Low Impact Development Plan (LID)

Project Name:

South Bay Galleria
1815 Hawthorne Boulevard
Redondo Beach, CA 90277

Prepared for:

Forest City Enterprises
50 Public Square, Suite 1360
Cleveland, OH 44113
Attn: Keith Geiger
(310) 371-1596

Submitted to:

City of Redondo Beach
415 Diamond Street
Redondo Beach, CA 90277
(310) 318-0661

Prepared by:

Tait & Associates, Inc.
Engineer: Michael P. Silvey  Registration No.: 58651
701 N. Parkcenter Drive
Santa Ana, CA 92705
(714)560-8200

Date: 3/3/2016
Revised Date: Click here to enter a date.
OWNER’S CERTIFICATION

Owner Certification

<table>
<thead>
<tr>
<th>Owner’s Name: Keith Geiger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
</tr>
<tr>
<td>Forest City Enterprises</td>
</tr>
<tr>
<td>Address</td>
</tr>
<tr>
<td>50 Public Square, Suite 1360</td>
</tr>
<tr>
<td>Email</td>
</tr>
<tr>
<td>Click here to enter text.</td>
</tr>
<tr>
<td>Telephone</td>
</tr>
<tr>
<td>(310) 371-1596</td>
</tr>
</tbody>
</table>

This Low Impact Development (LID) Plan is intended to comply with the requirements of County of Los Angeles for CAS004001, ORDER NO R4-2012-0175 which includes the requirement for the preparation and implementation of a LID Plan.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this LID Plan and will ensure that this LID Plan is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This LID Plan will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this LID. At least one copy of this LID Plan will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this LID Plan. The undersigned is aware that implementation of this LID Plan is enforceable under County of Los Angeles Water Quality Ordinance (Municipal Code Section CAS004001, ORDER NO R4-2012-0175).

"I, the undersigned, certify under penalty of law that the provisions of this LID have been reviewed and accepted and that the LID will be transferred to future successors in interest."

<table>
<thead>
<tr>
<th>Owner’s Signature</th>
<th>Date</th>
</tr>
</thead>
</table>
**PREPARER’S CERTIFICATION**

<table>
<thead>
<tr>
<th>Preparer (Engineer) Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparer (Engineer): Michael P. Silvey</strong></td>
</tr>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td><strong>Company</strong></td>
</tr>
<tr>
<td><strong>Address</strong></td>
</tr>
<tr>
<td><strong>Email</strong></td>
</tr>
<tr>
<td><strong>Telephone</strong></td>
</tr>
</tbody>
</table>

I hereby certify that this Low Impact Development (LID) Plan is in compliance with, and meets the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit for stormwater and non-stormwater discharges from the MS4 within the coastal watersheds of Los Angeles County (CAS004001, Order No R4-2012-0175).

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

<table>
<thead>
<tr>
<th>Preparer Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

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A. **LID REQUIREMENTS**

### A.1 LID Background

In 1987, The Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) was amended to provide that the discharge of pollutants to waters of the United States from stormwater is effectively prohibited, unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) Permit. The 1987 amendments to the CWA added Section 402 (p), which established a framework for regulating municipal, industrial and construction stormwater discharges under the NPDES program. In California, these permits are issued through the State Water Resources Control Board - (SWRCB) and the nine Regional Water Quality Control Boards.

On November 8, 2012, the Regional Water Quality Control Board, Los Angeles Region (RWQCB), adopted Order No.R4-2012-0175. This Order is the NPDES Permit (NPDES No. CAS004001) for municipal stormwater and urban runoff discharges within the County of Los Angeles.

As adopted in November 2012, the requirements of Order No. R4-2012-0175 (the "Permit") cover 84 cities and the unincorporated areas of Los Angeles County. Under the Permit, the Los Angeles County Flood Control District is designated as the Principal Permittee; the County of Los Angeles along with the 84 incorporated cities is designated as Permittees.

In compliance with the Permit, the Permittees have implemented a stormwater quality management program (SQMP) with the ultimate goal of accomplishing the requirements of the Permit and reducing the amount of pollutants in stormwater and urban runoff wherein new development/redevelopment projects are required to prepare a Low Impact Development (LID) report.
A.2 Designated Priority Project Categories

The project is classified as category items 1, 3, 9b, and 11a as listed in Table 1 below and is therefore classified as a Designated Project.

<table>
<thead>
<tr>
<th>Item</th>
<th>Applicable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>All development projects equal to 1 acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area.</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>Industrial parks 10,000 square feet or more of surface area.</td>
</tr>
<tr>
<td>3</td>
<td>Y</td>
<td>Commercial malls 10,000 square feet or more of surface area.</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>Retail gasoline outlets with 5,000 square feet or more of surface area.</td>
</tr>
<tr>
<td>5</td>
<td>N</td>
<td>Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of surface area.</td>
</tr>
<tr>
<td>6</td>
<td>N</td>
<td>Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces.</td>
</tr>
<tr>
<td>7</td>
<td>N</td>
<td>Streets and roads construction of 10,000 square feet or more of impervious surface area. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects.</td>
</tr>
<tr>
<td>8</td>
<td>N</td>
<td>Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) 5,000 square feet or more of surface area.</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area (ESA), where the development will:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>b. Create 2,500 square feet or more of impervious surface area</td>
</tr>
<tr>
<td>10</td>
<td>N</td>
<td>Single-family hillside homes.</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Redevelopment Projects:</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>a. Land disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site on Planning Priority Project categories.</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>b. Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, the entire project must be mitigated.</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>c. Where Redevelopment results in an alteration of less than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, only the alteration must be mitigated, and not the entire development.</td>
</tr>
</tbody>
</table>
Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways which does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Redevelopment does not include the repaving of existing roads to maintain original line and grade.

Existing single-family dwelling and accessory structures are exempt from the Redevelopment requirements unless such projects create, add or replace 1,000 square feet of impervious surface area.
### B. PROJECT AND SITE INFORMATION

#### B.1 Project Site Summary

**Table B.1**

<table>
<thead>
<tr>
<th>PROJECT INFORMATION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Project:</td>
<td>Commercial, Residential</td>
</tr>
<tr>
<td>Planning Area:</td>
<td>N/A</td>
</tr>
<tr>
<td>Community Name:</td>
<td>N/A</td>
</tr>
<tr>
<td>Development Name:</td>
<td>South Bay Galleria</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROJECT LOCATION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude &amp; Longitude (DMS): 33°52’16.72”N, 118°21’18.17”W</td>
<td></td>
</tr>
<tr>
<td>Project Watershed and Sub-Watershed: Dominguez Watershed</td>
<td></td>
</tr>
<tr>
<td>APN(s): 4082-018-006 , 4082-018-010</td>
<td></td>
</tr>
<tr>
<td>Map Book and Page No.: Book 169 Pages 78-79</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROJECT CHARACTERISTICS</th>
<th>Commercial, Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed or Potential Land Use(s)</td>
<td></td>
</tr>
<tr>
<td>Area of Impervious Project Footprint (SF)</td>
<td>1,250,575</td>
</tr>
<tr>
<td>Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement</td>
<td>1,017,130</td>
</tr>
<tr>
<td>Does the project consist of offsite road improvements?</td>
<td>Y ☒ N</td>
</tr>
<tr>
<td>Does the project propose to construct unpaved roads?</td>
<td>Y ☒ N</td>
</tr>
<tr>
<td>Is the project part of a larger common plan of development (phased project)?</td>
<td>Y ☒ N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXISTING SITE CHARACTERISTICS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area of existing Impervious Surfaces within the project limits (SF)</td>
<td>1,215,698</td>
</tr>
<tr>
<td>Are there any natural hydrologic features on the project site?</td>
<td>Y ☒ N</td>
</tr>
</tbody>
</table>
## B.2 Receiving Waters

Table B.2 below lists the stormwater runoff discharge points from the project site, classified as either a storm drain system or receiving waters. The table lists the receiving waters in order of travel, starting with the most upstream discharge point.

<table>
<thead>
<tr>
<th>STORM DRAIN SYSTEM OR RECEIVING WATER</th>
<th>EPA APPROVED 303(d) LIST IMPAIRMENTS</th>
<th>DESIGNATED BENEFICIAL USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>48” RCP Storm Drain in Hawthorne Boulevard</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Dominguez Channel (Lined portion above Vermont Ave)</td>
<td>Ammonia, Copper, Diazinon, Indicator Bacteria, Lead, Toxicity, Zinc</td>
<td>NAV, COMM, EST, MAR, MLD, RARE, MIGR SPWN, REC 1, REC 2</td>
</tr>
<tr>
<td>Dominguez Channel Estuary (Unlined portion below Vermont Ave)</td>
<td>Ammonia, Benthic Community Effects, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Benzo(a)anthracene, Chlordane (tissue), Chrysene (C1-C4), Coliform Bacteria, DDT (tissue &amp; sediment), Dieldrin (tissue), Lead (tissue), PCBs (Polychlorinated biphenyls), Phenanthrene, Pyrene, Sediment Toxicity, Zinc (sediment)</td>
<td>MUN, WARM, WILD, RARE, REC 1, REC 2</td>
</tr>
<tr>
<td>Los Angeles Harbor – Consolidated Slip</td>
<td>2-Methylnaphthalene, Benthic Community, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Benzo(a)anthracene, Cadmium (sediment), Chlordane (tissue), Chromium (sediment), Chrysene (C1-C4), Copper (sediment), DDT (tissue &amp; sediment), Dieldrin (tissue), Lead (tissue), PCBs (Polychlorinated biphenyls), Phenanthrene, Pyrene, Sediment Toxicity, Toxaphene (tissue), Zinc (sediment)</td>
<td>NAV, COMM, EST, MAR, WILD, RARE, MIGR SPWN, REC 1, REC 2</td>
</tr>
<tr>
<td>Los Angeles/Long Beach Inner Harbor</td>
<td>Beach Closures, Benthic Community, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Chrysene (C1-C4), Copper (sediment), DDT, PCBs (Polychlorinated biphenyls), Sediment Toxicity, Zinc (sediment)</td>
<td>IND, NAV, COMM, MAR, RARE, SHELL, REC 1, REC 2</td>
</tr>
<tr>
<td>Los Angeles/Long Beach Outer Harbor (inside breakwater)</td>
<td>DDT (Dichlorodiphenyltrichloroethane), PCBs (Polychlorinated biphenyls), Sediment Toxicity</td>
<td>NAV, COMM, MAR, RARE, SHELL, REC 1, REC 2</td>
</tr>
<tr>
<td>San Pedro Bay Near/Off Shore Zones</td>
<td>Chlordane, DDT (tissue &amp; sediment), PCBs (Polychlorinated biphenyls), Sediment Toxicity</td>
<td>N/A</td>
</tr>
</tbody>
</table>

For additional information refer to Appendix 10 for receiving waters maps.
B.3 Geotechnical Conditions

a. Topography

Existing Drainage Condition:

The existing site drains to several existing catch basins throughout the site. The catch basins on the western side of the site are tributary to a 24” RCP storm drain line on-site, which is tributary to a 48” RCP storm drain line on-site that runs north along Kingsdale Avenue and then turns to run east along Artesia Boulevard. The catch basins on the northern side of the site are also tributary to the 48” RCP storm drain line along Artesia Boulevard. The catch basins on the eastern side of the site are tributary to a 24” RCP storm drain line on-site, which is tributary to a 30” RCP storm drain line in Hawthorne Boulevard. The 48” RCP storm drain line along Artesia Boulevard and the 30” RCP storm drain line in Hawthorne Boulevard are both tributary to a 48” RCP storm drain line that runs north in Hawthorne Boulevard, then turns to run northeast in Redondo Beach Boulevard, which is tributary to a 42” RCP storm drain line running northeast in Redondo Beach Boulevard, tributary to a 48” RCP storm drain line running northeast in Redondo Beach Boulevard, tributary to the Dominguez Channel, tributary to Los Angeles Harbor, tributary to Long Beach Harbor.

Proposed Drainage Condition:

The proposed site is split into six drainage areas. Drainage Area 1 is 5.50 acres at the Northwest corner of the site that drains to a Torrent MaxWell Plus drywell system in the drive aisle north of the existing parking garage. The MaxWell Plus system in this area will contain one primary settling chamber with six drywells in series and an underground detention system to store the remaining mitigated volume that will be infiltrated by the drywells. Drainage Area 2 is 5.51 acres at the Northeast corner of the site that drains to a Torrent MaxWell Plus drywell system in the drive aisle and planting area north of the proposed hotel. The MaxWell Plus system in this area will contain one primary settling chamber with six drywells in series and an underground detention system to store the remaining mitigated volume that will be infiltrated by the drywells. Drainage Area 3 is 3.30 acres at the West side of the site that drains to a Torrent MaxWell Plus drywell system in the drive entry from Kingsdale Avenue. The MaxWell Plus system in this area will contain one primary settling chamber with four drywells in series and an underground detention system to store the remaining mitigated volume that will be infiltrated by the drywells. Drainage Area 4 is 5.50 acres at the East side of the site that drains to a Torrent MaxWell Plus drywell system in the planting area south of the drive entry from Hawthorne Boulevard. The MaxWell Plus system in this area will contain one primary settling chamber with six drywells in series and an underground detention system to store the remaining mitigated volume that will be infiltrated by the drywells. Drainage Area 5 is 4.64 acres at the Southwest corner of the site that drains to a Torrent MaxWell Plus drywell system in the drive aisle east of the proposed residential buildings. The MaxWell Plus system in this area will contain one primary settling chamber with five drywells in series and an underground detention system to store the remaining mitigated volume that will be infiltrated by the drywells.
b. Soil Type:

In accordance with Los Angeles County Public Works Soil Classification Maps, the project site is designated as soil classification 14. The referenced map is provided in Appendix 5.

In addition to the soil classification listed above, a project specific Geotechnical Report has been prepared by Converse Consultants, dated March 17, 2010. To summarize the Geotechnical findings, the soil type is classified as Click here to enter text.

The Geotechnical Report is included in Appendix 3 for reference.

c. Groundwater:

Per the project specific Geotechnical Report, groundwater was not encountered during the subsurface exploration to the maximum depth of 51.5 feet below the existing surface. The highest historic groundwater is 52 feet below the existing surface.

As determined through the State Water Board Geotracker database, this project site does not have any known groundwater contamination. The site previously had contamination, however, it was monitored and closed out with SWRCB. Closure reports were done and the site is listed as closed in the Geotracker website. In addition, the groundwater flows in a southwestern direction. The reference information is included in Appendix 3.

*Per geotechnical conditions listed above, stormwater infiltration for the site is feasible.* Refer to attached Geotechnical Report in Appendix 3 to further explain infiltration feasibility/infeasibility studies.

d. Other Geotechnical Issues:

To summarize the other site Geotechnical issues listed in the Geotechnical, refer to Table d.1 below.

<table>
<thead>
<tr>
<th>OTHER GEOTECHNICAL ISSUES</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collapsible Soil</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Expansive Soil</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Liquefaction</td>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>
B.4 Other Site Considerations

a. Off-site Drainage:

The project site does not anticipate any off-site run-on.

b. Significant Ecological Areas (SEAs)

The project’s Significant Ecological Areas (SEAs) are listed in Table B.4.b below and require a separate regulatory permit.

Table B.4.b

<table>
<thead>
<tr>
<th>Agency</th>
<th>Permit Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Department of Fish and Game, 1602 Streambed Alteration Agreement</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>US Army Corps of Engineers, CWA Section 404 Permit</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion</td>
<td>☐ Y ☒ N</td>
</tr>
</tbody>
</table>
### C. BEST MANAGEMENT PRACTICES

#### C.1 Site Design Principles

**Natural Areas:**

<table>
<thead>
<tr>
<th>Natural Area Design Criteria</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserve historically undisturbed areas.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Maintain surface flow patterns of undeveloped sites, including water body alignments, sizes and shapes</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Reserve areas with high permeability soils for either open space or retention based stormwater quality control measures.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Incorporate existing trees into site layout</td>
<td>☒ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Identify areas that may be restored or revegetated either during or post-construction</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Identify and avoid areas susceptible to erosion and sediment loss.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Concentrate or cluster development on less sensitive areas of the project site, while leaving the remaining land in a natural, undisturbed state. Less sensitive areas may include, but are not limited to, areas that are not adjacent to receiving waters or areas where erosion may be an issue.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Protect slopes from erosion by safely conveying stormwater runoff from the tops of slopes.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Limit clearing and grading of native vegetation at the project site to minimum amount needed to build lots, allow access, and provide fire protection.</td>
<td>☐ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Maintain existing topography and existing drainage divides to encourage dispersed flow.</td>
<td>☒ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Maximize trees and other vegetation at the project site by planting additional vegetation, clustering tree areas, and promoting use of native and/or drought-tolerant plants.</td>
<td>☒ Y ☐ N ☒ N/A</td>
</tr>
<tr>
<td>Promote natural vegetation by using parking lot islands and other landscaped areas. Integrate vegetation-based stormwater quality control measures within parking lot islands and landscaped areas.</td>
<td>☒ Y ☐ N ☒ N/A</td>
</tr>
</tbody>
</table>
C.2 Source Control Measures

Per the Los Angeles County Public Works Low Impact Development Manual, the following source control measures shall be implemented in the project design and as listed per LID Manual Table 5-1, also referenced in Appendix 9.

Fact sheets for each of the source control measures listed in Table C.2 below can be found in Appendix 9. The source controls shall be designed and implemented in accordance with these fact sheets.

Table C.2

<table>
<thead>
<tr>
<th>Source Control Measures</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm drain message and signage (S-1)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Material Storage Areas (S-2)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Trash Storage/Waste Handling Areas (S-3)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Loading/Unloading Dock Areas (S-4)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Vehicle/Equipment Repair/Maintenance Areas (S-5)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Vehicle/Equipment/Accessory Wash Areas (S-6)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Fuel &amp; Maintenance Areas (S-7)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Landscape Irrigation Practices (S-8)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Building Materials (S-9)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Animal Care and Handling Facilities (S-10)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Outdoor Horticulture Areas (S-11)</td>
<td>Y N N/A</td>
</tr>
</tbody>
</table>
D. STORMWATER QUALITY DESIGN VOLUME CALCULATION

The design storm, from which the Stormwater Quality Design Volume (SWQDv) is calculated, is defined as the **greater of**:

- The 0.75-inch, 24 hour storm rain event, or
- The 85th percentile, 24 hour rain event as determined from Los Angeles County 85th percentile precipitation isohyetal map, as provided in Appendix 4.

**D.1 Project Rainfall Depth:**

85th Percentile, 24 Hour Rain Event 0.90 Inches

The 85th percentile, 24 hour storm event is greater and therefore a rainfall depth of 0.90 inches is used to calculate the SWQDv.

**D.2 Project Calculated SWQDv:**

Per County of Los Angeles HydroCalc Program, the input and output values as calculated for the site SWQDv is provided in Appendix 4.

Below is a provided summary of the SWQDv calculated.

<table>
<thead>
<tr>
<th>DMA NAME OR ID</th>
<th>AREA (SQ FT)</th>
<th>SOIL TYPE</th>
<th>FLOW PATH (FT)</th>
<th>PERCENT IMPERVIOUS</th>
<th>SWQDv (CU-FT)</th>
<th>t_c (MIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMA 1</td>
<td>239,722</td>
<td>14</td>
<td>440</td>
<td>90%</td>
<td>14,612</td>
<td>23</td>
</tr>
<tr>
<td>DMA 2</td>
<td>239,846</td>
<td>14</td>
<td>490</td>
<td>90%</td>
<td>14,639</td>
<td>25</td>
</tr>
<tr>
<td>DMA 3</td>
<td>143,782</td>
<td>14</td>
<td>535</td>
<td>90%</td>
<td>8,768</td>
<td>26</td>
</tr>
<tr>
<td>DMA 4</td>
<td>239,517</td>
<td>14</td>
<td>725</td>
<td>90%</td>
<td>14,613</td>
<td>32</td>
</tr>
<tr>
<td>DMA 5</td>
<td>202,117</td>
<td>14</td>
<td>485</td>
<td>90%</td>
<td>12,328</td>
<td>24</td>
</tr>
<tr>
<td>DMA 6</td>
<td>235,840</td>
<td>14</td>
<td>510</td>
<td>90%</td>
<td>14,373</td>
<td>25</td>
</tr>
</tbody>
</table>

**TOTAL SWQDv** = 79,333
E. STORMWATER QUALITY CONTROL MEASURES –LID BMPs

Stormwater Quality Control Measures must be designed and implemented to detain the calculated SWQDv in the following order:

1) Infiltration (On-site Retention)  
2) Runoff Harvest and Use  
3) On-site biofiltration, off-site groundwater replenishment, off-site infiltration and/or bioretention, and off-site retrofit.

Additionally, pretreatment must be provided for stormwater quality control measures whose function may be adversely affected by sediment or other pollutants.
E.1 Infiltration (On-Site Retention):

The project site was analyzed for Infiltration feasibility.

Table E.1

<table>
<thead>
<tr>
<th>Infiltration Infeasibility</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>The corrected in-situ infiltration rate is less than 0.3 inches per hour, as determined</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>according to the most recent GMED Policy GS 200.1, and it is not technically feasible</td>
<td></td>
</tr>
<tr>
<td>to amend the in-situ soils to attain an infiltration rate necessary to achieve reliable</td>
<td></td>
</tr>
<tr>
<td>Locations where the seasonal high groundwater level is within 10 feet of the surface,</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>as determined according to the most recent GMED Policy GS 200.1;</td>
<td></td>
</tr>
<tr>
<td>Locations within 100 feet of a groundwater well used for drinking water;</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Brownfield development sites where infiltration poses a risk of pollutant mobilization;</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Other locations where pollutant mobilization is a documented concern (e.g., at or near</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>properties that are contaminated or store hazardous substances underground);</td>
<td></td>
</tr>
<tr>
<td>Locations with potential geotechnical hazards;</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Smart growth and infill or redevelopment locations where the density and/or nature of</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>the project would create significant difficulty for compliance with the onsite retention</td>
<td></td>
</tr>
<tr>
<td>requirement;</td>
<td></td>
</tr>
<tr>
<td>Locations where infiltration may adversely impact biological resources; or</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Locations where infiltration may cause health and safety concerns.</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Other:__________</td>
<td>□ Y  □ N</td>
</tr>
</tbody>
</table>

If yes has been checked for any of the above questions, then infiltration BMPs will not be used for the site and Harvest and Use will be assessed next for site feasibility. Additional Infiltration Infeasibility narrative is provided below.

If no has been checked for all above questions, then site infiltration is feasible and Table E.2 below lists the implemented Infiltration based BMPs.

Implemented Infiltration BMPs

Table E.1

<table>
<thead>
<tr>
<th>Infiltration based BMPs</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioretention (RET-1)</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Infiltration Basin (RET-2)</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Infiltration Trench (RET-3)</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Dry Well (RET-4)</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Permeable Pavement without an Underdrain (RET-5)</td>
<td>□ Y  □ N</td>
</tr>
<tr>
<td>Other:_____________________</td>
<td>□ Y  □ N</td>
</tr>
</tbody>
</table>
E.2 Runoff Harvest and Reuse Assessment:
Does the site capture 100% of the SWQDv through Infiltration based BMPs as listed above? ☑️ Y ☐ N

If yes has been checked, Harvest and Reuse BMP assessment is not required.

E.3 Alternative Compliance:
Does the site capture 100% of the SWQDv through Infiltration and/or Runoff Harvest and Use based BMPs as listed above? ☑️ Y ☐ N

If yes has been checked, Alternative Compliance is not required.

E.4 Pretreatment BMPs:
Is pretreatment required for the project site? ☐ Y ☑️ N

If yes has been checked, the following Pretreatment BMPs will be implemented on-site.

Table E.4

<table>
<thead>
<tr>
<th>Treatment-based Stormwater Quality Control Measures</th>
<th>☑️ Y ☐ N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Filters (T-1)</td>
<td></td>
</tr>
<tr>
<td>Constructed Wetlands (T-2)</td>
<td></td>
</tr>
<tr>
<td>Extended Detention Basins (T-3)</td>
<td></td>
</tr>
<tr>
<td>Wet Pond (T-4)</td>
<td></td>
</tr>
<tr>
<td>Permeable Pavement with an Underdrain (T-5)</td>
<td></td>
</tr>
<tr>
<td>Proprietary Devices (T-6)</td>
<td></td>
</tr>
<tr>
<td>Other:______________________</td>
<td></td>
</tr>
</tbody>
</table>
F. HYDROMODIFICATION

Projects may be exempt from implementation of hydromodication control measures where assessment of downstream channel conditions and proposed discharge hydrology indicate the adverse hydromodification effects to beneficial uses of natural drainage systems are unlikely.

Table F.1

<table>
<thead>
<tr>
<th>Exemptions</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>The replacement, maintenance, or repair of an existing permitted publicly-maintained flood control facility, storm drain, or transportation network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redevelopment of a previously developed site in an urbanized area that does not increase the effective impervious area or decrease the infiltration capacity of pervious areas compared to the pre-project conditions</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>Projects that have any increased discharge directly or through a storm drain to a sump, lake, area under tidal influence, into a waterway that has an estimated hundred year peak flow of 25,000 cfs or more, or other receiving water that is not susceptible to hydromodification impacts</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Projects that discharge directly or through a storm drain into concrete or otherwise engineered channel (channelized or armored with rip-rap, shotcrete), which in turn, discharge into receiving water that is not susceptible to hydromodification impacts</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Non-designated project disturbing less than 1 acre or creating less than 10,000 square feet of new impervious area; or</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Single-family homes that incorporate LID BMPs in accordance with the LID Standards Manual</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

If yes has been checked, Hydromodification control measures are not required. Refer to additional Hydromodification exemption narrative given below.

If no has been checked, Hydromodification control measures are required and must meet the design criteria set forth by the Los Angeles County LID Manual and as given below.

Additional Hydromodification Exemption Narrative:

The project site runoff sheet flows into dry wells and infiltrates. With the use of a dry well system, no effective increase in flow is anticipated.
G. **STORMWATER BMP MAINTENANCE**

**Maintenance Plan Requirements**

A Maintenance Plan is provided in Appendix 6 for each individual stormwater BMP. The Maintenance plan includes the following items:

**Table G.1**

<table>
<thead>
<tr>
<th>Maintenance Plan</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation plan and schedule, including a site map</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Maintenance and cleaning activities and schedule</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Equipment and resource requirements necessary to operate and maintain stormwater</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>quality control measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsible party for operation and maintenance.</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

**Table G.2**

<table>
<thead>
<tr>
<th>Site Map</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a site map showing boundaries of the site, acreage, and drainage patterns/contour lines. Show each discharge location from the project site and any drainage flowing onto the site. Distinguish between pervious and impervious surfaces on the map.</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Identify locations of existing and proposed storm drain facilities, private sanitary sewer systems, and grade breaks for purposes of pollution prevention.</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>With a legend, identify locations of expected sources of pollution generation (e.g. outdoor work and storage areas, heavy traffic areas, delivery areas, trash enclosures, fueling areas, industrial clarifies, and wash-racks). Identify any areas having contaminated soil or where pollutants are stored or have been stored/disposed of in the past.</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>With a legend, indicate types and locations of stormwater quality control measures that will be built to permanently control stormwater pollution, including Global Positioning System X and Y coordinates. Distinguish between pollution prevention, treatment, sewer diversion, and contaminated devices.</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

**Table G.3**

<table>
<thead>
<tr>
<th>Baseline Descriptions</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>List property owners and persons responsible for operation and maintenance of the on-site stormwater quality control measures. Include phone numbers and addresses.</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Identify the intended method of funding (i.e., homeowners association fees) for operation, inspection, routine maintenance, and upkeep of stormwater quality control measures.</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>
List all permanent stormwater quality control measures. Provide a brief description of each stormwater quality control measure and, if appropriate, fact sheets or additional information. | Y | N

A written description and checklist of all maintenance and waste disposal activities that will be performed. Distinguish between the maintenance appropriate for a 2-year establishment period and expected long-term maintenance. For example, maintenance requirements for vegetation in a constructed wetland may be more intensive during the first few years until the vegetation is established. The post-establishment maintenance plan must address maintenance needs (e.g., pruning, irrigation, weeding) for a larger, more stable system. Include maintenance performance procedures for facility components that require relatively unique maintenance knowledge, such as specific plant removal/replacement, landscape features, or constructed wetland maintenance. These procedures must provide sufficient detail to a person unfamiliar with maintenance to perform the activity or identify the specific skills or knowledge to perform and document the maintenance. | Y | N

A description of site inspection procedures and documentation system, including recordkeeping and retention requirements. | Y | N

An inspection and maintenance schedule, preferably in the form of a table or matrix, for each activity for all facility components. The schedule must show how it will satisfy the specified level of performance and how maintenance/inspection activities relate to storm events and seasonal issues. | Y | N

Identification of equipment and materials required to perform maintenance. | Y | N

As appropriate, list all housekeeping procedures for prohibiting illicit discharges or potential illicit discharges to the storm drain system. Identify housekeeping BMPs that reduce maintenance of stormwater quality control measures. | Y | N

<table>
<thead>
<tr>
<th>Table G.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spill Plan</td>
</tr>
<tr>
<td>Provide emergency notification procedures (phone and agency/persons to contact).</td>
</tr>
<tr>
<td>As appropriate for site, provide emergency containment and cleaning procedures.</td>
</tr>
<tr>
<td>Note downstream receiving waters, wetlands, or SEAs that may be affected by spills or chronic untreated discharges.</td>
</tr>
<tr>
<td>As appropriate, create an emergency sampling procedure for spills. Emergency sampling can protect the property owner from erroneous liability for downstream receiving area cleanups.</td>
</tr>
</tbody>
</table>

See BMP Fact Sheet SC-11 Spill Prevention, Control & Clean-up included in Appendix 5.

Identify appropriate persons to be properly trained and assure documentation of training. Training should include:

<table>
<thead>
<tr>
<th>Table G.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Good housekeeping procedures defined in the Maintenance Plan;</td>
</tr>
<tr>
<td>Proper maintenance of all pollution mitigation devices</td>
</tr>
<tr>
<td>Identification and cleanup procedures for spills and overflows</td>
</tr>
</tbody>
</table>
Large-scale spill or hazardous material response; and □ Y □ N
Safety concerns when maintain devices and cleaning spills. □ Y □ N

See the following BMP Fact Sheets included in Appendix 5:
SC-11 Spill Prevention, Control & Clean-up
SC-60 Housekeeping Practices

Table G.6

<table>
<thead>
<tr>
<th>Basic Inspection and Maintenance Activities</th>
<th>□ Y □ N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create and maintain on-site, a log for inspector names, dates, and stormwater quality control measure to be inspected and maintained. Provide a checklist for each inspection and maintenance category.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>Perform and document annual testing of any mechanical or electrical devices prior to wet weather.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>Report any significant changes in stormwater quality control measures to the site management. As appropriate, assure mechanical devices are working properly and/or landscaped plants are irrigated and nurtured to promote thick growth.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>Note any significant maintenance requirements due to spills or unexpected discharges.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>As appropriate, perform maintenance and replacement as scheduled or as needed in a timely manner to assure stormwater quality control measures are performing as designed and approved.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>Assure unauthorized low-flow discharges from the property do not bypass stormwater quality control measures.</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>Perform an annual assessment of each pollution-generating operation and its associated stormwater quality control measures to determine if any part of the pollution reduction train can be improved. Annual assessment reports must be submitted to LACDPW.</td>
<td>□ Y □ N</td>
</tr>
</tbody>
</table>

Operational or facility conditions or changes that significantly affect the character or quantity of pollutants discharging into the stormwater quality control measures may require modifications to the Maintenance Plan and/or additional stormwater quality control measures.

If future correction or modification of past stormwater quality control measures or procedures is required, the owner must obtain approval from LACDPW prior to commencing any work. Corrective measures or modifications must not cause discharges to bypass or otherwise impede existing stormwater quality control measures.

**Maintenance Agreement:**

Verification of maintenance provisions is required for all stormwater quality control measures. If required, verification, at a minimum, must include:

Table G.7

<table>
<thead>
<tr>
<th>Verification of Maintenance Provisions</th>
<th>□ Y □ N</th>
</tr>
</thead>
<tbody>
<tr>
<td>The owner/developer’s signed statement accepting responsibility for inspection and maintenance until the responsibility is legally transferred. An example Owners Certification Statement is provided in Appendix G; and either</td>
<td>□ Y □ N</td>
</tr>
<tr>
<td>A signed statement from the public entity assuming responsibility for stormwater quality control measure inspection and maintenance and certifying that it meets all design standards; or</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>Written conditions in the sales or lease agreement that require the recipient to assume responsibility for inspection and maintenance activities and to conduct a maintenance inspection at least once a year; or</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>Written text in project conditions, covenants, and restrictions for residential properties that assign maintenance responsibilities to a Home Owners Association for inspection and maintenance of stormwater quality control measures; or</td>
<td>☐ Y ☒ N</td>
</tr>
<tr>
<td>A legally enforceable maintenance agreement that assigns responsibility for inspection and maintenance of stormwater quality control measures to the owner/operator. A Maintenance Agreement with LACDPW must be executed by the owner/operator before occupancy of the project is approved.</td>
<td>☒ Y ☐ N</td>
</tr>
</tbody>
</table>
APPENDICES
APPENDIX 1
MAPS AND SITE PLANS
APPENDIX 2
CONSTRUCTION PLANS
APPENDIX 3
SOILS INFORMATION/REPORT
### Case Summary

**Report Date**: 2/1/1996

**Reported by**: Unknown

**Responsible Party**
- **Contact Name**: Duane Bishop
- **Address**: 50 Public Square, Ste. 1110, Cleveland, OH 44113

**Phone**: (216)-416-3722

**Site Location**
- **Facility Name**: South Bay Galleria South Lot
- **Facility Address**: 1501 Hawthorne Blvd, Redondo Beach, CA 90278

**Substances Released / Contaminant(s) of Concern**
- Gasoline

**Discovery/Abatement**
- **Date Discharge Began**: 1/30/1996
- **How Discovered**: Subsurface Monitoring
- **Date Stopped**: 1/8/1984

**Source/Cause**
- **Source of Discharge**: Tank
- **Cause of Discharge**: Unknown

**Case Type**
- Aquifer used for drinking water supply

**Remedial Action**
- No Remedial Actions Entered

**General Comments**

**Certification**
I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

### XII. REGULATORY USE ONLY

<table>
<thead>
<tr>
<th>LOCAL AGENCY CASE NUMBER</th>
<th>REGIONAL BOARD CASE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>902780061</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCAL AGENCY</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CONTACT NAME</th>
<th>INITIALS</th>
<th>ORGANIZATION NAME</th>
<th>EMAIL ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOHN AWUJO</td>
<td>JOA</td>
<td>LOS ANGELES COUNTY</td>
<td><a href="mailto:jawujo@dpw.acounty.gov">jawujo@dpw.acounty.gov</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>CONTACT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>900 S FREMONT AVE ALHAMBRA, CA 91803</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHONE TYPE</th>
<th>PHONE NUMBER</th>
<th>EXTENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHONE</td>
<td>(626)-458-3507</td>
<td></td>
</tr>
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<table>
<thead>
<tr>
<th>REGIONAL BOARD</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CONTACT NAME</th>
<th>INITIALS</th>
<th>ORGANIZATION NAME</th>
<th>EMAIL ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAVID M. BJOSTAD</td>
<td>DMB</td>
<td>LOS ANGELES RWQCB (REGION 4)</td>
<td><a href="mailto:dbjostad@waterboards.ca.gov">dbjostad@waterboards.ca.gov</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>CONTACT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>320 W. 4th Street, Suite 200 Los Angeles, CA 90013</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHONE TYPE</th>
<th>PHONE NUMBER</th>
<th>EXTENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>(213)-576-8712</td>
<td></td>
</tr>
</tbody>
</table>

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### CASE SUMMARY

**REPORT DATE**
2/1/1996

**HAZARDOUS MATERIAL INCIDENT REPORT FILED WITH OES?**

**I. REPORTED BY**
UNKNOWN

**CREATED BY**
UNKNOWN

**II. RESPONSIBLE PARTY**
UNKNOWN

**III. SITE LOCATION**

<table>
<thead>
<tr>
<th>FACILITY NAME</th>
<th>FACILITY ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOUTH BAY SOUTHERN SHOPPING C</td>
<td>ORIENTATION OF SITE TO STREET</td>
</tr>
<tr>
<td>1815 HAWTHORNE BLVD #201</td>
<td>CROSS STREET</td>
</tr>
<tr>
<td>REDONDO BEACH, CA 90278</td>
<td></td>
</tr>
<tr>
<td>LOS ANGELES COUNTY</td>
<td></td>
</tr>
</tbody>
</table>

**V. SUBSTANCES RELEASED / CONTAMINANT(S) OF CONCERN**

GASOLINE

**VI. DISCOVERY/ABATEMENT**

<table>
<thead>
<tr>
<th>DATE DISCHARGE BEGAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/30/1996</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE DISCOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/30/1996</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW DISCOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsurface Monitoring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE STOPPED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8/1984</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STOP METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**VII. SOURCE/CAUSE**

<table>
<thead>
<tr>
<th>SOURCE OF DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUSE OF DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
</tr>
</tbody>
</table>

**DISCHARGE DESCRIPTION**

**VIII. CASE TYPE**

<table>
<thead>
<tr>
<th>CASE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer used for drinking water supply</td>
</tr>
</tbody>
</table>

**IX. REMEDIAL ACTION**

<table>
<thead>
<tr>
<th>NO REMEDIAL ACTIONS ENTERED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**X. GENERAL COMMENTS**

**XI. CERTIFICATION**

I HEREBY CERTIFY THAT THE INFORMATION REPORTED HEREIN IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

**XII. REGULATORY USE ONLY**

<table>
<thead>
<tr>
<th>LOCAL AGENCY CASE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REGIONAL BOARD CASE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
## UNDERGROUND STORAGE TANK
### LOW RISK CASE REVIEW FORM

| Case reviewer: | Dave Bjostad | Unit Chief: | W-E | Section Chief: | Y-R | AEO: | Baill Batkarski | EC: | Tracy J. Huscus
|----------------|-------------|-------------|-----|----------------|-----|------|-----------------|----|----------------
| Date: 5/14/2009 | Date: 5/14/09 | Date: 6/2/09 | Date: 6/13 | Date: 6/13 |

### LUST File No.: 902780061

**Site Name/Address:** South Bay Galleria South Lot 1501 Hawthorne Blvd. Redondo Beach, CA 90278

**Responsible parties:** South Bay Associates SPE, LLC Attn: Duane Bishop

**Address:** 50 Public Square, Suite 1100 Cleveland, OH 44113

**Phone no.:** (216) 416-3722

**Investigation and Cleanup Priority: C-1**

### I. CASE INFORMATION (N/A = Not Applicable)

<table>
<thead>
<tr>
<th>Tank No.</th>
<th>Size in Gallons</th>
<th>Contents</th>
<th>Closed in-place/Removed/Active?</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6,000</td>
<td>Gasoline</td>
<td>Removed</td>
<td>1973</td>
</tr>
<tr>
<td>2</td>
<td>280</td>
<td>Waste Oil</td>
<td>Removed</td>
<td>1973</td>
</tr>
<tr>
<td>3</td>
<td>12,000</td>
<td>Gasoline</td>
<td>Removed</td>
<td>1984</td>
</tr>
</tbody>
</table>

### II. SITE CHARACTERIZATION INFORMATION (GW = groundwater, — = Not Reported)

**GW Basin:** Coastal Plain, West Coast Subbasin

**Beneficial uses:** Mun, Ind, Proc, Agr

**Depth to drinking water aquifer:** ~100 ft bgs

**Distance to nearest municipal supply well:** 4,142 feet (well ID 03314W34N04S)

**Vertical Distance between perched GW contamination and aquifer:** ~44 ft bgs

**GW highest depth:** 51 ft bgs

**GW lowest depth:** 56 ft bgs

**Well screen interval:** 45 - 65 feet bgs

**Flow direction:** Southwest

**Soil types:** Silty sand

**Maximum soil depth sampled:** 55 ft bgs

### III. SITE INSPECTION

**Pre-closure site inspection:** 5/28/2009

**Is there a sensitive receptor next to the site (school, church, hospital, kindergarten etc.?)**

If yes, brief description: No

### IV. MAXIMUM DOCUMENTED CONTAMINANT CONCENTRATIONS – Initial and Latest (ND = Non-detect; NRO = Not required)

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Initial Soil (mg/kg) 01/99</th>
<th>Initial Soil (mg/kg) LATEST</th>
<th>Soil Screen Levels (mg/kg)</th>
<th>Soil Screen Levels (mg/kg) LATEST</th>
<th>EPA SSA/MATL</th>
<th>California SSA/MATL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentration (mg/kg) LATEST</td>
<td>Concentration (mg/kg) LATEST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residential (mg/kg)</td>
<td>Industrial (mg/kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPH (Gas)</td>
<td>1,441</td>
<td>1,800</td>
<td>NE</td>
<td>NE</td>
<td>500</td>
<td>22,640</td>
</tr>
<tr>
<td>TPH (Diesel)</td>
<td>ND</td>
<td>900</td>
<td>NE</td>
<td>NE</td>
<td>1,000</td>
<td>NRQ</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.36</td>
<td>ND</td>
<td>1.1</td>
<td>5.6</td>
<td>0.018</td>
<td>13</td>
</tr>
<tr>
<td>Toluene</td>
<td>16.32</td>
<td>1.7</td>
<td>5,000</td>
<td>46,000</td>
<td>0.87</td>
<td>749</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>22.46</td>
<td>35 @ 15 ft bgs</td>
<td>5.7</td>
<td>29</td>
<td>2.8</td>
<td>545</td>
</tr>
<tr>
<td>Xylenes</td>
<td>181.08</td>
<td>226</td>
<td>600</td>
<td>2,600</td>
<td>7.8</td>
<td>4,431</td>
</tr>
<tr>
<td>Methyl tertiary butyl ether (MTBE)</td>
<td>ND</td>
<td>39</td>
<td>190</td>
<td>0.022</td>
<td>NRQ</td>
<td>13 (Primary)</td>
</tr>
<tr>
<td>Di-isopropyl ether (DPE)</td>
<td>NRQ</td>
<td>ND</td>
<td>NE</td>
<td>NE</td>
<td>NRQ</td>
<td>ND</td>
</tr>
<tr>
<td>Ethyl tertiary butyl ether (ETBE)</td>
<td>NRQ</td>
<td>ND</td>
<td>NE</td>
<td>NE</td>
<td>NRQ</td>
<td>ND</td>
</tr>
<tr>
<td>Tertiary amyl methyl ether (TAME)</td>
<td>NRQ</td>
<td>ND</td>
<td>NE</td>
<td>NE</td>
<td>NRQ</td>
<td>ND</td>
</tr>
<tr>
<td>Tertiary butyl alcohol (TBA)</td>
<td>NRQ</td>
<td>ND</td>
<td>NE</td>
<td>NE</td>
<td>NRQ</td>
<td>12 (NL)</td>
</tr>
<tr>
<td>Ethanol</td>
<td>NRQ</td>
<td>ND</td>
<td>NE</td>
<td>NE</td>
<td>NRQ</td>
<td>ND</td>
</tr>
</tbody>
</table>

*SLs = USEPA Risk-Based Screening Levels (May 2008)

**See attached Table 4-1**

<table>
<thead>
<tr>
<th>MCLs/NSLs (1/99)</th>
<th>MCLs/NSLs (1/99)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**V. FREE PRODUCT**

<table>
<thead>
<tr>
<th>Was free product encountered?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has free product been totally recovered?</td>
<td>N/A</td>
</tr>
<tr>
<td>When was free product recovery project completed?</td>
<td>N/A</td>
</tr>
</tbody>
</table>
VI. SOIL REMEDIATION

<table>
<thead>
<tr>
<th>Method: None</th>
<th>Duration of remediation: N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste manifest document: N/A</td>
<td>Volume of soil disposal/mass removal: N/A</td>
</tr>
</tbody>
</table>

VII. GROUNDWATER REMEDIATION

<table>
<thead>
<tr>
<th>Method: None</th>
<th>Duration of remediation: N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass removal: N/A</td>
</tr>
</tbody>
</table>

VIII. COMMENTS AND JUSTIFICATION FOR RECOMMENDED ACTION

Site Use

The site, which was a gasoline station through 1984, is currently a parking lot. Surrounding land consists of commercial including a movie theater, bank, and shopping mall.

Site History and Data Summary

Two 6,000-gallon gasoline USTs and a 280-gallon waste oil UST were removed in 1973. Three 12,000-gallon gasoline USTs were removed in 1984.

January to March 1996 - 14 soil borings (SP-1 to SP-9 and B-1 to B-5). Three borings were converted into monitoring wells MW-1 to MW-3.

March 2008 – 3 soil borings (SB-4 to SB-6). The three borings were converted into monitoring wells MW-4 to MW-6.

See attached Table 1 for soil sample results. The subject site is underlain primarily by silty sand.

Groundwater Monitoring Summary

Currently there are 3 groundwater monitoring wells at the site (MW-4 to MW-6). Three previous monitoring wells, MW-1 to MW-3, were sampled once in 1996 and were abandoned in 2008 because they were damaged. The three existing wells have been sampled quarterly since March 2008. Historical groundwater data are shown in the attached Tables I and II. Historical maximum concentrations of TPH₉, and BTEX were 22,640, 13, 749, 545, 4,431 µg/L, respectively. TPH₉ and BTEX were not detected during the most recent sampling event in February 2009. MTBE, TBA, ETBE, DIPE, TAME, and chlorinated VOCs have never been detected. Depth to groundwater is approximately 51 feet bgs and flow direction is to the southwest. Free product was not detected.

Contaminant Exposure Pathways Evaluation

Direct Contact

The risk of direct contact is considered to be low because residual concentrations of gasoline constituents in the soil beneath the site < 20 feet bgs were all below their respective EPA SLs, with the exception of ethylbenzene at 15 feet bgs in the former UST area. In the UST area, ethylbenzene was not detected shallower than 15 feet bgs and the site currently is paved, which limits the potential for direct contact to soil. Ethylbenzene was not detected above the SL at any of the boring locations near the dispensers or other areas away from the former USTs.

Protection of Drinking Water Aquifer

The impacts of the residual concentrations of gasoline constituents in the soil to the underlying drinking water aquifer is considered to be low because the UST sources were removed 25 years ago, and although some residual soil impacts remain, groundwater data from 2008 and 2009 indicate that groundwater is not being significantly impacted; no petroleum hydrocarbons were detected during the most recent groundwater sampling event in February 2009.

Plume Migration

The most recent groundwater results from February 2009 indicate there is not a residual groundwater plume beneath the site. Groundwater impacts identified in 1996 in the UST area (groundwater sample B-1) compared to groundwater data in 2008 and 2009 (MW-6, located approximately 5 feet from B-1) show that the plume has been reduced by natural attenuation to non-detect levels.
Vapor Intrusion

The risk of vapor intrusion is considered to be low because the residual soil contamination is below the interim vapor intrusion guidance (0.18 mg/kg of benzene at five feet bgs).

Factors Supporting Low Risk Closure

Based on the above assessment, staff recommends to grant a low-risk closure for the site for the following reasons:

- All USTs were removed in 1984.
- No free product has been observed in the monitoring wells.
- The extent of soil and groundwater contamination has been adequately defined.
- Groundwater concentrations from 2008 and 2009 indicate that the plume identified in 1996 has been naturally attenuated to non-detect levels.
- The risk of any residual soil and groundwater contamination to cause any human health and environmental concerns via major pathways, such as direct contact, drinking water ingestion, and vapor intrusion, is low.
- The nearest production well is 4,142 feet away.

Fee Title Holder Information

South Bay Associates SPE, LLC, 50 Public Square, Suite 1100, Cleveland, OH 44113, Attn: Duane Bishop

IX. MTBE FATE & TRANSPORT PLUME LENGTH MODELING ANALYSIS

MTBE modelling was not performed because MTBE has not been detected at the site.

X. ELECTRONIC DELIVERABLE FORMAT (EDF) SUBMISSION

Has electronic data reporting requirement been met? Yes

XI. AB 681 REQUIREMENT (Land Owner Notification)


Have landowner or impacted site notification requirements been met? Yes

Owner - South Bay Associates SPE, LLC

Responsible party - South Bay Associates SPE, LLC

Pre-closure letter sent date - Not required because the landowner and RP are the same.

(May 2009)
<table>
<thead>
<tr>
<th>Distance Above Groundwater</th>
<th>Carbon Range</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C4-C12</td>
<td>C13-C22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;150 feet</td>
<td>1,000</td>
<td>10,000</td>
</tr>
<tr>
<td>20-150 feet</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>&lt;20 feet</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance Above Groundwater</th>
<th>Gravel</th>
<th>Sand</th>
<th>Silt</th>
<th>Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 feet</td>
<td>B=0.044</td>
<td>B=0.077</td>
<td>B=0.165</td>
<td>B=0.8</td>
</tr>
<tr>
<td></td>
<td>T=2</td>
<td>T=4</td>
<td>T=9</td>
<td>T=43</td>
</tr>
<tr>
<td></td>
<td>E=8</td>
<td>E=17</td>
<td>E=34</td>
<td>E=170</td>
</tr>
<tr>
<td></td>
<td>X=23</td>
<td>X=48</td>
<td>X=93</td>
<td>X=466</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.039</td>
<td>MTBE = 0.078</td>
<td>MTBE = 0.156</td>
<td>MTBE = 0.75</td>
</tr>
<tr>
<td>120 feet</td>
<td>B=0.035</td>
<td>B=0.058</td>
<td>B=0.123</td>
<td>B=0.603</td>
</tr>
<tr>
<td></td>
<td>T=1.57</td>
<td>T=3.1</td>
<td>T=7</td>
<td>T=32</td>
</tr>
<tr>
<td></td>
<td>E=6.3</td>
<td>E=12.7</td>
<td>E=25.9</td>
<td>E=128</td>
</tr>
<tr>
<td></td>
<td>X=17.9</td>
<td>X=36</td>
<td>X=70.3</td>
<td>X=351</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.028</td>
<td>MTBE = 0.061</td>
<td>MTBE = 0.117</td>
<td>MTBE = 0.591</td>
</tr>
<tr>
<td>100 feet</td>
<td>B=0.028</td>
<td>B=0.046</td>
<td>B=0.094</td>
<td>B=0.471</td>
</tr>
<tr>
<td></td>
<td>T=1.3</td>
<td>T=2.57</td>
<td>T=5.4</td>
<td>T=25</td>
</tr>
<tr>
<td></td>
<td>E=5.1</td>
<td>E=9.86</td>
<td>E=20.4</td>
<td>E=101</td>
</tr>
<tr>
<td></td>
<td>X=14.4</td>
<td>X=28</td>
<td>X=55.1</td>
<td>X=276</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.020</td>
<td>MTBE = 0.05</td>
<td>MTBE = 0.091</td>
<td>MTBE = 0.464</td>
</tr>
<tr>
<td>80 feet</td>
<td>B=0.022</td>
<td>B=0.033</td>
<td>B=0.066</td>
<td>B=0.34</td>
</tr>
<tr>
<td></td>
<td>T=1</td>
<td>T=2</td>
<td>T=4</td>
<td>T=18</td>
</tr>
<tr>
<td></td>
<td>E=4</td>
<td>E=7</td>
<td>E=15</td>
<td>E=73</td>
</tr>
<tr>
<td></td>
<td>X=11</td>
<td>X=20</td>
<td>X=40</td>
<td>X=200</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.039</td>
<td>MTBE = 0.065</td>
<td>MTBE = 0.338</td>
</tr>
<tr>
<td>60 feet</td>
<td>B=0.018</td>
<td>B=0.026</td>
<td>B=0.048</td>
<td>B=0.241</td>
</tr>
<tr>
<td></td>
<td>T=0.72</td>
<td>T=1.4</td>
<td>T=2.8</td>
<td>T=13</td>
</tr>
<tr>
<td></td>
<td>E=2.9</td>
<td>E=4.9</td>
<td>E=10.7</td>
<td>E=52</td>
</tr>
<tr>
<td></td>
<td>X=7.3</td>
<td>X=13.9</td>
<td>X=28.4</td>
<td>X=141.5</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.03</td>
<td>MTBE = 0.048</td>
<td>MTBE = 0.247</td>
</tr>
<tr>
<td>40 feet</td>
<td>B=0.015</td>
<td>B=0.018</td>
<td>B=0.029</td>
<td>B=0.143</td>
</tr>
<tr>
<td></td>
<td>T=0.43</td>
<td>T=0.67</td>
<td>T=1.6</td>
<td>T=7.5</td>
</tr>
<tr>
<td></td>
<td>E=1.8</td>
<td>E=2.6</td>
<td>E=6.3</td>
<td>E=30</td>
</tr>
<tr>
<td></td>
<td>X=4.8</td>
<td>X=7.8</td>
<td>X=16.9</td>
<td>X=83</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.022</td>
<td>MTBE = 0.03</td>
<td>MTBE = 0.156</td>
</tr>
<tr>
<td>20 feet</td>
<td>B=0.011</td>
<td>B=0.011</td>
<td>B=0.011</td>
<td>B=0.044</td>
</tr>
<tr>
<td></td>
<td>T=0.15</td>
<td>T=0.3</td>
<td>T=0.45</td>
<td>T=2.9</td>
</tr>
<tr>
<td></td>
<td>E=0.7</td>
<td>E=0.7</td>
<td>E=2</td>
<td>E=9</td>
</tr>
<tr>
<td></td>
<td>X=1.75</td>
<td>X=1.75</td>
<td>X=5.3</td>
<td>X=24.5</td>
</tr>
<tr>
<td></td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.013</td>
<td>MTBE = 0.065</td>
</tr>
</tbody>
</table>

**Note:**
- TPH = Total petroleum hydrocarbons.
- BTEX = benzene, toluene, ethylbenzene, and xylene, respectively. MTBE = methyl tertiary butyl ether.
- Respective MCLs (ppm): B=0.01, T=0.15, E=0.3, X=1.75, MTBE=0.013.
- BTEX screening concentrations determined per the attenuation factor method as described in RWQCB Guidance for VOC Impacted Sites (March 1996), with a natural degradation factor of 11 for BTEX and of 3 for MTBE. Table values can be linearly interpolated between distance above groundwater and are proportional to fraction of each lithological thickness.
- Values in Table 4-1 are for soils above drinking water aquifers. All groundwater are considered as drinking water resources unless exempted by one of the criteria as defined under SWRCB Resolution 88-63 (TDS>3000 mg/L, or deliverability <200 gal/day, or existing contamination that cannot be reasonably treated). Regional Board staff will make a determination of potential water use at a particular site considering water quality objectives and beneficial uses. For non-drinking water aquifers, regardless of depth, TPH for ">150 feet" category in the table should be used; Distance above groundwater must be measured from the highest anticipated water level. Lithology is based on the USCS scale.
- In areas of naturally-occurring hydrocarbons, Regional Board staff will make determinations on TPH levels.

(revised 1/7/05) rev 05/08
CERTIFICATION DECLARATION
FOR COMPLIANCE WITH
FEE TITLE HOLDER NOTIFICATION REQUIREMENTS
(California Water Code Section 13307.1)

Please Print or Type

Fee Title Holder(s): SOUTHBAY ASSOCIATES, LLC., A RELIGIOUS LIMITED LIABILITY COMPANY B/Y: SOUTHBAY ASSOCIATES, A CALIFORNIA LIMITED PARTNERSHIP
BY: EYENON LLC, AN OHI0 CORPORATION ITS GENERAL PARTNER

Mailing Address: SOUTHBAY ASSOCIATES, LLC, 7777 HILTON HEAD DRIVE SUITE 150 CLEVELAND, OHIO 44113 attention: GENERAL COUNSEL

Contact Person: EYENON, LLC, 7777 HILTON HEAD DRIVE SUITE 150 CLEVELAND, OHIO 44113 attention: GENERAL COUNSEL

Telephone Number / Fax Number: (216) 416-3240

Site Name: SOUTHBAY SOUTHERN

Address: 1501 HAWTHORNE BLVD REDONDO BEACH CALIFORNIA

Contact Person: MARTIN LEE

Telephone Number / Fax Number: 213-488-0010

File Number: 902780061

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (See attached page for whom shall sign the Certification Declaration).

EVERETT H. SHINE

Printed Name of Person Signing

Signature

Official Title

Date Signed

2/26/09

California Environmental Protection Agency

Our mission is to preserve and enhance the quality of California's water resources for the benefit of present and future generations.
From: "Lee, Kenneth" <KennethLee@foreetcit.net>
To: "Dave Bjostad" <dbjostad@waterboards.ca.gov>, "Chris Rude @ California E...
CC: "Victor, Jennifer" <JenniferVictor@foreetcit.net>
Date: 5/5/2009 9:54 AM
Subject: RE: RE: South Bay Galleria UST case, Redondo Beach, CA

Dave: The following are the names of the entities per your request:

**Responsible Party**
South Bay Associates SPE, LLC
50 Public Square Suite 1100
Cleveland, Ohio 44113
Attention: Duane Bishop

**Property Owner**
South Bay Associates SPE, LLC
50 Public Square Suite 1100
Cleveland, Ohio 44113
Attention: Duane Bishop

Please copy me all notices and correspondences for the above entities at the following address:

Forest City Commercial Group
949 S. Hope Street
Los Angeles, CA 90015
Attention: Kenneth Lee

Thank you.

Kenneth Lee
Forest City Commercial Group
Vice President
West Coast Commercial Development
(O) 213 416-2282
(M) 213 280-8430

-----Original Message-----
From: Dave Bjostad [mailto:dbjostad@waterboards.ca.gov]
Sent: Thursday, April 30, 2009 9:22 AM
To: Chris Rude @ California Environmental
Cc: Lee, Kenneth
Subject: Fwd: RE: South Bay Galleria UST case, Redondo Beach, CA

Kenneth and Chris,

Do I read this correctly that the property owner and the responsible party for the UST are the same?

Also, you say Kenneth Lee is the POC for the project (meaning both the RP and property owner, I assume), while Attn: Duane Bishop is listed as part of the address, so I'm not sure if you want a copy to go to Duane Bishop or if he should be listed as the POC.
In response to your email on 3/12/09

Owner of record: South Bay Associates
Mailing address: 50 Public Sq Ste 1340 Terminal Tower OH 44113

Van Nuys Email Desk

-----Original Message-----
From: L.A. County - Office of The Assessor
Sent: Thursday, March 12, 2009 4:56 PM
To: Van Nuys
Subject: FW: Public Inquiry Form

-----Original Message-----
From: dbjostad@waterboards.ca.gov [mailto:dbjostad@waterboards.ca.gov]
Sent: Thursday, March 12, 2009 8:00 AM
To: L.A. County - Office of The Assessor
Subject: Public Inquiry Form

Name: Dave, Bjostad
Business Name: Regional Water Quality Control Board
Address: 320 W 4th St, Ste 200
Los Angeles, CA 90013
Email: dbjostad@waterboards.ca.gov
Phone: 213-576-6713
Fax:
Situs: 1501 Hawthorne Blvd (or 1515 Hawthorne Blvd)
Redondo Beach, CA 90278
AIN: 4082-019-043

Company Name:
Routing Index:

Comments: As a representative of the Regional Water Quality Control Board - Los Angeles Region, I request the property owner name, company (if any), and mailing address for the subject site in support of our Leaking Underground Storage Tank Program.
Asphalt paved parking lot

SP5

approximate lateral extent of impacted soil > 10 ppm

Location of former pump islands

SP6

SP7

SP8

SP1

Former Building

location of former 12,000 gallon USTs

SP9

SP2

SP3

SP4

B1

B2

LEGEND

Location and number of exploratory soil probe

Location and number of exploratory boring

REFERENCE: Plot Plan by Ninyo and Moore (1/29/96)

PLOT PLAN DETAIL
Forest City Development
Portion of Galleria at South Bay/Hawthorne Bl.

California
Environmental

Drawn By: J LW
Job #: EP196-1127

Checked By: CIB
Date: February 1996
Soil Data
### TABLE I

Laboratory Analysis of Soil Samples

<table>
<thead>
<tr>
<th>Sample I.D.</th>
<th>Date</th>
<th>EPA Method 8015PC (mg/Kg)</th>
<th>EPA Method 8260B mg/Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>Diesel</td>
</tr>
<tr>
<td>SP1 @ 5 ft.</td>
<td>1/30/96</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>SP2 @ 10 ft.</td>
<td>1/30/96</td>
<td>107</td>
<td>&lt;10</td>
</tr>
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<td>SP3 @ 25 ft.</td>
<td>1/30/96</td>
<td>583</td>
<td>&lt;10</td>
</tr>
<tr>
<td>SP4 @ 34 ft.</td>
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<td>SP5 @ 10 ft.</td>
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<td>&lt;10</td>
</tr>
<tr>
<td>SP6 @ 15 ft.</td>
<td>1/30/96</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<td>&lt;10</td>
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<td>SP9 @ 15 ft.</td>
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<td>&lt;10</td>
</tr>
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<td>SP9 @ 20 ft.</td>
<td>1/30/96</td>
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<td>&lt;10</td>
</tr>
<tr>
<td>B1 @ 45 ft.</td>
<td>1/30/96</td>
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<td>&lt;10</td>
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<tr>
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<td>3/29/96</td>
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</tr>
<tr>
<td>B3 @ 45 ft.</td>
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</tr>
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<td>B4 @ 45 ft.</td>
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<td>&lt;0.1</td>
<td>--</td>
</tr>
<tr>
<td>B5 @ 55 ft.</td>
<td>3/29/96</td>
<td>&lt;0.1</td>
<td>--</td>
</tr>
<tr>
<td>B5 @ 55 ft.</td>
<td>3/29/96</td>
<td>&lt;0.1</td>
<td>--</td>
</tr>
<tr>
<td>SB4 @ 5 ft.</td>
<td>3/25/08</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>SB4 @ 10 ft.</td>
<td>3/25/08</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>SB4 @ 15 ft.</td>
<td>3/25/08</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>SB4 @ 25 ft.</td>
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<td>&lt;0.5</td>
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<tr>
<td>SB4 @ 30 ft.</td>
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<td>&lt;0.5</td>
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<tr>
<td>SB4 @ 35 ft.</td>
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<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>SB4 @ 40 ft.</td>
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<td>&lt;0.5</td>
</tr>
<tr>
<td>Sample I.D.</td>
<td>Date</td>
<td>EPA Method 8015FC (mg/Kg)</td>
<td>EPA Method 8260B mg/Kg</td>
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<tr>
<td>------------</td>
<td>----------</td>
<td>---------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas</td>
<td>Diethyl</td>
</tr>
<tr>
<td>SB4@ 45 ft.</td>
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<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB4@ 50 ft.</td>
<td>3/25/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB4@ 55 ft.</td>
<td>3/25/08</td>
<td></td>
<td>1.0</td>
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<tr>
<td>SB5@ 5 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 10 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 15 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 20 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 25 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 30 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 35 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 40 ft.</td>
<td>3/26/08</td>
<td></td>
<td>8.8</td>
</tr>
<tr>
<td>SB5@ 45 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 50 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB5@ 55 ft.</td>
<td>3/26/08</td>
<td></td>
<td>&lt;0.50</td>
</tr>
<tr>
<td>SB6@ 5 ft.</td>
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<td>0.94</td>
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<td>3/26/08</td>
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<td>&lt;0.50</td>
</tr>
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<td>3/26/08</td>
<td></td>
<td>2.8</td>
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<tr>
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<td>3/26/08</td>
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<td>52</td>
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<tr>
<td>SB6@ 30 ft.</td>
<td>3/26/08</td>
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<td>19</td>
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<tr>
<td>SB6@ 35 ft.</td>
<td>3/26/08</td>
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<td>400</td>
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<td>SB6@ 40 ft.</td>
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<tr>
<td>Duplicate -3</td>
<td>3/26/08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Soil samples analyzed per EPA Method 8020 expressed as mg/Kg
- J flag denotes the estimated concentration between the laboratory practical quantitation limit (PQL) and the method detection limit (MDL)
Groundwater Data
GROUNDWATER CONTOUR MAP

LEGEND
- Location and number of groundwater monitoring well (installed March 2008)
- Location and number of groundwater monitoring well (abandoned March 2008)

Groundwater elevation contour-feet above mean sea level

Asphalt Paved Parking Lot

Location of Former Parking

Location of former 12,000 gallon USLs

Sidewalk

HAWKTHORNE BOULEVARD

GROUNDFWATER CONTOUR MAP

CALIFORNIA ENVIRONMENTAL

Client: FOREST CITY WEST

Location: SOUTH BAY GALLERIA

FEBRUARY 2009

Scale: 1 inch = 20 feet

127 Groundwater Contour Map
### Table I

**Groundwater Level Data**

<table>
<thead>
<tr>
<th>Monitoring Well I.D.</th>
<th>Date</th>
<th>Screened Interval (ft. bgs)</th>
<th>Elevation Reference Point Top of Casing</th>
<th>Depth to Groundwater (prior to purging)</th>
<th>Groundwater Elevation (relative to mean sea level)</th>
<th>Free Product Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW1</td>
<td>4/4/96</td>
<td>92.27</td>
<td>55.08</td>
<td>36.19</td>
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<tr>
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<td>4/4/96</td>
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<td>55.62</td>
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<td>55.81</td>
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<tr>
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<td>3/31/08</td>
<td>45-65</td>
<td>96.06</td>
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<td>40.46</td>
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<td>51.01</td>
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<td>6/27/08</td>
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<td>51.00</td>
<td>45.00</td>
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<td>51.04</td>
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<td>50.95</td>
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<td>3/31/08</td>
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<td>2/6/09</td>
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<td>44.27</td>
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<td>MW6</td>
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<td>44.67</td>
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</table>

MW1-MW3 abandoned in March 2008.

### Table for Current Quarter - Groundwater Level Data

<table>
<thead>
<tr>
<th>Monitoring Well I.D.</th>
<th>Date</th>
<th>Screened Interval (ft. bgs)</th>
<th>Elevation Reference Point Top of Casing</th>
<th>Depth to Groundwater (prior to purging)</th>
<th>Groundwater Elevation (relative to mean sea level)</th>
<th>Free Product Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW4</td>
<td>2/6/09</td>
<td>45-65</td>
<td>96.06</td>
<td>50.95</td>
<td>45.11</td>
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<tr>
<td>MW5</td>
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<td>45-65</td>
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<td>51.76</td>
<td>44.27</td>
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<td>Sample ID.</td>
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<td>EPA Method 8015 TPH-DRO (mg/L)</td>
<td>TPH-GRO</td>
<td>Benzene</td>
<td>Toluene</td>
<td>Ethyl Benzene</td>
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<tr>
<td>-----------</td>
<td>----------</td>
<td>--------------------------------</td>
<td>---------</td>
<td>---------</td>
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<tr>
<td>B1@55 ft.</td>
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<td>130</td>
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<td>1.4</td>
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<td>&lt;50**</td>
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<td>&lt;0.5</td>
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<td>&lt;0.50&lt;1.0</td>
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<td>&lt;0.5</td>
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</tbody>
</table>

**MW1-MW3 Abandoned by California Environmental in March 2008

**Analysis by EPA Method 8015M

1127.GW.RPT.1STQ09
California Environmental Geologists & Engineers, Inc.
# LABORATORY ANALYSIS RESULTS

**Client:** Cal Environmental  
**Project No:** NA  
**Project Name:** Redondo Beach  
**Method:** VOCs, OXY & TPH Gasoline by GC/MS  
**AA Project No:** A243460  
**Date Received:** 02/09/09  
**Date Reported:** 02/17/09  
**Units:** ug/L

<table>
<thead>
<tr>
<th>Date Sampled:</th>
<th>02/06/09</th>
<th>02/06/09</th>
<th>02/06/09</th>
<th>02/06/09</th>
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<td>02/10/09</td>
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<td>9B09003-03</td>
<td>9B09003-04</td>
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<td>Duplicate</td>
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**8260B+OXY+TPHG (EPA 8260B)**

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**Signature:**

Allen Aminian  
QA/QC Manager

American Analytics • 9755 Eton Avenue, Chatsworth, California 91311  
Tel: (818) 998-5547 • Fax: (818) 998-7258
# Laboratory Analysis Results

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<td>NA</td>
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</tr>
<tr>
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<td>Redondo Beach</td>
<td>Date Reported: 02/17/09</td>
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<td>Method:</td>
<td>VOCs, OXY &amp; TPH Gasoline by GC/MS</td>
<td>Units: µg/L</td>
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| Date Sampled:         | 02/06/09          | 02/06/09 | 02/06/09 | 02/06/09 | 02/10/09 |
| Date Prepared:        | 02/10/09          | 02/10/09 | 02/10/09 | 02/10/09 | 02/10/09 |
| Date Analyzed:        | 02/10/09          | 02/10/09 | 02/10/09 | 02/10/09 | 02/10/09 |
| AA ID No:             | 9B09003-01 9B09003-02 9B09003-03 9B09003-04 | 9B09003-04 |
| Client ID No:         | Trip Duplicate MW-4 MW-5 |  |
| Matrix:               | Water Water Water Water |  |
| Dilution Factor:      | 1 1 1 1 MRL |  |

8260B+OXY+THPG (EPA 8260B) (continued)

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<th>µg/L</th>
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<th>µg/L</th>
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Allen Aminian
QAVQC Manager

American Analytics • 9765 Eton Avenue, Chatsworth, California 91311
Tel: (818) 998-5547 • Fax: (818) 998-7258
**LABORATORY ANALYSIS RESULTS**

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<td>Units: ug/L</td>
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8260B+OXY+TPHG (EPA 8260B) (continued)

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**Surrogates**

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Bromofluorobenzene</td>
<td>100%</td>
<td>100%</td>
<td>102%</td>
<td>98.7%</td>
<td>70-140</td>
</tr>
<tr>
<td>Dibromofluoromethane</td>
<td>102%</td>
<td>101%</td>
<td>92.1%</td>
<td>102%</td>
<td>70-140</td>
</tr>
<tr>
<td>Toluene-d8</td>
<td>102%</td>
<td>101%</td>
<td>108%</td>
<td>100%</td>
<td>70-140</td>
</tr>
</tbody>
</table>

---

American Analytics • 9765 Eton Avenue, Chatsworth, California 91311
Tel: (818) 998-5547 • Fax: (818) 998-7258

Allen Aminian
QAV/GC Manager
Other Data
certified mobile laboratory for Total Petroleum Hydrocarbons using modified EPA Method 8015, for aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylenes (BTEX)) using EPA Method 8020 for methane and for fixed gases. The laboratory test report and chain-of-custody is enclosed in APPENDIX I. The laboratory tests on soil vapor samples are summarized below in TABLE I.

<table>
<thead>
<tr>
<th>Sample I.D. No.</th>
<th>methane ppmV</th>
<th>TPHV ppmV</th>
<th>benzene µg/L</th>
<th>toluene µg/L</th>
<th>ethylbenzene µg/L</th>
<th>xylenes µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV1 @ 5 ft.</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>SV2 @ 3 ft.</td>
<td>3</td>
<td>1</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>SV3 @ 5 ft.</td>
<td>1</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>SV4 @ 3.5 ft.</td>
<td>5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>SV5 @ 5 ft.</td>
<td>36</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>SV6 @ 3 ft.</td>
<td>2</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>detection limits</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

ND = Indicates not detected at indicated detection limit.

SOIL SAMPLING

On January 30, 1996, nine (9) test holes (SP1-SP9) and two (2) hollow-stem auger borings (B1-B2) were excavated on the subject property in locations depicted on the enclosed PLOT PLAN DETAIL. The test holes were excavated with a hydraulic push rig (Strataprobe). The two (2) borings were excavated with a CME 55 drill rig. The Strataprobe hydraulically drives a 1 inch diameter rod into the ground. The drill rig excavates an 8 inch boring using hollow stem auger. Soil samples were obtained from the
**Log of Boring SB6 (MW6)**

<table>
<thead>
<tr>
<th>Job Number: EP196-1127</th>
<th>Date: 3/26/2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Name: Forest City West</td>
<td>Drill Rig: B61 Hollow Stern Auger</td>
</tr>
<tr>
<td>Site Address: 1501 Hawthorne Boulevard Redondo Beach, CA</td>
<td>Sampling Method: CA Splitspoon</td>
</tr>
<tr>
<td>Logged By: Christopher E. Rude Environmental Scientist</td>
<td>Boring Diameter: 6 - inch</td>
</tr>
<tr>
<td>Reviewed By: Charles L. Buckley, CHG No. 55</td>
<td>Surface Conditions: Asphalt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Sample Type</th>
<th>Lithologic Description</th>
<th>USCS Code</th>
<th>P&amp;I Reading (ppmv)</th>
<th>Blows per Foot</th>
<th>Graphic Log</th>
<th>Well Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SD</td>
<td>Silty sand, fine grain, brown, slightly moist, dense, no hydrocarbon odor.</td>
<td>SM</td>
<td>0.0</td>
<td>30/30/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SD</td>
<td>Silty sand, fine grain, slightly moist, dense, no hydrocarbon odor.</td>
<td>SM</td>
<td>0.0</td>
<td>24/27/27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SD</td>
<td>Clayey sand, fine grain, brown, dense slightly moist, no hydrocarbon odor.</td>
<td>SM</td>
<td>0.9</td>
<td>30/50-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SD</td>
<td>Silty sand, fine grain, brown, dense, slightly moist, slight gasoline odor.</td>
<td>SM</td>
<td>1.9</td>
<td>30/50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SD</td>
<td>Silty sand and silty clay, olive brown to light gray, stiff, slight gasoline odor.</td>
<td>SM</td>
<td>387</td>
<td>30/50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>SD</td>
<td>Silty sand, fine grain, light brown, slight moist, gasoline odor.</td>
<td>SM</td>
<td>—</td>
<td>17/24/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>SD</td>
<td>Silty sand, fine grain, yellowish brown, gasoline odor.</td>
<td>SM</td>
<td>—</td>
<td>34/35/40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>SD</td>
<td>Silty sand, fine grain, light brown, slight moist, slight gasoline odor.</td>
<td>SM</td>
<td>2359</td>
<td>30/35/40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>SD</td>
<td>Silty sand, fine grain light brown, slight moist, gasoline odor.</td>
<td>SM</td>
<td>507</td>
<td>27/28/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>SD</td>
<td>Silty sand, fine grain. Light brown, moist, slight gasoline odor.</td>
<td>SM</td>
<td>28.6</td>
<td>24/50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
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<tr>
<td>65</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td>SM</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End @ 75 ft. bgs. Groundwater encountered at approximately 52.0 feet bgs. Set groundwater well using 2-inch diameter Schedule 80 PVC casing. Groundwater well is screened with fifteen feet of 0.020-inch screen. Filter pack consisting of No. 3 sand was placed within the annulus. The well was surged prior to placement of five feet of hydrated bentonite chips. Bentonite-cement grout was tremied from the bentonite chips to four feet bgs. Surface completion included a 12-inch traffic rated well box and concrete.

---

*Sample Types: S=Soil, W=Water, V=Vapor, D=Drive, G=Grab, N=No Recovery*
GEOTECHNICAL STUDY REPORT
Southbay Southern Project
Redondo Beach, California

Converse Project No. 10-31-124-01
March 17, 2010

PREPARED FOR
Brewer Development
7001 Preston Road, Suite 250
Dallas, TX 75205
March 17, 2010

Mr. Stacy McVey
Brewer Development
7001 Preston Road, Suite 250
Dallas, Texas 75205

Subject: GEOTECHNICAL STUDY REPORT
Southbay Southern Project
Redondo Beach, California
Converse Project No. 10-31-124-01

Dear Mr. McVey:

Enclosed is the geotechnical study report performed by Converse Consultants (Converse) for the proposed Southbay Southern Project located within the southeasterly portion of the South Bay Galleria Mall, in Redondo Beach, California. The purpose of the study was to evaluate the geotechnical site conditions with respect to the planned project, and to provide appropriate recommendations for design, site preparation and construction.

Based on our background review, field exploration, laboratory testing, geologic evaluation and geotechnical analysis, the site is suitable from a geotechnical standpoint for the proposed project, provided our conclusions and recommendations are implemented during design and construction.

We appreciate the opportunity to be of service to Brewer Development. If you should have any questions, please do not hesitate to contact us at (626) 930-1200.

CONVERSE CONSULTANTS

William H. Chu, P.E., G.E.
Senior Vice President/Principal Engineer

Dist: 6/Addressee

GDS/SCL/WHC/dlr
PROFESSIONAL CERTIFICATION

This geotechnical report for the proposed Southbay Southern Project in Redondo Beach, California has been prepared by the staff of Converse under the professional supervision of the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.

In the event that changes to the property occur, or additional, relevant information about the property is brought to our attention, the conclusions contained in this report may not be valid unless these changes and additional relevant information are reviewed and the recommendations of this report are modified or verified in writing.

Sean C. Lin, P.E.
Project Engineer

Geoffrey D. Stokes, P.G., C.E.G.
Senior Geologist

William H. Chu, P.E., G.E.
Senior Vice President / Principal Engineer
EXECUTIVE SUMMARY

The following is the summary of our geotechnical study including findings, conclusions, and recommendations, as presented in the body of this report. Please refer to the appropriate sections of the report for complete conclusions and recommendations. In the event of a conflict between this summary and the report, or an omission in the summary, the report content shall prevail.

♦ The proposed project consists of re-developing the site with approximately 110,000 square feet of new retail space and at-grade parking. Single story structures with relative light to medium foundation loads (isolated pads and continuous spread footings) were assumed in our geotechnical analysis.

♦ Our subsurface exploration was performed on February 25 and 26, 2010, with the aid of truck-mounted hollow-stem auger borings extending between depths of approximately 10.5 to 51.5 feet below the existing ground surface (bgs). The borings were located within and around the footprint of the planned improvements.

♦ Variable thickness undocumented fill soils were encountered in the borings, with depths ranging between approximately two (2) to twelve (12) feet below the existing ground surface. Thicker fills may exist at the site. The fill soils encountered in the borings generally consist of silty sand with occasional gravel and brick debris.

♦ The southeastern portion of the project area was formerly developed as a gas station, which was demolished circa 1982. Three underground storage tanks (USTs) were removed as a part of demolition, resulting up to reported 15 feet of backfill soils in the tank void areas. Considering that other portions of the site have also experience prior development/demolition, deeper depths of fill may exist across the site, especially in areas of former building foundations and where buried utility lines exist.

♦ Native soils characterized as Older Dune Deposits were encountered below the fill in all sixteen (16) borings drilled during our subsurface exploration. The dune deposits consists primarily of silty sand within the upper ten feet, and sand and sand with silt soils at depths of approximately 10 to 50 feet from grade. Sampling blow counts correlate with relatively dense to very dense conditions.

♦ Groundwater was not encountered during subsurface exploration. The highest recorded groundwater levels at the subject site is approximately 52 feet below the existing ground surface, as encountered during previous environmental studies performed by others.

♦ The upper six (6) feet of mixed undocumented fill and native alluvial soils have a “Very Low” expansion potential. Expansive soil mitigation measures for foundations supported on future fill soils derived from on-site sources, or supported on native dune deposit soils are not anticipated.
♦ Site soils have preliminary “negligible” concentrations of water soluble sulfates.

♦ Laboratory testing indicates that site soils, in general, are considered “non-corrosive” to buried ferrous metals.

♦ The sandy native soils tested for collapse/consolidation indicate a slight potential for collapse, but a moderate potential for compression under increased loads and saturated conditions.

♦ There are no known active faults projecting toward or extending across the proposed site. The site is not situated within a currently designated Alquist-Priolo Earthquake Fault Zone (formerly Special Studies Zones).

♦ The site is not located within a mapped Seismic Hazard Zone for either liquefaction or earthquake induced slope instability.

♦ Although clear of geologic hazards associated with fault rupture, liquefaction and slope instability, the site is located within a seismically active area and will be subject to intense ground motion during a significant seismic event. Site-specific parameters for seismic design are provided in the report, formulated in general accordance with Chapter 16, Sections 1613 and 1614 of the 2007 California Building Code.

♦ Perculation testing within the native silty sand soils at depths of approximately 5 to 10 feet below grade indicate infiltration rates of 1.29 to 2.81 inches per hour, correlating with relatively moderate infiltration.

♦ Site preparation will require remedial grading including removal of existing manmade structures and buried utilities, and over-excavation and re-compaction of existing undocumented fill soils.

♦ It is expected that site soils can be excavated with conventional heavy-duty earth-moving equipment in good working order. Excavated site soils free of organic matter and demolition debris are considered suitable for placement as compacted fill after proper processing. Such processing may include moisture conditioning and mixing, and removal/screening of oversized debris.

Results of our study indicate that the site is suitable from a geotechnical standpoint for the proposed development, provided that the recommendations contained in this report are incorporated into the design and construction of the project.
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1.0 INTRODUCTION

This report contains the findings, conclusions and recommendations of our geotechnical study performed at the location of the proposed Southbay Southern project planned within the southeastern portion of the South Bay Galleria Mall. The project area is situated along the west side of Hawthorne Boulevard between 178<sup>th</sup> Street and 180<sup>th</sup> Street in Redondo Beach, California (see Drawing No. 1, Site Location Map and Drawing No. 2, Boring Location Map).

The purpose of the study was to generate a report with geotechnical design parameters for use by the project design team, to aid in the preparation of project plans and specifications. This report is written for the project described herein and is intended for use solely by Brewer Development and their design team. This report should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

2.0 SITE CONDITIONS AND PROPOSED PROJECT

Existing improvements within the project area include a vacant structure formerly used as a grocery store and pharmacy (55,000 square feet) within the northwest portion of the site and a 13,500 square foot movie theater along the southern portion of the site. An approximately 7.7 acre vacant dirt lot, site of a demolished bowling alley, covers the southwestern portion of the project area. Asphalt pavement covers the remainder of the site with isolated landscaped islands (with mature trees) in the parking lot areas. The southeastern parking area was the site of a former gas station. Adjacent offsite improvements include a large retail store situated west of the vacant dirt lot, and a Bank of America building located north/northeast of the movie theater. The subject site is relatively flat lying, with surface elevations ranging from approximately 97 to 95 feet relative to mean-sea-level (MSL), down toward the east.

We understand that the area of the vacant lot (former bowling alley), existing movie theater and existing vacant grocery/pharmacy building will be re-developed with approximately 110,000 square feet of new retail space and at-grade parking pavement. A separate structure is also planned within the northeast portion of the site (see Drawing No. 3, Proposed Improvement Plan). The new structures will be single-story. Basement levels are not planned.
3.0 SITE COORDINATES

The coordinates representative of the project site location are shown on Drawing No. 1, Site Location Map. The site coordinates are:

North latitude: 33.8681 degrees
West longitude: 118.3542 degrees

These coordinates were used to calculate earthquake ground motions with the United States Geological Survey computer program Seismic Hazards Curves, Response Parameters and Design Parameters, Version 5.0.9a.

4.0 SCOPE OF WORK

Our scope of work, as outlined in our proposal dated February 8, 2010, consisted of the following tasks:

4.1 Task I: Project Set-up and Field Reconnaissance

A review of readily available geotechnical and geologic background documentation was performed as a part of our work, including published maps and reports, and historic aerial photographs dating back to 1952. A list of the documentation reviewed is presented in the References section at the end of this report.

A Converse representative visited the site prior to drilling to assess equipment accessibility and to mark the boring locations. Sixteen (16) boring locations (BH-1 through BH-16) were marked within the proposed site boundaries. This work was coordinated with the operations manager for the South Bay Galleria. Underground Service Alert of Southern California was also notified of our proposed drilling locations.

4.2 Task II: Field Exploration and Infiltration Testing

Our field exploration consisted of drilling, logging, and sampling sixteen (16) hollow-stem auger borings (BH-1 through BH-16) on February 25 and 26, 2010. The borings were advanced using truck mounted drill rig with an 8-inch diameter hollow stem auger to a maximum depth of 51.5 feet below the existing ground surface (bgs). The boring and locations are shown on Drawing No. 3, Proposed Improvement Plan, and Drawing No. 2, Boring Location Map.

The borings were visually logged by a geologist and sampled at regular intervals and at changes in subsurface soils. California Modified Sampler (Ring samples), Standard Penetration Test samples, and bulk soil samples were obtained for laboratory testing. The borings were backfilled with soil cuttings following the completion of drilling, with disturbed pavement surfaces were patched with asphalt concrete.
Two of the borings, BH-2 and BH-4, located within the northeastern portion of the site, were used for percolation testing prior to abandonment.

4.3 Task III: Laboratory Testing

Representative samples of the site soils were tested in our laboratory and the laboratory of Environmental Geotechnology Laboratory, Inc. of Arcadia to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- *In situ* moisture contents and dry densities (ASTM Standard D2216)
- Grain Size Distribution (ASTM Standard C136)
- Fines Content/Passing No. 200 Sieve (ASTM Standard D1140)
- Maximum Dry Density and Optimum-Moisture Content relationship (ASTM Standard D1557)
- Direct Shear (ASTM Standard D3080)
- Consolidation and Collapse (ASTM Standard D2435)
- Expansion Index (ASTM Standard D4829)
- Soil Corrosivity (Caltrans 643, 422, 417, and 532)
- R-Value (ASTM Standard D2844)

For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*. For *in-situ* moisture and dry densities, see the Logs of Borings in Appendix A, *Field Exploration*.

4.4 Task IV: Geotechnical Analyses and Report

Data obtained from the background review, exploratory borings, and laboratory-testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our study and evaluation.

5.0 SITE BACKGROUND

Historic aerial photographs were reviewed from the following website: www.HistoricAerials.com, a service by Nationwide Environmental Title Research, LLC; a database of aerial photographs from the United States Department of Agriculture (USDA) and United States Geological Survey (USGS). Readily available historic photographs for the site from the years 1952, 1972, 1980, 2004, and 2005, were viewed.

Review of historic aerial photos indicate the project area was used for small-plot agriculture circa 1952, with the former bowling alley, existing movie theater and former...
gas station constructed sometime before 1972. The existing grocery store and pharmacy building was constructed after the 1980 aerial photo, in an area formerly used for parking pavement. The 2004 shows the former gas station re-developed as parking pavement and the 2005 photo reflects current site conditions.

In preparation of this report, Converse has reviewed pertinent and readily available background information as listed the References at the end of the report text. Included in our review of background documentation is a geotechnical report for the adjacent property to the west, prepared by Geotechnical Professionals, Inc. (GPI). As a part of their work, GPI advanced 18 cone penetration tests (CPTs) to depths of 10 to 50 feet, and drilled 21 borings to depths of 2.5 to 25 feet. Soils encountered by GPI are described as sand and clayey sand fill soils over predominately sandy native soils. Groundwater was not encountered to the depths explored. GPI recommended remedial grading, including over-excavation of undocumented fill soils and compressible native soils, and replacement with engineered fill to support future structures. The estimated depths of over-excavation ranged from 2 to 17 feet.

Converse was also provided with two environmental reports by California Environmental (CE), documenting the soil and groundwater conditions below the area of the former gas station located at 1501 Hawthorne Boulevard. According to CE, the gas station was demolished in 1982, including the removal of three 12,000 gallon underground storage tanks (USTs). Documentation regarding the backfill of the UST voids is not available, but previous site assessments by CE indicate up to 15 feet of fill exists in these areas. Three older groundwater monitoring wells were abandoned, and three new wells were installed by CE in March 2008. Fine sandy soils with inter-bedded silts and clays were encountered to depths of 75 feet below grade, with first groundwater encountered at a depth of approximately 52 feet. The three newer wells were abandoned in July 2009, following site closure.

6.0 GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Regional Geologic Setting

The regional geologic setting consists of a broad sediment filled basin, known as the Los Angeles Basin, located at the convergence of the Transverse Ranges and Peninsular Ranges geomorphic provinces of California. The project site is located within the coastal plain portion of the Los Angeles Basin, locally referred to as the Torrance Plain. Sedimentary deposits within the Torrance Plain consist of older alluvial soils overlain to the west by older sandy sediments deposited in an eolian environment (dune sand), as mapped and described in the Seismic Hazard Zone Report for the Torrance Quadrangle (CDMG, 1998) and the Geologic Map of the Palos Verdes Peninsula and Vicinity by Dibblee (1999). Drawing No. 4, Geologic Map of Site Vicinity (based on Dibblee, 1999), has been prepared to show the location of the project site with respect to the regional geology.
6.2 Geology and Subsurface Profile of Project Site

Undocumented fill soils were encountered in each of the sixteen hollow-stem auger borings drilled, varying in depth from approximately 2 feet to 12 feet. Thicker fills may exist at the site. In general, the fill soils encountered are less than four feet in depth, with the exception of 6 feet encountered in boring BH-3 (planned isolated structure in northeast portion of site), and 12 feet encountered in boring BH-11 (planned Nordstrom Rack). The fill soils consist of silty sand with trace gravel and brick debris.

The fill soils reported by CE (2008) in the area of the former USTs (up to 15 feet deep) were not encountered during our subsurface work. These former UST sites are located beyond the limits of planned building construction.

Older dune deposits were encountered below the near-surface undocumented fill in all sixteen borings drilled as a part of subsurface exploration. The upper approximately 10 feet of natural soils encountered consist mainly of silty sand. Below depths of 10 feet, the older dune deposits consist mostly of sand and sand with silt to the maximum depth explored of 51.5 feet below ground surface (bgs). The older dune deposits are generally dense to very dense, based on blow count correlation. Drawing No. 5a, Geologic Cross Section A-A’, and Drawing No. 5b, Geologic Cross Section B-B’, have been drawn across the subject site and tied to the exploratory borings to illustrate the subsurface conditions encountered below the planned project.

For additional information on the subsurface conditions, see the Logs of Borings Data in Appendix A, Field Exploration.

6.3 Groundwater

Groundwater was not encountered during our recent subsurface exploration. First groundwater was encountered at a depth of approximately 52 feet bgs by CE during monitoring well installation in March 2008.

In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present within the nearer surface soils due to local conditions or during rainy seasons. Groundwater conditions below any given site vary depending on numerous factors including seasonal rainfall, local irrigation, and groundwater pumping, among other factors. The regional groundwater table is not expected to be encountered during the planned construction. However, the possibility of perched groundwater encountered during future grading and excavation cannot be completely precluded.
GEOLOGIC CROSS SECTION B-B'

Af = Undocumented Fill
Qoe = Older Dune Deposits

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=40'

LIMITS OF PROPOSED BUILDING STRUCTURE

BH-2

BH-3

TD=10'

Qoe

TD=51'

Qoe
6.4 **Percolation Testing**

Borings BH-2 and BH-4, located within the northeastern portion of the site, were utilized for an in-situ falling-head test procedure for percolation testing. Both holes were pre-soaked to depths of 10 feet below the ground surface prior to testing. During testing, the water level was re-filled to the ground surface at regular 30 minute intervals, except for the last 60 minutes of the test. Testing occurred for a period of approximately 4 hours at Boring No. BH-2, and approximately 7 hours at Boring No. BH-4. The percolation test results are shown in Appendix D, *Percolation Testing*.

6.5 **Subsurface Variations**

Based on results of the subsurface exploration and our experience, some variations in the continuity and nature of subsurface conditions within the project site should be anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations. If, during construction, subsurface conditions differ significantly from those presented in this report, this office should be notified immediately so that recommendations can be modified, if necessary.

7.0 **FAULTING AND SEISMIC HAZARDS**

The subject site is situated within a seismically active region. As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

The project site is not located within a currently designated State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zones) for surface fault rupture. No surface faults are known to project through or towards the site. The closest known faults to the project site with a mappable surface expression are the onshore segment of the Palos Verdes Fault, located approximately 6.5 kilometers to the south, and the on-shore segment of the Newport Inglewood Fault, located approximately 9.5 kilometers to the east. The approximate locations of local active faults with respect to the project site are tabulated on Table No. 1, *Summary of Regional Faults*, and are shown (excluding blind thrust faults) on Drawing No. 6, *Regional Fault Map*.

The data presented on Table No. 1, *Summary of Regional Faults*, was calculated using UBCSEIS Version 1.03 and EQFAULT Version 3.0 with updated fault data from “The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al., 2003)”, Appendix A, and other published geologic data.
Table No. 1, Summary of Regional Faults

<table>
<thead>
<tr>
<th>Fault Name and Section</th>
<th>Approximate * Distance to Site (kilometers)</th>
<th>Max. Moment Magnitude (Mmax)</th>
<th>Slip Rate (mm/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palos Verdes</td>
<td>6.5</td>
<td>7.3</td>
<td>3.00</td>
</tr>
<tr>
<td>Newport-Inglewood (L.A. Basin)</td>
<td>9.5</td>
<td>7.1</td>
<td>1.00</td>
</tr>
<tr>
<td>Puente Hills Blind Thrust**</td>
<td>21.5</td>
<td>7.1</td>
<td>0.70</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>23.1</td>
<td>6.6</td>
<td>1.00</td>
</tr>
<tr>
<td>Hollywood</td>
<td>24.3</td>
<td>6.4</td>
<td>1.00</td>
</tr>
<tr>
<td>Malibu Coast</td>
<td>24.4</td>
<td>6.7</td>
<td>0.30</td>
</tr>
<tr>
<td>Raymond</td>
<td>30.7</td>
<td>6.5</td>
<td>1.50</td>
</tr>
<tr>
<td>Elsinore-Whittier</td>
<td>33.7</td>
<td>6.8</td>
<td>2.50</td>
</tr>
<tr>
<td>Anacapa-Dume</td>
<td>34.0</td>
<td>7.5</td>
<td>3.00</td>
</tr>
<tr>
<td>Verdugo/Eagle Rock</td>
<td>34.0</td>
<td>6.9</td>
<td>0.50</td>
</tr>
<tr>
<td>Sierra Madre (Central)</td>
<td>41.2</td>
<td>7.2</td>
<td>2.00</td>
</tr>
<tr>
<td>Sierra Madre (San Fernando)</td>
<td>45.3</td>
<td>6.7</td>
<td>2.00</td>
</tr>
<tr>
<td>Clamshell-Sawpit</td>
<td>47.5</td>
<td>6.5</td>
<td>0.50</td>
</tr>
<tr>
<td>San Jose</td>
<td>47.5</td>
<td>6.4</td>
<td>0.50</td>
</tr>
<tr>
<td>San Gabriel</td>
<td>50.5</td>
<td>7.2</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* Distance from the site to the surface projection as computed by the computer program UBCSEIS, and per review of published geologic data and mapping in Appendix A of the 2002 California Fault Parameters Report (Cao et al., 2003).

** Distance from the site to nearest subsurface projection, per Shaw et al., 2002.

Palos Verdes Fault
The mapped trace of the Palos Verdes Fault is located about 6½ kilometers south of the project site along the northern margin of the Palos Verdes Hills. The major component of uplift and tectonic deformation of the Palos Verdes Peninsula is attributed to movement along this fault.

Newport Inglewood Fault
The Newport Inglewood fault zone is located approximately 9.5 kilometers east of the project site. The Newport Inglewood fault system is about 66 km long on shore and extends northwest from Huntington Beach through Long Beach to Culver City and the Cheviot Hills. The Newport Inglewood fault continues offshore to the southeast of Huntington Beach and makes landfall in La Jolla as the Rose Canyon fault. The Newport Inglewood fault is characterized by a series of uplifts and anticlines including Newport Mesa, Huntington Beach Mesa, Bolsa Chica Mesa, Alamitos Heights and Landing Hill, Signal Hill and Reservoir Hill, Dominguez Hills and Baldwin Hills.

Several earthquakes have occurred along the fault zone including the March 10, 1933 “Long Beach” earthquake of Mw 6.4, with its epicenter off Newport Beach, and smaller
earthquakes at Inglewood on June 20, 1920 (M 4.9), Gardena on November 14, 1941 (ML 4.8; downgraded from an initial estimate of 5.4). These earthquakes show evidence of right-lateral strike slip focal mechanisms.

The Newport Inglewood fault is considered to be active and considered capable of producing a maximum moment magnitude (Mw) 7.1 earthquake. The slip rate is considered to be about 1.0 mm/year but may range up to 2 to 3 mm/year along isolated segments (Cao et al., 2003).

Puente Hills Blind Thrust Fault
The potential for damage from earthquakes along a zone of north-dipping blind thrust faults in the northern Los Angeles Basin was illustrated by the ML 5.9 Whittier earthquake event on October 1, 1987. Smaller earthquakes experienced north/northeast of downtown Los Angeles on September 3, 1905 (est. M 5.3) and July 16, 1920 (est. M 5.0) are further indications of active faulting in the area.

Blind thrust faults are low angle reverse faults which generally have no surface trace. Conventional fault finding trenches, boreholes and paleoseismic dating methods used at the surface have limited use for investigation of these deeply buried thrust fault structures. The geometry and location of the blind thrust fault structures and thrust ramps are based on interpretation of oil well data, seismic and strong motion data solutions, high resolution geophysical data, paleoseismic studies and structural model analyses (Yeats, R.S. 2004; Dolan, J.F. et al., 2003). Examples of blind thrust fault landforms include folding and uplift of areas such as the Elysian, Repetto, Montebello and Puente Hills.

The nearest subsurface projection/interpretation of the Puente Hills Blind Thrust Fault is located approximately 22 kilometers north/northeast of the project site (Shaw et al., 2002). The Puente Hills Blind Thrust has been interpreted to include three segments with a combined length of approximately 42 kilometers and a depth range of 3 km to 13 km below ground surface, ramping down toward the east/northeast (Dolan, J.F., et al., 2003). Studies of the Puente Hills Blind Thrust have indicated the occurrence of at least four large (moment-magnitude 7.2 to 7.5) earthquakes for this fault system during the past 11,000 years (Dolan, J.F. et al., 2003). Recent revisions to fault parameter models have replaced the lower Elysian Park Thrust Fault with the Puente Hills Blind Thrust and Upper Elysian Park Blind Thrust (Cao, et al., 2003).

Seismic hazard fault models for the Los Angeles Basin and vicinity will continue to be refined as new information and technology develops and becomes available through time.
7.1 **Seismic History**

An analysis of the seismic history of the site was conducted using the computer program EQSEARCH, (Blake, 2000) from the most recent earthquake database available, and attenuation relationships proposed by Boore et al. (1997) for alluvium soil conditions. Based on the analysis of seismic history, the number of earthquakes and aftershocks with a moment magnitude of 5.0 or greater occurring within a distance of 100 kilometers was 52, since the Year 1900. Based on the analysis, the largest earthquake induced ground acceleration affecting the site since the year 1900 was approximately 0.14g, realized from the M\(_L\) 4.8 (downgraded from initial M 5.4 estimate) Gardena Earthquake in 1941.

Drawing No. 7, *Epicenters Map of Southern California Earthquakes (1800–1999)*, shows the mapped location of earthquake epicenters with magnitude 5.0 or greater in Southern California during the past 200 years. This historical seismicity map was prepared using the southern portion of Map Sheet 49, *Epicenters and Area Damaged by M>5 California Earthquakes, 1800 – 1999*, CGS, Toppozada and others 2000.

7.2 **Seismic Hazards**

As is the case for most areas of Southern California, seismic hazards resulting from earthquakes need to be considered in the design and construction of new projects. In addition to strong ground motion, such hazards included ground rupture, slope instability and liquefaction. As previously reported, the subject site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zones) for surface fault rupture.

The State of California Seismic Hazard Zone Map for the Torrance Quadrangle (March 25, 1999) shows that the project site is not located within an area of potential liquefaction. The project site is also not located within a mapped area of potential earthquake-induced landslides due to the relatively flat condition of the site topography. Drawing No. 8, *Seismic Hazard Zones Map*, has been prepared to show the mapped location of potential liquefaction and earthquake-induced landslide areas in relation to the project site.

7.3 **Other Effects of Seismic Activity and Geologic Hazards**

Other effects of seismic activity, besides surface fault rupture, soil liquefaction, and landslide, include lateral spreading, earthquake-induced flooding, tsunamis, and seiches. Other geologic hazards to be considered in southern California include methane gas and volcanic eruption hazards. Site-specific potential for each of these other seismic and geologic hazards is discussed in the following sections.
**Liquefaction:** Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within a depth of about 50 feet or less. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. The project site is not within mapped liquefaction potential zone as indicated in the Drawing No. 8, *Seismic Hazard Zones Map*. Due to dense older sand dune deposits encountered on the site, and lack of shallow ground water, it is our opinion that liquefaction potential is very low at the project site.

Differential settlement has been observed during earthquakes primarily when the soil underlying a structure liquefies non-uniformly. Based on the very low liquefaction potential at the project site, the settlement due to seismic shaking is negligible.

**Lateral Spreading:** Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat, with no nearby slopes or embankments. Under these circumstances, the potential for lateral spreading at the subject site is considered negligible.

**Earthquake-Induced Flooding:** This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The potential of earthquake induced flooding of the subject site is considered to be remote because of regional flood control structures.

**Tsunamis:** Tsunamis are tidal waves generated by fault displacement or major ground movement. Based on the location of the site from the ocean (approximately 4.5 kilometers west of the site), tsunamis do not pose a hazard.

**Seiches:** Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on site location, away from lakes and reservoirs, seiches do not pose a hazard.

### 8.0 SEISMIC ANALYSIS

#### 8.1 CBC Seismic Design Parameters

Seismic parameters based on the 2007 California Building Code, calculated with the United States Geological Survey computer program *Seismic Hazards Curves, Response Parameters and Design Parameters, Version 5.0.9a.*, and the site
coordinates 33.8681 degrees North Latitude, 118.3542 degrees West Longitude are provided on the following table:

Table No. 2, CBC Seismic Parameters

<table>
<thead>
<tr>
<th>Seismic Parameters</th>
<th>Seismic Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Class</td>
<td>D</td>
</tr>
<tr>
<td>Mapped Short period (0.2-sec) Spectral Response Acceleration, Ss</td>
<td>1.594g</td>
</tr>
<tr>
<td>Mapped 1-second Spectral Response Acceleration, S1</td>
<td>0.647g</td>
</tr>
<tr>
<td>Site Coefficient (from Table 1613.5.3(1)), Fa</td>
<td>1.0</td>
</tr>
<tr>
<td>Site Coefficient (from Table 1613.5.3(2)), Fv</td>
<td>1.5</td>
</tr>
<tr>
<td>MCE 0.2-sec period Spectral Response Acceleration, SMs</td>
<td>1.594g</td>
</tr>
<tr>
<td>MCE 1-second period Spectral Response Acceleration, SM1</td>
<td>0.971g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration for short period, SDs</td>
<td>1.063g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration for 1-second period, SD1</td>
<td>0.647g</td>
</tr>
<tr>
<td>Seismic Design Category</td>
<td>“D”</td>
</tr>
</tbody>
</table>

9.0 LABORATORY TESTING

Representative samples of the site soils were tested in our laboratory and the laboratory of Environmental Geotechnology Laboratory, Inc. of Arcadia to aid in the classification and to evaluate relevant engineering properties. Results of the various laboratory tests are summarized discussed below. For a more detailed description of the laboratory test methods and test results, see Appendix B, Laboratory Testing Program.

- **In-situ** Moisture and Dry Density – Results of in-situ moisture and dry density tests are presented on the Log of Borings in Appendix A, Field Exploration.

- Grain Size Analysis – Two (2) representative samples were tested to evaluate the relative grain size distribution of sandy samples. Results are presented in Appendix B, Laboratory Testing Program.

- Maximum Dry Density and Optimum Moisture Content – The moisture-density relationship of two (2) representative near surface soil samples are presented in Appendix B, Laboratory Testing Program. The test results indicate that the laboratory maximum dry density for representative samples of the upper six feet of soil are 120.5 to 122.5 pounds per cubic foot (pcf) at 10.5 and 8.5 percent moisture content.

- Direct Shear – One (1) direct shear tests were performed on representative sample in-situ samples and one (1) direct shear tests were performed on samples remolded to 90 percent relative compaction. Result of the direct shear tests is presented in Appendix B, Laboratory Testing Program. The test results indicate the sandy soils tested have moderate shear strengths.
• Consolidation Test – Two (2) consolidation tests were performed on representative samples of the sandy site soils encountered within the upper 10 feet. The results of the test are presented in Appendix B, *Laboratory Testing Program*. Based on the results of these tests, the compressibility of the site soils is considered moderate.

• Collapse Potential – Two (2) samples were loaded up to approximately 2.8 kips per square foot (ksf), allowed to stabilize under load, and then submerged to evaluate the moisture sensitivity (collapse/swell potential) of soils. The test was conducted in accordance with the ASTM standard D5333. The results of these tests are summarized in Appendix B, *Laboratory Testing Program*. The test results show the collapse index is “slight” for on-site soils.

• Expansion Index – Two (2) representative samples from the upper six (6) feet bgs of the site were tested to evaluate Expansion Index (EI). Test results are included in Appendix B, *Laboratory Testing Program*. The test results indicate that the site soils have a very low expansion potential (EI less than 20).

• Soil Corrosivity – Two (2) representative sample of the site soils was tested to evaluate soil corrosivity with respect to common construction materials such as concrete and steel. The test results are presented in Appendix B, *Laboratory Testing Program*. Test results are also discussed in Section 12.8, *Soil Corrosivity Evaluation, below.*

• R-Value – A representative bulk sample was tested to further evaluate the R-Value appropriate for pavement design. The results of the testing are presented in Appendix B, *Laboratory Testing Program*.

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration*.

10.0 FINDINGS AND CONCLUSIONS

Based on the results of our background review, subsurface exploration, laboratory testing, geotechnical analyses, and understanding of the planned construction, it is our opinion that the proposed project is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans, specifications, and are followed during site construction.

The following is a summary of the major geologic and geotechnical factors to be considered for the planned project:

• The site is suitable from a geotechnical viewpoint for the proposed construction of the Southbay Southern Project.

• Variable thickness undocumented fill soils were encountered in the borings, with depths ranging between approximately two (2) to twelve (12) feet below the existing ground
Thicker fills may exist at the site. The fill soils encountered in the borings generally consist of silty sand with occasional gravel and brick debris.

- The southeastern portion of the project area was formerly developed as a gas station, which was demolished circa 1982. Three underground storage tanks (USTs) were removed as a part of demolition, resulting up to 15 feet of backfill soils in the tank void areas. Considering that other portions of the site have also experienced prior development/demolition, deeper depths of fill may exist across the site, especially in areas of former building foundations and where buried utility lines exist.

- Remedial grading will be needed to over-excavate and re-compact existing undocumented fill soils for foundation and slab/pavement support. Following remedial grading, compacted fill soils are anticipated to have similar engineering characteristics with the underlying dense older dune deposit soils.

- The proposed buildings may use a conventional foundation system (spread footings and isolated pads) with slab-on-grade, supported on future compacted fill.

- The upper 10 feet of undocumented fill soils and native soils consist of silty sand soils. Older dune deposits underlying the undocumented fill and upper native soils consist primarily of sand and sand with silt from depths of approximately 10 to 50 feet from grade. Sampling blow counts correlate with dense to very dense conditions.

- Groundwater was not encountered in the exploratory borings drilled and is not anticipated within the zone of construction. The highest groundwater encountered below the subject site during previous work by others is approximately 52 feet below the existing ground surface.

- Percolation testing within the native silty sand soils at depths of approximately 5 to 10 feet below grade indicate infiltration rates of 1.29 to 2.81 inches per hour, correlating with relatively moderate infiltration.

- The upper six (6) feet of mixed undocumented fill and native alluvial soils have a “Very Low” expansion potential. Expansive soil mitigation measures for foundations supported on future fill soils derived from on-site sources, or supported on native alluvial soils are not anticipated.

- Site soils have “negligible” concentrations of water soluble sulfates.

- Laboratory testing indicates that site soils, in general, are considered “non-corrosive” to ferrous metals.

- The sandy soils tested for collapse/consolidation indicate a slight potential for collapse, and a potential for moderate compressibility under increased loads and saturated conditions.
REFERENCE: PORTION OF EPICENTERS AND AREAS DAMAGED
BY M7.5 CALIFORNIA EARTHQUAKES, 1860-1999
CALIFORNIA DEPARTMENT OF CONSERVATION,
MAP SHEET 49 DATED 2000.

Main Sources of Information:
- California Department of Conservation, Division of Mines and Geology.
- California Department of Water Resources, Division of Mines and Geology.
- California Geological Survey, Division of Mines and Geology.
- California Seismological Laboratory.

EPICENTERS MAP OF SOUTHERN CALIFORNIA EARTHQUAKES (1800-1999)

Converse Consultants
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No. Drawing No.
10-31-124-01 7
SEISMIC HAZARD ZONES MAP

PROJECT SITE

MAP EXPLANATION

Zones of Required Investigation:

Liquefaction
Areas where historic occurrence of liquefaction, or local geological, geometrical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 26936d would be required.

Earthquake-induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geometrical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 26936d would be required.

SCALE IN FEET
SCALE: 1"=2000'
REFERENCE: STATE OF CALIFORNIA
TORRANCE QUADRANGLE 1999
SEISMIC HAZARD ZONES

SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No.
10-31-124-01

Drawing No.
8

Converse Consultants
• There are no known active faults projecting toward or extending across the proposed site. The site is not situated within a currently designated Alquist-Priolo Earthquake Fault Zone (formerly Special Studies Zones).

• The site is not located within a mapped Seismic Hazard Zone for either liquefaction or earthquake induced slope instability.

• Although clear of geologic hazards associated with fault rupture, liquefaction and slope instability, the site is located within a seismically active area and will be subject to intense ground motion during a significant seismic event. Site-specific parameters for seismic design are provided in the report, formulated in general accordance with Chapter 16, Sections 1613 and 1614 of the 2007 California Building Code.

11.0 RECOMMENDATIONS - EARTHWORK AND SITE GRADING

11.1 General

Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial over-excavation grading is required to provide a relatively uniform soil condition across the site for support of the planned retail re-development project. To help reduce the potential for differential settlement, variations in the soil type, degree of compaction, and thickness of the compacted fill placed underneath the footings should be kept uniform. Site grading recommendations provided in this report are based on our experience with similar projects in the area and our site-specific geotechnical evaluation.

The existing undocumented fill soils and native soils removed during over-excavation may be placed as compacted fill in structural areas after proper processing (free of vegetation, shrubs, roots and debris). The site soil materials may contain scattered demolition debris. Earthwork should be performed with suitable equipment and techniques to selectively screen/remove debris from soils placed as engineered fill.

Soils containing organic materials should not be used as structural fill. The extent of over-excavation removal should be further evaluated by the geotechnical representative based on observations during grading.

11.2 Over-Excavation/Removal

Remedial over-excavation is recommended for the support of the proposed building structures and new parking pavement. The footprint of the new building structures should be over-excavated to depth of at least 4 feet as measured from existing grades, or to the depths of undocumented fill, whichever is deeper. Localized deeper removal will be needed where firm native soils are not exposed on the excavation bottom. For the proposed structure located at the northeast portion of the site, over-excavation
should be at least 6 feet bgs. The exposed bottom of the over-excavation area should be scarified at least 6 inches, moisture conditioned as needed to near-optimum moisture content, and compacted to 90 percent relative compaction (laboratory maximum density evaluated per ASTM D1577).

The lateral limits of the over-excavation should extend at least 5 feet beyond the building footprint, where feasible. However, over-excavation should not undermine adjacent off-site structures. Remedial grading should not extend within a projected 1:1 (horizontal to vertical) plane projected down from the outer edge of adjacent off-site structures. Shoring, structural underpinning, and/or slot cutting may be considered for remedial grading along the perimeter of the site.

Parking pavement and hardscape areas beyond the footprint of new building structures should be over-excavated to a depth of at least 2 feet, as measured from existing grades. Deeper removal will be needed if firm soil conditions are not exposed on the excavation bottom. The exposed bottom of the over-excavation area should be scarified at least 6 inches, moisture conditioned as needed to near-optimum moisture content, and compacted to 90 percent relative compaction. The lateral limits of the over-excavation should extend at least 2 feet beyond the pavement/hardscape areas, where feasible.

11.3 Engineered Fill

The approved bottom of the excavations should be scarified to a depth of at least six (6) inches. The scarified soils should be moisture conditioned to near-optimum moisture content and compacted to at least 90 percent of the laboratory maximum dry density to produce a firm and unyielding surface.

All engineered fill should be placed on competent, scarified and compacted native materials as evaluated by the geotechnical engineer and in accordance with the specifications presented in this section.

Excavated site soils, free of deleterious materials and rock particles larger than three (3) inches in the largest dimension, should be suitable for placement as compacted fill. Any proposed import fill should be evaluated and approved by Converse prior to import to the site. Import fill material should have an expansion index less than 20.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned to within three (3) percent of the optimum moisture content. All fill, if not specified otherwise elsewhere in this report, should be compacted to at least 90 percent of the laboratory dry density in accordance with the ASTM Standard D1557 test method.

The upper 12 inches of subgrade below new parking pavement areas should be compacted to 95 percent relative compaction.
At the time of our recent field exploration, *in-situ* moisture content of the upper five (5) feet of existing soils ranged from 4 to 9 percent. The optimum moisture content is about 8.5 to 10.5 percent. Therefore, some moisture conditioning may be necessary prior to the material being placed as compacted fill. The amount of processing required for proper moisture conditioning at the site will depend on the seasonal variations in the *in-situ* moisture conditions, the depth of cut, the equipment, and the processing method.

### 11.4 Excavatability

Based on our field exploration, the earth materials at the site may be excavated with conventional heavy-duty earth moving and trenching equipment. The onsite materials may contain occasional demolition debris. Earthwork should be performed with suitable equipment and methods for removal of debris from the engineered fill.

### 11.5 Expansive Soil

The result of expansion index testing indicated very low expansion potential (EI less than 20). The recommendations contained in this report are based upon the anticipated non-expansion soil conditions. Any proposed import fill should have an expansion index less than 20, and should be evaluated and approved by Converse prior to import to the site.

### 11.6 Shrinkage and Subsidence

Soil shrinkage and/or bulking as a result of remedial grading depends on several factors including the depth of over-excavation, and the grading method and equipment utilized, and average relative compaction. For preliminary estimation, bulking and shrinkage factors for various units of earth material at the site may be taken as presented below:

- The approximate shrinkage factor for the undocumented fill soils is estimated to range from five (5) to fifteen (15) percent.
- The approximate shrinkage factor for the native alluvial soils is estimated to range from five (5) to ten (10) percent.
- For estimation purposes, ground subsidence may be taken as 0.10 feet as a result of remedial grading.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.
11.7 **Slab Subgrade Preparation**

Final subgrade soils for structures and pavement/hardscape should be uniform and non-yielding. To obtain a uniform subgrade, soils should be well mixed and uniformly compacted. The subgrade soils should be non-expansive and well-drained. The near-surface site soils should be free draining. We recommend that at least the upper two (2) inches of subgrade soils underneath the slab-on-grade should be comprised of well-drained granular soils such as sands, gravel or crushed aggregate satisfying the following criteria:

- Maximum size ≤ 1.5 inches
- Percent passing U.S. #200 sieve ≤ 12 percent
- Sand equivalent ≥ 30

The subgrade soils should be moisture conditioned before placing concrete. The upper 12 inches of subgrade below planned parking pavement areas should be compacted to 95 percent relative compaction.

12.0 **DESIGN RECOMMENDATIONS**

The proposed building structures may be supported on spread footings extending into properly compacted fill.

12.1 **Shallow Foundations**

The design recommendations provided in this section are based on the assumption that in preparing the site, earthwork and grading recommendations presented in Section 11.2 and 11.3 and Appendix C will be implemented. The proposed building structures may be supported on shallow continuous and isolated spread foundations provided our recommendations are incorporated in the design and construction plans.

12.1.1 **Vertical Capacity**

Shallow continuous footing should be at least 24 inches wide and embedded at least 24 inches below lowest adjacent grade into compacted fill or firm native soils. The footing reinforcement should be based on the structural design. Conventional spread footings founded on compacted fill and/or dense alluvial soils may be designed for a net bearing pressure of 2,500 pounds per square foot (psf) for dead-plus-live-loads.

The net allowable bearing pressure can be increased by 400 psf for each additional foot of excavation depth and width up to a maximum value of 4,500 psf.
The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity.

12.1.2 Lateral Capacity

Resistance to lateral loads can be assumed to be provided by friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 between concrete and soil may be used with the dead load forces. An allowable passive earth pressure may be designed using an equivalent fluid pressure of 300 pcf for compacted fill or native soils. A factor of safety of 1.5 was applied in calculating passive earth pressure. The maximum value of the passive earth pressure should be limited to 3,000 psf for compacted fill or native soils. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third.

12.1.3 Dynamic Increases

Vertical and lateral bearing values indicated above are for the total dead loads and frequently applied live loads. If normal code requirements are applied for design, the above vertical bearing and lateral resistance values may be increased by 33 percent for short duration loading, which will include the effect of wind or seismic forces.

12.1.4 Settlement

The static settlement of structures supported on continuous and/or spread footings founded on compacted fill and/or dense native soils will depend on the actual footing dimensions and the imposed vertical loads. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than 0.5 inch. In order to evaluate differential settlement, data on the relative dimension of adjacent footings, magnitude of imposed loads and distance between footings is needed. In the absence of such data, and based on our experience on similar projects for similarly loaded footings, the differential settlement may be taken as equal to about one half of the total settlement over a horizontal distance of 30 feet.

12.2 Provisional Active Earth Pressure

The following provisional design values may be used for any utility vaults and/or walls below grade that are less than 6 feet high. As we understand, basement walls are not currently planned, but there may be some subsurface utility vaults.

The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any
hydrostatic pressure. The following fluid pressures are recommended for vertical walls with no hydrostatic pressure, no surcharge, and level backfill.

<table>
<thead>
<tr>
<th>Equivalent Fluid Pressure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Free to deflect (Cantilever)</td>
<td>30 (Triangular Distribution)</td>
</tr>
<tr>
<td>Restrained (At-rest)</td>
<td>45 (Triangular Distribution)</td>
</tr>
</tbody>
</table>

The recommended lateral pressures assume that the walls are fully back-drained to prevent build-up of hydrostatic pressure. Adequate drainage could be provided by means of permeable drainage materials wrapped in filter fabric installed behind the walls. The drainage system should consist of perforated pipe surrounded by free draining, uniformly graded, ¾ -inch washed, crushed aggregate, and wrapped in filter fabric such as Mirafi 140N or equivalent, and should extend to about 2 feet below the finished grade. The filter fabric should overlap approximately 12 inches or more at the joints. The subdrain pipe should consist of perforated, four-inch diameter, rigid ABS (SDR-35) or PVC A-2000, or equivalent, with perforations placed down. Alternatively, a prefabricated drainage composite system such as the Miradrain G100N or equivalent can be used. The subdrain should be connected to a sump pump.

12.3 Modulus of Subgrade Reaction

For the subject project, design of the structures supported on compacted fill subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction (k_s) of 180 pounds per square inch per inch.

12.4 Slabs-on-grade

The design of the slab-on-grade will depend on, among other factors, the expansion potential of the pad soils. Based on the expansion index test performed during this evaluation, the expansion potential of the site soils at a shallow depth is very low (EI less than 20). Accordingly, slabs-on-grade for building pads may be of the conventional type as opposed to post-tensioned.

Slabs-on-grade should be supported on properly compacted fill or deeper undisturbed native soils. Compacted fill used to support slabs-on-grade should be placed and compacted in accordance with report section 11.0 Recommendations – Earthwork and Site Grading, and the general recommendations given in Appendix C, Recommended Earthwork Specifications.

Slabs-on-grade should have a minimum thickness of four inches nominal for support of normal ground-floor live loads. Minimum reinforcement for slabs-on-grade should be No. 3 reinforcing bars, spaced at 18 inches on-center each way. The thickness and reinforcement of more heavily-loaded slabs will be dependent upon the anticipated
loads and should be designed by a structural engineer. A static modulus of subgrade reaction equal to 180 pounds per square inch per inch may be used in structural design of concrete slabs-on-grade.

If approved by the owner, equivalent welded wire mesh may be used for reinforcement of concrete slabs-on-grade. However, to be effective, it is imperative that the reinforcement be located within the center third of the slab thickness. The commonly used procedure of “hooking” the reinforcement during concrete placement seldom, if ever, results in proper location of the slab reinforcing.

It is critical that the exposed subgrade soils should not be allowed to desiccate prior to the slab pour. Care should be taken during concrete placement to avoid slab curling. Slabs should be designed and constructed as promulgated by the ACI and Portland Cement Association (PCA). Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

If moisture-sensitive floor coverings, such as vinyl tile, carpet, or wood floors, are used, slabs should be protected by a minimum 10-mil thick moisture retarder/barrier in conformance with ASTM E 1745 Class A requirements. If the retarder/barrier is used, it should be protected with 2 inches of sand placed above to prevent punctures and to aid in the concrete cure.

12.5 Flexible Pavement Recommendations

We have performed flexible pavement design analyses to provide pavement structural sections for new driveway and/or parking areas. Existing distressed pavement areas may be repaired/replaced with the following sections.

An R-value of 47 was used for pavement design based on our review of on-site sandy earth materials and our experiences with similar projects. Our recommendations are presented as the following:

The flexible pavement structural section design recommendations were performed in accordance with the method contained in the CALTRANS Highway Design Manual, Chapter 630 without the factor of safety. No specific traffic study was performed to determine the Traffic Index (TI) for the proposed project, therefore a wide range of TI values were evaluated. The recommended flexible pavement structural sections for various TI conditions are presented in the following table:
Table No. 3, Flexible Pavement Structural Sections

<table>
<thead>
<tr>
<th>Design R-value</th>
<th>Design TI</th>
<th>Asphalt Concrete (AC) Over Aggregate Base (AB) Structural Sections</th>
<th>Full AC Structural Section</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AC (inches)</td>
<td>AB (inches)</td>
</tr>
<tr>
<td>47</td>
<td>4</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>4.0</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>5.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Actual traffic index and traffic load should be determined by either Civil Engineer or Traffic Engineer. The above pavement sections are recommended as a guideline for basic usage of the indicated TI values, and may not be sufficient for actual traffic loading.

Base material shall conform to requirements for a Class 2 Aggregate Base (AB) or equivalent (such as crushed miscellaneous base - CMB) and should be placed in accordance with the requirements of the Standard Specifications for Public Works Construction (SSPWC, 2009 Edition).


12.6 Rigid Pavement Design

The Portland Cement Association's (PCA’s) Southwest Region Publication P-14, Portland Cement Concrete Pavement (PCCP) for Light, Medium, and Heavy Traffic, presents a "Portland Cement Concrete Pavement (PCCP) Design Nomograph for Cities and Counties Roads.” The pavement section presented in Table No. 7, Rigid Pavement Structural Sections, is based on this nomograph. Pavement sections are provided for the Traffic Indices (TIs) ranging from 4 to 9. An R-value of 47 was used for pavement design based on our review of on-site sandy earth materials and our experiences with the nearby projects on the campus.
Table No. 4, Rigid Pavement Structural Sections

<table>
<thead>
<tr>
<th>Design R-Value</th>
<th>Design Traffic Index (TI)</th>
<th>PCCP Pavement Section (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>6.0</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>7.0</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>9.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Actual traffic index and traffic load should be determined by either Civil Engineer or Traffic Engineer. The above pavement section is recommended for basic usage as indicated in the table and may not be sufficient for actual traffic loading.

Prior to placement of base aggregate, at least the upper 12 inches of subgrade soils below rigid pavement sections should be scarified, moisture-conditioned, if necessary, and recompacted to at least 95 percent relative compaction as defined by the ASTM D 1557 standard (current edition) test method.

The pavement section presented in Table No. 4 is based on a minimum 28-day Modulus of Rupture (M-R) of 500 psi and a compressive strength of 3,000 psi. The third point method of testing beams should be used to evaluate modulus of rupture. The concrete mix design should contain a minimum cement content of 5.5 sacks per cubic yard. Recommended maximum and minimum values of slump for pavement concrete are three inches to one inch, respectively.

Transverse contraction joints should not be spaced more than 15 feet and should be cut to a depth of ¼ the thickness of the slab. Longitudinal joints should not be spaced more than 12 feet apart. A longitudinal joint is not necessary in the pavement adjacent to the curb and gutter section.

All outside edges should conform to Section 201 of the 2009 Standard Specifications for Public Works Construction (SSPWC), and should be constructed in accordance with Section 302-6 of the SSPWC. Pavement subgrade should be prepared in accordance with Section 301 of the SSPWC. The upper 12 inches of subgrade should be compacted to a relative compaction of at least 95 percent as per the current ASTM D 1557 standard.

Positive drainage should be provided away from all pavement areas to prevent seepage of surface and/or subsurface water into the pavement base and/or subgrade.

12.7 Soil Corrosivity Evaluation
Converse retained The Environmental Geotechnical Laboratory, Inc., located in Arcadia, California, to test bulk soil samples from boring locations BH-3 (2 to 6 feet bgs) and BH-5 (2 to 6 feet bgs). The tests included minimum resistivity, pH, soluble sulfates, and chloride content, with the results summarized on the following table:

**Table No.5, Soil Corrosivity Test Results**

<table>
<thead>
<tr>
<th>Sample Location (Boring/Depth)</th>
<th>pH (CALTRANS 643)</th>
<th>Soluble Chlorides (CALTRANS 422) (ppm)</th>
<th>Soluble Sulfate (CALTRANS 417) (ppm)</th>
<th>Saturated Resistivity (CALTRANS 532) Ohm-cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3 (2-6)</td>
<td>8.48</td>
<td>85</td>
<td>90</td>
<td>2,700</td>
</tr>
<tr>
<td>BH-5 (2-6)</td>
<td>8.36</td>
<td>75</td>
<td>60</td>
<td>4,700</td>
</tr>
</tbody>
</table>

According to the Caltrans Corrosive Guidelines (2003), a corrosive area is one where any of the following conditions exist: the soil contains more than 500 ppm of chlorides, more than 2,000 ppm (0.2 percent) of sulfates, a pH of 5.5 or less, and a resistivity of 1,500 ohm-centimeters or less.

Since the soluble sulfate concentrations tested for this project are less than 2,000 ppm in the soil, mitigation measures to protect concrete in contact with the soils are not anticipated.

The pH, chloride content and resistivity values of the samples tested are in the non-corrosive range.

The test results presented herein are considered preliminary. Additional testing and evaluation of the as-graded soils is recommended. A corrosion engineer may be consulted for appropriate mitigation procedures and construction design, if needed. Conventional corrosion mitigation measures may include the following:

♦ Steel and wire concrete reinforcement should have at least three inches of concrete cover where cast against soil, unformed.

♦ Below-grade ferrous metals should be given a high-quality protective coating, such as 18-mil plastic tape, extruded polyethylene, coal-tar enamel, or Portland cement mortar.

♦ Below-grade metals should be electrically insulated (isolated) from above-grade metals by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade.
12.8 Site Drainage

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. We recommend that the landscape area immediately adjacent to the foundation shall be designed sloped away from the building with a minimum 5% slope gradient for at least 10 feet measured perpendicular to the face of the wall. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building per 2007 California Building Code.

Planters and landscaped areas adjacent to the building perimeter should be designed to minimize water infiltration into the subgrade soils. Gutters and downspouts should be installed on the roof, and runoff should be directed to the storm drain through non-erosive devices. Lower level walkways and open patio areas may require special drainage provisions and sump pumps to provide suitable drainage.

13.0 CONSTRUCTION RECOMMENDATIONS

13.1 General

Site soils should be excavatable using conventional heavy-duty excavating equipment. Temporary sloped excavation is feasible if performed in accordance with the slope ratios provided in Section 13.2, Temporary Excavations. Existing utilities should be accurately located and either protected or removed as required.

13.2 Temporary Excavations

Based on the materials encountered in the exploratory borings, sloped temporary excavations may be constructed according to the slope ratios presented in Table No. 6, Slope Ratios for Temporary Excavation. Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose dry sand should be constructed at a flatter gradient than presented in the following table.

Table No. 6, Slope Ratios for Temporary Excavation

<table>
<thead>
<tr>
<th>Maximum Depth of Cut (feet)</th>
<th>Maximum Slope Ratio* (horizontal: vertical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>vertical</td>
</tr>
<tr>
<td>4 - 8</td>
<td>1:1</td>
</tr>
<tr>
<td>8 +</td>
<td>1.5:1</td>
</tr>
</tbody>
</table>

*Slope ratio assumed to be uniform from top to toe of slope.

Surfaces exposed in slope excavations should be kept moist but not saturated to minimize raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including
construction, should not be placed within five (5) feet of the unsupported trench edge. The above maximum slopes are based on a maximum height of six (6) feet of stockpiled soils placed at least five (5) feet from the trench edge.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

13.3 Special Consideration for Excavation Adjacent to Existing Structures

Various utility lines and existing structure foundations may be within the excavation limits for the proposed project. The depths and locations of the existing facilities may require special construction considerations during excavation to protect these facilities (if necessary) during excavation.

Temporary excavations for the proposed improvements should not extend below a 1:1 (horizontal: vertical) plane extending beyond and down from the bottom of the existing utility lines or foundations. The remedial grading excavations should not cause loss of bearing and/or lateral support for adjacent off-site utilities or structures.

If remedial grading excavations extend below a 1:1 horizontal:vertical (H:V) plane extending beyond and down from the bottom of adjacent off-site utility lines or structure foundations, shoring or slot cutting shall be employed. “A-B-C” lot cuts exposing native sandy soils may be excavated with maximum 8 foot long sections to prevent the existing utility lines or off-site structures from becoming unstable. Backfill should be accomplished in the shortest period of time possible and in alternating sections.

Based on the proposed development, shoring is not anticipated. Tentative cantilevered shoring systems may include soldier piles with lagging to maintain temporary support of vertical wall excavations. Shoring design must consider the support of adjacent underground utilities and/or structures, and should consider the effects of shoring deflection on supported improvements. Due to sandy nature of on site soils, caving during the drilling of soldier-pile borings should be anticipated. A soldier pile system will require continuous lagging to control caving and sloughing in the excavation between soldier piles. Temporary cantilevered shoring should be designed to resist a lateral earth pressure equivalent to a fluid density of 25 pounds per cubic foot (pcf) for non-surcharged condition. This pressure is valid only for shoring retaining level ground. This equivalent fluid pressure is valid only for shoring supporting level ground. The value of earth pressure includes a factor of safety of 1.25. The shoring design engineer may add an appropriate factor of safety in designing the shoring system, if necessary.
Surcharge pressures from the existing structures should be added to the above earth pressures for surcharges within a horizontal distance less than or equal to the wall height. Surcharge coefficients of 40% of any uniform vertical surcharge should be added as a horizontal earth pressure for shoring design.

13.4 Geotechnical Services During Construction

This report has been prepared to aid in the site preparation and site grading plans and specifications, and to assist the architect, civil and structural engineers in the design of the proposed structure. It is recommended that this office be provided an opportunity to review final design drawings and specifications to verify that the recommendations of this report have been properly implemented.

Recommendations presented herein are based upon the assumption that adequate earthwork monitoring will be provided by Converse. Excavation bottoms should be observed by a Converse representative prior to the placement of compacted fill. Structural fill and backfill should be placed and compacted during continuous observation and testing by this office. Footing excavations should be observed by Converse prior to placement of steel and concrete for verification that footings are founded on satisfactory materials and excavations are free of loose and disturbed materials.

During construction, the geotechnical engineer and/or their authorized representatives should be present at the site to provide a source of advice to the client regarding the geotechnical aspects of the project and to observe and test the earthwork performed. Their presence should not be construed as an acceptance of responsibility for the performance of the completed work, since it is the sole responsibility of the contractor performing the work to ensure that it complies with all applicable plans, specifications, ordinances, etc.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor’s operations, and cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any recommended actions presented herein to be unsafe.

14.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the background review, field and laboratory studies, combined with an interpolation and extrapolation of soil conditions.
between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

Design recommendations given in this report are based on the assumption that the earthwork and site grading recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the final site grading and actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

This report was prepared for Brewer Development for the subject project described herein. Converse is not responsible for technical interpretations made by others of our exploratory information. Specific questions or interpretations concerning the findings and conclusions presented herein may require a written clarification to avoid any misunderstandings.
15.0 REFERENCES


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STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 2009, Public Works Standards, Inc.

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION, California Tests 643, 422, 417 and 532.


UNITED STATES GEOLOGICAL SURVEY (USGS), Torrance Quadrangle, California-Los Angeles Co., 7.5 Minute Series (Topographic) map, dated 1981.


APPENDIX A

FIELD EXPLORATION

Field exploration included a site reconnaissance and subsurface exploration program. During the site reconnaissance, the surface conditions were noted, and the approximate locations of the borings were marked for utility clearance. The exploratory borings were approximately located using existing boundary and other features as a guide and should be considered accurate only to the degree implied by the method used. The various field study methods performed are discussed below.

Sixteen (16) borings (BH-1 through BH-16) were drilled within the project site on February 25 and 26, 2010. The borings were advanced using both truck mounted drill rigs with eight inch diameter hollow-stem augers. The depths drilled were approximately 10.5 feet to 51.5 feet below ground surface (bgs). Encountered earth materials were continuously logged by a Converse geologist and classified in the field by visual examination in accordance with the Unified Soil Classification System (USCS). Where appropriate, field descriptions and classifications have been modified to reflect laboratory test results.

Ring samples of the subsurface materials were obtained at frequent intervals in the exploratory borings using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples are retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained.

Standard Penetration Test (SPT) was also performed using a standard (1.4-inches inside diameter and 2.0-inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, falling 30 inches for each blow. The recorded blow counts for every six inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings in the “BLOWS” column. The standard penetration test was performed in accordance with the ASTM Standard D1586 test method.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Unless a more precise depth can be established by other means, changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil symbols and terms is presented as Drawing No. A-1. The log of the exploratory boring is presented in Drawing Nos. A-2a through A-17, Log of Borings.
Borings BH-2 and BH-4, located within the northeastern portion of the site, were utilized for an in-situ falling-head test procedure for percolation testing. After drilling and sampling, a 2-inch diameter pipe surrounded by fine gravel was placed in each borehole. The lower 5 feet of the pipe was slotted to allow water percolation into the surrounding soils. Both holes were pre-soaked to depths of 10 feet below the ground surface prior to testing. After testing, the pipe was removed and the boreholes were backfilled with soils excavated the previous day. The percolation procedures and test results are presented in Appendix D, *Percolation Testing Procedure*. 
### Soil Classification Chart

#### Major Divisions

**Coarse Grained Soils**
- Gravel and Gravelly Soils
  - More than 50% of coarse fraction retained on No. 4 sieve
  - Symbols: GW, GP, GM, GC
  - Typical Descriptions: Well-Graded Gravels, Poorly Graded Gravels, Silt Gravels, Clayey Gravels

**Fine Grained Soils**
- Sands and Sandy Soils
  - More than 50% of coarse fraction passing on No. 4 sieve
  - Symbols: SW, SP, SM, SC
  - Typical Descriptions: Well-Graded Sands, Poorly Graded Sands, Silt Sands, Clayey Sands

- Silts and Clays
  - Liquid limit less than 50
  - Symbols: ML, CL, OL, MH, CH, OH
  - Typical Descriptions: Mereils, Gravels, Organic Silts, Organic Silty Clays, Organic Silt, Organic Clays

**Highly Organic Soils**
- Symbols: PT
- Typical Descriptions: Peat, Humus, Swamp Soils with High Organic Contents

#### Symbols

- **Graph**: Represents the soil type visually.
- **Letter**: Used to indicate the soil type.
- **Typical Descriptions**: Explains the characteristics of the soil type.

#### Sample Type

- **Standard Penetration Test**: Split barrel sampler in accordance with ASTM D-1586-94 Standard Test Method.
- **Drive Sample**: 2.4" I.D. sampler.
- **Drive Sample**: No recovery.
- **Bulk Sample**: Groundwater while drilling.
- **Bulk Sample**: Groundwater after drilling.

#### Boring Log Symbols

#### Laboratory Testing Abbreviations

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic Penetrometer</td>
<td>p</td>
</tr>
<tr>
<td>Direct Shear</td>
<td>ds</td>
</tr>
<tr>
<td>Direct Shear (single point)</td>
<td>ds*</td>
</tr>
<tr>
<td>Unconfined Compressive</td>
<td>uc</td>
</tr>
<tr>
<td>Triaxial Compression</td>
<td>c</td>
</tr>
<tr>
<td>Vane Shear</td>
<td>vs</td>
</tr>
<tr>
<td>Consistency</td>
<td>c</td>
</tr>
<tr>
<td>California Test</td>
<td>cal</td>
</tr>
<tr>
<td>Resistivity (R) Value</td>
<td>r</td>
</tr>
<tr>
<td>Chemical Analysis</td>
<td>ca</td>
</tr>
<tr>
<td>Electrical Resistivity</td>
<td>er</td>
</tr>
</tbody>
</table>

### Unified Soil Classification and Key to Boring Log Symbols

**Converse Consultants**

**Project Name**: SOUTH BAY SOUTHERN PROJECT

**Project No.**: 10-31-124-01

**Drawing No.**: A-1

**Redondo Beach, California**
**Log of Boring No. BH-1**

Dates Drilled: 2/25/2010  
Logged by: GDS  
Checked By: WHC  
Driving Weight and Drop: 140 lbs / 30 in  
Depth to Water (ft): NOT ENCOUNTERED

---

### SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>Drive</th>
<th>BULK</th>
<th>Moisture (%)</th>
<th>Dry Unit Wt. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5&quot; ASPHALT CONCRETE OVER 4&quot; BASE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FILL (Af):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLDER DUNE DEPOSITS (Qoe):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM): fine-grained, brown and light brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAND WITH SILT (SP-SM): fine-grained, light brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>4/5/9</td>
<td>4</td>
<td>102</td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>11/19/33</td>
<td>4</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 11.5 feet.  
No groundwater encountered during drilling.  
Borehole backfilled with soil cuttings and patched with asphalt concrete on 2-25-2010.

---

Converse Consultants  
Project Name  
SOUTHBAY SOUTHERN PROJECT  
REDONDO BEACH, CALIFORNIA  
Project No. 10-31-124-01  
Drawing No. A-2
Log of Boring No. BH-2

Dates Drilled: 2/25/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A  Depth to Water (ft): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS
This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; ASPHALT CONCRETE OVER 3&quot; BASE</td>
<td></td>
</tr>
<tr>
<td>FILL (AF): SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
</tr>
<tr>
<td>OLDER DUNE DEPOSITS (Qoe): SILTY SAND (SM): fine-grained, slightly cemented, brown.</td>
<td></td>
</tr>
<tr>
<td>SAND WITH SILT (SP-SM): fine-grained, light brown.</td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 10.5 feet.
Borehole used for percolation testing.
No groundwater encountered during drilling.
Pipe removed and borehole backfilled with soil cuttings and patched with asphalt concrete on 2-25-2010.

Converse Consultants
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project Name  Project No.  Drawing No.
SOUTHBAY SOUTHERN PROJECT  10-31-124-01  A-3

Log ID: 10-31-124-01 GPJ Template: LOG
# Log of Boring No. BH-3

**Dates Drilled:** 2/26/2010  
**Logged by:** GDS  
**Checked By:** WHC  
**Equipment:** 8" HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in  
**Ground Surface Elevation (ft):** N/A  
**Depth to Water (ft):** NOT ENCOUNTERED

## SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT Wt. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3&quot; ASPHALT CONCRETE OVER 3&quot; BASE</td>
<td>FILL (A0): SILTY SAND (SM): fine-grained, mottled brown and dark brown.</td>
<td>11/15/12</td>
<td>5</td>
<td>105</td>
<td>max, ca, er, al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OLDER DUNE DEPOSITS (Qoe): SILTY SAND (SM): fine-grained, brown.</td>
<td>11/15/19</td>
<td>6</td>
<td>108</td>
<td></td>
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<tr>
<td>15</td>
<td></td>
<td>-orange brown, slightly cemented</td>
<td>2/3/6</td>
<td>5</td>
<td>101</td>
<td>c</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, slightly cemented, orange brown.</td>
<td>12/24/50(5')</td>
<td>10</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>SAND (SP): fine-grained, light brown.</td>
<td>11/16/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAND TO SAND WITH SILT (SP/SP-SM): fine-grained, layered, light brown to yellow brown.</td>
<td>5/10/17</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>30</td>
<td></td>
<td>SAND (SP): fine-grained, light brown.</td>
<td>7/12/13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Project Name:** SOUTHBAY SOUTHERN PROJECT  
**Project No.:** 10-31-124-01  
**Drawing No.:** A-4a

---

**Project ID:** 10-31-124-01.GPJ  
**Template:** LOG
Log of Boring No. BH-3

Dates Drilled: 2/26/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A  Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
<th>SAMPLES</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>SILTY SAND (SM): fine-grained, yellow brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ma f(=18%)</td>
</tr>
<tr>
<td>45</td>
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<td>SAND (SP): fine-grained, yellow brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, light brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAND (SP): fine-grained, light brown to yellow brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 51.5 feet. No groundwater encountered during drilling. Borehole backfilled with soil cuttings and patched with asphalt concrete on 2-26-2010.
Log of Boring No. BH-4

Dates Drilled: 2/25/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A  Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
<th>SAMPLES</th>
<th>BULBS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>3&quot; ASPHALT CONCRETE OVER 3&quot; BASE</td>
<td>FILL (Af): SILTY SAND (SM): fine-grained, brown. OLDER DUNE DEPOSITS (Qoe): SILTY SAND (SM): fine-grained, slightly cemented, brown.</td>
<td>29/38/50(2&quot;)</td>
<td>4</td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10&quot;</td>
<td>-light brown to brown</td>
<td></td>
<td>5/10/20</td>
<td>4</td>
<td>105</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 10.5 feet.
Borehole used for percolation testing.
No groundwater encountered during drilling.
Pipe removed and borehole backfilled with soil cuttings and patched with asphalt concrete on 2-26-2010.
Log of Boring No. BH-5

Dates Drilled: 2/25/2010
Logged by: GDS
Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER
Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A
Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; ASPHALT CONCRETE OVER 6&quot; BASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>FILL (Af): SILTY SAND (SM): fine-grained, light brown.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>OLDER DUNE DEPOSITS (Qoe): SILTY SAND (SM): fine-grained, slightly cemented, brown.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>- orange brown with black specks</td>
</tr>
<tr>
<td>17/46/50(4°)</td>
<td></td>
<td>- trace clay</td>
</tr>
<tr>
<td>15/26/40</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, light brown to brown.</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SAND (SP): fine-grained, light brown.</td>
</tr>
<tr>
<td>12/30/50(5°)</td>
<td></td>
<td>- light brown and orange</td>
</tr>
<tr>
<td>11/26/50(5°)</td>
<td></td>
<td>- yellow brown and light brown</td>
</tr>
</tbody>
</table>

End of boring at 31.5 feet.
No groundwater encountered during drilling.
Borehole backfilled with soil cuttings and patched with asphalt concrete on 2-25-2010.

Converse Consultants

PROJECT NAME
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No. 10-31-124-01
Drawing No. A-6
### SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td><strong>FILL (AF):</strong>&lt;br&gt;SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td><strong>OLDER DUNE DEPOSITS (Qoe):</strong>&lt;br&gt;SILTY SAND (SM): fine-grained, brown to light brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>coe</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>-fine-grained, slightly cemented, orange brown with black specks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td><strong>SAND WITH SILT (SP):</strong> fine-grained, slightly cemented, orange brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>-fine-grained, light brown</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
# Log of Boring No. BH-7

## Dates Drilled: 2/26/2010

## Equipment: 8" HOLLOW STEM AUGER

## Driving Weight and Drop: 140 lbs / 30 in

## Ground Surface Elevation (ft): N/A

## Depth to Water (ft): NOT ENCOUNTERED

## SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>FILL (Af):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY SAND (SM): fine-grained, trace gravel and brick, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>OLDER DUNE DEPOSITS (Qoe):</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-trace clay, reddish brown and brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-slightly cemented, orange brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SAND WITH SILT (SP-SM): fine-grained, slightly cemented, orange brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SAND (SP): fine-grained, light brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-light brown with some orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>SAND WITH SILT (SP-SM): fine-grained, light brown with orange.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 31.5 feet.
No groundwater encountered during drilling.
Borehole backfilled with soil cuttings on 2-26-2010.
### SUMMARY OF SUBSURFACE CONDITIONS

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#### FILL (AF):
- **Silty Sand (SM):** fine-grained, brown.

#### Older Dune Deposits (Qoe):
- **Silty Sand (SM):** fine-grained, light brown and brown.
  - **Data:**
    - **5/6/10:** 11, 105

#### Silty Sand to Sand with Silt (SM/SP-SM):
- Fine-grained, trace of clay, light brown to orange brown.
  - **Data:**
    - **8/14/22:** 9, 100

#### Sand (SP):
- Fine-grained, light brown.
  - **Data:**
    - **10/18/28:** 6, 95

#### Data:
- **8/20/28:** 4, 95

### Log of Boring No. BH-9

**Dates Drilled:** 2/25/2010

**Logged by:** GDS

**Checked By:** WHC

**Equipment:** 8” HOLLOW STEM AUGER

**Driving Weight and Drop:** 140 lbs / 30 in

**Ground Surface Elevation (ft):** N/A

**Depth to Water (ft):** NOT ENCOUNTERED

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8/11/17 6</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>10</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>10/20/34 9</td>
<td>104</td>
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</tr>
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<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10/20/27 6</td>
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<td></td>
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<td>8/19/38 5</td>
<td>98</td>
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</tr>
<tr>
<td>25</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>15/28/50(4) 12</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>8/16/34 5</td>
<td>95</td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 31.5 feet. No groundwater encountered during drilling. Borehole backfilled with soil cuttings on 2-25-2010.

---

Converse Consultants

Project Name
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No. 10-31-124-01
Drawing No. A-10
# Log of Boring No. BH-10

**Dates Drilled:** 2/25/2010  
**Logged by:** GDS  
**Checked By:** WHC  
**Equipment:** 8" HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in  
**Ground Surface Elevation (ft):** N/A  
**Depth to Water (ft):** NOT ENCOUNTERED

## SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

### FILL (AF):
**SILTY SAND (SM):** fine-grained, trace gravel, brown.

### OLDER DUNE DEPOSITS (Qde):
**SILTY SAND (SM):** fine-grained, dark brown.

- **brown**  
  - **Date:** 7/8/18  
  - **Blows:** 10  
  - **Moisture (%):** 103  
  - **Unit Weight (pcf):** ds

- **fine-grained, trace clay, orange brown**  
  - **Date:** 9/17/27  
  - **Blows:** 12  
  - **Moisture (%):** 114

### SAND (SP):
**fine-grained, light brown.**

- **Date:** 11/19/33  
  - **Blows:** 5  
  - **Unit Weight (pcf):** 98

Log of Boring No. BH-11

Dates Drilled: 2/26/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A  Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>FILL (AF): SILTY SAND (SM): fine-grained, mottled orange brown and brown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-trace gravel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-fine-grained, orange brown and dark orange brown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-trace gravel, brick debris</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>OLDER DUNE DEPOSITS (Qce): SAND WITH SILT (SP-SM): fine-grained, orange brown.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SILTY SAND (SM): fine-grained, light brown.</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>SAND (SP): fine-grained, light brown.</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, yellow brown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAND (SP): fine-grained, yellow brown.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULBS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5/6/6</td>
<td>9</td>
<td>109</td>
<td></td>
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<tr>
<td>8/20/25</td>
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<td>6</td>
<td>108</td>
<td></td>
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<td>4/6/7</td>
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<td>7</td>
<td>104</td>
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<tr>
<td>8/16/20</td>
<td></td>
<td>12</td>
<td>112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/17/27</td>
<td></td>
<td>7</td>
<td>101</td>
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</tr>
<tr>
<td>8/20/34</td>
<td></td>
<td>3</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/14/19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/16/19</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/15/17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/9/16</td>
<td></td>
<td></td>
<td>wa (fc=33.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>wa (fc=3.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>wa (fc=14.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Project Name: SOUTHBAY SOUTHERN PROJECT  Project No.: 10-31-124-01
Drawing No.: A-12a  REDONDO BEACH, CALIFORNIA

Project ID: 10-31-124-01.GPJ; Template: LOG
Log of Boring No. BH-11

Dates Drilled: 2/26/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER
Ground Surface Elevation (ft): N/A
Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
<th>SAMPLES</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT Wt. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, thinly layered, yellow brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fine-grained, yellow brown and orange brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- light brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
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<td>50</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>End of boring at 51.5 feet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No groundwater encountered during drilling.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Borehole backfilled with soil cuttings on 2-26-2010.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Converse Consultants

Project Name
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No. 10-31-124-01  Drawing No. A-12b
### Log of Boring No. BH-12

**Dates Drilled:** 2/26/2010  
**Logged by:** GDS  
**Checked By:** WHC  
**Equipment:** 8" HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in  
**Ground Surface Elevation (ft):** N/A  
**Depth to Water (ft):** NOT ENCOUNTERED

#### SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY</th>
<th>SAMPLES</th>
<th>DRAYE</th>
<th>BULK</th>
<th>BLOWS</th>
<th>DRY UNIT WIT. (pct)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>FILL (Af): SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>OLDER DUNE DEPOSITS (Qoe): SILTY SAND (SM): fine-grained, orange brown.</td>
<td>8/13/17</td>
<td>6</td>
<td>109</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, orange-brown.</td>
<td>11/17/36</td>
<td>10</td>
<td>107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SAND (SP): fine-grained, light brown.</td>
<td>15/29/35</td>
<td>7</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>9/20/28</td>
<td>3</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9/12/26</td>
<td>4</td>
<td>92</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 21.5 feet.  
No groundwater encountered during drilling.  
Borehole backfilled with soil cuttings on 2-25-2010.
# Log of Boring No. BH-13

**Dates Drilled:** 2/26/2010  
**Logged by:** GDS  
**Checked By:** WHC  
**Equipment:** 8" HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in  
**Ground Surface Elevation (ft):** N/A  
**Depth to Water (ft):** NOT ENCOUNTERED

## SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLD DUNE DEPOSITS (Qoe):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>12/19/29</td>
<td>7</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>13/18/29</td>
<td>9</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>SAND WITH SILT (SP-SM):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>14/28/50(5&quot;)</td>
<td>7</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>SAND (SP):</td>
<td></td>
<td></td>
<td></td>
<td>12/22/33</td>
<td>3</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>13/29/50</td>
<td>2</td>
<td>102</td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 21.5 feet.  
No groundwater encountered during drilling.  
Borehole backfilled with soil cuttings on 2-25-2010.
Log of Boring No. BH-14

Dates Drilled: 2/25/2010  Logged by: GDS  Checked By: WHC
Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A  Depth to Water (ft): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS
This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

5.5" ASPHALT WITH NO BASE

FILL (AF):
SILT SAND (SM): fine-grained, reddish brown.
OLDER DUNE DEPOSITS (Qde):
SILT SAND (SM): fine-grained, brown to orange brown.
-orange brown
-mottled light brown and orange brown

5

10

15

SAND WITH SILT (SP-SM): fine-grained, light brown.

9/21/34  2  99

20

25

SILTY SAND (SM): fine-grained, trace clay, gray brown and orange brown.

11/19/50(5")  17  109

30

SAND WITH SILT (SP-SM): fine-grained, gray brown and orange brown.

End of boring at 31.5 feet.
No groundwater encountered during drilling.
Borehole backfilled with soil cuttings and patched with asphalt concrete on 2-25-2010.
**Log of Boring No. BH-15**

Dates Drilled: 2/26/2010  
Logged by: GDS  
Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER  
Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A  
Depth to Water (ft): NOT ENCOUNTERED

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td><strong>3&quot; ASPHALT CONCRETE WITH NO BASE</strong></td>
</tr>
</tbody>
</table>
|           |             | **FILL (A1):**  
| 5         |             | **Silty Sand (SM):** fine-grained, mottled orange brown and brown.  
|           |             | **OLDER DUNE DEPOSITS (Qoe):**  
| 10        |             | **Silty Sand (SM):** fine-grained, brown.  
|           |             | **SAND WITH SILT (SP-SM):** fine-grained, brown.  

End of boring at 11.5 feet.  
Groundwater not encountered during drilling.  
Borehole backfilled with soil cuttings and patched with asphalt concrete on 2-26-2010.
Log of Boring No. BH-16

Dates Drilled: 2/26/2010
Logged by: GDS
Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER
Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): N/A
Depth to Water (ft): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS
This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Samples</th>
<th></th>
<th></th>
<th></th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>FILL (Af):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY SAND (SM): fine-grained, trace gravel, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>OLDER DUNE DEPOSITS (Qo):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY SAND (SM): fine-grained, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-light brown and brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of boring at 11.5 feet.
Groundwater not encountered during drilling.
Borehole backfilled with soil cuttings on 2-28-2010
APPENDIX B

LABORATORY TESTING PROGRAM
APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, Field Exploration. The following is a summary of the laboratory tests conducted for this project.

**Moisture Content and Dry Density**

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, Field Exploration.

**Grain-Size Analysis**

To assist in classification of soils, mechanical grain-size analyses were performed on two (2) selected samples. Testing was performed in general accordance with the ASTM Standard C136 test method. Grain-size curve is shown in Drawing No. B-1, Grain Size Distribution Results.

**Percent Finer Than Sieve No. 200**

The percent finer than sieve No. 200 test was performed on five (5) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. The test results are presented in the following table and boring logs.

**Table No. 1, Summary of Percent Passing Sieve #200 Test Results**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Classification</th>
<th>Percent Passing Sieve No. 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3*</td>
<td>25</td>
<td>Sand (SP)</td>
<td>5.4</td>
</tr>
<tr>
<td>BH-3*</td>
<td>35</td>
<td>Silty Sand (SM)</td>
<td>18.0</td>
</tr>
<tr>
<td>BH-11</td>
<td>20</td>
<td>Silty Sand (SM)</td>
<td>33.3</td>
</tr>
<tr>
<td>BH-11</td>
<td>25</td>
<td>Sand (SP)</td>
<td>3.3</td>
</tr>
<tr>
<td>BH-11</td>
<td>30</td>
<td>Sand with Silt (SP-SM)</td>
<td>14.9</td>
</tr>
<tr>
<td>BH-11</td>
<td>35</td>
<td>Sand with Silt (SP-SM)</td>
<td>7.8</td>
</tr>
<tr>
<td>BH-11</td>
<td>40</td>
<td>Sand with Silt (SP-SM)</td>
<td>10.3</td>
</tr>
<tr>
<td>BH-11</td>
<td>45</td>
<td>Sand with Silt (SP-SM)</td>
<td>10.4</td>
</tr>
<tr>
<td>BH-11</td>
<td>50</td>
<td>Sand with Silt (SP-SM)</td>
<td>15.0</td>
</tr>
</tbody>
</table>
Maximum Dry Density Test
Two (2) laboratory maximum dry density-moisture content relationship tests were performed on representative bulk sample of the upper 6 feet of soil material. The testing was conducted in accordance with ASTM Standard D1557 laboratory procedure. The test result is presented on Drawing Nos. B-2, Moisture-Density Relationship Results.

Direct Shear
Direct shear test was performed on one (1) relatively undisturbed in-situ samples and one (1) sample remolded to approximately 90 percent relative compaction, at soaked moisture conditions. For each test, three brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The sample was then sheared at a constant strain rate of 0.005 inch/minute. Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B-3a and B-3b, Direct Shear Test Results, and in the following table.

Table No. B-2, Direct Shear Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Classification</th>
<th>Peak Strength Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-5*</td>
<td>2-6</td>
<td>Silty Sand (SM)</td>
<td>Friction Angle (degrees) 28</td>
</tr>
<tr>
<td>BH-10</td>
<td>10</td>
<td>Silty Sand (SM)</td>
<td>Friction Angle (degrees) 29</td>
</tr>
</tbody>
</table>
*Indicates remolded sample to 90% relative compaction

Consolidation
Consolidation test was performed on two (2) relatively undisturbed in-situ samples. Data obtained from this test procedure was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The sample was tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawing Nos. B-4a and 4b, Consolidation Test Results.
**Collapse Potential**

To evaluate the moisture sensitivity (collapse/swell potential) of the encountered soils, two (2) ring samples were loaded up to approximately 2.8 kips per square foot (ksf), allowed to stabilize under load, and then submerged. The test was conducted in accordance with the ASTM standard D5333. The results of these tests including results from consolidation tests are summarized in the following table.

<table>
<thead>
<tr>
<th>Boring No</th>
<th>Sample Depth (feet)</th>
<th>Soil Description</th>
<th>Percent Collapse(-) swell (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3*</td>
<td>10</td>
<td>Silty Sand (SM)</td>
<td>-0.59</td>
</tr>
<tr>
<td>BH-5</td>
<td>7.5</td>
<td>Silty Sand (SM)</td>
<td>-0.42</td>
</tr>
<tr>
<td>BH-6</td>
<td>5</td>
<td>Silty Sand (SM)</td>
<td>-1.41</td>
</tr>
<tr>
<td>BH-7*</td>
<td>10</td>
<td>Silty Sand (SM)</td>
<td>-2.21</td>
</tr>
</tbody>
</table>

*Indicates results from consolidation tests

**Expansion Index**

Two (2) representative bulk samples were tested to evaluate the expansion potential of materials encountered at the site. Test results are presented in the following table:

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Description</th>
<th>Expansion Index</th>
<th>Expansion Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3</td>
<td>2-6</td>
<td>Silty Sand (SM)</td>
<td>0</td>
<td>Very Low</td>
</tr>
<tr>
<td>BH-5</td>
<td>2-6</td>
<td>Silty Sand (SM)</td>
<td>3</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

**Soil Corrosivity**

Two (2) representative soil samples were tested to evaluate minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of these tests is to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by Environmental Geotechnical Laboratory, Inc. (EGL), located in Arcadia, California. The test results received from EGL are included in the following table.

<table>
<thead>
<tr>
<th>Sample Location (Boring/Depth)</th>
<th>pH (CALTRANS 643)</th>
<th>Soluble Chlorides (CALTRANS 422) (ppm)</th>
<th>Soluble Sulfate (CALTRANS 417) (ppm)</th>
<th>Saturated Resistivity (CALTRANS 632) Ohm-cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3/2'-6'</td>
<td>8.48</td>
<td>85</td>
<td>90</td>
<td>2,700</td>
</tr>
<tr>
<td>BH-5/2'-6'</td>
<td>8.36</td>
<td>75</td>
<td>60</td>
<td>4,700</td>
</tr>
</tbody>
</table>
R-value
A representative bulk soil sample was tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test result is shown in the following table.

Table No. B-6, R-value Test Result

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth, ft</th>
<th>Soil Classification</th>
<th>Measured R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-2</td>
<td>2-5</td>
<td>Silty Sand (SM)</td>
<td>47</td>
</tr>
</tbody>
</table>

Sample Storage
Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.
**GRAIN SIZE DISTRIBUTION RESULTS**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (ft)</th>
<th>Description</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>Cc</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3</td>
<td>25</td>
<td>SAND (SP)</td>
<td></td>
<td></td>
<td></td>
<td>1.31</td>
<td>2.17</td>
</tr>
<tr>
<td>BH-3</td>
<td>35</td>
<td>SILTY SAND (SM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (ft)</th>
<th>D100</th>
<th>D60</th>
<th>D30</th>
<th>D10</th>
<th>%Gravel</th>
<th>%Sand</th>
<th>%Silt</th>
<th>%Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3</td>
<td>25</td>
<td>0.595</td>
<td>0.214</td>
<td>0.166</td>
<td>0.098</td>
<td>0.0</td>
<td>94.6</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>BH-3</td>
<td>35</td>
<td>0.297</td>
<td>0.18</td>
<td>0.102</td>
<td>0.0</td>
<td>0.0</td>
<td>82.0</td>
<td>18.0</td>
<td></td>
</tr>
</tbody>
</table>
Curves of 100% Saturation for Specific Gravity Equal to:

- 2.80
- 2.70
- 2.60

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>BORING NO.</th>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>ASTM TEST METHOD</th>
<th>OPTIMUM WATER, %</th>
<th>MAXIMUM DRY DENSITY,pcf</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>BH-3</td>
<td>2-6</td>
<td>SILTY SAND (SM)</td>
<td>D1557 Method B</td>
<td>10.5</td>
<td>120.5</td>
</tr>
<tr>
<td>☐</td>
<td>BH-5</td>
<td>2-6</td>
<td>SILTY SAND (SM)</td>
<td>D1557 Method B</td>
<td>8.5</td>
<td>122.5</td>
</tr>
</tbody>
</table>

MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Project Name
SOUTHBAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No.
10-31-124-01

Drawing No.
B-2
DIRECT SHEAR TEST RESULTS

Converse Consultants

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>BH-5</th>
<th>DEPTH (ft)</th>
<th>2-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION</td>
<td>SILTY SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COHESION (psf)</td>
<td>150</td>
<td>FRICTION ANGLE (degrees):</td>
<td>28</td>
</tr>
<tr>
<td>MOISTURE CONTENT (%)</td>
<td>9.3</td>
<td>DRY DENSITY (pcf) :</td>
<td>108.4</td>
</tr>
</tbody>
</table>

NOTE: Ultimate Strength, remolded to 90% compaction.
### DIRECT SHEAR TEST RESULTS

**Boring No.:** BH-10  
**Depth (ft):** 10  
**Description:** SILTY SAND (SM)  
**Cohesion (psf):** 50  
**Friction Angle (degrees):** 29  
**Moisture Content (%):** 9.6  
**Dry Density (pcf):** 103.4

NOTE: Ultimate Strength.

---

**Converse Consultants**  
**Project Name:** SOUTH BAY SOUTHERN PROJECT  
**Project No.:** 10-31-124-01  
**Drawing No.:** B-3b  
**Location:** REDONDO BEACH, CALIFORNIA
BORING NO. : BH-3  
DESCRIPTION : SILTY SAND (SM)  
DEPTH (ft) : 10  

<table>
<thead>
<tr>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (pcf)</th>
<th>PERCENT SATURATION</th>
<th>VOID RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>INITIAL</td>
<td>4.7</td>
<td>101.3</td>
<td></td>
</tr>
<tr>
<td>FINAL</td>
<td>20.9</td>
<td>101.3</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER
CONSOLIDATION TEST RESULTS

Converse Consultants

SOUTH BAY SOUTHERN PROJECT
REDONDO BEACH, CALIFORNIA

Project No. 10-31-124-01
Drawing No. B-4b

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

<table>
<thead>
<tr>
<th>BORING NO. : BH-7</th>
<th>DEPTH (ft) : 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION : SILTY SAND (SM)</td>
<td></td>
</tr>
<tr>
<td>MOISTURE CONTENT (%)</td>
<td>DRY DENSITY (pcf)</td>
</tr>
<tr>
<td>INITIAL      10.2</td>
<td>106.6</td>
</tr>
<tr>
<td>FINAL        18</td>
<td>106.6</td>
</tr>
</tbody>
</table>
APPENDIX C

EARTHWORK SPECIFICATIONS
APPENDIX C

EARTHWORK SPECIFICATIONS

C1.1 Scope of Work

The work includes all labor, supplies and construction equipment required to construct the building pads in a good, workmanlike manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Fill
- Observation and Testing

C1.2 Site Inspection

1. The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

2. This Geotechnical Study Report by Converse Consultants may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the
Contractor from performing such independent study and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

C1.3 Authority of the Geotechnical Engineer

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.

2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.

3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

C1.4 Site Clearing

1. Clearing and grubbing shall consist of the removal of all existing structures, pavement, utilities, vegetation and demolition debris from areas to be graded.

2. Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

C1.5 Excavations

1. Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment in good working order.

C1.6 Preparation of Fill Areas

1. All organic material, organic soils, undocumented fill soils and demolition debris should be removed from the proposed building areas.

2. Existing undocumented fill is not considered suitable for supporting structures or additional fill. Over-excavation should include the depth of undocumented fill, with a minimum depth of 4 feet from existing grade or the depths to the undocumented fill, whichever is deeper, and extended to five (5) feet beyond the building limits where permitted by property line constraints. The undocumented fill is expected to be 6 feet in depth adjacent to soil Boring No. BH-3 and 12 feet in depth adjacent to Boring No. BH-11. For the proposed structure located at the
northeast portion of the site, over-excavation should be at least 6 feet bgs. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. The actual depth of removal should be evaluated based on observations made during grading. Thickness of compacted fill underneath the buildings should be kept uniform. After the required removals have been made, the exposed native earth materials shall be excavated to provide a zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork. The fill thickness under structures should not vary.

3. The subgrade in all areas to receive fill shall be scarified to a minimum depth of six (6) inches, the soil moisture adjusted between optimum and three (3) percent above optimum for fine-grained soils and within three (3) percent of optimum moisture content for granular soils, and then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Scarification may be terminated on moderately hard to hard, cemented earth materials with the approval of the Geotechnical Engineer.

4. Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.

5. All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

C1.7 Placement and Compaction of Fill

1. Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.

2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:
   a. All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.
   b. Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) at about three (3) percent above optimum moisture for fine grained soils, and within three (3) percent of optimum for granular soils.
3. Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

4. All fill placed at the site shall be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. The on-site soils shall be moisture conditioned within three (3) percent above the optimum moisture content. At least the upper 12 inches of subgrade soils underneath the concrete apron, pavement and parking areas should be compacted to a minimum of 95 percent relative compaction.

5. Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be benched into competent materials. The height and width of the benches shall be at least two (2) feet.

6. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 compaction method.

7. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.

8. It shall be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It shall be the contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.

C1.8 Trench Backfill

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
2. Trench backfill shall be compacted to a minimum relative compaction of 90 percent as per ASTM Standard D1557 test method.

3. Rocks larger than one (1) inch should not be placed within 12 inches of the top of the pipeline or within the upper 12 inches of pavement or structure subgrade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter, and rocks shall be well mixed with finer soil.

4. The pipe design engineer should select bedding material for the pipe. Bedding materials generally should have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method.

5. Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for granular soils and between optimum and three (3) percent above optimum for fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

6. The contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.

7. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.

8. Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

9. It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.

10. Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

C1.9 Observation and Testing

1. During the progress of grading, the Geotechnical Engineer will provide observation of the fill placement operations.

2. Field density tests will be made during grading to provide an opinion on the degree of compaction being obtained by the contractor. Where compaction of
less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.

3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill placed.
APPENDIX D

PERCOLATION TESTING PROCEDURE
APPENDIX D

PERCOLATION TESTING PROCEDURE

The continuous pre-soak falling-head test procedure for water infiltration testing was utilized to evaluate soil infiltration of the native soils encountered between depths of 5 to 10 feet below the ground surface. Test locations at borings BH-2 and BH-4 were prepared by placing a 2-inch diameter PVC pipe surrounded by gravel after drilling and sampling. Water was filled to the surface in both borings to pre-soak prior to testing.

Testing started the following day by filling the pipe until the water level reached existing grade. A water level measurement was taken at 30 minute intervals, and the test hole was refilled to approximately the same depth as the initial water level following each reading, except the last hour of testing where the water was allowed to continuously drain without refilling. The testing occurred for approximately 4 hours at boring location BH-2 and 7 hours at boring location BH-4.

Percolation Analysis

The percolation test results are shown on the following data sheets. A gravel correction factor was applied to the initial data set, in general accordance with Los Angeles County guidelines, resulting in calculated infiltration rates of approximately 2.81 inches per hour at boring location BH-2 and 1.29 inches per hour at boring location BH-4.

The natural site soils tested are primarily sandy with moderate infiltration capacity. Should the decision be made to percolate water runoff into the underlying native soils, such percolation zones should be placed a minimum distance of 10 feet laterally from any existing or future planned building or subsurface structure as not to disturb or undermine foundations. Infiltration of water should begin at a depth of 5 feet below grade and into sandy soils similar to those tested.

\[
\begin{align*}
D &= \text{Diameter of the Boring Hole} \\
T_i &= \text{Test Start Time, } T_f = \text{Test End Time, } \Delta T = \text{Change in Time} \\
d_B &= \text{Depth to Bottom} \\
d_i &= \text{Start Depth to Water Surface (relative to grade)} \\
d_f &= \text{End Depth to Water Surface (relative to grade)} \\
\Delta d (F) &= \text{Change in Depth to Water Surface} \\
L_{ave} &= \text{Average Length of Water column} = d_B - ((d_f + d_i) / 2) \\
Q &= \text{Gallons of Water per Square Foot per Day} = \Delta d \times D \times 9 / L_{ave} \times \Delta T \\
\text{Per Inch (MPI)} &= 180 / Q \\
\text{Inches Per Hour} &= 60 / \text{MPI}
\end{align*}
\]
### Percolation Testing

**Test No.** BH-2  
**Job Name:** Southbay Southern  
**Job No.:** 10-31-124-01  
**Location:** Redondo Beach, CA  
**Test Date:** February 26, 2010

---

<table>
<thead>
<tr>
<th>Gravel Pack Depth</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel Pack Correction</td>
<td>37.5%</td>
</tr>
</tbody>
</table>

#### Time of Testing

<table>
<thead>
<tr>
<th>Initial Time</th>
<th>Final Time</th>
<th>Time Interval</th>
<th>Depth to Bottom</th>
<th>Initial Height</th>
<th>Final Height</th>
<th>Drop in Height</th>
<th>Average length of water column</th>
<th>Q</th>
<th>Minutes per Inch (180/Q)</th>
<th>Inches per Hour (60/mpi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_i$</td>
<td>$T_f$</td>
<td>$^{\wedge} T$</td>
<td>$d_b$</td>
<td>$d_i$</td>
<td>$d_f$</td>
<td>$F = d_f - d_i = x d$</td>
<td>$L_{ave}$</td>
<td>$Q$</td>
<td>12.07</td>
<td>14.9</td>
</tr>
<tr>
<td>Presoak</td>
<td>2/26/2010</td>
<td>12:04 PM</td>
<td>5.50</td>
<td>10.0</td>
<td>0.00</td>
<td>6.67</td>
<td>6.67</td>
<td>11.61</td>
<td>13.9</td>
<td>15.5</td>
</tr>
<tr>
<td>5:55:00 AM</td>
<td>6:25:00 AM</td>
<td>0.50</td>
<td>6:30:00 AM</td>
<td>7:00:00 AM</td>
<td>0.50</td>
<td>10.0</td>
<td>0.00</td>
<td>10.0</td>
<td>13.9</td>
<td>15.5</td>
</tr>
<tr>
<td>7:05:00 AM</td>
<td>7:35:00 AM</td>
<td>0.50</td>
<td>7:40:00 AM</td>
<td>8:10:00 AM</td>
<td>0.50</td>
<td>10.0</td>
<td>0.00</td>
<td>10.0</td>
<td>13.9</td>
<td>15.5</td>
</tr>
<tr>
<td>8:15:00 AM</td>
<td>8:45:00 AM</td>
<td>0.50</td>
<td>8:46:00 AM</td>
<td>8:56:00 AM</td>
<td>0.17</td>
<td>10.0</td>
<td>0.00</td>
<td>10.0</td>
<td>13.9</td>
<td>15.5</td>
</tr>
<tr>
<td>9:06:00 AM</td>
<td>9:16:00 AM</td>
<td>0.17</td>
<td>9:18:00 AM</td>
<td>9:26:00 AM</td>
<td>0.17</td>
<td>10.0</td>
<td>0.00</td>
<td>10.0</td>
<td>13.9</td>
<td>15.5</td>
</tr>
<tr>
<td>9:36:00 AM</td>
<td>9:46:00 AM</td>
<td>0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.87</td>
<td>13.4</td>
<td>14.1</td>
</tr>
</tbody>
</table>

#### Boring Gravel Pack Correction

- $Q_{corr} = 0.5 \times (4.6) + 0.5 \times (12.28)$

- $Q_{corr} = 8.44$  

---

**Concerns/Issues:**

---

### Uncorrected Averages

<table>
<thead>
<tr>
<th>Q</th>
<th>Minutes per Inch (180/Q)</th>
<th>Inches per Hour (60/mpi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.07</td>
<td>14.9</td>
<td>4.0</td>
</tr>
</tbody>
</table>

---

**Gravel Pack Correction:**

- $E = 8.44$  

---

**Technical:** GDS
## Percolation Testing

<table>
<thead>
<tr>
<th>Job Name:</th>
<th>Southbay Southern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job No.:</td>
<td>10-31-124-31</td>
</tr>
<tr>
<td>Location:</td>
<td>Redondo Beach, CA</td>
</tr>
<tr>
<td>Test Date:</td>
<td>February 26, 2010</td>
</tr>
</tbody>
</table>

**Depth of Boring (d₀):** 10.0 feet  
**Diameter of Boring (D):** 0.67 feet  
**Technician:** GDS  
**Concerns/Issues:**

---

### Gravel Pack Correction

<table>
<thead>
<tr>
<th>Gravel Pack Depth</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel Pack Correction</td>
<td>37.5%</td>
</tr>
</tbody>
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### Time of Testing vs. Depth to Water Level

<table>
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<tr>
<th>Initial Time</th>
<th>Final Time</th>
<th>Time Interval</th>
<th>Depth to Bottom</th>
<th>Initial Height</th>
<th>Final Height</th>
<th>Drop in Height</th>
<th>Average length of water column</th>
<th>Q</th>
<th>Minutes per Inch (150/Q)</th>
<th>Inches per Hour (60/mph)</th>
</tr>
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<tbody>
<tr>
<td>T₁</td>
<td>Tᵣ</td>
<td>^ T</td>
<td>d₀</td>
<td>d₁</td>
<td>dᵣ</td>
<td>F = dᵣ - d₁ = -d</td>
<td>lₚwq</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(hr)</td>
<td>(feet)</td>
<td></td>
<td>(feet)</td>
<td>(feet)</td>
<td>(feet)</td>
<td>(feet)</td>
<td>(feet)</td>
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#### Presoak

- **Date:** 2/25/2010  
- **Time:** 12:35 PM

**Percolation Test**

- **6:00:00 AM to 6:30:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.08 feet  
  - dᵣ: 4.08 feet  
  - lₚwq: 7.96 feet  
  - Q: 6.18 gph  
  - 29.1 inches per hour
  - 2.1 inches per minute

- **6:35:00 AM to 7:05:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.00 feet  
  - dᵣ: 4.00 feet  
  - lₚwq: 8.00 feet  
  - Q: 6.03 gph  
  - 29.9 inches per hour
  - 2.0 inches per minute

- **7:10:00 AM to 7:40:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.17 feet  
  - dᵣ: 4.17 feet  
  - lₚwq: 7.92 feet  
  - Q: 6.03 gph  
  - 29.9 inches per hour
  - 2.0 inches per minute

- **7:45:00 AM to 8:15:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.25 feet  
  - dᵣ: 4.25 feet  
  - lₚwq: 7.88 feet  
  - Q: 6.51 gph  
  - 27.7 inches per hour
  - 2.2 inches per minute

- **8:20:00 AM to 8:50:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.25 feet  
  - dᵣ: 4.25 feet  
  - lₚwq: 7.88 feet  
  - Q: 6.51 gph  
  - 27.7 inches per hour
  - 2.2 inches per minute

- **8:50:00 AM to 9:20:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 3.92 feet  
  - dᵣ: 3.92 feet  
  - lₚwq: 8.04 feet  
  - Q: 5.88 gph  
  - 30.6 inches per hour
  - 2.0 inches per minute

- **9:20:00 AM to 9:50:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.08 feet  
  - dᵣ: 4.08 feet  
  - lₚwq: 7.96 feet  
  - Q: 6.18 gph  
  - 29.1 inches per hour
  - 2.1 inches per minute

- **9:55:00 AM to 10:25:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 3.92 feet  
  - dᵣ: 3.92 feet  
  - lₚwq: 8.04 feet  
  - Q: 5.88 gph  
  - 30.6 inches per hour
  - 2.0 inches per minute

- **10:30:00 AM to 11:00:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 4.08 feet  
  - dᵣ: 4.08 feet  
  - lₚwq: 7.96 feet  
  - Q: 6.18 gph  
  - 29.1 inches per hour
  - 2.1 inches per minute

- **11:10:00 AM to 11:40:00 AM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 3.67 feet  
  - dᵣ: 3.67 feet  
  - lₚwq: 8.17 feet  
  - Q: 5.42 gph  
  - 33.2 inches per hour
  - 1.8 inches per minute

- **11:45:00 AM to 12:15:00 PM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 5.17 feet  
  - dᵣ: 5.17 feet  
  - lₚwq: 5.58 feet  
  - Q: 3.24 gph  
  - 55.5 inches per hour
  - 1.1 inches per minute

- **12:15:00 PM to 12:45:00 PM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 6.50 feet  
  - dᵣ: 6.50 feet  
  - lₚwq: 4.17 feet  
  - Q: 3.85 gph  
  - 46.7 inches per hour
  - 1.3 inches per minute

- **12:45:00 PM to 1:15:00 PM:** 0.50 hours
  - d₀: 10.0 feet  
  - d₁: 7.98 feet  
  - dᵣ: 7.98 feet  
  - lₚwq: 2.96 feet  
  - Q: 4.40 gph  
  - 40.9 inches per hour
  - 1.5 inches per minute

---

**Boring Gravel Pack Correction:** 2.11  
**% of Gravel Pack to Total Depth:** 0.50  
**Q with Gravel Correction:** \(0.5 \times 2.11 + 0.5 \times 5.62\) = 3.86  
**Uncorrected Averages:** 5.62, 33.45, 1.87  
**Gravel Pack Correction:** 3.86, 46.60, 1.29
APPENDIX 4
BMP CALCULATIONS
85th Percentile 24-hr Rainfall Isohyetal Map

PROJECT SITE = 0.9 IN.

85th Percentile 24-hr Rainfall Depth
Soil Identification Table

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<td>CHINO SILT LOAM</td>
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<td>SANTA MONICA MOUNTAINS</td>
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# Peak Flow Hydrologic Analysis

**File location:** K:/Drawings/SP/SP3237G/LID/Appendices/Appendix 4 - BMP Calculations/South Bay Galleria - 1.pdf  
**Version:** HydroCalc 0.3.1-beta

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<tr>
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<tr>
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## Output Results

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</tr>
<tr>
<td>24-Hr Clear Runoff Volume (cu-ft)</td>
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![Hydrograph (South Bay Galleria: 1)](image-url)
### Input Parameters

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### Output Results

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### Hydrograph (South Bay Galleria: 2)

![Hydrograph](image)
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## Output Results

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### Output Results

| Parameter                                                          | Value      |
|                                                                  |            |
| Modeled (85th percentile storm) Rainfall Depth (in)               | 0.9        |
| Peak Intensity (in/hr)                                            | 0.2313     |
| Undeveloped Runoff Coefficient (Cu)                              | 0.1        |
| Developed Runoff Coefficient (Cd)                                | 0.82       |
| Time of Concentration (min)                                      | 30.0       |
| Clear Peak Flow Rate (cfs)                                       | 1.0433     |
| Burned Peak Flow Rate (cfs)                                      | 1.0433     |
| 24-Hr Clear Runoff Volume (ac-ft)                                | 0.3355     |
| 24-Hr Clear Runoff Volume (cu-ft)                                | 14612.5678 |

### Diagram

[Hydrograph (South Bay Galleria: 4)](chart-url)
# Peak Flow Hydrologic Analysis

File location: K:/Drawings/SP/SP3237G/LID/Appendices/Appendix 4 - BMP Calculations/9_South Bay Galleria - 5.pdf

Version: HydroCalc 0.3.1-beta

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## Output Results

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![Hydrograph (South Bay Galleria: 5)](image-url)
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<td>425.0</td>
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<tr>
<td>Flow Path Slope (vft/hft)</td>
<td>0.015</td>
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<tr>
<td>85th Percentile Rainfall Depth (in)</td>
<td>0.9</td>
</tr>
<tr>
<td>Percent Impervious</td>
<td>0.9</td>
</tr>
<tr>
<td>Soil Type</td>
<td>14</td>
</tr>
<tr>
<td>Design Storm Frequency</td>
<td>85th percentile storm</td>
</tr>
<tr>
<td>Fire Factor</td>
<td>0</td>
</tr>
<tr>
<td>LID</td>
<td>True</td>
</tr>
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</table>

### Output Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeled (85th percentile storm) Rainfall Depth (in)</td>
<td>0.9</td>
</tr>
<tr>
<td>Peak Intensity (in/hr)</td>
<td>0.2676</td>
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<tr>
<td>Undeveloped Runoff Coefficient (Cu)</td>
<td>0.1</td>
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<tr>
<td>Developed Runoff Coefficient (Cd)</td>
<td>0.82</td>
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<tr>
<td>Time of Concentration (min)</td>
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<tr>
<td>Clear Peak Flow Rate (cfs)</td>
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<tr>
<td>Burned Peak Flow Rate (cfs)</td>
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</tr>
<tr>
<td>24-Hr Clear Runoff Volume (ac-ft)</td>
<td>0.1452</td>
</tr>
<tr>
<td>24-Hr Clear Runoff Volume (cu-ft)</td>
<td>6323.2228</td>
</tr>
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</table>

### Hydrograph (South Bay Galleria: 6)

![Hydrograph](image)
LID DESIGN CALCULATIONS

For a commercial development project, the following applies:

- Infiltrate or retain the change in the volume of the runoff from the water quality storm on the parcel level.

**Hydrologic Parameters**

Soil = 14
Assume 90% impervious, 10% pervious.
P (Percolation Rate) = 2 in/hr
T (Drawdown Time) = 72 hr

**Design Storm**

85th percentile for Redondo Beach, CA = 0.90 in
0.75 in storm over 24hr
Design Storm = 0.90 in

**BMP Retention Volume Required (LID-0.90 in)**

<table>
<thead>
<tr>
<th>DMA NAME OR ID</th>
<th>AREA (SQ FT)</th>
<th>FLOW PATH (FT)</th>
<th>SWQDv (CU-FT)</th>
<th>t_c (MIN)</th>
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<tbody>
<tr>
<td>DMA 1</td>
<td>239,722</td>
<td>440</td>
<td>14,612</td>
<td>23</td>
</tr>
<tr>
<td>DMA 2</td>
<td>239,626</td>
<td>665</td>
<td>14,613</td>
<td>30</td>
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<td>DMA 3</td>
<td>237,432</td>
<td>555</td>
<td>14,480</td>
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<td>DMA 4</td>
<td>239,723</td>
<td>675</td>
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<td>DMA 5</td>
<td>240,497</td>
<td>605</td>
<td>14,666</td>
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<tr>
<td>DMA 6</td>
<td>103,826</td>
<td>425</td>
<td>6,323</td>
<td>22</td>
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</table>

Total SWQDv = 79,333

Total Volume Required, V_{BMPreq} = 79,306 ft³
BMP Required For Infiltration

MaxWell Plus Drywell
-1 primary chamber and 1 drywell
-Additional drywell added if necessary after field tests

System Storage Volume

Vol. of Primary Settling Chamber (10’ @ 4’ diameter) = $10’ \times \pi \times \left(\frac{4’}{2}\right)^2 = 126 \text{ ft}^3$
Vol. of Secondary Settling Chamber (10’ @ 4’ diameter) = $10’ \times \pi \times \left(\frac{4’}{2}\right)^2 = 126 \text{ ft}^3$

**DMA 1**
Number of Secondary Chambers = 6
Total Storage Volume of Drywell System = $126 \text{ ft}^3 + (6 \times 126 \text{ ft}^3) = 880 \text{ ft}^3$
Total Storage Volume of Underground Detention System = $13,959 \text{ ft}^3$

**DMA 2**
Number of Secondary Chambers = 6
Total Storage Volume of Drywell System = $126 \text{ ft}^3 + (6 \times 126 \text{ ft}^3) = 880 \text{ ft}^3$
Total Storage Volume of Underground Detention System = $13,959 \text{ ft}^3$

**DMA 3**
Number of Secondary Chambers = 6
Total Storage Volume of Drywell System = $126 \text{ ft}^3 + (6 \times 126 \text{ ft}^3) = 880 \text{ ft}^3$
Total Storage Volume of Underground Detention System = $13,959 \text{ ft}^3$

**DMA 4**
Number of Secondary Chambers = 6
Total Storage Volume of Drywell System = $126 \text{ ft}^3 + (6 \times 126 \text{ ft}^3) = 880 \text{ ft}^3$
Total Storage Volume of Underground Detention System = $13,959 \text{ ft}^3$

**DMA 5**
Number of Secondary Chambers = 6
Total Storage Volume of Drywell System = $126 \text{ ft}^3 + (6 \times 126 \text{ ft}^3) = 880 \text{ ft}^3$
Total Storage Volume of Underground Detention System = $13,959 \text{ ft}^3$
DMA 6

Number of Secondary Chambers = 3
Total Storage Volume of Drywell System = 126 ft$^3$ + (3 x 126 ft$^3$) = 503 ft$^3$
Total Storage Volume of Underground Detention System = 6,917 ft$^3$

Total Number of Primary Settling Chambers = 6
Total Number of Drywells = 33

Infiltration Volume

Infiltration Rate (from Geotech Report) = 2.05 in/hr = 0.000047 ft/sec

Safety Factor = 2

Infiltration Rate = $0.000047 \text{ ft/sec} \div 2 = 0.0000237 \text{ ft/sec}$

-Infiltration begins at 10’ below ground grade and the maximum preliminary depth of 40’ to maintain 10’ separation from ground water that may be evident

DMA 1

Infiltration Zone provided (6 drywells) = $6 \times h \pi d = 6 \times 32’ \times \pi \times 4’ = 2,413 \text{ ft}^2$

Required rate of disposal = $2,413 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.057247 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.057247 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$
= $14,838 \text{ ft}^3$

DMA 2

Infiltration Zone provided (6 drywells) = $6 \times h \pi d = 6 \times 32’ \times \pi \times 4’ = 2,413 \text{ ft}^2$

Required rate of disposal = $2,413 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.057247 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.057247 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$
= $14,838 \text{ ft}^3$
**DMA 3**

Infiltration Zone provided (6 drywells) = $6 \times h \pi d = 6 \times 32' \times \pi \times 4' = 2,413 \text{ ft}^2$

Required rate of disposal = $2,413 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.057247 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.057247 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$

$= 14,838 \text{ ft}^3$

**DMA 4**

Infiltration Zone provided (6 drywells) = $6 \times h \pi d = 6 \times 32' \times \pi \times 4' = 2,413 \text{ ft}^2$

Required rate of disposal = $2,413 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.057247 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.057247 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$

$= 14,838 \text{ ft}^3$

**DMA 5**

Infiltration Zone provided (6 drywells) = $6 \times h \pi d = 6 \times 32' \times \pi \times 4' = 2,413 \text{ ft}^2$

Required rate of disposal = $2,413 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.057247 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.057247 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$

$= 14,838 \text{ ft}^3$

**DMA 6**

Infiltration Zone provided (3 drywells) = $3 \times h \pi d = 3 \times 32' \times \pi \times 4' = 1,206 \text{ ft}^2$

Required rate of disposal = $1,206 \text{ ft}^2 \times 0.0000237 \text{ ft/sec} = 0.028623 \text{ ft}^3/\text{sec}$

Vol. of Water infiltrated in first 72 hours = $0.028623 \text{ ft}^3/\text{sec} \times 72 \text{ hrs} \times 3600 \text{ sec/hr}$

$= 7,419 \text{ ft}^3$
APPENDIX 5
BMP DETAIL AND FACT SHEETS
ITEM NUMBERS

1. MANHOLE CONE — MODIFIED FLAT BOTTOM.
2. STABILIZED BACKFILL— TWO-SACK SLURRY MIX.
3. BOLTED RING & GRATE/Cover — DIAMETER AS SHOWN. CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS. BOLTED IN 2 LOCATIONS AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
4. GRANULAR BASE OR PAVING (BY OTHERS).
5. COMPACTED BASE MATERIAL (BY OTHERS).
6. PUREFLO® DEBRIS SCREEN — ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL .265" MAX. SWG FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.
7. PRE-CAST LINER — 4000 PSI CONCRETE 48" ID. X 54" OD. CENTER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.
8. MIN. 6" Ø DRILLED SHAFT.
9. SUPPORT BRACKET — FORMED 12 GA. STEEL. FUSION BONDED EPOXY COATED.
10. OVERFLOW PIPE — SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
11. DRAINAGE PIPE — ADS HIGHWAY GRADE WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE. DIAMETER AS NOTED.
12. BASE SEAL — GEOTEXTILE, POLY LINER OR CONCRETE SLURRY.
13. ROCK — CLEAN AND WASHED 3/8" TO 1-1/2" AGGREGATE.
14. FLOFAST® DRAINAGE SCREEN — SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. DIAMETER VARIES 96" OVERALL LENGTH WITH TRI-B COUPLER.
15. MIN. 4" Ø SHAFT — DRILLED TO MAINTAIN PERMEABILITY OF DRAINAGE SOILS.
16. FABRIC SEAL — U.V. RESISTANT GEOTEXILE — TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION.
17. ABSORBENT — HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL 2 (2) PER CHAMBER.
18. CONNECTOR PIPE — 4" Ø SCH. 40 PVC.
19. VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.
20. INTAKE SCREEN — 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
21. FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY/SECONDARY SETTLE CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.
22. OPTIONAL INLET PIPE (BY OTHERS).
23. NON-WOVEN GEOTEXTILE SLEEVE, MIRAFL® 140 NL. MIN. 6 FT DIAMETRAL, HELD APART 10 FEET OFF THE BOTTOM OF EXCAVATION.
24. EIGHT(8) 1.25" DIAMETER HOLES PER FOOT WHERE NOTED.
25. OPTIONAL OUTLET PIPE (BY OTHERS).
Description and Purpose
Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications
Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations
- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation
- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase
of construction. Clearly show how the rainy season relates to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs

- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.

- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.

- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.

- Monitor the weather forecast for rainfall.

- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.

- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.

- Apply permanent erosion control to areas deemed substantially complete during the project’s defined seeding window.

**Costs**

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.
Inspection and Maintenance

- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.

- Amend the schedule when changes are warranted.

- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References


Description and Purpose
Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications
Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.

- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.

- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.

- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Limitations
- Requires forward planning by the owner/developer,
Preservation Of Existing Vegetation  EC-2

contractor, and design staff.

- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.

- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

**Implementation**

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site’s landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

**Timing**

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

**Design and Layout**

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.

- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.

- Consider the impact of grade changes to existing vegetation and the root zone.

- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.

- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.
**Preservation Of Existing Vegetation  EC-2**

**Costs**
There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

**Inspection and Maintenance**
During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.
Preservation Of Existing Vegetation  EC-2

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References
County of Sacramento Tree Preservation Ordinance, September 1981.


Water Conservation Practices

Description and Purpose
Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications
Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations
- None identified.

Implementation
- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.
- Direct construction water runoff to areas where it can soak

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

Potential Alternatives
None
into the ground or be collected and reused.

- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

**Costs**
The cost is small to none compared to the benefits of conserving water.

**Inspection and Maintenance**
- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occurring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

**References**
**Description and Purpose**

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

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

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

**Suitable Applications**

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

**Limitations**

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

**General**

- Avoid paving during the wet season when feasible.

- Reschedule paving and grinding activities if rain is forecasted.

- Train employees and sub-contractors in pollution prevention and reduction.

- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).

- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.

- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. These materials should be stored consistent with WM-3, Stockpile Management.

- Disposal of PCC (Portland cement concrete) and AC (asphalt concrete) waste should be in conformance with WM-8, Concrete Waste Management.

**Saw Cutting, Grinding, and Pavement Removal**

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.

- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:

  - AC grindings, pieces, or chunks used in embankments or shoulder backing should not be allowed to enter any storm drains or watercourses. Install inlet protection and perimeter controls until area is stabilized (i.e. cutting, grinding or other removal activities are complete and loose material has been properly removed and disposed of) or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; SE-5, Fiber Rolls, or SE-13 Compost Socks and Berms

  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt should be recycled or disposed of properly.

- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by a vacuum attachment to the grinding machine, or by sweeping, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.

- Pavement removal activities should not be conducted in the rain.

- Collect removed pavement material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
Paving and Grinding Operations

- If removed pavement material cannot be recycled, transport the material back to an approved storage site.

**Asphaltic Concrete Paving**
- If paving involves asphaltic cement concrete, follow these steps:
  - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.
  - Old asphalt should be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

**Portland Cement Concrete Paving**
- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect waste materials by dry methods, such as sweeping or shoveling, and return to aggregate base stockpile or dispose of properly. Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if authorized by the local wastewater authority.

**Sealing Operations**
- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate should not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized (i.e. all sealing operations are complete and cured and loose materials have been properly removed and disposed).
- Inlet protection (SE-10, Storm Drain Inlet Protection) should be used during application of seal coat, tack coat, slurry seal, and fog seal.
- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

**Paving Equipment**
- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials and dispose of in accordance with the applicable regulations. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.
- Substances used to coat asphalt transport trucks and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.
- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.
- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.
**Thermoplastic Striping**
- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.

- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move.

- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.

- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

**Raised/Recessed Pavement Marker Application and Removal**
- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.

- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing.

- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.

- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

**Costs**
- All of the above are low cost measures.

**Inspection and Maintenance**
- Inspect and verify that activity-based BMPs are in place prior to the commencement of paving and grinding operations.

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Sample stormwater runoff required by the General Permit.

- Keep ample supplies of drip pans or absorbent materials onsite.

- Inspect and maintain machinery regularly to minimize leaks and drips.

**References**
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.
Paving and Grinding Operations


Illicit Connection/Discharge

Description and Purpose
Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

Suitable Applications
This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

Limitations
Illicit connections and illegal discharges or dumping, for the purposes of this BMP, refer to discharges and dumping caused by parties other than the contractor. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

Implementation
Planning
- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.
- Inspect site regularly during project execution for evidence
of illicit connections, illegal dumping or discharges.

- Observe site perimeter for evidence for potential of illicitly discharged or illegally dumped material, which may enter the job site.

**Identification of Illicit Connections and Illegal Dumping or Discharges**

- **General** – unlabeled and unidentifiable material should be treated as hazardous.

- **Solids** - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.

- **Liquids** - signs of illegal liquid dumping or discharge can include:
  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Abnormal water flow during the dry weather season

- **Urban Areas** - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:
  - Abnormal water flow during the dry weather season
  - Unusual flows in sub drain systems used for dewatering
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Excessive sediment deposits, particularly adjacent to or near active offsite construction projects

- **Rural Areas** - Illicit connections or illegal discharges involving irrigation drainage ditches are detected by visual inspections. Signs of an illicit discharge can include:
  - Abnormal water flow during the non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

**Reporting**

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

**Cleanup and Removal**

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.
Costs
Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

Inspection and Maintenance
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect the site regularly to check for any illegal dumping or discharge.

- Prohibit employees and subcontractors from disposing of non-job related debris or materials at the construction site.

- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

References
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


Description and Purpose
Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project’s risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

Suitable Applications
Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.
Concrete Curing

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.

- Minimize the drift by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.

- Use proper storage and handling techniques for concrete curing compounds. Refer to WM-1, Material Delivery and Storage.

- Protect drain inlets prior to the application of curing compounds.

- Refer to WM-4, Spill Prevention and Control.

Water Curing for Bridge Decks, Retaining Walls, and other Structures

- Direct cure water away from inlets and watercourses to collection areas for evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.

- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.

- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.

- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
Concrete Curing

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.

- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.

- Inspect cure containers and spraying equipment for leaks.

References


Concrete Finishing

Description and Purpose
Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

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

Concrete and its associated curing materials have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications
These procedures apply to all construction locations where concrete finishing operations are performed.

Categories

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Targeted Constituents

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Potential Alternatives
None
Concrete Finishing

Limitations
- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation
- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control. Refer to EC-9, Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering). Refer to NS-2 Dewatering Operations.
- Protect inlets during sandblasting operations. Refer to SE-10, Storm Drain Inlet Protection.
- Refer to WM-8, Concrete Waste Management for disposal of concrete debris.
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to WM-6, Hazardous Waste Management.

Education
- Educate employees, subcontractors, and suppliers on proper concrete finishing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor’s superintendent or representative to oversee and enforce concrete finishing procedures.

Costs
These measures are generally of low cost.

Inspection and Maintenance
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts concrete dust and debris as required by the General Permit.
Concrete Finishing

- Sweep or vacuum up debris from sandblasting at the end of each shift.
- At the end of each work shift, remove and contain liquid and solid waste from containment structures, if any, and from the general work area.
- Inspect containment structures for damage prior to use and prior to onset of forecasted rain.

References
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


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

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

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

Categories

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Legend:
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- □ Secondary Category

Targeted Constituents

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Potential Alternatives

SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-10 Storm Drain Inlet Protection
SE-14 Biofilter Bags
Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.

- Do not use in locations where ponded water may cause a flooding hazard. Runoff typically ponds temporarily on the upstream side of silt fence.

- Do not use silt fence to divert water flows or place across any contour line. Fences not constructed on a level contour, or fences used to divert flow will concentrate flows resulting in additional erosion and possibly overtopping or failure of the silt fence.

- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.

- Not effective unless trenched and keyed in.

- Not intended for use as mid-slope protection on slopes greater than 4:1 (H:V).

- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.

- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.

- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.

- The maximum slope perpendicular to the fence line should be 1:1.

- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft² of ponding area should be provided for every acre draining to the fence.

- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.

- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
Silt fences should remain in place until the disturbed area is permanently stabilized, after which, the silt fence should be removed and properly disposed.

Silt fence should be used in combination with erosion source controls up slope in order to provide the most effective sediment control.

Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

**Design and Layout**
The fence should be supported by a plastic or wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Woven geotextile material should contain ultraviolet inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 °F to 120 °F.

Layout in accordance with attached figures.

For slopes steeper than 2:1 (H:V) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.

For slopes adjacent to sensitive receiving waters or Environmentally Sensitive Areas (ESAs), silt fence should be used in conjunction with erosion control BMPs.

**Standard vs. Heavy Duty Silt Fence**

*Standard Silt Fence*
- Generally applicable in cases where the slope of area draining to the silt fence is 4:1 (H:V) or less.
- Used for shorter durations, typically 5 months or less
- Area draining to fence produces moderate sediment loads.

*Heavy Duty Silt Fence*
- Use is generally limited to 8 months or less.
- Area draining to fence produces moderate sediment loads.
- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fence fabric has higher tensile strength.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
  - Posts are metal (steel or aluminum)

**Materials**

*Standard Silt Fence*
- Silt fence material should be woven geotextile with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The
reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec\(^{-1}\) and 0.15 sec\(^{-1}\) in conformance with the requirements in ASTM designation D4491.

- Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

**Heavy-Duty Silt Fence**

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts or bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement for health and safety purposes.

**Installation Guidelines – Traditional Method**

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy-duty wire staples at least 1 in. long. The mesh should extend into the trench.

- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.

- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with native material and compacted.

- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where, due to specific site conditions, a 3 ft setback is not available, the silt fence may be constructed at the
toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and more difficult to maintain.

- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case should the reach exceed 500 ft.
- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.
- See typical installation details at the end of this fact sheet.

**Installation Guidelines - Static Slicing Method**

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 inches into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
  - Ease of installation (most often done with a 2 person crew). In addition, installation using static slicing has been found to be more efficient on slopes, in rocky soils, and in saturated soils.
  - Minimal soil disturbance.
  - Greater level of compaction along fence, leading to higher performance (i.e. greater sediment retention).
  - Uniform installation.
  - Less susceptible to undercutting/undermining.

**Costs**

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.
- In tests, the slicing method required 0.33 man hours per 100 linear feet, while the trenched based systems required as much as 1.01 man hours per linear foot.

**Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.
Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.

Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.

Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.

Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

References


NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier. In no case shall the reach length exceed 500'.

2. The last 8'-0" of fence shall be turned up slope.

3. Stake dimensions are nominal.

4. Dimension may vary to fit field condition.

5. Stakes shall be spaced at 8'-0" maximum and shall be positioned on downstream side of fence.

6. Stakes to overlap and fence fabric to fold around each stake on full turn. Secure fabric to stake with 4 staples.

7. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joints. The tops of the stakes shall be secured with wire.

8. For end stake, fence fabric shall be folded around two stakes on full turn and secured with 4 staples.

9. Minimum 4 staples per stake. Dimensions shown are typical.

10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.

11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.

12. Joining sections shall not be placed at sump locations.

13. Sandbag rows and layers shall be offset to eliminate gaps.

14. Add 3-4 bags to cross barrier on downstream side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbances.
Description and Purpose
A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

Suitable Applications
Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
- To act as a grade control structure.

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

Potential Alternatives
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-14 Biofilter Bags
Limitations

- Not to be used in live streams or in channels with extended base flows.

- Not appropriate in channels that drain areas greater than 10 acres.

- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow is expected, as installation may damage vegetation.

- Require extensive maintenance following high velocity flows.

- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.

- Do not construct check dams with straw bales or silt fence.

- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General
Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout
Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a “permanent” ditch or swale being constructed early and used as a “temporary” conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don’t use check dams. Consider alternative BMPs, or.

- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see “Spacing Between Check Dams” detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of
Check Dams

the ditch or swale (see “Typical Rock Check Dam” detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see “Gravel Bag Check Dam” detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer’s instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.

- Check dams should be placed at a distance and height to allow small pools to form between each check dam.

- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.

- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.
Check Dams

- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.

- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.

**Materials**

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.

- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.

- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.

- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.

- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

**Installation**

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.

- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.

- Upper rows or gravel and sand bags shall overlap joints in lower rows.

- Fiber rolls should be trenched in, backfilled, and firmly staked in place.

- Install along a level contour.

- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

**Costs**

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

**Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.
Check Dams

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.

- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.

- Remove accumulated sediment prior to permanent seeding or soil stabilization.

- Remove check dam and accumulated sediment when check dams are no longer needed.

References


Check Dams

ELEVATION

TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE

GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE
'L' = THE DISTANCE SUCH THAT POINTS 'A' AND 'B' ARE OF EQUAL ELEVATION.

SPACING BETWEEN CHECK DAMS
Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

- At the end of a downward slope where it transitions to a steeper slope.

- Along the perimeter of a project.

- As check dams in unlined ditches with minimal grade.

- Down-slope of exposed soil areas.

- At operational storm drains as a form of inlet protection.
Fiber Rolls

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be \(\frac{1}{4}\) to \(\frac{1}{3}\) of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.
Fiber Rolls

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.

- Start building trenches and installing rolls from the bottom of the slope and work up.

- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.

- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.

- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.

- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.

- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.

- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Repair or replace split, torn, unraveling, or slumping fiber rolls.

- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed.
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

- Repair any rills or gullies promptly.

**References**


**Fiber Rolls**

**TYPICAL FIBER ROLL INSTALLATION**

- Install fiber roll along a level contour.
- Vertical spacing measured along the face of the slope varies between 10' and 20'.
- Install a fiber roll near slope where it transitions into a steeper slope.

**ENTRENCHMENT DETAIL**

- Fiber roll 8" min.
- Slope varies.
- 5/4" x 3/4" wood stakes max 4' spacing.
- 12" min.
Gravel Bag Berm SE-6

Description and Purpose
A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

Suitable Applications
Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels

- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Categories

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

Legend:
- Primary Category
- Secondary Category

Targeted Constituents

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

Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Roll
- SE-8 Sandbag Barrier
- SE-14 Biofilter Bags
- At the top of slopes to divert runoff away from disturbed slopes.
- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

**Limitations**
- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Durability of gravel bags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months.
- Easily damaged by construction equipment.
- When used to detain concentrated flows, maintenance requirements increase.

**Implementation**

**General**
A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

**Design and Layout**
- Locate gravel bag berms on level contours.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.
Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.

- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 (H:V) or flatter

- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 (H:V) or flatter.

- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

**Materials**

- **Bag Material:** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd², Mullen burst strength exceeding 300 lb/in² in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
Bag Size: Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

Fill Material: Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs
Material costs for gravel bags are average and are dependent upon material availability. $2.50-3.00 per filled gravel bag is standard based upon vendor research.

Inspection and Maintenance
BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

Reshape or replace gravel bags as needed.

Repair washouts or other damage as needed.

Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

References
Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.


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

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

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

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

- If not mixed with debris or trash, consider incorporating the removed sediment back into the project.

**Costs**

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd³ hopper) to $88/hour (9 yd³ hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

**Inspection and Maintenance**

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- When actively in use, points of ingress and egress must be inspected daily.

- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.

- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.

- Adjust brooms frequently; maximize efficiency of sweeping operations.

- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

**References**


Storm Drain Inlet Protection

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

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

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

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

Legend:
- ✓ Primary Category
- × Secondary Category

Targeted Constituents
- Sediment ✓
- Nutrients ✓
- Trash ×
- Metals
- Bacteria
- Oil and Grease
- Organics

Potential Alternatives
- SE-1 Silt Fence
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-14 Biofilter Bags

CASQA
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Construction
www.casqa.org
Storm Drain Inlet Protection

- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.

- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.

- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General
Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout
Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.

  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.

  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.

- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.
Six types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- **Silt Fence**: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.

- **Excavated Drop Inlet Sediment Trap**: An excavated area around the inlet to trap sediment (SE-3).

- **Gravel bag barrier**: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.

- **Block and Gravel Filter**: Appropriate for flows greater than 0.5 cfs.

- **Temporary Geotextile Storm drain Inserts**: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.

- **Biofilter Bag Barrier**: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.

Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.

Provide area around the inlet for water to pond without flooding structures and property.

Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.

Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

**Installation**

**DI Protection Type 1 - Silt Fence** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.

1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.

2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.

3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.

4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.
5. Backfill the trench with gravel or compacted earth all the way around.

- **DI Protection Type 2 - Excavated Drop Inlet Sediment Trap** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd³/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- **DI Protection Type 3 - Gravel bag** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.
  
  2. Leave room upstream of barrier for water to pond and sediment to settle.
  
  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.
  
  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- **DI Protection Type 4 – Block and Gravel Filter** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.
  
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- **DI Protection Type 5 – Temporary Geotextile Insert (proprietary)** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.
**Storm Drain Inlet Protection**

**DI Protection Type 6 - Biofilter bags** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

1. Construct in a gently sloping area.
2. Biofilter bags should be placed around inlets to intercept runoff flows.
3. All bag joints should overlap by 6 in.
4. Leave room upstream for water to pond and for sediment to settle out.
5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

**Costs**

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

**Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.

- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Inspect and maintain temporary geotextile insert devices according to manufacturer’s specifications.

- Remove storm drain inlet protection once the drainage area is stabilized.
- Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References


NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.
Storm Drain Inlet Protection

Section A-A

Plan

DI PROTECTION TYPE 2

NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.
Storm Drain Inlet Protection

TYPICAL PROTECTION FOR INLET ON SUMP

TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:
1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed.
5. Not applicable in areas with high silts and clays without filter fabric.

DI PROTECTION TYPE 3
NOT TO SCALE
Storm Drain Inlet Protection

Concrete block laid lengthwise on sides @ perimeter of opening

Hardware cloth or wire mesh

Runoff with sediment

Filtered water

D1 PROTECTION — TYPE 4
NOT TO SCALE
Stabilized Construction Entrance/Exit  TC-1

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

Suitable Applications
Use at construction sites:

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

Limitations

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

Categories

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</table>

Legend:
✓ Primary Objective
✗ Secondary Objective

Targeted Constituents

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

Potential Alternatives
None
Implementation

General
A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
Stabilized Construction Entrance/Exit TC-1

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

- Designate combination or single purpose entrances and exits to the construction site.

- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.

- Implement SE-7, Street Sweeping and Vacuuming, as needed.

- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

**Inspection and Maintenance**

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.

- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.

- Keep all temporary roadway ditches clear.

- Check for damage and repair as needed.

- Replace gravel material when surface voids are visible.

- Remove all sediment deposited on paved roadways within 24 hours.

- Remove gravel and filter fabric at completion of construction

**Costs**

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

**References**

Stabilized Construction Entrance/Exit  TC-1


Stabilized Construction Entrance/Exit  TC-1

Crushed aggregate greater than 3” but smaller than 6”
Filter fabric
Original grade
12” Min, unless otherwise specified by a soils engineer

SECTION B-B

NOTE:
Construct sediment barrier and channelize runoff to sediment trapping device

Temporary pipe culvert as needed

50’ or maximum allowed by site or four times the circumference of the largest construction vehicle tire, whichever is greater

PLAN

B

B

Match Existing Grade
Stabilized Construction Entrance/Exit TC-1

Crushed aggregate greater than 3" but smaller than 6''.

Filter fabric

Original grade

12" Min, unless otherwise specified by a soils engineer

SECTION B-B

Crushed aggregate greater than 3" but smaller than 6''.

Corrugated steel panels

Original grade

Filter fabric

12" Min, unless otherwise specified by a soils engineer

SECTION A-A

NOT TO SCALE

NOTE:
Construct sediment barrier and channelize runoff to sediment trapping device

Sediment trapping device

EXISTING PAVED ROADWAY

Corrugated steel panels

10' min or as required to accommodate anticipated traffic, whichever is greater.

or max allowed by site

24'

Match Existing Grade

50' or maximum allowed by site

or four times the circumference of the largest construction vehicle tire, whichever is greater

PLAN

NOTS
Entrance/Outlet Tire Wash

**Description and Purpose**
A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

**Suitable Applications**
Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

**Limitations**
- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

**Implementation**
- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

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

**Legend:**
- ✓ Primary Objective
- ✗ Secondary Objective

**Targeted Constituents**
- Sediment ✓
- Nutrients
- Trash
- Metals
- Bacteria
- Oil and Grease
- Organics

**Potential Alternatives**
TC-1 Stabilized Construction Entrance/Exit
Entrance/Outlet Tire Wash

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.

- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.

- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.

- Implement SC-7, Street Sweeping and Vacuuming, as needed.

**Costs**
Costs are low for installation of wash rack.

**Inspection and Maintenance**
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.

- Inspect routinely for damage and repair as needed.

**References**
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


Entrance/Outlet Tire Wash

12" Min, unless otherwise specified by a soils engineer

Crushed aggregate greater than 3" but smaller than 6"

Corrugated steel panels

Original grade

Filter fabric

SECTION A-A
NOT TO SCALE

Crushed aggregate greater than 3" but smaller than 6"

Original grade

Filter fabric

12" Min, unless otherwise specified by a soils engineer

SECTION B-B
NOT TO SCALE

Ditch to carry runoff to a sediment trapping device

Paved roadway

Match existing grade

Wash Rack

Water supply & hose

NOTE:
Many designs can be field fabricated, or fabricated units may be used.

TYPICAL TIRE WASH
NOT TO SCALE
Description and Purpose
Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

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

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

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

Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds

Concrete compounds

Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.
Hazardous materials storage onsite should be minimized.

Hazardous materials should be handled as infrequently as possible.

Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.

Employees and subcontractors should be trained on the proper material delivery and storage practices.

Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.

If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

**Material Storage Areas and Practices**

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.

- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.

- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.

- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.

- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

- Materials should be covered prior to, and during rain events.

- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.
Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.

Stockpiles should be protected in accordance with WM-3, Stockpile Management.

Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.

Proper storage instructions should be posted at all times in an open and conspicuous location.

An ample supply of appropriate spill clean up material should be kept near storage areas.

Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

Keep an accurate, up-to-date inventory of material delivered and stored onsite.

Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

Contain and clean up any spill immediately.

Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.

See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.

If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

Keep storage areas clean and well organized, including a current list of all materials onsite.

Inspect labels on containers for legibility and accuracy.
Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


Description and Purpose
Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications
This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

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Legend:
- Primary Category
- Secondary Category

Targeted Constituents

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Potential Alternatives
None
Limitations
Safer alternative building and construction products may not be available or suitable in every instance.

Implementation
The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the
application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.

- Train employees and subcontractors in proper material use.

- Supply Material Safety Data Sheets (MSDS) for all materials.

- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.

- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.

- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.

- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.

- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.

- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.

- Document the location, time, chemicals applied, and applicator’s name and qualifications.

- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.

- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.

- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.
Material Use

- Provide containment for material use areas such as masons’ areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

**Costs**
All of the above are low cost measures.

**Inspection and Maintenance**
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Ensure employees and subcontractors throughout the job are using appropriate practices.

**References**
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


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

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

Limitations
- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.

- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.

- Plastic sheeting breaks down faster in sunlight.

- The use of plastic materials should be avoided when feasible and photodegradable plastics should not be used.

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

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

Potential Alternatives
None
On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.

All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.

Protect all stockpiles from stormwater run-on using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.

Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.

Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.

Place bagged materials on pallets and under cover.

Ensure that stockpile coverings are installed securely to protect from wind and rain.

Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

**Protection of Non-Active Stockpiles**

Non-active stockpiles of the identified materials should be protected further as follows:

**Soil stockpiles**

- Cover and project soil stockpiles with soil stabilization measures and a temporary perimeter sediment barrier at all times.

- Consider temporary vegetation for topsoil piles that will be stockpiled for extended periods.

**Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base**

- Provide covers and protect these stockpiles with a temporary perimeter sediment barrier at all times.

**Stockpiles of “cold mix”**

- Cover cold mix stockpiles and place them on plastic sheeting (or comparable material) and surround the stockpiles with a berm all times.

**Stockpiles of fly ash, stucco, hydrated lime**

- Cover stockpiles of materials that may raise the pH of runoff (i.e., basic materials) with plastic and surround the stockpiles with a berm at all times.
Stockpile Management

Stockpiles/Storage of wood (*Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate*)

- Cover treated wood with plastic sheeting (or comparable material) and surround with a berm at all times.

**Protection of Active Stockpiles**

Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.

- Stockpiles of “cold mix” and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.

- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

**Costs**

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

**Inspection and Maintenance**

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).

- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

- Sediment shall be removed when it reaches one-third of the barrier height.

**References**

Description and Purpose
Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications
This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals
Spill Prevention and Control

- Fuels
- Lubricants
- Other petroleum distillates

**Limitations**
- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

**Implementation**
The following steps will help reduce the stormwater impacts of leaks and spills:

**Education**
- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a “significant spill” is for each material they use, and what is the appropriate response for “significant” and “insignificant” spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor’s superintendent or representative oversee and enforce proper spill prevention and control measures.

**General Measures**
- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110, 117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn’t compromise clean up activities.
- Do not bury or wash spills with water.
Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.

Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.

Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.

Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.

Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

**Cleanup**

- Clean up leaks and spills immediately.

- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

**Minor Spills**

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.

- Use absorbent materials on small spills rather than hosing down or burying the spill.

- Absorbent materials should be promptly removed and disposed of properly.

- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

**Semi-Significant Spills**

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.
Spill Prevention and Control

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

**Significant/Hazardous Spills**

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110, 119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

**Reporting**

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.

- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:
Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.

- Regularly inspect onsite vehicles and equipment for leaks and repair immediately.

- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.

- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

- Place drip pans or absorbent materials under paving equipment when not in use.

- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.

- Promptly transfer used fluids to the proper waste or recycling drums. Don’t leave full drip pans or other open containers lying around.

- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.

- Discourage “topping off” of fuel tanks.

- Always use secondary containment, such as a drain pan, when fueling to catch spills/leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.

Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

References
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


Description and Purpose
Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications
This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials
- Highway planting wastes, including vegetative material,
plant containers, and packaging materials

**Limitations**
Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

**Implementation**
The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

**Education**
- Have the contractor’s superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.
Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

Require that employees and subcontractors follow solid waste handling and storage procedures.

Prohibit littering by employees, subcontractors, and visitors.

Minimize production of solid waste materials wherever possible.

**Collection, Storage, and Disposal**

- Littering on the project site should be prohibited.

- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.

- Trash receptacles should be provided in the contractor’s yard, field trailer areas, and at locations where workers congregate for lunch and break periods.

- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.

- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.

- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.

- Construction debris and waste should be removed from the site biweekly or more frequently as needed.

- Construction material visible to the public should be stored or stacked in an orderly manner.

- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.

- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.

- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.

- Segregate potentially hazardous waste from non-hazardous construction site waste.

- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.

Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

**Costs**
All of the above are low cost measures.

**Inspection and Maintenance**
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Inspect construction waste area regularly.

- Arrange for regular waste collection.

**References**


Description and Purpose
Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications
This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products  
- Concrete Curing Compounds  
- Palliatives  
- Septic Wastes  
- Stains  
- Wood Preservatives  
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

- Asphalt Products  
- Pesticides  
- Acids  
- Paints  
- Solvents  
- Roofing Tar

Legend:
- Primary Objective
- Secondary Objective

Targeted Constituents

<table>
<thead>
<tr>
<th>Sediment</th>
<th>Nutrients</th>
<th>Trash</th>
<th>Metals</th>
<th>Bacteria</th>
<th>Oil and Grease</th>
<th>Organics</th>
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Potential Alternatives
None

Categories

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

Potential Alternatives

| Petroleum Products |
| Roofing Tar |
|任何在加利福尼亚州被认定为危险废物的材料，Title 22 Division 4.5，或列出在40 CFR Parts 110, 117, 261, or 302|
Hazardous Waste Management

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

**Limitations**

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

**Implementation**

The following steps will help reduce stormwater pollution from hazardous wastes:

**Material Use**

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.

- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. “Paint out” brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

The following actions should be taken with respect to temporary contaminant:

- Ensure that adequate hazardous waste storage volume is available.
- Ensure that hazardous waste collection containers are conveniently located.
- Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
- Minimize production or generation of hazardous materials and hazardous waste on the job site.
- Use containment berms in fueling and maintenance areas and where the potential for spills is high.
- Segregate potentially hazardous waste from non-hazardous construction site debris.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.
- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.

- Place hazardous waste containers in secondary containment.

- Do not allow potentially hazardous waste materials to accumulate on the ground.

- Do not mix wastes.

- Use all of the product before disposing of the container.

- Do not remove the original product label; it contains important safety and disposal information.

**Waste Recycling Disposal**

- Select designated hazardous waste collection areas onsite.

- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.

- Place hazardous waste containers in secondary containment.

- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.

- Recycle any useful materials such as used oil or water-based paint.

- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- Arrange for regular waste collection before containers overflow.

- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

**Disposal Procedures**

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.

- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.

- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.

- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.
**Hazardous Waste Management**  
**WM-6**

**Education**
- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor’s superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

**Costs**
All of the above are low cost measures.

**Inspection and Maintenance**
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.
Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.

The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.

A copy of the hazardous waste manifests should be provided.

References
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


**Concrete Waste Management**

**Description and Purpose**
Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or onsite in a designated area, and by employee and subcontractor training.

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

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

**Suitable Applications**
Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result from demolition activities.
- Slurries containing portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.

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<thead>
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<th>Categories</th>
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<td>NS</td>
<td>Non-Stormwater Management Control</td>
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<tr>
<td>WM</td>
<td>Waste Management and Materials Pollution Control</td>
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**Legend:**
- ✔ Primary Category
- ✗ Secondary Category

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**Potential Alternatives**
None
Concrete Waste Management WM-8

- Concrete trucks and other concrete-coated equipment are washed onsite.
- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

**Limitations**
- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

**Implementation**
The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or berm area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washout should be lined so there is no discharge into the underlying soil.
- 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.
- See typical concrete washout installation details at the end of this fact sheet.

**Education**
- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
Arrange for contractor’s superintendent or representative to oversee and enforce concrete waste management procedures.

Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

**Concrete Demolition Wastes**

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.
- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

**Concrete Slurry Wastes**

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

**Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures**

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.

Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.

Washout of concrete trucks should be performed in designated areas only.

Only concrete from mixer truck chutes should be washed into concrete washout.

Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.

Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.

Temporary Concrete Washout Facility (Type Above Grade)

- Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

- Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).

- Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage, and should be removed from the site and replaced when the container reaches 75% capacity.

Temporary Concrete Washout Facility (Type Below Grade)

- Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.

- Lath and flagging should be commercial type.

- Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

**Removal of Temporary Concrete Washout Facilities**

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations.

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

**Costs**

All of the above are low cost measures. Roll-off concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

**Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

**References**

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.


**Concrete Waste Management**

**WM-8**

---

**Plan**

**NOT TO SCALE**

**Type: **"Below Grade"

---

**Section A-A**

**NOT TO SCALE**

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**Section B-B**

**NOT TO SCALE**

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**Notes**

1. Actual layout determined in field.

2. The concrete washout sign shall be installed within 30 ft of the temporary concrete washout facility.

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**November 2009**  
California Stormwater BMP Handbook  
Construction  
www.casqa.org
Concrete Waste Management

1. Actual layout determined in field.
2. The concrete washout sign shall be installed within 30 ft of the temporary concrete washout facility.

NOTES
Sanitary/Septic Waste Management   WM-9

Description and Purpose
Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications
Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations
None identified.

Implementation
Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures
- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.
Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.

Consider safety as well as environmental implications before placing temporary sanitary facilities.

Wastewater should not be discharged or buried within the project site.

Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.

Only reputable, licensed sanitary and septic waste haulers should be used.

Sanitary facilities should be located in a convenient location.

Temporary septic systems should treat wastes to appropriate levels before discharging.

If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.

Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.

Sanitary and septic facilities should be maintained in good working order by a licensed service.

Regular waste collection by a licensed hauler should be arranged before facilities overflow.

If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

**Education**

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.

- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.

- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.

- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).

- Establish a continuing education program to indoctrinate new employees.

**Costs**

All of the above are low cost measures.
Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Arrange for regular waste collection.

- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.

- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References


APPENDIX 6
OPERATION AND MAINTENANCE PLAN
OPERATION AND MAINTENANCE OF MaxWell® DRYWELL

The Operation and Maintenance Format will include the following key components:

1.) Inspection Guidelines:

**New installations**
Newly installed systems should receive a thorough visual examination following the first several significant rainfall events. This assessment will assure that there is no standing water, and that runoff or nuisance water flows are being eliminated within the allowable 48 hour draw-down timeframe.

**Ongoing Operations**
At a minimum, the drainage structures should be inspected annually, and within 48 hours following a significant storm event to ensure that there is no standing water in the chambers.

2.) Maintenance Format:

After the first 12-months of entering service, it is recommended that an initial cleaning be undertaken. This will help to establish the amount of accumulated particulate matter and debris to be expected on a yearly basis. Thereafter, the systems should receive inspection at least annually, and cleaning should be undertaken when the evaluation reveals that 15% or more of the original chamber volume is occupied by silt and sediment.

During the maintenance operation, all screens and filters should be serviced and the floating absorbent blankets replaced, along with the geo-textile fabric at the bottom of the chambers. Should repair be needed, descriptions of deficiencies and estimated costs for suggested corrections should be provided. The above information shall be submitted in writing to the Owner at the conclusion of the maintenance service. Replacement is recommended for drywells that no longer dispose of ponded water within 48 hours after cleaning.

3.) Maintenance Records:

A written log shall be kept on-site of all inspections and maintenance performed on the drainage systems.
APPENDIX 7
MAINTENANCE AGREEMENT
COVENANT AND AGREEMENT
REGARDING THE MAINTENANCE OF LOW IMPACT DEVELOPMENT (LID) &
NATIONAL POLLUTANTS DISCHARGE ELIMINATION SYSTEM (NPDES) BMPs

The undersigned, _______________ ("Owner"), hereby certifies that it owns the real
property described as follows ("Subject Property"), located in the County of Los Angeles, State of California:

LEGAL DESCRIPTION

ASSESSOR’S ID # __________________ TRACT NO. __________________ LOT NO. __________________

ADDRESS: _________________________________

Owner is aware of the requirements of the County of Los Angeles’ Green Building Standards Code, Title 31, Section 4.106.4 (LID),
and National Pollutant Discharge Elimination System (NPDES) permit. The following post-construction BMP features have been
installed on the Subject Property:

☐ Porous pavement
☐ Cistern/rain barrel
☐ Infiltration trench/pit
☐ Bioretention or biofiltration
☐ Rain garden/planter box
☐ Disconnect impervious surfaces
☐ Dry Well
☐ Storage containers
☐ Landscaping and landscape irrigation
☐ Green roof
☐ Other:

The location, including GPS x-y coordinates, and type of each post-construction BMP feature installed on the Subject
Property is identified on the site diagram attached hereto as Exhibit 1.

Owner hereby covenants and agrees to maintain the above-described post-construction BMP features in a good and
operable condition at all times, and in accordance with the LID/NPDES Maintenance Guidelines, attached hereto as
Exhibit 2.

Owner further covenants and agrees that the above-described post-construction BMP features shall not be removed from
the Subject Property unless and until they have been replaced with other post-construction BMP features in accordance
with County of Los Angeles’ Green Building Standards Code, Title 31 and NPDES permit.

Owner further covenants and agrees that if Owner hereafter sells the Subject Property, Owner shall provide printed
educational materials to the buyer regarding the post-construction BMP features that are located on the Subject Property,
including the type(s) and location(s) of all such features, and instructions for properly maintaining all such features.

Owner makes this Covenant and Agreement on behalf of itself and its successors and assigns. This Covenant and
Agreement shall run with the Subject Property and shall be binding upon owner, future owners, and their heirs,
successors and assigns, and shall continue in effect until the release of this Covenant and Agreement by the County of
Los Angeles, in its sole discretion.

Owner(s):
By: __________________________ Date: __________________________
By: __________________________ Date: __________________________

(PLEASE ATTACH NOTARY)

REFERENCE

PLAN CHECK NO.: __________________________ DISTRICT OFFICE NO.: __________________________

ATTACHMENTS
COVENANT FOR MAINTENANCE OF WATER QUALITY (WQ) DEVICES

I (we) ________________________________, hereby certify that I (we) am (are) the legal owner(s) of Tract # ____ , and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the WQ system shown on attached Exhibit A map and on Grading Plan GPC # ___________ , on file in the office of the Director of Public Works, in a good and functional condition at least once a year and retain proof of the inspection. The owner(s) shall perform this responsibility, unless the County discharges this obligation through a subsequently recorded written instrument.

The undersigned also covenants and agrees for himself, his heirs, successors, and assigns, to indemnify, defend, and save harmless the County, its agents, officers and employees from and against any and all liability, expenses, including defense costs and legal fees, and claims for damages of any nature whatsoever, including, but not limited to, bodily injury, death, personal injury, or property damage arising from or connected with the construction or maintenance of said work.

Owner(s):

By: ________________________________ Date: ____________________

By: ________________________________ Date: ____________________
APPENDIX 8
BMP INSPECTION MAINTENANCE RECORDS
APPENDIX 9
SOURCE CONTROL MEASURES
S-2: Outdoor Material Storage Area

Purpose

The County defines outdoor material storage areas as areas or facilities whose sole purpose is the storage of materials. Materials, including raw materials, by-products, finished products, and waste products, stored outdoors can become sources of pollutants in stormwater runoff if not handled or stored properly. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity present.

Materials may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Contamination of stormwater runoff may be prevented by eliminating the possibility of stormwater runoff contact with the material storage areas either through diversion, cover, or capture of the stormwater runoff. Design considerations may also include minimizing the storage area. The source control measures presented in this fact sheet must meet local permitting requirements.

Some materials, such as those containing heavy metals or toxic compounds, are of more concern than other materials. Toxic and hazardous materials must be prevented from coming in contact with stormwater runoff. Non-toxic or non-hazardous materials, such as debris and sediment, can also have significant impacts on receiving waters. Contact between non-toxic or non-hazardous materials and stormwater runoff should be limited, and such materials prevented from being discharged with stormwater runoff.

Materials are classified into three categories based on the potential risk of pollutant release associated with stormwater runoff contact – high risk, medium risk, and low risk. General types of materials under each category are presented in Table D-1. The categorization of the potential pollutant risk is used to determine the design specifications, which are presented in Table D-2, for design features at the project site.
Table D-1. Classification of Materials for Potential Pollutant Risk

<table>
<thead>
<tr>
<th>High Risk Materials</th>
<th>Medium Risk Materials</th>
<th>Low Risk Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Recycled materials with discharge potential</td>
<td>• Clean recycled materials without discharge potential</td>
<td>• Washed gravel/rock</td>
</tr>
<tr>
<td>• Corrosives</td>
<td>• Metal (excluding lead and copper, and any metals with oil/grease coating)</td>
<td>• Finished lumber (non-pressure treated)</td>
</tr>
<tr>
<td>• Food items</td>
<td>• Sawdust/bark chips</td>
<td>• Rubber or plastic products (excluding small pieces)</td>
</tr>
<tr>
<td>• Chalk/gypsum products</td>
<td>• Sand/soil</td>
<td>• Clean, precast concrete products</td>
</tr>
<tr>
<td>• Scrap or salvage goods</td>
<td>• Unwashed gravel/rock</td>
<td>• Glass products (new)</td>
</tr>
<tr>
<td>• Feedstock/grain</td>
<td></td>
<td>• Inert products</td>
</tr>
<tr>
<td>• Fertilizers</td>
<td></td>
<td>• Gaseous products</td>
</tr>
<tr>
<td>• Pesticides</td>
<td></td>
<td>• Products in containers that prevent contact with stormwater (fertilizers and pesticides excluded)</td>
</tr>
<tr>
<td>• Compost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Asphalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lime/lye/soda ash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Animal/human wastes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rubber and plastic pellets or other small pieces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Uncured concrete/cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lead and copper, and any metals with oil/grease coating</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Design Specifications

Design specifications for material storage areas are regulated by local building and fire codes, ordinances, and zoning requirements. Source control measures presented in this fact sheet are intended to enhance and be consistent with local code and ordinance requirements while addressing stormwater runoff concerns. The design specifications, presented in Table D-2, must be incorporated into the design of outdoor material storage areas when stored materials could contribute pollutants to the storm drain system. The level of controls required varies relative to the risk category of the material stored.

As general guidance, downspouts and roofs should be directed away from outdoor materials storage areas, and such storage areas should slope towards a dead-end sump to collect stormwater runoff, non-stormwater runoff, and spills. Stormwater runoff, non-stormwater runoff, and spills must be disposed of in accordance with local, state, and federal laws. Locations of design features, including the features presented in Table D-2, must be included on site maps or plans. Additionally, site maps or plans must show all storage areas for chemicals and/or waste materials, with a tank/drum schedule indicating tank capacities, materials of construction, and contents.
Table D-2. Design Specifications for Outdoor Material Storage Areas

<table>
<thead>
<tr>
<th>Design Feature</th>
<th>Design Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surfacing</td>
<td>• High-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o Construct/pave outdoor material storage areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to the materials being stored.</td>
</tr>
<tr>
<td></td>
<td>• Medium-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o Construct/pave outdoor material storage areas with Portland cement concrete.</td>
</tr>
<tr>
<td></td>
<td>• Low-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o There are no requirements for surfacing.</td>
</tr>
<tr>
<td>Enclosures and Covers</td>
<td>• High-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o Place materials in an enclosure such as a shed, cabinet, or other structure that prevents contact with stormwater runoff; or</td>
</tr>
<tr>
<td></td>
<td>o Cover entire storage area with a permanent canopy, roof, or awning to prevent precipitation from making direct contact with and collecting within the storage area. Direct stormwater runoff from the cover away from the storage area to a stormwater runoff disposal point that meets all applicable code, ordinance, and LID Standards Manual requirements. For cover structures that do not include sidewalls, include a roof overhang that extends beyond the grade break.</td>
</tr>
<tr>
<td></td>
<td>o Covers 10 feet high or less should extend a minimum of 3 feet beyond the perimeter of the hydraulically-isolated storage area.</td>
</tr>
<tr>
<td></td>
<td>o Covers higher than 10 feet should extend a minimum of either 20 percent of the cover's height or 5 feet beyond the perimeter of the hydraulically-isolated storage area, whichever is greater.</td>
</tr>
<tr>
<td></td>
<td>o LACDPW may grant waivers for covers on a case-by-case basis.</td>
</tr>
<tr>
<td></td>
<td>• Medium-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o At a minimum, completely cover material with temporary plastic sheeting during storm events.</td>
</tr>
<tr>
<td></td>
<td>• Low-Risk Materials:</td>
</tr>
<tr>
<td></td>
<td>o There are no requirements for enclosures or covers.</td>
</tr>
</tbody>
</table>
Table D-2. Design Specifications for Outdoor Material Storage Areas (continued)

<table>
<thead>
<tr>
<th>Hydraulic Isolation and Drainage</th>
<th>High-Risk Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o Hydraulically-isolate storage area with grading, berms, drains, dikes, or curbs to prevent stormwater run-on from surrounding areas or roof drains.</td>
</tr>
<tr>
<td></td>
<td>o Direct stormwater runoff from surrounding areas away from the hydraulically-isolated storage area to a stormwater runoff disposal point that meets all applicable LID Standards Manual requirements.</td>
</tr>
<tr>
<td></td>
<td>o Drainage facilities are not required for the hydraulically-isolated storage area. However, if drainage facilities are provided, drainage from the hydraulically-isolated storage area must be directed to a stormwater runoff disposal point as determined by LACDPW.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium-Risk Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Drainage from storage area may be allowed, on a case-by-case basis with approval from LACDPW, to a treatment control measure or standard storm drain(s).</td>
</tr>
<tr>
<td>o For erodible material, provide grading and a structural containment barrier on at least three sides of each stockpile to prevent stormwater run-on from surrounding areas and migration of material due to wind erosion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low-Risk Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Provide appropriate drainage from the storage area to minimize contact with materials.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spill Containment</th>
<th>All Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o Implement spill containment measures where materials are stored in tanks, drums, or similar containers and that may potentially enter the storm drain system, sanitary sewer system, or contaminate the soil. Spill containment must be designed for the volume of the largest tank/drum or 10 percent of the tank/drum total (whichever is greater).</td>
</tr>
<tr>
<td></td>
<td>o Separate spill containment systems for all tanks containing incompatible materials such as acids, bases, reactive or flammable materials.</td>
</tr>
<tr>
<td></td>
<td>o Clean, repair, and seal (using epoxy or equivalent sealant compatible with the stored materials) the interior wall and floors within all spill containment areas. Identify the areas to be sealed on the site maps.</td>
</tr>
<tr>
<td></td>
<td>o Bond the contact joint for spill containment walls or dikes constructed on existing concrete, masonry or asphalt to the existing surface. Identify the areas to be bonded on the site maps.</td>
</tr>
<tr>
<td></td>
<td>o Cover the spill containment areas with a roof or awning to minimize collection of stormwater runoff within.</td>
</tr>
<tr>
<td></td>
<td>o Store materials collected in spill containment areas until its quality and an appropriate approved disposal method have been determined.</td>
</tr>
</tbody>
</table>

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate
permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

**Maintenance Requirements**

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor material storage areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Any enclosures and secondary/spill containment areas should be checked periodically to ensure spills are contained efficiently. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.
S-3: Outdoor Trash Storage and Waste Handling Area

Purpose

Stormwater runoff from areas where trash is stored or handled can be polluted. Loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or receiving waters. Waste handling operations (i.e., dumpsters, litter control, waste piles) may be sources of stormwater pollution.

Design Specifications

Wastes from commercial and industrial sites are typically hauled away for disposal by either public or commercial carriers that may have design or access requirements for waste storage areas. Design specifications for waste handling areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications, listed below in Table D-3, are recommendations and are not intended to conflict with requirements established by the waste hauler. The design specifications are intended to enhance local codes and ordinances while addressing stormwater runoff concerns. The waste hauler should be contacted prior to the design of trash storage and collection areas to determine established and accepted guidelines for designing trash collection areas. All hazardous waste must be handled in accordance with the legal requirements established in Title 22 of the California Code of Regulations. Conflicts or issues should be discussed with LACDPW staff.

Table D-3. Design Specifications for Outdoor Trash Storage and Waste Handling Area

<table>
<thead>
<tr>
<th>Design Feature</th>
<th>Design Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surfacing</td>
<td>• Construct/pave outdoor trash storage and waste handling area with Portland cement concrete or an equivalent impervious surface.</td>
</tr>
<tr>
<td>Screens/Covers</td>
<td>• Install a screen or wall around trash storage area to prevent off-site transport of loose trash.</td>
</tr>
<tr>
<td></td>
<td>• Use lined bins or dumpsters to reduce leaking of liquid wastes.</td>
</tr>
<tr>
<td></td>
<td>• Use waterproof lids on bins/dumpsters or provide a roof to cover storage area enclosure (LACDPW discretion) to prevent precipitation from entering containers.</td>
</tr>
<tr>
<td>Grading/Drainage</td>
<td>• Berm and/or grade waste handling area to prevent stormwater run-on.</td>
</tr>
<tr>
<td></td>
<td>• Locate waste handling area at least 35 feet from storm drains.</td>
</tr>
<tr>
<td></td>
<td>• Divert drainage from adjoining roofs and pavement away from adjacent trash storage areas.</td>
</tr>
<tr>
<td>Signs</td>
<td>• Post signs on all dumpsters and/or inside enclosures prohibiting disposal of liquids and hazardous materials in accordance with any waste disposal ordinance.</td>
</tr>
</tbody>
</table>
Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor trash storage and waste handling areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.
S-4: Outdoor Loading/Unloading Dock Area

Purpose

Materials spilled, leaked, or lost during loading or unloading may collect on impervious surfaces or in the soil and be carried away by stormwater runoff or when the area is cleaned. Precipitation may also wash pollutants from machinery used to load or unload materials. In particular, loading docks have the potential to contribute heavy metals, nutrients, suspended solids, oils, and grease to stormwater runoff due to the heavy truck traffic and loading and unloading activities. Depressed loading docks (e.g., truck wells) are contained areas that can also accumulate water.

Design Specifications

Design specifications for outdoor loading/unloading dock areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. Additionally, individual businesses may have their own design or access requirements for loading docks. Design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications presented in Table D-4 are not intended to conflict with requirements established by individual businesses, but should be followed to the maximum extent practicable.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces, such as depressed loading docks. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. If a water quality inlet or infiltration system is installed, it must be maintained as indicated by the manufacturer or installer. Outdoor loading/unloading dock areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.
### Table D-4. Design Specifications for Outdoor Loading/Unloading Dock Area

<table>
<thead>
<tr>
<th>Design Feature</th>
<th>Design Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surfacing</strong></td>
<td>• Construct/pave outdoor loading/unloading dock areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to materials being handled in the loading/unloading dock area.</td>
</tr>
</tbody>
</table>
| **Covers**                      | • Cover outdoor loading/unloading dock areas to a distance of at least 10 feet beyond the loading dock or building face if there is no raised dock. If the cover or roof structure does not include sidewalls, then the roof overhang must extend beyond the grade break. The overhang must extend a minimum of 20 percent of the roof height.  
• For interior transfer bays, provide a minimum 10-foot “No Obstruction Zone” to allow trucks or trailers to extend at least 5 feet inside the building. Identify “No Obstruction Zone” clearly on site plans and paint zone with high visibility floor paint.  
• If covers or interior transfer bays are not feasible, install a seal or door skirt and provide a cover to shield all material transfers between trailers and building.  
• LACDPW may grant waivers for covers on a case-by-case basis. |
| **Hydraulic Isolation/Drainage** | • For outdoor loading/unloading dock areas, hydraulically-isolate the first six feet of paved area measured from the building or dock face with grading, berms, or drains to prevent stormwater run-on from surrounding areas or roof drains. Direct stormwater runoff (e.g., from downspouts/roofs) and drainage from surrounding areas away from hydraulically-isolated areas to a stormwater runoff discharge point that meets all applicable LID Standards Manual requirements.  
• For interior transfer bays or bay doors, prevent stormwater runoff from surrounding areas from entering the building with grading or drains. Do not install interior floor drains in the “No Obstruction Zone”. Hydraulically-isolate the “No Obstruction Zone” from any interior floor drains.  
• Do not install direct connections to storm drains from depressed loading docks. Connect drains or direct drainage from hydraulically-isolated loading/unloading dock area to an approved sediment/oil/water separator system connected a discharge location as determined by LACDPW. Provide a manual emergency spill diversion valve upstream of separator system to direct flow, in the event of a spill, to an approved spill containment vault sized to contain a volume equal to 125% of largest container handled at the facility. Provide additional emergency means, such as drain plugs or drain covers, to prevent spills or contaminated stormwater runoff from entering the storm drain system. |
S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system. The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

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1 If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.
- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.\(^2\)
- Implement Integrated Pest Management practices.

For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

**Maintenance Requirements**

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

\(^2\) As determined by the City of Los Angeles, Building and Safety Division
S-9: Building Materials Selection

Purpose

Building materials can potentially contribute pollutants of concern to stormwater runoff through leaching. For example, metal buildings, roofing, and fencing materials may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. The use of alternative building materials can reduce pollutant sources in stormwater runoff by eliminating compounds that can leach into stormwater runoff. Alternative building materials may also reduce the need to perform maintenance activities (i.e., painting) that involve pollutants of concern, and may reduce the volume of stormwater runoff. Alternative materials are available to replace lumber and paving.

Design Specifications

Lumber

Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.

Roofs, Fencing, and Metals

Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:

- Metal roofs;
- Chain-link fencing and siding; and
- Metal downspouts, vents, flashing, and trim on roofs.

Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic.

Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET-7) in Appendix E.
Pesticides

The use of pesticides around foundations can be reduced through the use of alternative barriers. Sand barriers can be applied around foundations to deter termites, as they cannot tunnel through sand. Metal shields also block termites from tunneling. Additionally, diatomaceous earth can be used to repel or kill a wide variety of other pests.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., signs) must be maintained by the owner/operator as required by local codes and ordinances. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.
APPENDIX 10
HYDROMODIFICATION
DOMINGUEZ CHANNEL & LA HARBOR WATERSHEDS

LEGEND
- DOMINGUEZ CHANNEL & L. A. HARBOR WATERSHED
- UNINCORPORATED AREA
- DAM / LAKE / RESERVOIR
- MAJOR RIVER
- MAJOR CHANNEL

COUNTY OF LOS ANGELES

PACIFIC OCEAN

DOMINGUEZ Channel and L. A. Harbor Watersheds

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

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