# Appendix F

# Preliminary Water Quality Management Plan

# City of Santa Ana

## Priority Project

# Water Quality Management Plan (WQMP)

**Project Name:**

**South Coast Plaza Village**

**Santa Ana, CA 92704**

**1561 WEST SUNFLOWER AVENUE**

**Prepared for:**

**Segerstrom Hines**

**2800 Post Oak Blvd, 49th Floor**

**Houston, Texas 77056**

**(713) 966-2603**

**Prepared by:**

**Tait & Associates, Inc.**

**701 N Parkcenter Drive**

**Santa Ana, CA 92705**

**(714) 560-8200**

**Date Prepared: September 4th, 2024**

| Project Owner's Certification | | | |
|---|---|---|---|
| Planning Application No. (If applicable) | | Grading Permit No. | |
| Tract/Parcel Map and Lot(s) No. | | Building Permit No. | |
| Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers) | | | 1561 WEST SUNFLOWER AVENUE, AP #412-131-10, 412-131-20, 412-131-21, 412-451-01, 412-451-02, 412-451-03, 412-451-04 |

This Water Quality Management Plan (WQMP) has been prepared for Hines by Tait & Associates, Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Representation on the Authority of Parties/Signatories. Each person signing this Agreement represents and warrants that he or she is duly authorized and has legal capacity to execute and deliver this Agreement. Each party represents and warrants to the other that the execution and delivery of the Agreement and the performance of such party's obligations hereunder have been duly authorized and that the Agreement is a valid and legal agreement binding on such party and enforceable in accordance with its terms. This agreement is binding on any successors in interest, designees or transferees. Attach proof of authority to execute this agreement.

| **Owner:** | | | |
|---|---|---|---|
| Title | | | |
| Company | Hines | | |
| Address | 2800 Post Oak Blvd, 49th Floor, Houston, Texas 77056 | | |
| Email | | | |
| Telephone # | (173) 966-2603 | | |
| I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein. | | | |
| Owner Signature | **TO BE SIGNED AT FINAL WQMP** | Date | |

| **Preparer (Engineer):David Sloan, P.E.** | | | |
|---|---|---|---|
| Title | Project Manager | PE Registration # | 82595 |
| Company | Tait & Associates, Inc. | | |
| Address | 701 Park Center Dr. Santa Ana, CA 92705 | | |
| Email | dsloan@tait.com | | |
| Telephone # | (714) 560-8200 | | |
| I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board. | | | |
| Preparer Signature | **TO BE SIGNED AT FINAL WQMP** | Date | |
| Place Stamp Here | | | |

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## Attachments

# Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

| **Project Infomation** | | | |
|---|---|---|---|
| Permit/Application No. (If applicable) | N/A | Grading or Building Permit No. (If applicable) | N/A |
| Address of Project Site (or Tract Map and Lot Number if no address) and APN | 561 WEST SUNFLOWER AVENUE; AP #412-131-10, 412-131-20, 412-131-21, 412-451-01, 412-451-02, 412-451-03, 412-451-04 | | |
| | | | |
| **Water Quality Conditions of Approval or Issuance** | | | |

| | |
|---|---|
| Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.) | **[ WQ01 ] WATER QUALITY MANAGEMENT PLAN**<br><br>Prior to the issuance of any grading or building permits, the applicant shall submit for review and approval by the Manager, Permit Services, a Water Quality Management Plan (WQMP) specifically identifying Best Management Practices (BMPs) that will be used onsite to control predictable pollutant runoff. The applicant shall utilize the Orange County Drainage Area Management Plan (DAMP), Model WQMP, and Technical Guidance Manual for reference, and the County's WQMP template for submittal. This WQMP shall include the following:<br><br>- Detailed site and project description<br>- Potential stormwater pollutants<br>- Post-development drainage characteristics<br>- Low Impact Development (LID) BMP selection and analysis<br>- Structural and Non-Structural source control BMPs<br>- Site design and drainage plan (BMP Exhibit)<br>- GIS coordinates for all LID and Treatment Control BMPs<br>- Operation and Maintenance (O&M) Plan that (1) describes the long-term operation and maintenance requirements for BMPs identified in the BMP Exhibit; (2) identifies the entity that will be responsible for long-term operation and maintenance of the referenced BMPs; and (3) describes the mechanism for funding the long-term operation and maintenance of the referenced BMPs<br><br>The BMP Exhibit from the approved WQMP shall be included as a sheet in all plan sets submitted for plan check and all BMPs shall be depicted on these plans. Grading and building plans must be consistent with the approved BMP exhibit. |

## Conceptual WQMP

| | |
|---|---|
| Was a Conceptual Water Quality Management Plan previously approved for this project? | Yes |

## Watershed-Based Plan Conditions

| | |
|---|---|
| Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS. | Upper Newport Bay – Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Sedimentation/Siltation, Toxicity<br><br>Lower Newport Bay – Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Toxicity |

# Section II Project Description

## II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.*

| **Description of Proposed Project** | | | | |
|---|---|---|---|---|
| Development Category (From Model WQMP, Table 7.11-2; or -3): | Category 8: Significant Redevelopment Project | | | |
| Project Area ($ft^2$): 750,540 sf or 17.25 ac | Number of Dwelling Units: N/A | | SIC Code: 6513 | |
| Project Area | Pervious | | Impervious | |
| | Area (acres or sq ft) | Percentage | Area (acres or sq ft) | Percentage |
| Pre-Project Conditions | 2.93 | 17 | 14.32 | 83 |
| Post-Project Conditions | 2.07 | 12 | 15.18 | 88 |
| Drainage Patterns/Connections | **Existing Drainage Patterns:**<br>Drainage area A is located on the west side of the property. Water sheet flows westerly and then southerly along the gutter on Bear Street. Flow is eventually picked up via an existing catch basin and 42" underground storm drain line system that runs along Bear Street. The water in storm drain pipe then flows easterly along Sunflower Avenue to discharge into Santa Ana Delhi Channel, then Upper & Lower Newport Bay, and eventually into Pacific Ocean. | | | |

Drainage area B is located adjacent and on the east side of Drainage area A. Water sheet flows westerly and then southerly on-site. Flow is collected through an existing on-site grated inlet and 12" underground storm drain line. It is then picked up by the 42" underground storm drain line system that runs along Bear Street, confluencing with the flow from Drainage area A. The water in the 42" storm drain pipe then flows easterly along Sunflower Avenue to discharge into Santa Ana Delhi Channel, then Upper & Lower Newport Bay, and eventually into Pacific Ocean.

Drainage area C is located on the east side of the property. Water sheet flows easterly and then southerly, which is collected through an existing on-site catch basin and 18" underground storm drain line. It is then collected by the 36" underground storm drain line system that runs southerly along Plaza Drive, and then to the storm drain manhole on Sunflower Avenue. The confluence flow of the 36" pipe and 42" pipe is then picked up by the 54" storm drain line. Water then flows easterly along Sunflower Avenue to discharge into Santa Ana Delhi Channel, then Upper & Lower Newport Bay, and eventually into Pacific Ocean.

**Proposed Drainage Patterns:**

Proposed grading and storm drain network will be designed to match existing drainage and flow patterns described above so as to utilize the capacities available in the existing public storm drain system. Based on current hydraulic models, the proposed site will not increase the peak storm water flows from the site and assumes a site with a minimum of 13,000 sf of cumulative building rooftop courtyard areas being planted with full depth pervious soil/material being built on the roofs.

The impervious surface includes walkway areas in the podium area, roads that allow for vehicular traffic, which are anticipated to be paved with asphalt or decorative pavement. Storm water within the Paved areas outside of the podium's footprint will sheet flow to Filterra units that will be sized with the flow-based method. The podium and roof drainage will be collected by a series of roof drains that will be routed to proposed Modular Wetlands Systems (MWS) via storm drain system. The MWS will be sized at a later date per each private development, and units will be sized with the flow-based method. The project will propose discharge locations along S. Plaza Drive, Sunflower Avenue, and S. Bear Street for the treatment flows.

| | |
|---|---|
| Narrative Project Description:<br>(Use as much space as necessary.) | **Community Name:**<br>South Coast Plaza Village<br>**Building Use & Activities Conducted:**<br>Commercial (restaurants, offices, movie theater)<br>**Routinely conducted outdoor activities:**<br>Parking<br>**Existing Site Conditions:**<br>The proposed project site comprised of 17.23-acres, located in the City of Santa Ana, Orange County, California. The site is at the North-East corner Sunflower Avenue and Bear Street with Plaza Drive separating the 2 project areas. Area 1 west of Plaza Drive is 14.04 acres and Area 2 east of Plaza Drive is 3.19 acres. The current land use is Commercial with restaurants, offices, and stores in Area 1 and a movie theater in Area 2.<br>**Proposed Site Conditions:**<br>The proposed project is comprised of 8 blocks of buildings and subterranean parking levels. The project will be mixed use, with commercial spaces or parking garage uses at the ground level and residential apartments or towers above. |

## II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.*

| **Pollutants of Concern** | | | |
|---|---|---|---|
| Pollutant | Check One for each: E=Expected to be of concern N=Not Expected to be of concern | | Additional Information and Comments |
| Suspended-Solid/ Sediment | E ☒ | N ☐ | Consists of soils or other surficial materials that are eroded and then transported or deposited by wind, water, or gravity. Excessive sedimentation can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth. Sediments in runoff also transport other pollutants that adhere to them, including trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and phosphorus. The largest source of suspended solids / sediment is typically erosion from disturbed soils. |
| Nutrients | E ☒ | N ☐ | Includes the macro-nutrients nitrogen and phosphorus. They commonly exist in the form of mineral salts dissolved or suspended in water and as particulate organic matter transported by stormwater. Excessive discharge of nutrients to water bodies and streams can cause eutrophication, including excessive aquatic algae and plant growth, loss of dissolved oxygen, release of toxins in sediment, and significant swings in hydrogen ion concentration (pH). Primary sources of nutrients in urban runoff are fertilizers, trash and |

| | | | |
|---|---|---|---|
| | | | debris, and eroded soils. Urban areas with improperly managed landscapes can be substantial sources. |
| Heavy Metals | E ☒ | N ☐ | Includes certain metals that can be toxic to aquatic life if concentrations become high enough to stress natural processes. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and are also raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Copper and zinc are typically associated with building materials, including galvanized metal and ornamental copper, and automotive products, including tires and brake pads. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns regarding the potential for release of metals to the environment have already led to restricted metal usage in certain applications, for example lead additives in gasoline. The primary source of metals in urban stormwater is typically commercially available metal products and automobiles. |
| Pathogens (Bacteria/Virus) | E ☒ | N ☐ | Includes bacteria and viruses, which are ubiquitous microorganisms that thrive under a range of environmental conditions. Water containing excessive pathogenic bacteria and viruses can create a harmful environment for humans and aquatic life. The source of pathogenic bacteria and viruses is typically the transport of animal or human fecal wastes from the watershed, but pathogenic organisms do occur in the natural environment. |
| Pesticides | E ☒ | N ☐ | Expected as a pollutant of concern due to proposed onsite landscaping. |
| Oil and Grease | E ☒ | N ☐ | Characterized as high-molecular weight organic compounds. Elevated oil and grease content can decrease the aesthetic value of the water body, as |

| | | | |
|---|---|---|---|
| | | | well as the water quality. Introduction of these pollutants to water bodies may occur due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. |
| Toxic Organic Compounds | E ☒ | N ☐ | Includes organic compounds (pesticides, solvents, hydrocarbons) which at toxic concentrations constitute a hazard to humans and aquatic organisms. Stormwater coming into contact with organic compounds can transport excessive levels organics to receiving waters. Dirt, grease, and grime retained in cleaning fluid or rinse water may also absorb levels of organic compounds that are harmful or hazardous to aquatic life. Sources of organic compounds include landscape maintenance areas, vehicle maintenance areas, waste handling areas, and potentially most other urban areas. |
| Trash and Debris | E ☒ | N ☐ | Includes trash, such as paper, plastic, and various waste materials, that can typically be found throughout the urban landscape, and debris which includes waste products of natural origin which are not naturally discharged to water bodies such as landscaping waste, woody debris, etc. The presence of trash and debris may have a significant impact on the recreational value of a water body and upon the health of aquatic habitat. |

## II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.*

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

The project is within the Newport Bay watershed. Downstream drainage facilities from the project are stabilized until reaching a portion of channel in the upper Newport Bay which is unstable earth, therefore downstream streams are potentially susceptible to HCOCs.

The 2-year, 24 hour storm event analysis produces the following results:

Pre-development: Tc = 14.31 min. Volume = 75,076 cf

Post-development: Tc = 13.49 min. Volume = 83,757 cf

The change in time of concentration is 5.7% decrease and the change in volume is 11.6% increase, therefore HCOCs exists for the project. Hydrology calculations for the 2-year, 24-hour storm event are included in the Appendix of this report.

The increase of 8,681 cf of runoff volume is less than the total DCV of 14,519 cf, therefore the DCV is the controlling treatment requirement volume of the project rather than the HCOCs.

HCOCs will be mitigated with the implementation of biotreatment BMPs that result in water not immediately discharged, and by nature increase the time of concentration. Additionally, due to roof runoff starting at the building roof 6 stories above ground, the time of concentration will be reduced as a result of the project.

## II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the Technical Guidance Document (TGD).*

The proposed storm drain system will largely maintain the same drainage pattern(s), and connectivity that exists today. Refer to the WQMP Plot plan attached with this report.

1. Backbone Drainage Areas "1-16" collects the drive aisle, hardscape and landscape runoff outside of the Podium footprints where surface flows will drain to a proposed BMP Filterra Units. After which will flows will continue to the onsite backbone storm drain system which will outlet to a connection point on the adjacent roadways of the site to an existing City of Santa Ana storm drain line.

2. Podium Drainage Area "A-H" collects the hardscape and landscape runoff within the podiums footprints which drains to a proposed BMP via the onsite storm drain system. Flows that enter this BMP will go through a modular wetland system and then pipped to the onsite backbone storm drain system which will outlet to a connection point on the adjacent roadways of the site to an existing City of Santa Ana storm drain line.

Backbone drainage and water quality systems associated with the collective system will be constructed ahead of each residential unit construction. Upon authorization of each building unit, the associated localized drainage and water quality systems will be constructed with each building prior to connecting to the on-site storm drain system.

## II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

Hines is the project owner. Hines will be responsible for the maintenance of all the proposed site stormwater Best Management Practices (BMP) devices to be installed in accordance with this Water Quality Management Plan.

# Section III Site Description

## III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

| | |
|---|---|
| Name of Planned Community/Planning Area (if applicable) | South Coast Plaza Village |
| Location/Address | The site is at the North-East corner Sunflower Avenue and Bear Street |
| | |
| General Plan Land Use Designation | Commercial |
| Zoning | SD48 (Specific Development) |
| Acreage of Project Site | 17.23 |
| Predominant Soil Type | The project site location resides within the hydrology soil group C. |

## III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the Technical Guidance Document (TGD).*

| **Site Characteristics** | |
|---|---|
| Precipitation Zone | The site is located in the 0.75, 85th Percentile Rainfall Zone.<br>See *Attachment C* for map. |
| Topography | The site is relatively flat. |

| | |
|---|---|
| Drainage Patterns/Connections | **Existing Drainage Patterns:**<br>See Section II.1 of this WQMP for existing drainage pattern.<br><br>**Proposed Drainage Patterns:**<br>See Section II.1 of this WQMP for proposed drainage pattern.<br><br>**Existing/Proposed Drainage Connections:**<br>See Section II.1 of this WQMP for proposed drainage pattern. |
| Soil Type, Geology, and Infiltration Properties | The site is located in Soil Group C.<br>See *Attachment C* for map. |
| Hydrogeologic (Groundwater) Conditions | Per geotechnical report, groundwater has been encountered from 10′ to 20′ below existing surface. |
| Geotechnical Conditions (relevant to infiltration) | Since the site soil consists mainly of Soil Group C, infiltration is not feasible. |
| Off-Site Drainage | The existing storm drain on Sunflower Avenue flows east and then south to discharge into Santa Ana Delhi Channel. Santa Ana Delhi Channel runs south adjacent to Bristol Street. Ultimately Santa Ana Delhi Channel discharges to the Upper Newport Bay, Lower Newport Bay, and then to the Pacific Ocean. |
| Utility and Infrastructure Information | Project includes on-site parking lots with underground utilities. On-site infrastructures will have no impact on proposed BMP's. |

## III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the Technical Guidance Document (TGD).*

| | |
|---|---|
| Receiving Waters | -Santa Ana Delhi Channel<br>-Upper Newport Bay<br>-Lower Newport Bay<br>-Pacific Ocean |
| 303(d) Listed Impairments | Upper Newport Bay – Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Sedimentation/Siltation, Toxicity<br>Lower Newport Bay – Chlordane, Copper, DDT, Indicator Bacteria, |

| | |
|---|---|
| | Malathion, Nutrients, PCBs, Toxicity |
| Applicable TMDLs | Santa Ana Delhi Channel/Newport Bay (Copper, Nutrients, Sediments, Toxics, Bacteria, Pathogens, Pesticides, PCBs) |
| Pollutants of Concern for the Project | Suspended-Solid/ Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil and Grease, Toxic Organic Compounds, Trash and Debris |
| Environmentally Sensitive and Special Biological Significant Areas | None |

# Section IV Best Management Practices (BMPs)

## IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. (Please ask your assigned planner or plan checker regarding whether your project is part of an approved WIHMP or equivalent.)
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II-*3.2.2 *of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

| | | |
|---|---|---|
| (NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis? | YES ☐ | NO ☒ |
| If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities. | There are currently no applicable approved WHIMP's within the watershed for this project. | |

| **Project Performance Criteria** | |
|---|---|
| If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP) | According to Section 7.II-2.4.2.2 within the Model WQMP Template (MWQMP), the LID implementation requirement identified in the permit states that:<br><br>For proposed projects within the North County permit area that may have an HCOC, each Priority Project proponent must determine the impact of the proposed development on the downstream hydrologic characteristics. The evaluation of potential impacts is based on the following for a two-year frequency storm event:<br><br>• Increases in runoff volume;<br>• Decreases in infiltration;<br>• Changes in time of concentration;<br>• Potential for increases in post development downstream erosion; and,<br>• Potential for adverse downstream impacts on physical structure, aquatic and riparian habitat.<br><br>A project does not have an HCOC if either of the following conditions is met:<br><br>• The volumes and time of concentration of stormwater runoff for the post development condition do not significantly exceed those of the predevelopment condition for a two-year frequency storm event (a difference of five percent or less is considered insignificant).<br>• The site infiltrates at least the runoff from a two-year storm event. |
| List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP) | Based on the model WQMP Section 7.II-2.4.3, the following performance criteria for LID implementation have been established for the North Orange County permit:<br><br>"priority projects must infiltrate, harvest and reuse, evapotraspire, or biotreat/biofilter the 85tg percentile 24 hour storm event (Design Capture Volume) " |

| | |
|---|---|
| List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP) | For the North orange County Permit area, sizing of treatment control BMPs shall be based on either the unmet volume after claiming applicable water quality credits and as calculated in the Technical Guidance Document based on either volume or flow. |
| Calculate LID design storm capture volume for Project. | LID DCV calculations are provided in Attachment B. |

## IV.2. Site Design and Drainage

Describe site design and drainage including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP "BMP Exhibit."
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs.

*Refer to Section 2.4.2 in the Technical Guidance Document (TGD).*

BMP utilization in Site Design to Maximum Extent Practicable (MEP):

Since infiltration and harvest and reuse are not feasible, the next hierarchy will utilize the biofiltration and bioretention strategy for treating the design capture volume. Due to geotechnical concerns related to clayey layers of soil, infiltration strategies were not proposed. Areas shall incorporate bioretention planters and proprietary biofiltration devices.

Streets, Landscape, Sidewalks, & Building Roof

Per the reasons stated above, infiltration and/ or Harvest and use methods are not considered for these areas of the project site. The streets area lack either adequate space or are infeasible to implement these LID BMP strategies. The proposed bio treatment strategy consists of using a biotreatment planter sized for the design capture volume. The location of the biotreatment basins and proprietary biofiltration devices (Modular Wetlands Units) can be seen on the WQMP Plot Plan included in Attachment D.

## IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.*

### IV.3.1 Hydrologic Source Controls (HSCs)

Hydrologic Source Controls (HSCs) are not required. No HSC's will be proposed for this project. The site BMP will meet the DCV with LID BMP.

| Name | Included? |
|---|---|
| Localized on-lot infiltration | ☐ |
| Impervious area dispersion (e.g. roof top disconnection) | ☐ |
| Street trees (canopy interception) | ☐ |
| Residential rain barrels (not actively managed) | ☐ |
| Green roofs/Brown roofs | ☐ |
| Blue roofs | ☐ |
| Impervious area reduction (e.g. permeable pavers, site design) | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

## IV.3.2 Infiltration BMPs

Underground infiltration **will not be utilized** for this project.

| Name | Included? |
|---|---|
| Bioretention without underdrains | ☐ |
| Rain gardens | ☐ |
| Porous landscaping | ☐ |
| Infiltration planters | ☐ |
| Retention swales | ☐ |
| Infiltration trenches | ☐ |
| Infiltration basins | ☐ |
| Drywells | ☐ |
| Subsurface infiltration galleries | ☐ |
| French drains | ☐ |
| Permeable asphalt | ☐ |
| Permeable concrete | ☐ |
| Permeable concrete pavers | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Infiltration BMPs will not be utilized for this project due to high groundwater and being located within a groundwater protection area. See *Attachment G* for Infiltration Feasibility Worksheet.

Infiltration is not recommended because the site consists of Type C soils, which are not feasible for infiltration.

## IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Rainwater Harvesting **will not be utilized** for this project.

| Name | Included? |
|---|---|
| All HSCs; *See Section IV.3.1* | ☐ |
| Surface-based infiltration BMPs | ☐ |
| Biotreatment BMPs | ☐ |
| Above-ground cisterns and basins | ☐ |
| Underground detention | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with evapotranspiration and/or rainwater harvesting BMPs in combination with infiltration BMPs. If not, document below how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

N/A

## IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

| Name | Included? |
|---|---|
| Bioretention with underdrains | ☐ |
| Stormwater planter boxes with underdrains | ☐ |
| Rain gardens with underdrains | ☐ |
| Constructed wetlands | ☐ |
| Vegetated swales | ☐ |
| Vegetated filter strips | ☐ |
| Proprietary vegetated biotreatment systems | ☒ |
| Wet extended detention basin | ☐ |
| Dry extended detention basins | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. If not, document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

DMAs "1-16" & "A-H" will be treated with propriety biofiltration devices. Please Refer to Attachment 'B' of this report for BMP calculations and Attachment 'D' for location of BMP devices.

As a conservative approach, calculating the DCV for each sub area has been assumed to be 90% impervious.

## IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

| Hydromodification Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| N/A | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## IV.3.6 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP*.

| Regional/Sub-Regional LID BMPs |
|---|
| Reginal/Sub-Regional LID BMPs are not applicable for this project. |

## IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

| Treatment Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| N/A | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## IV.3.8 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

| Non-Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| N1 | Education for Property Owners, Tenants and Occupants | ☒ | ☐ | |
| N2 | Activity Restrictions | ☒ | ☐ | |
| N3 | Common Area Landscape Management | ☒ | ☐ | |
| N4 | BMP Maintenance | ☒ | ☐ | |
| N5 | Title 22 CCR Compliance (How development will comply) | ☐ | ☒ | Project does not produce hazardous waste. |
| N6 | Local Industrial Permit Compliance | ☐ | ☒ | Project is not industrial. |
| N7 | Spill Contingency Plan | ☒ | ☐ | |
| N8 | Underground Storage Tank Compliance | ☐ | ☒ | Project does not propose underground storage tanks. |
| N9 | Hazardous Materials Disclosure Compliance | ☐ | ☒ | Project site does not produce hazardous waste. |
| N10 | Uniform Fire Code Implementation | ☒ | ☐ | |
| N11 | Common Area Litter Control | ☒ | ☐ | |
| N12 | Employee Training | ☒ | ☐ | |
| N13 | Housekeeping of Loading Docks | ☐ | ☒ | No loading docks on property |
| N14 | Common Area Catch Basin Inspection | ☒ | ☐ | |
| N15 | Street Sweeping Private Streets and Parking Lots | ☒ | ☐ | |
| N16 | Retail Gasoline Outlets | ☐ | ☒ | Project site does not have retail gasoline. |

*N1-Education for property Owners, Tenants and occupants*

Education materials will be provided to the tenants by owner/developer and periodically thereafter by the owner/developer to inform tenants of their potential impacts to downstream water quality. Materials include those described in Section VII of this WQMP and provided in Attachment A of this WQMP. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

*N2-Activity Restrictions*

Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&R's), or other equally effective measure. These may include restrictions or guideline for activities such as home repair/painting, landscaping, vehicle washing/repair, proper disposal of residential waste and chemical/fluids.

*N3-Common Area Landscape Management*

Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.

All maintenance must be consistent with the City of Santa Ana requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the documents included in Attachment A.

*N4-BMP Maintenance*

BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

*N7- Spill Contingency Plan*

The building operator shall prepare a Spill Contingency Plan. The plan shall describe how the employees will prepare for and respond to spill of hazardous materials. The plan shall describe the stockpiling of cleanup materials, how to notify the responsible agencies, how to dispose of cleanup materials, the documentation of the spill of hazardous material events.

See Attachment A for additional information on plan preparation:

IC17 Spill Prevention and Cleanup

SC-11 Spill Prevention, Control and Cleanup

*N10- Uniform Fire Code Implementation*

The owner is responsible for complying with the Orange County Fire Department requirements regarding proper management of hazardous materials and emergency response plans. An inventory of hazardous materials should be maintained on-site and an emergency response plans should be established.

*N11-Common area litter control*

The owners will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The owners may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations for investigation.

*N12-Employee Training*

The owner shall prepare a training manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Materials.

*N14-Common area catch basin inspection*

The owners must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). As required by the Technical Guidance Document, at least 80% of the project's private drainage facilities must be inspected, cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year period.

*N15-Street Sweeping Private Streets and Parking Lots*

The owners must sweep outdoor streets regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are streets or driveways/drive isles are to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

## IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

| Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| S1 | Provide storm drain system stenciling and signage | ☒ | ☐ | |
| S2 | Design and construct outdoor material storage areas to reduce pollution introduction | ☐ | ☒ | This project does not propose the outdoor storage of hazardous materials. |
| S3 | Design and construct trash and waste storage areas to reduce pollution introduction | ☒ | ☐ | |
| S4 | Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control | ☒ | ☐ | |
| S5 | Protect slopes and channels and provide energy dissipation | ☐ | ☒ | This project does not contain slopes or channel of significance to require the use of energy dissipation devices. |
| | Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit) | ☐ | ☒ | Not Applicable to this project. |
| S6 | Dock areas | ☐ | ☒ | Not Applicable to this project. |
| S7 | Maintenance bays | ☐ | ☒ | Not Applicable to this project. |
| S8 | Vehicle wash areas | ☐ | ☒ | Not Applicable to this project. |
| S9 | Outdoor processing areas | ☐ | ☒ | Not Applicable to this project. |
| S10 | Equipment wash areas | ☐ | ☒ | Not Applicable to this project. |
| S11 | Fueling areas | ☐ | ☒ | Not Applicable to this project. |
| S12 | Hillside landscaping | ☐ | ☒ | Not Applicable to this project. |
| S13 | Wash water control for food preparation areas | ☐ | ☒ | Not Applicable to this project. |
| S14 | Community car wash racks | ☐ | ☒ | Not Applicable to this project. |

*S1-Provide storm drain system stenciling and signage*

All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the Owner. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

*S3-Design and construct trash and waste storage areas to reduce pollution introduction*

The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

*S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control*

All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

## IV.4 Alternative Compliance Plan (If Applicable)

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the WQMP.*

### IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying water quality credits.*

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td colspan="2">☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td>☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
</table>

| | |
|---|---|
| Calculation of Water Quality Credits<br>(if applicable) | N/A |

### IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the Model WQMP.*

N/A

# Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

| **BMP Inspection/Maintenance** | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| **Non-Structural Source Control BMPs** | | | |
| **N1. Education for Property Owners, Tenants and Occupants** | Owner | The owner shall prepare a training manual along with the Operations and Maintenance Manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new employees. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Materials. Additional education material may be found in the following website : http://www.ocwatershed.com/PublicEd/resources/business-brochures.html | Quarterly. Training shall be provided upon hire and regular intervals thereafter. |
| **N2. Activity Restrictions** | Owner | The property owner shall ensure that the rules and guidelines as determined on the project conditions of approval or other policies are followed at all times once the project is operations. Prohibited activities for the project that promoted water quality includes:<br>• Prohibit discharges of fertilizer, pesticides, or animal wastes to streets or storm drains.<br>• Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into streets or storm drains. Requirement to keep dumpster lids closed at all times.<br>• Prohibit vehicle washing, maintenance, or repair on the premises or restrict those activities to designated | Ongoing |

| | | | |
|---|---|---|---|
| | | areas. | |
| **N3. Common Area Landscape Management** | Owner | Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications. | Weekly |
| **N4. BMP Maintenance** | Owner | All proposed BMP's shall be regularly maintained. | Ongoing |
| **N7. Spill Contingency Plan** | Owner | The owner shall develop a spill contingency plan. Owner shall ensure adequate spill/leak prevention measures are stored on-site and employees are made aware of their location. Owner shall ensure adequate training on spill response procedures, cleanup procedures, and reporting. This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills. Refer to Attachment A SC-11 for additional information on Inspection/Maintenance procedures and activities. | Yearly Training of Employees & Every time handling of hazardous materials is required |
| **N10. Uniform Fire Code Implementation** | Owner | The owner is responsible for complying with the Orange County Fire Department requirements regarding proper management of hazardous materials and emergency response plans. An inventory of hazardous materials should be maintained on-site and an emergency response plans should be established. | Procedures shall be established prior to building occupancy. |
| **N11. Common Area Litter Control** | Owner | The Owner will be required to implement trash management and litter control procedures in the common areas aimed at reducing pllution of drainage water. The Owner may contract with their landscape maintenace firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations to the Owner for investigation. | Ongoing |

| | | | |
|---|---|---|---|
| **N12. Employee Training** | Owner | The owner shall prepare a training manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Materials. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html | Training shall be provided upon hire and regular intervals thereafter. Quarterly. |
| **N14. Common Area Catch Basin Inspection** | Owner | The owner must ensure that the on-site inlet and drain pipe will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). | Monthly<br>-Before and after predicted storm events |
| **N15. Street Sweeping Private Streets and Parking Lots** | Owner | The Owner must sweep outdoor lots regularyly (minimum monthly), or as needed to maintain parking lot surface without trash, debris, or other removable solids, and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are outdoor areas/lots to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer). | Monthly |
| **Structural Source Control BMPs** | | | |
| **S1. Provide Storm Drain System Stenciling and Signage** | Owner | All catch basins/inlets/outlets/parkway drains on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled using an approved stencil to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins & parkway drains is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by | Annually |

| | | | |
|---|---|---|---|
| | | the Owner. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water. | |
| **S3. Design Trash Enclosures to Reduce Pollutant Introduction** | Owner | The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area. | Ongoing |
| **S4. Use Efficient Irrigation Systems and Landscape Design** | Owner | All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.<br>See CASQA Stormwater Handbook BMP Fact Sheet SD-12 for additional information S4. Use Efficient Irrigation Systems and Landscape Design implementation/maintenance activities. | Monthly |
| **Stormcapture Vaults** | Owner | For Inspection and Maintenance Procedures and Implementation – Refer to the Attached Inspection & Maintenance Guide. | Inspection is conducted a minimum of twice per year. |
| **Modular Wetlands Systems** | Owner | For Inspection and Maintenance Procedures and Implementation – Refer to the Attached Inspection & Maintenance Guide. | Inspection is conducted a minimum of twice per year. |
| **Biofiltration Basin** | Owner | Visual Inspection for trash and debris accumulation and dispose of any trash and debris accumulation. Inspect for standing water, and vegetation condition per the specifications included in the manual.<br>In addition to the items listed above, refer to the following pages for Bioretention Operations and Maintenance General Requirements. | Prior and following the rainy season<br>Ongoing |

# Section VI BMP Exhibit (Site Plan)

## VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

## VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

# Section VII Educational Materials

Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

| Education Materials | | | |
|---|---|---|---|
| **Residential Material (http://www.ocwatersheds.com)** | **Check If Applicable** | **Business Material (http://www.ocwatersheds.com)** | **Check If Applicable** |
| The Ocean Begins at Your Front Door | ☒ | Tips for the Automotive Industry | ☐ |
| Tips for Car Wash Fund-raisers | ☐ | Tips for Using Concrete and Mortar | ☒ |
| Tips for the Home Mechanic | ☐ | Tips for the Food Service Industry | ☒ |
| Homeowners Guide for Sustainable Water Use | ☐ | Proper Maintenance Practices for Your Business | ☒ |
| Household Tips | ☐ | **Other Material** | **Check If Attached** |
| Proper Disposal of Household Hazardous Waste | ☒ | | |
| Recycle at Your Local Used Oil Collection Center (North County) | ☒ | Tips for Protecting Your Watershed | ☐ |
| Recycle at Your Local Used Oil Collection Center (Central County) | ☐ | DF-1 Drainage Facility Operation and Maintenance | ☐ |
| Recycle at Your Local Used Oil Collection Center (South County) | ☐ | IC-3 Building Maintenance | ☐ |
| Tips for Maintaining a Septic Tank System | ☐ | IC-6 Erodible Surfaces | ☐ |
| Responsible Pest Control | ☐ | IC-7 Landscape Maintenance | ☐ |
| Sewer Spill | ☒ | IC-15 Parking Lot and Storage Area Maintenance | ☐ |
| Tips for the Home Improvement Projects | ☐ | IC-17 Spill Prevention, Control & Cleanup | ☐ |
| Tips for Horse Care | ☐ | FP-2 Landscape Maintenance | ☐ |
| Tips for Landscaping and Gardening | ☒ | FP-3 Roads, streets, and highways operation and maintenance | ☐ |
| Tips for Pet Care | ☐ | FP-4 Sidewalk, plaza, and fountain maintenance and cleaning | ☐ |
| Tips for Pool Maintenance | ☐ | | ☐ |
| Tips for Residential Pool, Landscape and Hardscape Drains | ☐ | | ☐ |
| Tips for Projects Using Paint | ☐ | | ☐ |

# Attachment A

# Educational Materials

# The Ocean Begins at Your Front Door


*Never allow pollutants to enter the street, gutter or storm drain!*

*Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.*

*Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.*

## Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

## Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

## Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

## The Effect on the Ocean

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

Follow these simple steps to help reduce water pollution:

## Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

## Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

## Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

## Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

## Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

## Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

## Common Pollutants

### *Home Maintenance*

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

### *Lawn and Garden*

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

### *Automobile*

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

# For More Information

**California Environmental Protection Agency**
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

**Earth 911 -** Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

**Health Care Agency's Ocean and Bay Water Closure and Posting Hotline**
(714) 433-6400 or visit www.ocbeachinfo.com

**Integrated Waste Management Dept. of Orange County** (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

**O.C. Agriculture Commissioner**
(714) 447-7100 or visit www.ocagcomm.com

**Stormwater Best Management Practice Handbook**
Visit www.cabmphandbooks.com

**UC Master Gardener Hotline**
(714) 708-1646 or visit www.uccemg.com

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The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

## Orange County Stormwater Program

| | |
|---|---|
| Aliso Viejo | (949) 425-2535 |
| Anaheim Public Works Operations | (714) 765-6860 |
| Brea Engineering | (714) 990-7666 |
| Buena Park Public Works | (714) 562-3655 |
| Costa Mesa Public Services | (714) 754-5323 |
| Cypress Public Works | (714) 229-6740 |
| Dana Point Public Works | (949) 248-3584 |
| Fountain Valley Public Works | (714) 593-4441 |
| Fullerton Engineering Dept. | (714) 738-6853 |
| Garden Grove Public Works | (714) 741-5956 |
| Huntington Beach Public Works | (714) 536-5431 |
| Irvine Public Works | (949) 724-6315 |
| La Habra Public Services | (562) 905-9792 |
| La Palma Public Works | (714) 690-3310 |
| Laguna Beach Water Quality | (949) 497-0378 |
| Laguna Hills Public Services | (949) 707-2650 |
| Laguna Niguel Public Works | (949) 362-4337 |
| Laguna Woods Public Works | (949) 639-0500 |
| Lake Forest Public Works | (949) 461-3480 |
| Los Alamitos Community Dev. | (562) 431-3538 |
| Mission Viejo Public Works | (949) 470-3056 |
| Newport Beach, Code & Water Quality Enforcement | (949) 644-3215 |
| Orange Public Works | (714) 532-6480 |
| Placentia Public Works | (714) 993-8245 |
| Rancho Santa Margarita | (949) 635-1800 |
| San Clemente Environmental Programs | (949) 361-6143 |
| San Juan Capistrano Engineering | (949) 234-4413 |
| Santa Ana Public Works | (714) 647-3380 |
| Seal Beach Engineering | (562) 431-2527 x317 |
| Stanton Public Works | (714) 379-9222 x204 |
| Tustin Public Works/Engineering | (714) 573-3150 |
| Villa Park Engineering | (714) 998-1500 |
| Westminster Public Works/Engineering | (714) 898-3311 x446 |
| Yorba Linda Engineering | (714) 961-7138 |
| Orange County Stormwater Program | (877) 897-7455 |

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

# The Ocean Begins at Your Front Door

# The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

## 1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.

- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

## 2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.

- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

## 3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.

- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

***DID YOU KNOW?***

***Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community***

## 4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.

- **Solution:** Pick up after your pets!

## 5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.

- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

## 6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.

- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

## A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

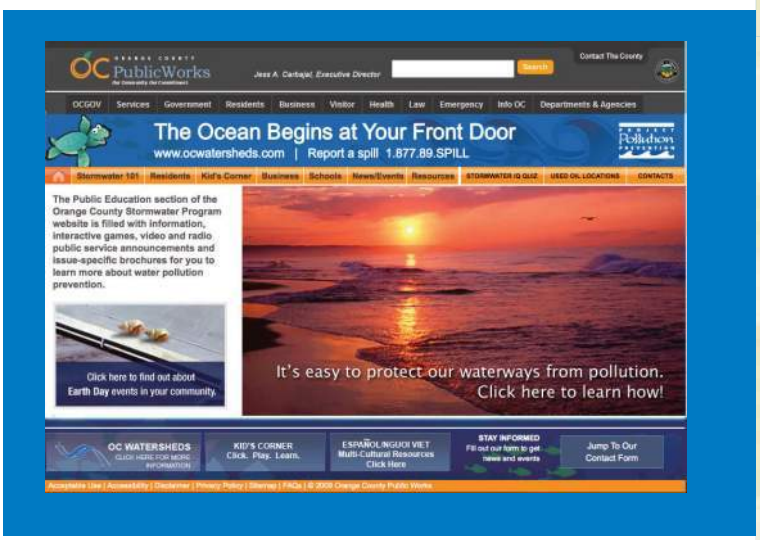
Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

## Thank you for making water protection a priority!

For more information, please visit www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com




To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL \ (1-877-897-7455)

**Special Thanks to**
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos

# RUNOFF, RAINWATER AND REUSE

## Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

## Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

### What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

# OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

## Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

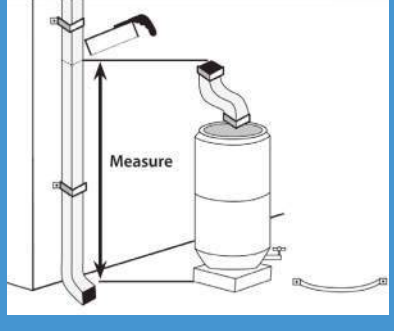
## Rain Barrels

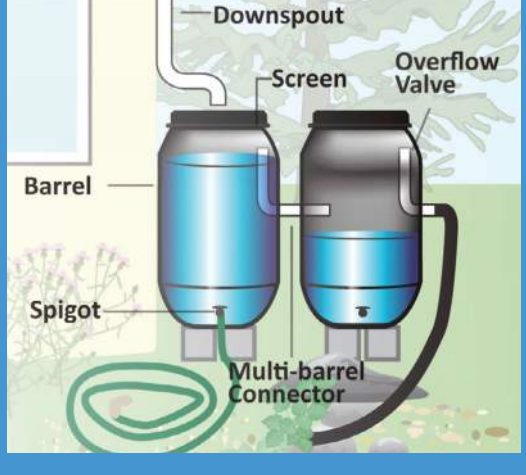
Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.

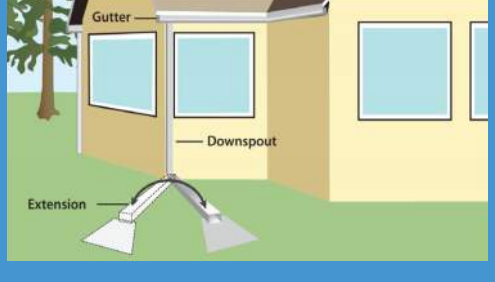
Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.

## Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.




Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.

For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

# OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

### Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

### Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

### Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

# IRRIGATE EFFICIENTLY

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

### Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.**

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
**at 1-877-89-SPILL (1-877-897-7455).**

**For emergencies, dial 911.**

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

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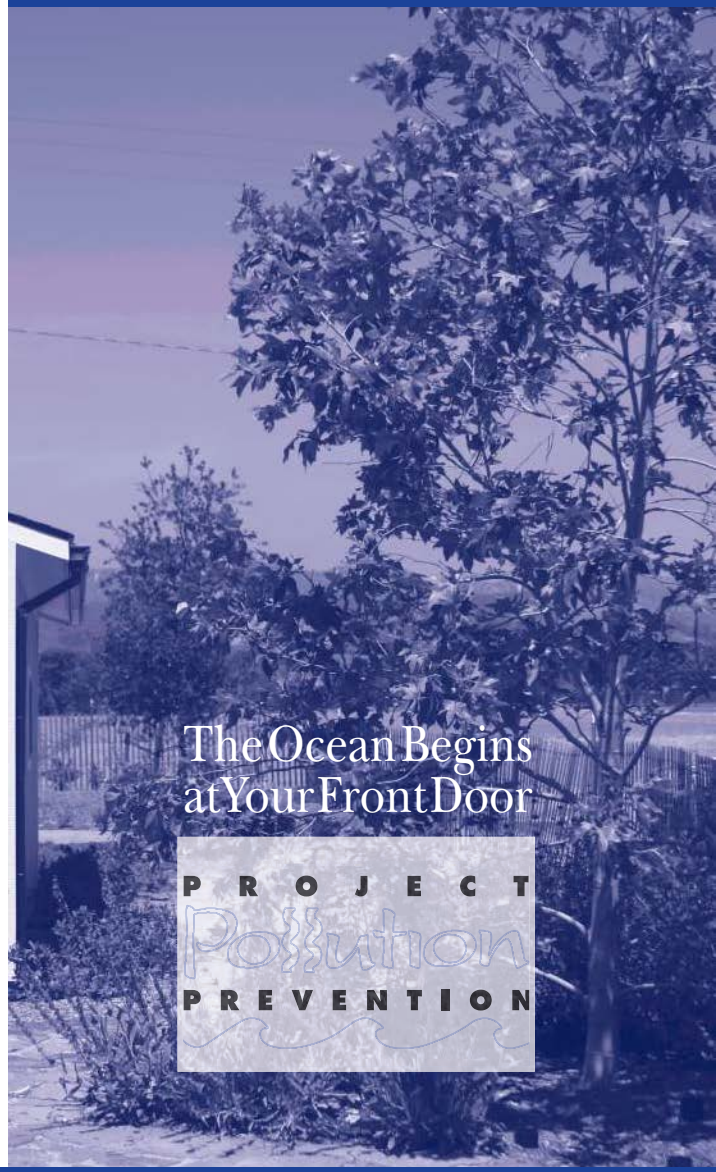
Help Prevent Ocean Pollution:

# Responsible Pest Control



# Tips for Pest Control

## *Key Steps to Follow:*

### *Step 1:* **Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.**

Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

### *Step 2:* **Determine how many pests are present and causing damage.**

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

### *Step 3:* **If a pesticide must be used, choose the least toxic chemical.**

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

### *Step 4:* **Wear appropriate protective clothing.**

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

### *Step 5:* **Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.**

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

### *Step 6:* **In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.**

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

### *Step 7:* **Properly store and dispose of unused pesticides.**

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

**Household Hazardous Waste Collection Center**
**(714) 834-6752**
**www.oclandfills.com**

PROJECT Pollution PREVENTION

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

**UCCE Master Gardener Hotline:**
**(714) 708-1646**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455)**.**

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

# Tips for Landscape & Gardening

# Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

## *General Landscaping Tips*

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

## *Garden & Lawn Maintenance*

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

**Household Hazardous Waste Collection Centers**

| | |
|---|---|
| **Anaheim:** | 1071 N. Blue Gum St. |
| **Huntington Beach:** | 17121 Nichols St. |
| **Irvine:** | 6411 Oak Canyon |
| **San Juan Capistrano:** | 32250 La Pata Ave. |

**For more information, call (714) 834-6752 or visit www.oclandfills.com**

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never dump paint into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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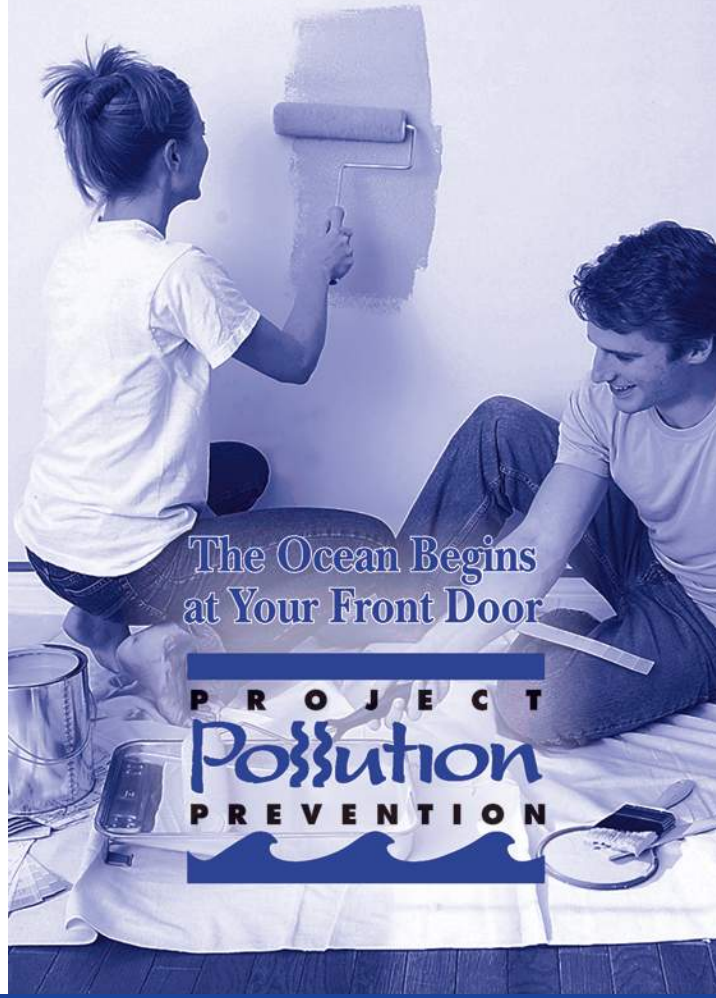
# Help Prevent Ocean Pollution:

# Tips for Projects Using Paint



# Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

## *Purchasing Paint*

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

## *Painting*

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

## *Cleaning*

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

## *Storing Paint*

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

## *Alternatives to Disposal*

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

## *Disposing of Paint*

- Never put wet paint in the trash.

### *For water-based paint:*

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

### *For oil-based paint:*

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

### *Aerosol paint:*

- Dispose of aerosol paint cans at a HHWCC.

## *Spills*

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

**Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com.**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.

# Tips for Using Concrete and Mortar

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

# Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

## *Before the Project*

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

## *During the Project*

- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.

- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.

## *Clean-Up*

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts should be recycled at a local construction and demolition recycling company. (See information below)

- Recycle cement wash water by pumping it back into cement mixers for reuse.

## *Spills*

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

**For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.**

**For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.**

# Building & Grounds Maintenance SC-41

**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

**Targeted Constituents**

| | |
|---|---|
| Sediment | ✓ |
| Nutrients | ✓ |
| Trash | |
| Metals | ✓ |
| Bacteria | ✓ |
| Oil and Grease | |
| Organics | |

## Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

### *Pollution Prevention*

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

### *Suggested Protocols*

*Pressure Washing of Buildings, Rooftops, and Other Large Objects*

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

*Landscaping Activities*

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

*Building Repair, Remodeling, and Construction*

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

*Mowing, Trimming, and Planting*

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

*Fertilizer and Pesticide Management*

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

*Inspection*

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

***Training***

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

***Other Considerations***

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

## Requirements

***Costs***

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

***Maintenance***

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

## Supplemental Information

***Further Detail of the BMP***

*Fire Sprinkler Line Flushing*

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

## References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

# Parking/Storage Area Maintenance SC-43

**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

**Targeted Constituents**

| | |
|---|---|
| Sediment | ✓ |
| Nutrients | |
| Trash | ✓ |
| Metals | ✓ |
| Bacteria | |
| Oil and Grease | ✓ |
| Organics | ✓ |

## Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

## Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

### *Pollution Prevention*

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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# SC-43 Parking/Storage Area Maintenance

***Suggested Protocols***

*General*

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

*Controlling Litter*

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

*Surface Cleaning*

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

*Surface Repair*

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

*Inspection*

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

***Training***

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

***Other Considerations***

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

# SC-43 Parking/Storage Area Maintenance

## Requirements

### *Costs*

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

### *Maintenance*

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

## Supplemental Information

### *Further Detail of the BMP*

*Surface Repair*

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

## References and Resources


California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

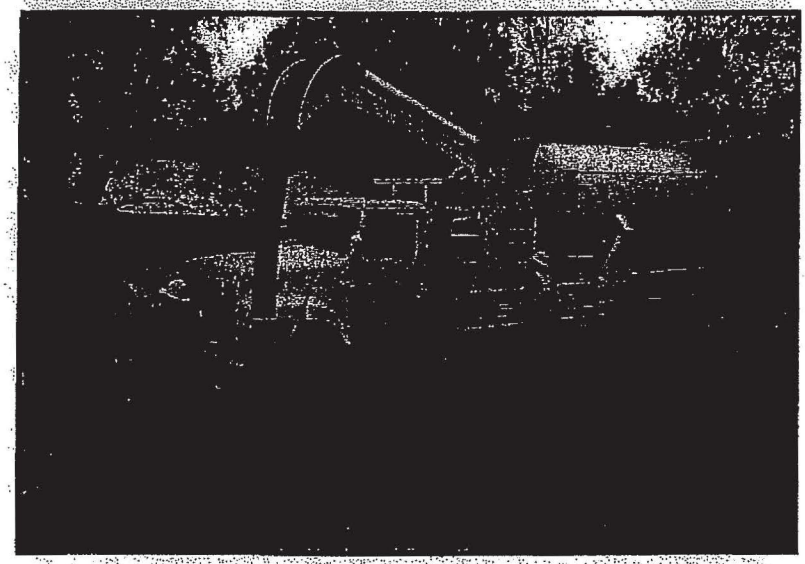
Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

# Drainage System Maintenance SC-44



**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize

## Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

**Targeted Constituents**

| | |
|---|---|
| Sediment | ✓ |
| Nutrients | |
| Trash | ✓ |
| Metals | |
| Bacteria | ✓ |
| Oil and Grease | |
| Organics | |

## Approach

### *Pollution Prevention*

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

### *Suggested Protocols*

*Catch Basins/Inlet Structures*

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

*Storm Drain Conveyance System*

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

*Pump Stations*

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

*Open Channel*

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

*Illicit Connections and Discharges*

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

*Illegal Dumping*

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

***Training***

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

***Spill Response and Prevention***

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

***Other Considerations (Limitations and Regulations)***

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

## Requirements

***Costs***

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

***Maintenance***

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

## Supplemental Information

***Further Detail of the BMP***

*Storm Drain Flushing*

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

## References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

# Housekeeping Practices SC-60

## Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Approach

### *Pollution Prevention*

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

### *Suggested Protocols*

*General*

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

## Targeted Constituents

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

***Training***

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

***Other Considerations***

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

## Requirements

### *Costs*

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

### *Maintenance*

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

## Supplemental Information

### *Further Detail of the BMP*

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

### *Examples*

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

## References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

# Plaza and Sidewalk Cleaning SC-71

**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

**Targeted Constituents**

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

## Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

## Approach

### *Pollution Prevention*

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

### *Suggested Protocols*

*Surface Cleaning*

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

*Graffiti Removal*

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

*Surface Removal and Repair*

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

*Concrete Installation and Repair*

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

*Controlling Litter*

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

***Training***

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

### *Other Considerations*

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

## Requirements

### *Costs*

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

### *Maintenance*

Not applicable

## Supplemental Information

### *Further Detail of the BMP*

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

## References and Resources

Bay Area Stormwater Management Agencies Association (BASMAA). 1996. Pollution From Surface Cleaning Folder http://www.basmaa.org

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

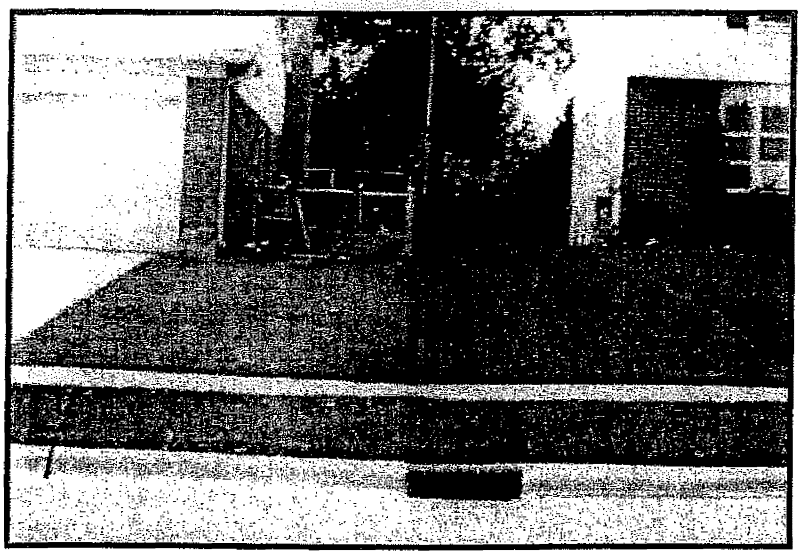
Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November.

# Efficient Irrigation SD-12



**Design Objectives**

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

## Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

## Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

## Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

## Design Considerations

### *Designing New Installations*

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

***Redeveloping Existing Installations***

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

## Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

# Trash Storage Areas SD-32

## Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

## Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

**Design Objectives**

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

## Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

## Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

### *Designing New Installations*

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

### *Redeveloping Existing Installations*

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

## Additional Information

### *Maintenance Considerations*

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

## Other Resources

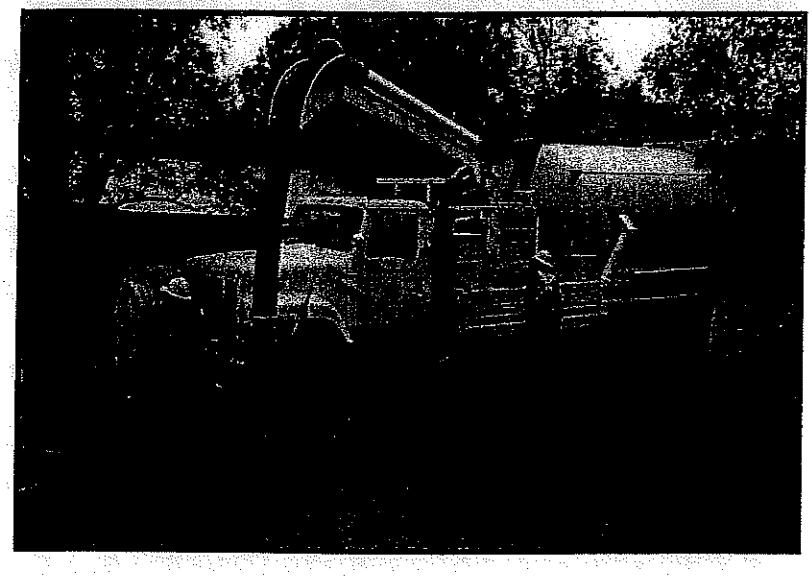
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

# Drainage System Maintenance SC-44



**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize

## Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

**Targeted Constituents**

| | |
|---|---|
| Sediment | ✓ |
| Nutrients | |
| Trash | ✓ |
| Metals | |
| Bacteria | ✓ |
| Oil and Grease | |
| Organics | |

## Approach

### *Pollution Prevention*

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

### *Suggested Protocols*

*Catch Basins/Inlet Structures*

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

CASQA California Stormwater Quality Association

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

*Storm Drain Conveyance System*

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

*Pump Stations*

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

*Open Channel*

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

*Illicit Connections and Discharges*

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

*Illegal Dumping*

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

***Training***

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

***Spill Response and Prevention***

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

***Other Considerations (Limitations and Regulations)***

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

## Requirements

***Costs***

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

***Maintenance***

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

## Supplemental Information

***Further Detail of the BMP***

*Storm Drain Flushing*

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

## References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

# Attachment B

# Calculations

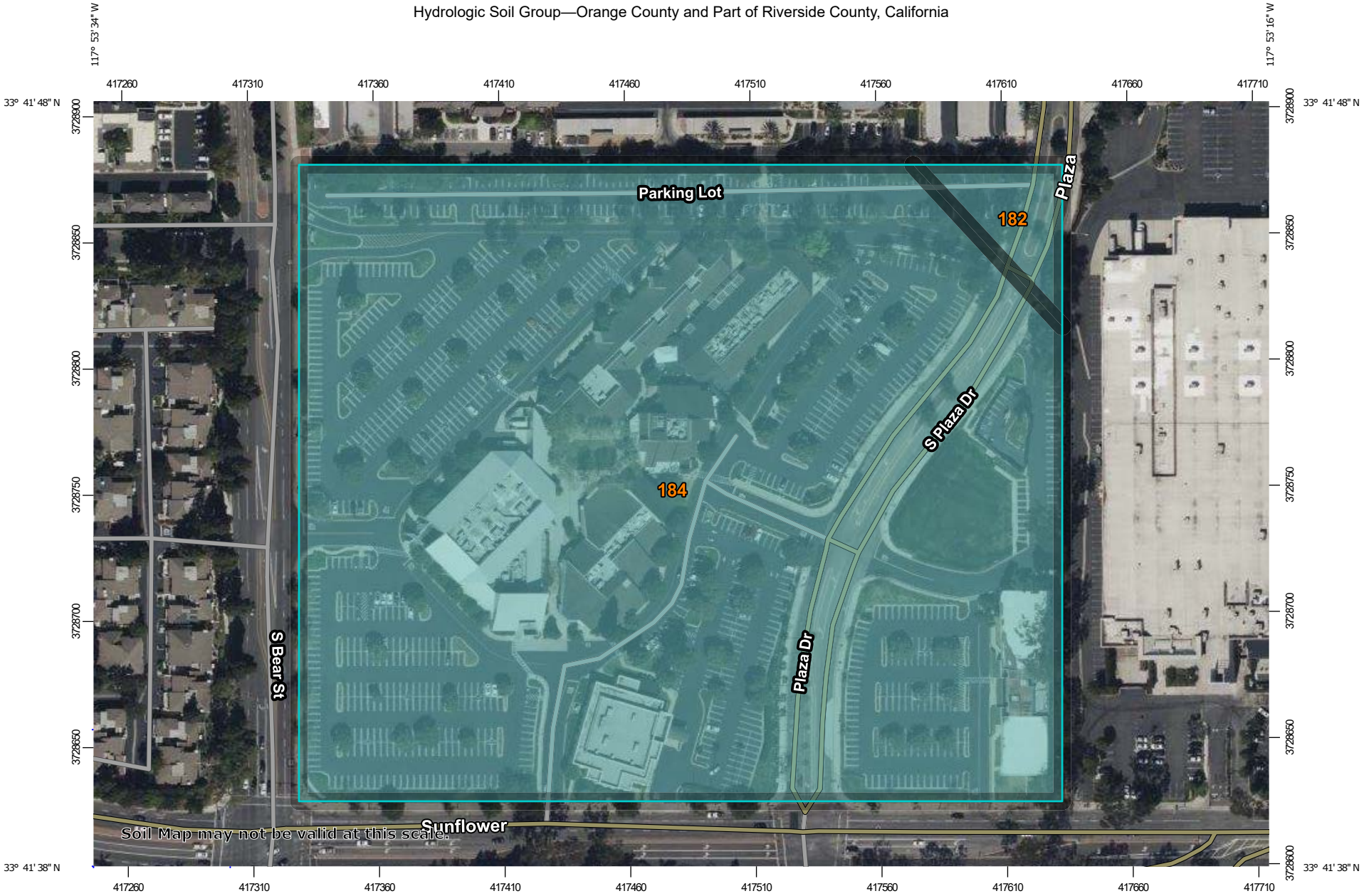
**Project:** South Coast Plaza Village
**Total Area(AC)** 17.25
**Total DCV (required) cf** 14,519

**Capture Efficiency Method**

| Drainage Area | Area (sf) | Area (AC) | Rainfall Depth (in) | Pervious Area (sf) | Pervious Area (ac) | Impervious Area (ac) | Impervious ratio | C (0.75ximp+0.15) | TC (MIN) | I1 | $Q_{DESIGN}$ (CFS) | DCV(cf) (CxdxA) | BMP USED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **12370** | 0.28 | 0.281 | **1237** | 0.03 | **0.26** | 0.90 | 0.83 | **10** | **0.225** | 0.05 | 239 | **Filterra Unit** |
| **2** | **20135** | 0.46 | 0.281 | **2013** | 0.05 | **0.42** | 0.90 | 0.83 | **10** | **0.225** | 0.09 | 389 | **Filterra Unit** |
| **3** | **14306** | 0.33 | 0.281 | **1431** | 0.03 | **0.30** | 0.90 | 0.83 | **10** | **0.225** | 0.06 | 276 | **Filterra Unit** |
| **4** | **12091** | 0.28 | 0.281 | **1209** | 0.03 | **0.25** | 0.90 | 0.83 | **10** | **0.225** | 0.05 | 234 | **Filterra Unit** |
| **5** | **32730** | 0.75 | 0.281 | **3273** | 0.08 | **0.68** | 0.90 | 0.83 | **10** | **0.225** | 0.14 | 632 | **Filterra Unit** |
| **6** | **29173** | 0.67 | 0.281 | **2917** | 0.07 | **0.60** | 0.90 | 0.83 | **10** | **0.225** | 0.12 | 564 | **Filterra Unit** |
| **7** | **12709** | 0.29 | 0.281 | **1271** | 0.03 | **0.26** | 0.90 | 0.83 | **10** | **0.225** | 0.05 | 246 | **Filterra Unit** |
| **8** | **17129** | 0.39 | 0.281 | **1713** | 0.04 | **0.35** | 0.90 | 0.83 | **10** | **0.225** | 0.07 | 331 | **Filterra Unit** |
| **9** | **13438** | 0.31 | 0.281 | **1344** | 0.03 | **0.28** | 0.90 | 0.83 | **10** | **0.225** | 0.06 | 260 | **Filterra Unit** |
| **10** | **10158** | 0.23 | 0.281 | **1016** | 0.02 | **0.21** | 0.90 | 0.83 | **10** | **0.225** | 0.04 | 196 | **Filterra Unit** |
| **11** | **6967** | 0.16 | 0.281 | **697** | 0.02 | **0.14** | 0.90 | 0.83 | **10** | **0.225** | 0.03 | 135 | **Filterra Unit** |
| **12** | **8746** | 0.20 | 0.281 | **875** | 0.02 | **0.18** | 0.90 | 0.83 | **10** | **0.225** | 0.04 | 169 | **Filterra Unit** |
| **13** | **8860** | 0.20 | 0.281 | **886** | 0.02 | **0.18** | 0.90 | 0.83 | **10** | **0.225** | 0.04 | 171 | **Filterra Unit** |
| **14** | **12536** | 0.29 | 0.281 | **1254** | 0.03 | **0.26** | 0.90 | 0.83 | **10** | **0.225** | 0.05 | 242 | **Filterra Unit** |
| **15** | **27522** | 0.63 | 0.281 | **2752** | 0.06 | **0.57** | 0.90 | 0.83 | **10** | **0.225** | 0.12 | 532 | **Filterra Unit** |
| **16** | **10676** | 0.25 | 0.281 | **1068** | 0.02 | **0.22** | 0.90 | 0.83 | **10** | **0.225** | 0.05 | 206 | **Filterra Unit** |
| A | **43459** | 1.00 | 0.281 | **4346** | 0.10 | **0.90** | 0.90 | 0.83 | **10** | **0.225** | 0.19 | 840 | MWS |
| B | **36629** | 0.84 | 0.281 | **3663** | 0.08 | **0.76** | 0.90 | 0.83 | **10** | **0.225** | 0.16 | 708 | MWS |
| C | **58331** | 1.34 | 0.281 | **5833** | 0.13 | **1.21** | 0.90 | 0.83 | **10** | **0.225** | 0.25 | 1,127 | MWS |
| D | **86893** | 1.99 | 0.281 | **8689** | 0.20 | **1.80** | 0.90 | 0.83 | **10** | **0.225** | 0.37 | 1,679 | MWS |
| E | **40749** | 0.94 | 0.281 | **4075** | 0.09 | **0.84** | 0.90 | 0.83 | **10** | **0.225** | 0.17 | 787 | MWS |
| F | **48518** | 1.11 | 0.281 | **4852** | 0.11 | **1.00** | 0.90 | 0.83 | **10** | **0.225** | 0.21 | 937 | MWS |
| G | **129982** | 2.98 | 0.281 | **12998** | 0.30 | **2.69** | 0.90 | 0.83 | **10** | **0.225** | 0.55 | 2,511 | MWS |
| H | **57428** | 1.32 | 0.281 | **5743** | 0.13 | **1.19** | 0.90 | 0.83 | **10** | **0.225** | 0.24 | 1,109 | MWS |
| Total | 694,107 | 17.25 | | 75,154 | 1.73 | 15.53 | 0.90 | 0.83 | - | - | 3.20 | 14,519 | |

# Attachment C

# Orange County Technical Guidance Maps


117° 53' 34" W
117° 53' 16" W
33° 41' 48" N
33° 41' 38" N
417260
417310
417360
417410
417460
417510
417560
417610
417660
417710
3728900
3728850
3728800
3728750
3728700
3728650
3728600
Parking Lot
182
184
Plaza
S Plaza Dr
Plaza Dr
S Bear St
Sunflower
Soil Map may not be valid at this scale.
Map Scale: 1:2,140 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 30 60 120 180
Feet
0 100 200 400 600
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 16, Sep 6, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 14, 2022—Mar 17, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 182 | Omni silt loam, drained | C | 0.5 | 2.5% |
| 184 | Omni clay, drained | C | 18.5 | 97.5% |
| **Totals for Area of Interest** | | | **19.0** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

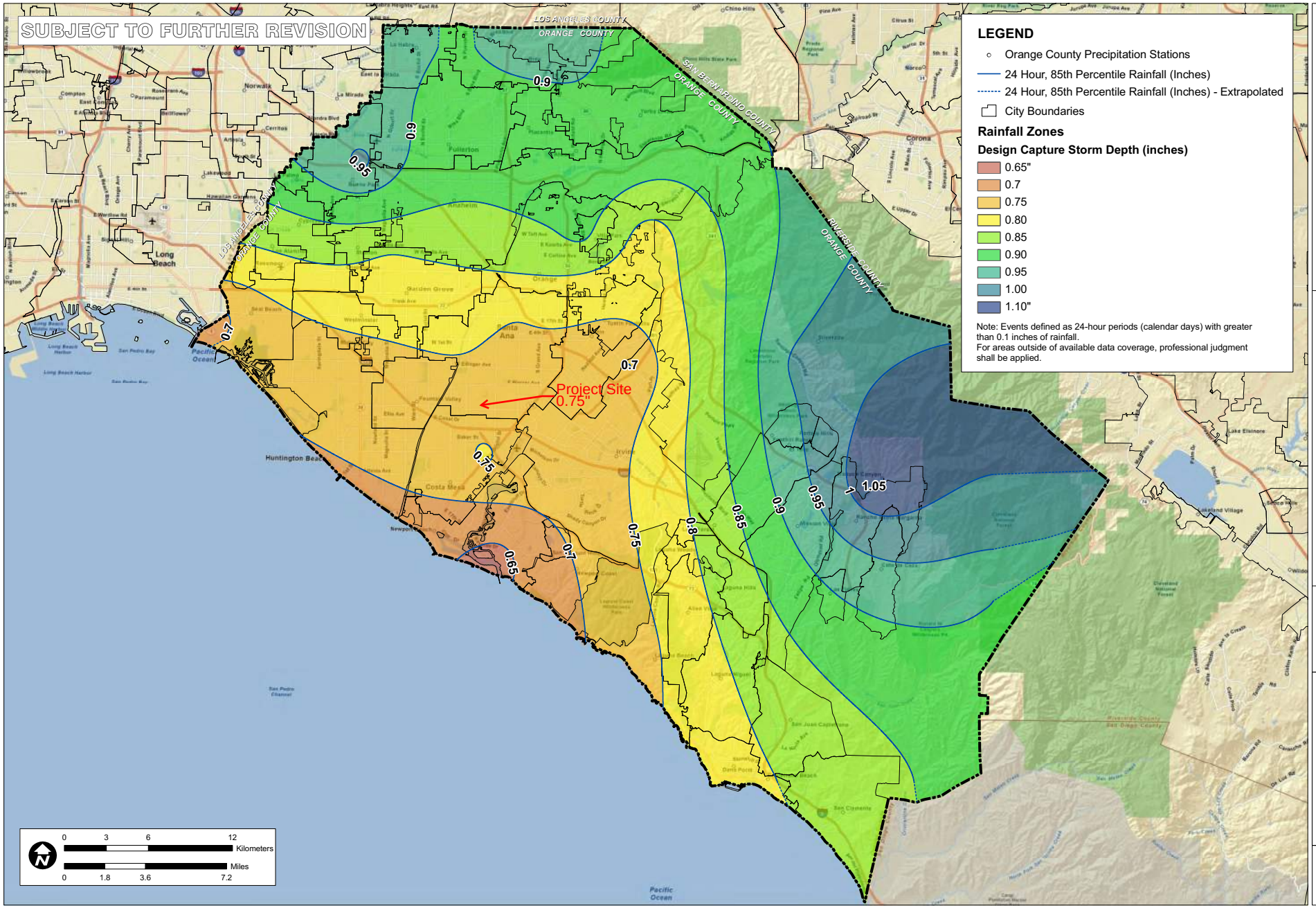
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher




P:\Y526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\Y526E_FigureXVI-1_RainfallZones_20110215.mxd

TITLE
RAINFALL ZONES

ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT

JOB
ORANGE CO. CA

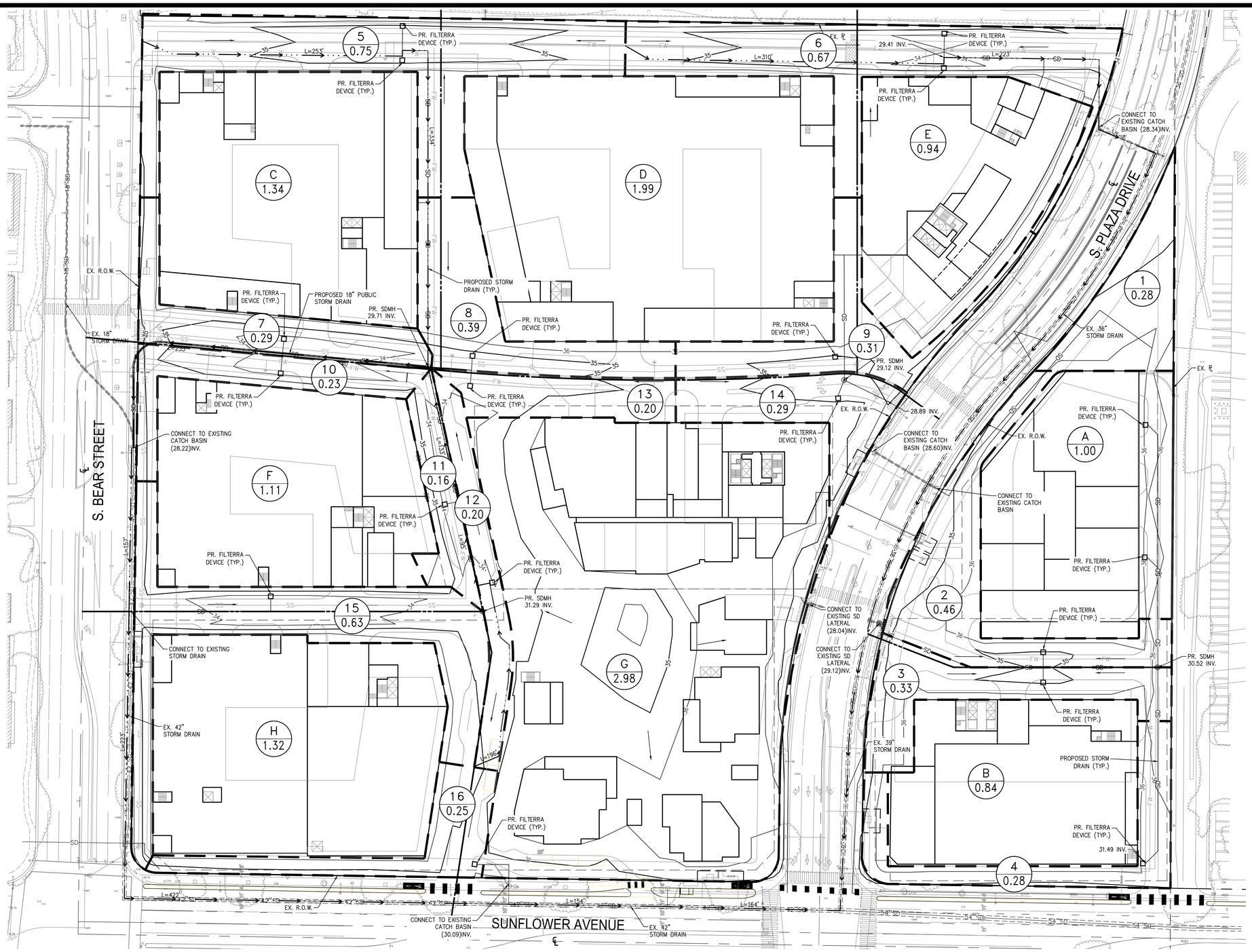
| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/29/10 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-1

# Attachment D

# Drainage Maps & Hydrology Narrative




| Drainage Area | Area (sf) | Area (AC) | Rainfall Depth (in) | Pervious Area (sf) | Pervious Area (ac) | Impervious Area (ac) | Impervious ratio | C (0.75ximp+0.15) | TC (MIN) | I1 | $Q_{DESIGN}$ (CFS) | DCV(cf) (CxdxA) | BMP USED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12370 | 0.28 | 0.281 | 1237 | 0.03 | 0.26 | 0.90 | 0.83 | 10 | 0.225 | 0.05 | 239 | Filterra Unit |
| 2 | 20135 | 0.46 | 0.281 | 2013 | 0.05 | 0.42 | 0.90 | 0.83 | 10 | 0.225 | 0.09 | 389 | Filterra Unit |
| 3 | 14306 | 0.33 | 0.281 | 1431 | 0.03 | 0.30 | 0.90 | 0.83 | 10 | 0.225 | 0.06 | 276 | Filterra Unit |
| 4 | 12091 | 0.28 | 0.281 | 1209 | 0.03 | 0.25 | 0.90 | 0.83 | 10 | 0.225 | 0.05 | 234 | Filterra Unit |
| 5 | 32730 | 0.75 | 0.281 | 3273 | 0.08 | 0.68 | 0.90 | 0.83 | 10 | 0.225 | 0.14 | 632 | Filterra Unit |
| 6 | 29173 | 0.67 | 0.281 | 2917 | 0.07 | 0.60 | 0.90 | 0.83 | 10 | 0.225 | 0.12 | 564 | Filterra Unit |
| 7 | 12709 | 0.29 | 0.281 | 1271 | 0.03 | 0.26 | 0.90 | 0.83 | 10 | 0.225 | 0.05 | 246 | Filterra Unit |
| 8 | 17129 | 0.39 | 0.281 | 1713 | 0.04 | 0.35 | 0.90 | 0.83 | 10 | 0.225 | 0.07 | 331 | Filterra Unit |
| 9 | 13438 | 0.31 | 0.281 | 1344 | 0.03 | 0.28 | 0.90 | 0.83 | 10 | 0.225 | 0.06 | 260 | Filterra Unit |
| 10 | 10158 | 0.23 | 0.281 | 1016 | 0.02 | 0.21 | 0.90 | 0.83 | 10 | 0.225 | 0.04 | 196 | Filterra Unit |
| 11 | 6967 | 0.16 | 0.281 | 697 | 0.02 | 0.14 | 0.90 | 0.83 | 10 | 0.225 | 0.03 | 135 | Filterra Unit |
| 12 | 8746 | 0.20 | 0.281 | 875 | 0.02 | 0.18 | 0.90 | 0.83 | 10 | 0.225 | 0.04 | 169 | Filterra Unit |
| 13 | 8860 | 0.20 | 0.281 | 886 | 0.02 | 0.18 | 0.90 | 0.83 | 10 | 0.225 | 0.04 | 171 | Filterra Unit |
| 14 | 12536 | 0.29 | 0.281 | 1254 | 0.03 | 0.26 | 0.90 | 0.83 | 10 | 0.225 | 0.05 | 242 | Filterra Unit |
| 15 | 27522 | 0.63 | 0.281 | 2752 | 0.06 | 0.57 | 0.90 | 0.83 | 10 | 0.225 | 0.12 | 532 | Filterra Unit |
| 16 | 10676 | 0.25 | 0.281 | 1068 | 0.02 | 0.22 | 0.90 | 0.83 | 10 | 0.225 | 0.05 | 206 | Filterra Unit |
| A | 43459 | 1.00 | 0.281 | 4346 | 0.10 | 0.90 | 0.90 | 0.83 | 10 | 0.225 | 0.19 | 840 | MWS |
| B | 36629 | 0.84 | 0.281 | 3663 | 0.08 | 0.76 | 0.90 | 0.83 | 10 | 0.225 | 0.16 | 708 | MWS |
| C | 58331 | 1.34 | 0.281 | 5833 | 0.13 | 1.21 | 0.90 | 0.83 | 10 | 0.225 | 0.25 | 1,127 | MWS |
| D | 86893 | 1.99 | 0.281 | 8689 | 0.20 | 1.80 | 0.90 | 0.83 | 10 | 0.225 | 0.37 | 1,679 | MWS |
| E | 40749 | 0.94 | 0.281 | 4075 | 0.09 | 0.84 | 0.90 | 0.83 | 10 | 0.225 | 0.17 | 787 | MWS |
| F | 48518 | 1.11 | 0.281 | 4852 | 0.11 | 1.00 | 0.90 | 0.83 | 10 | 0.225 | 0.21 | 937 | MWS |
| G | 129982 | 2.98 | 0.281 | 12998 | 0.30 | 2.69 | 0.90 | 0.83 | 10 | 0.225 | 0.55 | 2,511 | MWS |
| H | 57428 | 1.32 | 0.281 | 5743 | 0.13 | 1.19 | 0.90 | 0.83 | 10 | 0.225 | 0.24 | 1,109 | MWS |
| Total | 694,107 | 17.25 | | 75,154 | 1.73 | 15.53 | 0.90 | 0.83 | - | - | 3.20 | 14,519 | |

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | REVISIONS | | |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San Diego Riverside Dallas
Dallas Atlanta


# WQMP PLOT PLAN

## SOUTH COAST VILLAGE
SOUTH COAST PLAZA
ADDRESS / LOCATION
ADDITIONAL INFORMATION

DRAWN: JM
DATE:
CHECKED: DS/RH
DATE:
REVISION #:
DATE:
JOB NO: SP48310



5/15/2019 Internal Review

Sep 04, 2024 – 2:36pm by csutherland K:\Drawings\SP\SP48310 - Santa Ana\ENG\WQMP\SP48310- WQMP.dwg

## LEGEND

- PROPOSED HYDROLOGY BOUNDARY
- PROPOSED LANDSCAPE
- 40 — HYDROLOGY NODE
- FLOW DIRECTION
- A / 0.5 — AREA NO. / ACREAGE

TOTAL IMPERVIOUS = 88%

S. BEAR STREET

S. PLAZA DRIVE

SUNFLOWER AVENUE

N

0 40' 80'

SCALE: 1" = 40'

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | REVISIONS | | |

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San Diego Seattle Atlanta

# PROPOSED CONDITION HYDROLOGY MAP

SOUTH COAST VILLAGE
SOUTH COAST PLAZA
ADDRESS / LOCATION
ADDITIONAL INFORMATION

DRAWN: JM
DATE:
CHECKED: DS/RH
DATE:
REVISION #:
DATE:
JOB NO. SP4831D

1 OF 1

5/15/2019 Internal Review

Sep 04, 2024 - 10:44am by cauthentod K:\Drawings\SP\SP4831D - Santa Ana\CIVIL\Hydrology\SP4831D-HYD PROT.dwg

# Attachment E

# Geotechnical Report

NMG Geotechnical, Inc.

April 28, 2021

Project No. 21034-01

To: South Coast Plaza
3315 Fairview Road
Costa Mesa, California, 92626

Attention: Mr. Bryce Osborn, Director of Architecture and Planning

Subject: Geotechnical Feasibility Study for Proposed Project at South Coast Plaza Village, Santa Ana, California

## INTRODUCTION and EXECUTIVE SUMMARY

At your request and authorization, NMG Geotechnical, Inc. (NMG) has performed a geotechnical feasibility study for the subject site located at the northeast corner of Bear Street and Sunflower Avenue. (See Site Location Map, Figure 1.) The primary purpose of our study was to provide a summary of the geologic and geotechnical conditions, along with an evaluation of the feasibility of the planned project with respect to identified geotechnical constraints.

### Geologic Conditions

- Deep alluvium below the site consists of interlayered sands, silts and clays with the upper 15 to 20 feet being predominantly clays with relatively high expansion potential;
- Groundwater is on the order of 10 to 20 feet below existing ground surface, with potential artesian conditions (the water table in the sand layer below the clay in under some pressure);
- Site is in a mapped liquefaction hazard zone with confirmed liquefiable layers;
- Site is not located within an Alquist-Priolo Fault Zone and no faults are mapped in the immediate site vicinity; and
- Site will experience seismic shaking from earthquakes on nearby active faults.

### Geotechnical Constraints

Seismic shaking, liquefaction induced ground settlement, shallow groundwater, settlement of the heavier structures, and expansive soil are the primary geotechnical design constraints. Heavier structures (towers and multi-level parking structures) will require either deep pile foundations or mat slab (raft) foundations with ground improvement, such as rammed aggregate piers or stone columns. Conventional foundations may be feasible for intermediate structures with ground improvements. Lighter structures may be supported on stiff shallow foundations. Groundwater and wet soil conditions will require proactive measures, such as local dewatering and soft ground stabilization for excavations deeper than approximately 10 feet.

Based on our study, we conclude that the subject property is feasible for the planned development from a geotechnical viewpoint provided the recommendations herein are carried forward to the next phases of exploration, design and construction.

## ATTACHMENTS

Figure 1 - Site Location Map – Rear of Text
Figure 2 - 1972 Historic Aerial Photograph– Rear of Text
Figure 3 - Seismic Hazard Map – Rear of Text
Figure 4 - Regional Fault Map– Rear of Text
Plate 1 - Boring and CPT Location Map – In Pocket
Plate 2 - Geologic Cross-Section A-A' – In-Pocket
Appendix A - References
Appendix B - Boring and CPT Logs with Shear Wave Velocities
Appendix C - Liquefaction Analysis
Appendix D - Seismic Analysis

## SCOPE OF SERVICES

Our scope of services for this study included the following:

- City of Santa Ana public archive search and review of acquired geotechnical reports;
- Research and review of published and unpublished data/maps and our recent experience of this locale pertaining to the geologic conditions, including underlying soil types, recent and historic groundwater levels, and impacts of shallow groundwater on construction;
- Review of available online historic aerial photographs and topographic maps dating back to 1952;
- Site reconnaissance to observe existing conditions, meet with South Coast Plaza (SCP) representatives and mark cone penetrometer (CPT) locations;
- Clearance of potential underground utility conflicts with CPT locations through DigAlert and SCP Village facilities staff;
- Advancement of six CPT probes to 50 and 120 feet below ground with shear wave velocity measurement in two 120-foot-deep probes;
- Geologic analysis and development of Cross-Section A-A';
- Site seismicity analysis;
- Liquefaction and settlement analyses using cone penetrometer (CPT) data;
- Conceptual foundation alternative analysis;
- Preparation of this report summarizing our findings, conclusions and recommendations.

The references reviewed for this study are listed in Appendix A. The approximate CPT locations and historic borings by others are shown on Plate 1, the Boring and CPT Location Map (in pocket). Geologic Cross-Section A-A' is also included in pocket (Plate 2). CPT and boring logs are included in Appendix B. Liquefaction and seismic settlement analyses from the CPT data are included in Appendix C. Seismic analysis is attached in Appendix D.

## SITE DESCRIPTION

The subject site, referred to as South Coast Plaza Village (the Village) is located north of the main South Coast Plaza shopping mall. The location is shown on Figure 1, Site Location Map. The site is approximately 17.2-acres, bounded by Bear Street on the west, Sunflower Avenue on the south, a retail property on the east, and a residential development on the north. The site is currently occupied by a central main cluster of restaurant and retail buildings, a stand-alone restaurant (Morton's Steakhouse) next to Sunflower Avenue and a stand-alone theater at the southeast corner of the property. The theater and portions of the parking lot are separated from the main Village by South Plaza Drive, which traverses in a north south direction through the eastern portion of the site. The remainder of the site is paved parking, driveways and landscape areas. These features are also shown on the aerial photograph used for the base of our CPT and Boring Location Map, Plate 1.

## PROPOSED DEVELOPMENT

We understand that the proposed project will include demolition of the existing retail and commercial buildings in order to construct new multi-story, multi-family residential buildings, with a combination of podium parking and one level of underground parking. Project concepts include four to five 25-story high-rise buildings. The exact location, configuration of the structures and other details of the project are in the conceptual stages. Site concepts we have reviewed show Plaza Drive remaining in its current general alignment.

## HISTORIC DATA AND GEOTECHNICAL REPORTS

We researched three primary sources for historic data related to the site: published and internet data bases, NMG in-house archives, and City of Santa Ana public works archives. No reports were available from South Coast Plaza archives. Our research is summarized as follows:

- Published and internet data bases include those of the State of California Geologic Survey (CGS), United States Geologic Survey (USGS), Geotracker (environmental data), NETR Historic Aerials, among other sources.
- NMG archives yielded prior studies and reports related to demolition of the Planet Hollywood restaurant (current Morton's pad) and parking lot pavement rehabilitation. Parking lot related reports included both design and construction phase reports.
- City of Santa Ana archives yielded the original geotechnical investigation report for the entire site by LeRoy Crandall and Associates (Crandall, 1973); the design investigation and as-graded reports for Morton's Steakhouse (Giles, 2001a, and 2001b); and a pile design report for a Planet Hollywood portico feature (Crandall, 1993).

These data were used along with the CPT data to develop our site geologic model and understanding of the existing geotechnical conditions and constraints. The information is provided and referenced through this report. Appendix A has a complete listing of references.

## SITE HISTORY

The following site history is based on historic aerial photographs (NETR, 2021) and topographic maps (USGS, 2021):

- Between 1892 and the 1950s, Sunflower Street and Bear Street were constructed. The 1892 topographic map shows a marsh to the south and southeast of the site, but not onsite. There was a house at the northwest corner of the property, just offsite. The site appears to be undeveloped or possibly used for row crops.
- The 1935 topographic map shows a ditch with water along the eastern property boundary.
- Between 1952 and 1963, the historic aerials show the site was still undeveloped and possibly planted with row crops, and the offsite house is still visible. Sunflower and Bear Streets were in place as two-lane roads and the ditch was along the eastern property boundary.
- The 1965 topographic map shows a building in the northwest corner of the subject property, to the southeast of the previously mentioned house.
- The 1972 aerial photo shows the site was being graded and buildings were being constructed. It appeared that the central and northeast portion of the site had lighter soils, possibly imported sandy soils to raise grades and/or replace unsuitable native soils. (See Figure 2, a historic aerial photograph.) It also shows the larger building in the northwest corner of the site.
- The 1972 topographic map shows some buildings were constructed onsite with Plaza Drive in between, as well as the buildings in South Coast Plaza and the retail center to the east of the subject site.
- By 1980, buildings for the Village were constructed in a similar configuration as today, except for the empty pad on the east side of South Plaza Drive (Figure 2), north of the theater. The large building in the northwest corner was still in place.
- By 1995, the building in the northwest corner had been removed and replaced with a parking lot and a building was constructed on the empty pad.
- By 2002, the building located along the southern central portion of the site had been replaced with the larger Morton's restaurant.
- In 2013, the building on the pad north of the theater was demolished to create an empty pad, currently covered with turf. The site has remained relatively unchanged since then to the present.

## SUMMARY OF GEOTECHNICAL CONDITIONS

### Regional Geologic Setting

The subject site is located within the Peninsular Range Province of California, in the southeast portion of the Orange County Basin on the U.S. Geological Survey 7.5-minute Newport Beach Quadrangle. The site is underlain by 10 to 15 feet of Holocene-age alluvium and on the order of 900 feet of Quaternary-age alluvium (CDMG, 1980).

### Earth Units and Soil Characteristics

Prior studies at the Village have included borings to depths of 51 feet deep throughout the site and our CPTs were performed to depths of up to120 feet. The alluvium below the site consists primarily of clay and silt in the upper 15 to 20 feet, with local thin lenses of sandy alluvium. Below 20 feet, there is considerably more sand and sandy silt layers, with local thin layers of clay. The alluvium below a depth of 50 feet in CPTs is similar to interlayered sand and silt with some clay, but is generally much denser with layers of very dense stiff soil.

Based on the U.S. Department of Agriculture soil mapping (1978), the near-surface native soils consist of the Omni Clay (CL/CH), which has a high shrink/swell potential, is highly corrosive to metals, and moderately corrosive to concrete. This soil is also categorized as having a low permeability and is in Hydrologic Group D. Please note there could be 2 to 3 feet of imported sandy soils overlying the native deposits that was placed during the original grading in the early 1970s.

### Groundwater

Groundwater was encountered during the original investigation by LeRoy Crandall in borings drilled at the site in 1973 at depths of 10 and 20 feet (Crandall, 1973). The 50-foot-deep borings were drilled with a rotary wash boring that included the use of drilling mud, so groundwater could not be recorded. Borings LRB-1, -11, -16, -20, -23 and -26 were drilled to depths of 18 to 21 feet and left open for a period of time (1.5 to 15 hours), with groundwater levels rising between 2.5 to 5 feet. This indicates that the groundwater is under artesian pressures. The shallower borings, between 14 and 15 feet deep, encountered minor seepage at depths of 10 to 15 feet. The potentiometric groundwater surface (the level to which groundwater rises in a well or boring which penetrates an aquifer, also called a piezometric surface) is shown on Cross-Section A-A' (Plate 2). The clayey alluvium may also be saturated; however, the permeability of the clay is so low that it acts as a confining layer. Once borings are drilled into the sandy layers, the permeability of the sands and the aquifer pressure causes the groundwater in the borings to rise given sufficient time.

From our past experience at nearby sites, drilling into these sandy layers with artesian conditions can result in sand being forced up into the hollow drilling stem, causing the auger to seize up and bringing drilling to a standstill. To remove the auger, water needs to be added to the hollow-stem of the auger in order to create a sufficient hydraulic pressure head to counteract the hydraulic uplift and be able to remove sand out of the auger.

For Morton's, Giles drilled borings in 2001 that did not encounter groundwater to depths of 15 feet (Giles, 2001a). One boring, GB-5, was drilled to a depth of 50 feet and reported groundwater at a depth of 19.5 feet. However, they did not leave the boring open to allow any time-dependent rise in the water level.

Numerous borings and four groundwater wells were installed by Petroleum Industry Consultants (PIC) and Dames and Moore (D&M) for the former Sears Automotive Center at the north end of South Coast Plaza (PIC, 1989 and D&M, 1992a). Borings drilled by PIC to depths of 15 to 19 feet did not encounter groundwater and one boring drilled to a depth of 25 feet encountered groundwater at a depth of 20 feet. Approximately half of the twenty borings drilled by D&M (1992a) to depths of 20 to 21 feet, locally encountered groundwater at depths of 20 to 21 feet. The four wells were drilled and installed at depths of 31 to 32 feet. Groundwater was encountered during drilling at depths of 20 to 21 feet, and after a few days, the potentiometric groundwater levels in the wells were at 15 to 19 feet deep (a rise of up to 6 feet). The direction of groundwater flow during the D&M investigation had a slight gradient of 0.001 toward the southwest.

At another site located to the northeast of the subject site, numerous groundwater wells were installed and monitored between 1991 and 2015. The groundwater levels were found to fluctuate between 4 and 20.5 feet deep, with the shallowest levels being between December and March.

NMG was the consultant on a project with similar geologic conditions near the intersection of MacArthur Boulevard and Main Street in Santa Ana. This development included a seven-story parking structure with one subterranean level. During construction, groundwater wells were ineffective dewatering because of the very low permeability of the clays. A perimeter trench was excavated and filled with gravel and pumped at the four corners during construction. In addition, the 5-foot-deep shear wall footing had standing water, and additional sump pumps had to be used for dewatering that excavation. The garage slab was a structural slab and the structural engineer calculated the hydrostatic uplift forces and found that dewatering around the perimeter of the building needed to continue until the seven stories were constructed.

**Seismicity, Faulting, and Seismic Hazards**

Based on background review, no known active faults are located within or adjacent to the subject site, nor is it located within an Alquist-Priolo Fault Rupture Hazard Zone (CGS, 2020). Therefore, the potential for primary ground rupture is considered very low at the site. The primary seismic hazard at the subject site is ground shaking due to a future earthquake on one of the major regional active faults and potential ground deformation due to liquefaction.

Using the USGS de-aggregation computer program (USGS, 2021) and the site coordinates of 33.6956 degrees north latitude and -117.8908 degrees west longitude, the closest major active faults to the site are the San Joaquin Hills Blind Thrust Fault located 4 km (2.5 miles) south of the site and the Newport-Inglewood Fault, approximately 8.8 km (5.5 miles) southwest of the site. The San Joaquin Hills Blind Thrust Fault with a moment magnitude of 7.15 is considered the controlling fault for this site.

The site is not located within a zone of earthquake induced landslide as mapped by the State; however, the site is mapped as having potentially liquefiable soil (CDMG, 1997).

Tsunami and seiche are not considered secondary seismic hazards at this site due to the elevation and location.

**Liquefaction**

Liquefaction is a phenomenon when relatively loose granular soils below the water table "liquefy" during sufficiently strong seismic shaking or man-made ground vibrations. This can result in loss of bearing capacity, ground disturbance (sand boils), and/or ground settlement. For the design earthquake of magnitude 7.15, our liquefaction analysis using the CPT data indicates the site has low to moderate liquefaction potential. Total settlements on the order of 1 to 2 inches were calculated. The risk of bearing capacity loss and ground disturbance is low due to the clay layer that caps the site and the depth to the liquefaction prone layers.

**Static Settlement**

Preliminary settlement analysis for a conceptual 25-story residential tower was performed with software which uses the CPT data to estimate consolidation characteristics of the onsite soils. For the analysis, we assumed live and dead loads on the order of 125 to 150 pounds per square foot of floor area for the 25-story building with a 120-foot by 120-foot square footprint. With these assumptions, the analysis resulted in 1 to 2 inches of total settlements below a mat slab foundation. From our experience, settlements calculated using CPT data are very convenient and rapid but tend to underestimate total settlements compared to more conventional methods (borings to collect and test soil samples). However, for feasibility purposes, the order of magnitude values from these analyses are considered sufficient.

**Storm Water Treatment/Storage**

Predominantly, the subject site is underlain by fine-grained soil (clay and silt) in the upper 15 to 20 feet, with low permeabilities. The soils are categorized as Hydrologic Class D soils (USDA, 1978) and per the Orange County Technical Guidance Document for WQMP (2013), the site may be considered infeasible for infiltration. Because of the clay soils and the relatively shallow groundwater, the site is not suitable for treatment of storm water with onsite infiltration. Underground treatment and/or detention systems below approximately 15 to 20 feet may need to account for hydrostatic uplift (buoyant) forces due to the shallow groundwater.

**Existing Asphalt Pavements and Fill**

NMG has conducted a number of pavement studies for parking and driveway areas at the Village (NMG, 1995a, 1995b, 1996a, 1996b). The numerous shallow borings through the existing asphalt pavement sections determined the thickness of asphalt concrete (AC), aggregate base (AB), and where encountered, a sand subbase (SB) layer. AC thickness was generally 4 inches, with a few areas with as little as 2 inches and other areas with up to 7 inches. AB thicknesses were generally 4 to 6 inches, with as little as 3 inches and up to 9 inches is some areas. SB

consisting of imported sand with relatively high R-values was encountered in many but not all areas of the parking lot. It was generally 8 to 12 inches thick but as thin as 1 inch and as thick as 32 inches in some areas.

In addition to the imported SB under certain areas of asphalt pavement, existing buildings and some areas of adjacent concrete flatwork reportedly have 2 to 4 feet of imported sand fill, which was recommended to mitigate the expansive clays (Crandall, 1973, Giles, 2001a).

# CONCLUSIONS AND RECOMMENDATIONS

Based on our feasibility-level study, we conclude that the proposed development is feasible provided the geotechnical constraints described herein are mitigated. The primary geotechnical design constraints are potential settlements due to heavier structural loads, seismic shaking, seismically induced settlement, shallow groundwater, and near-surface clays with high expansion potential. The primary grading and construction phase issues will be the relatively shallow groundwater which will require local dewatering and inflow control for excavations deeper than approximately 15 to 20 feet (may vary across the site due to variation in geology). Seepage and saturated soil conditions will be encountered near or below 10 feet, which will require mitigation during construction. These and other conditions are discussed in more detail below.

## 1. Foundation Types and Remedial Measures

The site is underlain by moderately compressible soils as well as soil with low to moderate potential for seismically induced settlements. Structural foundation designs will depend on the structural loads and the settlement tolerance of the structures. The near-surface soil is also generally clayey with high expansion potentials. The expansion potentials will primarily impact the more lightly loaded structures and slabs-on-grade. Foundation considerations for three structure categories are as follows:

**High Rise Buildings and Multi-level Parking Structures:** Structures with relatively large dead and live loads, such as the 25-story towers, will require settlement mitigation, both for static settlements on the order of several inches, and seismically induced settlements estimated to be on the order to 1 to 2 inches. The combined static and seismic settlements are expected to exceed the tolerances of such structures. Therefore, these structures will require either pile foundations on the order of 50 feet deep, or a mat/raft foundation over ground improvements. In-situ ground improvement options include rammed aggregate piers, stone columns, injection grouting, or deep soil mixing (lime or cement). Conceptually, ground improvements may need to extend approximately 30 feet below foundations. The planned underground parking will partially mitigate structural settlements (unloading of soil weight). The settlement constraints may also apply to parking structures with more than four levels above ground.

**Moderately Loaded Structures:** Structures with more moderate loads, such as three- to five-story buildings or parking structures with 4 or less levels may be supported on mat slabs, shallower piles, or conventional foundations over ground improvements. As with the heavier structures, one level of underground parking will partially mitigate structural settlements. The feasibility of these foundation options will depend on the structural loads and settlement tolerances of the structures.

**Lightly Loaded Structures:** One- to three-story structures generally will not have the same settlement constraints as heavier structures. However, they will be more susceptible to adverse impacts of the expansive soils if they are constructed on-grade. (Mitigation of expansive soil with respect to foundations and slabs-on-grade will not apply to structures over one level of subterranean parking.) Where necessary, expansive soils are typically mitigated with extra stiff post-tensioned slabs-on-grade, ribbed (waffle-type) slabs-on-grade, or removal of three to five feet of the clay soil and replacement with granular soils having very low expansion potential. For

large areas, lime treatment of the upper 4 feet of soil is sometimes used to mitigate expansive soil.

As the project details regarding structural information become more established, your consulting team, including experienced general contractor or construction manager, architect, and structural engineer, should evaluate the various foundation alternatives. A geotechnical specialty contractor should also be engaged to evaluate the feasibility, suitability, and economics of various ground improvement options for the above discussed structures at this site.

## 2. Shallow Groundwater

The relatively shallow groundwater at the site may impact subterranean foundation and slab-on-grade design with respect to hydrostatic uplift forces for portions of structures below the design water table. If applicable, the forces are typically mitigated with the weight of structures and structural slabs. Floating slabs may not be feasible for subterranean structures if they are below the potentiometric groundwater surface.

Excavations deeper than approximately 10 to 15 feet are likely to encounter groundwater seepage, and excavations deeper than 15 feet may encounter artesian conditions. Measures to manage or prevent inflows of water into excavations during construction will be necessary. Local experience indicates that dewatering wells (well points) will not be effective due to the relatively low permeability of the majority of soils at the site. Gravel filled cutoff trenches around excavations for subterranean parking structures with sump pumps have been employed successfully on nearby projects. For larger and deeper excavations, some type of in-situ cutoff walls, such as sheet piling, jet grouting, or mixed in-place soil cement walls, may be desirable if pumping and discharge of large volumes of groundwater to local storm drain or sewer system is problematic.

At some point, we recommend installation of groundwater observation wells to verify the onsite conditions. Pumping tests should also be performed for design of foundation excavation dewatering systems and to estimate potential dewatering discharge volumes. The potential for ground settlement and associated potential impacts to adjacent areas caused by a prolonged lowering of the water table should also be evaluated, as needed.

Local sump pumps are expected to be sufficient for control of groundwater in excavations for buried utilities, as those excavations are typically smaller and for shorter durations.

## 3. Wet Soil Conditions

Excavations within one to two feet of the groundwater table and deeper may encounter soft, wet soils which will require stabilization prior to construction of structures and heavier pipelines. Stabilization measures typically will involve a gravel layer on the order of one to several feet thick. Placing a geotextile or geogrid under the gravel will reduce the thickness of required gravel and also provide added bearing capacity for support of workers and equipment. Excavated soil may also be too wet for re-use as compacted fill without drying.

## 4. Seismicity

The seismic parameters provided herein were used for our liquefaction analysis. These parameters may also be used for structures that have a fundamental period (T) of less than 0.96 seconds (1.5 times $T_s$). The seismic response coefficient, $G_s$, should be determined per the parameters provided below and using the equation 12.8-2 in publication ASCE 7-16. For structures with fundamental periods of great than or equal to 0.96 seconds, ground motion hazard analysis per Section 21.2 of ASCE 7-16 will need to be performed. Time history analysis may also be needed based on discussions with and collaboration with the project structural engineer.

| ***Selected Seismic Design Parameters from 2019 CBC/ASCE 7-16*** | ***Seismic Design Values*** | ***Reference*** |
|---|---|---|
| Latitude | 33.6956 North | |
| Longitude | 117.8908 West | |
| Controlling Seismic Source | San Joaquin Hills | USGS, 2021 |
| Distance to Controlling Seismic Source | 2.5 mi (4.1 km) | USGS, 2021 |
| Site Class per Table 20.3-1 of ASCE 7-16 | D | SEA/OSHPD, 2021 |
| Spectral Acceleration for Short Periods (Ss) | 1.29 g | SEA/OSHPD, 2021 |
| Spectral Accelerations for 1-Second Periods ($S_1$) | 0.46 g | SEA/OSHPD, 2021 |
| Site Coefficient $F_a$, Table 11.4-1 of ASCE 7-16 | 1.0 | SEA/OSHPD, 2021 |
| Site Coefficient $F_v$, Table 11.4-2 of ASCE 7-16 | 1.8 | |
| Design Spectral Response Acceleration at Short Periods ($S_{DS}$) from Equation 11.4-3 of ASCE 7-16 | 0.86 g | SEA/OSHPD, 2021 |
| Design Spectral Response Acceleration at 1-Second Period ($S_{D1}$) from Equation 11.4-4 of ASCE 7-16 | 0.55 g | |
| $T_S$, $S_{D1}$/ $S_{DS}$, Section 11.4.6 of ASCE 7-16 | 0.64 sec | |
| $T_L$, Long-Period Transition Period | 8 sec | SEA/OSHPD, 2021 |
| Peak Ground Acceleration Corrected for Site Class Effects ($PGA_M$) from Equation 11.8-1 of ASCE 7-16 | 0.61 g | SEA/OSHPD, 2021 |
| Seismic Design Category, Section 11.6 of ASCE 7-16 | D | |

## 5. Site Demolition

Existing buried structures, foundations, utilities and pipelines and prior backfill should be removed, with resulting excavations backfilled with engineered fill. Fourteen 4-foot-diameter concrete piles from the old Planet Hollywood building were cut off approximately 8 feet below ground prior to construction of Morton's. The remnants of the piles may be encountered in excavations deeper than 8 feet.

Aggregate derived from crushing concrete and existing AC, along with the existing AB from paved areas, may be suitable for stabilizing saturated excavation bottoms or as bedding under pipelines. Frequently, these materials can also be tested and classified for use as crushed miscellaneous base (CMB), which can be used for future pavements and below structural slabs-

on-grade. However, onsite crushing and recycling is often not economical if onsite stockpile locations are not available. An experienced general contractor should be consulted in this matter.

## 6. Remedial Grading

Typically, three to five feet of newly compacted fill is recommended below structures at grade (not below ground), especially in areas where demolition activities may result in significant ground disturbance. Deeper remedial removals are not likely to add significant value from a structural design standpoint. For non-structural areas, less overexcavation and recompaction is generally recommended, on the order of two feet. Where deep utilities are to be removed, the backfill should be compacted with observation and testing by the geotechnical consultant.

## 7. Additional Exploration, Testing, and Analyses

Significant additional site exploration, soil testing, and analyses is recommended for design of the planned structures, other project elements, and for planning/estimating purposes. The recommended tasks, some of which have been mentioned in prior sections, are summarized as follows:

a) Groundwater observation wells (minimum of three locations) should be installed and monitored for a minimum of one year. The locations should have multiple wells with varying depths to study the potential for perched water tables and artesian pressures.

b) Once the water table conditions are better understood from the observation wells, groundwater pumping tests should be performed sometime before construction in order to estimate flows and assist in evaluating various groundwater control alternatives.

c) Additional CPT probes and small-diameter borings should be performed across the site to refine the geologic model of the interlayered soils. Some of the CPTs and borings should be sited specifically at the high-rise tower locations when the tower locations are finalized.

d) Soil samples collected from the borings should be tested for various engineering soil properties, especially with respect to settlement potential, to be used for structure specific settlement analysis. Tests to determine lateral earth pressures for underground structures, parameters for shallow and deep foundations, and soil properties for ground improvement analyses should also be performed.

e) More rigorous liquefaction analysis and settlement analyses will be necessary with the additional data, along with more precise foundation loads provided by the project structural engineer.

f) Additional seismic analysis will be necessary once more specific structure design information is available in order to provide the necessary parameters for structural design.

g) As alluded to in prior sections, a team of design and construction professionals should collaborate from very early in the planning process to evaluate the alternatives for foundations, ground improvement to mitigate settlement and liquefaction, and groundwater control.

## LIMITATIONS

This feasibility report has been prepared for the exclusive use of our client, South Coast Plaza, within the specific scope of services requested by them for the South Coast Plaza Village project. This report or its contents should not be used or relied upon for other projects or purposes or by other parties without the written consent of South Coast Plaza and NMG. Our methodology for this study is based on local geotechnical standards of practice, care, and requirements of governing agencies for a given time. No warranty or guarantee, express or implied is given.

The findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from limited geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can be very different in between data points, and can also change over time. As a feasibility study, our conclusions and recommendations are not comprehensive with respect to design of the project and should be viewed only as broadly representative of the primary geotechnical issues. As already stated, significant additional geotechnical work will be require to provide conclusions and recommendations suitable for design of specific project elements including structures, pavements, storm water treatment systems, utilities, etc.

NMG's expertise and scope of services did not include assessment of potential subsurface environmental contaminants or environmental health hazards.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

Ted Miyake, RCE 44864
Principal Engineer

Terri Wright, CEG 1342
Principal Geologist

TM/TW/grd

Distribution: (1) Addressee (E-Mail)
(1) Mr. Jeff Reese, South Coast Plaza (E-Mail)
(1) Mr. Jason Poulsen, South Coast Plaza (E-Mail)



0 500 1,000 Feet

1 inch = 1,000 feet

N

# SITE LOCATION MAP

SOUTH COAST PLAZA VILLAGE
SANTA ANA, CALIFORNIA

Project Number: 21034-01 Project By: TM/TW
Name:SCPlaza/SCPVillage
Date: 4/28/2021

Figure 1

NMG

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## 1972 HISTORIC AERIAL PHOTO

N

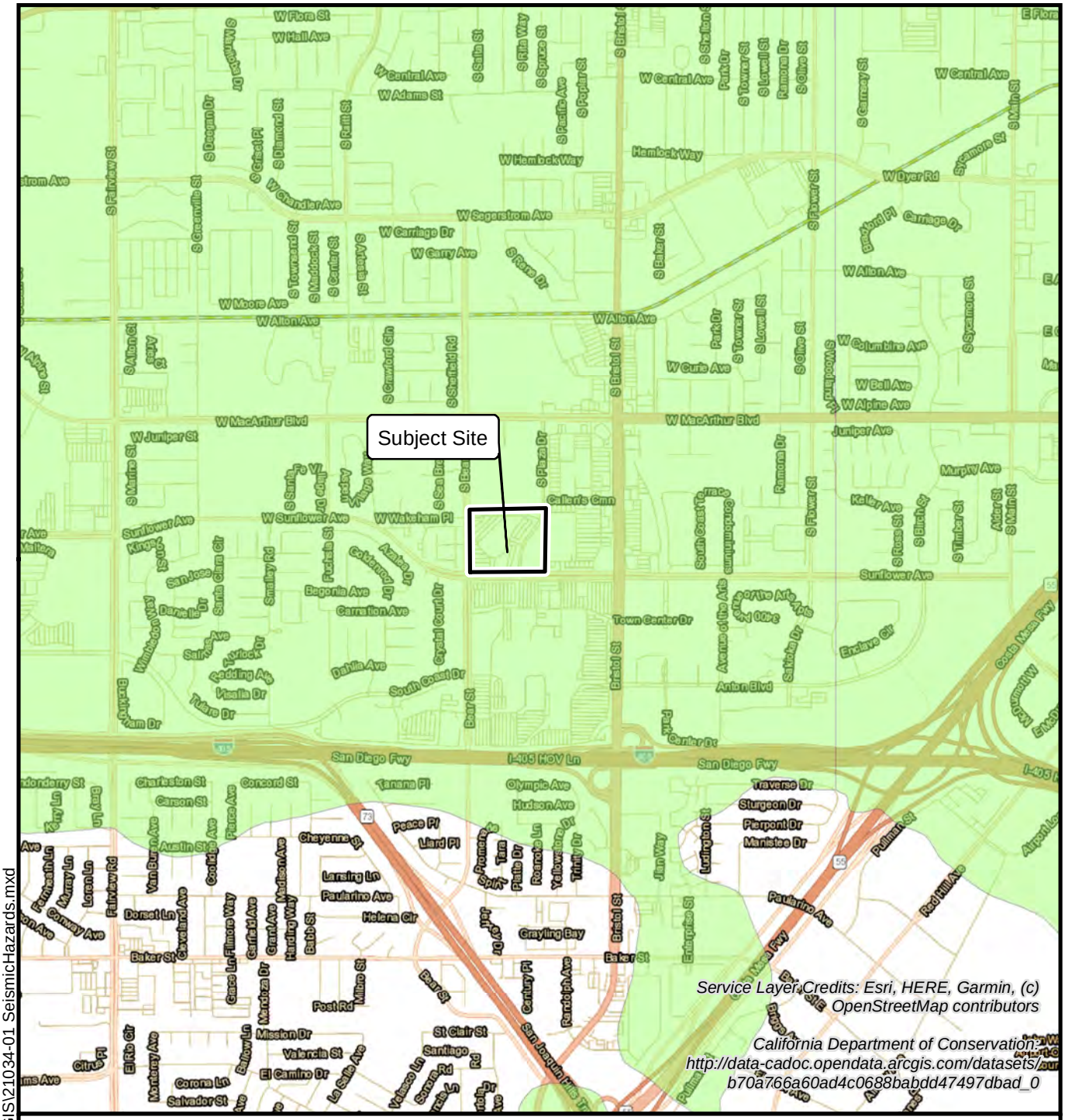
SOUTH COAST PLAZA VILLAGE
SANTA ANA, CALIFORNIA

Project Number: 21034-01

Project Name: SCPlaza/SCP

Date: 4/28/2021 Figure No. 2

NMG
Geotechnical, Inc.




## Legend

- Earthquake-Induced Landslide Zones
- Liquefaction Zones

0 1,000 2,000 Feet

1 inch = 2,000 feet

N

# SEISMIC HAZARDS AND FAULT ZONES MAP

Base: California Geological Survey, Earthquake Zones of Required Investigation, Newport Beach Quadrangle
Dated: April 15, 1998

SOUTH COAST PLAZA VILLAGE
SANTA ANA, CALIFORNIA

Project Number:21034-01 By: TM/TW
Project Name: SCPlaza/SCP
Date: 4/28/2021 Figure 3

NMG

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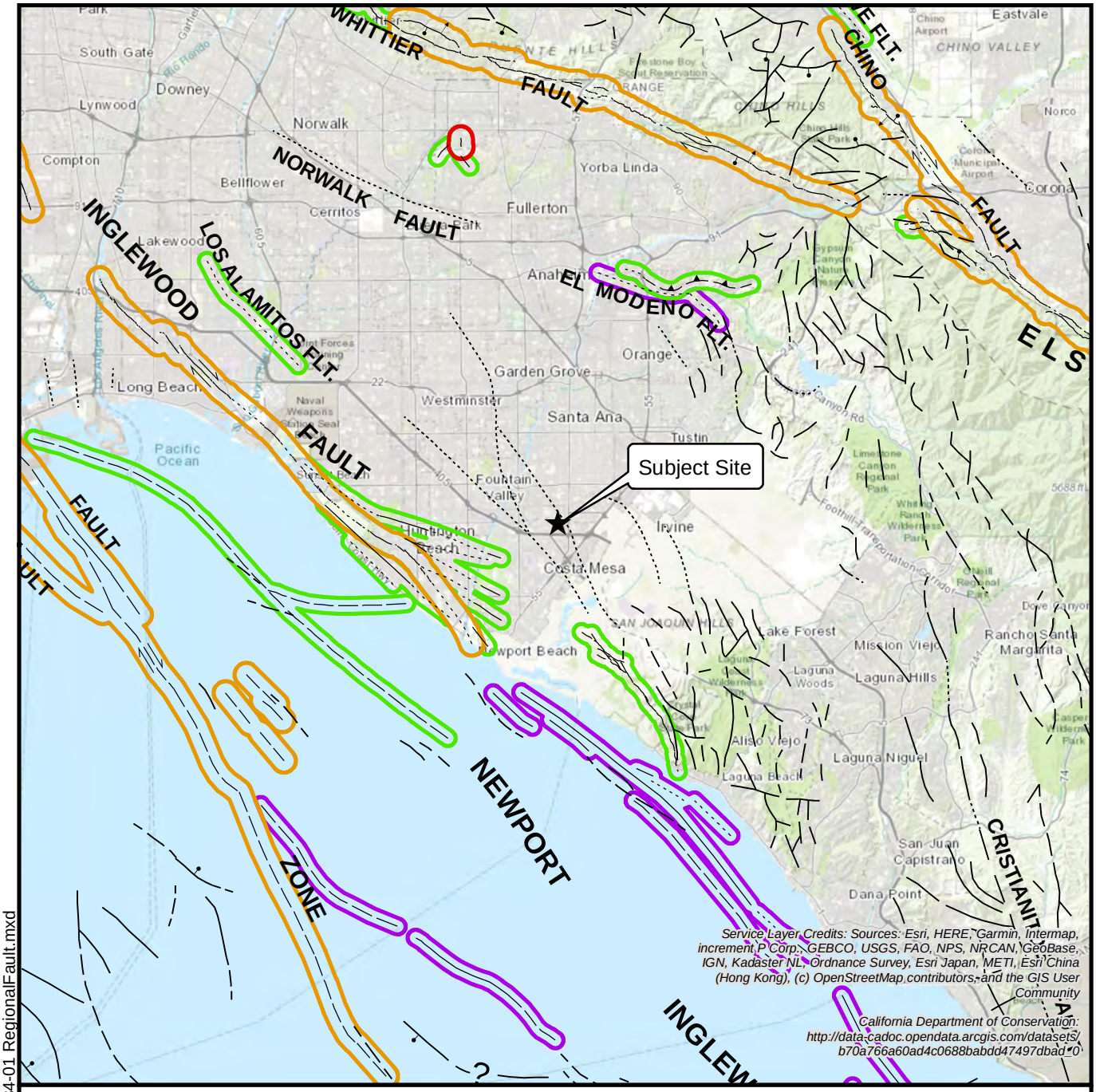


## Legend

**Faults**

- Certain
- Approximately Located
- Concealed

**Recency of Movement**

- Historic
- Holocene
- Late Quaternary
- Quaternary

0 3 6 Miles

1 inch = 6 miles

N

# REGIONAL FAULT MAP

Base: California Geological Survey, Fault Activity Map of California, 2010

SOUTH COAST PLAZA VILLAGE
SANTA ANA, CALIFORNIA

Project Number: 21034-01 By: TM/TW
Project Name: SCPlaza/SCP
Date: 04/28/2021 Figure 4

NMG

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# APPENDIX A

# APPENDIX A

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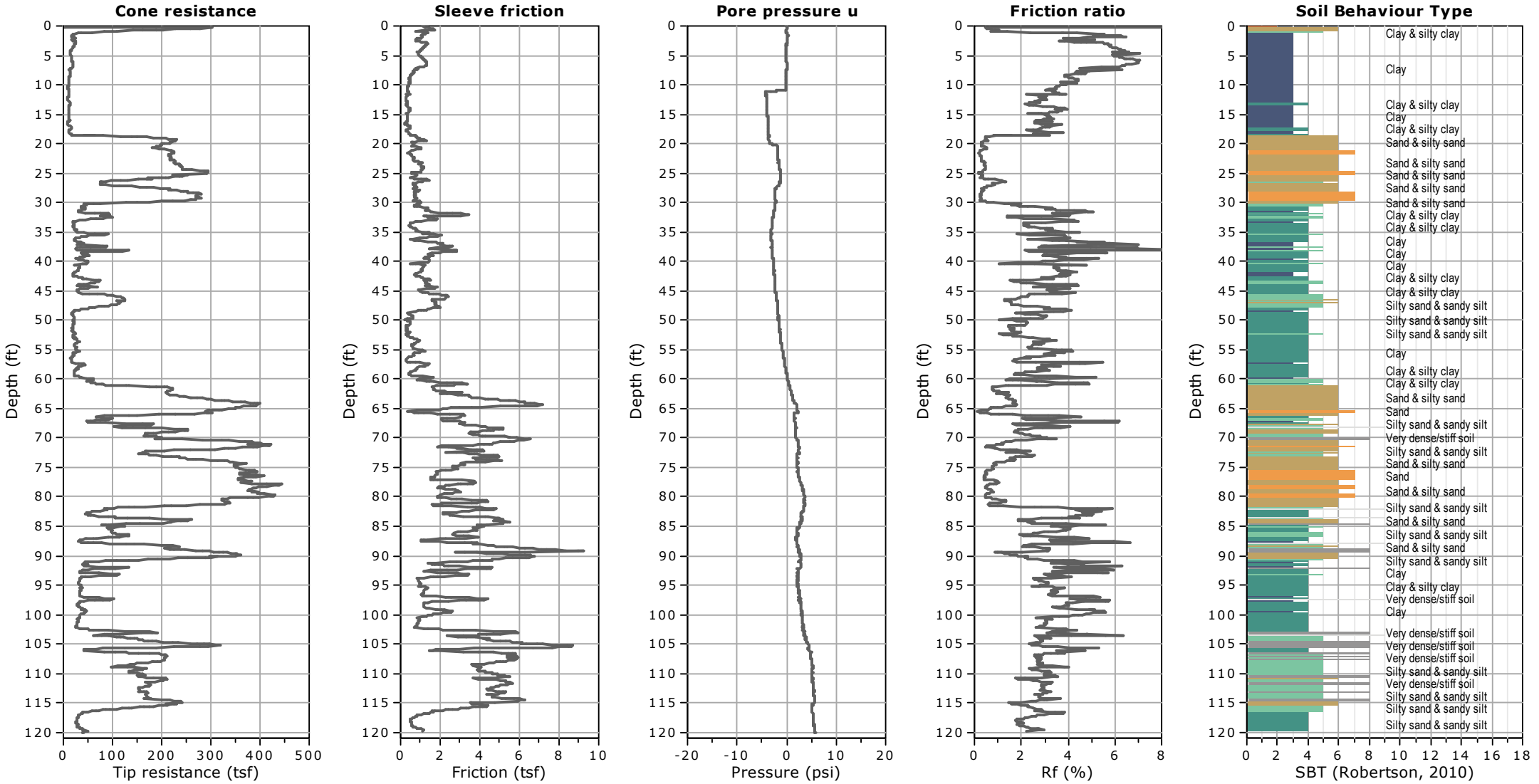
# APPENDIX B

# CPTs
# THIS INVESTIGATION

**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

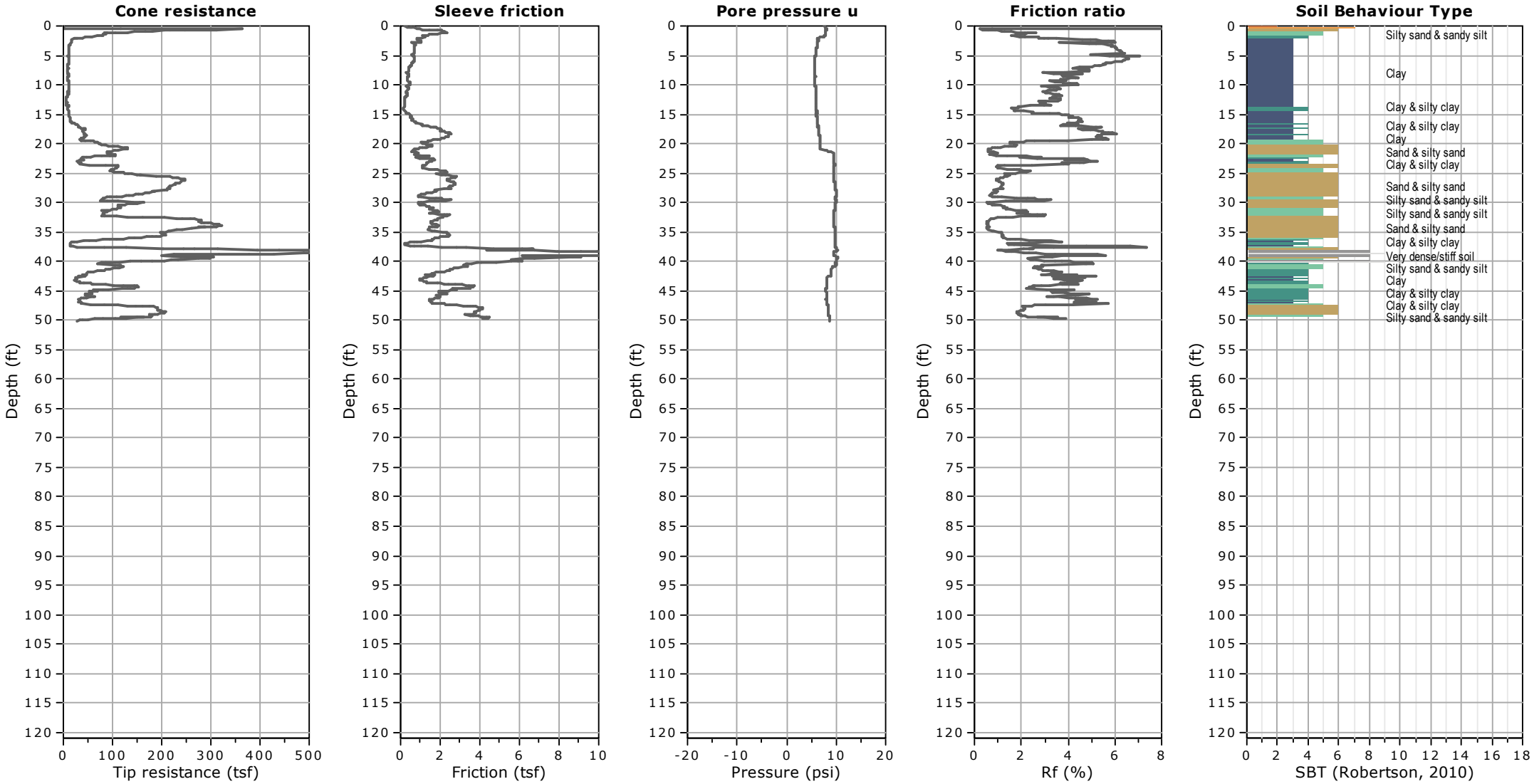
**CPT-1**
Total depth: 120.16 ft, Date: 4/14/2021



**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

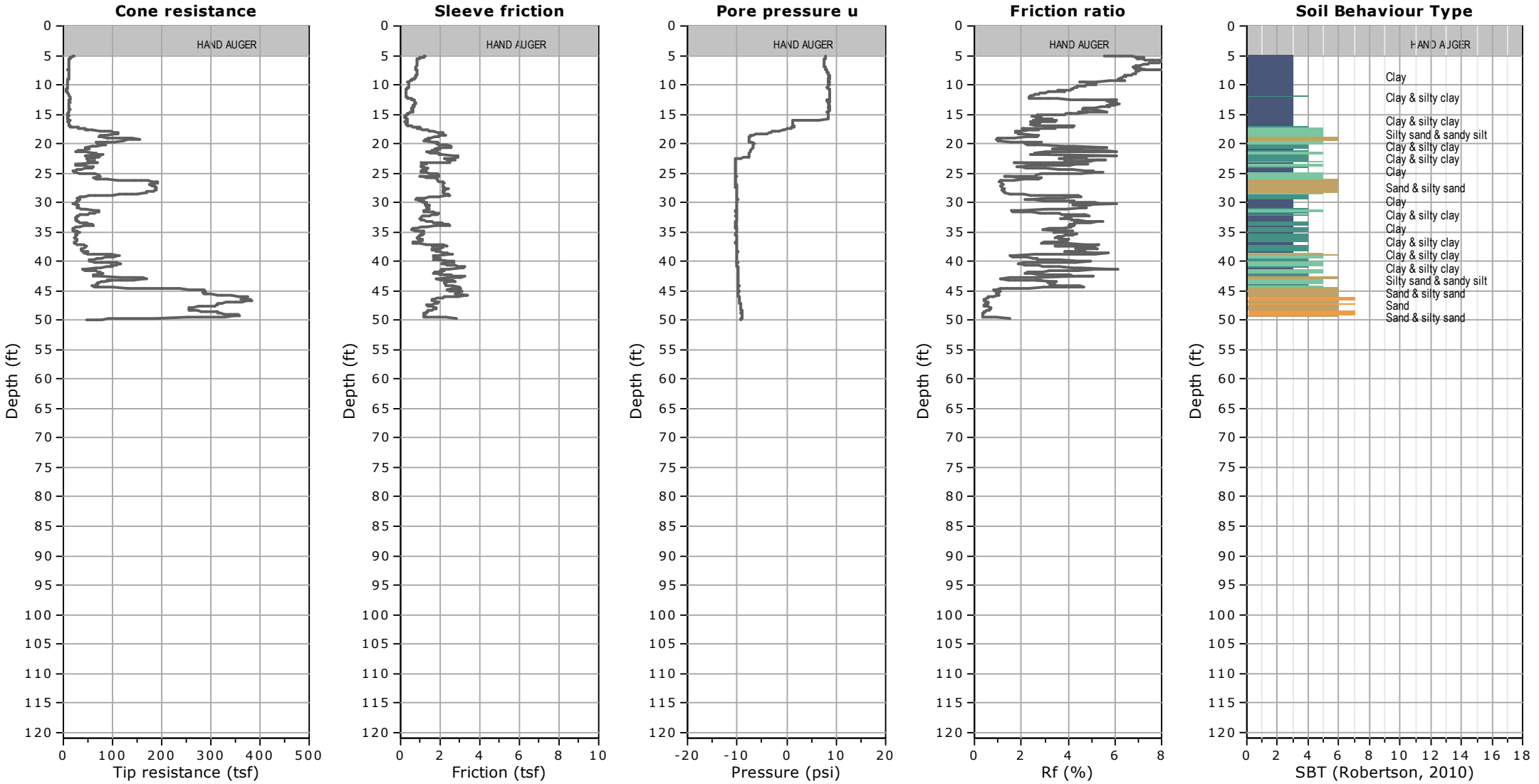
**CPT-2**
Total depth: 50.11 ft, Date: 4/14/2021



**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

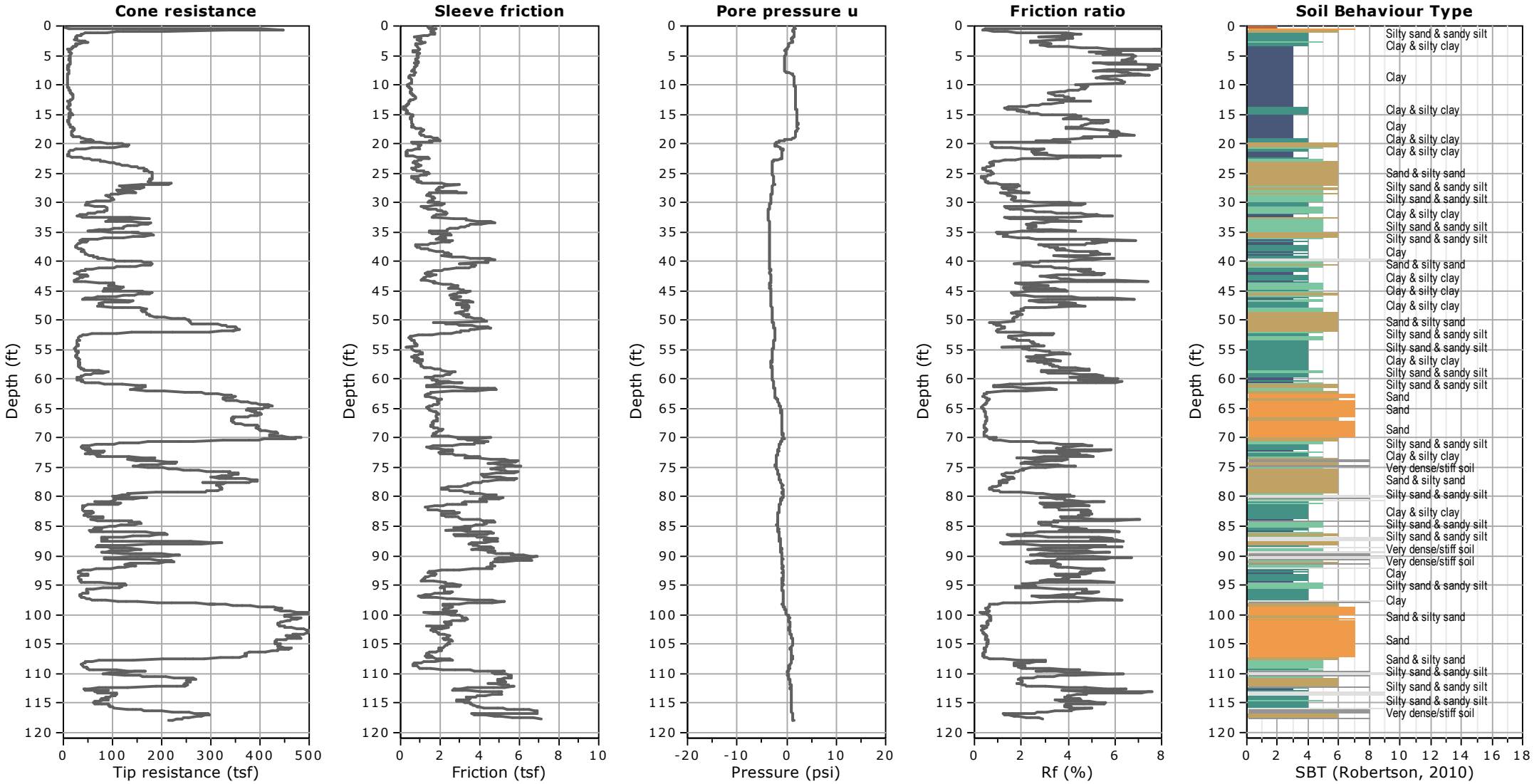
**CPT-3**
Total depth: 50.02 ft, Date: 4/14/2021



**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

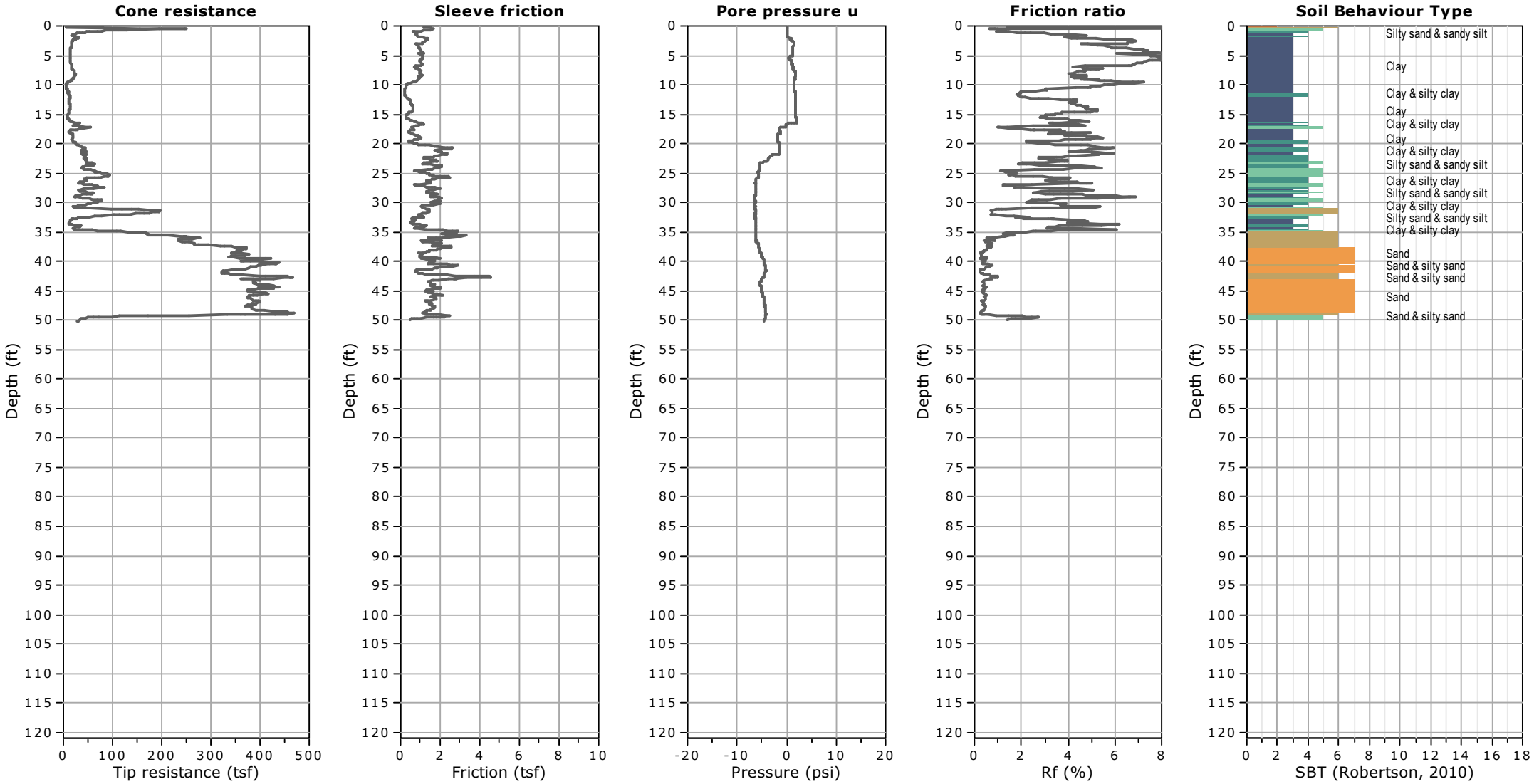
**CPT-4**
Total depth: 118.08 ft, Date: 4/14/2021



**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

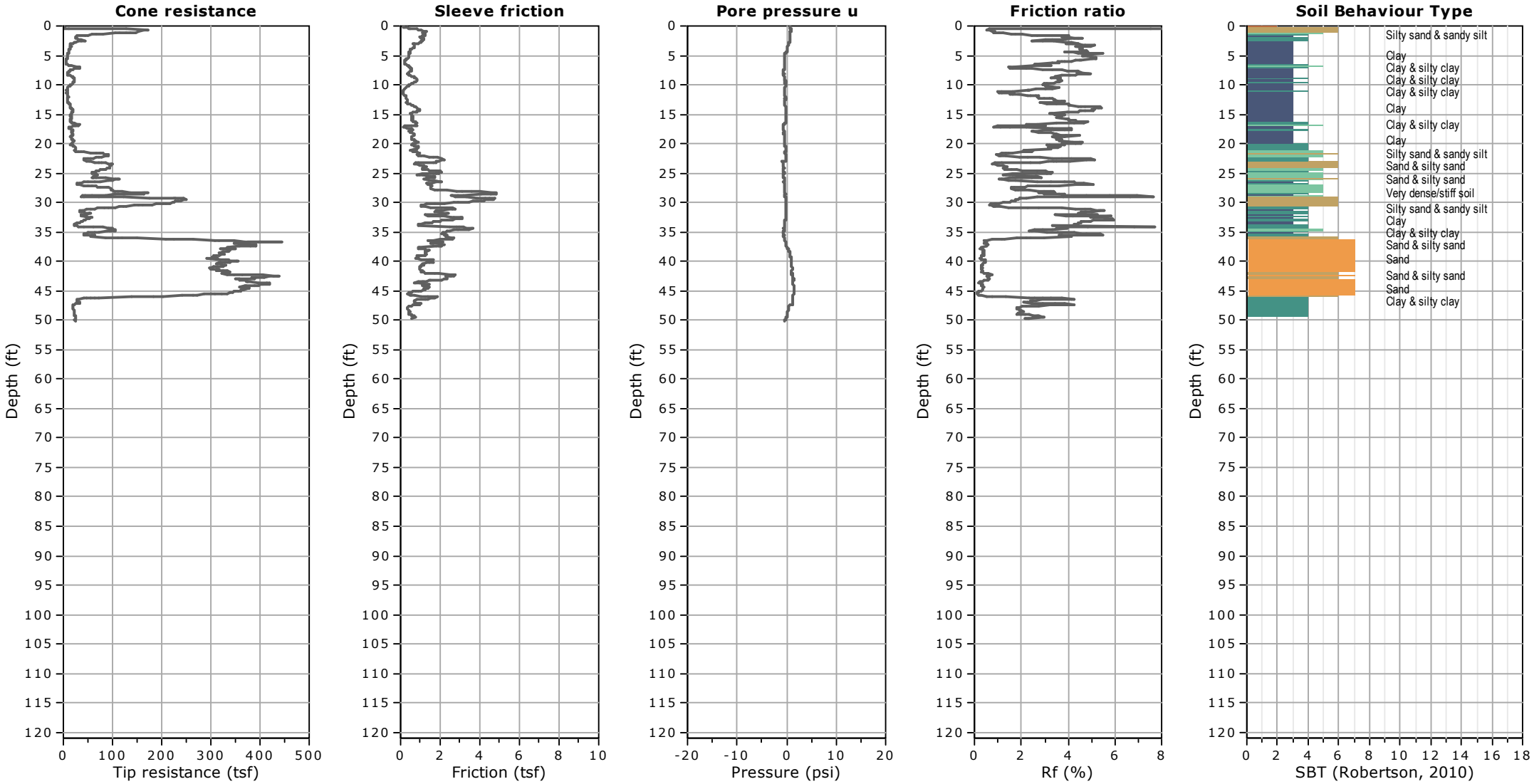
**CPT-5**
Total depth: 50.26 ft, Date: 4/14/2021



**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **NMG Geotechnical / South Coast Plaza**
**Location:** **Costa Mesa, CA**

**CPT-6**
Total depth: 50.09 ft, Date: 4/14/2021



**Kehoe Testing & Engineering**
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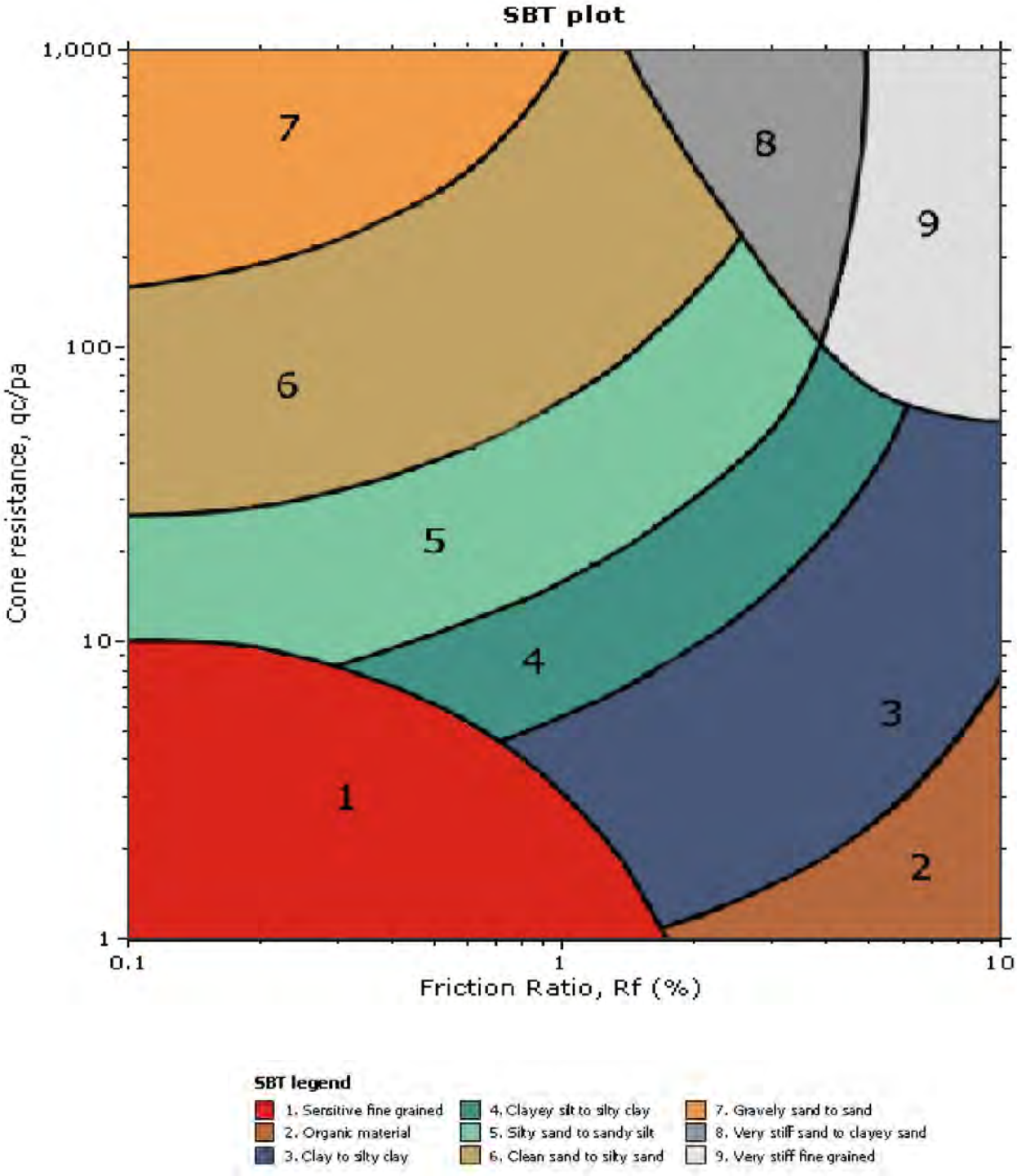
steve@kehoetesting.com
www.kehoetesting.com



NMG Geotechnical
South Coast Plaza
Costa Mesa, CA

CPT Shear Wave Measurements

| Location | Tip Depth (ft) | Geophone Depth (ft) | Travel Distance (ft) | S-Wave Arrival (msec) | S-Wave Velocity from Surface (ft/sec) | Interval S-Wave Velocity (ft/sec) |
|---|---|---|---|---|---|---|
| CPT-1 | 5.15 | 4.15 | 4.61 | 4.14 | 1113 | |
| | 10.20 | 9.20 | 9.41 | 15.96 | 590 | 407 |
| | 15.12 | 14.12 | 14.26 | 27.38 | 521 | 424 |
| | 20.05 | 19.05 | 19.15 | 36.18 | 529 | 556 |
| | 25.16 | 24.16 | 24.24 | 42.70 | 568 | 780 |
| | 30.22 | 29.22 | 29.29 | 48.04 | 610 | 945 |
| | 35.37 | 34.37 | 34.43 | 53.64 | 642 | 918 |
| | 40.22 | 39.22 | 39.27 | 59.20 | 663 | 871 |
| | 45.14 | 44.14 | 44.19 | 65.20 | 678 | 819 |
| | 50.10 | 49.10 | 49.14 | 70.66 | 695 | 908 |
| | 55.18 | 54.18 | 54.22 | 75.80 | 715 | 988 |
| | 60.30 | 59.30 | 59.33 | 81.56 | 727 | 888 |
| | 65.26 | 64.26 | 64.29 | 86.20 | 746 | 1068 |
| | 70.14 | 69.14 | 69.17 | 90.34 | 766 | 1178 |
| | 75.20 | 74.20 | 74.23 | 95.16 | 780 | 1049 |
| | 80.12 | 79.12 | 79.15 | 99.26 | 797 | 1200 |
| | 85.20 | 84.20 | 84.22 | 103.50 | 814 | 1198 |
| | 90.03 | 89.03 | 89.05 | 107.92 | 825 | 1092 |
| | 95.10 | 94.10 | 94.12 | 113.16 | 832 | 967 |
| | 100.16 | 99.16 | 99.18 | 118.40 | 838 | 965 |
| | 105.12 | 104.12 | 104.14 | 124.08 | 839 | 873 |
| | 110.07 | 109.07 | 109.09 | 127.78 | 854 | 1338 |
| | 115.03 | 114.03 | 114.05 | 132.12 | 863 | 1143 |
| | 120.11 | 119.11 | 119.13 | 136.40 | 873 | 1187 |

Shear Wave Source Offset - 2 ft

S-Wave Velocity from Surface = Travel Distance/S-Wave Arrival
Interval S-Wave Velocity = (Travel Dist2-Travel Dist1)/(Time2-Time1)

NMG Geotechnical
South Coast Plaza
Costa Mesa, CA

CPT Shear Wave Measurements

| Location | Tip Depth (ft) | Geophone Depth (ft) | Travel Distance (ft) | S-Wave Arrival (msec) | S-Wave Velocity from Surface (ft/sec) | Interval S-Wave Velocity (ft/sec) |
|---|---|---|---|---|---|---|
| CPT-4 | 5.09 | 4.09 | 4.55 | 4.18 | 1089 | |
| | 10.10 | 9.10 | 9.32 | 15.96 | 584 | 404 |
| | 15.12 | 14.12 | 14.26 | 26.24 | 543 | 481 |
| | 20.08 | 19.08 | 19.18 | 33.48 | 573 | 680 |
| | 25.03 | 24.03 | 24.11 | 39.92 | 604 | 765 |
| | 30.12 | 29.12 | 29.19 | 46.04 | 634 | 829 |
| | 35.10 | 34.10 | 34.16 | 51.48 | 664 | 914 |
| | 40.09 | 39.09 | 39.14 | 56.62 | 691 | 969 |
| | 45.14 | 44.14 | 44.19 | 61.70 | 716 | 993 |
| | 50.03 | 49.03 | 49.07 | 65.96 | 744 | 1147 |
| | 60.10 | 59.10 | 59.13 | 77.72 | 761 | 856 |
| | 65.09 | 64.09 | 64.12 | 82.64 | 776 | 1014 |
| | 70.11 | 69.11 | 69.14 | 87.56 | 790 | 1020 |
| | 75.13 | 74.13 | 74.16 | 92.48 | 802 | 1020 |
| | 80.05 | 79.05 | 79.08 | 96.80 | 817 | 1139 |
| | 85.24 | 84.24 | 84.26 | 101.80 | 828 | 1038 |
| | 90.06 | 89.06 | 89.08 | 106.84 | 834 | 956 |
| | 95.14 | 94.14 | 94.16 | 111.64 | 843 | 1058 |
| | 100.10 | 99.10 | 99.12 | 115.80 | 856 | 1192 |
| | 105.02 | 104.02 | 104.04 | 120.12 | 866 | 1139 |
| | 110.14 | 109.14 | 109.16 | 124.40 | 877 | 1196 |
| | 115.12 | 114.12 | 114.14 | 128.04 | 891 | 1368 |
| | 118.01 | 117.01 | 117.03 | 130.84 | 894 | 1032 |

Shear Wave Source Offset - 2 ft

S-Wave Velocity from Surface = Travel Distance/S-Wave Arrival
Interval S-Wave Velocity = (Travel Dist2-Travel Dist1)/(Time2-Time1)

# BORINGS BY OTHERS

# RECORD OF SUBSURFACE EXPLORATION

BORING NO. & LOCATION: 1 - Southwest Building
SURFACE ELEVATION: 101.5
COMPLETION DATE: 2/2/01
FIELD REPRESENTATIVE: Rich Koester

PROJECT: Proposed Morton's Restaurant
PROJECT LOCATION: Plaza Drive, Costa Mesa, California
GILES PROJECT NUMBER: 2G-0102001

GILES ENGINEERING ASSOCIATES, INC.
Milwaukee Los Angeles
Madison Dallas Atlanta
Washington, D.C.

| MATERIAL DESCRIPTION | Feet Below Surface | Sample No. & Type | N | $q_u$ (tsf) | $q_p$ (tsf) | $q_s$ (tsf) | W (%) | PID | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| Dark Brown Silty fine Sand, trace Clay (Fill)-Moist | | 1-AU | -- | | | | | | |
| | | 2-CS | 12 | | | | | BDL | |
| Brown Clayey fine to medium Sand (Fill)-Moist | | 3-CS | 11 | | | | | BDL | |
| Dark Gray fine to medium Sand, trace Silt (Fill)-Moist | 5 | 4-CS | 11 | | 4.5+ | | 27 | BDL | |
| Gray and Brown mottled Silty Clay-Moist | | 5-CS | 9 | | 2.8 | | 30 | BDL | |
| Gray Silty Clay-Moist | 10 | 6-CS | 9 | | | | | BDL | |
| Gray and Brown mottled Silty Clay-Moist | | 7-SS | 8 | 2.5 | 2.3 | | | BDL | |
| Boring terminated at 15 feet | 15 | | | | | | | | |

| WATER OBSERVATION DATA | REMARKS |
|---|---|
| WATER ENCOUNTERED DURING DRILLING: None | CS (California Sampler): N-value does not correlate directly to Standard Penetration Test (SS) |
| WATER LEVEL AFTER REMOVAL: None | |
| CAVE DEPTH AFTER REMOVAL: 13.2 ft. | |
| WATER LEVEL AFTER HOURS: | |
| CAVE DEPTH AFTER HOURS | |

# RECORD OF SUBSURFACE EXPLORATION

BORING NO. & LOCATION: 2 - Northwest Building
SURFACE ELEVATION: 101.6
COMPLETION DATE: 2/2/01
FIELD REPRESENTATIVE: Rich Koester

PROJECT: Proposed Morton's Restaurant
PROJECT LOCATION: Plaza Drive, Costa Mesa, California
GILES PROJECT NUMBER: 2G-0102001

GILES ENGINEERING ASSOCIATES, INC.
Milwaukee Los Angeles Madison Dallas Atlanta Washington, D.C.

| MATERIAL DESCRIPTION | Feet Below Surface | Sample No. & Type | N | $q_u$ (tsf) | $q_p$ (tsf) | $q_s$ (tsf) | W (%) | PID | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| Brown Clayey fine Sand, some Gravel (Possible Fill)-Very Moist | | 1-AU | -- | | | | | | |
| | | 2-SS | 7 | | 1.0 | 0.5 | 28 | BDL | |
| Dark Brown and Gray mottled Silty Clay-Moist | | | | | | | | | |
| | | 3-SS | 8 | 4.0 | 3.2 | | 27 | BDL | |
| | 5 | | | | | | | | |
| Brown and Gray mottled Silty Clay-Moist | | 4-SS | 9 | 2.5 | 2.1 | | 33 | BDL | |
| Gray Silty Clay-Moist | | 5-SS | 6 | 1.9 | 1.7 | | 34 | BDL | |
| | 10 | | | | | | | | |
| Gray and Brown mottled Silty Clay, little fine Sand-Moist | | | | | | | | | |
| | | 6-SS | 9 | 2.9 | 2.8 | | 16 | BDL | |
| | 15 | | | | | | | | |
| Boring terminated at 15 feet | | | | | | | | | |

| WATER OBSERVATION DATA | REMARKS |
|---|---|
| WATER ENCOUNTERED DURING DRILLING: None | |
| WATER LEVEL AFTER REMOVAL: None | |
| CAVE DEPTH AFTER REMOVAL: 13.1 ft. | |
| WATER LEVEL AFTER HOURS: | |
| CAVE DEPTH AFTER HOURS: | |

SUBSURFACE EXPLORATION 2G0102001.GPJ GIL_CORP.GDT 2/16/01

# RECORD OF SUBSURFACE EXPLORATION

BORING NO. & LOCATION: 3 - Northeast Building
SURFACE ELEVATION: 102.1
COMPLETION DATE: 2/2/01
FIELD REPRESENTATIVE: Rich Koester

PROJECT: Proposed Morton's Restaurant
PROJECT LOCATION: Plaza Drive, Costa Mesa, California
GILES PROJECT NUMBER: 2G-0102001

GILES ENGINEERING ASSOCIATES, INC.
Milwaukee Los Angeles
Madison Dallas Atlanta
Washington, D.C.

| MATERIAL DESCRIPTION | Feet Below Surface | Sample No. & Type | N | $q_u$ (tsf) | $q_p$ (tsf) | $q_s$ (tsf) | W (%) | PID | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| Brown fine to medium Sand, little Clay (Fill)-Moist | | 1-AU | -- | | | | | | |
| | | 2-CS | 15 | | | | | BDL | |
| Dark Brown Silty fine to medium Sand (Fill)-Moist | | 3-CS | 13 | | | | | BDL | |
| | 5 | 4-CS | 15 | | 3.7 | | 31 | BDL | |
| Gray and Brown mottled Silty Clay-Moist | | 5-CS | 13 | | 3.0 | | 34 | BDL | |
| | | 6-CS | 7 | | 1.8 | 0.8 | 34 | BDL | |
| Dark Gray Silty Clay-Moist | 10 | | | | | | | | |
| Brown and Gray mottled Silty Clay, trace fine Sand-Moist | | 7-SS | 8 | 2.5 | 3.0 | | 18 | BDL | |
| | 15 | | | | | | | | |
| Boring terminated at 15 feet | | | | | | | | | |

| | WATER OBSERVATION DATA |
|---|---|
| ▽ | WATER ENCOUNTERED DURING DRILLING: None |
| ▼ | WATER LEVEL AFTER REMOVAL: None |
| | CAVE DEPTH AFTER REMOVAL: 13.1 ft. |
| ▼ | WATER LEVEL AFTER HOURS: |
| | CAVE DEPTH AFTER HOURS: |

**REMARKS**

CS (California Sampler): N-value does not correlate directly to Standard Penetration Test (SS).

# RECORD OF SUBSURFACE EXPLORATION

BORING NO. & LOCATION: 4 - Southeast Building
SURFACE ELEVATION: 101.5
COMPLETION DATE: 2/2/01
FIELD REPRESENTATIVE: Rich Koester

PROJECT: Proposed Morton's Restaurant
PROJECT LOCATION: Plaza Drive, Costa Mesa, California
GILES PROJECT NUMBER: 2G-0102001

GILES ENGINEERING ASSOCIATES, INC.
Milwaukee Los Angeles
Madison Dallas Atlanta
Washington, D.C.

| MATERIAL DESCRIPTION | Feet Below Surface | Sample No. & Type | N | $q_u$ (tsf) | $q_p$ (tsf) | $q_s$ (tsf) | w (%) | PID | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| Dark Brown Silty fine Sand (Fill)-Moist | | 1-AU | -- | | | | | | |
| Brown fine to medium Sand, trace Clay (Fill)-Moist | | 2-SS | 8 | | | | | BDL | |
| | | 3-SS | 11 | 4.1 | 4.2 | | 27 | BDL | |
| Dark Gray Silty Clay-Moist | 5 | | | | | | | | |
| | | 4-SS | 9 | | 3.4 | | 28 | BDL | |
| Gray and Brown mottled Silty Clay-Moist | | | | | | | | | |
| Dark Gray Silty Clay-Moist | | 5-SS | 7 | 2.6 | 2.2 | | 26 | BDL | |
| | 10 | | | | | | | | |
| Gray-Brown Silty Clay, little fine Sand-Moist | | 6-SS | 10 | 2.2 | 3.4 | | 17 | BDL | |
| Boring terminated at 15 feet | 15 | | | | | | | | |

| | WATER OBSERVATION DATA | REMARKS |
|---|---|---|
| ▽ | WATER ENCOUNTERED DURING DRILLING: None | |
| ▽ | WATER LEVEL AFTER REMOVAL: None | |
| | CAVE DEPTH AFTER REMOVAL: 13.0 ft. | |
| ▼ | WATER LEVEL AFTER HOURS. | |
| | CAVE DEPTH AFTER HOURS. | |

SUBSURFACE EXPLORATION 2G0102001.GPJ GIL_CORP.GDT 2/16/01

# RECORD OF SUBSURFACE EXPLORATION

| | |
|---|---|
| BORING NO. & LOCATION: 5 - Center of Building | PROJECT: Proposed Morton's Restaurant |
| SURFACE ELEVATION: 102.0 | PROJECT LOCATION: Plaza Drive, Costa Mesa, California |
| COMPLETION DATE: 2/2/01 | |
| FIELD REPRESENTATIVE: Rich Koester | GILES PROJECT NUMBER: 2G-0102001 |

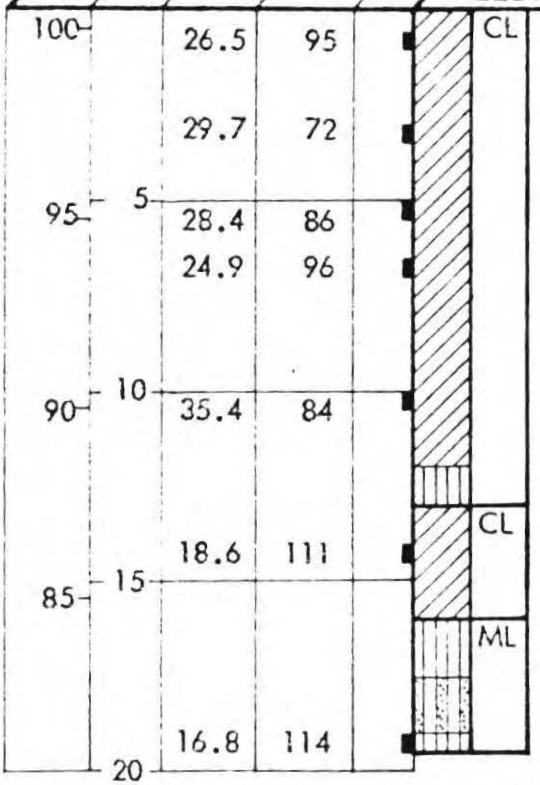
GILES ENGINEERING ASSOCIATES, INC.
Milwaukee Los Angeles
Madison Dallas Atlanta
Washington, D.C.

| MATERIAL DESCRIPTION | Feet Below Surface | Sample No. & Type | N | $q_u$ (tsf) | $q_p$ (tsf) | $q_s$ (tsf) | w (%) | PID | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| Dark Brown Clayey Silt, little fine Sand, trace Organic Matter (Fill)-Moist | | 1-AU | -- | | | | | | |
| | | 2-SS | 5 | | | | | BDL | |
| Brown Clayey fine to medium Sand (Fill)-Moist | | 3-SS | 13 | | 4.4 | | 24 | BDL | See Figure 2 |
| Dark Gray-Brown Silty Clay-Moist | 5 | | | | | | | | |
| Gray and Brown mottled Silty Clay-Moist | | 4-SS | 6 | 2.3 | 2.5 | | 33 | BDL | |
| Dark Gray Silty Clay-Moist | | 5-SS | 6 | 2.9 | 2.4 | | 35 | BDL | |
| | 10 | | | | | | | | |
| Gray and Brown mottled Silty Clay-Moist | | 6-SS | 8 | 2.2 | 2.8 | | 20 | BDL | |
| | 15 | | | | | | | | |
| Gray and Brown mottled Silty Clay, little fine Sand-Moist | | 7-SS | 3 | 1.7 | 1.3 | 0.6 | 20 | BDL | |
| | 20 | | | | | | | | |
| Brown fine to medium Sand-Wet | | 8-SS | 4 | | | | | BDL | P200 = 7% |
| | 25 | | | | | | | | |
| Brown and Gray Silt, some fine Sand-Moist | | 9-SS | 11 | | | | | BDL | P200 = 60% |
| | 30 | | | | | | | | |
| Brown and Gray Silty Clay-Moist | | 10-SS | 6 | | | | 25 | BDL | |
| | 35 | | | | | | | | |
| Brown and Gray mottled Clayey Silt, little fine Sand, trace Gravel-Moist | | 11-SS | 13 | | | | 24 | BDL | |
| | 40 | | | | | | | | |
| Brown and Gray mottled Clayey Silt, some fine Sand-Moist | | 12-SS | 12 | | | | 22 | BDL | |
| | 45 | | | | | | | | |
| | | 13-SS | 37 | | | | | BDL | P200 = 12% |
| Brown fine to medium Sand-Moist | 50 | | | | | | | | |
| Boring terminated at 50 feet | | | | | | | | | |

| | WATER OBSERVATION DATA | REMARKS |
|---|---|---|
| ▽ | WATER ENCOUNTERED DURING DRILLING: 19.5 ft. | |
| ▽ | WATER LEVEL AFTER REMOVAL: | |
| | CAVE DEPTH AFTER REMOVAL: | |
| ▼ | WATER LEVEL AFTER HOURS: | |
| ▬ | CAVE DEPTH AFTER HOURS: | |

BORING 1
DATE DRILLED January 11, 1971
EQUIPMENT USED: 24"-Diameter Bucket

ELEVATION 100.4*




SILTY CLAY - dark greyish-brown

Dark grey

Some organic matter

Layer of Clayey Silt - reddish-brown

SILTY CLAY - reddish-brown and grey

CLAYEY SILT - reddish-brown and grey

Layer of Silty Sand

NOTE: Water seepage encountered at 13' and below 17½'. Water level at a depth of 10' 3 hours after completion of drilling. No caving.

Soils classified in accordance with the Unified Soil Classification System.

* Elevations refer to assumed datum; see Plate 1.

LOG OF BORING

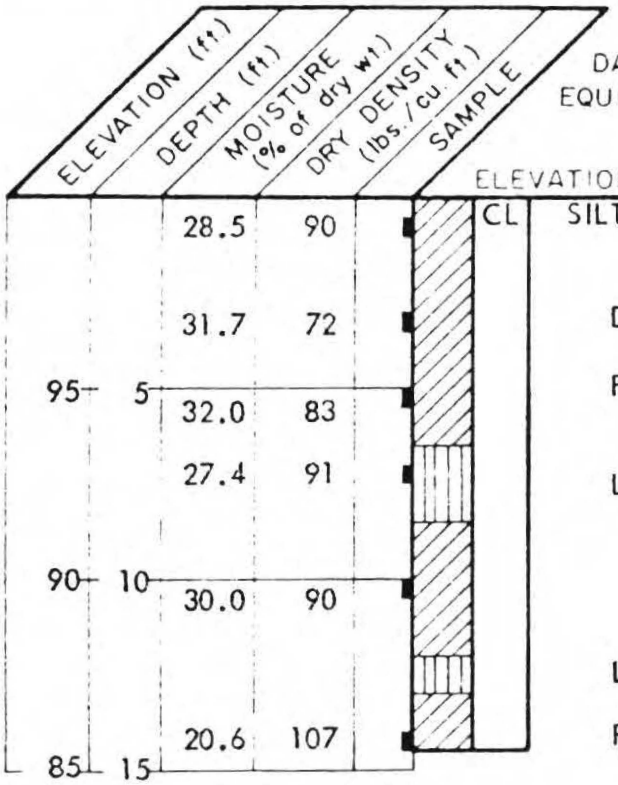
LEROY CRANDALL AND ASSOCIATES

PLATE A-1

BORING 2

DATE DRILLED January 8, 1971

EQUIPMENT USED 24"-Diameter Bucket




NOTE: Slight seepage encountered at 13'. No caving.

LOG OF BORING

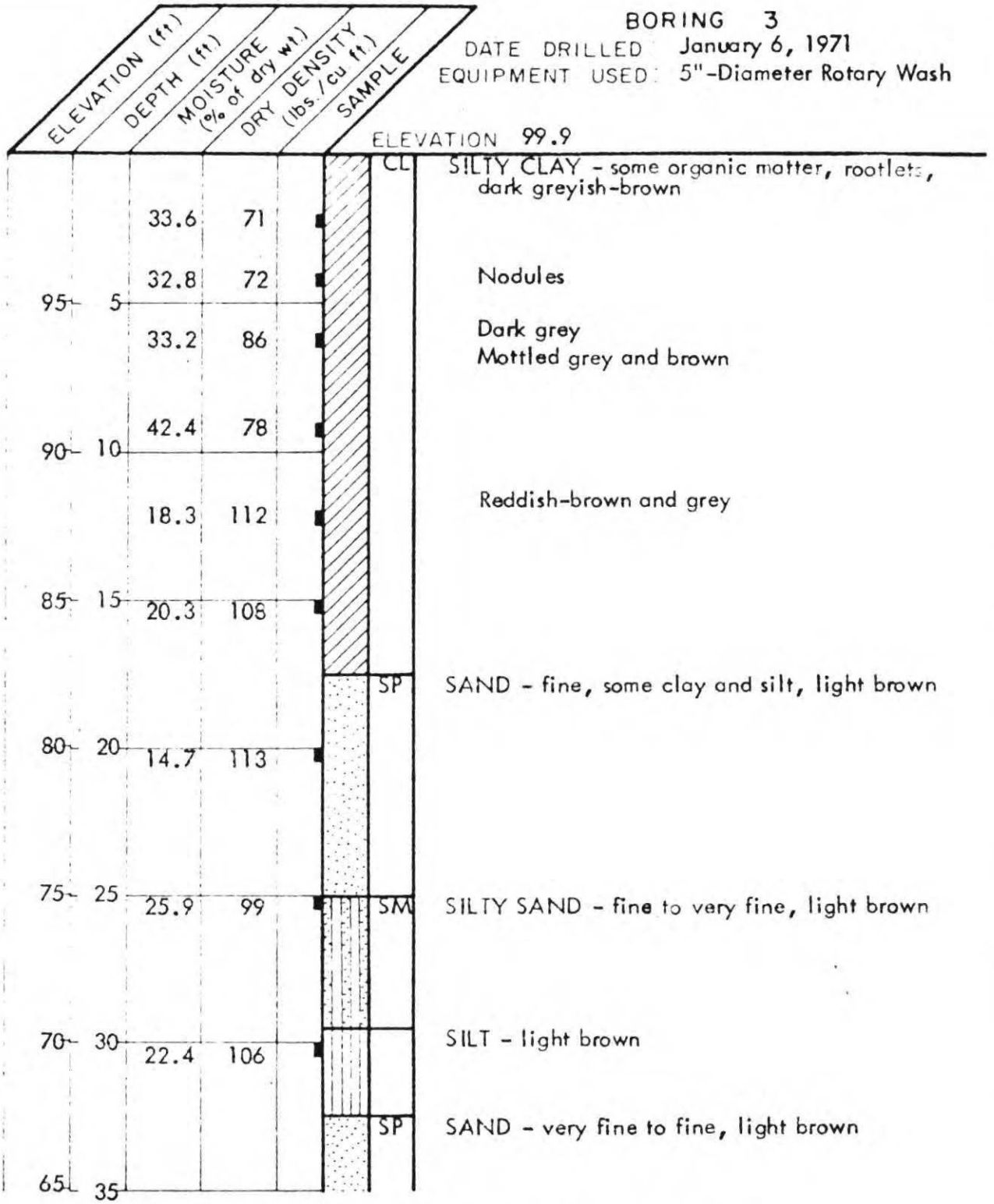
LEROY CRANDALL AND ASSOCIATES

PLATE A-2

BORING 3

DATE DRILLED January 6, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash




(CONTINUED ON FOLLOWING PLATE)

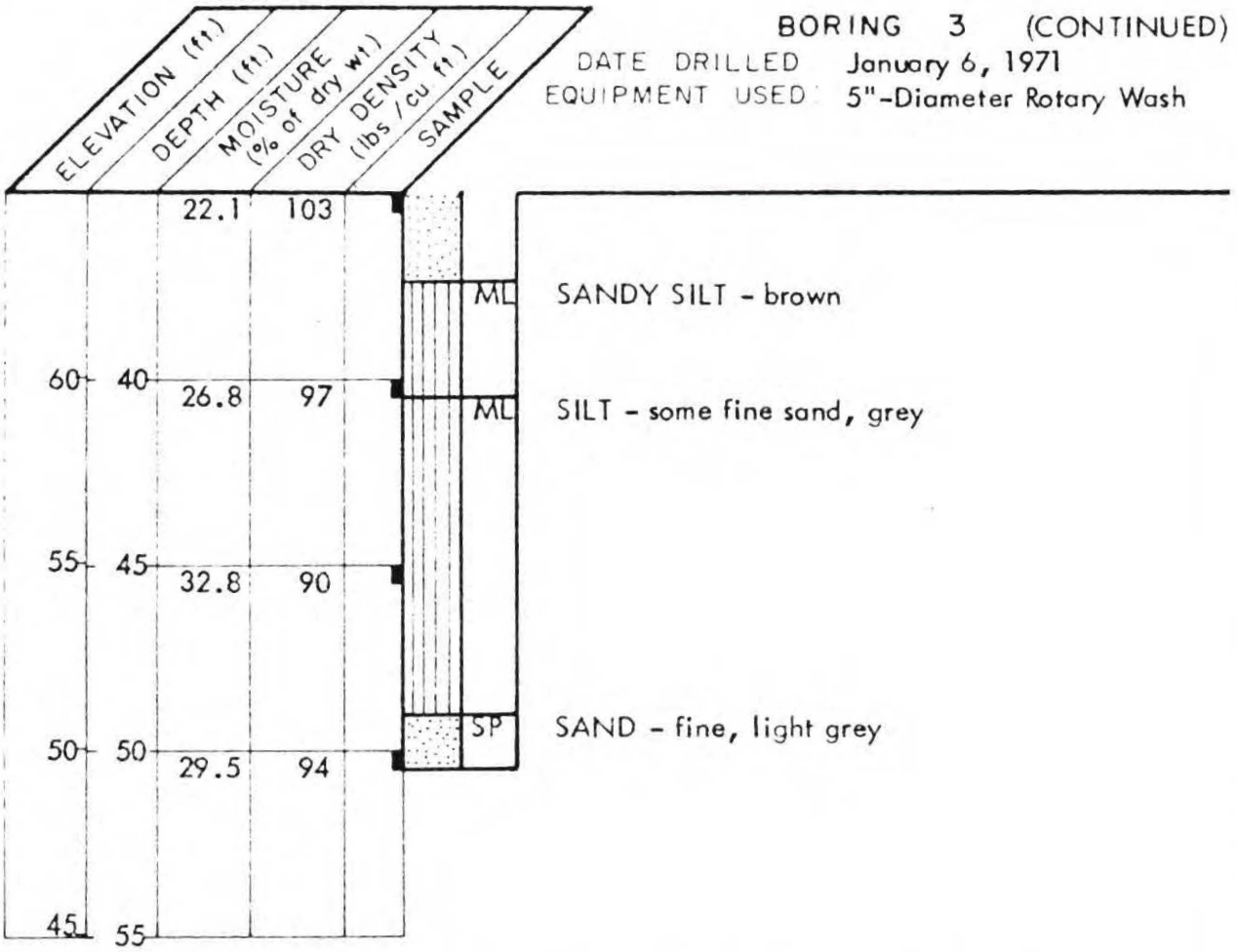
LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 3 (CONTINUED)

DATE DRILLED January 6, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash




NOTE: Water level not established. Drilling mud used in drilling porcess. Boring cased from 7' to 11' due to loss of circulation.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

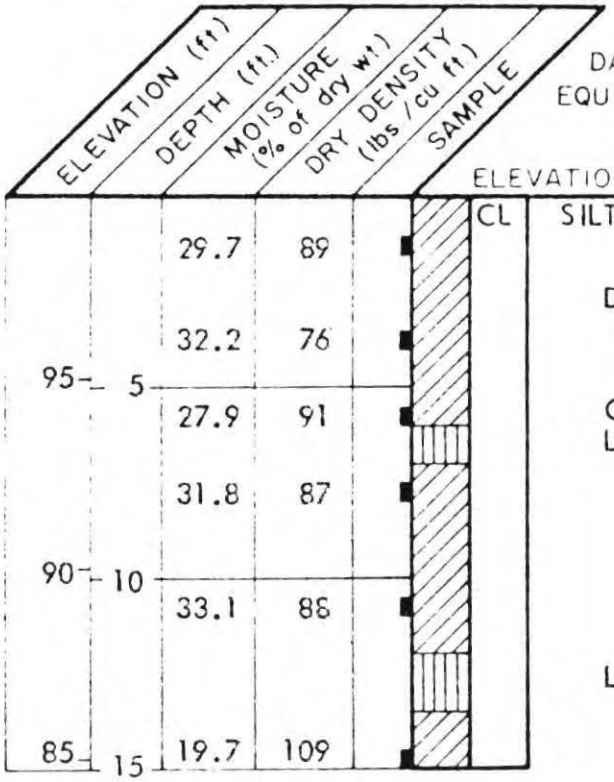
PLATE A-4

BORING 4

DATE DRILLED January 8, 1971

EQUIPMENT USED: 24"-Diameter Bucket

ELEVATION 99.8




SILTY CLAY - dark greyish-brown

Dark grey

Greyish-brown
Layer of Clayey Silt, brown

Layer of Clayey Silt, reddish-brown and grey

NOTE: Water seepage encountered at $12\frac{1}{2}$'. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

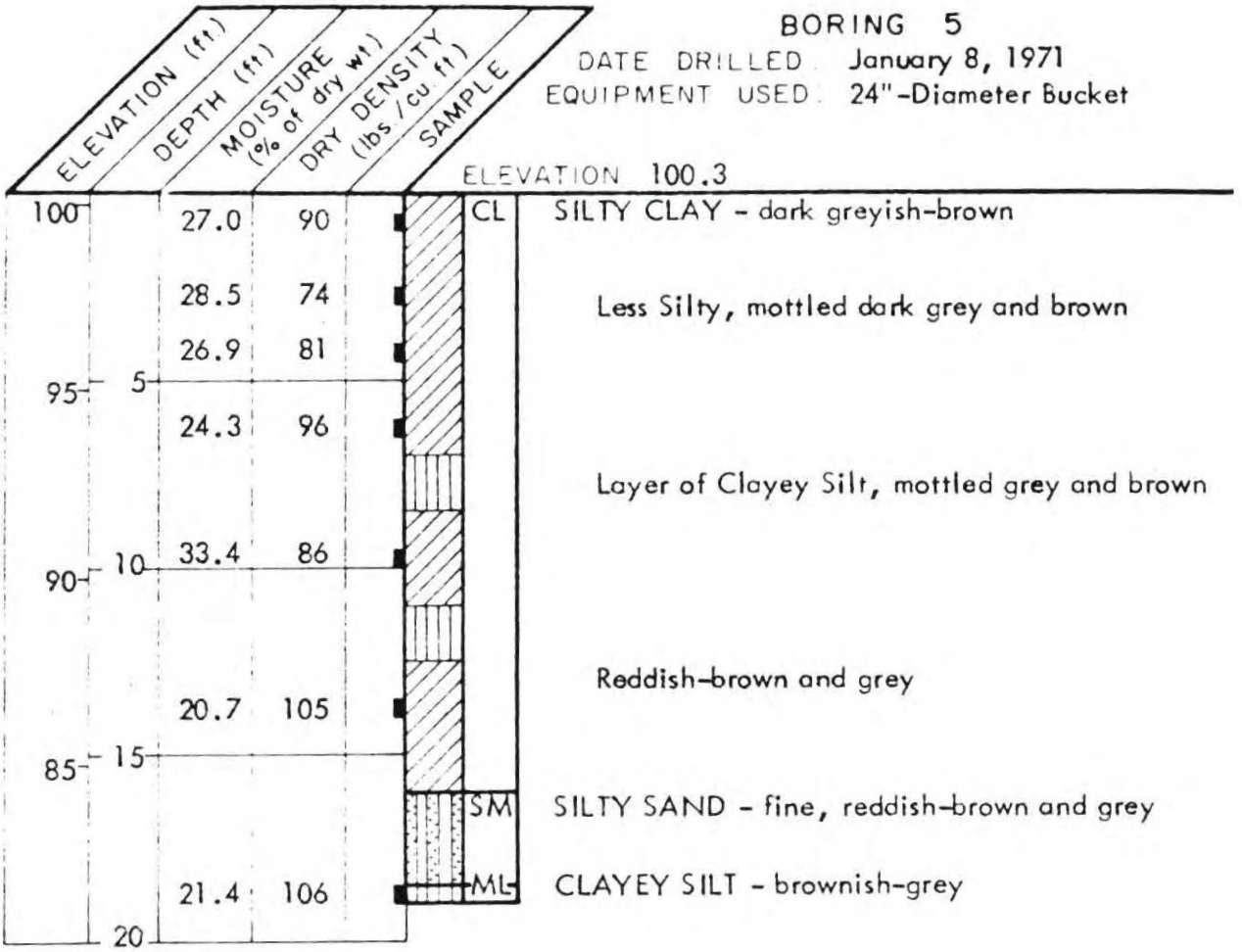
PLATE A-5

BORING 5

DATE DRILLED January 8, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 100.3




NOTE: Slight seepage encountered at 12½'. Water level measured at a depth of 16', 40 minutes after completion of drilling. No caving.

LOG OF BORING

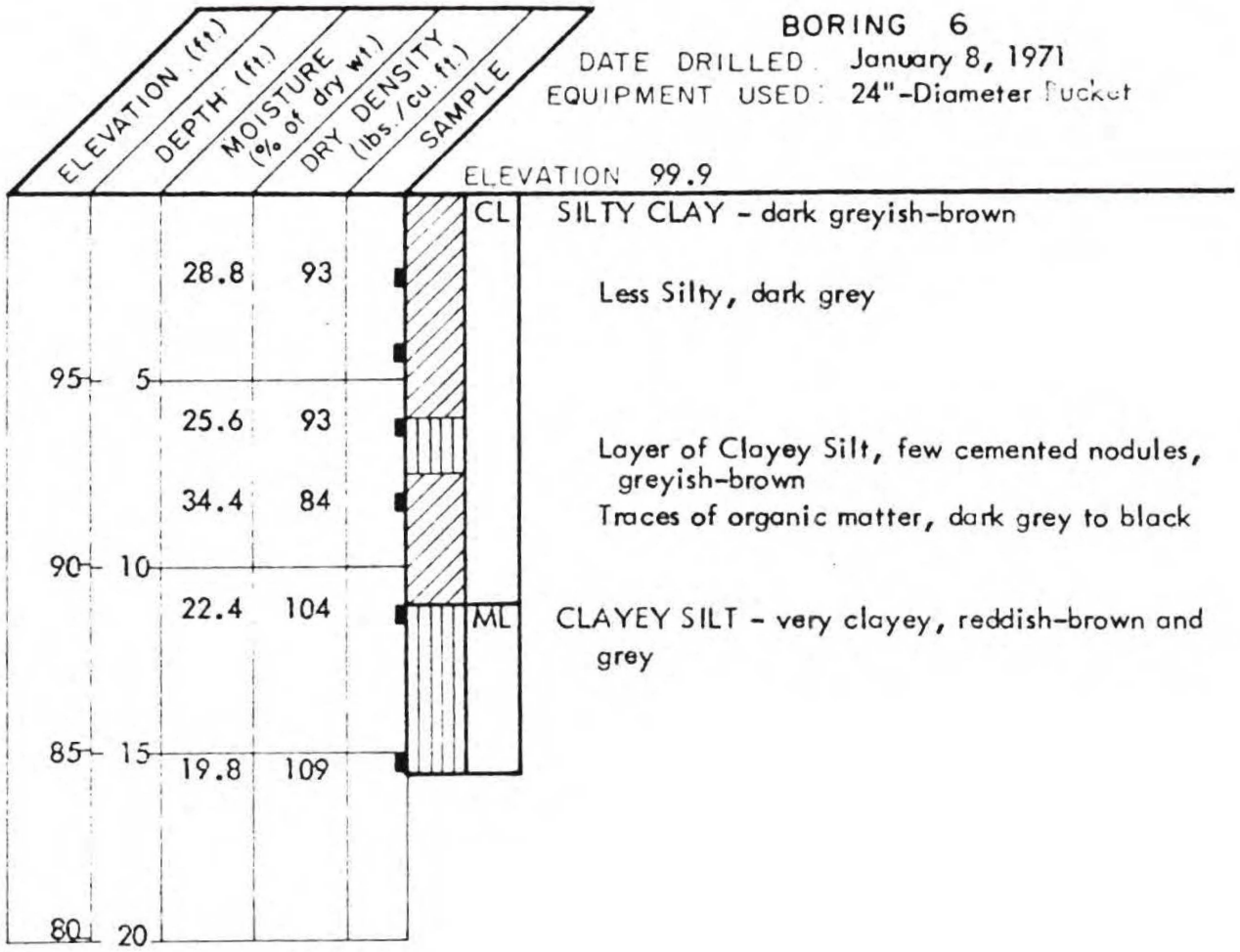
LEROY CRANDALL AND ASSOCIATES

PLATE A-6

BORING 6

DATE DRILLED January 8, 1971

EQUIPMENT USED 24"-Diameter Bucket




NOTE: Slight water seepage encountered at 11'. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-7

BORING 7

DATE DRILLED January 8, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 99.9

| ELEVATION (ft.) | DEPTH (ft.) | MOISTURE (% of dry wt.) | DRY DENSITY (lbs./cu ft.) | SAMPLE | | |
|---|---|---|---|---|---|---|
| | | 28.8 | 91 | | CL | SILTY CLAY - dark greyish-brown |
| | | 33.0 | 73 | | | Less silty, dark grey |
| 95 | 5 | | | | | |
| | | 32.9 | 84 | | | Layer of Clayey Silt |
| | | 32.4 | 88 | | | |
| 90 | 10 | | | | | |
| | | 36.4 | 83 | | ML | CLAYEY SILT - very clayey, reddish-brown and grey |
| 85 | 15 | 21.9 | 106 | | | |
| | | | | | SC | CLAYEY SAND - fine, reddish-brown and grey |
| 80 | 20 | 16.5 | 111 | | SP | SAND - fine, reddish-brown and grey |

NOTE: Water seepage encountered at 11', 12', and 13½'. Water level at depth of 9' 5½ hours after completion of drilling.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-8

BORING 8

DATE DRILLED January 7, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash

ELEVATION 99.8

| ELEVATION (ft.) | DEPTH (ft.) | MOISTURE (% of dry wt.) | DRY DENSITY (lbs./cu. ft.) | SAMPLE | | |
|---|---|---|---|---|---|---|
| | | 30.3 | 89 | ■ | CL | SILTY CLAY - rootlets, some organic matter, dark greyish-brown |
| | | 26.8 | 93 | ■ | | Mottled grey and brown |
| 95 | 5 | 23.8 | 94 | ■ | | Very silty |
| | | 39.4 | 78 | ■ | | Layer of Clay - grey |
| 90 | 10 | 23.4 | 103 | ■ | | Light brown |
| | | | | | | Cemented nodules |
| 85 | 15 | 24.8 | 99 | ■ | | |
| | | | | | SP | SAND - fine to very fine, some silt, greyish-brown |
| 80 | 20 | 23.9 | 101 | ■ | | |
| 75 | 25 | 22.1 | 104 | ■ | | |

(CONTINUED ON FOLLOWING PLATE)

LOG OF BORING

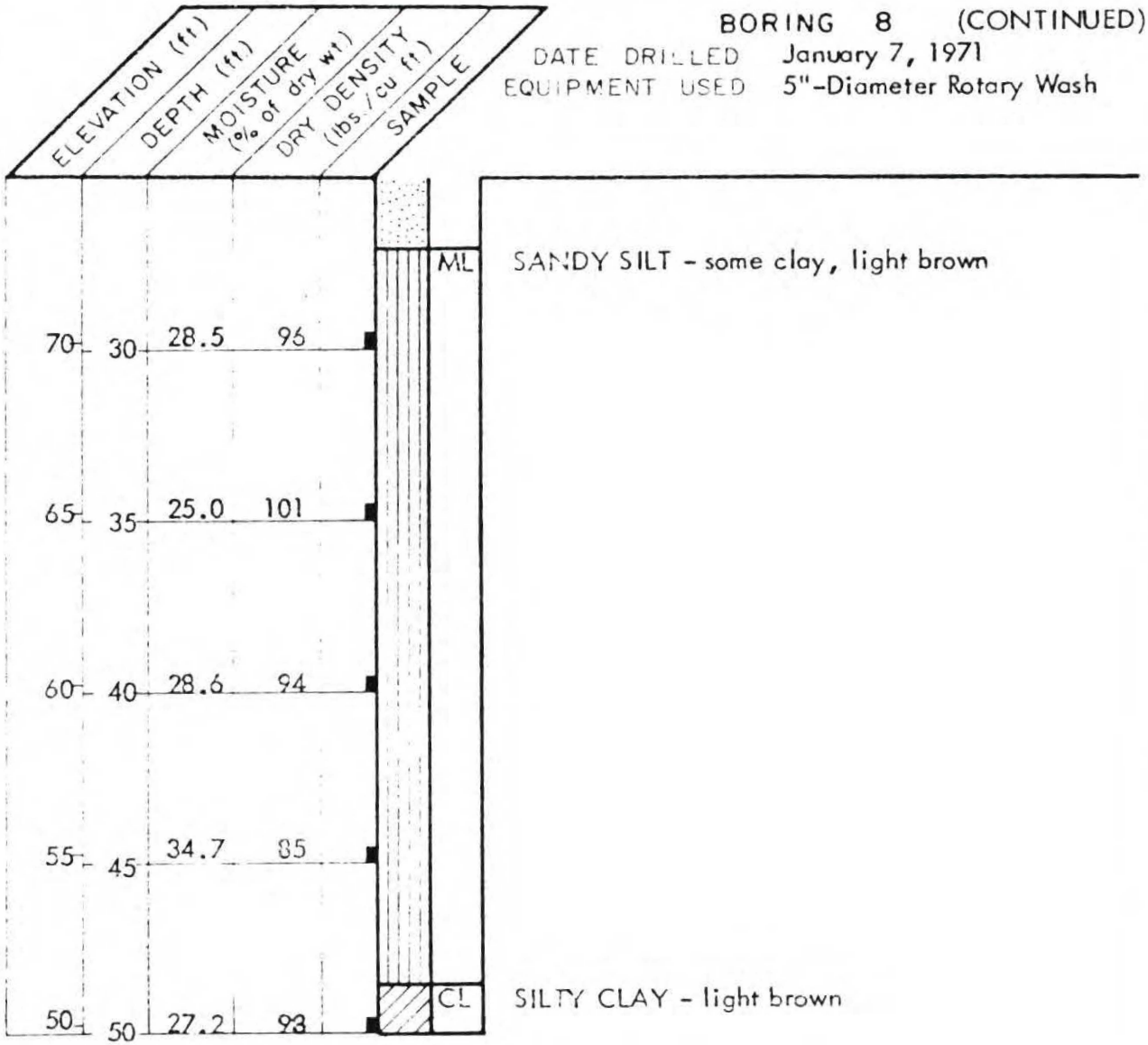
LEROY CRANDALL AND ASSOCIATES

PLATE A-9

BORING 8 (CONTINUED)

DATE DRILLED January 7, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash



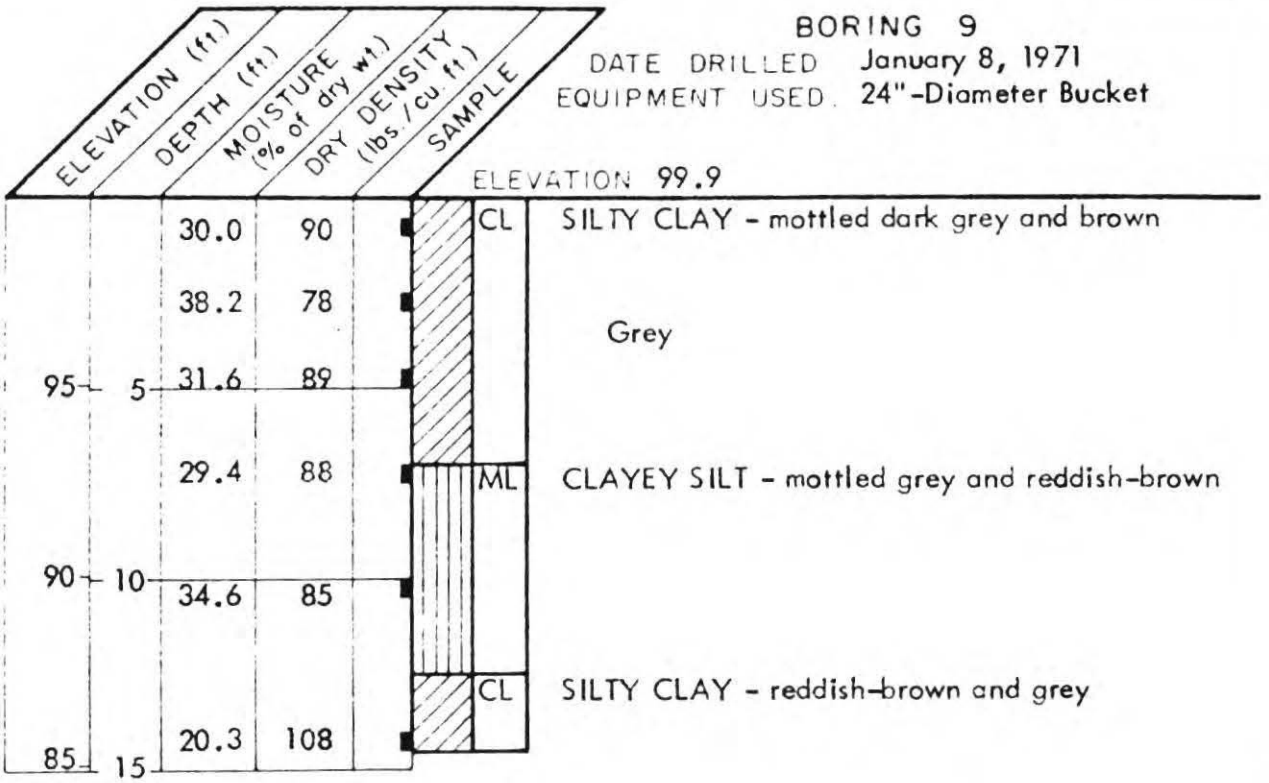

NOTE: Water level not established. Drilling mud used in drilling process. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-10

BORING 9
DATE DRILLED January 8, 1971
EQUIPMENT USED 24"-Diameter Bucket



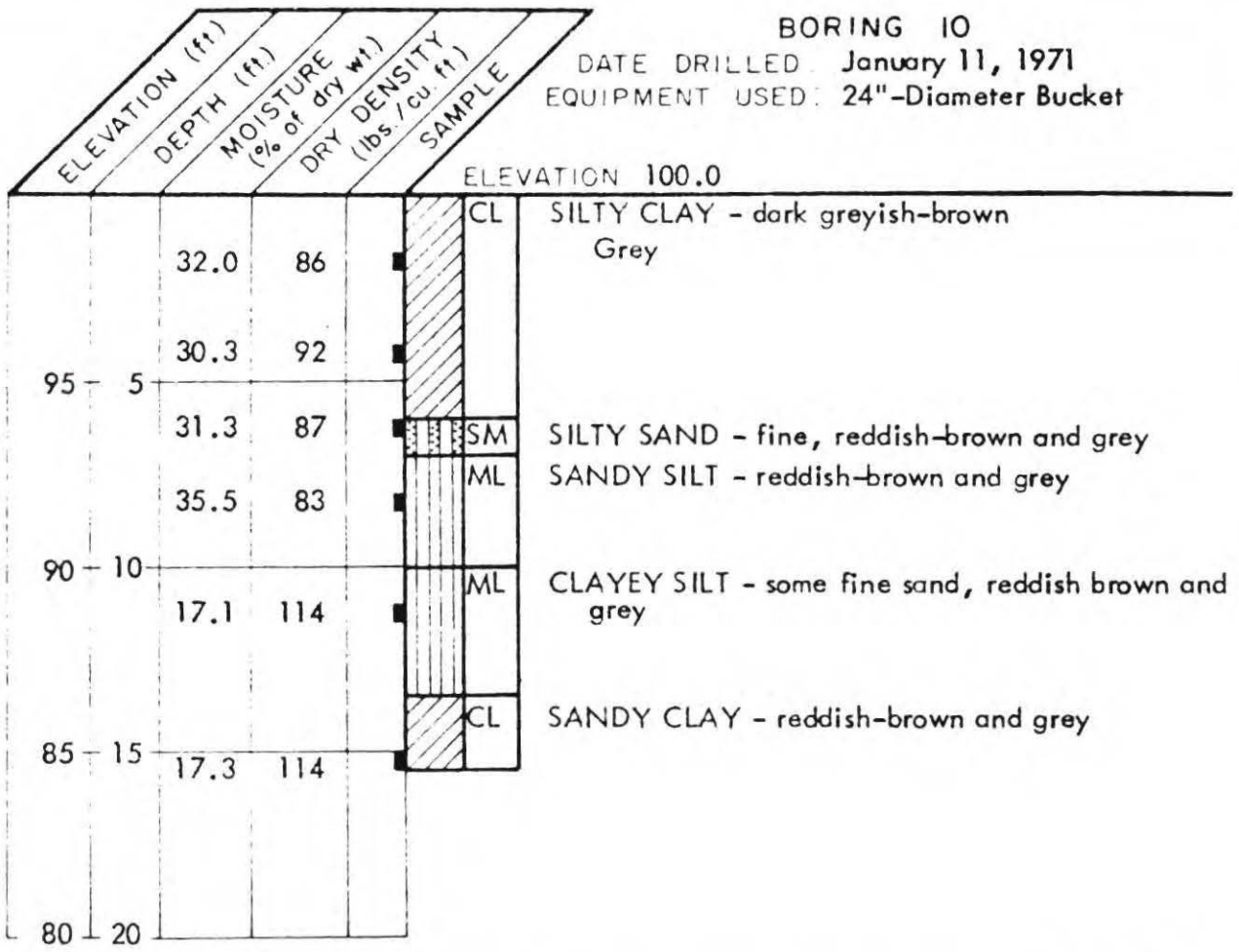

NOTE: Slight water seepage encountered at $12\frac{1}{2}$'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-11

BORING 10
DATE DRILLED January 11, 1971
EQUIPMENT USED: 24"-Diameter Bucket




NOTE: Slight water seepage encountered at 10' and 13½'. No caving.

LOG OF BORING

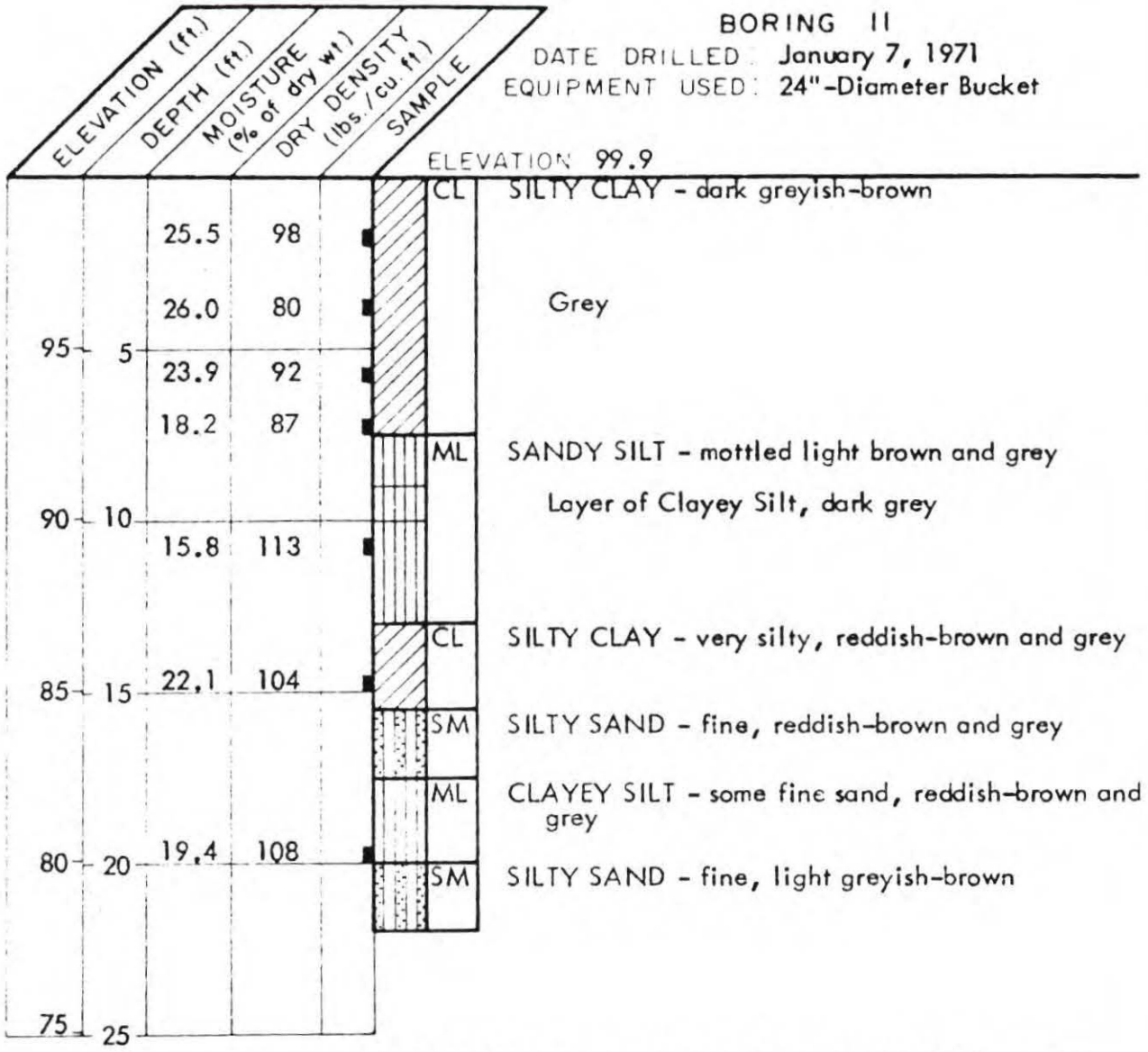
LEROY CRANDALL AND ASSOCIATES

PLATE A-12

BORING 11

DATE DRILLED: January 7, 1971

EQUIPMENT USED: 24"-Diameter Bucket




NOTE: Slight water seepage encountered at 12'. Water level measured at a depth of 9' 15 hours after completion of drilling. Sloughing below 19½'.

LOG OF BORING

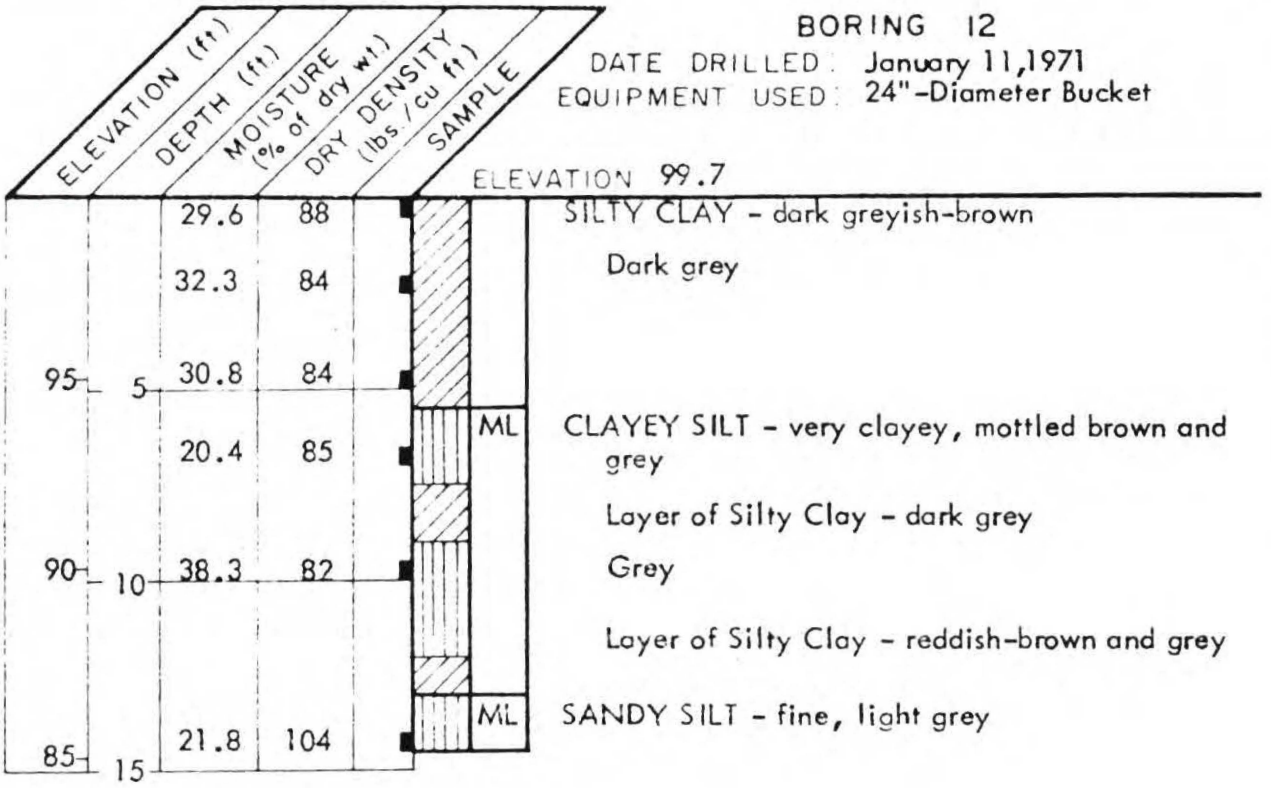
LEROY CRANDALL AND ASSOCIATES

PLATE A-13

BORING 12

DATE DRILLED: January 11, 1971

EQUIPMENT USED: 24"-Diameter Bucket




NOTE: Slight water seepage encountered from 10½' to 12' and at 13'. No caving.

LOG OF BORING

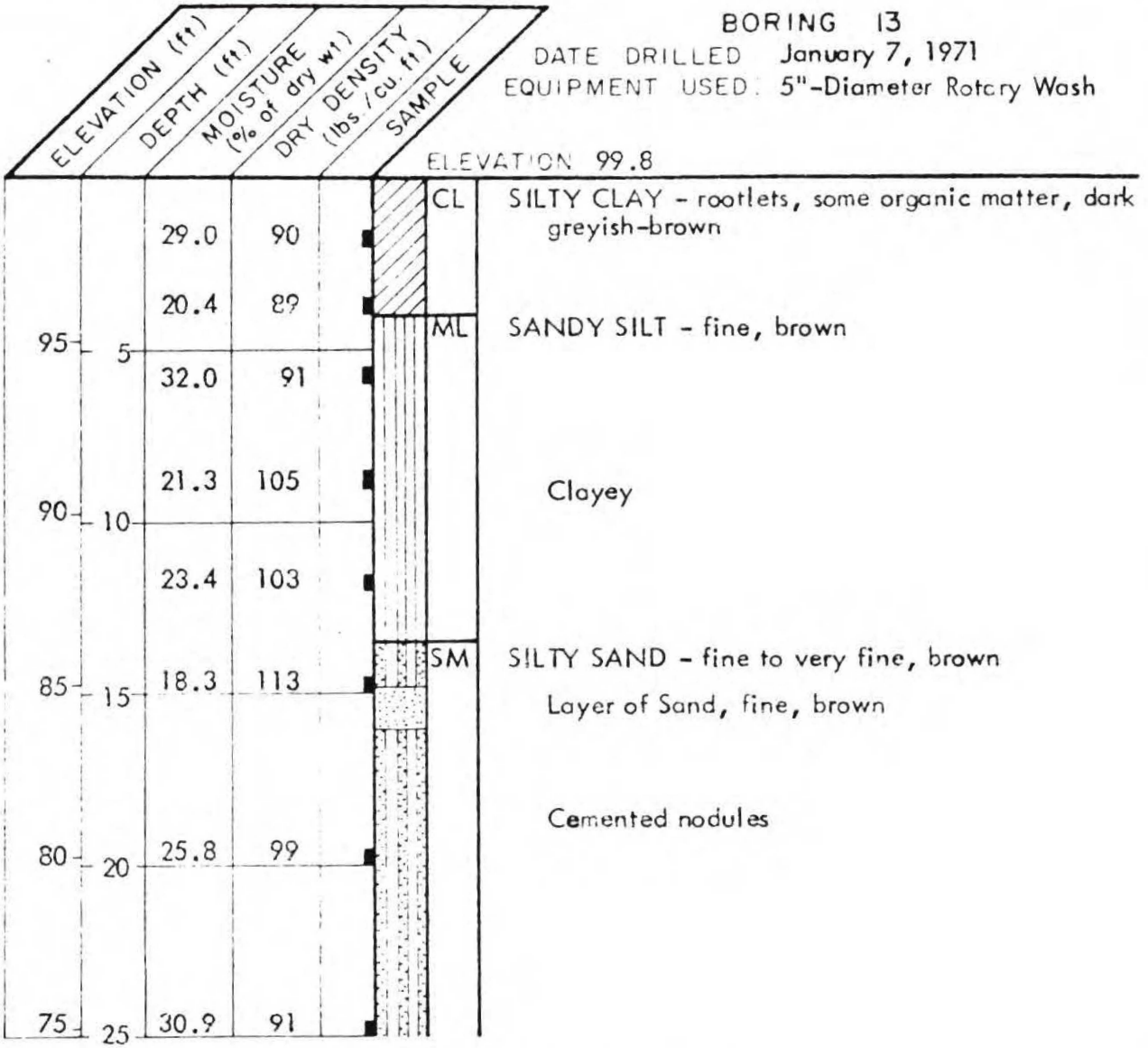
LEROY CRANDALL AND ASSOCIATES

PLATE A-14

BORING 13

DATE DRILLED January 7, 1971

EQUIPMENT USED: 5"-Diameter Rotary Wash



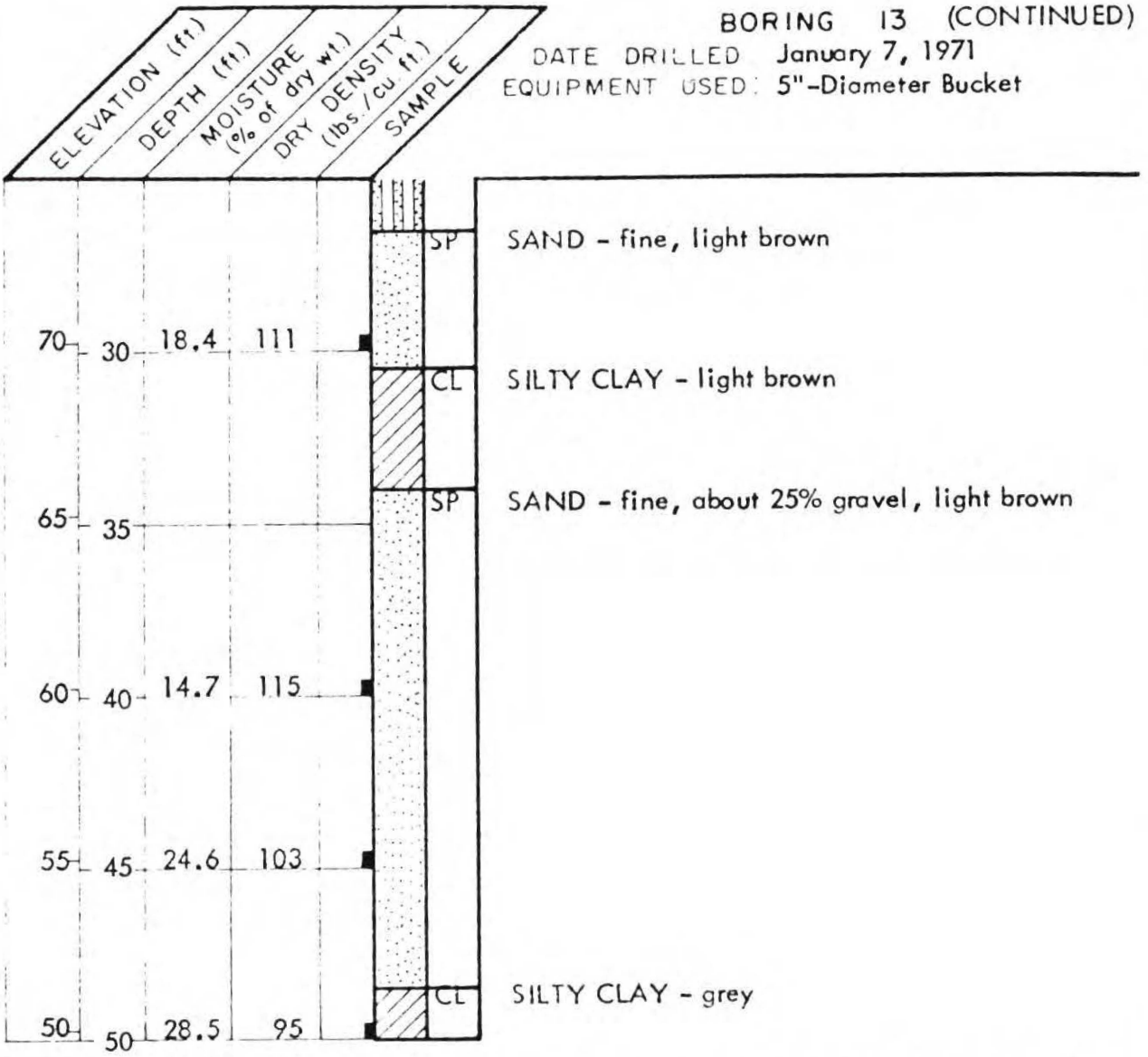

(CONTINUED ON FOLLOWING PLATE)

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-15

BORING 13 (CONTINUED)
DATE DRILLED January 7, 1971
EQUIPMENT USED: 5"-Diameter Bucket




NOTE: Water level not established. Drilling mud used in drilling process.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-16

BORING 14
DATE DRILLED: January 11, 1971
EQUIPMENT USED: 24"-Diameter Bucket

ELEVATION 100.1

| ELEVATION (ft.) | DEPTH (ft.) | MOISTURE (% of dry wt.) | DRY DENSITY (lbs./cu. ft.) | SAMPLE | | |
|---|---|---|---|---|---|---|
| 100 | | 31.9 | 87 | | CL | SILTY CLAY - dark greyish-brown |
| | | 31.6 | 86 | | | Mottled grey and brown |
| 95 | 5 | 27.6 | 93 | | | Layer of Silty Sand, fine, reddish-brown and grey |
| | | 23.8 | 93 | | ML | CLAYEY SILT - reddish-brown and grey<br>Layer of Sandy Silt, reddish-brown and grey |
| 90 | 10 | 21.0 | 108 | | CL | SILTY CLAY - very silty, reddish-brown and grey |
| | | | | | SC | CLAYEY SAND - fine, reddish-brown and grey |
| | 15 | 17.4 | 113 | | SM | SILTY SAND - fine, reddish-brown and grey |

NOTE: Slight water seepage encountered at $10\frac{1}{2}$' and 13'. No caving.

LOG OF BORING

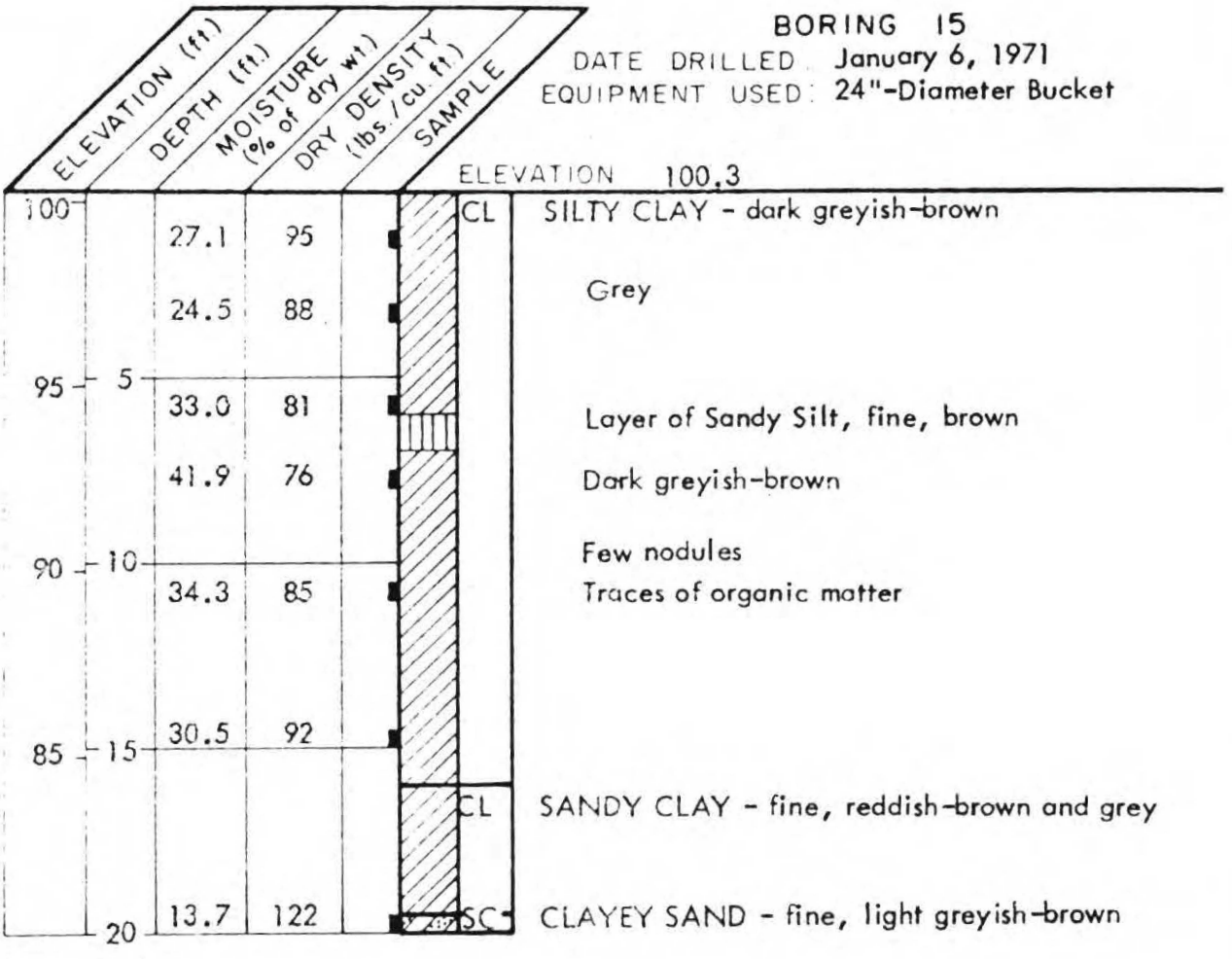
LEROY CRANDALL AND ASSOCIATES

PLATE A-17

BORING 15

DATE DRILLED January 6, 1971

EQUIPMENT USED 24"-Diameter Bucket

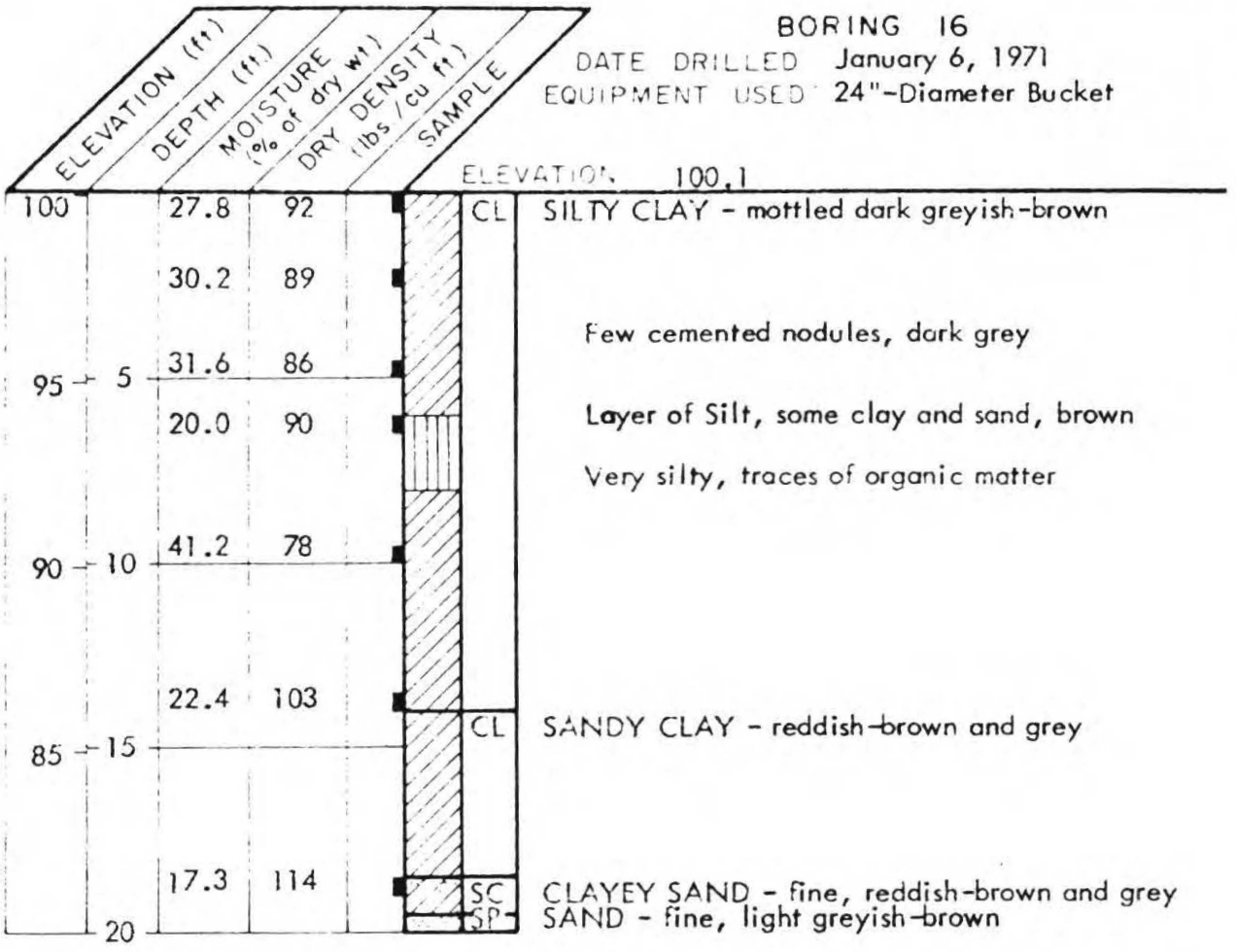



NOTE: Slight water seepage at 12' and 19½'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-18



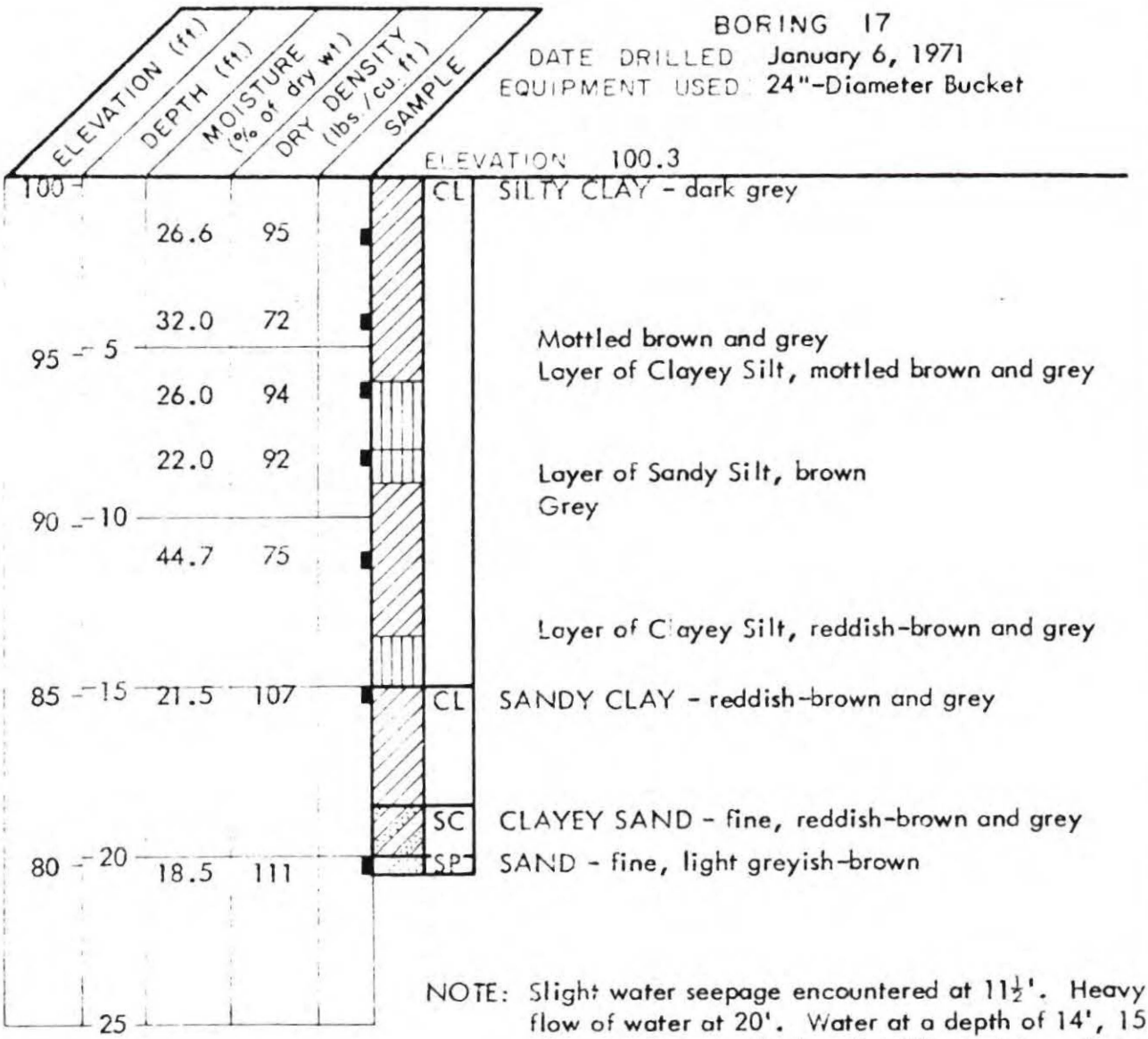

NOTE: Moderate water seepage encountered at 12' to 14' and at 18½'. Water level at a depth of 9½' 14½ hours after completion of drilling. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-19

BORING 17
DATE DRILLED January 6, 1971
EQUIPMENT USED 24"-Diameter Bucket




NOTE: Slight water seepage encountered at 11½'. Heavy flow of water at 20'. Water at a depth of 14', 15 minutes after completion of drilling. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-20

BORING 18

DATE DRILLED January 6, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash

ELEVATION 100.0

| ELEVATION (ft) | DEPTH (ft) | MOISTURE (% of dry wt) | DRY DENSITY (lbs/cu ft) | SAMPLE | | |
|---|---|---|---|---|---|---|
| | | 33.1 | 84 | ■ | CL | SILTY CLAY - dark greyish-brown<br>Mottled brown and grey |
| | | 19.7 | 98 | ■ | | |
| 95 | 5 | 21.2 | 98 | ■ | | |
| | | 39.8 | 80 | ■ | | Greyish-brown |
| 90 | 10 | 18.4 | 111 | ■ | | |
| 85 | 15 | 21.9 | 104 | ■ | | |
| | | | | | SP | SAND - fine, few fine gravel, light brown |
| 80 | 20 | 15.9 | 118 | ■ | | |
| | | | | | | 25% gravel |
| 75 | 25 | 13.1 | 122 | ■ | | |

(CONTINUED ON FOLLOWING PLATE)

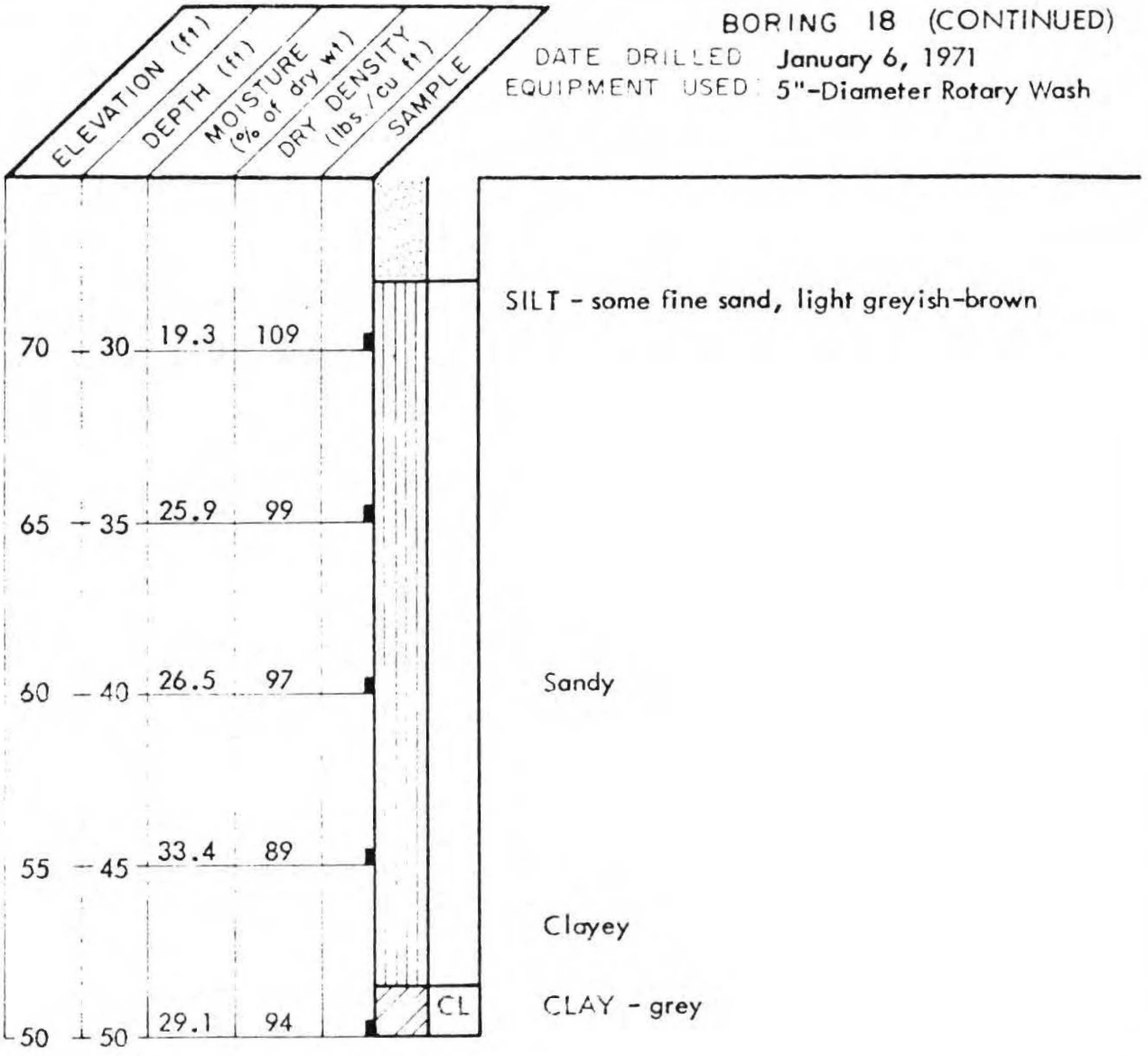
LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

BORING 18 (CONTINUED)

DATE DRILLED January 6, 1971

EQUIPMENT USED 5"-Diameter Rotary Wash




NOTE: Water level not established. Drilling mud used in drilling process.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-22

BORING 19

DATE DRILLED January 6, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 100.1

| ELEVATION (ft) | DEPTH (ft) | MOISTURE (% of dry wt) | DRY DENSITY (lbs/cu ft) | SAMPLE | | |
|---|---|---|---|---|---|---|
| 100 | | 25.7 | 94 | ■ | CL | SILTY CLAY - mottled grey and brown |
| | | 29.2 | 83 | ■ | | Dark brownish-grey |
| 95 | 5 | 25.0 | 88 | ■ | | |
| | | 24.0 | 99 | ■ | | |
| 90 | 10 | 37.4 | 81 | ■ | | Few cemented nodules, traces of organic matter |
| | | | | | | Reddish-brown and grey |
| | | | | | | Sandy |
| | | 21.5 | 105 | ■ | | |
| 85 | 15 | | | | SC | CLAYEY SAND - fine, reddish-brown and grey |
| | | 13.7 | 114 | ■ | SP | SAND - fine, light brown |
| | 20 | | | | | |

NOTE: Water seepage encountered at 15½' and 18'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-23

BORING 20

DATE DRILLED January 6, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 99.7

| ELEVATION (ft) | DEPTH (ft) | MOISTURE (% of dry wt) | DRY DENSITY (lbs/cu ft) | SAMPLE | | |
|---|---|---|---|---|---|---|
| | | 27.6 | 93 | | CL | SILTY CLAY - dark greyish-brown |
| | | 27.2 | 90 | | | Dark grey |
| 95 | 5 | 26.9 | 91 | | | Mottled dark grey and brown |
| | | 38.3 | 79 | | CL | CLAY - greyish-brown |
| 90 | 10 | | | | | |
| | | 32.2 | 88 | | | Dark grey<br>Reddish-brown and grey |
| | | | | | | Traces of organic matter |
| 85 | 15 | 23.3 | 102 | | ML | SANDY SILT - few cemented nodules, light grey |
| | | | | | SP | SAND - fine, light greyish-brown |
| 80 | 20 | | | | | |

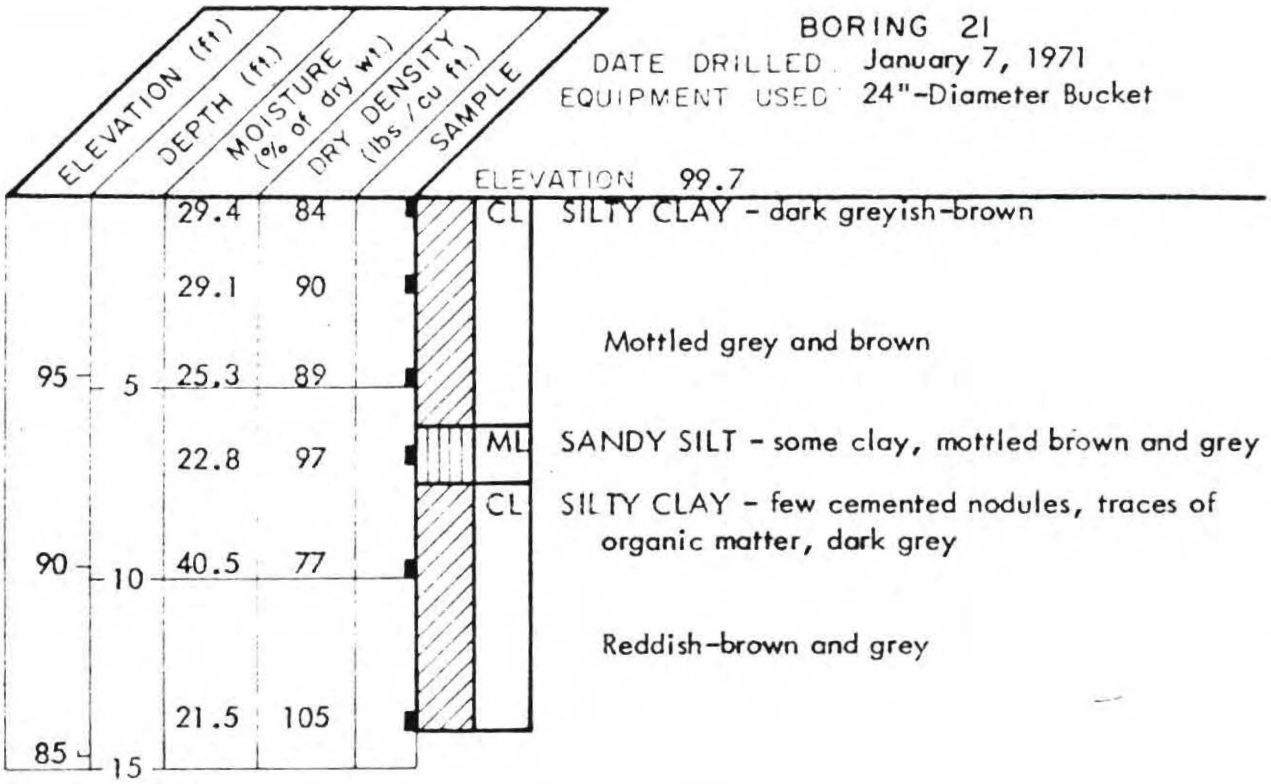
NOTE: Slight water seepage encountered at 15' and 17'. Water level measured at a depth of 10' 1½ hours after completion of drilling. Heavy caving below 17'.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-24

BORING 21
DATE DRILLED January 7, 1971
EQUIPMENT USED 24"-Diameter Bucket




NOTE: Slight water seepage encountered at 12½'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-25

BORING 22

DATE DRILLED January 7, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 100.1

| ELEVATION (ft) | DEPTH (ft) | MOISTURE (% of dry wt) | DRY DENSITY (lbs./cu ft) | SAMPLE | | |
|---|---|---|---|---|---|---|
| 100 | | 21.3 | 103 | ■ | CL | SILTY CLAY - dark greyish-brown |
| | | 26.0 | 81 | ■ | | |
| 95 | 5 | 23.5 | 95 | ■ | | Layers of Sandy Silt, some clay, light brown |
| | | 26.5 | 91 | ■ | | |
| | | | | | | Dark grey |
| 90 | 10 | 18.1 | 112 | ■ | | Reddish-brown and grey |
| | | | | | ML | CLAYEY SILT - some fine sand, few cemented nodules, traces of organic matter, grey |
| | 15 | 20.8 | 107 | ■ | | |

NOTE: Slight water seepage encountered at 14'. No caving.

LOG OF BORING

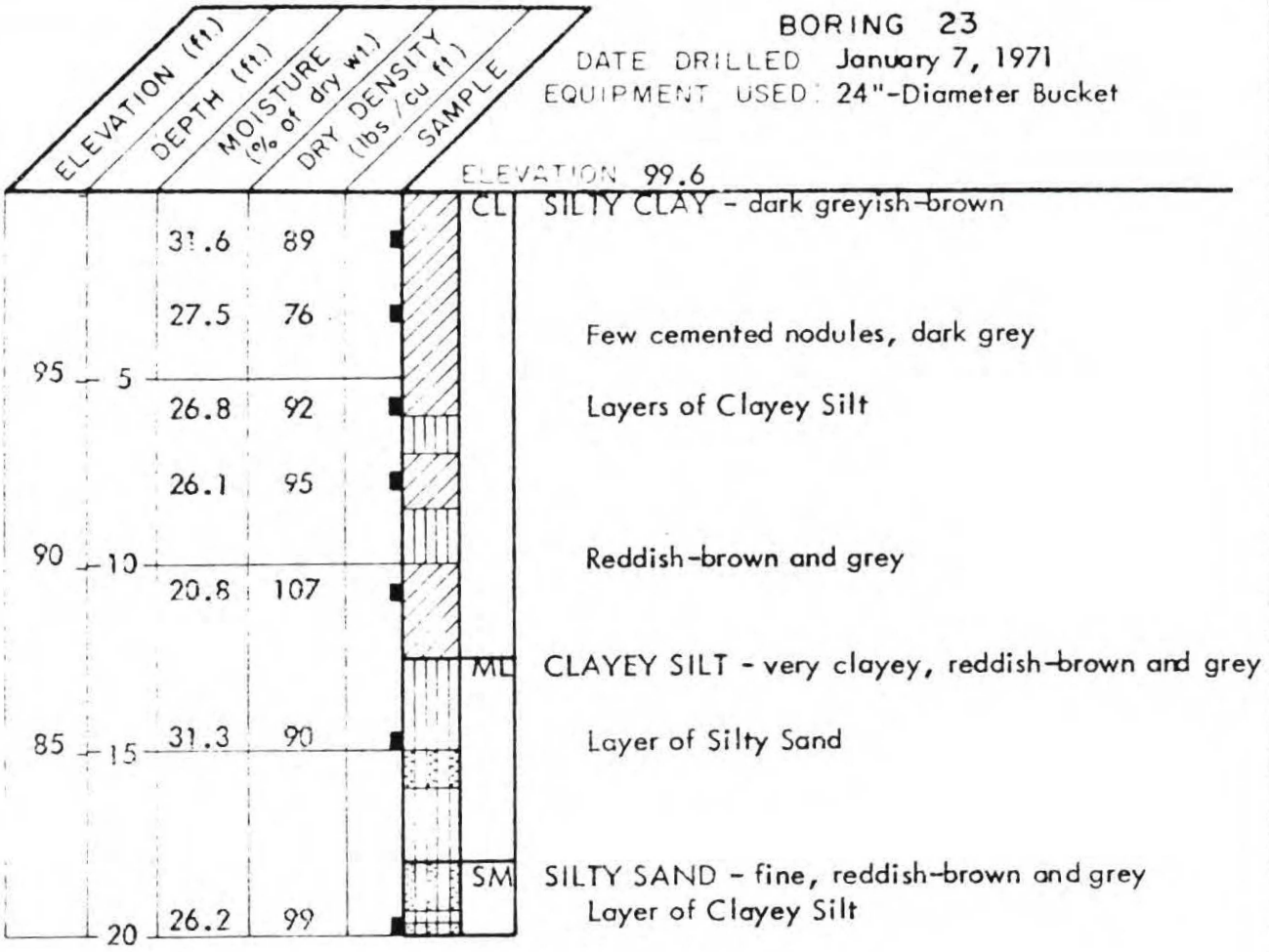
LEROY CRANDALL AND ASSOCIATES

PLATE A-26

BORING 23

DATE DRILLED January 7, 1971

EQUIPMENT USED: 24"-Diameter Bucket




NOTE: Moderate water seepage at 13½' to 16' and below 18'. Water level measured at a depth of 10' 6 hours after completion of drilling. Slight sloughing from 14' to 16½'.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-27

BORING 24

DATE DRILLED January 7, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 99.5

| ELEVATION (ft) | DEPTH (ft) | MOISTURE (% of dry wt) | DRY DENSITY (lbs/cu ft) | SAMPLE | | |
|---|---|---|---|---|---|---|
| | | 29.9 | 90 | ■ | CL | SILTY CLAY - dark greyish-brown |
| | | 34.1 | 83 | ■ | | |
| 95 | 5 | 28.1 | 89 | ■ | | Grey |
| | | 17.4 | 97 | ■ | | Layer of Clayey Silt, light brown and grey |
| 90 | 10 | 25.7 | 98 | ■ | | Dark grey<br>Traces of organic matter, reddish-brown and grey |
| | | | | | ML | CLAYEY SILT - very clayey, reddish-brown and grey |
| 85 | 15 | 21.0 | 107 | ■ | SM | SILTY SAND - fine, grey and brown |

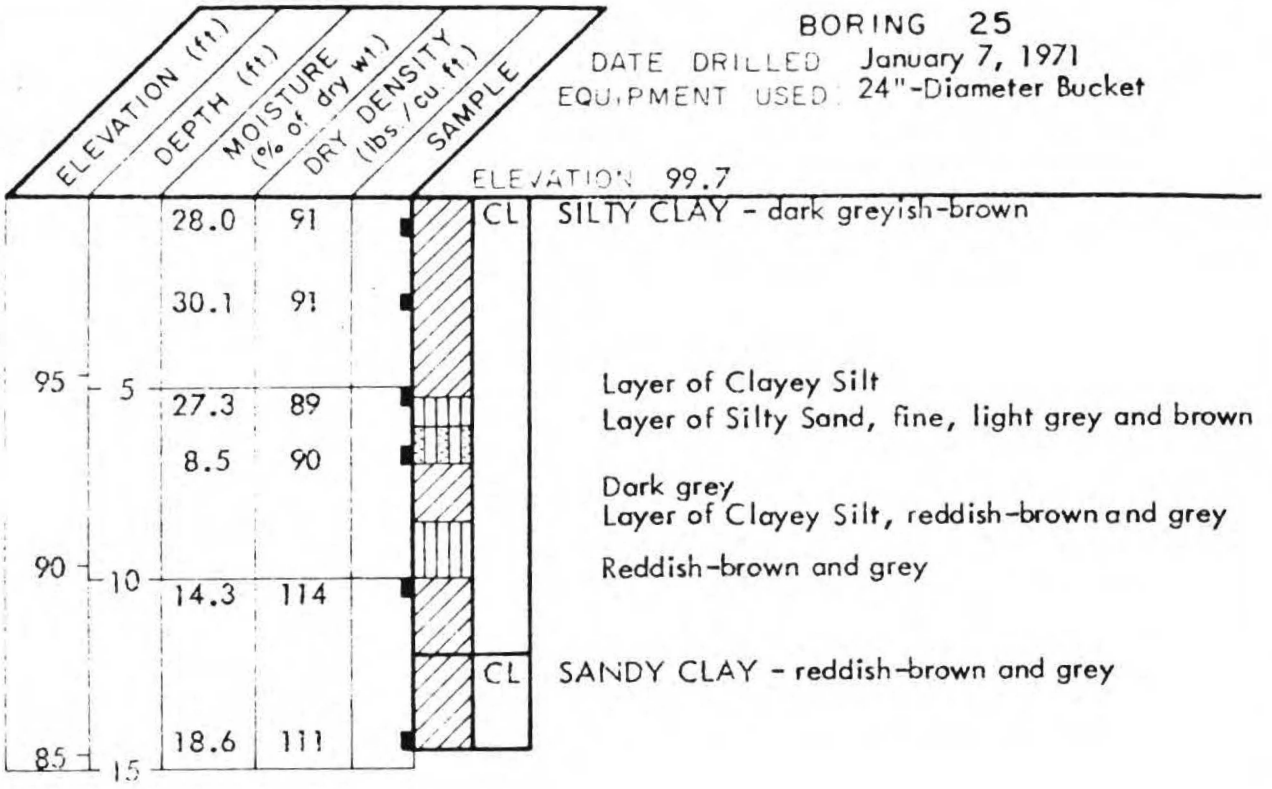
NOTE: Slight water seepage at $13\frac{1}{2}'$. No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-28

BORING 25
DATE DRILLED January 7, 1971
EQUIPMENT USED 24"-Diameter Bucket

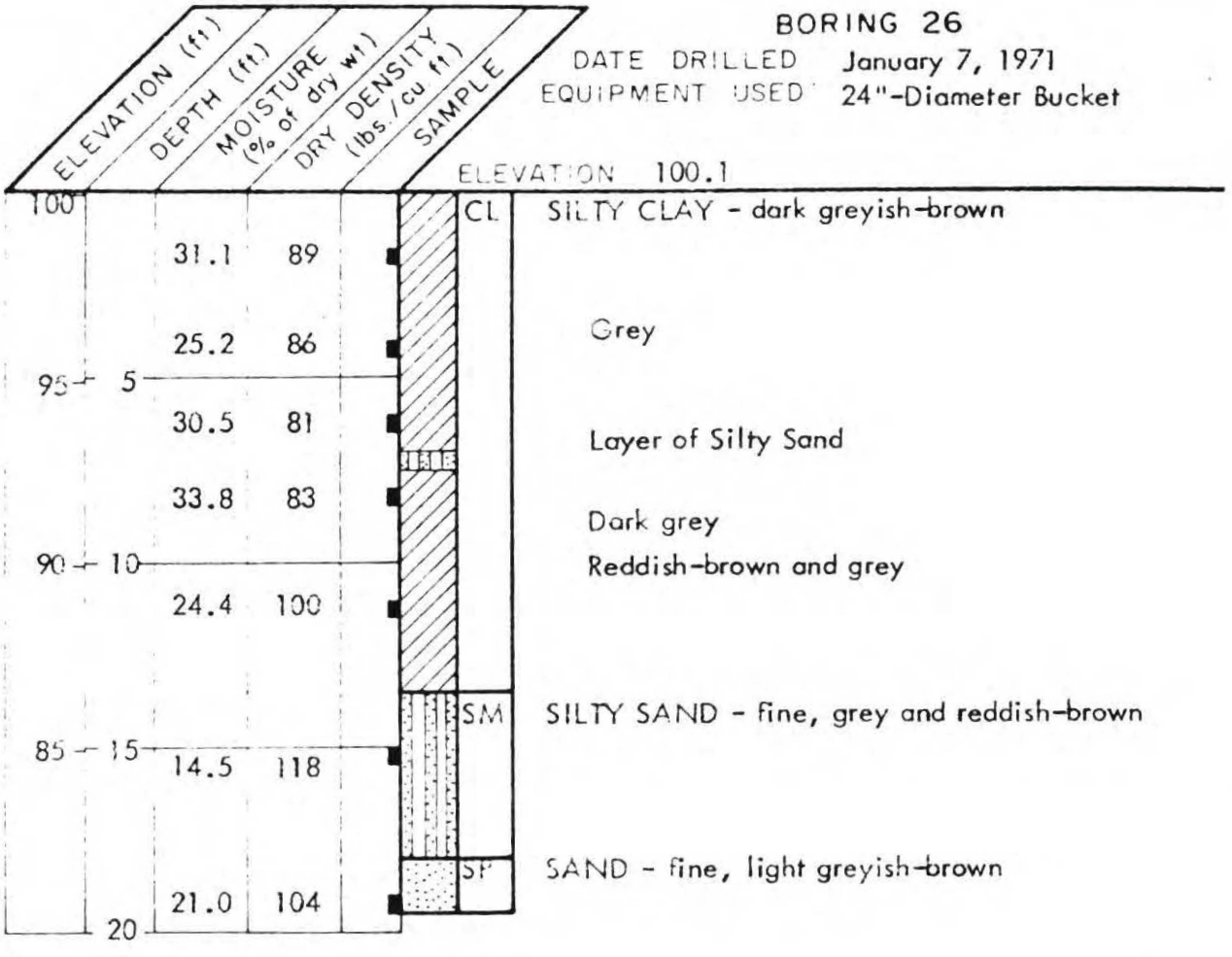



NOTE: Slight water seepage encountered at $14\frac{1}{2}$'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-29




NOTE: Water seepage encountered at 14' and 18½'. Water level measured at a depth of 11' 4 hours after completion of drilling. Caving below 18'.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

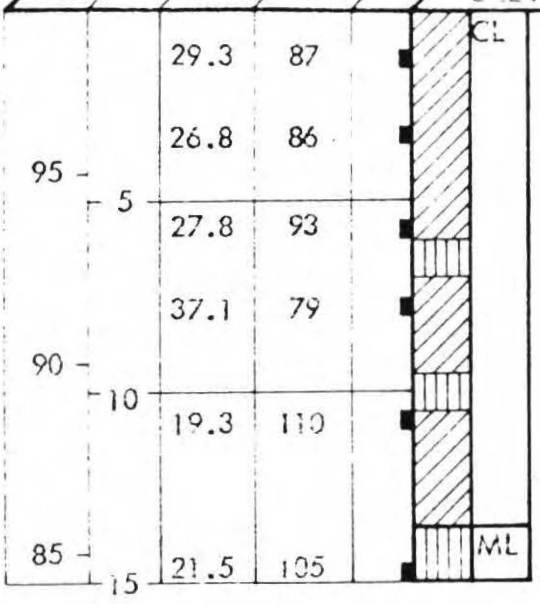
PLATE A-30

BORING 27

DATE DRILLED January 11, 1971

EQUIPMENT USED 24"-Diameter Bucket

ELEVATION 99.3




SILTY CLAY - dark greyish-brown

Layer of Sandy Silt

Layer of Clayey Silt

Layer of Sandy Silt

Reddish-brown and grey

CLAYEY SILT - greyish-brown

NOTE: Slight water seepage encountered at 10½'.
No caving.

LOG OF BORING

LEROY CRANDALL AND ASSOCIATES

PLATE A-31

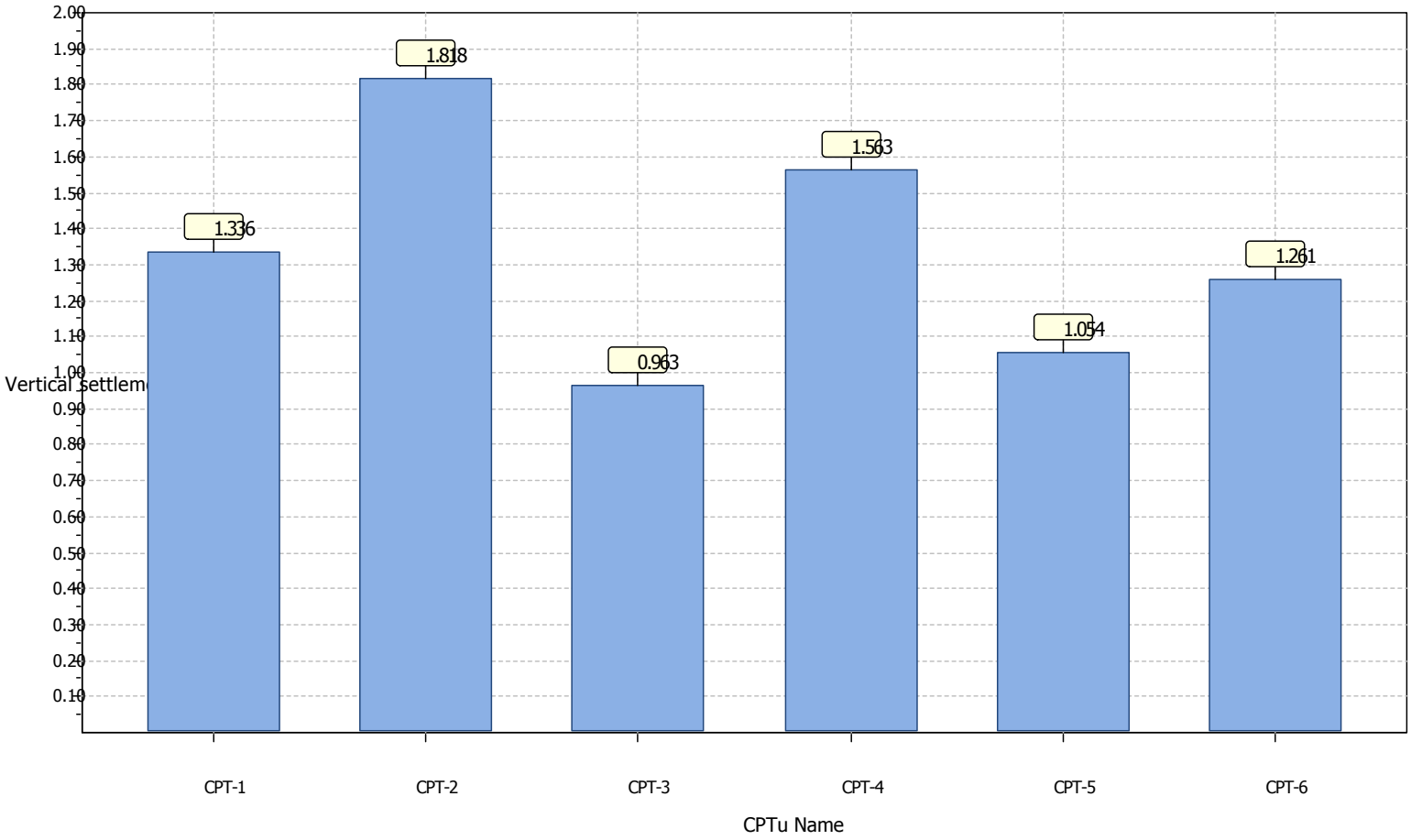
# APPENDIX C

**NMG Geotechnical, Inc.**
17991 Fitch
Irvine, CA 92614

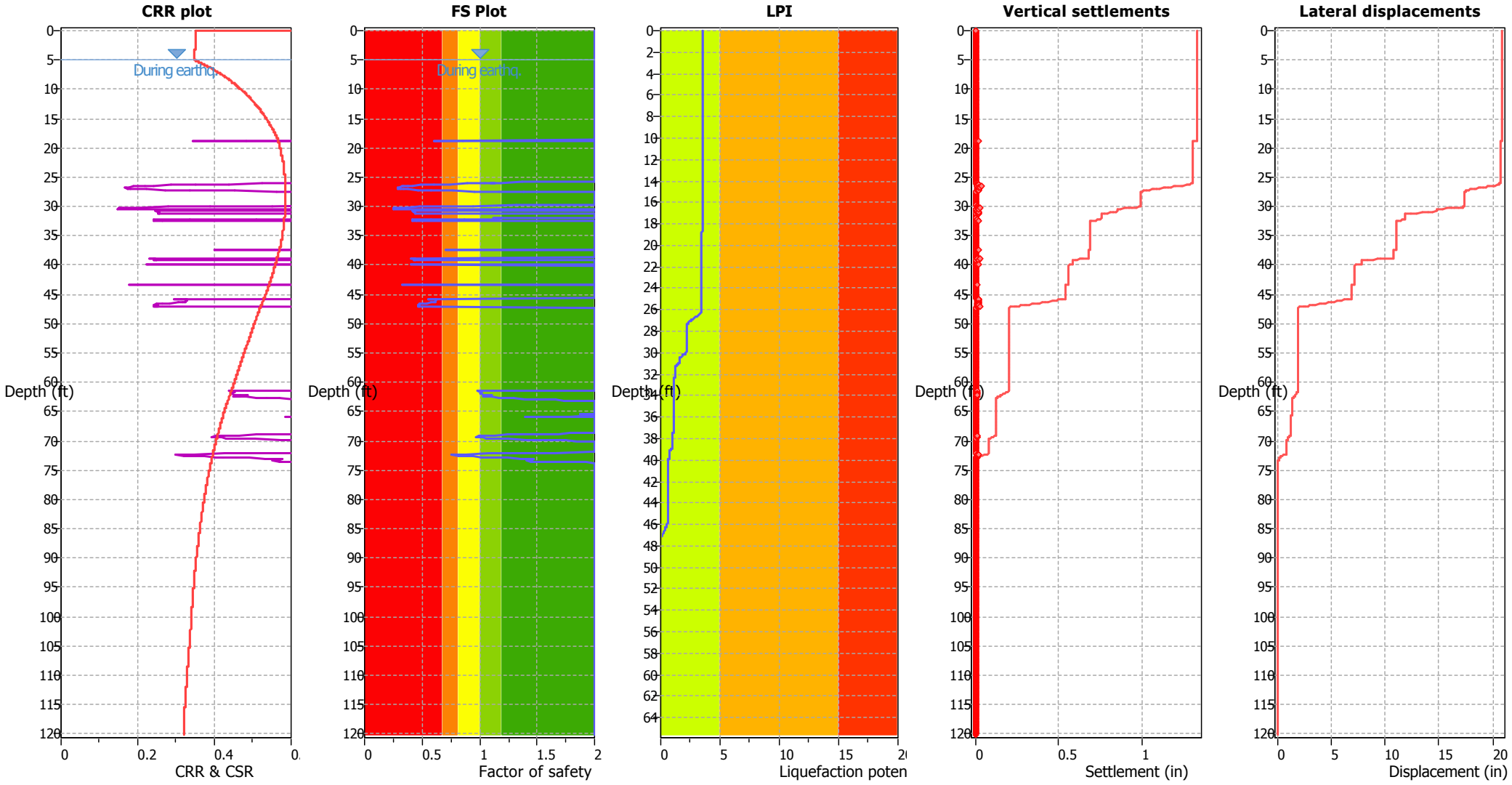
**Project title : South Coast Plaza**

**Location :**

## Overall vertical settlements report



# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | 75.00 ft |

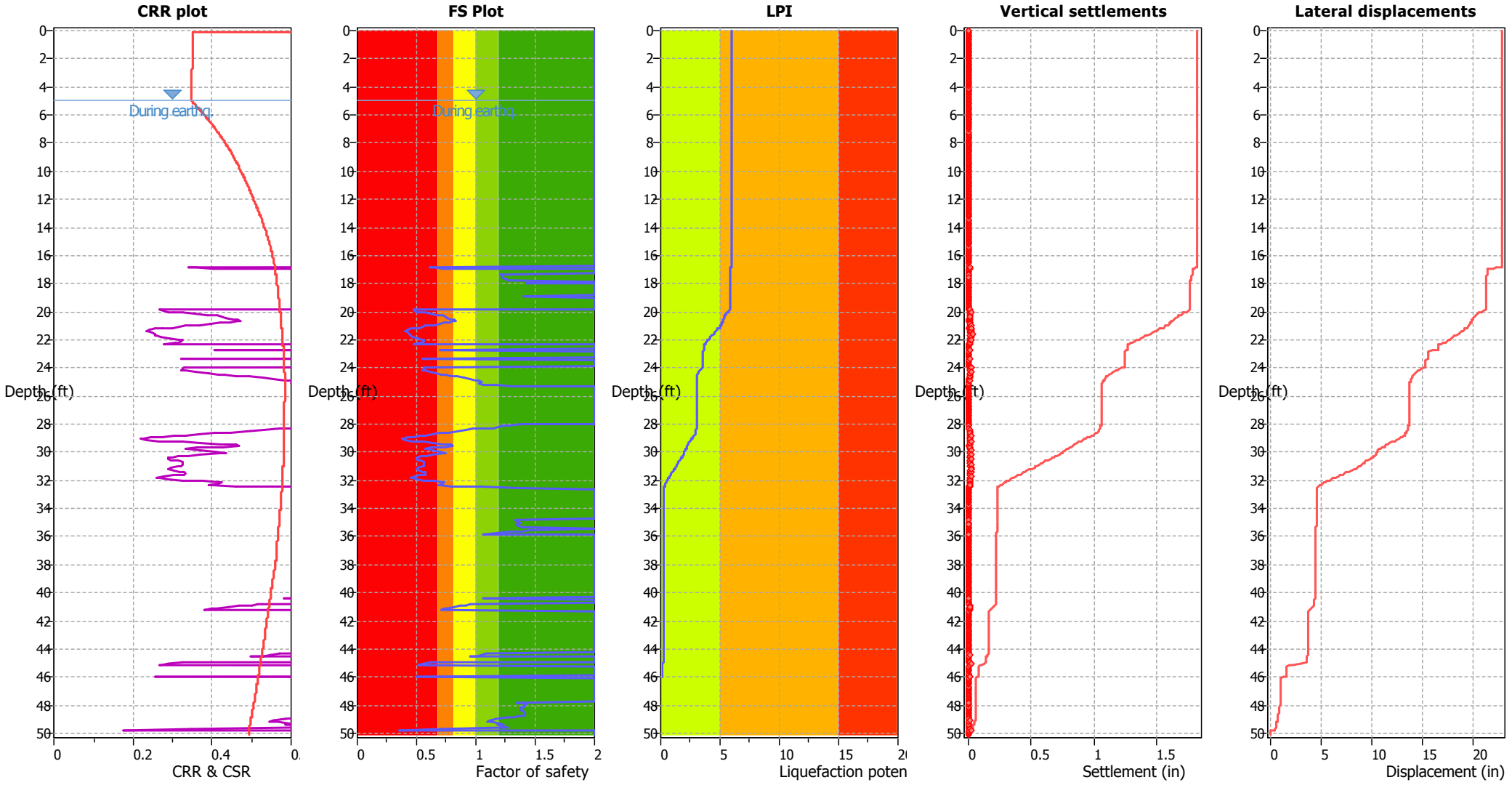
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | N/A |

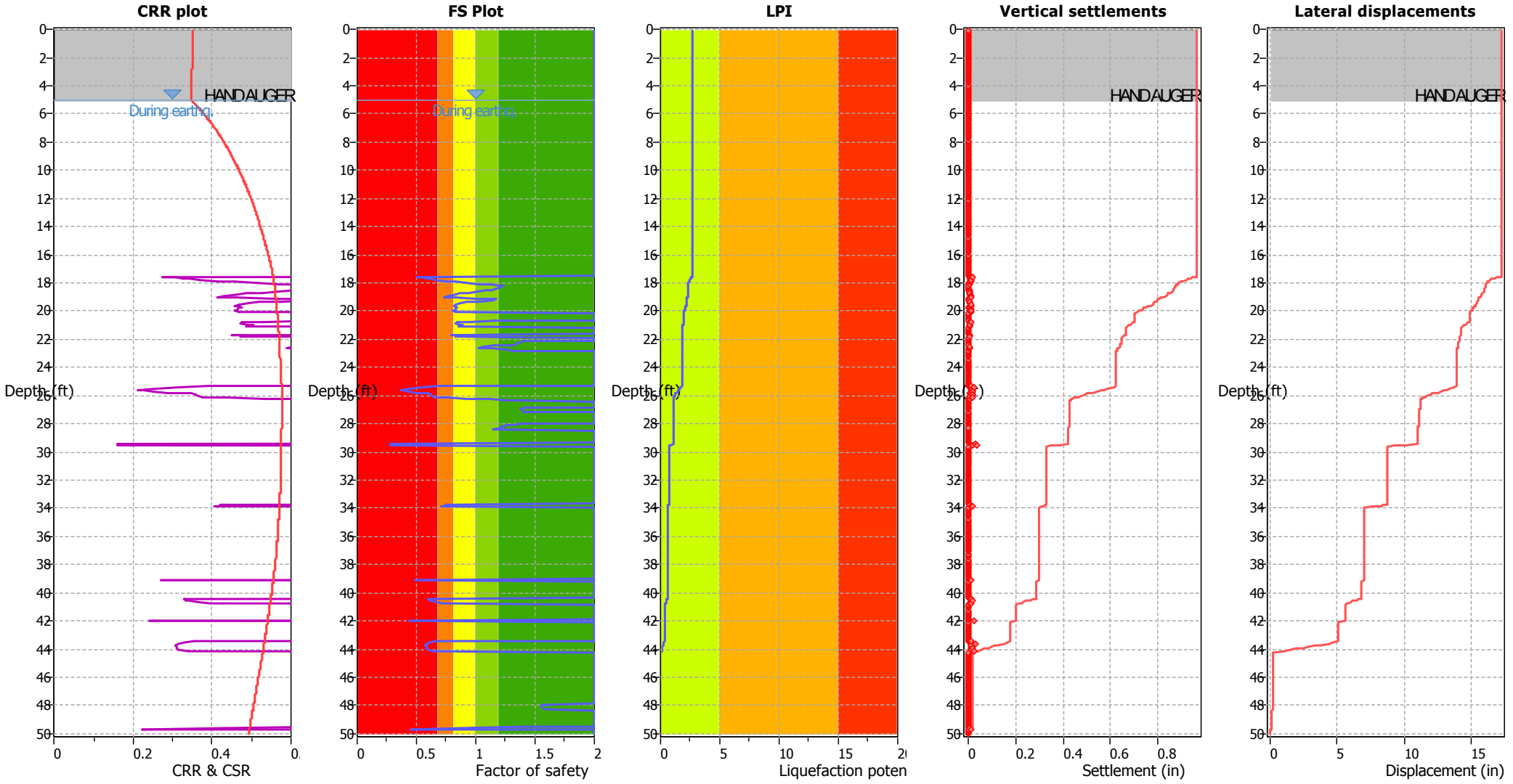
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | N/A |

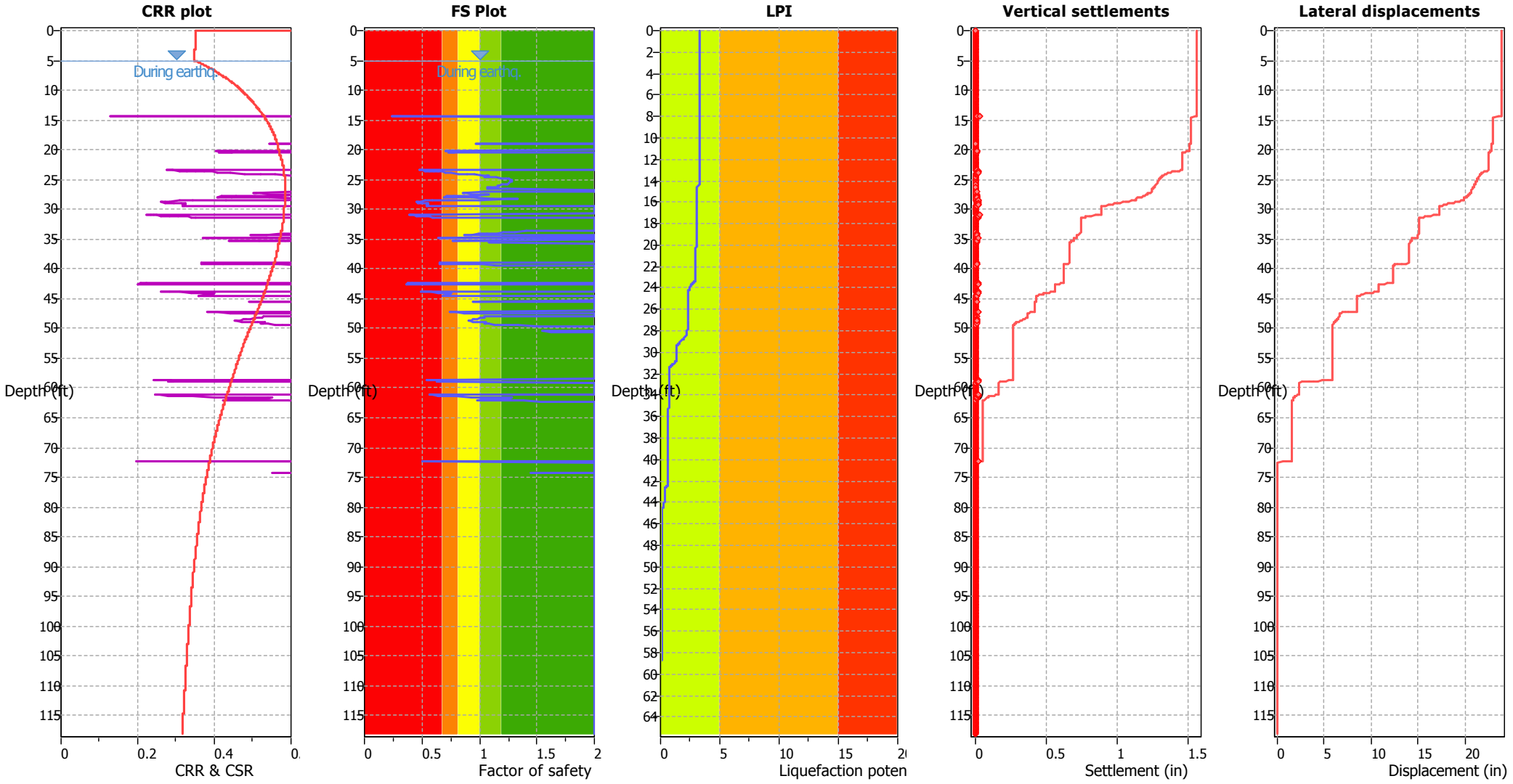
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | 75.00 ft |

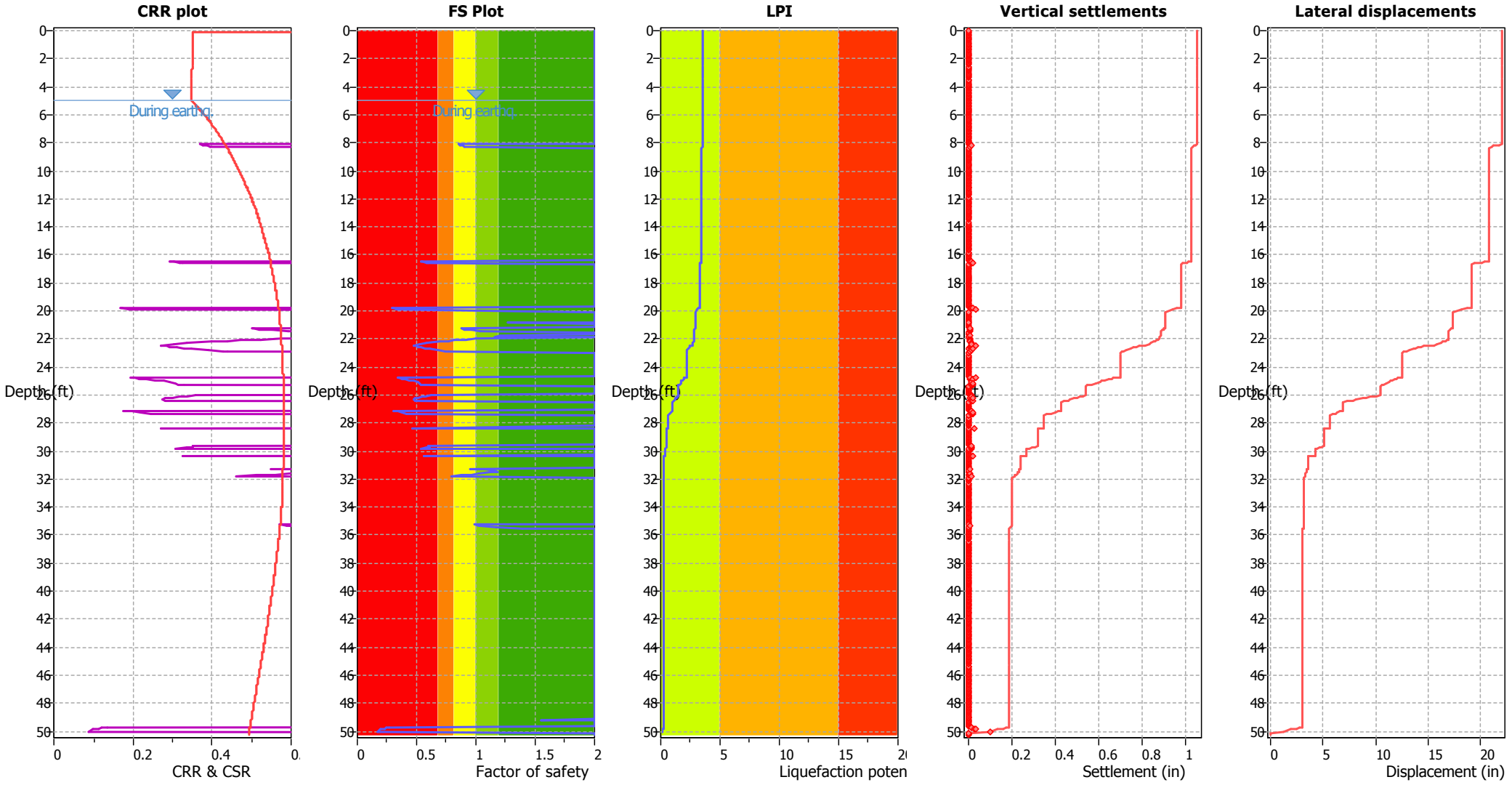
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | N/A |

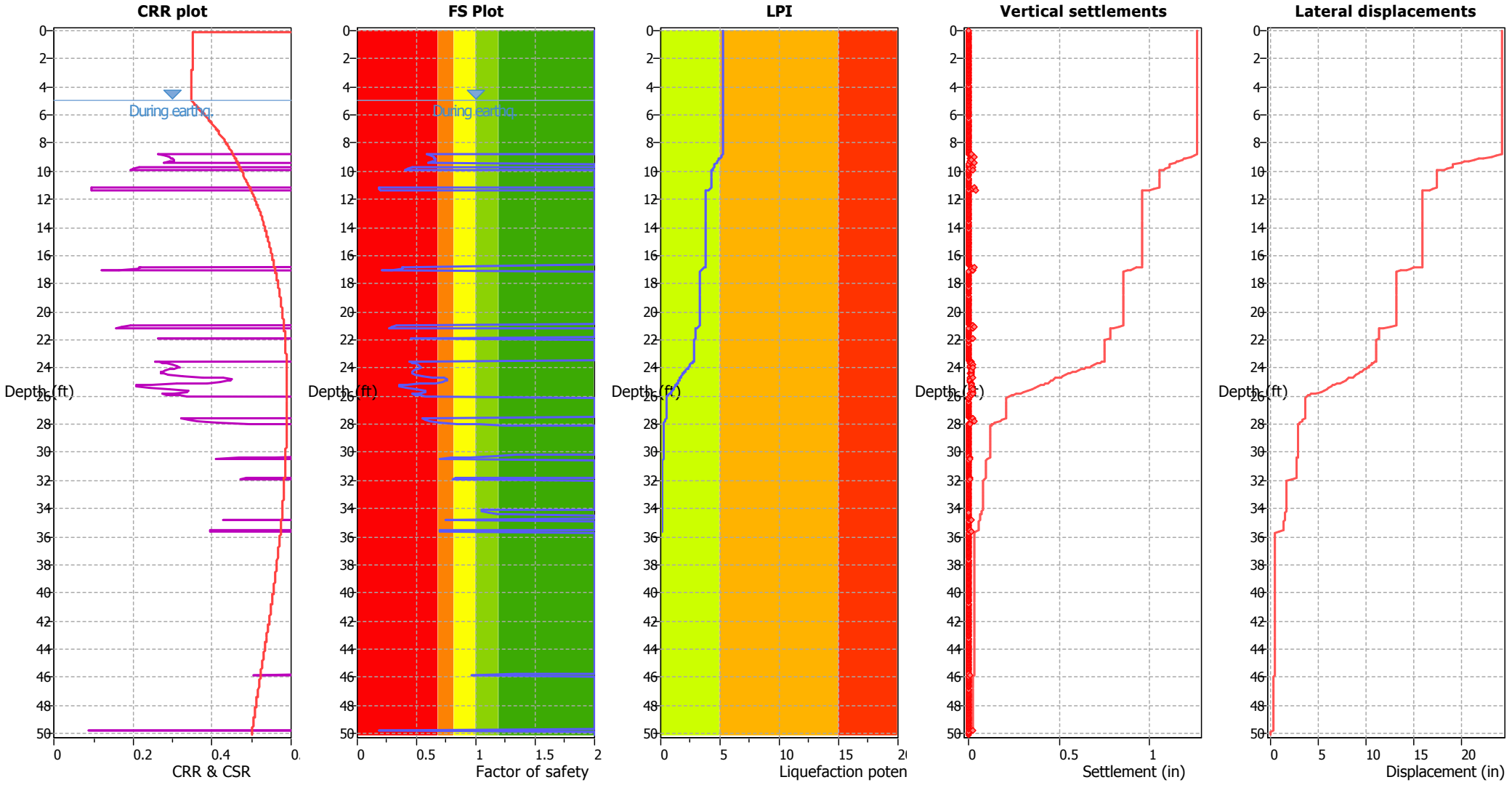
**F.S. color scheme**

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 5.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 3 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | No |
| Earthquake magnitude $M_w$: | 7.15 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.61 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 5.00 ft | Fill height: | N/A | Limit depth: | N/A |

**F.S. color scheme**

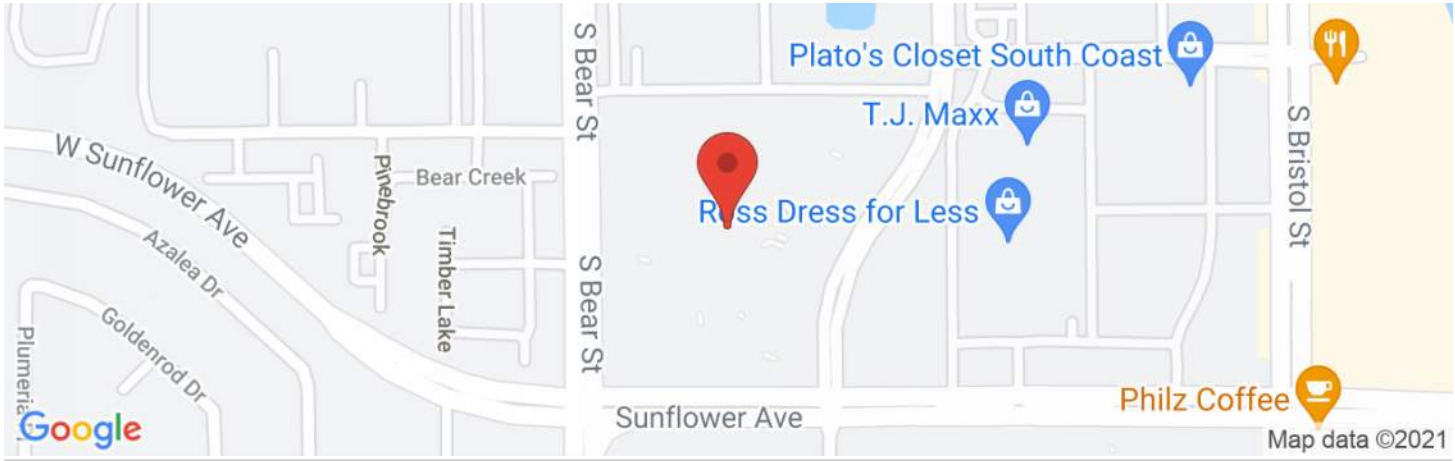
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

# APPENDIX D

## Latitude, Longitude: 33.6956, -117.8908




| | |
|---|---|
| **Date** | 4/21/2021, 2:18:40 PM |
| **Design Code Reference Document** | ASCE7-16 |
| **Risk Category** | III |
| **Site Class** | D - Stiff Soil |

| Type | Value | Description |
|---|---|---|
| $S_S$ | 1.29 | $MCE_R$ ground motion. (for 0.2 second period) |
| $S_1$ | 0.463 | $MCE_R$ ground motion. (for 1.0s period) |
| $S_{MS}$ | 1.29 | Site-modified spectral acceleration value |
| $S_{M1}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{DS}$ | 0.86 | Numeric seismic design value at 0.2 second SA |
| $S_{D1}$ | null -See Section 11.4.8 | Numeric seismic design value at 1.0 second SA |

| Type | Value | Description |
|---|---|---|
| SDC | null -See Section 11.4.8 | Seismic design category |
| $F_a$ | 1 | Site amplification factor at 0.2 second |
| $F_v$ | null -See Section 11.4.8 | Site amplification factor at 1.0 second |
| PGA | 0.552 | $MCE_G$ peak ground acceleration |
| $F_{PGA}$ | 1.1 | Site amplification factor at PGA |
| $PGA_M$ | 0.608 | Site modified peak ground acceleration |
| $T_L$ | 8 | Long-period transition period in seconds |
| SsRT | 1.29 | Probabilistic risk-targeted ground motion. (0.2 second) |
| SsUH | 1.397 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration |
| SsD | 2.011 | Factored deterministic acceleration value. (0.2 second) |
| S1RT | 0.463 | Probabilistic risk-targeted ground motion. (1.0 second) |
| S1UH | 0.5 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D | 0.693 | Factored deterministic acceleration value. (1.0 second) |
| PGAd | 0.826 | Factored deterministic acceleration value. (Peak Ground Acceleration) |
| $C_{RS}$ | 0.923 | Mapped value of the risk coefficient at short periods |
| $C_{R1}$ | 0.925 | Mapped value of the risk coefficient at a period of 1 s |

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U.S. Geological Survey - Earthquake Hazards Program

# Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

## Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.6956

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

-117.8908

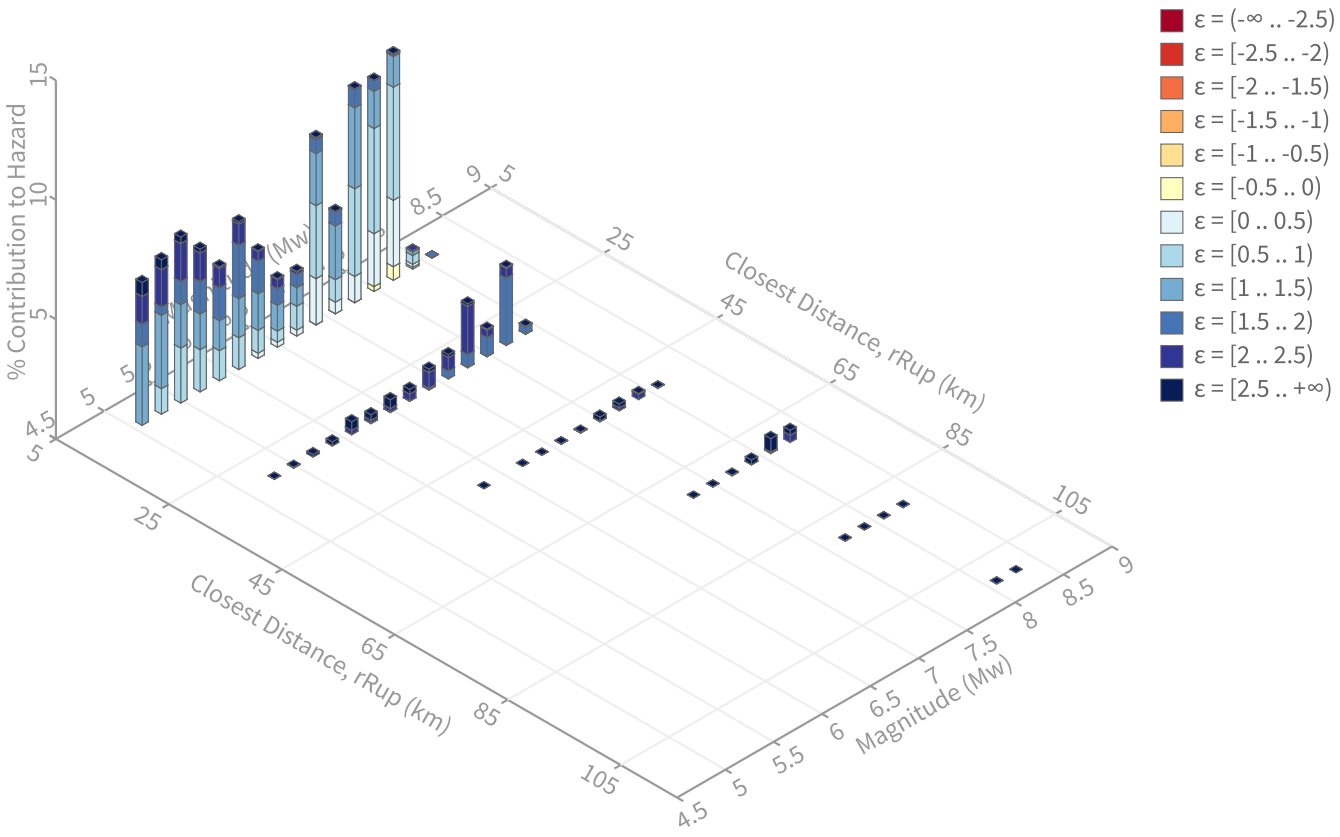
Site Class

259 m/s (Site class D)

## Deaggregation

Component

Total



# Summary statistics for, Deaggregation: Total

## Deaggregation targets

**Return period:** 2475 yrs
**Exceedance rate:** 0.0004040404 $yr^{-1}$
**PGA ground motion:** 0.65239994 g

## Recovered targets

**Return period:** 2950.9624 yrs
**Exceedance rate:** 0.00033887249 $yr^{-1}$

## Totals

**Binned:** 100 %
**Residual:** 0 %
**Trace:** 0.06 %

## Mean (over all sources)

**m:** 6.62
**r:** 11.6 km
**$\varepsilon_0$:** 1.3 σ

## Mode (largest m-r bin)

**m:** 7.69
**r:** 7.43 km
**$\varepsilon_0$:** 0.62 σ
**Contribution:** 9.47 %

## Mode (largest m-r-$\varepsilon_0$ bin)

**m:** 7.68
**r:** 8.26 km
**$\varepsilon_0$:** 0.72 σ
**Contribution:** 4.73 %

## Discretization

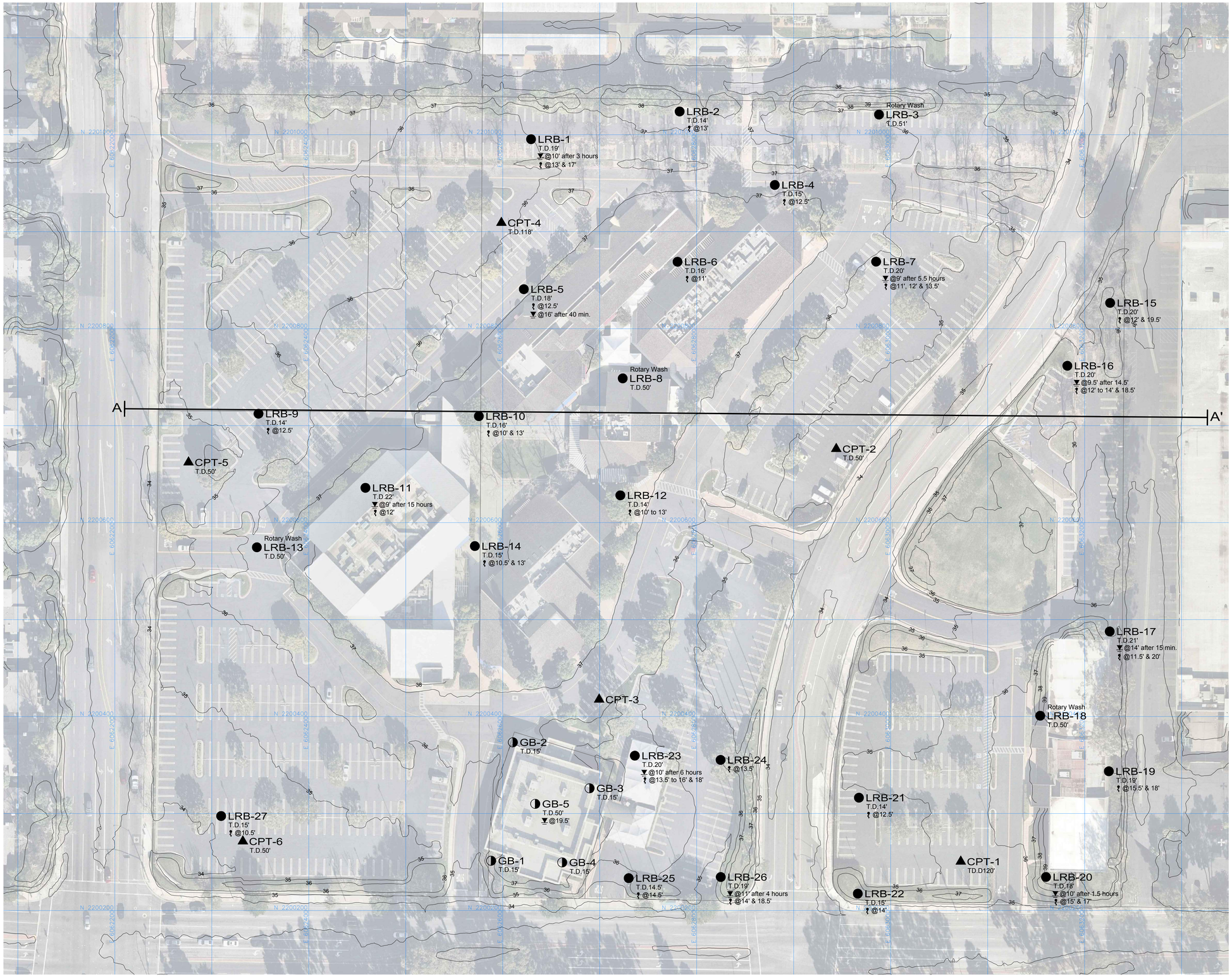
**r:** min = 0.0, max = 1000.0, Δ = 20.0 km
**m:** min = 4.4, max = 9.4, Δ = 0.2
**ε:** min = -3.0, max = 3.0, Δ = 0.5 σ

## Epsilon keys

**ε0:** [-∞ .. -2.5)
**ε1:** [-2.5 .. -2.0)
**ε2:** [-2.0 .. -1.5)
**ε3:** [-1.5 .. -1.0)
**ε4:** [-1.0 .. -0.5)
**ε5:** [-0.5 .. 0.0)
**ε6:** [0.0 .. 0.5)
**ε7:** [0.5 .. 1.0)
**ε8:** [1.0 .. 1.5)
**ε9:** [1.5 .. 2.0)
**ε10:** [2.0 .. 2.5)
**ε11:** [2.5 .. +∞]

## Deaggregation Contributors

| Source Set ↳ Source | Type | r | m | $\varepsilon_0$ | lon | lat | az | % |
|---|---|---|---|---|---|---|---|---|
| UC33brAvg_FM32 | System | | | | | | | 29.05 |
| San Joaquin Hills [0] | | 4.05 | 7.15 | 0.54 | 117.895°W | 33.672°N | 187.60 | 9.60 |
| Newport-Inglewood alt 2 [0] | | 8.85 | 7.49 | 0.93 | 117.962°W | 33.644°N | 229.09 | 5.03 |
| Compton [0] | | 14.68 | 7.34 | 1.07 | 118.043°W | 33.702°N | 273.14 | 3.83 |
| Palos Verdes [6] | | 26.72 | 7.46 | 2.04 | 118.139°W | 33.574°N | 239.61 | 1.58 |
| Whittier alt 2 [2] | | 25.46 | 7.64 | 1.85 | 117.755°W | 33.895°N | 29.47 | 1.19 |
| Anaheim [0] | | 11.61 | 6.91 | 1.30 | 117.943°W | 33.780°N | 332.98 | 1.17 |
| UC33brAvg_FM31 | System | | | | | | | 25.84 |
| San Joaquin Hills [0] | | 4.05 | 7.53 | 0.44 | 117.895°W | 33.672°N | 187.60 | 6.82 |
| Newport-Inglewood alt 1 [0] | | 8.94 | 7.46 | 0.93 | 117.964°W | 33.645°N | 230.34 | 5.56 |
| Compton [0] | | 14.68 | 7.27 | 1.11 | 118.043°W | 33.702°N | 273.14 | 3.66 |
| Whittier alt 1 [2] | | 25.52 | 7.58 | 1.88 | 117.758°W | 33.897°N | 28.65 | 1.56 |
| Palos Verdes [6] | | 26.72 | 7.29 | 2.14 | 118.139°W | 33.574°N | 239.61 | 1.45 |
| Anaheim [0] | | 11.61 | 6.86 | 1.32 | 117.943°W | 33.780°N | 332.98 | 1.17 |
| UC33brAvg_FM31 (opt) | Grid | | | | | | | 22.74 |
| PointSourceFinite: -117.891, 33.700 | | 4.99 | 5.59 | 1.07 | 117.891°W | 33.700°N | 0.00 | 5.75 |
| PointSourceFinite: -117.891, 33.700 | | 4.99 | 5.59 | 1.07 | 117.891°W | 33.700°N | 0.00 | 5.75 |
| PointSourceFinite: -117.891, 33.772 | | 8.95 | 5.94 | 1.54 | 117.891°W | 33.772°N | 0.00 | 1.54 |
| PointSourceFinite: -117.891, 33.772 | | 8.95 | 5.94 | 1.54 | 117.891°W | 33.772°N | 0.00 | 1.54 |
| PointSourceFinite: -117.891, 33.790 | | 11.00 | 5.77 | 1.87 | 117.891°W | 33.790°N | 0.00 | 1.40 |
| PointSourceFinite: -117.891, 33.790 | | 11.00 | 5.77 | 1.87 | 117.891°W | 33.790°N | 0.00 | 1.40 |
| UC33brAvg_FM32 (opt) | Grid | | | | | | | 22.38 |
| PointSourceFinite: -117.891, 33.700 | | 5.00 | 5.58 | 1.08 | 117.891°W | 33.700°N | 0.00 | 5.56 |
| PointSourceFinite: -117.891, 33.700 | | 5.00 | 5.58 | 1.08 | 117.891°W | 33.700°N | 0.00 | 5.56 |
| PointSourceFinite: -117.891, 33.772 | | 8.96 | 5.93 | 1.55 | 117.891°W | 33.772°N | 0.00 | 1.55 |
| PointSourceFinite: -117.891, 33.772 | | 8.96 | 5.93 | 1.55 | 117.891°W | 33.772°N | 0.00 | 1.55 |
| PointSourceFinite: -117.891, 33.790 | | 11.02 | 5.76 | 1.87 | 117.891°W | 33.790°N | 0.00 | 1.41 |
| PointSourceFinite: -117.891, 33.790 | | 11.02 | 5.76 | 1.87 | 117.891°W | 33.790°N | 0.00 | 1.41 |




## LEGEND

*OTHER SYMBOLS - LOCATIONS ARE APPROXIMATE*

- **LRB-27** T.D.15' @10.5' — ROTARY WASH OR BUCKET-AUGER BORING BY LEROY CRANDALL (1973), SHOWING TOTAL DEPTH AND DEPTH TO SEEPAGE AND/OR GROUNDWATER
- **GB-5** T.D.15' @19.5' — HOLLOW STEM AUGER BORING BY GILES (2001), SHOWING TOTAL DEPTH AND DEPTH TO GROUNDWATER
- **CPT-6** T.D.50' — CONE PENETROMETER TEST BY NMG (2021), SHOWING TOTAL DEPTH
- A — A' CROSS-SECTION

GRAPHIC SCALE

40 0 20 40 80

( IN FEET )
1 inch = 40 ft.

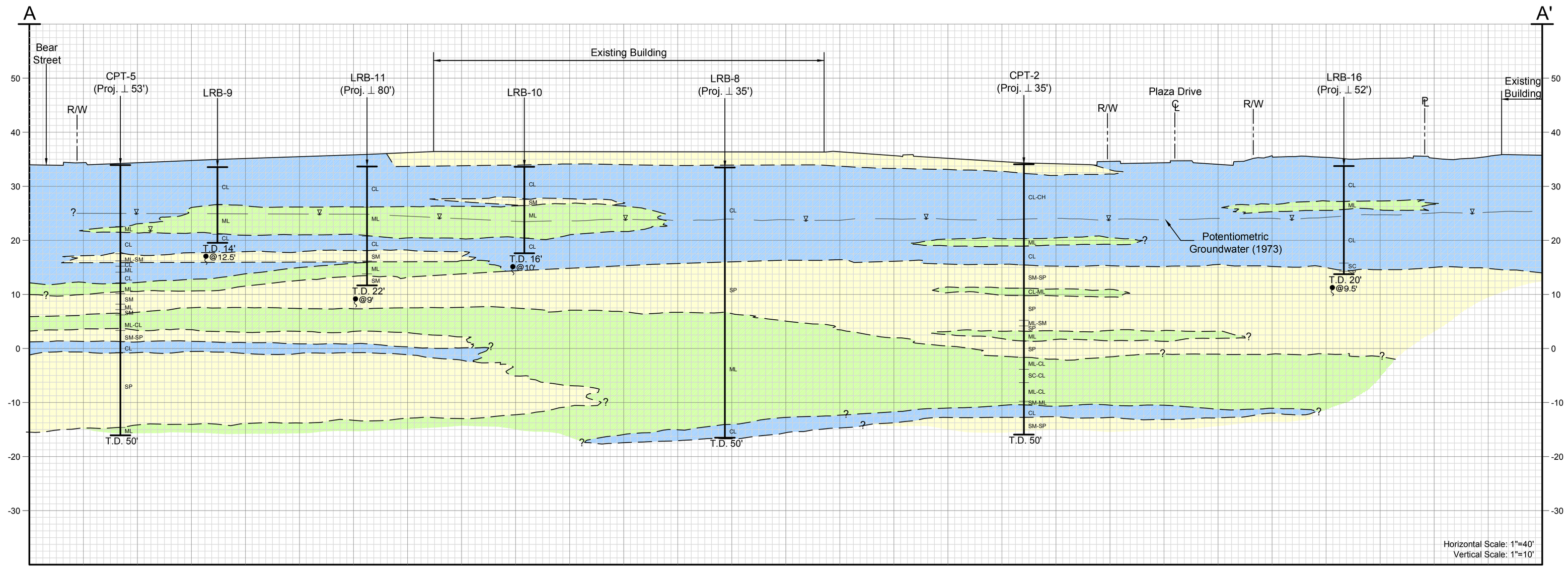
DRAFT

PLATE 1

BORING AND CPT LOCATION MAP
SOUTH COAST PLAZA VILLAGE
SANTA ANA, CALIFORNIA

| | |
|---|---|
| Project No.: 21034-01 | By:TM/TW |
| Project Name: SCPlaza/SCPVillage | NMG |
| Date: 4/28/2021 | SCALE: 1" = 40' |

Geotechnical, Inc.




## LEGEND

- CLAYS (CL, CH)
- SILTS (ML)
- SANDS (SM, SC, SP)

DRAFT

PLATE 2

| | |
|---|---|
| Project No.: 21034-01 | By:TM/TW |
| Project Name: SCPlaza/SCPVillage | |
| Date: 4/28/2021 | SCALE: 1" = 40' |

NMG Geotechnical, Inc.

# Attachment F

# Water Quality Impairment List

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | San Diego Creek Reach 1 | River & Stream | 80111000 / 18070201 | • Benthic Community Effects<br>◦ Source Unknown | 7.8 Miles | 2014 | 5A | 2027 |
| | | | | • DDT (Dichlorodiphenyltrichloroethane)<br>◦ See TMDL documentation | 7.8 Miles | 2014 | 5B | 2013 |
| | | | | *The USEPA approved the Newport Bay Organochlorine compounds TMDL on November 12, 2013 which includes this pollutant (Total DDT-sum of 4,4'- and 2,4'- isomers of DDT, DDE, and DDD) for San Diego Creek. The data used for the TMDL assessment includes additional data and may use different assessment guidelines than those used in the integrated report. Nonetheless, it is important to note that this pollutant is being addressed by an USEPA approved TMDL.* | | | | |
| | | | | • Indicator Bacteria<br>◦ Source Unknown | 7.8 Miles | 2014 | 5A | 2019 |
| | | | | *While this Decision was based on a sufficient number of exceedances the of E. coli Single Sample objective, it should be noted that Enterococcus, Fecal Coliform and Total Coliform objectives no longer apply to the REC 1 Beneficial Use for fresh waters in Region 8. As such the Enterococcus, Fecal Coliform and Total Coliform LOEs will be retired. Further, the Single Sample objective was only used because of the lack of representative 30-day, 5-sample Geomean values, as per the Region 8 Basin Plan (2016 update) on page 4-17, footnote 3. When representative 30-day, 5-sample Geomean values are collected the Single Sample E. coli LOE will be retired.* | | | | |
| | | | | • Malathion<br>◦ Source Unknown | 7.8 Miles | 2014 | 5A | 2027 |
| | | | | • Nutrients<br>◦ Source Unknown | 7.8 Miles | 1996 | 5B | 1999 |
| | | | | • Sedimentation/Siltation<br>◦ Source Unknown | 7.8 Miles | 1996 | 5B | 1999 |
| | | | | • Selenium<br>◦ Source Unknown | 7.8 Miles | 2006 | 5A | 2007 |
| | | | | • Toxaphene<br>◦ See TMDL documentation | 7.8 Miles | 2006 | 5B | 2013 |
| | | | | • Toxicity<br>◦ Source Unknown | 7.8 Miles | 2014 | 5A | 2025 |
| 8 | Newport Bay, Upper (Ecological Reserve) | Estuary | 80111000 / 18070201 | • Chlordane<br>◦ See TMDL documentation | 653 Acres | 2006 | 5B | 2013 |
| | | | | • Copper<br>◦ Marinas and Recreational Boating | 653 Acres | 2006 | 5A | 2007 |
| | | | | • DDT (Dichlorodiphenyltrichloroethane)<br>◦ See TMDL documentation | 653 Acres | 2006 | 5B | 2013 |
| | | | | • Indicator Bacteria<br>◦ Source Unknown | 653 Acres | 2010 | 5B | 2000 |
| | | | | *The following LOEs had been incorrectly linked to Upper Newport Bay during the 2010 cycle : 8075, 8076, 8077 and 8078. They have not been used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. They have been copied over to Lower Newport Bay (where the sampling points are located) and have new LOE #'s.* | | | | |
| | | | | • Malathion<br>◦ Source Unknown | 653 Acres | 2014 | 5A | 2027 |
| | | | | • Nutrients<br>◦ Source Unknown | 653 Acres | 2006 | 5B | 1999 |
| | | | | • PCBs (Polychlorinated biphenyls)<br>◦ See TMDL documentation | 653 Acres | 2006 | 5B | 2013 |
| | | | | • Sedimentation/Siltation<br>◦ Agriculture<br>◦ Channel Erosion<br>◦ Construction/Land Development<br>◦ Erosion/Siltation | 653 Acres | 2006 | 5B | 1999 |
| | | | | • Toxicity<br>◦ Source Unknown | 653 Acres | 2014 | 5A | 2027 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings) | Bay & Harbor | 80114000 / 18070201 | • Chlordane<br>◦ See TMDL documentation | 767 Acres | 2006 | 5B | 2013 |
| | | | | • Copper<br>◦ Marinas and Recreational Boating | 767 Acres | 2006 | 5A | 2019 |
| | | | | • DDT (Dichlorodiphenyltrichloroethane)<br>◦ See TMDL documentation | 767 Acres | 1990 | 5B | 2013 |
| | | | | • Indicator Bacteria<br>◦ Source Unknown | 767 Acres | 2010 | 5B | 2000 |
| | | | | *The following LOEs had been incorrectly linked to Lower Newport Bay during the 2010 cycle : 8147, 8148, 8149, 8150, 8151, 8152, 8153, 8154, 8155, 8156, 8157, 8158, 8159, 8160, 8161, 8162, 28355, 28357, 28361, 28367, 28373, 28377, 28379, 28381, 28383. They have not been used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. They have been copied over to Upper Newport Bay (where the sampling points are located) and have new LOE #'s. LOE 26162 was created during the 2010 cycle and incorrectly combined sampling locations in both Upper and Lower Newport Bay. The data in LOE 26162 has been reanalyzed and 2 new LOEs have been created for those data in the proper waterbodies. LOE 26162 is not used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. In the 2010 cycle, the Shellfish Harvest Objective that was used in the LOEs was the Ocean Plan Total Coliform value, rather than the existing Region 8 Basin Plan Objective that was based on Fecal Coliform. While combining the LOEs written using the Ocean Plan Total Coliform objective results in a delisting for the Shellfish Harvest Beneficial Use, analysis of the 2008 -2010 Fecal Coliform data from the Beach Watch program resulted in 7 months of exceedance out of 23 months (where samples were collected) and based on weight of evidence, the decision was made to leave the Shellfish Harvest listing in place for Fecal Coliform.* | | | | |
| | | | | • Nutrients<br>◦ Source Unknown | 767 Acres | 1992 | 5B | 1999 |
| | | | | • PCBs (Polychlorinated biphenyls)<br>◦ See TMDL documentation | 767 Acres | 1990 | 5B | 2013 |
| | | | | • Toxicity<br>◦ Source Unknown | 767 Acres | 2014 | 5A | 2019 |

# Attachment G

# Infiltration BMP Feasibility Worksheet & Summary of Harvested

**Table 2.7: Infiltration BMP Feasibility Worksheet**

| | *Infeasibility Criteria* | *Yes* | *No* |
|---|---|---|---|
| 1 | **Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to **Appendix VIII** (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria. | | X |
| Provide basis:<br><br>Groundwater was encountered at 23 feet below surface per Geotechnical Report in Appendix J. | | | |
| 2 | Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert):<br>• The BMP can only be located less than 50 feet away from slopes steeper than 15 percent<br>• The BMP can only be located less than eight feet from building foundations or an alternative setback.<br>• A study prepared by a geotechnical professional or an available watershed study substantiates that storm water infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level. | | X |
| Provide basis:<br><br>Infiltration BMP would pose a significant risk because of insufficient setbacks from building structures. | | | |
| 3 | Would infiltration of the DCV from drainage area **violate downstream water rights**? | | X |
| Provide basis:<br><br>N/A | | | |

**Table 2.7: Infiltration BMP Feasibility Worksheet (continued)**

| | *Partial Infeasibility Criteria* | *Yes* | *No* |
|---|---|---|---|
| 4 | Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils? | | X |
| Provide basis:<br><br>The predominant soil type is C. Refer to Attachment E for Hydrologic Soils Group. | | | |
| 5 | Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in **Appendix VII**. | | |
| Provide basis:<br>N/A | | | |
| 6 | Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** | | X |
| Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: | | | |
| 7 | Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** | | X |
| | | | |

**Table 2.7: Infiltration BMP Feasibility Worksheet (continued)**

| **Infiltration Screening Results (check box corresponding to result):** | | |
|---|---|---|
| 8 | Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See **Appendix XVII**)<br><br>Provide narrative discussion and supporting evidence:<br><br>Section VIII.3 of the TGD, infiltration is prohibited within 250 feet of contaminated sites. GeoTracker Cleanup Site Map in Attachment C locates a Leaky Underground Storage Tank (LUST) cleanup site located within 250 feet of the project area limit, concluding in infiltration infeasiability for this site. | **Infiltration is infeasible due to C type soils.** |
| 9 | If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent.<br><br>Provide basis:<br><br>Section VIII.3 of the TGD, infiltration is prohibited within 250 feet of contaminated sites. GeoTracker Cleanup Site Map in Attachment C locates a Leaky Underground Storage Tank (LUST) cleanup site located within 250 feet of the project area limit, concluding in infiltration infeasiability for this site. | **Infiltration is infeasible due to C type soils.** |
| 10 | If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply.<br><br>Provide basis:<br><br>Although groundwater was not encountered until 15 feet, the design infiltration rate is below the minimum of 0.3 in/hr. | **Infiltration is infeasible due to C type soils.** |
| 11 | If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable. | **Infiltration is infeasible due to C type soils.** |

### Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility

| General Landscape Type | Conservation Design: $K_L$ = 0.35 | | | Active Turf Areas: $K_L$ = 0.7 | | |
|---|---|---|---|---|---|---|
| *Closest ET Station* | *Irvine* | *Santa Ana* | *Laguna* | *Irvine* | *Santa Ana* | *Laguna* |
| **Design Capture Storm Depth, inches** | **Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac** | | | | | |
| 0.60 | 0.66 | 0.68 | 0.72 | 0.33 | 0.34 | 0.36 |
| 0.65 | 0.72 | 0.73 | 0.78 | 0.36 | 0.37 | 0.39 |
| 0.70 | 0.77 | 0.79 | 0.84 | 0.39 | 0.39 | 0.42 |
| 0.75 | 0.83 | 0.84 | 0.90 | 0.41 | 0.42 | 0.45 |
| 0.80 | 0.88 | 0.90 | 0.96 | 0.44 | 0.45 | 0.48 |
| 0.85 | 0.93 | 0.95 | 1.02 | 0.47 | 0.48 | 0.51 |
| 0.90 | 0.99 | 1.01 | 1.08 | 0.49 | 0.51 | 0.54 |
| 0.95 | 1.04 | 1.07 | 1.14 | 0.52 | 0.53 | 0.57 |
| 1.00 | 1.10 | 1.12 | 1.20 | 0.55 | 0.56 | 0.60 |

### Worksheet J: Summary of Harvested Water Demand and Feasibility

| | | | | |
|---|---|---|---|---|
| 1 | What demands for harvested water exist in the tributary area (check all that apply): | | | |
| 2 | Toilet and urinal flushing | | ☐ | |
| 3 | Landscape irrigation | | ☑ | |
| 4 | Other:_____ | | ☐ | |
| 5 | What is the design capture storm depth? (**Figure III.1**) | d | 0.75 | inches |
| 6 | What is the project size? | A | 17.25 | ac |
| 7 | What is the acreage of impervious area? | IA | 15.53 | ac |
| | For projects with multiple types of demand ( toilet flushing, indoor demand, and/or other demand) | | | |
| 8 | What is the minimum use required for partial capture? (**Table X.6**) | N/A | | gpd |
| 9 | What is the project estimated wet season total daily use? | N/A | | gpd |
| 10 | Is partial capture potentially feasible? (Line 9 > Line 8?) | N/A | | |
| | For projects with only toilet flushing demand | | | |
| 11 | What is the minimum TUTIA for partial capture? (**Table X.7**) | N/A | | |
| 12 | What is the project estimated TUTIA? | N/A | | |

**Worksheet J: Summary of Harvested Water Demand and Feasibility**

| | | | |
|---|---|---|---|
| 13 | Is partial capture potentially feasible? (Line 12 > Line 11?) | | |
| | For projects with only irrigation demand | | |
| 14 | What is the minimum irrigation area required based on conservation landscape design? ( **Table X.8**) | X | ac |
| 15 | What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2) | X | ac |
| 16 | Is partial capture potentially feasible? (Line 15 > Line 14?) | No | |

Provide supporting assumptions and citations for controlling demand calculation:

Line 14: KL x Line 7
Line 14: 15.53 x 0.84 = 13.04
Line 15: Landscape area = 1.73
Line 15 < Line 14 ; Therefore, re-use for irrigation is not feasible

**Table VIII.1: Recommendations/Requirements for BMP Selection to Minimize Groundwater Quality Impacts**

| Tributary Area Risk Category | Narrative Description of Category | Example Land Use Activities | BMP Selection Requirements |
|---|---|---|---|
| **Low Runoff Contamination Potential** | BMP receives runoff from a mix of land covers that are expected to have relatively clean runoff; significant spills in tributary area are unlikely. | • Rooftops with roofing material and downspouts free of copper and zinc<br>• Patios, sidewalks, and other pedestrian areas<br>• Mixed residential land uses with applicable source controls<br>• Institutional land uses with applicable source controls<br>• Driveways and minor streets | • Any infiltration BMP type may be used<br>• Pretreatment for sediment is strongly recommended, as applicable, to mitigate clogging |
| **Moderate Runoff Contamination Potential** | BMP receives runoff from a mix of land covers, more than 10 percent of which have the potential to generate stormwater pollutants at levels that could potentially contaminate groundwater; there is potential for minor spills in the tributary area. | • Roadways greater than 5,000 ADT but less than 25,000 ADT<br>• Commercial and institutional parking lots<br>• Commercial land uses<br>• Light industrial that does not include usage of chemicals that are mobile in stormwater and groundwater<br>• Trash storage areas | • Any infiltration BMP type may be used<br>• Pretreatment shall be used<br>• The type of pretreatment shall be selected to address potential groundwater contaminants potentially found in stormwater runoff. |
| **High Runoff Contamination Potential** | BMP receives runoff from a mix of land covers, more than 10 percent of which have significant unavoidable potential to generate stormwater pollutants in quantities that could be detrimental to groundwater quality; and/or there is significant potential for major spills that could drain to BMPs. | • Roads greater than 25,000 ADT<br>• Heavy and light industrial pollutant source areas, including areas with exposed industrial activity and high use industrial truck traffic, and any areas that cannot be isolated these areas. Does not include lower risk source sources areas within industrial zones (e.g., roofs, offices, and parking areas) that are hydrologically isolated from industrial pollutant source areas<br>• Automotive repair shops<br>• Car washes<br>• Fleet storage areas<br>• Nurseries, agriculture, and heavily managed landscape areas with extensive use of fertilizer<br>• Fueling stations (infiltration prohibited under all conditions) | • Infiltration is prohibited unless advanced pretreatment and spill isolation can be feasibly used and enhanced monitoring and inspection are implemented.<br>• Large projects[18] must evaluate feasibility of advanced pretreatment and spill isolation.<br>• Small projects[18] may consider infiltration to be infeasible with narrative discussion. |

[18] See Table VIII.2 for definition of "Large" and "Small" projects.

# Attachment H

# BMP's info & Details

# Filterra Bioscape Owner's Manual

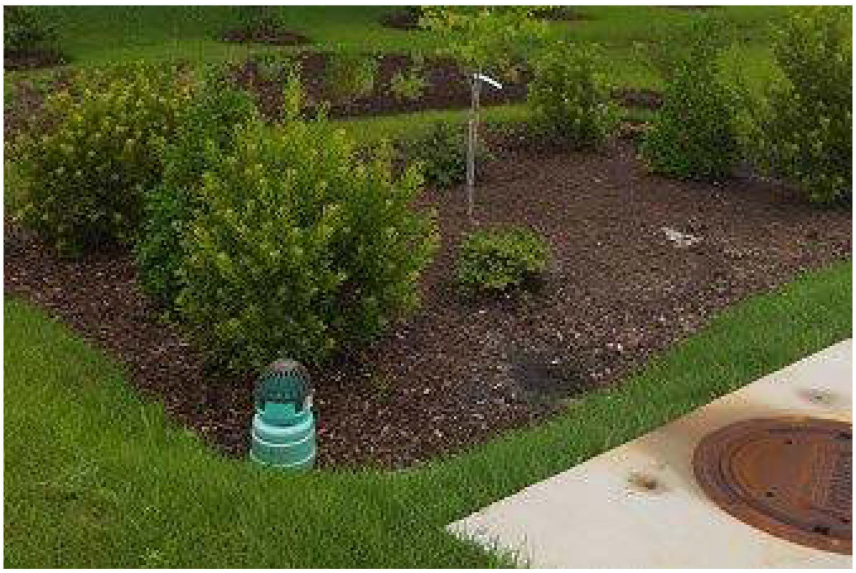
(No Precast Vault Provided)

filterra®

Bioscape®

CONTECH®
ENGINEERED SOLUTIONS

This Owner's Manual applies to Filterra Bioscape ONLY (Filterra installed directly into an excavated basin or other customer provided container, such as a large cast-in-place vault).



filterra® Bioscape®

# Table of Contents



CONTECH® ENGINEERED SOLUTIONS

# Introduction

Thank you for your purchase of the Filterra® Bioscape® System. Filterra® is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. The system's biota (vegetation and soil microorganisms) then further breakdown and absorb captured pollutants. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

Included with your purchase is a Supervised Activation service as well as a 1-year warranty from delivery of the system. In some cases, a Final Site Assessment (assessment of unit condition, mulch replacement, debris removal and pruning) may also be included for systems smaller than 1000 sf in size. Check your order documentation for further information.

Filterra® Bioscape® systems should not be activated until the site is stabilized to prevent construction related runoff from entering and contaminating the system. For Filterra® Bioscape® systems installed within an excavated basin, Contech provides an erosion control sock around the perimeter to provide an extra layer of protection. However, these protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra® Bioscape® system.

# Design and Installation

Each project presents different scopes for the use of Filterra® Bioscape® systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra® Bioscape® sizing (by rainfall region) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra® Bioscape® systems as shown in approved plans. A comprehensive installation manual is available from Contech.

# Activation Overview

Activation of the Filterra® Bioscape® system is a procedure completed by the contractor to place the system into working condition. This involves the following items:

- Installation of the Filterra® Bioscape® underdrain system
- Installation of the Filterra® media layer
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra® systems

## Minimum Requirements

The minimum requirements for Filterra® Bioscape®Activation are as follows:

1. The purchaser must have sourced vegetation meeting the requirements outlined in the Filterra® Bioscape® Activation Package
2. A pre-construction meeting is required to discuss site requirements, logistics planning and activation FAQ and red flags.
3. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.
4. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra® system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra® system.
5. All immediate upstream and downstream structures should be placed with piping into the system already installed for connection during activation.

An Activation Checklist is included in the Filterra® Bioscape® Activation Package to ensure proper conditions are met for Activation. A charge of $1500.00 will be invoiced for each Supervised Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

## Filterra Plant Selection Overview

A Plant List is available on the Contech website highlighting recommended plants for Filterra® Bioscape® systems in your area. Keep in mind that plants are subject to availability due to seasonality. Plants installed in the Filterra® Bioscape® system shall be container-grown plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation. It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra® Bioscape® system. The "Filterra® Bioscape® Activation Package" document is included as an appendix and discusses proper selection of the plants within Filterra® Bioscape® systems.

## Warranty Overview

Refer to the Contech® Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra® Bioscape® system's warranty and waive the manufacturer provided Final Site Assessment (if applicable):

- Unauthorized activation or performance of any of the items listed in the activation overview without Contech supervision or input
- Removal of any Filterra® system components
- Failure to prevent construction related runoff from entering the Filterra® system
- Failure to properly store and protect any Filterra® components (including media and underdrain stone) that are shipped separately to the site

## Routine Maintenance Guidelines

With proper routine maintenance, the biofiltration media within the Filterra® Bioscape® system should last as long as traditional bioretention media. Routine maintenance can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

## Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan of your Filterra® media.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra® Bioscape® is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials entering the inlet. This may include trash, silt and leaves etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

## When to Maintain?

Maintenance visits are typically scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally recommended; In regions with less rainfall often only (1) one visit per annum is sufficient. Varying land uses can affect maintenance frequency; e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Manufacturer and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the maintenance provider of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology.

## Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not included as part of the Final Site Assessment (if applicable). Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra® (where the cleaned runoff drains to, such as drop inlet) and block off the throat of the Filterra®. The Supplier should be informed immediately.

## Maintainenance Visit Summary

Maintenance visits are typically scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

1. Inspection of Filterra® Bioscape® and surrounding area
2. Removal of erosion control stones
3. Removal of debris, trash and mulch
4. Removal and disposal of erosion control sock from system perimeter (should be completed at 6 month or 12 month maintenance depending upon site characteristics). A new erosion control sock is no longer needed after the first year.
5. Mulch replacement
6. Plant health evaluation and pruning or replacement as necessary
7. Clean area around Filterra®
8. Complete paperwork

# Plant Care for Filterra® Systems

After Activation, the Contractor is responsible for proper care of the vegetation until the site is handed over to the Owner. After that, it is the Site Owner's responsibility to care for the vegetation. Contech recommends the following care for the plants:

1. To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
2. Plant staking may be required.
3. With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
4. Contech recommends irrigation of the Filterra® Vegetation. The following guidance will help to ensure the vegetation is properly irrigated.

## Irrigation Recommendations:

- Each Filterra® system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra® plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore if dry periods exceed 3 weeks, irrigation may be required.

*** Five gallons per square yard approximates 1 inch of water. Therefore for a 6' x 6 foot Filterra® approximately 20-60 gallons of applied water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five gallon bucket to estimate the applied water flow rate. Then calculate the time needed to irrigate the Filterra®, For example is the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6'x6' filter.*

## Plant Replacement:

In some cases, plants will require replacement. Please follow the procedures below to ensure a properly functioning Filterra® system.

1. Remove the existing plant, and leave as much of the Filterra® media in place as possible.
2. Select a replacement per the Filterra® Bioscape® Activation Package.
3. Prior to removing the plant from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
4. Cut away any roots which are growing out of the container drain holes.
5. Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
6. Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
7. Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
8. All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
9. Reinstall or add mulch to a depth of 3" per Contech's mulch specifications for Filterra® systems.

# Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.

## 1. Inspection of Filterra and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

| | |
|---|---|
| Standing Water | yes \| no |
| Is Bypass Clear | yes \| no |

If yes answered to any of these observations, record with close-up photograph (numbered).

## 2. Removal of erosion control stones

- Set aside erosion control stones for reuse after mulch has been replaced.
- Dig out silt (if any) and mulch and remove trash & foreign items.

Record on Maintenance Report the following:

Is scour present around the inlet areas? yes | no

If answering yes, consider adding additional erosion control stone.

## 3. Removal of debris, trash and mulch

- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

| | |
|---|---|
| Silt/Clay | yes \| no |
| Bypass Clear | yes \| no |
| Leaves | yes \| no |
| # of Buckets Removed | _____ |

## 4. Removal and Disposal of Erosion Control Sock

- Remove and dispose of erosion control sock if site conditions allow (site should be fully stabilized). Erosion control sock is no longer needed after 1-year post activation.

## 5. Mulch Replacement

- Add mulch evenly across entire system to a depth of three inches.

## 6. Vegetation health evaluation and pruning

- Examine the vegetation health and replace if necessary. Prune vegetation to encourage growth in the correct directions. Since Filterra® Bioscape® systems can contain many plants, only notation of individual damaged or unhealthy plants is necessary.
  - » Record on Maintenance Report the following:
  - » Vegetation Health
  - » Vegetation Damage

Document damaged or unhealthy plants with photographs.

## 7. Clean side slopes and area around the Filterra Bioscape system

- Remove all trash and debris to be disposed of appropriately.

## 8. Complete paperwork

- Complete Maintenance Report. Some jurisdictions require submission of maintenance reports in accordance with approvals. It is the responsibility of the owner to comply with local regulations.

## Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing, barricades when working in close proximity to traffic and safety hats, glasses, and shoes.

Most visits require minor trash removal and a full replacement of mulch. Mulch should be a double shredded, hardwood variety.

# Maintenance Checklist

| Drainage System Failure | Problem | Conditions to Check | Condition that Should Exist | Actions |
|---|---|---|---|---|
| Inlet | Excessive sediment or trash accumulation. | Accumulated sediments or trash impair free flow of water into Filterra. | Inlet should be free of obstructions allowing free distributed flow of water into Filterra. | Sediments and/or trash should be removed. |
| Mulch Cover | Trash and floatable debris accumulation. | Excessive trash and/or debris accumulation. | Minimal trash or other debris on mulch cover. | Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used. |
| Mulch Cover | "Ponding" of water on mulch cover. | "Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils. | Stormwater should drain freely and evenly through mulch cover. | Recommend contact manufacturer and replace mulch as a minimum. |
| Vegetation | Plants not growing or in poor condition. | Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants. | Plants should be healthy and pest free. | Contact manufacturer for advice. |
| Vegetation | Plant growth excessive. | Plants should be appropriate to the species and location of Filterra. | | Trim/prune plants in accordance with typical landscaping and safety needs. |
| *Maintenance is ideally to be performed twice annually.* | | | | |

# Filterra Inspection & Maintenance Log

**Filterra System Size/Model:**_____ **Location:** _____

| Date | Mulch & Debris Removed | Depth of Mulch Added | Mulch Brand | Vegetation Species | Issues with System | Comments |
|---|---|---|---|---|---|---|
| *1/1/17* | *5 – 5 gal Buckets* | *3"* | *Lowe's Premium Brown Mulch* | *Galaxy Magnolia* | *- Standing water in downstream structure* | *- Removed blockage in downstream structure* |
| | | | | | | |
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# Appendix 1 – Filterra® Bioscape® Activation Package

## FILTERRA® BIOSCAPE® ACTIVATION PACKAGE

(No Precast Vaults Provided)

CONTECH® ENGINEERED SOLUTIONS

It is the purchaser's responsibility to Activate the Filterra Bioscape System and provide adequate measures to prevent construction related runoff from entering the Filterra Bioscape system.

Included with your purchase is Supervised Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system. The purchaser must ensure that the site is acceptable for Filterra Bioscape Activation. A checklist (included as page 2 of this document must be completed and submitted to the Contech Activation Coordinator. The minimum requirements for Filterra Bioscape Activation are as follows:

1. The purchaser must have sourced vegetation meeting the requirements outlined in "Plant Selection for Filterra Systems" below.
2. A pre-construction meeting is required to discuss site requirements, logistics planning and activation FAQ and red flags.
3. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.
4. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.
5. All immediate upstream and downstream structures should be placed with piping into the system already installed for connection during activation.

## Plant Selection for Filterra® Bioscape® Systems

All Filterra systems require vegetation for proper long-term performance. As indicated in the Filterra Bioscape Activation Package, the Contractor is responsible for sourcing the proper vegetation prior to Supervised Activation. Contech or a Contech representative will supervise installation the vegetation during the Activation process.

Contractors must ensure the vegetation meets the following 3 requirements:

1. Select plant(s) as specified in the engineering plans and specifications AND that are listed on Contech's Configuration Specific Plant Lists.
2. All plants MUST be container-grown in nursery containers no larger than 15 gallons. Crated and/or Ball/Burlap plants are NOT permitted.
3. Quantities should be selected based on plant palette options found starting on page 3 of this document.

If Contech or Contech's representative shows up for Supervised Activation and any of the 3 requirements above are not met, Activation cannot be performed and the Contractor will be billed a $1,500 Unprepared Site fee*.

* *UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor.*

# Filterra® Contractor Activation Checklist

Requested Activation Date: _____ System Designation: _____

Project Name: _____

Site Contact Name: _____ Site Contact Phone/Email: _____

Site Owner/End User Name: _____ Site Owner/End User Phone/Email: _____

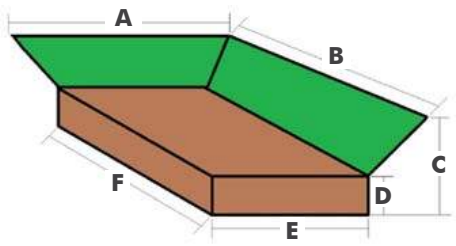
Please complete the following checklist, sign, date, and submit with your activation request to your Contech Project Consultant. Along with the checklist, fill out the as-built dimensions of the Filterra Bioscape system excavation(s), and attach photos of the Filterra Bioscape excavation(s). This information is essential to ensure the proper amount of material is provided.

## Checklist:

- ☐ Upstream drainage area to Filterra Bioscape system is stabilized.
- ☐ Filterra Bioscape excavated per plan dimensions to bottom of Filterra underdrain stone depth. Surface area of media area must match order quantities.
- ☐ If additional depth of drain rock is required per site plans, additional drain rock is installed to the Filterra Bioscape underdrain pipe elevation.
- ☐ Excavation sides vertical from bottom of excavation to top of mulch (Approximately 34" when 6" underdrain is utilized).
- ☐ Excavation sides maximum slope 3:1 from top of mulch to finished grade.
- ☐ Side slopes above top of mulch elevation stabilized with sod or other slope stabilization.
- ☐ Bioscape Inlet (BSI) structure or other inlet/bypass structure installed and properly backfilled with maximum 3:1 slopes to top of mulch elevation.
- ☐ Inflow pipe(s) connected from BSI or other inlet structure to edge of Filterra Bioscape system excavation.
- ☐ Outflow pipe(s) connected from edge of Filterra Bioscape system excavation to downstream structure.
- ☐ Outflow pipe(s) are SDR35, properly sized per site plan underdrain pipe size(s).
- ☐ Excavation is dry and free from construction related sediment and debris.
- ☐ Bottom of excavation is properly scarified.
- ☐ Excavation is accessible by standard construction equipment.
- ☐ Plants have been purchased in accordance with the guidance in "Plant Selection for Filterra Bioscape Systems"
- ☐ Photos attached.

NOTE: Please ensure that all of the above conditions have been met prior to activation request. A mobilization fee (minimum $1000.00) applies for each activation visit requested by Customer where Contech determines that the site does not meet the above conditions suitable for activation.

## As-Built Dimensions




| | | |
|---|---|---|
| A. | OVERALL EXCAVATION WIDTH: | _____FT |
| B. | OVERALL EXCAVATION LENGTH: | _____FT |
| C. | OVERALL EXCAVATION HEIGHT: | _____FT |
| D. | FILTERRA BED HEIGHT: | _____FT |
| E. | FILTERRA MEDIA BED WIDTH: | _____FT |
| F. | FILTERRA MEDIA BED LENGTH: | _____FT |

Signature _____ Date _____

* *UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor.*

# Filterra® Bioscape Plant Palettes

**KEY:** (refer to plant lists for species sizing)

**A. EXTRA SMALL GRASS**
- Up to 2′ mature spread
- 1-2 gallon typical (1 gal. minimum)

**B. SMALL GRASS/SHRUB**
- 2′-4′ mature spread
- 1-7 gallon typical

**C. MEDIUM SHRUB**
- 4′-6′ mature spread
- 1-7 gallon typical

**D. LARGE SHRUB OR EXTRA LARGE SHRUB OR TREE**
- 6′ mature spread and greater, 30′ max. mature height
- Up to 15 gallon maximum

**NOTE**: *For larger vaults and in-ground Filterra Bioscape systems, palettes can be scaled (i.e. Qty 6 of the 175 SF Palette can be used for a 1056 SF Filterra Bioscape).*

**MIX & MATCH SUBSTITUTION OPTIONS:**

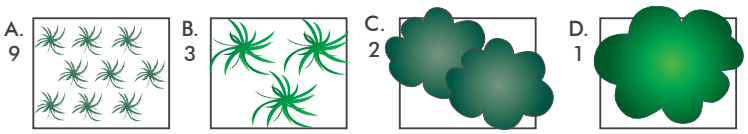
1 Large Shrub or Extra Large Shrub or Tree
- 2 Medium Shrubs
- 4 Small Grass/SHrubs
- 12 Extra Small Grasses

1 Medium Shrub
- 2 Small Grass/Shrubs
- 6 Extra Small Grasses

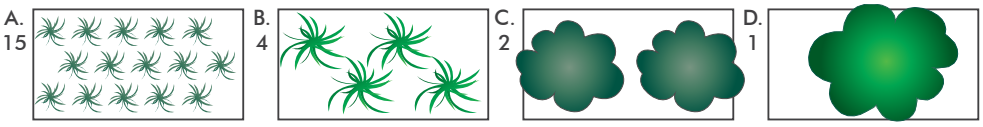
1 Small Grass/Shrub
- 3 Extra Small Grasses

25 SF example

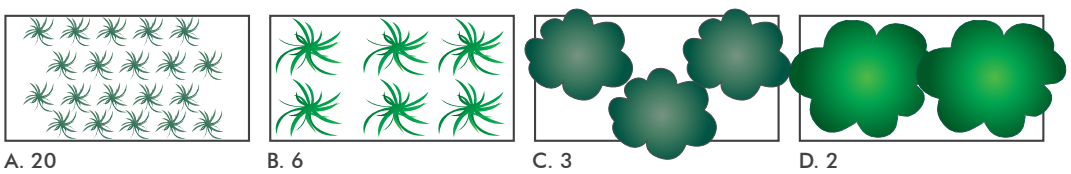

50 SF example




75 SF example

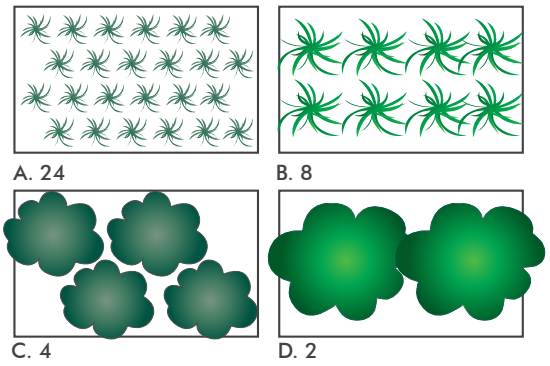



100 SF example

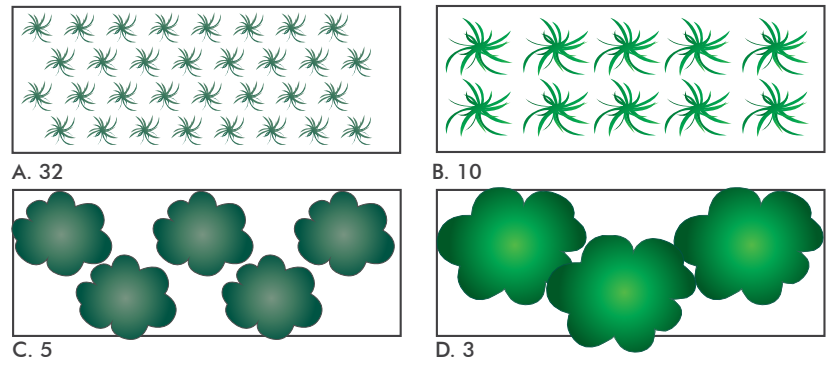



* *UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor.*

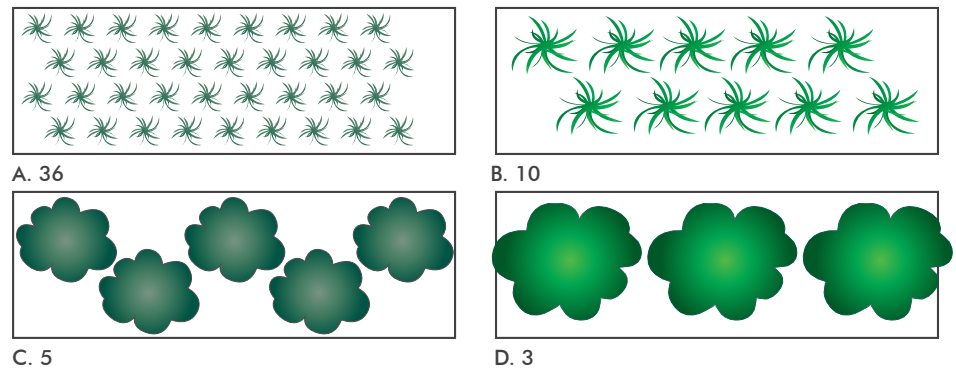
125 SF example




150 SF example




175 SF example




In some cases, Contech may consider alternate plant species as approved by the Product Manager. Please list the plant name in the space below and submit this sheet to your Contech Activation Coordinator. If the plant species is approved, either the Product Manager or the Activation Coordinator will sign the form and return to you for inclusion with your Activation Checklist.

Requested Plant Species: _____ Approved: _____

Date: _____

* *UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor.*

## NOTES

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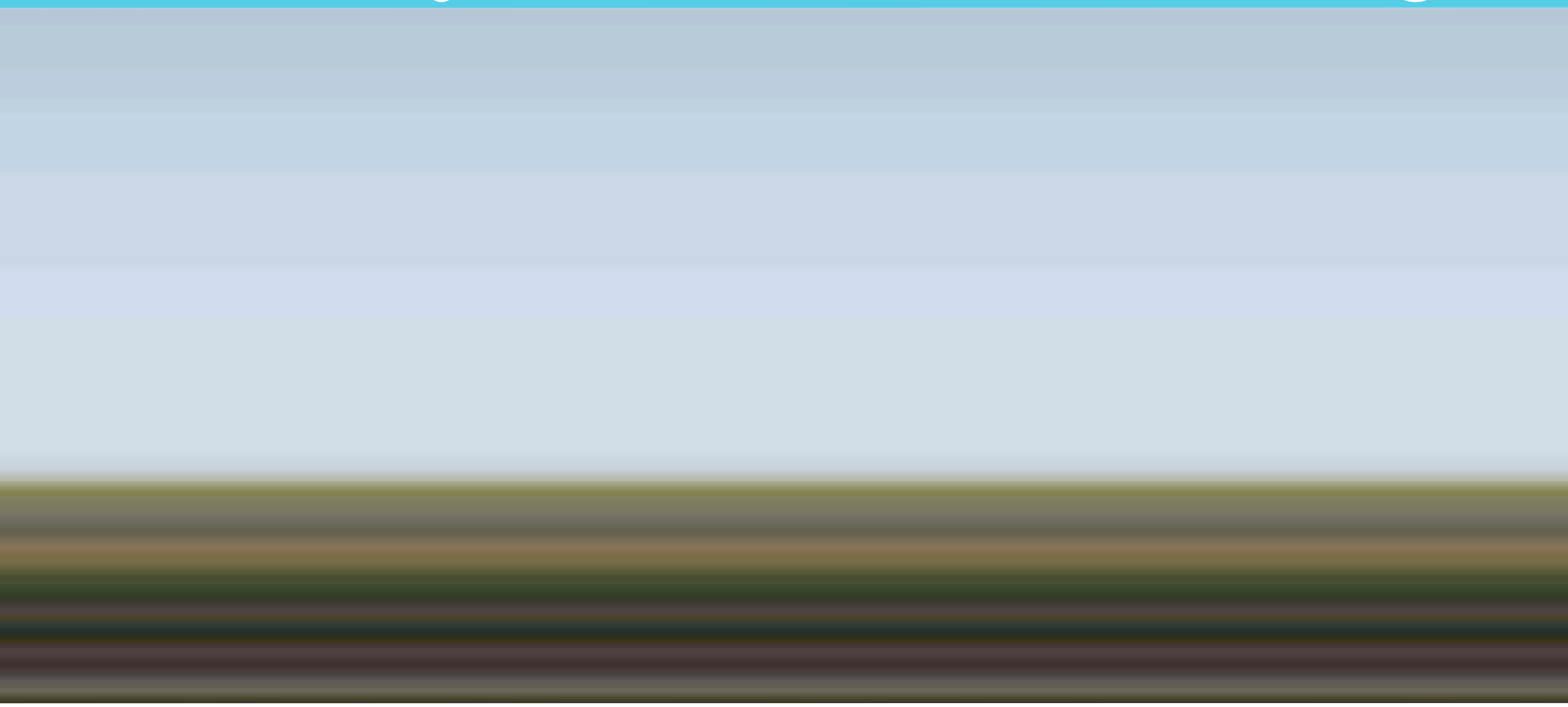
# Modular Wetlands® Linear Stormwater Biofiltration

# The experts you need to solve your stormwater challenges



**Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.**

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

## Your Contech Team

### STORMWATER CONSULTANT

*It's my job to recommend the best solution to meet permitting requirements.*

### STORMWATER DESIGN ENGINEER

*I work with consultants to design the best approved solution to meet your project's needs.*

### REGULATORY MANAGER

*I understand the local stormwater regulations and what solutions will be approved.*

### SALES ENGINEER

*I make sure our solutions meet the needs of the contractor during construction.*

**Contech is your partner in stormwater management solutions**


# Restoring Nature's Presence in Urban Areas – Modular Wetlands® Linear

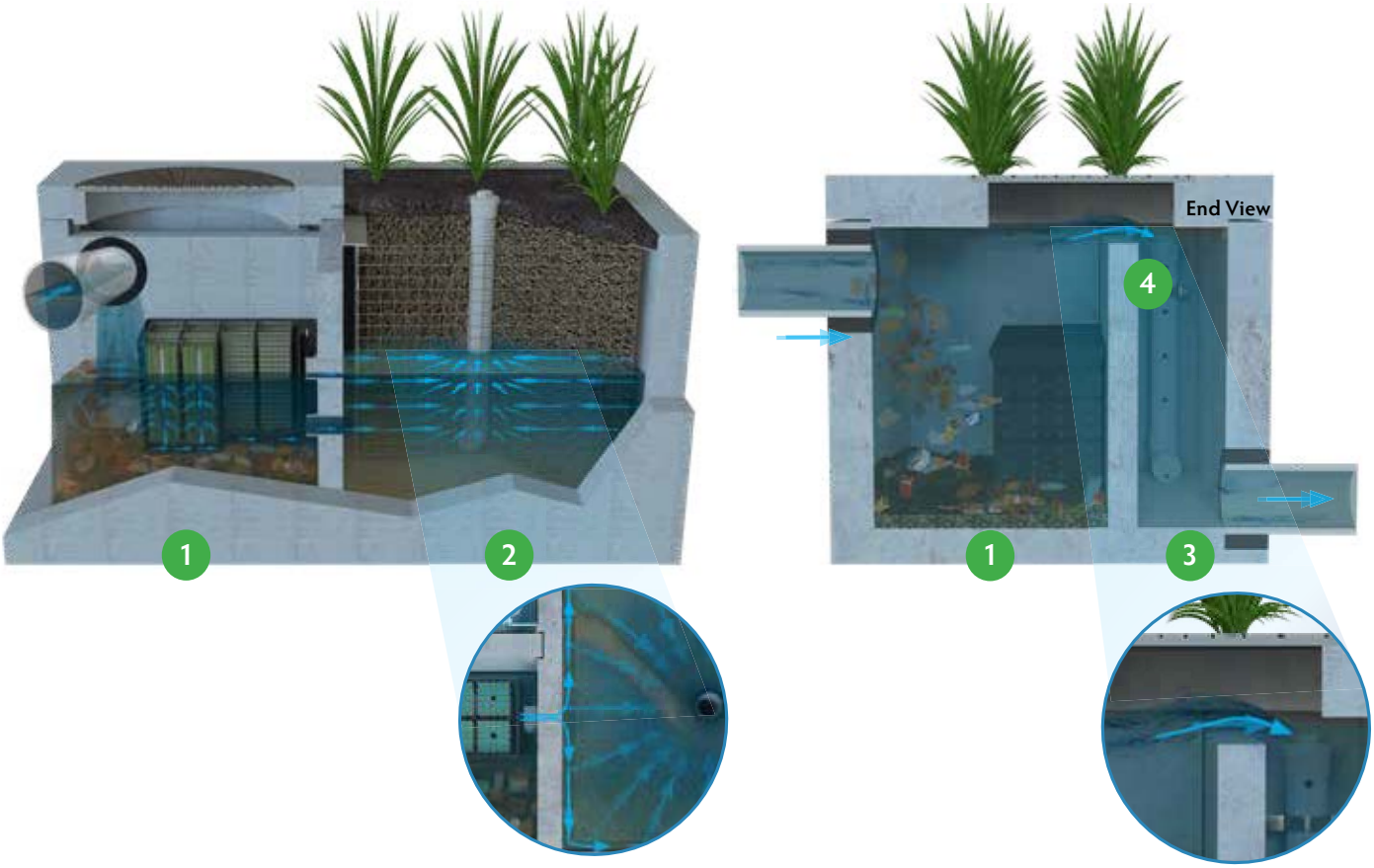
*As cities grow, there is less space for natural solutions to treat stormwater. Contech understands this and is committed to providing compact, Low Impact Development (LID) solutions like the Modular Wetlands Linear to protect our nation's waterways.*

The Modular Wetlands® Linear is the only biofiltration system to utilize patented horizontal flow, allowing for a small footprint, high treatment capacity, and design versatility. It is also the only biofiltration system that can be routinely installed downstream of storage for additional volume control and treatment.

With numerous regulatory approvals, the system's aesthetic appeal and superior pollutant removal make it the ideal solution for a wide range of stormwater applications, including urban development projects, commercial parking lots, residential streets, mixed-use developments, streetscapes, and more.

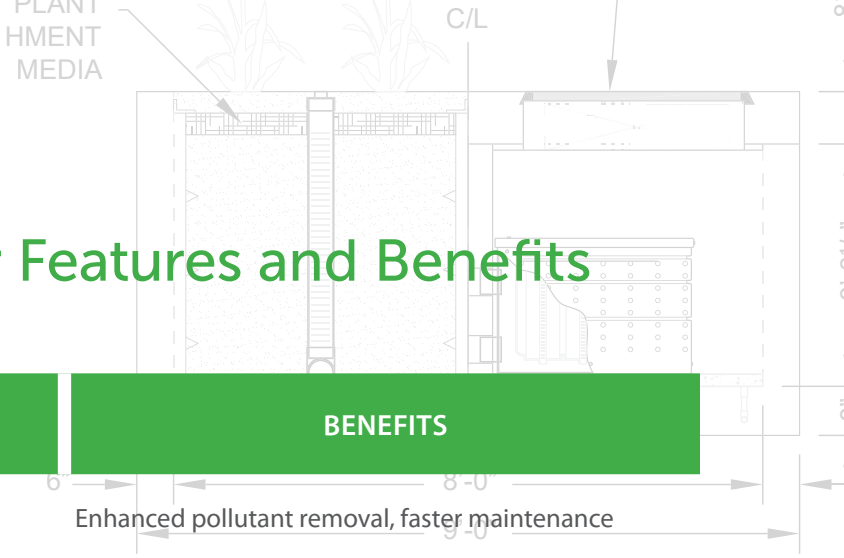
MODULAR WETLANDS®

# How the Modular Wetlands® Linear Works




1. **PRETREATMENT** | Stormwater enters the pretreatment chamber where total suspended solids settle, and trash and debris are contained within the chamber. Stormwater then travels through the pretreatment filter boxes that provide additional treatment.
2. **BIOFILTRATION** | As water enters the biofiltration chamber, it fills the void space in the chamber's perimeter. Horizontal forces push the water inward through the biofiltration media, where nutrients and metals are captured. The water then enters the drain pipe to be discharged.
3. **DISCHARGE** | The specially designed vertical drain pipe and orifice control plate control the flow of water through the media to a level lower than the media's capacity, ensuring media effectiveness. The water then enters the horizontal drain pipe to be discharged.
4. **BYPASS** | During peak flows, an internal weir in the side-by-side configuration allows high flows to bypass treatment, eliminating flooding and the need for a separate bypass structure. Bypass is not provided in the end-to end configuration.

## Using horizontal flow to improve performance




# Modular Wetlands® Linear Features and Benefits

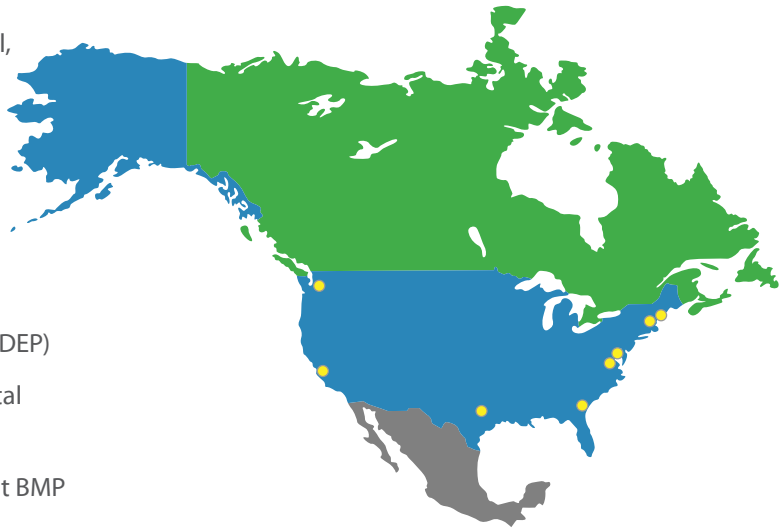
| FEATURE | BENEFITS |
|---|---|
| Pretreatment chamber | Enhanced pollutant removal, faster maintenance |
| Horizontal flow biofiltration | Greater filter surface area |
| Performance verified by both the WA DOE and NJ DEP | Superior pollutant capture with confidence |
| Built-in high flow bypass | Eliminates flooding and the need for a separate bypass structure |
| Available in multiple configurations and sizes | Flexibility to meet site-specific needs |

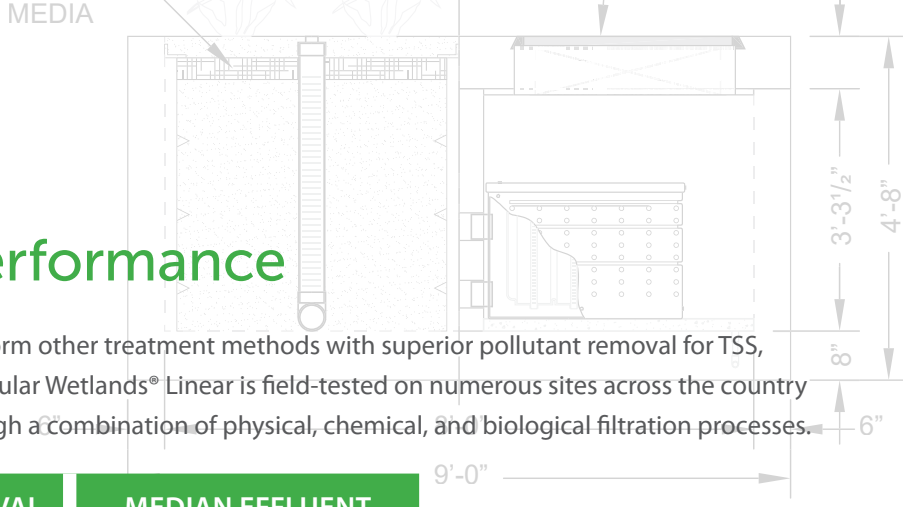
**The Modular Wetlands system offers many different configurations.**

# Select Modular Wetlands® Linear Approvals

Modular Wetlands Linear is approved through numerous local, state and federal programs, including but not limited to:

- Washington State Department of Ecology TAPE
- California Water Resources Control Board, Full Capture Certification
- Virginia Department of Environmental Quality (VA DEQ)
- New Jersey Department of Environmental Protection (NJDEP)
- Maryland Department of the Environment - Environmental Site Design (ESD)
- Rhode Island Department of Environmental Management BMP
- Texas Commission on Environmental Quality (TCEQ)
- Atlanta Regional Commission Certification






# Modular Wetlands® Performance

The Modular Wetlands® Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, and hydrocarbons. The Modular Wetlands® Linear is field-tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes.

| POLLUTANT OF CONCERN | MEDIAN REMOVAL EFFICIENCY | MEDIAN EFFLUENT CONCENTRATION (MG/L) |
|---|---|---|
| Total Suspended Solids (TSS) | 89% | 12 |
| Total Phosphorus - TAPE (TP) | 61% | 0.041 |
| Nitrogen (TN) | 23% | 1 |
| Total Copper (TCu) | 50% | 0.006 |
| Total Dissolved Copper | 37% | 0.006 |
| Total Zinc (TZn) | 66% | 0.019 |
| Dissolved Zinc | 60% | 0.0148 |
| Motor Oil | 79% | 0.8 |

*Sources:*
*TAPE Field Study - 2012*
*TAPE Field Study - 2013*

*Note: Some jurisdictions recognize higher removal rates. Contact your Contech Stormwater Consultant for performance expectations.*

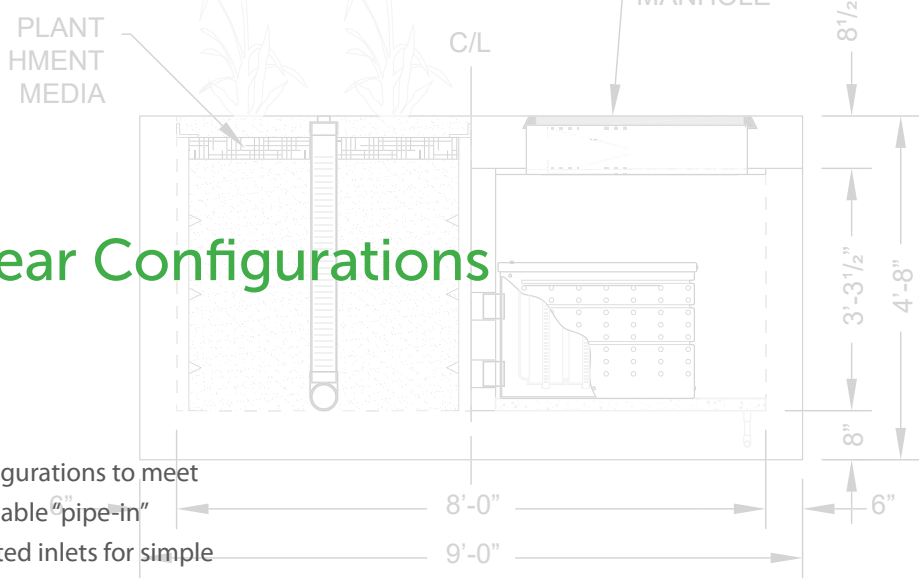
# Modular Wetlands® Linear Maintenance

The Modular Wetlands® Linear is a self-contained treatment train. Maintenance requirements for the unit consist of five simple steps that can be completed using a vacuum truck. The system can also be cleaned by hand.

- Remove trash from the screening device
- Remove sediment from the separation chamber
- Periodically replace the pretreatment cartridge filter media
- Replace the drain down filter media
- Trim vegetation

*Most Modular Wetland Linear systems can be cleaned in about thirty minutes.*

## Multiple configurations allow for easy site integration




# Modular Wetlands® Linear Configurations

**Multiple system configurations integrate with site hydraulic design and layout ...**

The Modular Wetlands Linear is offered in multiple configurations to meet site specific needs. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.

## Curb Inlet

The Curb Inlet configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions.

## Vault

The Vault configuration can be used in end-of-the-line installations. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements, or for traffic-rated designs (no plants).

## Downspout

The Downspout configuration is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

# A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

## THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

## TAKE THE NEXT STEP

For more information: www.ContechES.com



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# Attachment I

# Master Covenant and Agreement and Maintenance & Operation Plan

TBD FOR FINAL WQMP