control. The California Water Code authorizes the SWRCB to implement the provisions of the CWA, including the authority to regulate

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[3] A small municipal separate storm sewer system (MS4) is any MS4 not already covered by the Phase I program as a medium or large MS4. The Phase II Rule automatically covers on a nationwide basis all small MS4s located in "urbanized areas" as defined by the Bureau of the Census (unless waived by the NPDES permitting authority), and on a case-by-case basis those small MS4s located outside of urbanized areas that the NPDES permitting authority designates.

[4] USEPA. U.S. Environmental Protection Agency - Clean Water Act. July 2011. < https://www.epa.gov/laws-regulations/summary-clean-water-act >.

waste disposal and require cleanup of discharges of hazardous materials and other pollutants.

Under the California Water Code (CWC), the State of California is divided into nine RWQCBs, governing the implementation and enforcement of the CWC and CWA. The Project Site is located within Region 4, also known as the Los Angeles Region. Each RWQCB is required to formulate and adopt a Basin Plan for its region. This Plan must adhere to the policies set forth in the CWC and established by the SWRCB. The RWQCB is also given authority to include within its regional plan water discharge prohibitions applicable to particular conditions, areas, or types of waste.

California Anti-Degradation Policy

The California Anti-degradation Policy, otherwise known as the *Statement of Policy with Respect to Maintaining High Quality Water in California,* was adopted by the SWRCB (State Board Resolution No. 68-16) in 1968. Unlike the Federal Anti-degradation Policy, the California Anti-degradation Policy applies to all waters of the State, not just surface waters. The policy states that whenever the existing quality of a water body is better than the quality established in individual Basin Plans, such high quality shall be maintained and discharges to that water body shall not unreasonably affect present or anticipated beneficial use of such water resource.

California Toxic Rule

In 2000, the EPA promulgated the California Toxic Rule, which establishes water quality criteria for certain toxic substances to be applied to waters in the State. The EPA promulgated this rule based on the EPA's determination that the numeric criteria are necessary in the State to protect human health and the environment. The California Toxic Rule establishes acute (i.e., short-term) and chronic (i.e., long-term) standards for bodies of water such as inland surface waters and enclosed bays and estuaries that are designated by the Los Angeles RWQCB (LARWQCB) as having beneficial uses protective of aquatic life or human health.

Board Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties

As required by the CWC, the LARWQCB has adopted a plan entitled "Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties" (Basin Plan). Specifically, the Basin Plan designates beneficial uses for surface and groundwaters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the State's anti-degradation policy, and describes implementation programs to protect all waters in the Los Angeles Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and

regulations. Those of other agencies are referenced in appropriate sections throughout the Basin Plan.[5]

The Basin Plan is a resource for the LARWQCB and others who use water and/or discharge wastewater in the Los Angeles Region. Other agencies and organizations involved in environmental permitting and resource management activities also use the Basin Plan. Finally, the Basin Plan provides valuable information to the public about local water quality issues.

NPDES Permit Program

The NPDES permit program was first established under authority of the CWA to control the discharge of pollutants from any point source into the waters of the United States. As indicated above, in California, the NPDES stormwater permitting program is administered by the SWRCB through its nine RWQCBs.

The General Permit

SWRCB Order No. 2012-0006-DWQ known as "The General Permit" was adopted on July 17, 2012. This NPDES permit establishes a risk-based approach to stormwater control requirements for construction projects by identifying three project risk levels. The main objectives of the General Permit are to:

1. Reduce erosion
2. Minimize or eliminate sediment in stormwater discharges
3. Prevent materials used at a construction site from contacting stormwater
4. Implement a sampling and analysis program
5. Eliminate unauthorized non-stormwater discharges from construction sites
6. Implement appropriate measures to reduce potential impacts on waterways both during and after construction of projects
7. Establish maintenance commitments on post-construction pollution control measures

California mandates requirements for all construction activities disturbing more than one acre of land to develop and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP documents the selection and implementation of Best Management Practices (BMPs) for a specific construction project, charging owners with stormwater quality

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[5] Los Angeles Regional Water Quality Control Board. LARWQCB Basin Plan. <http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/> accessed November 8, 2018.

management responsibilities. A construction site subject to the General Permit must prepare and implement a SWPPP that meets the requirements of the General Permit.[6, 7]

Long Beach Storm Water System (MS4) Permit

As described above, USEPA regulations require that MS4 permittees implement a program to monitor and control pollutants being discharged into the municipal system from both industrial and commercial projects that contribute a substantial pollutant load to the MS4.

On February 6, 2014, the LARWQCB adopted Order No. R4-2014-0024 under the CWA and the Porter-Cologne Act. This Order is the NPDES permit or MS4 permit for municipal stormwater and urban runoff discharges within the City of Long Beach. An amendment of the NPDES permit R4-2014-0024A was adopted on September 9, 2016 and is currently in effect.

City of Long Beach Stormwater Management Program

As part of the Long Beach Waste Discharge Report submitted for its NPDES permit, the City included among other programs, a stormwater management program. In accordance with the objectives of the federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, the Long Beach Storm Water Management Program contains elements, practices, and activities to reduce or eliminate pollutants in stormwater to the maximum extent practicable. In accordance with this program, Long Beach Municipal Code (LBMC) Chapter 18.95 includes requirements relating to development planning and construction, including source control BMPs. Additional requirements include treatment control BMPs and requirements regarding erosion control, peak runoff, and BMP maintenance for projects located adjacent to or directly discharging to environmentally sensitive areas. Post-construction structural or treatment control BMPs designed to mitigate (infiltrate or treat) the volume of runoff produced from a 85th percentile or a 0.75-inch storm event (whichever is greater) prior to its discharge to a stormwater conveyance system are also required for these specific projects. In addition, in accordance LBMC Chapter 8.96, construction projects are required to prepare a SWPPP that will incorporate construction site BMPs.

Given the potential for the proposed project to contribute pollutant loads to stormwater flows during construction and operation of proposed uses, the project is subject to the requirements of the NPDES permits and municipal code requirements.

The City of Long Beach implements the requirement to incorporate stormwater BMPs through the City's plan review and approval process. During the review process, project plans are reviewed for compliance with the City's General Plan, zoning ordinances, and

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6 State Water Resources Control Board. State Water Resources Control Board. July 2012, http://www.swrcb.ca.gov/water_issues/programs/npdes/.

7 USEPA. U.S. Environmental Protection Agency - NPDES. July 2012, https://www.epa.gov/npdes.

other applicable local ordinances and codes, including storm water requirements. Plans and specifications are reviewed to ensure that the appropriate BMPs are incorporated to address storm water pollution prevention goals. The Standard Urban Stormwater Mitigation Plan (SUSMP) provisions that are applicable to new residential and commercial developments include, but are not limited to, the following:[8]

- Peak Storm Water Runoff Discharge Rate: Post-development peak storm water runoff discharge rates shall not exceed the estimated pre-development rate for developments where the increased peak storm water discharge rate will result in increased potential for downstream erosion;
- Provide storm drain system Stenciling and Signage (only applicable if a catch basin is built on-site);
- Properly design outdoor material storage areas to provide secondary containment to prevent spills;
- Properly design trash storage areas to prevent off-site transport of trash; and
- Provide proof of ongoing BMP Maintenance of any structural BMPs installed.

Design Standards for Structural or Treatment control BMPs:

- Conserve natural and landscaped areas;
- Provide planter boxes and/or landscaped areas in yard/courtyard spaces;
- Properly design trash storage areas to provide screens or walls to prevent off-site transport of trash; and
- Provide proof on ongoing BMP maintenance of any structural BMPs installed.

Design Standards for Structural or Treatment Control BMPs:

- Post-construction treatment control BMPs are required to incorporate, at a minimum, either a volumetric or flow based treatment control design or both, to mitigate (infiltrate, filter or treat) storm water runoff.

In addition, project applicants subject to the SUSMP requirements must select source control and, in most cases, treatment control BMPs from the list approved by the RWQCB. The BMPs must control peak flow discharge to provide stream channel and over bank flood protection, based on flow design criteria selected by the local agency. Further, the source

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8 City of Long Beach Stormwater Management Best Practices website, http://www.longbeach.gov/pw/resources/stormwater-management/best-practices/; accessed November 29, 2018.

and treatment control BMPs must be sufficiently designed and constructed to collectively treat, infiltrate, or filter stormwater runoff from one of the following:

- The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area, from the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998)*;

- The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in *California Stormwater Best Management Practices Handbook—Industrial/ Commercial, (1993)*;

- The volume of runoff produced from a 0.75-inch storm event, prior to its discharge to a stormwater conveyance system; or

- The volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for "treatment" (0.75-inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.

Long Beach Municipal Code

Chapter 8.96. Stormwater and Runoff Pollution Control. This chapter reinforces the requirements of the Federal Clean Water Act and the State Porter Cologne Act (including Construction General Permit requirements) within the City.

Additionally, unless otherwise permitted by a NPDES permit, the ordinance prohibits industrial and commercial developments from discharging untreated wastewater or untreated runoff into the storm drain system. Furthermore, the ordinance prohibits trash or any other abandoned objects/materials from being deposited such that they could be carried into the storm drains. Lastly, the ordinance not only makes it a crime to discharge pollutants into the storm drain system and imposes fines on violators, but also gives City public officers the authority to issue citations or arrest business owners or residents who deliberately and knowingly dump or discharge hazardous chemicals or debris into the storm drain system.

Earthwork activities, including grading, are governed by Long Beach Municipal Code Chapter 18.75, Grading, Excavations and Fills. Specifically, Section 18.75.080 includes regulations pertaining to erosion control, and Section 18.75.010 includes general construction requirements.

Low Impact Development (LID)

The LID regulation was adopted by the City of Long Beach on November 16, 2010 as Chapter 18.74 of the Long Beach Municipal Code and approved by Ordinance No. ORD-10-0035; and amended on November 12, 2013 by Ordinance No. ORD-13-0024.

The LID design manual was created by the City of Long Beach Department of Development Services in collaboration with the Department of Public Works and the Office of Sustainability. The Building Official shall prepare, maintain, and update, as deemed necessary and appropriate, the LID BMP Design Manual to include LID standards and practices and standards for stormwater pollution mitigation. The LID Best Management Practices Manual shall also include technical feasibility and implementation parameters, alternative compliance for technical infeasibility, as well as other rules, requirements and procedures as the City deems necessary. [9]

LID is a stormwater management strategy with goals to mitigate the impacts of increased runoff and stormwater pollution as close to its source as possible. LID promotes the use of natural infiltration systems, evapotranspiration, and the reuse of stormwater. The goal of these LID practices is to remove nutrients, bacteria, and metals from stormwater while also reducing the quantity and intensity of stormwater flows. Through the use of various infiltration strategies, LID is aimed at minimizing impervious surface area. Where infiltration is not feasible, the use of bioretention, rain gardens, green roofs, and rain barrels that will store, evaporate, detain, and/or treat runoff may be used.

The intent of the City of Long Beach LID standards is to:

- Require the use of LID practices in future developments and redevelopments to encourage the beneficial use of rainwater and urban runoff;
- Reduce stormwater/urban runoff while improving water quality;
- Promote rainwater harvesting;
- Reduce offsite runoff and provide increased groundwater recharge;
- Reduce erosion and hydrologic impacts downstream; and
- Enhance the recreational and aesthetic values in our communities.

The City of Long Beach LID Ordinance conforms to the regulations outlined in the NPDES Permit and SUSMP.

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[9] City of Long Beach. "Low Impact Development (LID) Best Management Practices Handbook Design Manual." November, 2010.

2.3. GROUNDWATER HYDROLOGY AND QUALITY

Board Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties

As required by the California Water Code, the LARWQCB has adopted the Basin Plan. Specifically, the Basin Plan designates beneficial uses for surface and groundwaters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the State's anti-degradation policy, and describes implementation programs to protect all waters in the Los Angeles Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. Those of other agencies are referenced in appropriate sections throughout the Basin Plan.

The Basin Plan is a resource for the Regional Board and others who use water and/or discharge wastewater in the Los Angeles Region. Other agencies and organizations involved in environmental permitting and resource management activities also use the Basin Plan. Finally, the Basin Plan provides valuable information to the public about local water quality issues.

Safe Drinking Water Act (SDWA)

The Federal Safe Drinking Act, established in 1974, sets drinking water standards throughout the country and is administered by the USEPA. The drinking water standards established in the SDWA, as set forth in the Code of Federal Regulations (CFR), are referred to as the National Primary Drinking Water Regulations (Primary Standards, Title 40, CFR Part 141) and the National Secondary Drinking Water Regulations (Second Standards, 40 CFR Part 143). California passed its own Safe Drinking Water Act in 1986 that authorizes the State's Department of Health Services (DHS) to protect the public from contaminants in drinking water by establishing maximum contaminants levels (MCLs), as set forth in the CCR, Title 22, Division 4, Chapter 15, that are at least as stringent as those developed by the USEPA, as required by the federal Safe Drinking Water Act.

California Water Plan

The California Water Plan (the Plan) provides a framework for water managers, legislators, and the public to consider options and make decisions regarding California's water future. The Plan, which is updated every five years, presents basic data and information on California's water resources including water supply evaluations and assessments of agricultural, urban, and environmental water uses to quantify the gap between water supplies and uses. The Plan also identifies and evaluates existing and proposed statewide demand management and water supply augmentation programs and projects to address the State's water needs.

The goal for the California Water Plan Update is to meet Water Code requirements, receive broad support among those participating in California's water planning, and be a useful

document for the public, water planners throughout the state, legislators and other decision-makers.

3. ENVIRONMENTAL SETTING

3.1. SURFACE WATER HYDROLOGY

3.1.1. REGIONAL

As illustrated in Figure 9, the Project Site is located within the Los Angeles River Watershed Reach 1 in the Los Angeles Basin. The Watershed encompasses an area of approximately 834 square miles and is bounded, at its headwaters, by the Santa Monica, Santa Susana, and San Gabriel mountains to the north and west. The southern portion of the Watershed captures runoff from urbanized areas surrounding downtown Los Angeles. Jurisdictions in the Watershed include the City of Los Angeles (33%), 42 other cities (29%), and eight agencies (37%). The 55-mile long Los Angeles River originates in western San Fernando Valley and flows through the central portion of the city south to San Pedro Bay near Long Beach. Most portions of the Los Angeles River are completely channelized for flood protection, as are many of its tributaries including Compton Creek, Rio Hondo, Arroyo Seco, and Tujunga Wash. They are fed by a complex underground network of storm drains and a surface network of tributaries

3.1.2. LOCAL

Underground storm drain facilities in the Project vicinity (see Figure 2) consist of the following:

- **3rd Street:** There is an existing 84" reinforced concrete pipe (RCP) west of 3rd Street maintained by Los Angeles Flood Control District.

- **4th Street:** There is an existing 15" unreinforced concrete pipe (UCP) storm drain line between Pacific Avenue and Solana Court owned and maintained by the City of Long Beach.

The stormwater runoff from the Project Site is discharge into three off-site storm drainage catch basins, two are located at the northeast corner of the 3rd Street and Pacific Avenue intersection and one is located at the southeast corner of the 4th Street and Pacific Avenue intersection. The catch basins connects into underground storm drainage pipes which convey stormwater through various underground pipe networks and ultimately into the Los Angeles River. Los Angeles River generally flows towards the southwest, ultimately discharging into the Pacific Ocean at the San Pedro Bay.

3.1.3. PROJECT SITE

Based on the applicant supplied title survey (see Figure 1) and site observations, it is determined that under the existing conditions the Project Site is divided into three drainage areas, which are described below and shown in Figure 3. These drainage areas are

determined by the drainage patterns and flow paths of stormwater that are tributary to a common point or area. The Site generally consists of impervious surface parking.

- Area A1 consists of the surface parking lot located on the southern part of the Project Site.
- Area A2 consists of the surface parking lot located on the northern part of the Project Site.
- Area A3 consists of 1,340 sf of Pacific Avenue sidewalk and 1,410 sf of Roble Way vacation.

Figure 5 shows all the input parameters used to analyze the existing Site. Table 1 summarizes the existing volumetric flow rates generated by a 50-year storm event.

Table 1- Existing Drainage Stormwater Runoff Calculations

Drainage Area	Area (Acres)	Percent Imperviousness (%)	Q_{50} (cfs) (volumetric flow rate measured in cubic feet per second)
Project Site			
A1	0.486	100%	1.38
A2	0.688	100%	1.96
A3	0.063	100%	0.18
TOTAL	**1.237**	**100%**	**3.52**

3.2. Surface Water Quality

3.2.1. Regional

As stated above, the Project Site lies within the Los Angeles River Watershed. Constituents of concern listed for Los Angeles River Reach 1 under California's Clean Water Act Section 303(d) List include: Ammonia, Cadmium, Copper, Cyanide, Bacteria, Diazinon, Lead, Nutrients (Algae), Trash, Zinc, Ph.[10] No TMDL data have been recorded by EPA for this waterbody.[11]

[10] https://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml; accessed December 3, 2018.

[11] https://iaspub.epa.gov/waters10/attains_waterbody.control?p_au_id=CAR4051200019990202083037&p_cycle=2016&p_state=CA&p_report_type=A; accessed November 21, 2018.

3.2.2. LOCAL

In general, urban stormwater runoff occurs following precipitation events, with the volume of runoff flowing into the drainage system depending on the intensity and duration of the rain event. Contaminants that may be found in stormwater from developed areas include sediments, trash, bacteria, metals, nutrients, organics and pesticides. The source of contaminants includes surface areas where precipitation falls, as well as the air through which it falls. Contaminants on surfaces such as roads, maintenance areas, parking lots, and buildings, which are usually contained in dry weather conditions, may be carried by rainfall runoff into drainage systems. The City of Long Beach typically installs catch basins with screens to capture debris before entering the storm drain system. In addition, the City conducts routine street cleaning operations, as well as periodic cleaning and maintenance of catch basins, to reduce stormwater pollution within the City.

3.2.3. PROJECT SITE

Based on the applicant supplied Title survey (see Figure 1), site observations, and the fact that the existing site was developed prior to the enforcement of storm water quality Best Management Practices (BMP) design, implementation and maintenance, it appears the Project Site currently does not implement BMPs and has no means of treatment for stormwater runoff.

3.3. GROUNDWATER HYDROLOGY AND QUALITY

3.3.1. GROUNDWATER HYDROLOGY

3.3.1.1. REGIONAL

Groundwater use for domestic water supply is a major beneficial use of groundwater basins in Los Angeles County. The City of Long Beach overlies the Los Angeles Coastal Plain Groundwater Basin (Basin). The Basin comprises the Hollywood, Santa Monica, Central, and West Coast Subbasin. Groundwater flow in the Basin is generally south-southwesterly and may be restricted by natural geological features. Replenishment of groundwater basins occurs mainly by percolation of precipitation throughout the region via permeable surfaces, spreading grounds, and groundwater migration from adjacent basins, as well as injection wells designed to pump freshwater along specific seawater barriers to prevent the intrusion of salt water.

3.3.1.2. LOCAL

Within the Basin, the Project Site specifically overlies the West Coast Subbasin (Subbasin), which underlies the southeast portion of the Basin. The Subbasin is bounded on the north by the Ballona Escarpment, an abandoned erosional channel from the Los Angeles River.

On the east it is bounded by the Newport-Inglewood fault zone, and on the south and west by the Pacific Ocean and consolidated rocks of the Palos Verdes Hills.[12]

Natural replenishment of the Basin's groundwater supply is largely limited to underflow from the Central Basin through and over the Newport-Inglewood fault zone. Water spread in the Central Basin percolates into aquifers there, and eventually some crosses the Newport-Inglewood fault to supplement the groundwater supply in the West Coast Basin. Seawater intrusion occurs in some aquifers that are exposed to the ocean offshore. The groundwater flow within the Subbasin generally flows northeast to southwest.

LBWD has a right to pump 0.7 acre-feet from the West Coast Basin, but LBWD currently has no wells in the West Coast Basin and, therefore, does not exercise those water rights.[13]

3.3.1.3. PROJECT SITE

The existing Project Site is improved with existing parking lot, there is currently no contribution to groundwater recharge. The below discussion is based upon a review of relevant previous investigations and on-site explorations conducted as part of the *Updated Geotechnical Investigation*, dated January 31, 2017. "The City of Long Beach General Plan (2004) and the City of Long Beach Safety Element (1988) indicate the historic high groundwater level at the site is reported to be approximately 25 feet and 30 feet below the ground surface, respectively." Furthermore "groundwater was encountered in borings B2, B6 and B7 at depths of approximately 29 feet, 32 feet and 32 feet below existing ground surface respectively."[14]

3.3.2. GROUNDWATER QUALITY

3.3.2.1. REGIONAL

As stated above, the City of Long Beach overlies the Los Angeles Coastal Plain Groundwater Basin, which falls under the jurisdiction of the LARWQCB. According to LARWQCB's Basin Plan, objectives applying to all ground waters of the region include bacteria, chemical constituents and radioactivity, mineral quality, nitrogen (nitrate, nitrite), and taste and odor.[15]

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[12] https://water.ca.gov/LegacyFiles/groundwater/bulletin118/basindescriptions/4-11.03.pdf; accessed November 28, 2018.

[13] http://www.lbwater.org/sites/default/files/documents/LBWD2015UWMP.pdf; accessed November 21, 2018.

[14] Geotechnical report titled "Updated Geotechnical Investigation", by Geocon West, Inc, dated January 31, 2017.

[15] Los Angeles Regional Water Quality Control Board, Basin Plan, March 2013, http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/electronics_documents/Final%20Chapter%203%20Text.pdf accessed December 5, 2018.

3.3.2.2. LOCAL

As stated above, the Project Site specifically overlies the West Coast Subbasin. Based upon LARWQCB's Basin Plan, constituents of concern listed for the West Coast Subbasin include boron, chloride, sulfate, Total Dissolved Solids (TDS), and nitrate.[16]

3.3.2.3. PROJECT SITE

The Project Site is 100% impervious in the existing condition and does not contribute to groundwater recharge. Due to no perviousness of the site, it does not appear possible for surface water borne contaminants to percolate into the groundwater and affect the groundwater quality. However, groundwater quality may be impacted by past and existing activities at the Project Site. Other types of risk such as underground storage tanks (UST) have a greater potential to impact groundwater.

Based on the historical information review completed by Partner Engineering and Science as a part of Phase I Environmental Site Assessment Report dated January 4, 2017, the subject property was occupied by an automotive station from as early as 1933 to 1948. Partner was not able to obtain further information pertaining to the actual operations of the automotive station and based on the lack of information and potential nature of operations considered this former facility a recognized environmental condition. Partner recommended a limited subsurface investigation to determine the presence or absence of soil and/or groundwater contamination due to the historical use of the subject property as an automotive station.

Based on an investigation and on-site explorations conducted as part of the Phase II Subsurface Investigation Report dated April 6, 2017 by Partner Engineering and Science, Inc. Partner conducted a subsurface investigation at the subject property to identify the location of on-site USTs, former tankholds and/or other associated features and investigate the potential impact of petroleum and hydrocarbons and/or volatile organic compounds (VOCs) to soil as a consequence of a release or releases from the former on-site station.

The geophysical survey Partner conducted as part of the Phase II Investigation identified a former building footprint in the northwest corner of the subject property with backfilled excavations located to the north and south. The size, diagonal orientation to the adjacent streets, and position in relation to the Pacific Avenue and 4th street intersection is consistent with the former building footprint being the remaining foundation of a small gas station.

Partner indicated that the backfilled excavation south of the former gas station footprint is likely the remnants of a waste oil UST that was removed. Furthermore the backfilled excavation north of the former building footprint is likely the former location of the main USTs, the pump island, and product piping. No current or remaining USTs were detected in the area.

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[16] Ibid.

Partner analyzed 4 soil samples from the Site and found that none of the analyzed soil samples contained detectable concentrations of total petroleum hydrocarbons (TPH-cc) or volatile organic compounds (VOCs) above their respective Practical Quantitation Limits (PQLs) and the PQLs were below their respective screening levels. The screening levels were compared to the maximum soil screening levels established and enforced by the LARWQCB and the regional screening levels established by EPA. The laboratory results can be found in the Appendix C of the Phase II Subsurface Investigation Report. In addition there does not appear to be any evidence of tankholds remaining at the subject property as a result of the former gasoline station. Partner recommends that no further investigation with respect to the former on-site service station operations is done at this time.

4. SIGNIFICANCE THRESHOLDS

4.1. SURFACE WATER HYDROLOGY

Appendix G of the State of California's CEQA Guidelines provides a set of sample questions that address impacts with regard to surface water hydrology. These questions are as follows:

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, in a manner which would result in substantial erosion or siltation on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in flooding on- or off-site;
- 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
- 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;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as result of the failure of levee or dam;

4.2. SURFACE WATER QUALITY

Appendix G of the CEQA Guidelines provides a set of sample questions that address impacts with regard to surface water quality. These questions are as follows:

Would the project:

- Violate any water quality standard or waste discharge requirements; or
- Otherwise substantially degrade water quality.

4.3. GROUNDWATER HYDROLOGY AND QUALITY

Appendix G of the CEQA Guidelines provides a sample question that addresses impacts with regard to groundwater. This question is as follows:

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 lowering of the local groundwater table;

5. METHODOLOGY

5.1. SURFACE WATER HYDROLOGY

The Project Site is located within the City of Long Beach, and drainage collection, treatment and conveyance are regulated by the City. The City uses Los Angeles County Hydrology Manual as its basis of design for storm drainage facilities. The LACDPW Hydrology Manual requires projects to have drainage facilities that meet the Urban Flood level of protection. The Urban Flood is runoff from a 25-year frequency design storm falling on a saturated watershed. A 25-year frequency design storm has a probability of 1/25 of being equaled or exceeded in any year. To provide a more conservative analysis, this report analyzes the larger storm event threshold, i.e., the 50-year frequency design storm event.

The Modified Rational Method was used to calculate storm water runoff. The "peak" (maximum value) runoff for a drainage area is calculated using the formula, **Q = CIA**

Where,

Q = Volumetric flow rate (cfs)

C = Runoff coefficient (dimensionless)

I = Rainfall Intensity at a given point in time (in/hr)

A = Basin area (acres)

The Modified Rational Method assumes that a steady, uniform rainfall rate will produce maximum runoff when all parts of the basin area are contributing to outflow. This occurs when the storm event lasts longer than the time of concentration. The time of concentration

(Tc) is the time it takes for rain in the most hydrologically remote part of the basin area to reach the outlet.

The method assumes that the runoff coefficient (C) remains constant during a storm. The runoff coefficient is a function of both the soil characteristics and the percentage of impervious surfaces in the drainage area.

LACDPW has developed a time of concentration calculator, Hydrocalc, to automate time of concentration calculations as well as the peak runoff rates and volumes using the Modified Rational Method design criteria as outlined in the Hydrology Manual. The data input requirements include: sub-area size, soil type, land use, flow path length, flow path slope and rainfall isohyet. The Hydrocalc Calculator was used to calculate the storm water peak runoff flow rate for the Project conditions by evaluating an individual sub-area independent of all adjacent subareas. See Figures 3 and 4 for the Hydrocalc Calculator results and Figure 6 for the Isohyet Map.

5.2. SURFACE WATER QUALITY

5.2.1. CONSTRUCTION

Construction BMPs will be designed and maintained as part of the implementation of the local SWPPP (Erosion Control Plan) in compliance with the General Permit. The Erosion Control Plan shall be implemented when construction commences and, before any site clearing or demolition activity. During construction, the Erosion Control Plan will be referred to regularly and amended as changes occur throughout the construction process.

5.3. GROUNDWATER HYDROLOGY AND QUALITY

The significance of this Project as it relates to the level of the underlying groundwater table of the Central Groundwater Basin included a review of the following considerations:

Analysis and Description of the Project's Existing Condition

- Identification of the West Coast Subbasin as the underlying groundwater basin, and description of the level, quality, direction of flow, and existing uses for the water;
- Description of the location, existing uses, production capacity, quality, and other pertinent data for spreading grounds and potable water wells in the vicinity (usually within a one mile radius); and
- Area and degree of permeability of soils on the Project Site.

Analysis of the Proposed Project Impact on Groundwater Level

- Description of the rate, duration, location and quantity of extraction, dewatering, spreading, injection, or other activities;

- The projected reduction in groundwater resources and any existing wells in the vicinity (usually within a one mile radius); and

- The projected change in local or regional groundwater flow patterns.

In addition, this report discusses the impact of both existing and proposed activities at the Project Site on the groundwater quality of the underlying West Coast Subbasin.

Short-term groundwater quality impacts could potentially occur during construction of the Project as a result of soil or shallow groundwater being exposed to construction materials, wastes, and spilled materials. These potential impacts are qualitatively assessed.

Project Design Features

Per the LID Manual requirements governing the Project stormwater management, infiltration facilities shall be sized to capture and infiltrate the design capture volume based on the runoff produced from the greater between the 85th percentile storm event and the 0.75-inch storm event. To meet these requirements, the Project proposes the installation of storm drains capturing the entire Project site runoff and through storm pipes conveying the runoff towards either a capture and use system or filtration planter boxes. The typical capture and use and planter box system are illustrated in Exhibit 2.

6. PROPOSED IMPACT ANALYSIS

6.1. CONSTRUCTION

6.1.1. SURFACE WATER HYDROLOGY

Construction activities for the Project would include demolition of the existing hardscape, excavating down to a maximum depth of 46 feet bgs to build up the underground structure, building up the structures, and constructing hardscape and landscape around the structures. It is anticipated that up to approximately 90,000 cubic yards of soil would be graded, most of which would be exported to construct the Project. These activities have the potential to temporarily alter existing drainage patterns and flows on the Project Site by exposing the underlying soils, modifying flow direction, and making the Project Site temporarily more permeable. Also, exposed and stockpiled soils could be subject to erosion and conveyance into nearby storm drains during storm events. In addition, construction activities such as earth moving, maintenance/operation of construction equipment, and handling/storage/disposal of materials could contribute to pollutant loading in stormwater runoff.

However, as the construction site would be greater than one acre, the Project would be required to obtain coverage under the NPDES General permit. In accordance with the requirements of this permit, the Project would implement a SWPPP that specifies BMPs and erosion control measures to be used during construction to manage runoff flows and prevent pollution. BMPs would be designed to reduce runoff and pollutant levels in runoff during construction. The NPDES and SWPPP measures are designed to (and would in fact)

contain and treat, as necessary, stormwater or construction watering on the Project site so runoff does not impact off-site drainage facilities or receiving waters. Construction activities would be temporary, and flow directions and runoff volumes during construction would be controlled.

In addition, the Project would be required to comply with all applicable City grading permit regulations that require necessary measures, plans, and inspections to reduce sedimentation and erosion. Thus, through compliance with all NPDES General Construction Permit requirements, including preparation of a SWPPP, implementation of BMPs, and compliance with applicable City grading regulations, the Project would not substantially alter the Project Site drainage patterns in a manner that would result in substantial erosion, siltation, or flooding on- or off-site. Similarly, adherence to standard compliance measurements in construction activities would avoid flooding, substantially increasing or decreasing the amount of surface water flow from the Project Site into a water body, or a permanent, adverse change to the movement of surface water. As such, construction-related impacts to surface water hydrology would be less than significant.

6.1.2. SURFACE WATER QUALITY

Construction activities such as earth moving, maintenance/operation of construction equipment, potential dewatering, and handling/storage/disposal of materials could contribute to pollutant loading in stormwater runoff. However, as previously discussed, the Project would be required to obtain coverage under the NPDES General Permit (order No. 2012-0006-DWQ). In accordance with the requirements of the permit, the Project Applicants would prepare and implement a site-specific SWPPP adhering to the California Stormwater Quality Association (CASQA) BMP Handbook. The SWPPP would specify BMPs to be used during construction. BMPs would include, but would not necessarily be limited to: erosion control, sediment control, non-stormwater management, and materials management BMPs. Refer to Exhibit 1 for typical SWPPP BMPs implemented during the construction of development projects.

As discussed below, the Project may require dewatering during construction. Dewatering operations are practices that discharge non-stormwater, such as groundwater, that must be removed from a work location and discharged into the storm drain system to proceed with construction. Discharges from dewatering operations can contain high levels of fine sediments, which, if not properly treated, could lead to exceedance of the NPDES requirements. If groundwater is encountered during construction, temporary pumps and filtration would be utilized in compliance with the NPDES dewatering permit. The temporary system would comply with all relevant NPDES requirements related to construction and discharges from dewatering operations. If dewatering is required, the treatment and disposal of the dewatered water would occur in accordance with the requirements of LARWQCB's Waste Discharge Requirements for Discharges of Groundwater from Construction and Project Dewatering to Surface Waters in Coastal Watersheds of Los Angeles and Ventura Counties.

With the implementation of site-specific BMPs included as part of the required Erosion Plan, the Project would reduce or eliminate the discharge of potential pollutants from the stormwater runoff. In addition, the Project Applicant would be required to comply with City grading permit regulations, which require implementation of necessary measures, plans (including a wet weather erosion control plan if construction occurs during the rainy season), and inspection to reduce sedimentation and erosion. Therefore, with compliance with NPDES requirements and City grading regulations, construction of the Project would not result in discharge that would cause: (1) pollution which would alter the quality of the water of the State (i.e. Los Angeles River) to a degree which unreasonably affects beneficial uses of the waters; (2) contamination of the quality of the water of the State by waste to a degree which creates a hazard to the public health through poisoning or through the spread of diseases; or (3) nuisance that would be injurious to health; affect an entire community or neighborhood, or any considerable number of persons; and occurs during or as a result of the treatment or disposal of wastes. Furthermore, construction of the Project would not result in discharges that would cause regulatory standards to be violated.

6.1.3. GROUNDWATER HYDROLOGY AND QUALITY

6.1.3.1. GROUNDWATER HYDROLOGY

As stated above, construction activities for the Project would include demolition of an existing hardscape areas, excavating down to a maximum depth of 46 feet bgs to build up the underground structure, building up the structures, and constructing hardscape and landscape around the structures. Since measured groundwater was discovered at a depth of 29 feet bgs temporary dewatering operations are expected. When groundwater is encountered during the construction, temporary pumps and filtration would be utilized in compliance all applicable regulations and requirements, including with all relevant NPDES requirements related to construction and discharges from dewatering operations. The temporary dewatering will be active during excavation and during the construction of the basement slabs and basement walls. The walls and slab will be designed to withstand hydrostatic and buoyant forces and the groundwater is expected to return to measured levels. No operational dewatering is expected or anticipated. Therefore, the Project would not substantially deplete groundwater supplies in a manner that would result in a net deficit in aquifer volume or lowering of the local groundwater table.

6.1.3.2. GROUNDWATER QUALITY

During on-site grading and building construction, hazardous materials, such as fuels, paints, solvents, and concrete additives, could be used and present a risk to groundwater, and would therefore require proper management and, in some cases, disposal. The management of any resultant hazardous wastes could increase the opportunity for hazardous materials releases into groundwater. As such, BMPs will be implemented per the SWPPP to mitigate any hazardous materials on the Project Site. Furthermore compliance with all applicable federal, state, and local requirements concerning the handling, storage and disposal of hazardous waste, would reduce the potential for the construction of the Project to release contaminants into groundwater that could affect existing contaminants, expand the area or increase the level of groundwater contamination,

or cause a violation of regulatory water quality standards at an existing production well. Therefore, the Project would not result in any substantial increase in groundwater contamination through hazardous materials releases and impacts on groundwater quality would be less than significant.

6.2. OPERATION

6.2.1. SURFACE WATER HYDROLOGY

The Project will meet the requirements of the City's LID standards.[17] Under section 3.1.3. of the LID Manual, post-construction stormwater runoff from a new development must be infiltrated, evapotranspirated, captured and used, and/or treated through high efficiency BMPs onsite for at least the volume of water produced by the greater of the 85th percentile storm or the 0.75 inch storm event. The LID Manual prioritized the selection of BMPs used to comply with stormwater mitigation requirement. The order of priority is:

1. Infiltration Systems
2. Stormwater Capture and Use
3. High Efficient Biofiltration/Bioretention Systems
4. Combination of Any of the Above

Feasibility screening delineated in the LID manual is applied to determine which BMP will best suit the Project. Based on the screening criteria and Geocon West geotechnical report, infiltration is considered feasible. However, as stated above, the groundwater was encountered at 29 feet during Geocon West's soil boring analysis. The LID guidelines require the infiltration systems to maintain at least ten feet of clearance to the groundwater, property line or any basement structure. Thus, due to the Project's estimated depth of 46 feet below the ground surface and the proposed underground footprint, infiltration is considered infeasible. The Project proposes to implement either a capture and use system or planter boxes to satisfy the LID requirements.

The Project will decrease the percentage of impervious area compared to the existing conditions on the Project Site. The Project site currently consists of existing paved parking lots with no pervious surface. The Project will develop two buildings surrounded by hardscape and landscape including a green roof. The proposed Project will be approximately 69.8% impervious after construction. Based on site investigations, under the existing conditions it appears that stormwater discharges from the Project Site without treatment or on-site detention. The Project would improve these conditions by adding BMPs to the site.

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[17] The Low Impact Development (LID) Best Management Practices (BMP) Design Manual was adopted by the City of Long Beach on November 16, 2010 to reflect Low Impact Development (LID) requirements.

Under the proposed conditions illustrated in Figure 4, the Project Site would consist of one proposed drainage area that would drain via building roof drains, surface flow, and subterranean drainage to the proposed BMPs.

- **Project Site**
    - The proposed area consists of the entire Project Site

Proposed runoff was analyzed for a 50-year storm event. Refer to Figure 6 for the parameters used for analyzing the proposed site drainage using HydroCalc and Figure 8 for the LA County Hydrology Data Map. Table 2 shows the proposed volumetric flow rates generated by a 50-year storm event.

Table 2 - Proposed Drainage Stormwater Runoff Calculations			
Drainage Area	Area (acres)	Percent Imperviousness (%)	Q_{50} (cfs) (volumetric flow rate measured in cubic feet per second)
Project Site			
Proposed Project	1.237	69.8%	3.35
TOTAL	**1.237**	**69.8%**	**3.35**

Table 3 shows the existing and the proposed 50-year frequency design storm event peak flow rates within the Project Site. A comparison of the pre- and post-Project peak flow rates indicates that there will be a decrease (4.83%) in stormwater runoff.

Table 3 – Proposed Drainage Stormwater Runoff Calculations Summary		
Pre-Project Q_{50} (cfs)	**Post-Project Q_{50} (cfs)**	**Incremental Decrease from Existing to Proposed Condition**
3.52	**3.35**	**4.83%**

Consequently, the Project would not cause flooding during the 50-year developed storm event, would not create runoff which would exceed the capacity of existing or planned drainage systems, would not substantially reduce or increase the amount of surface water in a water body, or result in a permanent adverse change to the movement of surface water.

Earthquake-induced flooding can result from the failure of dams or other water-retaining structures resulting from earthquakes. According to the California Geological Survey,

2009, Tsunami Inundation Map for Emergency Planning, State of California, County of Los Angeles, Long Beach Quadrangle, March 1, 2009. (Refer to Figure 11), the Project Site is not located in a potential dam inundation area, therefore the potential for earthquake-induced flooding to adversely impact the site is considered very low.

The Project Site is not located within a 0.2% annual chance floodplain area identified by the Federal Emergency Management Agency (FEMA) and published in the Flood Insurance Rate Maps (FIRM).[18] The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 500-year floodplain are labeled Zone C or Zone X (unshaded). As shown on Figure 10, the Project Site is located within the Zone X (unshaded) and is therefore located outside the 0.2% annual chance floodplain area.[19]

6.2.2. SURFACE WATER QUALITY

Compliance with the LID requirements for the Project Site would ensure stormwater treatment with post-construction BMPs that are required to control pollutants associated with storm events up to the 85th percentile storm event, per the City's Stormwater Program. It follows that, the Project BMPs would control stormwater runoff and result in a minor decrease in runoff. In order to meet the LID requirements, it is estimated that a total of 2,199 cubic feet of stormwater will need to be mitigated throughout the Project Site (refer to Figure 7). To achieve this design capture volume, the Applicant would both install a capture and use system or planter boxes on the site. The detention tank would temporarily store the captured stormwater until the stored volume is entirely used through the irrigation systems. Typical capture and use systems and planter boxes are illustrated in Exhibit 2.

In addition, as described above, as part of the SUSMP for the Project to manage post-construction stormwater runoff, the Project would include the installation of building roof drain downspouts, area drains, and planter drains throughout the Project Site to collect roof and Site runoff and direct stormwater away from buildings through a series of storm drain pipes. This on-site stormwater conveyance system would serve to prevent on-Site flooding and nuisance water on the Project Site.

The Project would not increase concentrations of the items listed as constituents of concern for the Los Angeles River Reach 1.

As discussed above, the Project would likely implement a capture and use system as a BMP for managing stormwater runoff in accordance with current LID requirements. Since it appears there are currently no existing on-Site BMPs, stormwater run-off during post-Project conditions would result in improved surface water quality due to the decreased

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[18] FIRMs depict the 100-year floodplain as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. FIRMs depict the 500-year floodplain as Zone B or Zone X (shaded).

[19] Based on FIRM Number 06037C1964F, effective on 09/26/2008.

impervious area and the stormwater now being captured, treated and used for irrigation rather than directly entering the public stormdrain system without treatment.

Due to the incorporation of the required LID BMP(s), operation of the Project would not result in discharges that would cause: (1) pollution which would alter the quality of the waters of the State (i.e., Los Angeles River Reach 1) to a degree which unreasonably affects beneficial uses of the waters; (2) contamination of the quality of the waters of the State by waste to a degree which creates a hazard to the public health through poisoning or through the spread of diseases; or (3) nuisance that would be injurious to health; affect an entire community or neighborhood, or any considerable number of persons; and occurs during or as a result of the treatment or disposal of wastes.

As is typical of most urban existing uses and proposed developments, stormwater runoff from the Project Site has the potential to introduce pollutants into the stormwater system. Anticipated and potential pollutants generated by the Project are sediment, nutrients, pesticides, metals, pathogens, and oil and grease. Release of such pollutants would be minimized by implementation of LID BMPs.

Furthermore, operation of the Project would not result in discharges that would cause regulatory standards to be violated. The existing Project Site is 100% impervious and consists of existing paved surface parking lots. The Project will decrease the percentage of impervious surface to 69.8%. As stated above, it appears that the existing conditions on the Project Site discharge without any means of treatment. However, the Project would include the installation of LID BMPs, which would mitigate at minimum the first flush or the equivalent of the greater between the 85th percentile storm and first 0.75-inch of rainfall for any storm event. The Project BMPs will control stormwater runoff with no increase in runoff resulting from the Project.

6.2.3. GROUNDWATER HYDROLOGY AND QUALITY

6.2.3.1. GROUNDWATER HYDROLOGY

Regarding groundwater recharge, the Project Site is 100% impervious in the existing conditions, therefore there is no groundwater recharge potential. The Project will develop hardscape, landscape and structures that cover the entire Project Site with mostly impervious surfaces, and therefore the groundwater recharge potential will remain minimal. As stated above, the stormwater which bypasses the BMP systems would discharge to an approved discharge point in the public right-of-way and not result in infiltration of a large amount of rainfall that would affect groundwater hydrology, including the direction of groundwater flow. Therefore, the Project's potential impact on groundwater recharge is less than significant.

As discussed above, it is estimated that the Project development would require excavations to a depth of approximately 46 feet below grade. As described in *Updated Geotechnical Investigation,* by Geocon West, Inc, dated January 31, 2017, the historic high groundwater level in the vicinity of the Project Site was on the order of 25 feet below grade. If

groundwater is encountered during construction, temporary pumps and filtration would be utilized in compliance with the NPDES permit. The temporary system would comply with all relevant NPDES requirements related to construction and discharges from dewatering operations. Furthermore, there are no active wells or spreading grounds within one mile of the Project Site and the Project would not include new injection or supply wells.

6.2.3.2. GROUNDWATER QUALITY

The Project does not include the installation or operation of water wells, or any extraction or recharge system that is in the vicinity of the coast, an area of known groundwater contamination or seawater intrusion, a municipal supply well or spreading ground facility.

Operational activities which could affect groundwater quality include spills of hazardous materials and leaking underground storage tanks. No underground storage tanks are currently operated or will be operated by the Project. In addition, while the Project would introduce more density and land uses to the Project Site which would slightly increase the use of potentially hazardous materials as described above, the Project would comply with all applicable existing regulations regarding the handling and potentially required cleanup of hazardous materials. Therefore, the Project would not affect or expand any potential areas of contamination, increase the level of contamination, or cause regulatory water quality standards at an existing production well to be violated, as defined in the California Code of Regulations, Title 22, Division 4, Chapter 15 and the Safe Drinking Water Act.

Additionally, the Project would both include the installation of a capture and use system or planter boxes as a mean of treatment and disposal of the volume of water produced by the greater of the 85th percentile storm or the 0.75-inch storm event.

6.3. CONCLUSION

In conclusion, the Project will improve the Site's hydrologic function. The Project design will likely include the implementation of either a capture and use system or planter boxes that would comply with the City's LID requirements. Whereas stormwater from the Project Site currently sheet flows without treatment into the underground storm drain network that ultimately discharges to the Los Angeles River Reach 1, the proposed capture and use system will capture the stormwater for irrigation. Furthermore, as evaluated above the surface water hydrology, water quality and groundwater impacts would be less than significant.

APPENDICES

FIGURE 1
Title Survey

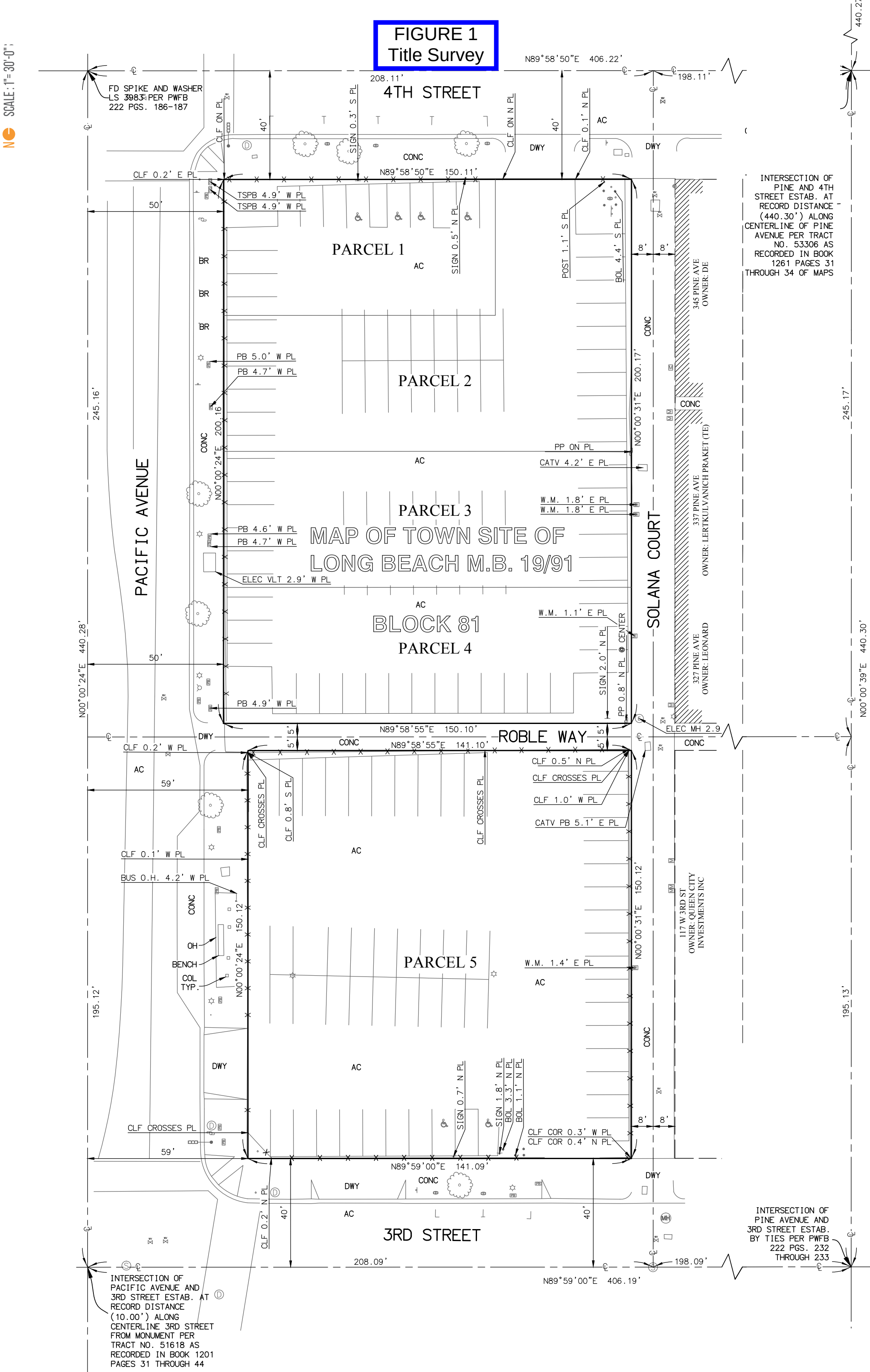


FIGURE 2
Existing Storm Drainage Infrastructure

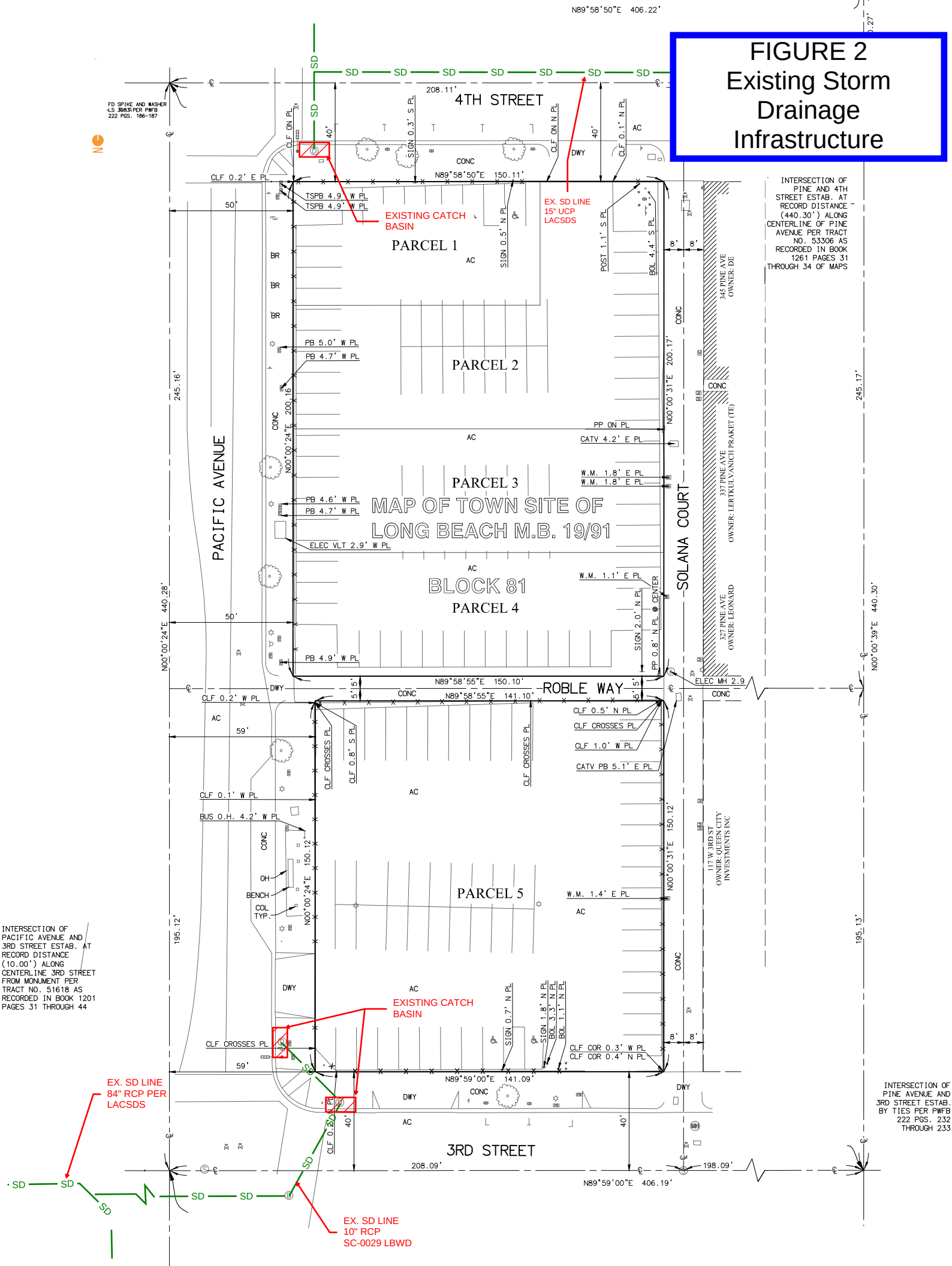
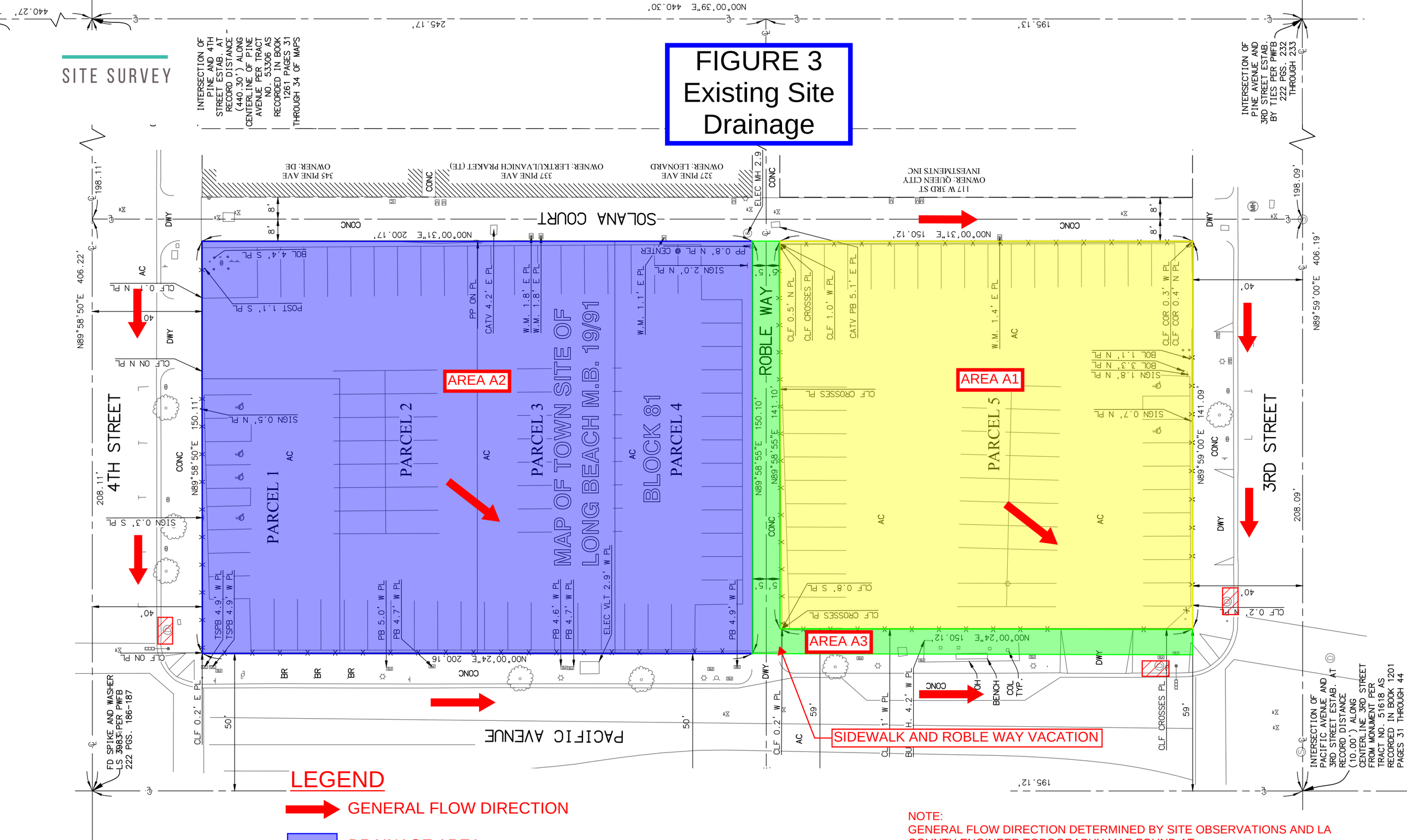


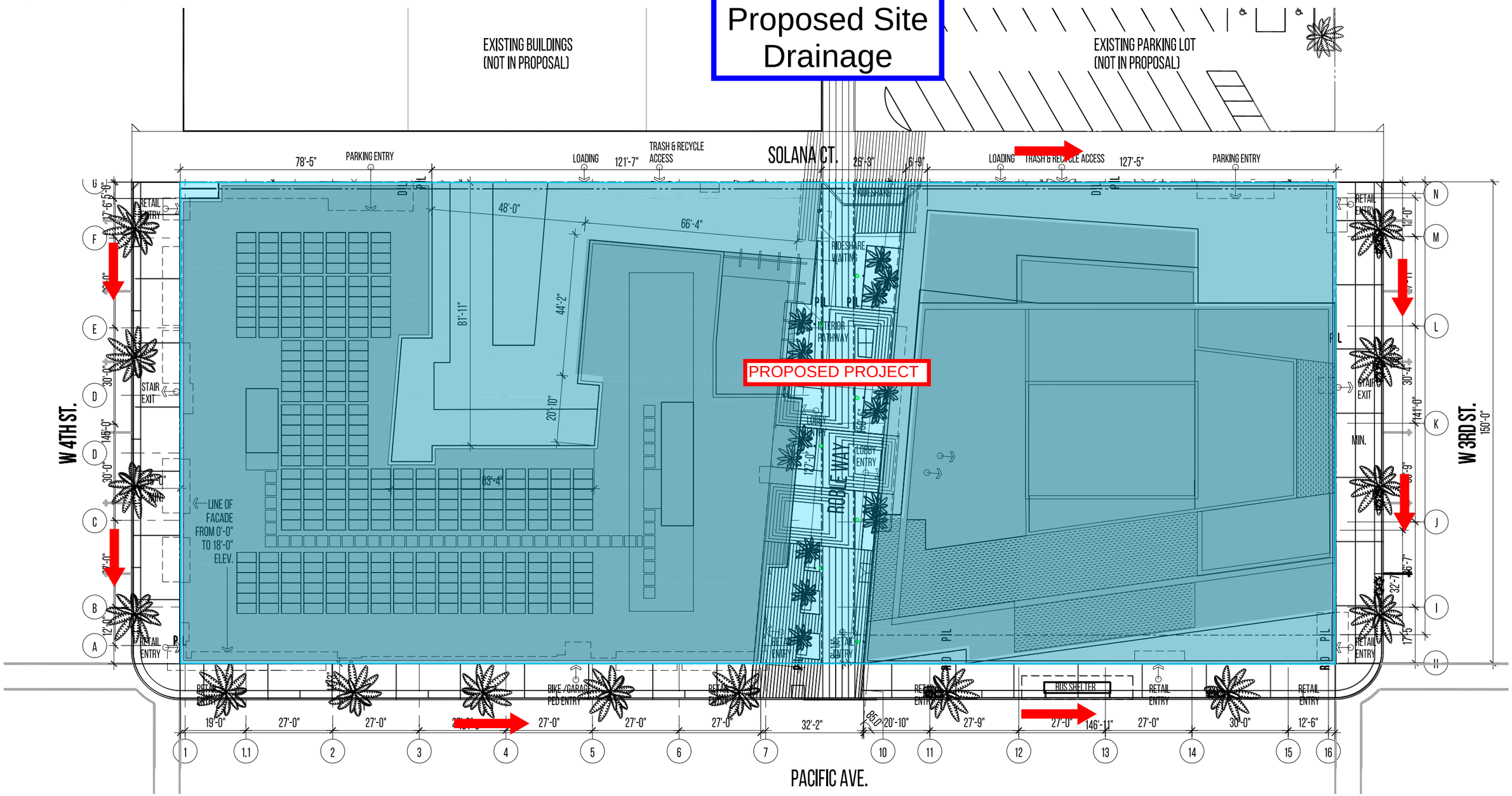
FIGURE 3
Existing Site Drainage



NOTE:
GENERAL FLOW DIRECTION DETERMINED BY SITE OBSERVATIONS AND LA COUNTY ENGINEER TOPOGRAPHY MAP FOUND AT:
http://dpw.lacounty.gov/sur/nas/landrecords/CETopo/QuadSheets/LONGBEACH.pdf

OVERALL SITE PLAN

FIGURE 4 Proposed Site Drainage



LEGEND

GENERAL FLOW DIRECTION

DRAINAGE AREA

SCALE : 1"= 30'-0" N

FIGURE 5
Existing Flow Analysis - A1

Peak Flow Hydrologic Analysis

File location: P:/2018/1800866 3rd and Pacific/ENGR/EIR/Technical Reports/Hydrology and Water Resource Technical Report/Attachments/3rd and Paci
Version: HydroCalc 1.0.2

Input Parameters

Project Name	3rd and Pacific
Subarea ID	Existing Drainage - A1
Area (ac)	0.486
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.3
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.3
Peak Intensity (in/hr)	3.1621
Undeveloped Runoff Coefficient (Cu)	0.7538
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.3831
Burned Peak Flow Rate (cfs)	1.3831
24-Hr Clear Runoff Volume (ac-ft)	0.1916
24-Hr Clear Runoff Volume (cu-ft)	8345.5946

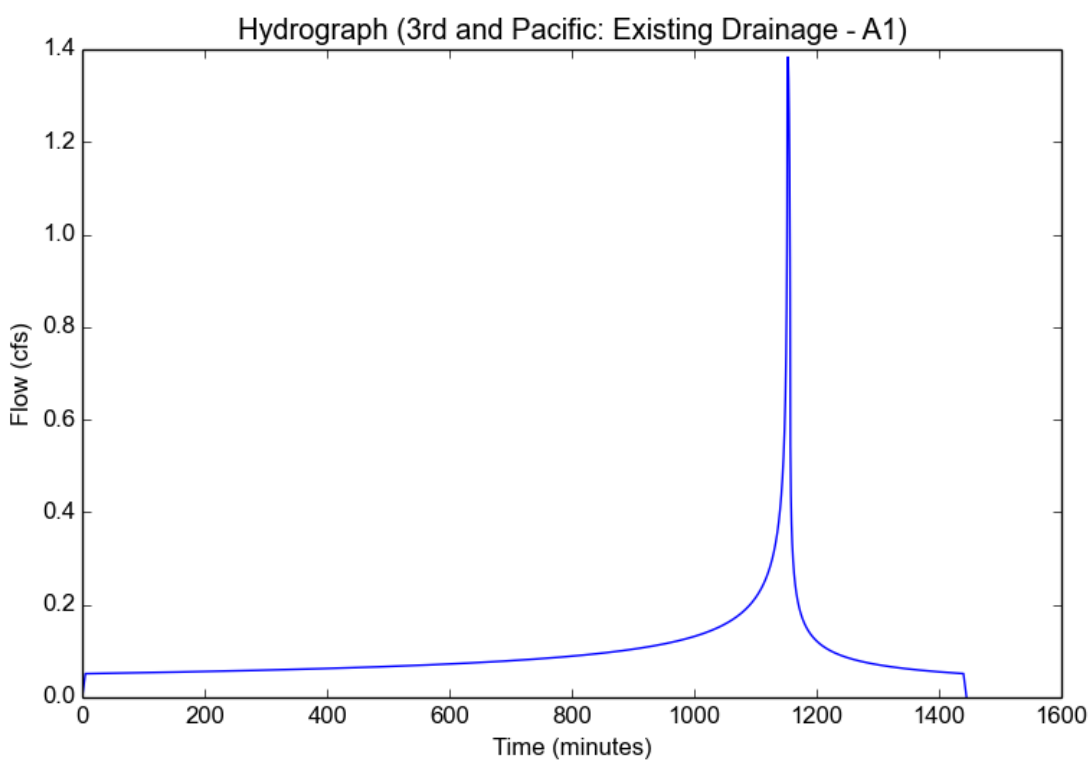


FIGURE 5
Existing Flow Analysis - A2

Peak Flow Hydrologic Analysis

File location: P:/2018/1800866 3rd and Pacific/ENGR/EIR/Technical Reports/Hydrology and Water Resource Technical Report/Attachments/3rd and Paci
Version: HydroCalc 1.0.2

Input Parameters

Project Name	3rd and Pacific
Subarea ID	Existing Drainage - A2
Area (ac)	0.688
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.3
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.3
Peak Intensity (in/hr)	3.1621
Undeveloped Runoff Coefficient (Cu)	0.7538
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.958
Burned Peak Flow Rate (cfs)	1.958
24-Hr Clear Runoff Volume (ac-ft)	0.2712
24-Hr Clear Runoff Volume (cu-ft)	11814.3397

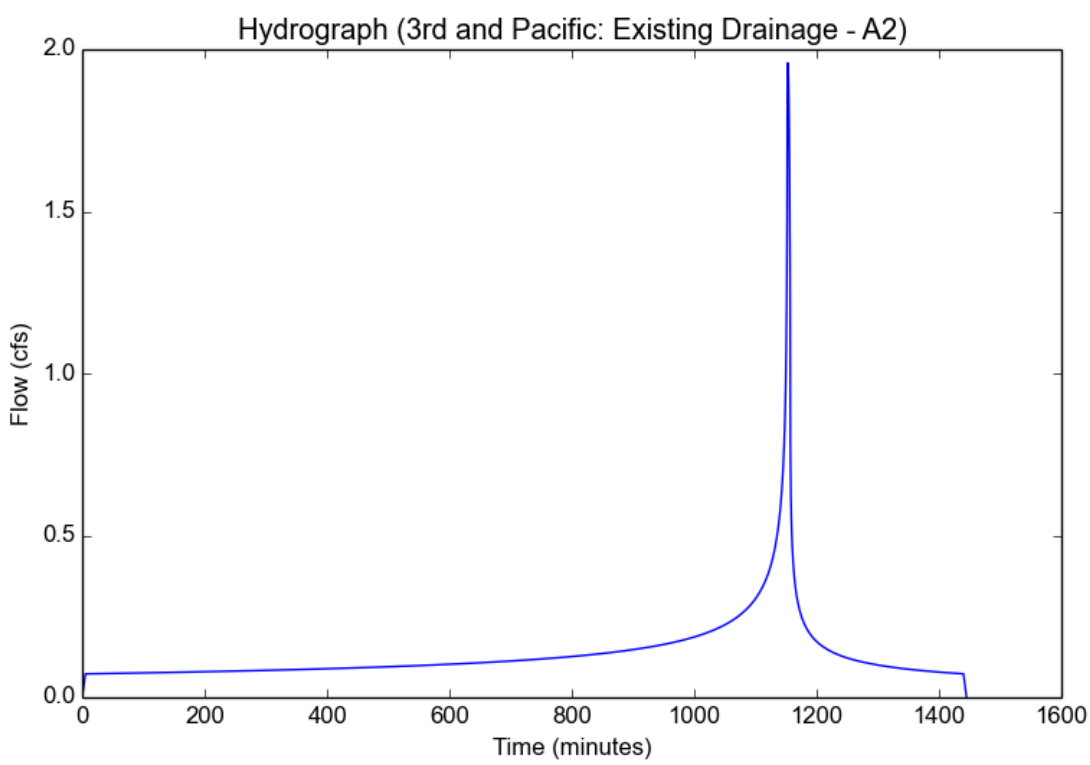


FIGURE 5
Existing Flow Analysis - A3

Peak Flow Hydrologic Analysis

File location: P:/2018/1800866 3rd and Pacific/ENGR/EIR/Technical Reports/Hydrology and Water Resource Technical Report/Attachments/3rd and Paci
Version: HydroCalc 1.0.2

Input Parameters

Project Name	3rd and Pacific
Subarea ID	Existing Drainage - A3
Area (ac)	0.063
Flow Path Length (ft)	100.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.3
Percent Impervious	1.0
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.3
Peak Intensity (in/hr)	3.1621
Undeveloped Runoff Coefficient (Cu)	0.7538
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.1793
Burned Peak Flow Rate (cfs)	0.1793
24-Hr Clear Runoff Volume (ac-ft)	0.0248
24-Hr Clear Runoff Volume (cu-ft)	1081.8363

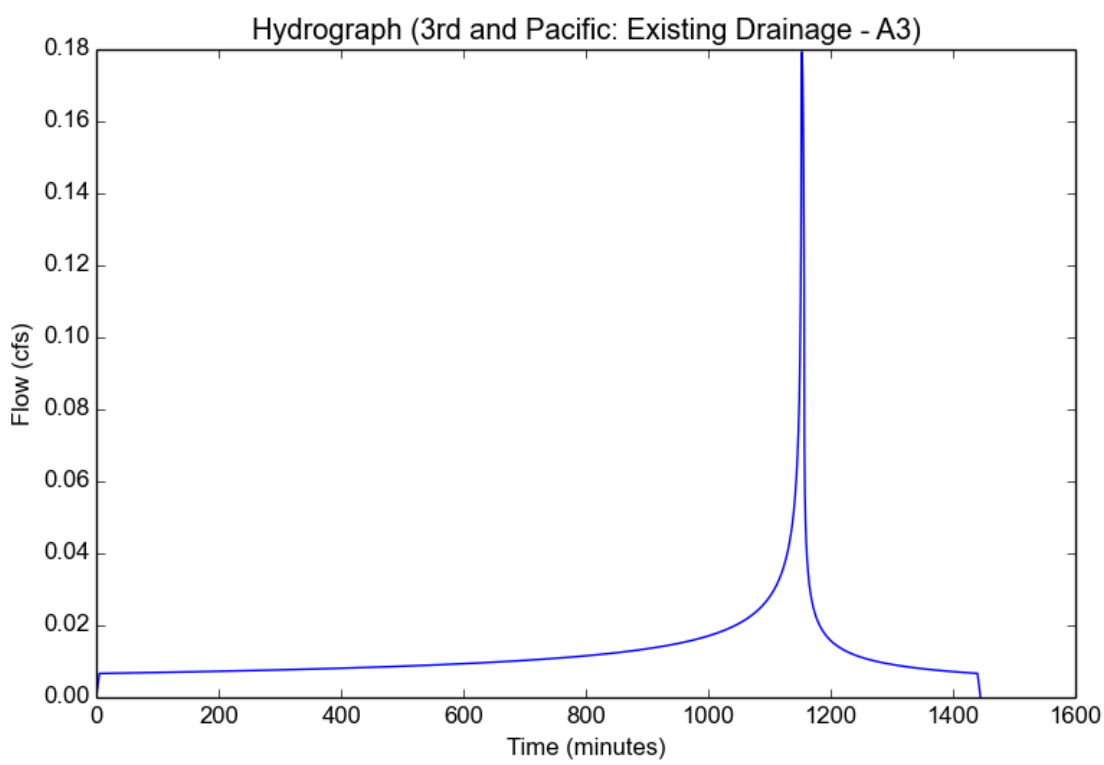


FIGURE 6
Proposed Flow Analysis

Peak Flow Hydrologic Analysis

File location: P:/2018/1800866 3rd and Pacific/ENGR/EIR/Technical Reports/Hydrology and Water Resource Technical Report/Attachments/Figure 6_Pe
Version: HydroCalc 1.0.2

Input Parameters

Project Name	3rd and Pacific
Subarea ID	Proposed Project
Area (ac)	1.237
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.3
Percent Impervious	0.698
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.3
Peak Intensity (in/hr)	3.1621
Undeveloped Runoff Coefficient (Cu)	0.7538
Developed Runoff Coefficient (Cd)	0.8558
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.3477
Burned Peak Flow Rate (cfs)	3.3477
24-Hr Clear Runoff Volume (ac-ft)	0.364
24-Hr Clear Runoff Volume (cu-ft)	15856.735

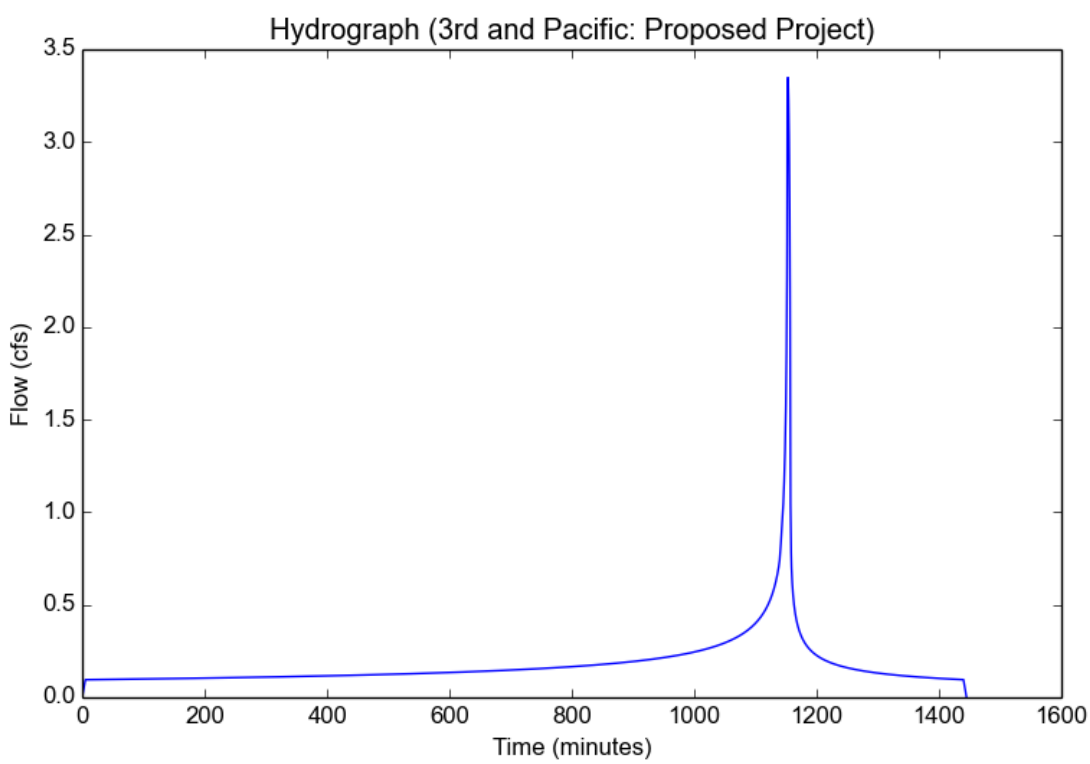


FIGURE 7

Peak Flow Hydrologic Analysis

File location: P:/2018/1800866 3rd and Pacific/ENGR/EIR/Technical Reports/Hydrology and Water Resource Technical Report/Attachments/Figure 7_Est
Version: HydroCalc 1.0.2

Input Parameters

Project Name	3rd and Pacific
Subarea ID	Preliminary LID
Area (ac)	1.237
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.698
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.2332
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.6584
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.19
Burned Peak Flow Rate (cfs)	0.19
24-Hr Clear Runoff Volume (ac-ft)	0.0505
24-Hr Clear Runoff Volume (cu-ft)	2199.0013

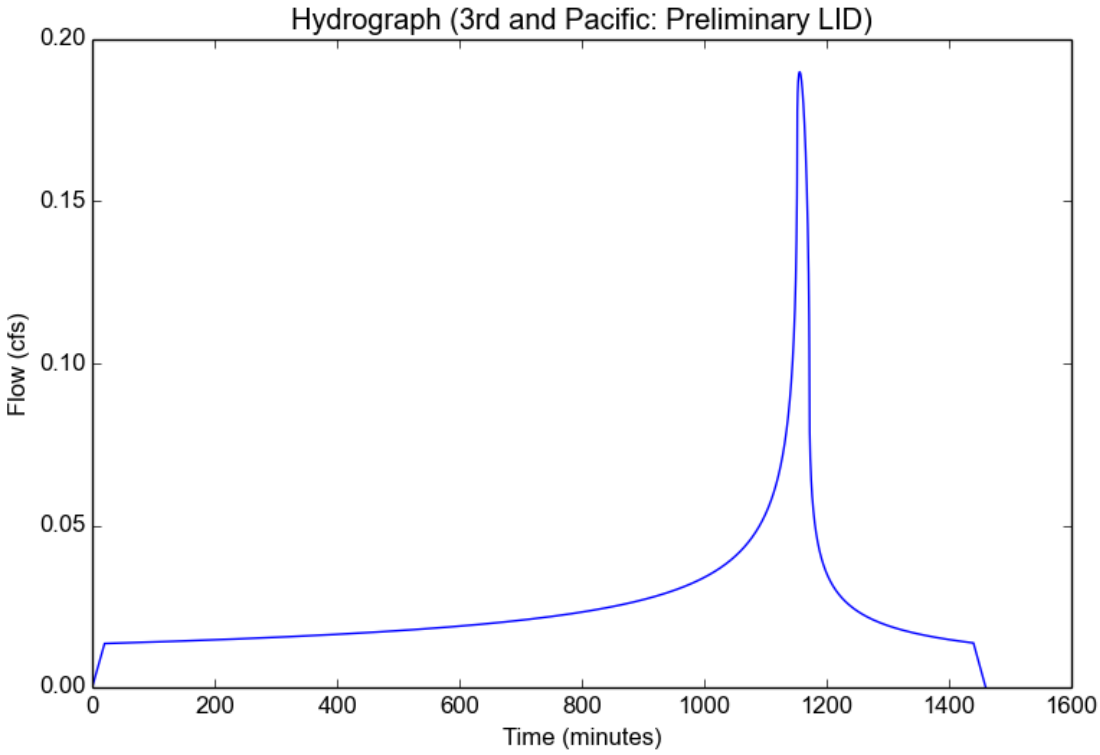
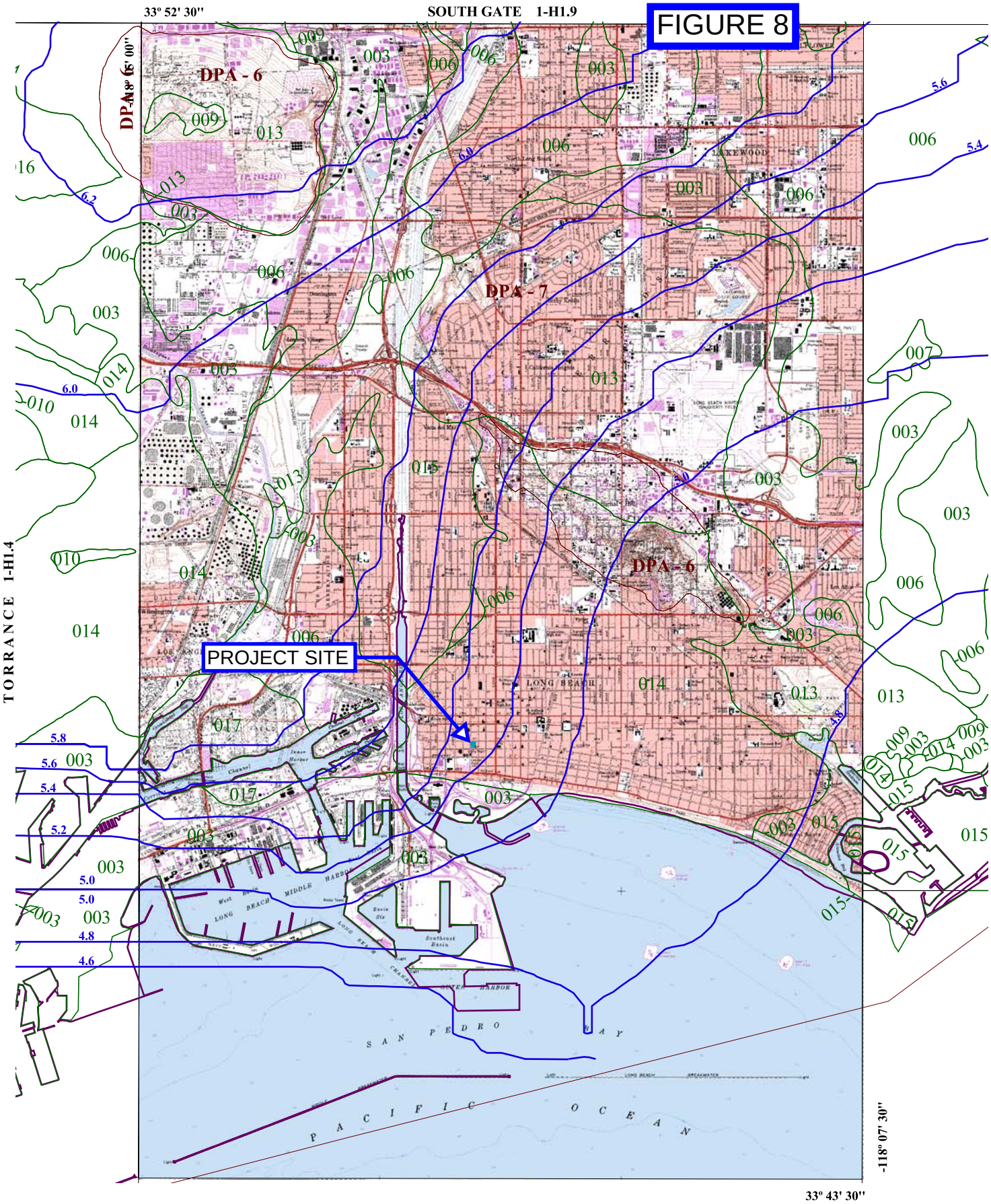


FIGURE 8



N
W E
S

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

LONG BEACH
50-YEAR 24-HOUR ISOHYET

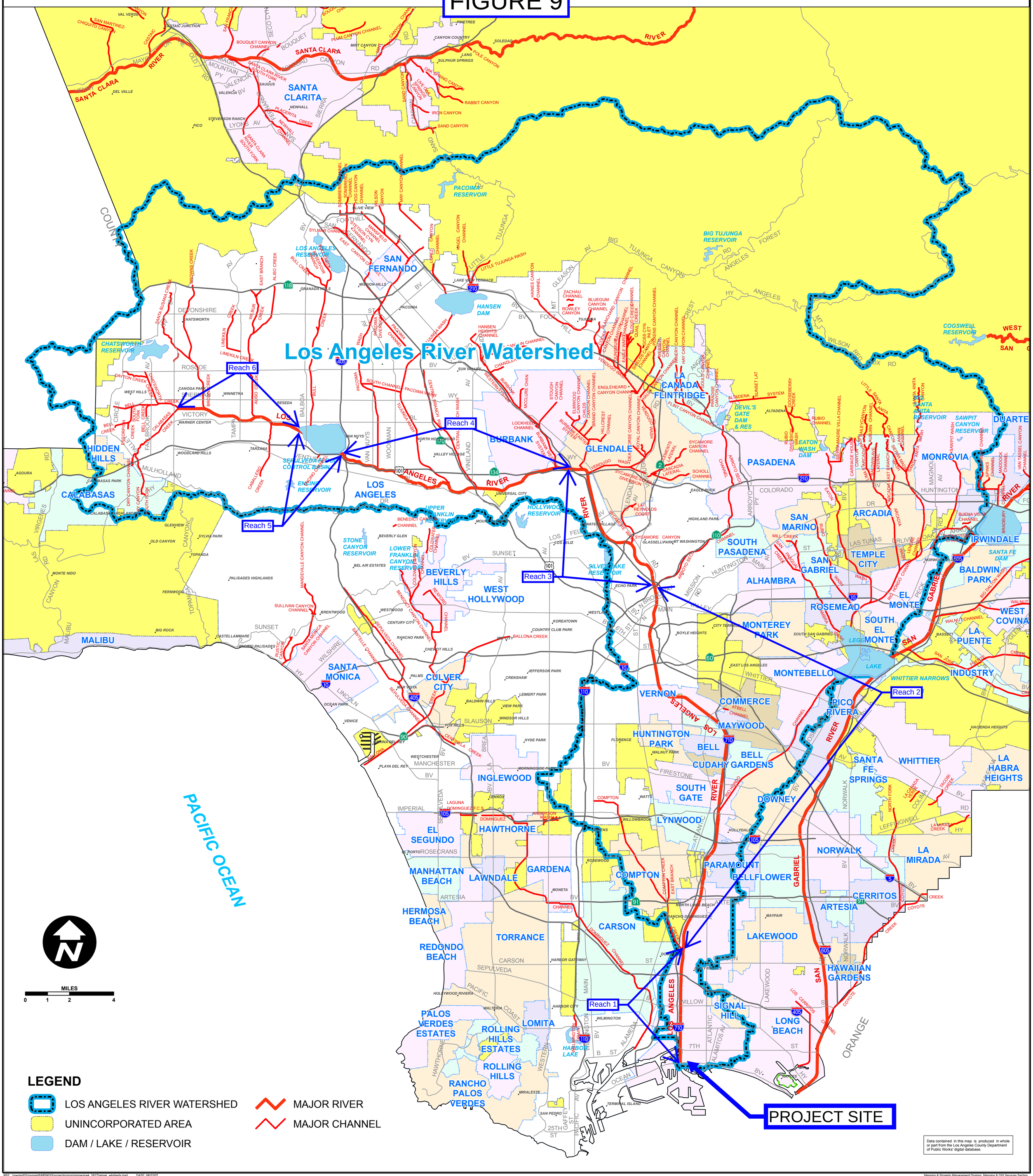
1-H1.5

LOS ANGELES COUNTY PUBLIC WORKS
Public Service That Works

COUNTY OF LOS ANGELES

LOS ANGELES RIVER WATERSHED

FIGURE 9



Data contained in this map is produced in whole or part from the Los Angeles County Department of Public Works' digital database.

REF: \\pwgisd02\mpmgis$\MPMGIS\projects\mpm\gismaps\wk_2627\lariver_wtrsheds.mxd DATE: 08/22/07

Mapping & Property Management Division, Mapping & GIS Services Section

FIGURE 10

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later and from National Geospatial Intelligence Agency imagery produced at a scale of 1:4,000 from photography dated 2003 or later.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

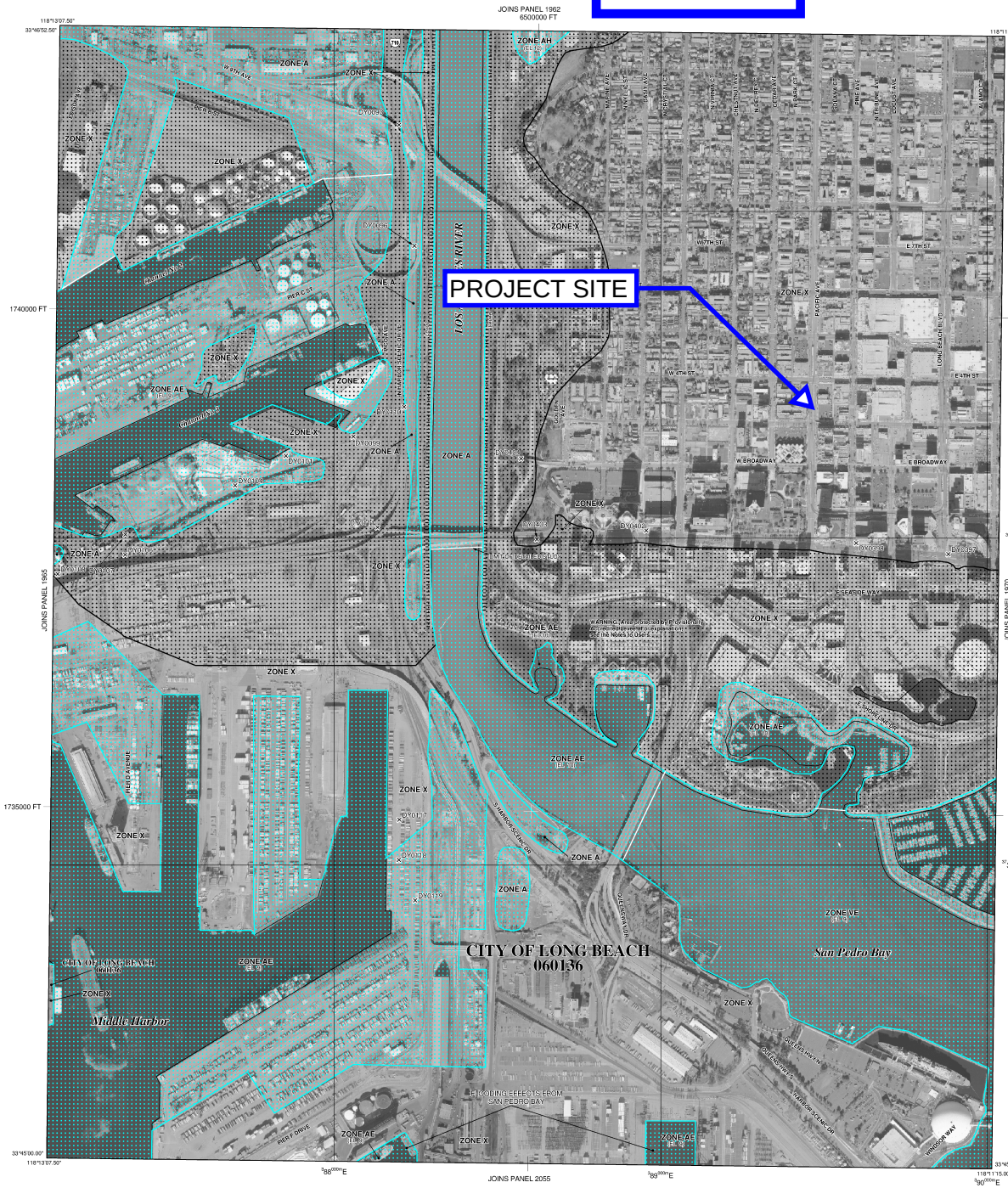
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

WARNING: This levee, dike, or other structure has been provisionally accredited and mapped as providing protection from the 1-percent-annual-chance flood. To maintain accreditation, the levee owner or community is required to submit documentation necessary to comply with 44 CFR Section 65.10 by October 16, 2009. Because of the risk of overtopping or failure of the structure, communities should take proper precautions to protect lives and minimize damages in these areas, such as issuing an evacuation plan and encouraging property owners to purchase flood insurance.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 - - - - - 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid values, zone 11
6000000 FT	5000-foot grid ticks: California State Plane coordinate system, V zone (FIPSZONE 0405), Lambert Conformal Conic
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1964F

FIRM
FLOOD INSURANCE RATE MAP
LOS ANGELES COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1964 OF 2350
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LONG BEACH, CITY OF	060136	1964	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06037C1964F

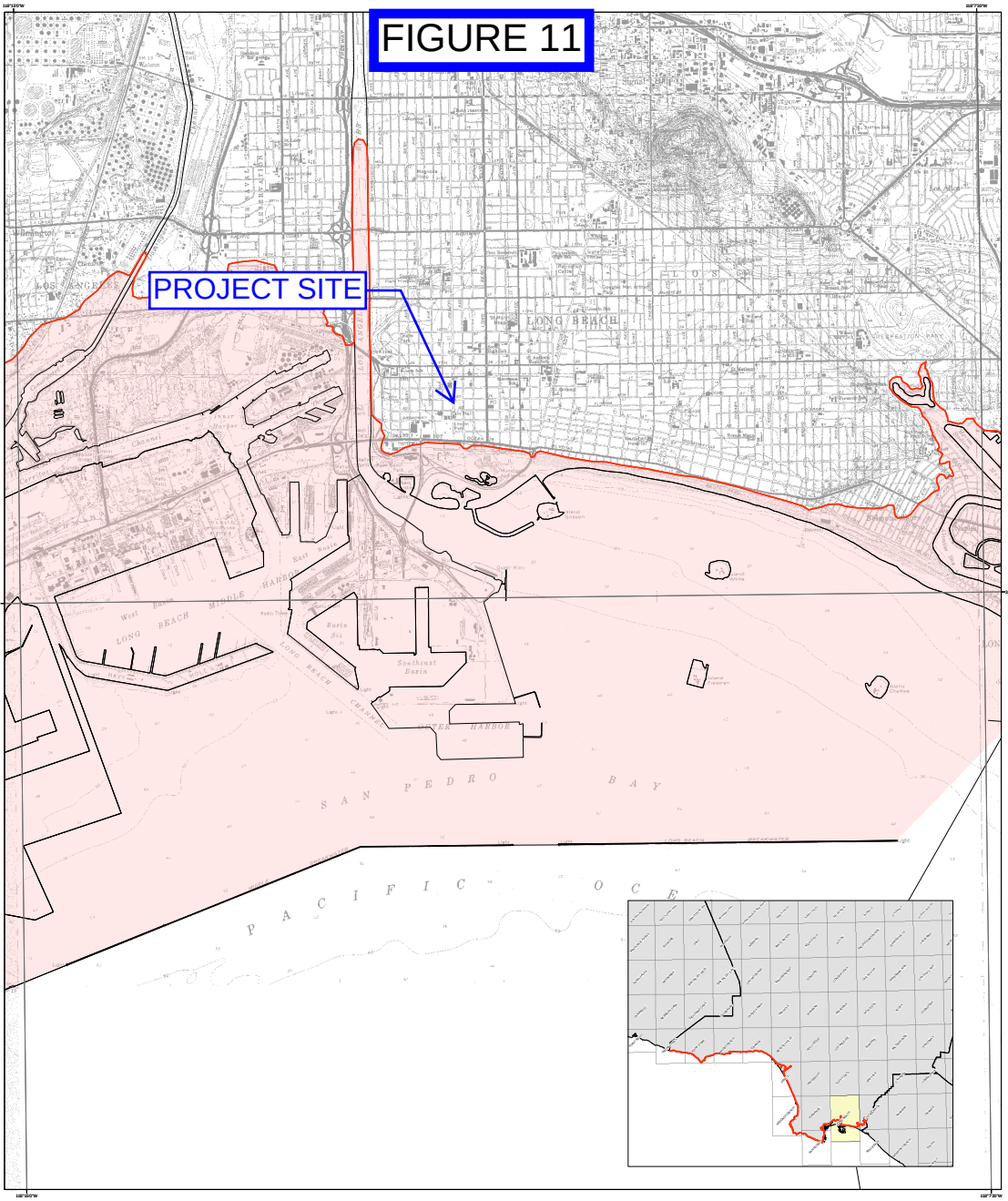
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

California Emergency Management Agency
California Geological Survey
University of Southern California

Tsunami Inundation Map for Emergency Planning
Long Beach Quadrangle

State of California
County of Los Angeles



TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

State of California ~ County of Los Angeles
LONG BEACH QUADRANGLE

March 1, 2009

SCALE 1:24,000

METHOD OF PREPARATION

Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near-shore grids with a 3 arc-second (75- to 90-meters) resolution or higher, were adjusted to "Mean High Water" sea-level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping.

A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides (Table 1). Local tsunami sources that were considered include offshore reverse-thrust faults, restraining bends on strike-slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others which can occur around the Pacific Ocean "Ring of Fire."

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher-resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line (U.S. Geological Survey, 1993; Intermap, 2003; NOAA, 2004). The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historic inundation information (Lander, et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event.

This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region (Table 1). For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event.

References:

Intermap Technologies, Inc., 2003, Intermap product handbook and quick start guide: Intermap NEXTmap document on 5-meter resolution data, 112 p.

Lander, J.F., Lockridge, P.A., and Kozuch, M.J., 1993, Tsunamis Affecting the West Coast of the United States 1806-1992: National Geophysical Data Center Key to Geophysical Record Documentation No. 29, NOAA, NESDIS, NGDC, 242 p.

National Atmospheric and Oceanic Administration (NOAA), 2004, Interferometric Synthetic Aperture Radar (IfSAR) Digital Elevation Models from GeoSAR platform (EarthData): 3-meter resolution data.

Titov, V.V., and Gonzalez, F.I., 1997, Implementation and Testing of the Method of Tsunami Splitting (MOST): NOAA Technical Memorandum ERL PMEL – 112, 11 p.

Titov, V.V., and Synolakis, C.E., 1998, Numerical modeling of tidal wave runup: Journal of Waterways, Port, Coastal and Ocean Engineering, ASCE, 124 (4), pp 157-171.

U.S. Geological Survey, 1993, Digital Elevation Models: National Mapping Program, Technical Instructions, Data Users Guide 5, 48 p.

Table 1: Tsunami sources modeled for the Los Angeles County coastline.

Sources (M = moment magnitude used in modeled event)		Areas of Inundation Map Coverage and Sources Used		
		Malibu	Santa Monica	Los Angeles Harbor
Local Sources	Anacapa-Dume Fault	X	X	
	Catalina Fault	X	X	X
	Channel Island Thrust Fault		X	
	Newport-Inglewood Fault			X
	Santa Monica Fault	X	X	
	Palos Verdes Landslide #1		X	X
	Palos Verdes Landslide #2			X
Distant Sources	Cascadia Subduction Zone #2 (M9.2)		X	X
	Central Aleutians Subduction Zone#1 (M8.9)		X	X
	Central Aleutians Subduction Zone#2 (M8.9)		X	X
	Central Aleutians Subduction Zone#3 (M9.2)	X	X	X
	Chile North Subduction Zone (M9.4)	X	X	X
	1960 Chile Earthquake (M9.3)		X	X
	1964 Alaska Earthquake (M9.2)	X	X	X
	Japan Subduction Zone #2 (M8.8)		X	X
	Kuril Islands Subduction Zone #2 (M8.8)		X	X
	Kuril Islands Subduction Zone #3 (M8.8)		X	X
	Kuril Islands Subduction Zone #4 (M8.8)		X	X

MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

PURPOSE OF THIS MAP

This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions nor for any other regulatory purpose.

The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Tsunamis are rare events; due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.

Please refer to the following websites for additional information on the construction and/or intended use of the tsunami inundation map:

State of California Emergency Management Agency, Earthquake and Tsunami Program: http://www.oes.ca.gov/WebPage/oeswebsite.nsf/Content/B1EC51BA215931768825741F005E8D807?OpenDocument

University of Southern California – Tsunami Research Center: http://www.usc.edu/dept/tsunamis/2005/index.php

State of California Geological Survey Tsunami Information: http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/index.htm

National Oceanic and Atmospheric Agency Center for Tsunami Research (MOST model): http://nctr.pmel.noaa.gov/time/background/models.html

MAP BASE

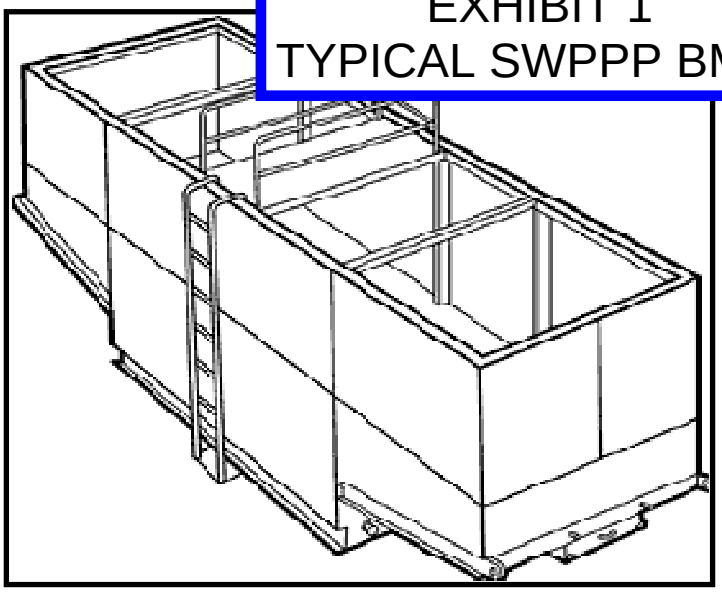
Topographic base maps prepared by U.S. Geological Survey as part of the 7.5-minute Quadrangle Map Series (originally 1:24,000 scale). Tsunami inundation line boundaries may reflect updated digital orthophotographic and topographic data that can differ significantly from contours shown on the base map.

DISCLAIMER

The California Emergency Management Agency (CalEMA), the University of Southern California (USC), and the California Geological Survey (CGS) make no representation or warranties regarding the accuracy of this inundation map nor the data from which the map was derived. Neither the State of California nor USC shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of this map.

Dewatering Operations NS-2

EXHIBIT 1
TYPICAL SWPPP BMPs



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment that, if not properly treated, could lead to exceedences of the General Permit requirements.

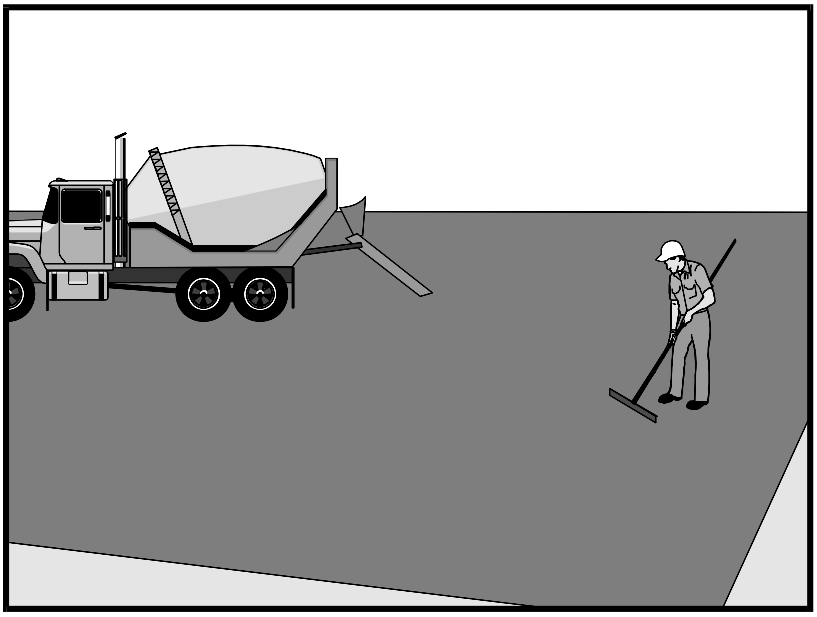
Suitable Applications

These practices are implemented for discharges of non-stormwater from construction sites. Non-stormwaters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area to facilitate construction.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (stormwater) from depressed areas at a construction site.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

Paving and Grinding Operations NS-3



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☒

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for pH and turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

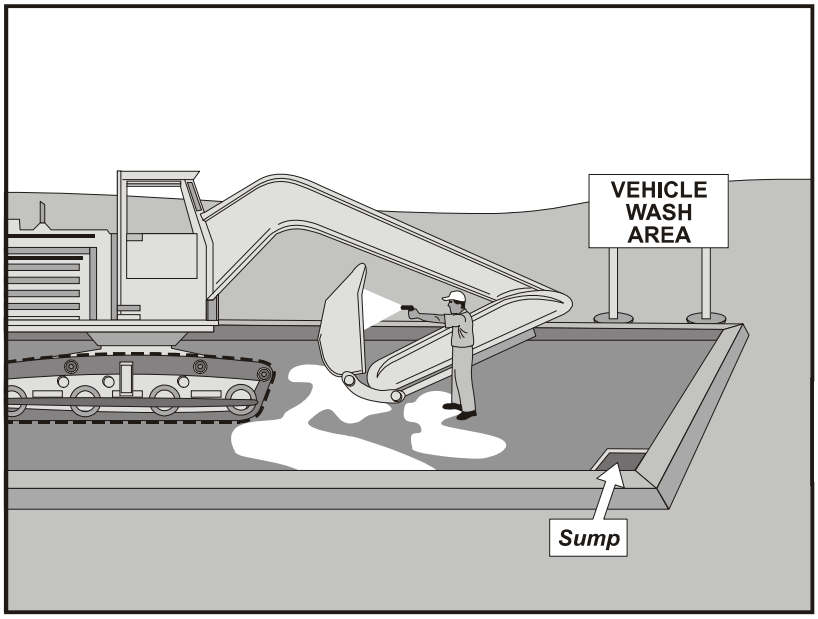
Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Paving opportunities may be limited during wet weather.
- Discharges of freshly paved surfaces may raise pH to environmentally harmful levels and trigger permit violations.

Vehicle and Equipment Cleaning NS-8



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

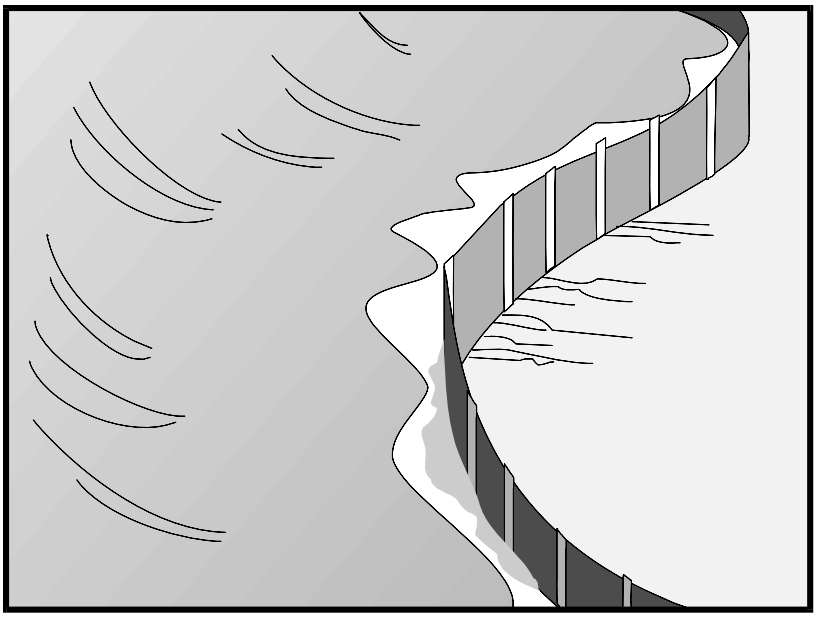
Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

Silt Fence SE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-10 Storm Drain Inlet Protection

SE-14 Biofilter Bags

Description and Purpose

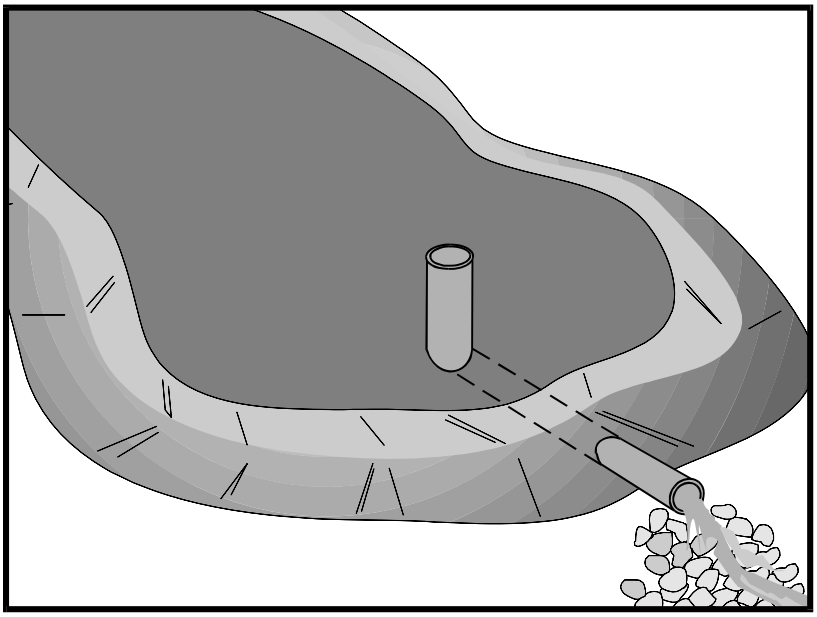
A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (SE-10). Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

Sediment Basin SE-2



Categories		
EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

Description and Purpose

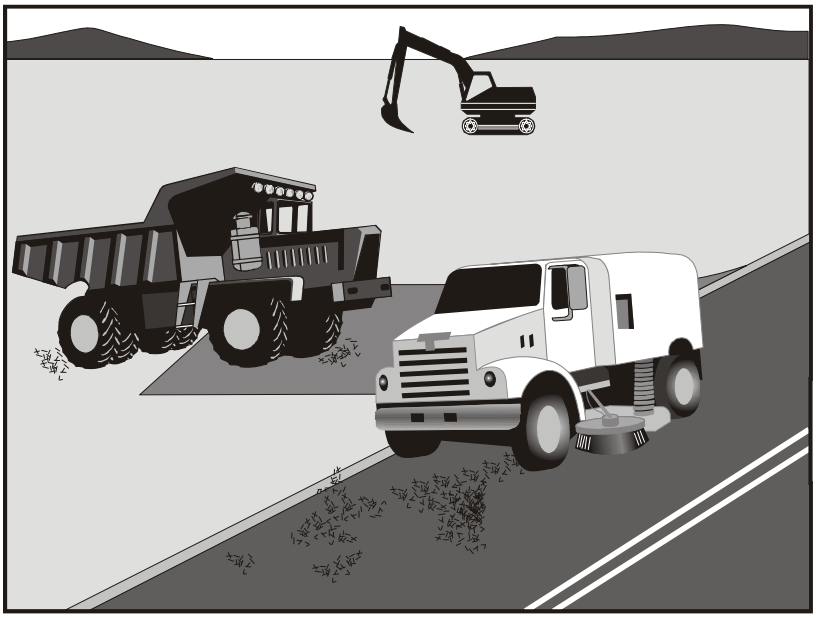
A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site
  and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

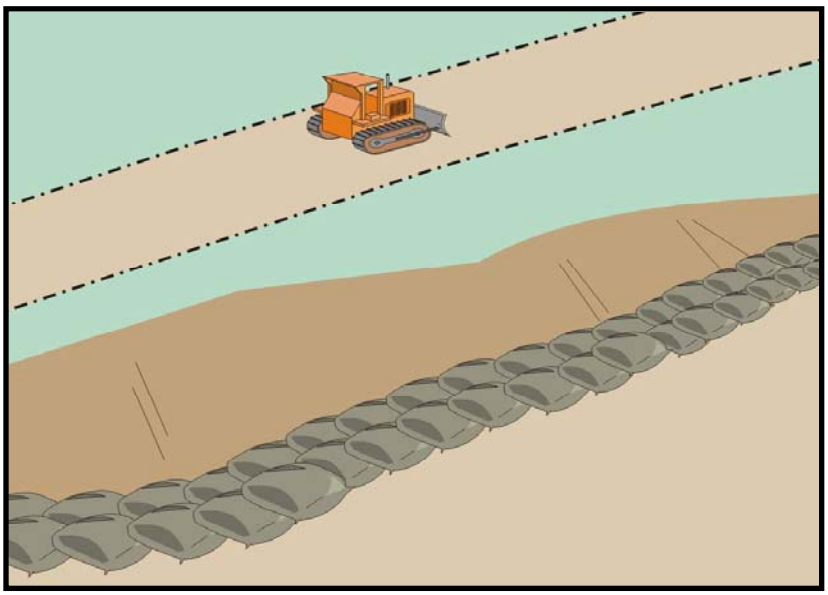
Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

Sandbag Barrier SE-8



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

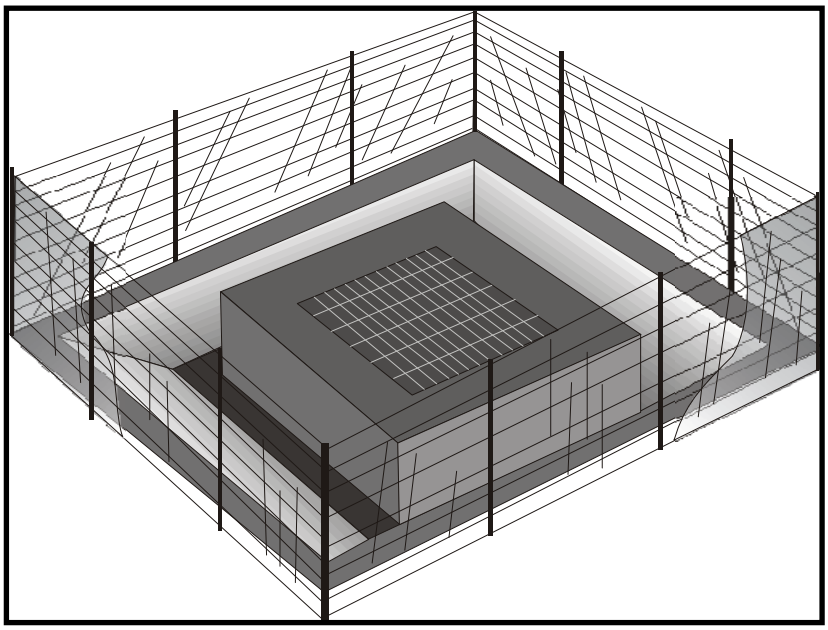
SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-14 Biofilter Bags

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

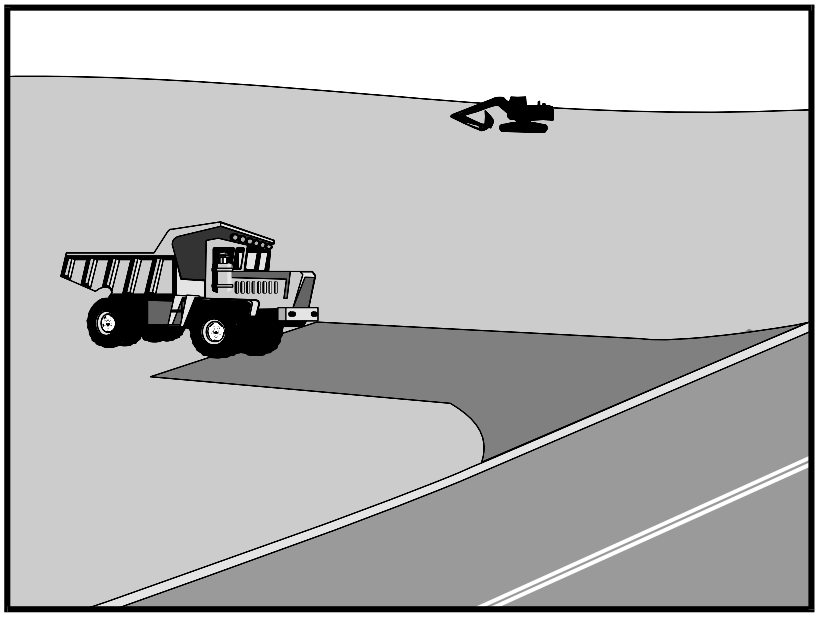
Suitable Applications

Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.

Stabilized Construction Entrance/Exit TC-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

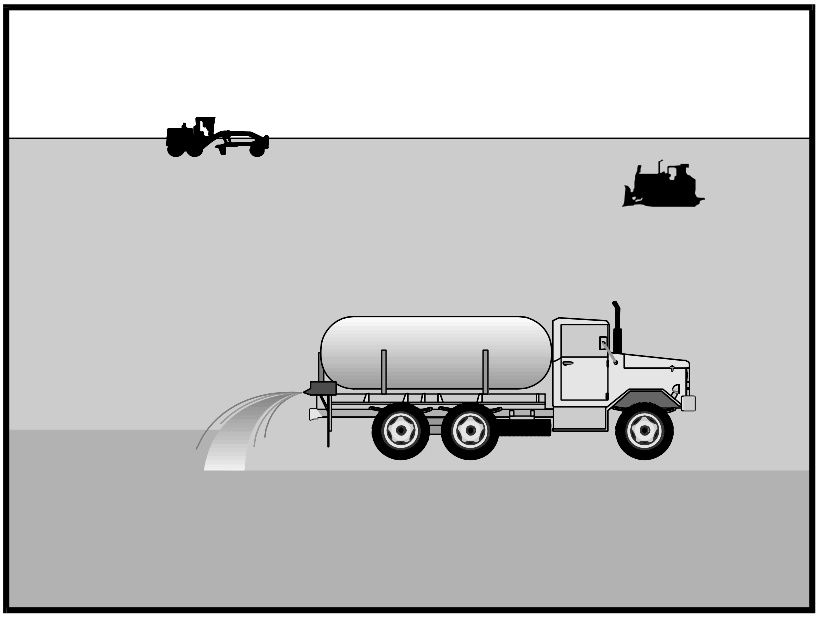
Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water

Wind Erosion Control WE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

Description and Purpose

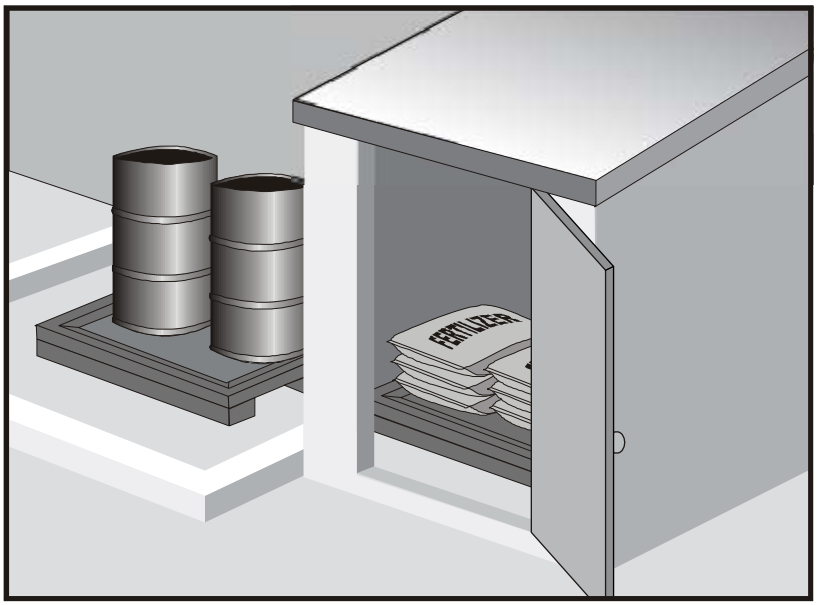
Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

Material Delivery and Storage WM-1



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

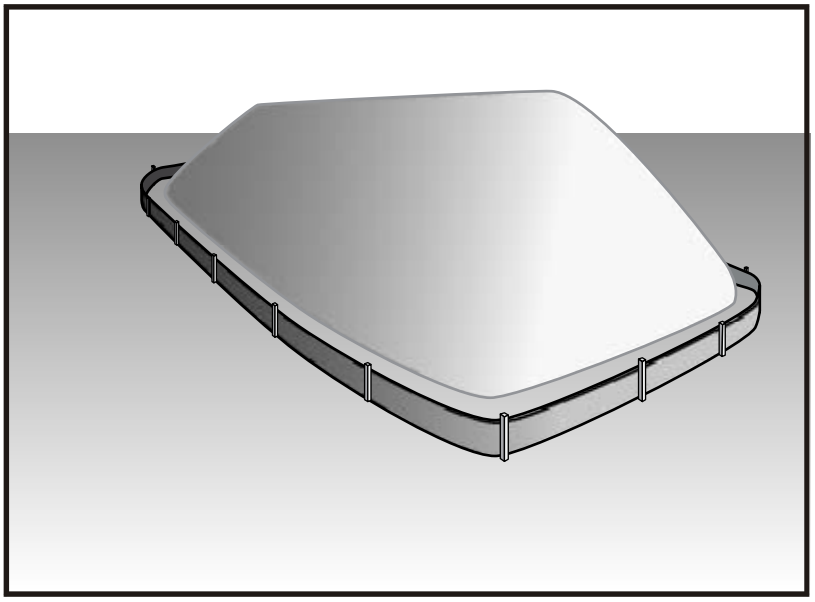
This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Stockpile Management WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

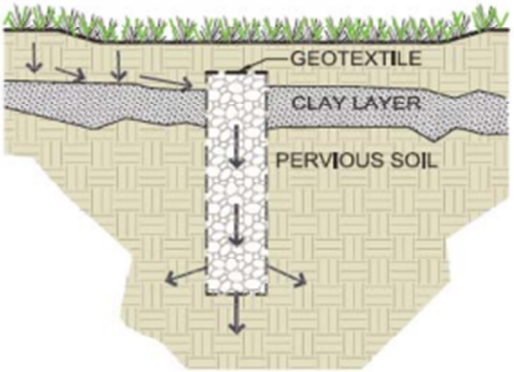
Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

EXHIBIT 2
TYPICAL LID BMPs

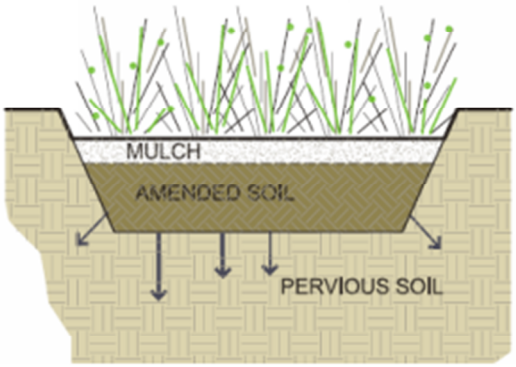
Dry Wells

A dry well is defined as an excavated, bored, drilled, or driven shaft or hole whose depth is greater than its width. Drywells are similar to infiltration trenches in their design and function, as they are designed to temporarily store and infiltrate runoff, primarily from rooftops or other impervious areas with low pollutant loading. A dry well may be either a drilled borehole filled with aggregate or a prefabricated storage chamber or pipe segment.



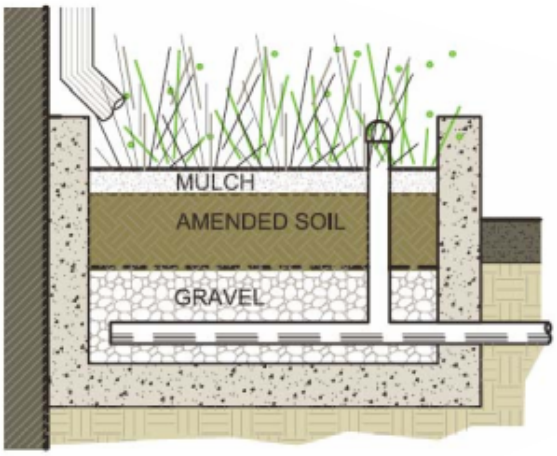
Bioretention

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, plantings, and, optionally, a subsurface gravel reservoir layer.



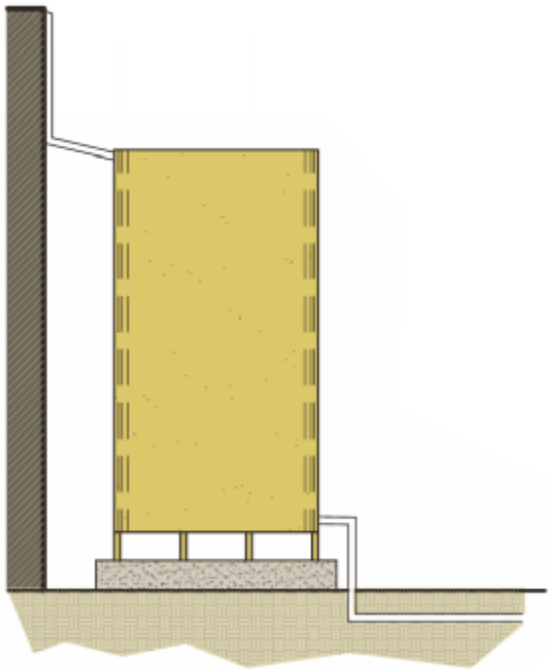
Planter Boxes

Planter boxes are bioretention treatment control measures that are completely contained within an impermeable structure with an underdrain (they do not infiltrate). They are similar to bioretention facilities with underdrains except they are situated at or above ground and are bound by impermeable walls. Planter boxes may be placed adjacent to or near buildings, other structures, or sidewalks.



4.5 CAPTURE AND USE BMPS

Capture and Use refers to a specific type of BMP that operates by capturing stormwater runoff and holding it for efficient use at a later time. On a commercial or industrial scale, capture and use BMPs are typically synonomous with cisterns, which can be implemented both above and below ground. Cisterns are sized to store a specified volume of water with no surface discharge until this volume is exceeded. The primary use of captured runoff is for subsurface drip irrigation purposes. The temporary storage of roof runoff reduces the runoff volume from a property and may reduce the peak runoff velocity for small, frequently occurring storms. In addition, by reducing the amount of stormwater runoff that flows overland into a stormwater conveyance system, less pollutants are transported through the conveyance system into local streams and the ocean. The onsite use of the harvested water for non-potable domestic purposes conserves City-supplied potable water and, where directed to unpaved surfaces, can recharge groundwater in local aquifers.



Cistern Example