Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

LOW IMPACT DEVELOPMENT (LID)

FOR:
PENTAIR
10951 WEST LOS ANGELES AVENUE
MOORPARK, CALIFORNIA 93021
APNs: 511-200-26

OWNER:
AMIR DEVELOPMENT COMPANY
8730 WILSHIRE BOULEVARD, SUITE 300
BEVERLY HILLS, CA 90211
PHONE: (310) 657-8987
CONTACT: STEVEN JUHNKE

MAY 20, 2022

JOB NO. 3885

PREPARED BY:
THIENES ENGINEERING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PHONE: (714) 521-4811
FAX: (714) 521-4173
CONTACT: MIRA BOGDANOVA (mira@thieneseng.com)

LOW IMPACT DEVELOPMENT (LID)

FOR

“PENTAIR”

PREPARED BY MIRA BOGDANOVA
UNDER THE SUPERVISION OF:

5/20/2022

REINHARD STENZEL DATE
R.C.E. 56155
EXP. 12/31/2022

TABLE OF CONTENTS

APPENDICES

Appendix A SWQDv Calculations
Appendix B LID Site Plan
Appendix C BMP Operation and Maintenance
Appendix D Maintenance and Covenant Agreement
Appendix E Educational Materials
Appendix F Infiltration Report

1.0 Project Description

The project site is located at 10951 West Los Angeles Avenue in the City of Moorpark, California (Figure 1), at APNs: 511-200-26 of Ventura County.

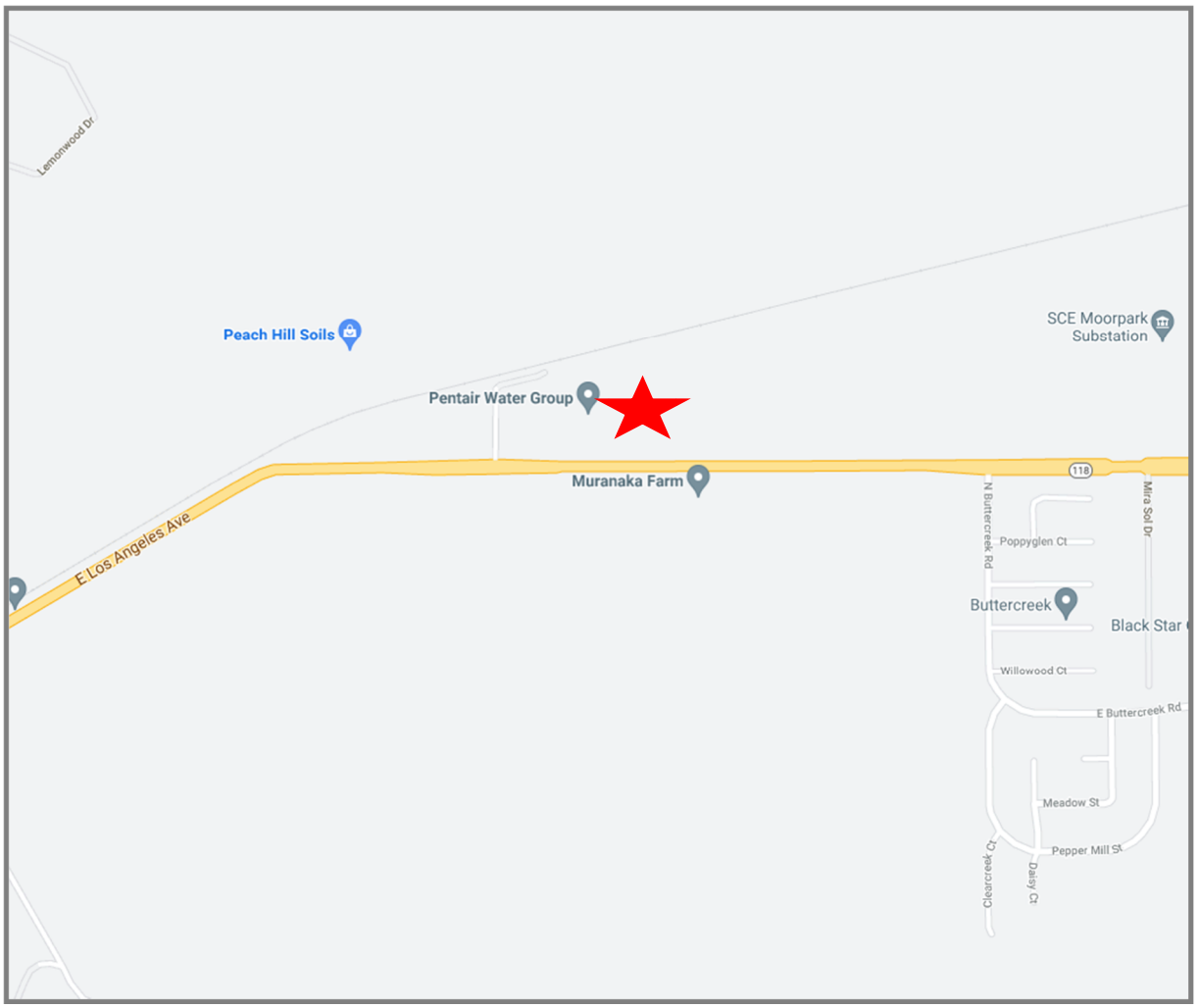


Figure 1 - Vicinity Map (North↑)

The project site encompasses approximately 5.65 acres. Proposed improvements consist of one commercial type building of approximately 90,600 square feet. There will be a truck yard west of the building, vehicle parking lots surrounding the building, and landscape areas scattered throughout the site. The portion of the existing Gabbert Canyon Channel under the site's proposed entry driveway will be replaced with a reinforced concrete box culvert, while the remainder of the channel will remain unchanged.

The entire project site is required to incorporate appropriate LID measures into the design plan. The project will reduce the EIA to less than 5% for the project by retaining the SQDV through the use of an underground retention system.

1.1 Existing Site Description

The project site is an undeveloped dirt lot. It generally surface flows southwesterly to the Gabbert Canyon Channel. An open dirt area immediately to the north of the project and a portion of the easterly neighboring dirt lot surface drains to the site. The existing northerly hillside slopes, north of the railroad tracks, surface drains southerly and crosses under the railroad via a 36-inch pipe, then discharges onto the project site.

1.2 Proposed Site Description

The proposed building, westerly truck yard and northerly parking lot (Subareas 1A-5A, 3.90 acres) drain to catch basins in the truck yard. Runoffs are then conveyed southerly via a proposed onsite storm drain that will connect to the existing Gabbert Canyon Channel.

The easterly and southerly parking lots (Subareas 6B-9B, 1.15 acres) drain southerly to a catch basin in the southerly parking lot. Runoffs from these parking lots are then conveyed westerly via a proposed lateral to the same proposed onsite storm drain system, then southerly to Gabbert Canyon Channel.

The south-westerly drive aisle, immediately north of the site's entry driveway (Subarea 10C, 0.25 acre) drain to a catch basin in the drive aisle. Runoffs from the drive aisle are then conveyed southerly via the same proposed onsite storm drain system to Gabbert Canyon Channel.

The site's southerly frontage landscape area (subarea 11D, 0.30 acres) will surface drain southerly to Gabbert Canyon Channel without being routed to the LID BMPs. This landscape area is considered self-treating areas.

The site's southerly entry driveway fronting Los Angeles Avenue (subarea 12E, 0.05 acres) will surface drain southerly to Los Angeles Avenue without being routed to the LID BMPs.

Tributary offsite flows will be conveyed via proposed storm drains through the project site to Gabbert Canyon Channel under proposed condition, utilizing the same proposed channel connection as the aforementioned onsite flows. Northerly offsite flows will be intercepted by a proposed large grate inlet adjacent to the site's northerly property line (south of existing railroad right-of-way), then conveyed southerly via a proposed 30" storm drain traversing through the site to the proposed connection to Gabbert Canyon Channel. Easterly offsite flows will be intercepted by a proposed C.M.P. riser adjacent to the site's easterly property line, then conveyed southerly via a proposed 18" storm drain traversing through the site to the same proposed connection to Gabbert Canyon Channel.

1.3 Geological Investigation

Per the project's geotechnical engineering investigation performed by NorCal Engineering on July 14, 2020, infiltration is considered feasible. Infiltration rates range from 16.4 to 24.0 in/hr, and an underground retention system will be utilized to meet stormwater treatment requirements. Refer to Appendix F for more information on the subsurface investigation.

2.0 Project Specific Requirements

The project is a new development project that creates one acre or more of impervious surfaces. The design standards apply to the entire development. It also has provision applicable to individual priority project categories for parking lots.

2.1 Peak Storm Water Runoff Discharge Rates

Post-development drainage patterns will continue to travel southerly into Gabbert Canyon Channel. The proposed project will not increase flow rates, volumes, or time of concentration compared to existing conditions.

2.2 Conserve Natural Areas

The following measures are required and should be included in the lot layout, consistent with applicable General Plan and Local Area Plan policies and if appropriate and feasible with the given site conditions:

- *Concentrate or cluster improvements on the least-sensitive portions of the lot and leave the remaining land in a natural undisturbed state; at a minimum, sensitive portions of the lot should include areas covered under Clean Water Act Section 404 such as riparian areas and wetlands;*
- *Limit clearing and grading of native vegetation on the lot to the minimum area needed to build the home, allow access, and provide fire protection; and*
- *Maximize trees and other vegetation at the site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought-tolerant plants.*

The property was previously mass graded with no natural areas to conserve.

2.3 Minimize Storm Water Pollutants of Concern

Stormwater runoff from a site has the potential to contribute oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens to the stormwater conveyance system. The development must be designed so as to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff of directly connected impervious areas (DCIA), to the stormwater conveyance system as approved by the building official. Pollutants of concern, consist of any pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna.

In meeting this specific requirement, "minimization of the pollutants of concern" will require the incorporation of a BMP or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the Maximum Extent Practicable.

Anticipated pollutants generated from the proposed development are:

- Sediment (TSS and Turbidity)
- Nutrients
- Metals/Metalloids
- Pesticides
- Organic Materials/Oxygen Demanding Substances
- Oil and Grease/Organics Associated with Petroleum
- Bacteria and Viruses
- Trash & Debris

The receiving waters and their impairments are:

- Calleguas Creek Reach 6: Ammonia, Chlordane, Chloride, Chlorpyrifos, Diazinon, Dieldrin, Indicator Bacteria, Nitrate and Nitrite, Nitrogen as Nitrate (NO3), Sedimentation/Siltation, Sulfates, Total Dissolved Solids and Toxicity.
- Calleguas Creek Reach 3: Ammonia, Chlordane, Chloride, DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Indicator Bacteria, Nitrate and Nitrite, PCBs (Polychlorinated biphenyls), Sedimentation/Siltation, Total Dissolved Solids, Toxaphene and Trash.
- Calleguas Creek Reach 2: Ammonia, ChemA, Chlordane, Copper, DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Endosulfan, Indicator Bacteria, PCBs (Polychlorinated biphenyls), Sedimentation/Siltation, Toxaphene, Toxicity, and Trash.
- Calleguas Creek Reach 1: Ammonia, ChemA, Chlordane, Copper, DDT (Dichlorodiphenyltrichloroethane), Dieldrin, Endosulfan, Indicator Bacteria, PCBs (Polychlorinated biphenyls), Sedimentation/Siltation, Toxaphene, Toxicity, and Trash.

The pollutants of concern of the project site are:

- Sediment
- Nutrients
- Metals/Metalloids
- Pesticides
- Trash and Debris
- Other Organics
- Bacteria and Viruses
- Salinity
- Toxicity

The proposed project will treat stormwater runoff and disconnect runoff from impervious areas by means of underground retention system.

2.4 Protect Slopes and Channels

Project plans must include BMPs consistent with local codes and ordinances and LID to decrease the potential of slopes and/or channels from eroding and impacting stormwater runoff:

- *Convey runoff safely from the tops of slopes and stabilize disturbed slopes.*
- *Utilize natural drainage systems to the maximum extent practicable.*
- *Control or reduce or eliminate flow to natural drainage systems to the maximum extent practicable.*
- *Stabilize permanent channel crossings.*
- *Vegetate slopes with native or drought tolerant vegetation.*
- *Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion, with the approval of all agencies with jurisdiction, e.g., the U.S. Army Corps of Engineers and the California Department of Fish and Game.*

Existing slopes will remain undisturbed. There are no natural drainage systems or channel crossings to protect.

2.5 Provide Storm Drain System Stenciling and Signage

Storm drain stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets. The stencil contains a brief statement that prohibits the dumping of improper materials into the stormwater conveyance system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna, are effective supplements to the anti-dumping message.

- *All storm drain inlets and catch basins within the project area must be stenciled with prohibitive language (such as: "NO DUMPING – DRAINS TO OCEAN") and/or graphical icons to discourage illegal dumping.*
- *Signs and prohibitive language and/or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area.*
- *Legibility of stencils and signs must be maintained.*

All proposed inlets will be stenciled with prohibitive language and/or graphical icons to prevent dumping. Legibility of the stencils/markers will be maintained on a yearly basis, or as needed.

2.6 Properly Design Outdoor Material Storage Areas

Outdoor material storage areas refer to storage areas or storage facilities solely for the storage of materials. Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following Structural or Treatment BMPs are required:

- *Materials with the potential to contaminate stormwater must be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system; or (2) protected by secondary containment structures such as berms, dikes, or curbs.*
- *The storage area must be paved and sufficiently impervious to contain leaks and spills.*
- *The storage area must have a roof or awning to minimize collection of stormwater within the secondary containment area.*

There are no proposed outdoor material storage areas for this project. Any and all materials will be stored indoors.

2.7 Properly Design Trash Storage Areas

A trash storage area refers to an area where a trash receptacle or receptacles are located for use as a repository for solid wastes. Loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. All trash container areas must meet the following Structural or Treatment Control BMP requirements (individual single family residences are exempt from these requirements):

- *Trash container areas must have drainage from adjoining roofs and pavement diverted around the area(s).*
- *Trash container areas must be screened or walled to prevent off-site transport of trash.*

Trash enclosures will be located away from roof drainage. The bin's lid will remain close when not in use and will be walled off to prevent transport by wind and contact with rainfall.

2.8 Provide Proof of Ongoing BMP Maintenance

Improper maintenance is one of the most common reasons why water quality controls will not function as designed or which may cause the system to fail entirely. It is important to consider who will be responsible for maintenance of a permanent BMP, and what equipment is required to perform the maintenance properly. If Structural or Treatment Control BMPs are required or included in project plans, the applicant must provide verification of maintenance provisions through such means as may be appropriate, including, but not limited to legal agreements, covenants, CEQA mitigation requirements and/or Conditional Use Permits.

The verification will include the developer's signed statement, as part of the project application, accepting responsibility for all Structural and Treatment Control BMP maintenance until the time the property is transferred and, where applicable, a signed agreement from the public entity assuming responsibility for Structural or Treatment Control BMP maintenance. The transfer of property to a private or public owner must have conditions requiring the recipient to assume responsibility for maintenance of any Structural or Treatment Control BMP to be included in the sales or lease agreement for that property, and will be the owner's responsibility. The condition of transfer shall include a provision that the property owners conduct maintenance inspection of all Structural or Treatment Control BMPs at least once a year and retain proof of inspection.

For residential properties where the Structural or Treatment Control BMPs are located within a common area, which will be maintained by a homeowner's association, language regarding the responsibility for maintenance must be included in the project's conditions, covenants and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what stormwater management facilities are present, signs that maintenance is needed, how the necessary maintenance can be performed, and assistance that the Permittee can provide. The transfer of this information shall also be required with any subsequent sale of the property.

Structural or Treatment Control BMPs located within a public area proposed for transfer will be the responsibility of the developer until accepted for transfer by the appropriate public agency. Structural or Treatment Control BMPs proposed for transfer must meet design standards adopted by the public entity for the BMP installed and should be approved by the appropriate public agency prior to its installation.

The property owner/operator will maintain proof of ongoing maintenance at the site as recorded in the covenant and agreement (see Appendix D).

2.9 Design Standards for Structural or Treatment Controls BMPs

The following categories of Planning Priority Projects are required to design and implement post-construction treatment controls to mitigate stormwater pollution:

- *a) Single-family hillside residential developments of one acre or more of surface area;*
- *b) Housing developments (includes single family homes, multifamily homes, condominium, and apartments) of ten units or more;*
- *c) A 43,560 square feet or more impervious surface area industrial/commercial development;*
- *d) Automotive service facilities (SIC 5013, 5014, 5541, 7532-7534 and 7536-7538) [5,000 square feet or more of surface area];*
- *e) Retail gasoline outlets [5,000 square feet or more of impervious surface area and with projected Average Daily Traffic (ADT) of 100 or more vehicles]. Subsurface Treatment Control BMPs which may endanger public safety (i.e., create an explosive environment) are considered not appropriate;*
- *f) Restaurants (SIC 5812) [5,000 square feet or more of surface area];*
- *g) Parking lots 5,000 square feet or more of surface area or with 25 or more parking spaces;*
- *h) Projects located in, adjacent to or discharging directly to an ESA that meet the following threshold conditions:*
    - *(1) Discharge stormwater and urban runoff that is likely to impact a sensitive biological species or habitat; and*
    - *(2) Create 2,500 square feet or more of impervious surface area.*
- *i) Redevelopment projects in subject categories that meet Redevelopment thresholds.*

The project is required to incorporate appropriate stormwater mitigation measures into the design plan for the entire site. The proposed project will treat and mitigate flows per LID guidelines by

effectively treating the pollutants of concern by means of underground storage and proprietary biofiltration units.

2.10 Provisions Applicable to Individual Priority Project Categories

2.10.A Single Family Hillside Home

The project site is not a single family hillside development.

2.10.A.1 Conserve Natural Areas

The project site is not a single family hillside development.

2.10.A.2 Protect Slopes and Channels

The project site is not a single family hillside development.

2.10.A.3 Provide Storm Drain System Stenciling and Signage

The project site is not a single family hillside development.

2.10.A.4 Divert Roof Runoff to Vegetated Areas Before Discharge

The project site is not a single family hillside development.

2.10.A.5 Direct Surface Flow to Vegetated Areas Before Discharge

The project site is not a single family hillside development.

2.10.B 43,560 Square Feet Industrial/Commercial Developments

2.10.B.1 Properly Design Loading/Unloading Dock Areas

Loading/unloading dock areas have the potential for material spills to be quickly transported to the storm water conveyance system. To minimize this potential, the following design criteria are required:

- *Cover loading dock areas or design drainage to minimize run-on and runoff of storm water.*
- *Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.*

The proposed project will construct one aboveground truck dock. The concrete surface is designed to minimize run-on to the loading docks and will be treated by underground retention. A hydrodynamic separator will be utilized to filter out pollutants prior to entering the

underground retention system. Additionally, the proposed building will be utilized as a warehouse for finished goods and consequently, items being loaded and unloaded do not have the potential to contribute to stormwater pollution.

2.10.B.2 Properly Design Repair/Maintenance Bays

Oil and grease, solvents, car battery acid, coolant and gasoline from the repair/maintenance bays can negatively impact storm water if allowed to come into contact with storm water runoff. Therefore, design plans for repair bays must include the following:

- *Repair/maintenance bays must be indoors or designed in such a way that do not allow storm water run-on or contact with storm water runoff.*
- *Design a repair/maintenance bay drainage system to capture all washwater, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.*

Not applicable, the proposed project will not include any repair or maintenance bays.

2.10.B.3 Properly Design Vehicle/Equipment Wash Areas

The activity of vehicle/equipment washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the stormwater conveyance system. Project plans are required to designate an area for washing/steam cleaning of vehicles and equipment. This area is required to be:

- *Self-contained and/or covered, equipped with a clarifier, or other pretreatment facility, and properly connected to a sanitary sewer or to a permitted disposal facility.*

Not applicable, the proposed project will not include any vehicle/equipment wash areas.

2.10.C Restaurants

2.10.C.1 Properly Design Equipment/Accessory Wash Areas

The activity of outdoor equipment/accessory washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the storm water conveyance system. Include in the project plans an area for the washing/steam cleaning of equipment and accessories. This area must be:

- *Self-contained, equipped with a grease trap, and properly connected to a sanitary sewer.*
- *If the wash area is to be located outdoors, it must be covered, paved, have secondary containment, and be connected to the sanitary sewer.*

The proposed project is not a restaurant.

2.10.D Retail Gasoline Outlets

2.10.D.1 Properly Design Fueling Area

Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the storm water conveyance system. The project plans must include the following BMPs:

- *The fuel dispensing area must be covered with an overhanging roof structure or canopy. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the fueling area.*
- *The fuel dispensing area must be paved with Portland cement concrete (or equivalent smooth impervious surface), and the use of asphalt concrete shall be prohibited.*
- *The fuel dispensing area must have a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable.*
- *At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.*

The proposed project is not a retail gasoline outlet.

2.10.E Automotive Repair Shops

2.10.E.1 Properly Design Fueling Area

Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the storm water conveyance system. The project plans must include the following BMPs:

- *The fuel dispensing area must be covered with an overhanging roof structure or canopy. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the fueling area.*
- *The fuel dispensing area must be paved with Portland cement concrete (or equivalent smooth impervious surface), and the use of asphalt concrete shall be prohibited.*
- *The fuel dispensing area must have a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable.*
- *At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.*

Not applicable, no fuel dispensing areas proposed.

2.10.E.2 Properly Design Repair/Maintenance Bays

Oil and grease, solvents, car battery acid, coolant and gasoline from the repair/maintenance bays can negatively impact storm water if allowed to come into contact with storm water runoff. Therefore, design plans for repair bays must include the following:

- *Repair/maintenance bays must be indoors or designed in such a way that doesn't allow storm water run-on or contact with storm water runoff.*
- *Design a repair/maintenance bay drainage system to capture all wash-water, leaks and spills.*
- *Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.*

The proposed project is not an automotive repair shop.

2.10.E.3 Properly Design Vehicle/Equipment Wash Areas

The activity of vehicle/equipment washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the storm water conveyance system. Include in the project plans an area for washing/steam cleaning of vehicles and equipment. This area must be:

- *Self-contained and/or covered, equipped with a clarifier, or other pretreatment facility, and properly connected to a sanitary sewer or to a permitted disposal facility.*

The proposed project is not an automotive repair shop.

2.10.E.4 Properly Design Loading/Unloading Dock Areas

Loading/unloading dock areas have the potential for material spills to be quickly transported to the storm water conveyance system. To minimize this potential, the following design criteria are required:

- *Cover loading dock areas or design drainage to minimize run-on and runoff of storm water.*
- *Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.*

The proposed project is not an automotive repair shop.

2.10.F Parking Lots

2.10.F.1 Properly Design Parking Area

Parking lots contain pollutants such as heavy metals, oil and grease, and polycyclic aromatic hydrocarbons that are deposited on parking lot surfaces by motor-vehicles. These pollutants are

directly transported to surface waters. To minimize the offsite transport of pollutants, the following design criteria are required:

- *Reduce impervious land coverage of parking areas.*
- *Infiltrate runoff before it reaches storm drain system.*
- *Treat runoff before it reaches storm drain system.*

The proposed project is designed so that pollutants from the impervious surfaces are disconnected prior to discharging offsite. Runoff from the parking lots are transported through underground retention system for treatment.

2.10.F.2 Properly Design to Limit Oil Contamination and Perform Maintenance

Parking lots may accumulate oil, grease, and water insoluble hydrocarbons from vehicle drippings and engine system leaks.

- *Treat to remove oil and petroleum hydrocarbons at parking lots that are heavily used (e.g. fast food outlets, lots with 25 or more parking spaces, sports event parking lots, shopping malls, grocery stores, discount warehouse stores).*
- *Ensure adequate operation and maintenance of treatment systems particularly sludge and oil removal, and system fouling and plugging prevention control.*

The project owner will ensure that grease and oil are contained. The parking lot will be swept on a monthly basis, minimum, and before any rain events. Absorbent materials will be used to collect any spilled oil, and disposed of properly, to ensure they do not contaminate stormwater. The entire site will utilize hydrodynamic separators to collect drainage from impervious areas prior to flowing through the underground retention system for treatment. Hydrocarbon booms and oil skimmers from the hydrodynamic separators improve removal efficiency.

2.11 Waiver

A Permittee may, through adoption of an ordinance or code incorporating the treatment requirements of the SUSMP, provide for a waiver from the requirement if impracticability for a specific property can be established. A waiver of impracticability shall be granted only when all other Structural or Treatment Control BMPs have been considered and rejected as infeasible. Recognized situations of impracticability include, (i) extreme limitations of space for treatment on a redevelopment project, (ii) unfavorable or unstable soil conditions at a site to attempt infiltration, and (iii) risk of ground water contamination because a known unconfined aquifer lies beneath the land surface or an existing or potential underground source of drinking water is less than 10 feet from the soil surface. Any other justification for impracticability must be separately petitioned by the Permittee and submitted to the Regional Board for consideration. The Regional Board may consider approval of the waiver justification or may delegate the authority to approve a class of waiver justifications to the Regional Board Executive Officer. The supplementary waiver justification becomes recognized and effective only after approval by the Regional Board or the Regional Board Executive Officer. A waiver granted by a Permittee

to any development or redevelopment project may be revoked by the Regional Board Executive Officer for cause and with proper notice upon petition.

The proposed project does not require a waiver of impracticability from any LID conditions.

2.12 Mitigation Funding

The Permittees may propose a management framework, for endorsement by the Regional Board Executive Officer, to support regional or sub-regional solutions to storm water pollution, where any of the following situations occur:

- *A waiver for impracticability is granted;*
- *Legislative funds become available;*
- *Off-site mitigation is required because of loss of environmental habitat; or*
- *An approved watershed management plan or a regional storm water mitigation plan exists that incorporates an equivalent or improved strategy for storm water mitigation.*

No management framework for mitigation funding is necessary for the proposed project.

Funding will be the responsibility of the owner:

Amir Development Company
8730 Wilshire Boulevard, Suite 300
Beverly Hills, CA 90211
Phone: (310) 657-8987
Contact: Steven Juhnke

2.13 Limitation on Use of Infiltration BMPs

Three factors significantly influence the potential for storm water to contaminate ground water. They are (i) pollutant mobility, (ii) pollutant abundance in storm water, (iii) and soluble fraction of pollutant. The risk of contamination of groundwater may be reduced by pretreatment of storm water. A discussion of limitations and guidance for infiltration practices is contained in, Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration, Report No. EPA/600/R-94/051, USEPA (1994).

In addition, the distance of the groundwater table from the infiltration BMP may also be a factor determining the risk of contamination. A water table distance separation of ten feet depth in California presumptively poses negligible risk for storm water not associated with industrial activity or high vehicular traffic.

Infiltration BMPs are not recommended for areas of industrial activity or areas subject to high vehicular traffic (25,000 or greater average daily traffic (ADT) on main roadway or 15,000 or more ADT on any intersecting roadway) unless appropriate pretreatment is provided to ensure groundwater is protected and the infiltration BMP is not rendered ineffective by overload.

See Section 1.3 of this LID report for details.

2.14 Alternative Certification for Storm Water Treatment Mitigation

In lieu of conducting detailed BMP review to verify Structural or Treatment Control BMPs adequacy, a Permittee may elect to accept a signed certification from a Civil Engineer or a Licensed Architect registered in the State of California, that the plan meets the criteria established herein. The Permittee is encouraged to verify that certifying person(s) have been trained on BMP design for water quality, not more than two years prior to the signature date. Training conducted by an organization with storm water BMP design expertise (e.g., a University, American Society of Civil Engineers, American Society of Landscape Architects, American Public Works Association, or the California Water Environment Association) may be considered qualifying.

A California licensed civil engineer has provided a detailed BMP review of this report.

2.15 Resources and Reference

California Storm Water Best Management Practices Handbooks for New Development and Redevelopment (2003) and Industrial/Commercial (2014).

3.0 Low Impact Development

BMPs shall be implemented in the following order of preference:

1) **BMPs that promote infiltration**
   a) **Infiltration is feasible and the project will utilize an underground retention system**.

2) BMPs that store and beneficially use stormwater runoff

3) BMPs that utilize the runoff for other water conservation uses including, but not limited to, BMPs that incorporate vegetation to promote pollutant removal and runoff volume reduction and integrate multiple uses, and BMPs that percolate runoff through engineered soil and allow it to discharge downstream slowly.

APPENDIX A

SWQDv Calculations

Table 6-4: Infiltration Facility Safety Factor Determination Worksheet
DA 1

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	2	0.50
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
		Combined Safety Factor, $S_{TOT} = S_A \times S_B$			**2.1875**
Measured Infiltration Rate, in/hr					8.2
Design Infiltration Rate, in/hr					**3.75**

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

FLOW-BASED BMP DESIGN (pretreatment)

$C_{BMP} = 0.858(imp)^3 - 0.78(imp)^2 + 0.774(imp) + 0.04$
i = 0.2 in/hr
SQDF = C * i * Area

DA 1 – BAR "A"

Drainage Area (acres)	**A =**	5.65	acres
Drainage Area (sq-ft)		**246,114**	sq-ft
Impervious Coeff		0.95	< 1.0
Runoff Coeff	**C =**	**0.81**	
Rainfall Intensity	**i =**	**0.2**	
Flow (cfs)	SQDF =	**0.91**	

ADS Barracuda S4
Q-required = 0.91 cfs
Q-provided = 1.25 cfs

Project Name: PentAir Site

STEP 5: APPLY BMPS TO REDUCE EIA TO <=5%

New development and redevelopment projects (Categories 1-6, 8, and 9) must reduce EIA to <=5%

Step 5a: Calculate Allowable EIA

EIA is defined as impervious area that is hydrologically connected via sheet flow over a hardened conveyance or impervious surface without any intervening medium to mitigate flow volume.

The allowable "EIA" for a project is calculated as:

$$EIA_{allowable} = (A_{project})*(\%_{allowable}) \quad \text{Equation 2-1}$$

Where:

$EIA_{allowable}$ = The maximum impervious area from which runoff can be treated and discharged offsite (and not retained onsite) [acres]

$A_{project}$ = The total project area [acres] [1]

$\%_{allowable}$ = 5 percent

Input:		**Units**
$A_{project}$ [1]	5.65	Acres
$\%_{allowable}$	5.00%	Percent
$EIA_{allowable}$	**0.28**	Acres

Step 5b: Calculate Impervious Area to be Retained

The impervious area from which runoff must be retained onsite is the total impervious area minus the EIA allowable, which should be calculated as follows:

$$A_{retain} = TIA - EIA_{allowable} = (IMP*A_{project}) - EIA_{allowable} \quad \text{Equation 2-2}$$

Where:

A_{retain} = the drainage area from which runoff must be retained [acres]

TIA = total impervious area [acres]

IMP = imperviousness of project area (%)

Input:		**Units**
Imperviousness	95.00%	
$A_{project}$ [1]	5.65	Acres
$EIA_{allowable}$	0.28	Acres
A_{retain}	**5.09**	Acres

Project Name: PentAir Site

BMPS TO REDUCE EIA TO <=5%, CONT.

Step 5c: Calculate the Volume to be Retained (SQDV)

The runoff volume that is to be retained onsite should be calculated using Equation 2-3 below:

$$V_{retain} = C*(0.75/12)*A_{retain}$$ Equation 2-3

Where:

V_{retain} = The stormwater quality design volume (SQDV) that must be retained onsite [ac-ft]

C = runoff coefficient (equals 0.95 for impervious surfaces)

Input:		**Units**
C	0.95	
A_{retain}	5.09	Acres
V_{retain}	0.302	ac-ft
	98,382.3	gallons
	13,151.7	cu.ft.

Continue to Step 5d

VOLUME-BASED BMP DESIGN

Design infiltration rate = 3.75 in/hr
d_{max} = 180 inches = Design infiltration rate x 48 hours = 3.75 in/hr x 48 hrs
d_{BMP} = 34.8 inches = [(6 inches + 6 inches) x 0.40] + 30 inches
$d_{max} > d_{BMP}$

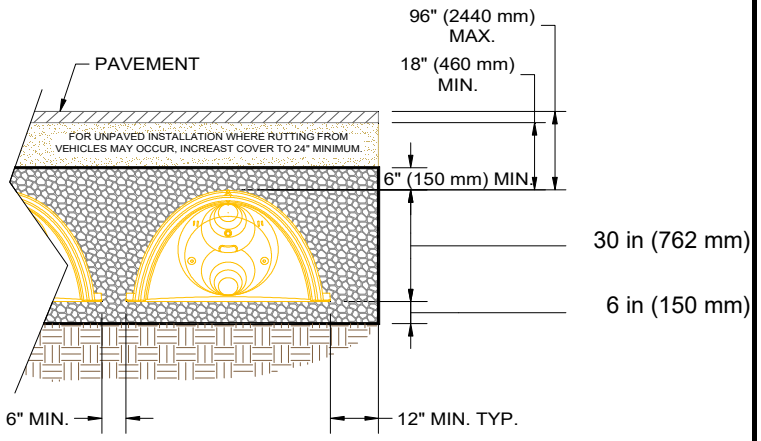
StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management℠

Units: **Imperial**

Project: PentAir
By:
Point of Contact
Date:

System Requirements

Required Storage Volume	**13,152**	CF
Select Stormtech Chamber System	SC-740	
Stone Porosity (Industry Standard = 40%)	**40%**	
Stone Foundation Depth	6	Inches
Storage Volume Per Chamber	74.90	CF
Avg Cover over Chambers (18 in min. & 96 in max.)	18	Inches
Number of Chambers Required	176	Each
Required Bed Size	6,325	SF
Tons of Stone Required	729	Tons
Volume of Excavation	1,054	CY
Area of Filter Fabric	1,787	SY
# of End Caps Required	**18**	Each
Length of ISOLATOR ROW	**142.4**	FT
ISOLATOR FABRIC	**79**	SY



Is the limiting dimension for the bed the width or length? **width**

Controlled by Width (Rows)

Width	**45**	FT
# of Chambers Long	20	EA
# of Rows	9	EA
Actual Length	146.00	FT
Actual Width	44.25	FT

4 of the chambers rows will contain only 19 chambers

Controlled by Length

Length	**100**	FT
# of Chambers Long	-	EA
# of Rows	-	EA
Actual Length	-	FT
Actual Width	-	FT

Material Estimate

To use this sheet: Please enter data into the blue and green cells. If switching between Imperial and Metric units please check the correct units and data is input in the green cells.

Please call StormTech @ 888-892-2694 for conceptual cost estimates.

APPENDIX B

LID Site Plan

Last Update:1/11/22
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"VICINITY MAP"

FOR

PENTAIR SITE

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

RAILROAD

EX 36" S.D.

INLET FOR OFFSITE RUN-ON

SD FOR OFFSITE RUN-ON

1A 0.40 AC

2A 1.35 AC

3A 0.45 AC

4A 0.65 AC

5A 1.05 AC

6B 0.20 AC

7B 0.30 AC

8B 0.25 AC

9B 0.40 AC

10C 0.25 AC

12E 0.05 AC

11D 0.30 AC

RD

INLET FOR OFFSITE RUN-ON

SD FOR OFFSITE RUN-ON

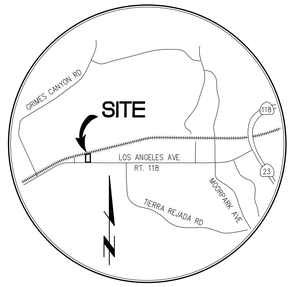
SD CONNECTION TO GABBERT CANYON CHANNEL

GABBERT CANYON CHANNEL

E. LOS ANGELES AVENUE

N.A.P.

N.A.P.



VICINITY MAP

N.T.S.

LEGEND

1. LOADING/UNLOADING DOCKS
2. LANDSCAPE/IRRIGATION
3. STORM DRAIN STENCIL: "NO DUMPING-DRAINS TO RIVER"
4. TRASH ENCLOSURE
5. STORMTECH SC-740 CHAMBERS FOR INFILTRATION
6. HYDRODYNAMIC SEPARATOR (MODEL SHOWN ON PLAN)

NOTES:

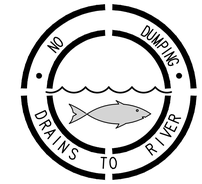
RD ROOF DRAIN

BOUNDARY

DRAINAGE AREAS

SURFACE FLOW DIRECTION

SD FLOW DIRECTION



SAMPLE STENCIL TO BE USED NEAR GRATE AND CURB OPENING INLETS

0 15 30 60 90

SCALE: 1"=30'

Last Update:5/24/22
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CITY OF MOORPARK

PUBLIC WORKS DEPARTMENT

LID SITE MAP

PENTAIR

LOS ANGELES AVENUE MOORPARK, CA

3885/1 OF 2 SHEETS

PREPARED FOR:

AMIR DEVELOPMENT COMPANY
8730 WILSHIRE BOULEVARD, SUITE 300
BEVERLY HILLS, CA 90211
PHONE: (310) 657-8987

PREPARED BY:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH:(714)521-4811 FAX:(714)521-4173

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____

Public Works Director _____ R.C.E. _____

Sheet 1 of 2 Sheets

STORMTECH SC-740 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH SC-740 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

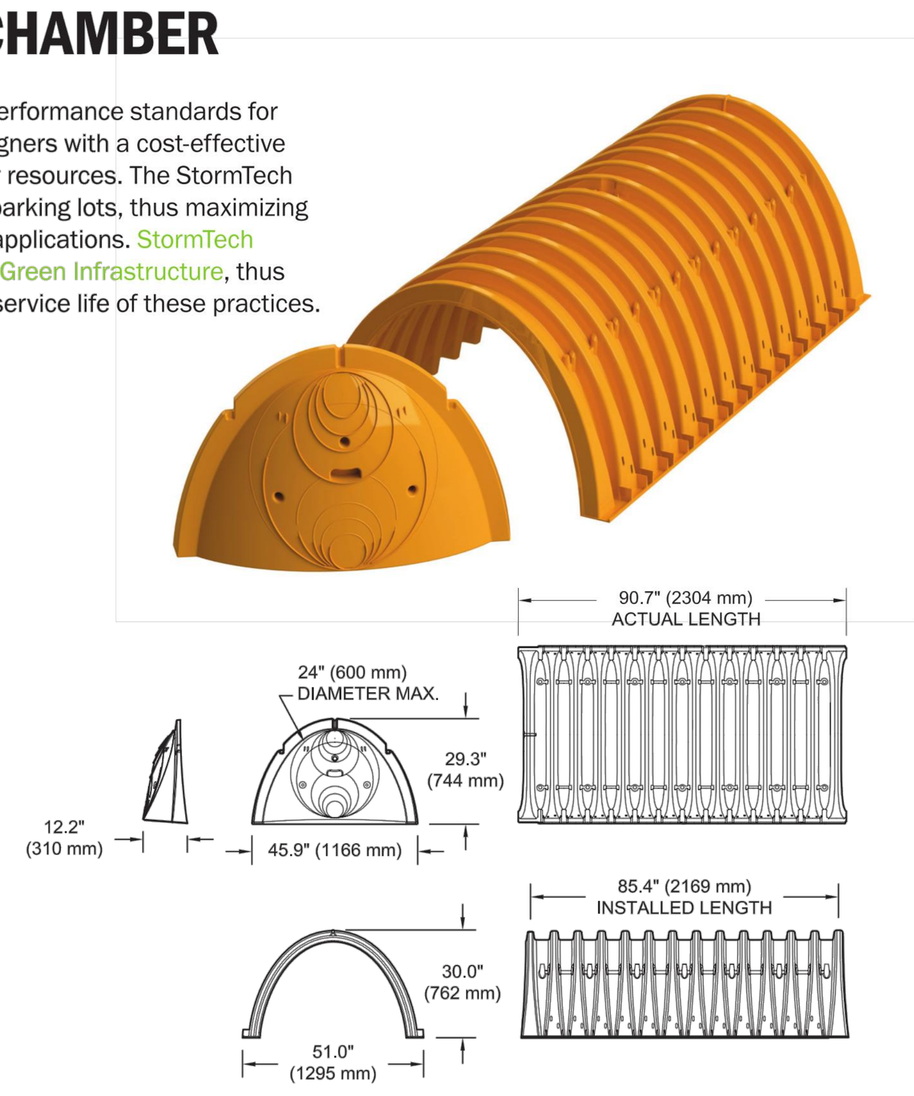
Chamber Storage
45.9 ft³ (1.30 m³)

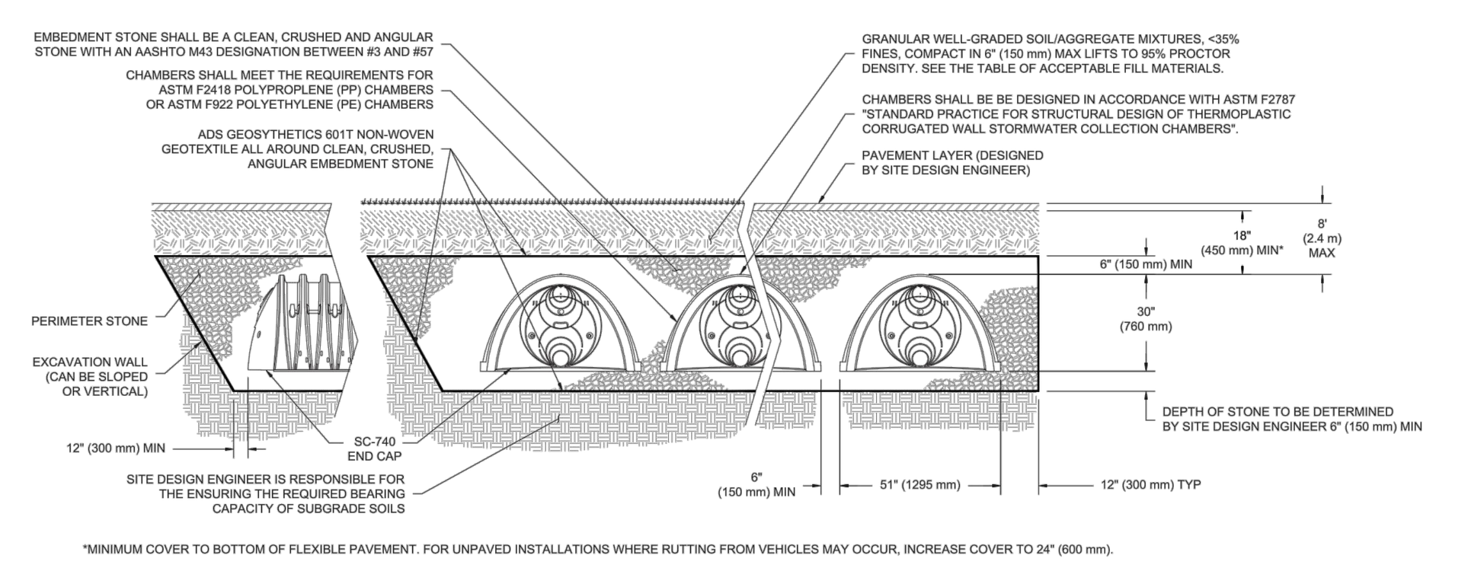
Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.





SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	↑	45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)	↓	45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)	↑	0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)	↓	0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

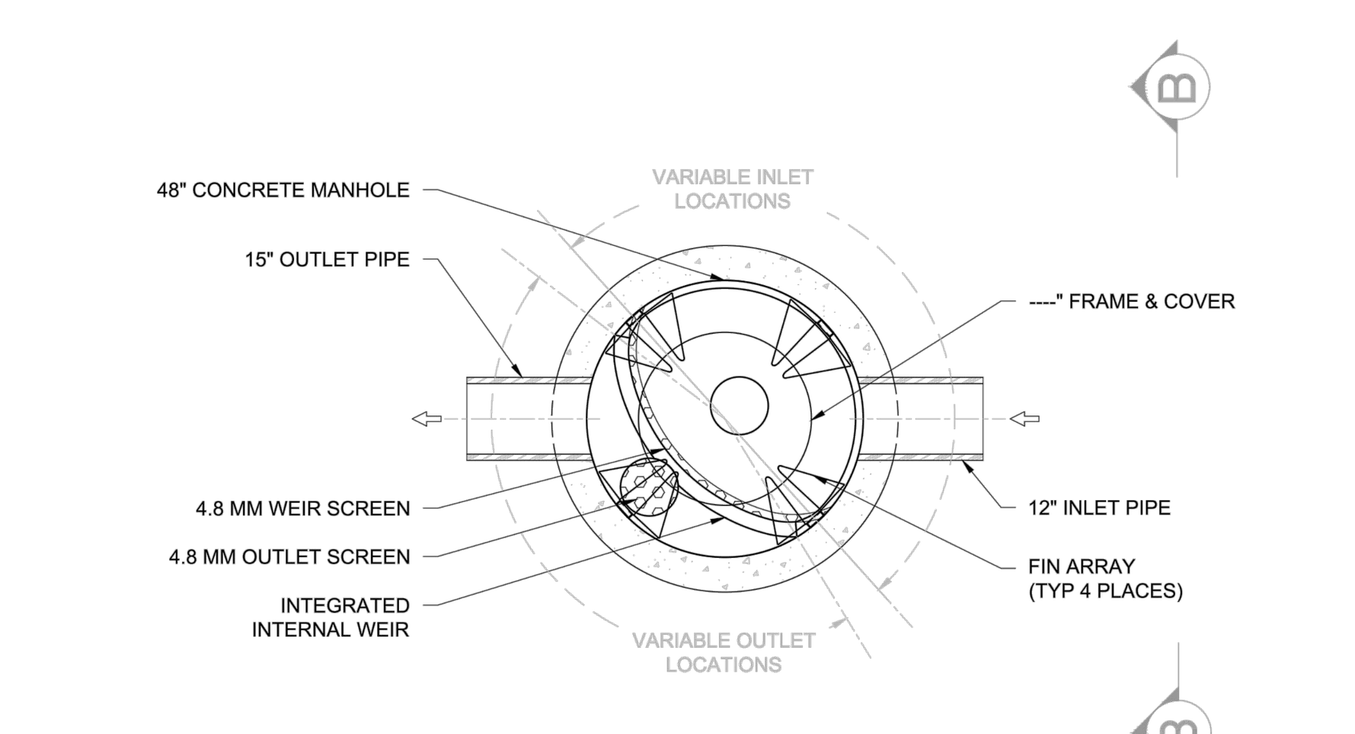
Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.

Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

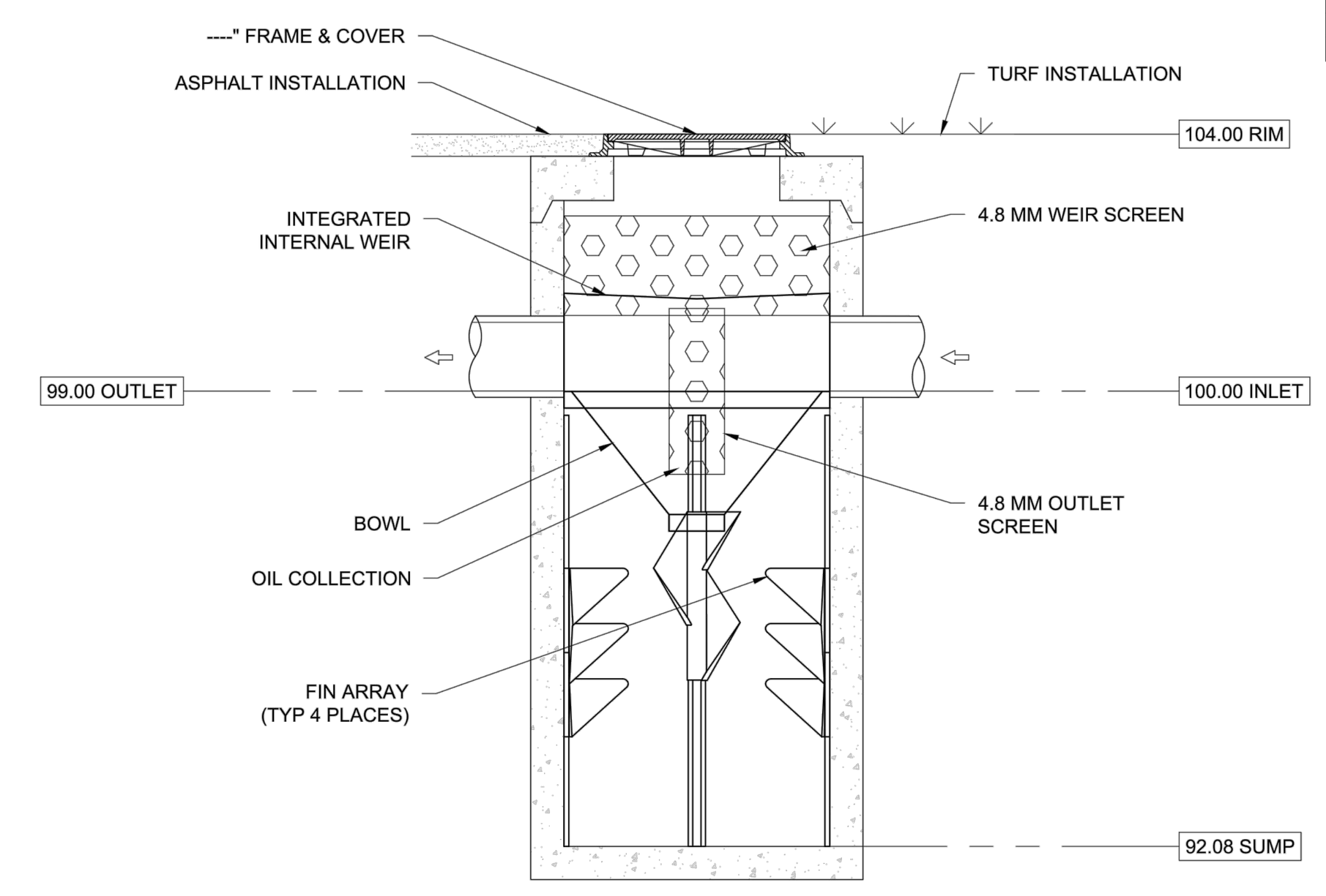
THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

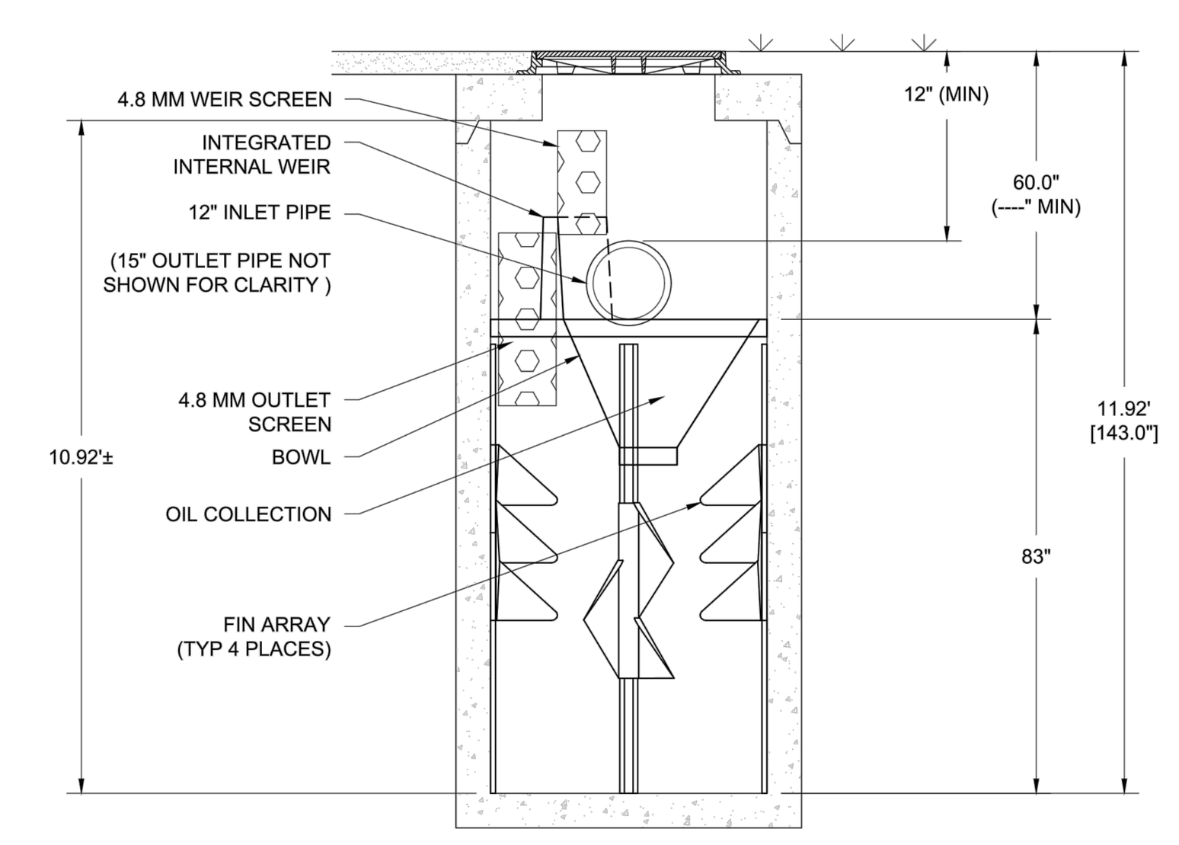


PLAN VIEW
NTS

BARRACUDA S4	
UNIT ID	SW#!
PEAK FLOW RATE (CFS)	
TREATMENT FLOW RATE (CFS)	



SECTION VIEW A-A
NTS



SECTION VIEW B-B
NTS

BARRACUDA S4
STANDARD DETAIL
DATE: 10/20/17 DRAWN: EKH
PROJECT #: CHECKED: ---

REV	DWN	CKD	DESCRIPTION

Barracuda® 1030 Deer Hollow Drive, Mount Airy, MD 21771, 1-800-BAYSAVER, 1-800-229-7283

ADS ADVANCED DRAINAGE SYSTEMS, INC. 4640 TRUEMAN BLVD HILLIARD, OH 43026

NOT TO SCALE

SHEET 1 OF 1

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Last Update: 5/24/22
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CITY OF MOORPARK
PUBLIC WORKS DEPARTMENT

LID SITE MAP

PENTAIR

LOS ANGELES AVENUE
MOORPARK, CA

PREPARED FOR:
AMIR DEVELOPMENT COMPANY
8730 WILSHIRE BOULEVARD, SUITE 300
BEVERLY HILLS, CA 90211
PHONE: (310) 657-8987

PREPARED BY:
Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by ______ Date ______
Checked by ______ Date ______
Designed by ______ Date ______
Checked by ______ Date ______

Approved by ______ Date ______
Public Works Director R.C.E. ______

Sheet 2 of 2 Sheets

3885/2 OF 2 SHEETS

APPENDIX C

BMP Operation and Maintenance

BMP Operation and Maintenance			
BMP	**Operation/Maintenance**	**Inspection Frequency**	**Responsibility**
Storm Drain Stencil and Signage	➢ Visually inspect for legibility and replace/repaint as necessary.	Annually	Owner
Parking Lot Sweeping	➢ At a minimum, sweep on a monthly basis.	Monthly (minimum)	Owner
Underground Chambers	➢ The isolator row shall be inspected semi-annually (October 1st and February 1st) and maintained once sediment depth is greater than 3-inches. The isolator row shall be inspected and maintained by a qualified technician and he/she will properly dispose of all wastes. A manhole is installed in order to inspect and maintain the isolator row. It is installed per OSHA codes to ensure operator and inspector safety.	Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.	Owner
Hydrodynamic Separator	➢ Open access hatches or manholes. Remove gross solids from screening basket upon reaching 25% capacity. Hinges open the bottom screen panels to access sedimentation chambers. Vacuum out sedimentation chamber when any chamber reaches 25% capacity.	Inspected semi-annually (by October 1st and February 1st) and maintained, upon reaching 25% capacity, through maintenance service contract with the vendor or equally qualified contractor.	Owner
Maintenance Log	➢ Keep a log of all inspection and maintenance performed on the above mentioned BMPs for at least 5 years. Keep this log on-site.	Ongoing	Owner

I.10 Proprietary Device Inspection and Maintenance Checklist

Date:_____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility:_____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Refer to the manufacturer's instructions for maintenance/inspection requirements, below are generic guidelines to supplement manufacturer's recommendations.				
Underground Vault				
Sediment Accumulation on Media	Sediment depth exceeds 0.25-inches.			
Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.			
Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.			
Sediment in Drain Pipes or Cleanouts	When drain pipes, clean-outs, become full with sediment and/or debris.			
Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.			
Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.			
Vault Structure Includes Cracks in Wall, Bottom, Damage to	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.			

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.			
Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.			
Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, or misaligned.			
Below Ground Cartridge Type				
Filter Media	Drawdown of water through the media takes longer than 1 hour and/or overflow occurs frequently.			
Short Circuiting	Flows do not properly enter filter cartridges.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Storm Drain Signage SD-13

Design Objectives

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

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

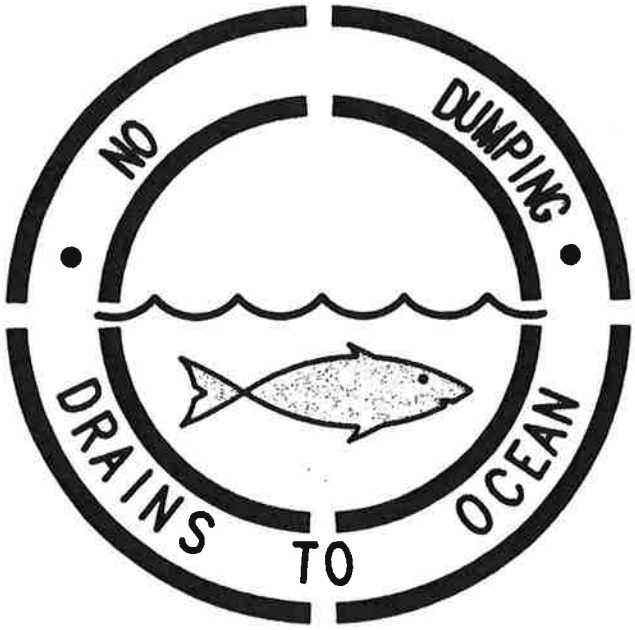
Other Resources

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

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

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

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



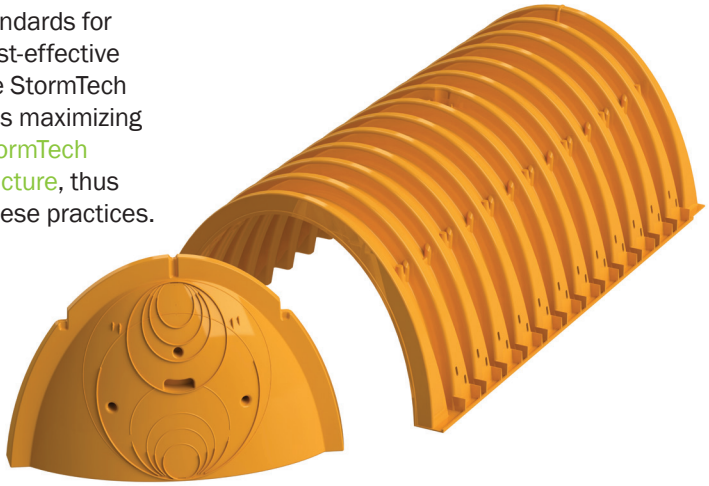
SAMPLE STENCIL TO BE USED NEAR
GRATE AND CURB OPENING INLETS
SYMBOL TO BE 24" IN DIAMETER

Thienes Engineering
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

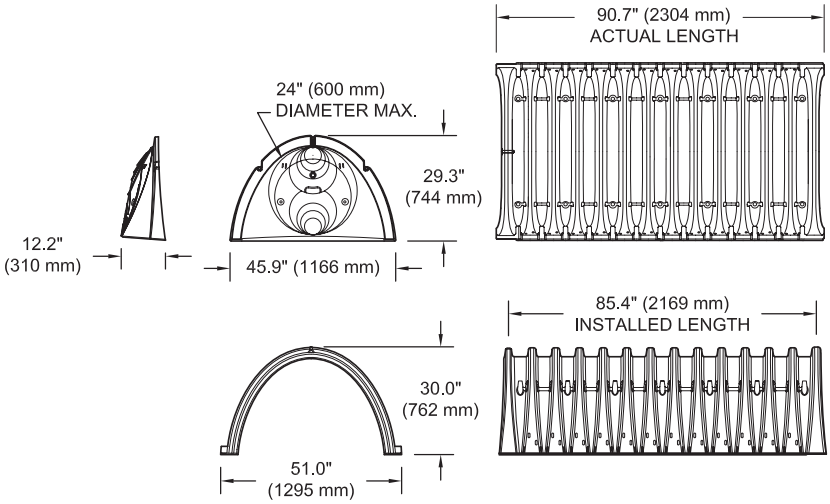
SAMPLE CATCH BASIN STENCIL
PER BMP SD-13

STORMTECH SC-740 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH SC-740 CHAMBER
(not to scale)



Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

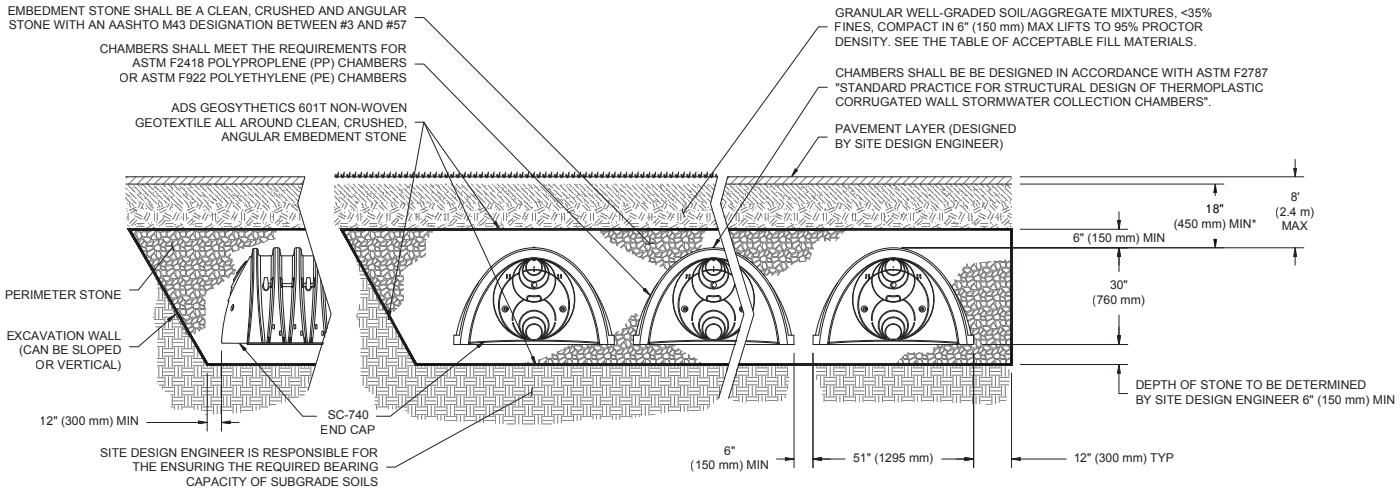
Chamber Storage
45.9 ft³ (1.30 m³)

Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)		45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)		45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)		0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)		0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

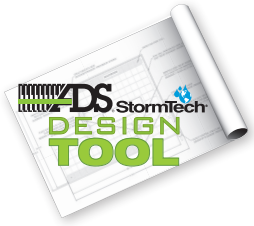
ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.



Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
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StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

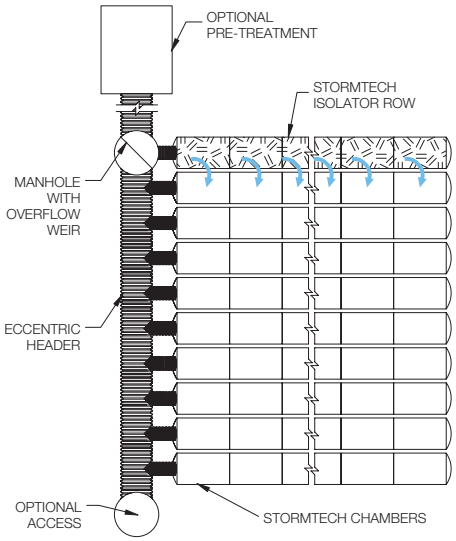
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

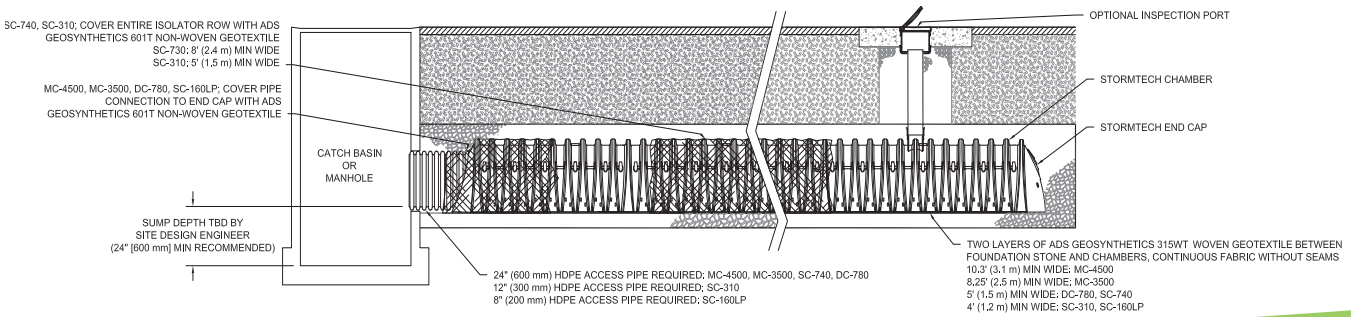
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



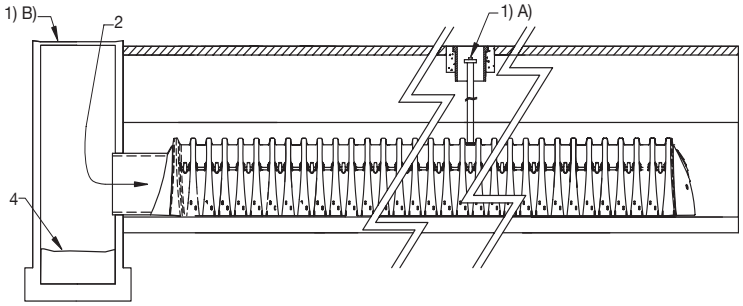
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Maintenance Guide

BaySaver Barracuda™

July 2017

One of the advantages of the BaySaver Barracuda is the ease of maintenance. Like any system that collects pollutants, the BaySaver Barracuda must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manhole through the manhole cover. This allows them to gain vacuum hose access to the bottom of the manhole to remove sediment and trash. There is no confined space entry necessary for inspection or maintenance.

The entire maintenance procedure typically takes from 2 to 4 hours, depending on the size of the system, the captured material, and the capacity of the vacuum truck.

Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and thereafter on an annual basis. Typically, the system needs to be cleaned every 1-3 years.

Excessive oils, fuels or sediments may reduce the maintenance cycle. Periodic inspection is important.

Determining When to Clean

To determine the sediment depth, the maintenance contractor should lower a stadia rod into the manhole until it contacts the top of the captured sediment and mark that spot on the rod. Then push the probe through to the bottom of the sump and mark that spot to determine sediment depth.

Maintenance should occur when the sediment has reached the levels indicated in the Storage Capacity Chart.

BaySaver Barracuda Storage Capacities

Model	Manhole Diameter	Treatment Chamber Capacity	Standard Sediment Capacity (20" depth)	NJDEP Sediment Capacity (50% of standard depth)
S3	36"	212 gallons	0.44 cubic yards	0.22 cubic yards
S4	48"	564 gallons	0.78 cubic yards	0.39 cubic yards
S5	60"	881 gallons	1.21 cubic yards	0.61 cubic yards
S6	72"	1269 gallons	1.75 cubic yards	0.88 cubic yards
S8	96"	3835 gallons	3.10 cubic yards	1.55 cubic yards
S10	120"	7496 gallons	4.85 cubic yards	2.43 cubic yards

Maintenance Instructions

1. Remove the manhole cover to provide access to the pollutant storage. Pollutants are stored in the sump, below the bowl assembly visible from the surface. You'll access this area through the 10" diameter access cylinder.

2. Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment. See figure 1.
3. Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. Fill the cleaned manhole with water until the level reaches the invert of the outlet pipe.
5. Replace the manhole cover.
6. Dispose of the polluted water, oils, sediment and trash at an approved facility.
   - Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
   - Some localities treat the pollutants as leachate. Check with local regulators about disposal requirements.
   - Additional local regulations may apply to the maintenance procedure.

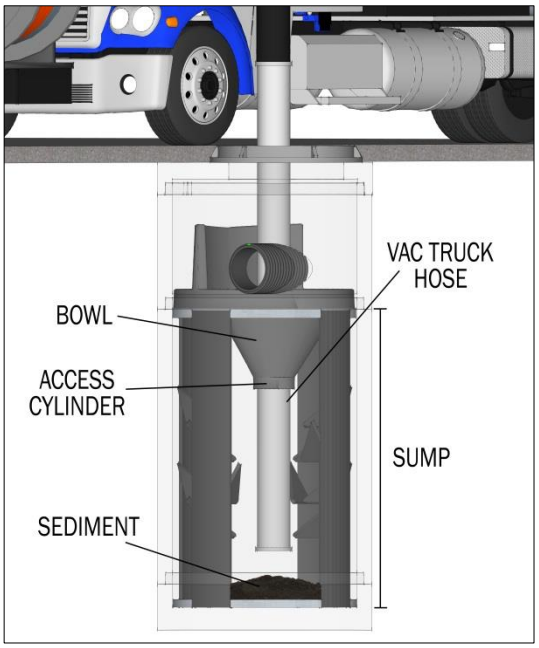

Figure 1

APPENDIX D

Maintenance and Covenant Agreement

(Long Form)

Recorded at the request of:

City of Moorpark

After recording, return to:

City of Moorpark

City Clerk

Stormwater Treatment Device Access and Maintenance Agreement

OWNER: Amir Development Company

PROPERTY ADDRESS: 10951 West Los Angeles Avenue, Moorpark, CA 93021

APN:

THIS AGREEMENT is made and entered into in _____, California, this ___ day of _____, by and between Amir Development Company _____, hereinafter referred to as "Owner" and the CITY OF Moorpark _____, a municipal corporation, located in the County of Ventura, State of California hereinafter referred to as "CITY";

WHEREAS, the Owner owns real property ("Property") in the City of Moorpark , County of Ventura, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as PentAir Site within the Property described herein, the City required the project to employ on-site control measures to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install a set of underground infiltration chambers and a hydrodynamic separator hereinafter referred to as "Device", as the on-site control measure to minimize pollutants in urban runoff;

WHEREAS, said Device has been installed in accordance with plans and specifications accepted by the City;

WHEREAS, said Device, with installation on private property and draining only private property, is a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner in accordance with the terms of this Agreement;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of Device and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1) Owner hereby provides the City of City's designee complete access, of any duration, to the Device and its immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2) Owner shall use its best efforts diligently to maintain the Device in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of material(s) from the Device and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

3) In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs, attorney's fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full.

4) The City may require the owner to post security in form and for a time period satisfactory to the city of guarantee of the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director may withdraw any previous stormwater related approval with respect to the property

on which a Device has been installed until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

5) This agreement shall be recorded in the Office of the Recorder of Ventura County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

6) In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

7) It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

8) The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

9) Time is of the essence in the performance of this Agreement.

10) Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

IF TO CITY:	IF TO OWNER:
_____	Steven Juhnke
_____	8730 Wilshire Boulevard Suite 300
_____	Beverly Hills, CA 90211

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

APPROVED AS TO FORM:

City Attorney

OWNER:

Owner

Name: Steven Juhnke

Title: Vice President

CITY OF Moorpark :

Name:

Title:

OWNER:

Name: Steven Juhnke

Title: Vice President

ATTEST:

City Clerk Date

Notaries on Following Page

EXHIBIT A

(Legal Description)

EXHIBIT B

(Map/illustration)

APPENDIX E

Educational Materials

Non-Stormwater Discharges SC-10

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.

- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and

- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:

  - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
- ✓ Pools of water in low lying areas when a rain event has not occurred; and
- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- □ If evidence of non-stormwater discharges is discovered:
  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.
- □ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- □ Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- □ Isolate problem areas and plug illicit discharge points.
- □ Locate and evaluate discharges to the storm drain system.
- □ Visual Inspection and Inventory:
  - ✓ Inventory and inspect each discharge point during dry weather.
  - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
  - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- □ A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.

- Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.

- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

  - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

  - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and
- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

- Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.
- Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.
- Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.
- Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.
- More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.
- CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.
- CCTV can also be used to detect dye introduced into the sanitary sewer.
- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ An anonymous tip/reporting mechanism; and
  - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).
- One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Spill and Leak Prevention and Response

- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, 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 a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See SC-11 Spill Prevention Control and Cleanup.

Employee Training Program

- Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.
- Consider posting a quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.
- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Quality Assurance and Record Keeping

Performance Evaluation

- Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.
- Develop document and data management procedures.
- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Annually document and report the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.
- Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.
  - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges
  - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.
- Indoor floor drains may require re-plumbing if cross-connections are detected.
- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.
- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;
- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;
- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

References and Resources

Center for Watershed Protection, 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, EPA Cooperative Agreement X-82907801-0.

Dublin San Ramon Sanitation District. http://www.dsrsd.com/wwrw/smoketest.html.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Sacramento Stormwater Management Program, *Best Management Practices for Industrial Storm Water Pollution Control*, Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

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

Southern California Coastal Water Research Project, 2013. *The California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches,* Technical Report 804.

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

US EPA. National Pollutant Discharge Elimination System. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=111.

WEF Press Alexandria, Virginia, 2009.Existing Sewer Evaluation and Rehabilitation: *WEF Manual of Practice No. FD-6 ASCE/EWRI Manuals and Reports on Engineering Practice No. 62, Third Edition.*

Spill Prevention, Control & Cleanup SC-11

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

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- ✓ Facility map of the locations of industrial materials;
- ✓ Notification and evacuation procedures;
- ✓ Cleanup instructions;
- ✓ Identification of responsible departments; and
- ✓ Identify key spill response personnel.

- ☐ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Spill and Leak Prevention and Response

Spill Prevention

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- ☐ If illegal dumping is observed at the facility:

  - ✓ Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
  - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- ☐ Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- ☐ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

Preventative Maintenance

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.

- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

- ☐ Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- ☐ Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- ☐ Label all containers according to their contents (e.g., solvent, gasoline).

- ☐ Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- ☐ Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- ☐ Identify key spill response personnel.

Spill Response

- ☐ Clean up leaks and spills immediately.

- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- ☐ On paved surfaces, clean up spills with as little water as possible.

  - ✓ Use a rag for small spills, 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 a certified laundry (rags) or disposed of as hazardous waste.

  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).

- ☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

- ☐ Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

- ☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ Clean-up procedures; and
  - ✓ Responsible parties.

Employee Training Program

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident;
- Weather conditions;
- Duration of the spill/leak/discharge;

- Cause of the spill/leak/discharge;
- Response procedures implemented;
- Persons notified; and
- Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- Date and time the inspection was performed;
- Name of the inspector;
- Items inspected;
- Problems noted;
- Corrective action required; and
- Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure;
- Spills and overfills due to operator error; and
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect 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.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use absorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent 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 contaminate 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 your 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

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

  Cover fueling area if possible.

  Use a perimeter drain or slope pavement inward with drainage to a sump.

  Pave fueling area with concrete rather than asphalt.

- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off" of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- Develop procedures to prevent/mitigate spills to storm drain systems.
- Identify responsible departments.

- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Address spills at municipal facilities, as well as public areas.
- Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

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

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

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

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

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

The Stormwater Managers Resource Center. http://www.stormwatercenter.net/.

Outdoor Loading/Unloading SC-30

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by wind, stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Approach

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

General Pollution Prevention Protocols

- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

Good Housekeeping

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains inlets in the area.
- Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Material Handling and Waste Management

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.

Employee Training Program

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- Conduct regular inspections and make repairs and improvements as necessary.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

Loading and Unloading of Liquids

- Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program, *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: *Best Management Practices*. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Outdoor Equipment Operations SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, and solid waste treatment and disposal are examples of process operations that can lead to contamination of stormwater runoff. The targeted constituents will vary for each site depending on the operation being performed.

Approach

Implement source control BMPs to limit exposure of outdoor equipment to direct precipitation and stormwater run-on. Refer to SC-22 Vehicle and Equipment Repair for additional information.

General Pollution Prevention Protocols

- ☐ Perform the activity during dry periods whenever possible.
- ☐ Install secondary containment measures where leaks and spills may occur.
- ☐ Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.
- ☐ Connect process equipment area to public sanitary sewer or facility wastewater treatment system when possible. Some jurisdictions require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Good Housekeeping

- ☐ Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.

Objectives
■ Cover
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover the work area with a permanent roof if possible.
- Use drop cloths for sanding and painting operations.
- Use a vacuum for fine particle clean-up in pavement cracks and crevices.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention).
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Use roll down or permanent walls when windy/breezy to prevent wind transport of particulates/pollutants.

Preventative Maintenance

- Design outdoor equipment areas to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump.
- Dry clean the work area regularly. Do not wash outdoor equipment with water if there is a direct connection to the storm drain.
- Pave area with concrete rather than asphalt.
- Inspect outdoor equipment regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the outdoor equipment area before October 1 each year.

Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.

Material Handling and Waste Management

- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drain or sewer connections.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees on proper equipment operation and maintenance procedures.
- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Ensure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for outdoor equipment, types and quantities of materials removed and disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Providing cover over outdoor equipment may be impractical or cost-prohibitive.
  - ✓ Operate outdoor equipment only during periods of dry weather.
- Regular operations and time limitations may require outdoor activities during wet weather.
  - ✓ Designate specific areas for outdoor activities.
  - ✓ Allow time for work area clean-up after each shift.
  - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
  - ✓ Design and install secondary containment and good housekeeping BMPs for outdoor equipment area.
- Storage sheds often must meet building and fire code requirements.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities will already have indoor covered areas where vehicle and equipment repairs take place and will require no additional capital expenditures.
- If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

References and Resources

Minnesota Pollution Control Agency. *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*, February 2013. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Waste Handling & Disposal SC-34

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

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

General Pollution Prevention Protocols

- ☐ Accomplish reduction in the amount of waste generated using the following source controls:
  - ✓ Production planning and sequencing;
  - ✓ Process or equipment modification;
  - ✓ Raw material substitution or elimination;
  - ✓ Loss prevention and housekeeping;
  - ✓ Waste segregation and separation; and
  - ✓ Close loop recycling.
- ☐ Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- ☐ Recycle materials whenever possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Use the entire product before disposing of the container.
- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- Provide containers for each waste stream at each work station. Allow time after shift to clean area.

Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Preventative Maintenance

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Spill Response and Prevention Procedures

- Keep your spill prevention and plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - ✓ Vehicles equipped with baffles for liquid waste; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.

Material Handling and Waste Management

Litter Control

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315,* Revised. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL and 303(d) list pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests

Objectives
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	

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by methods that pose a lower risk to employees, the public, and the environment.

- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies
- Procedures
  - ✓ Standard operating procedures (SOPs);
  - ✓ Purchasing guidelines and procedures; and
  - ✓ Bid packages (services and supplies).
- Materials
  - ✓ Preferred or approved product and supplier lists;
  - ✓ Product and supplier evaluation criteria;
  - ✓ Training sessions and manuals; and
  - ✓ Fact sheets for employees.

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC-20 – SC-22) and SC-41 Building and Grounds Maintenance.

Employee Training Program

- Employees who handle potentially harmful materials should be trained in the use of safer alternatives.
- Purchasing departments should be trained on safer alternative products and encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.
- Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources provided in this fact sheet.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds"

- Alternative products may not be available, suitable, or effective in every case.

- ✓ Minimize use of hazardous/harmful products if no alternative product is available.

Regulatory Considerations

This BMP has no regulatory requirements unless local/municipal ordinance applies. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements;
- Storm water runoff sampling requirements;
- Training and licensing requirements; and
- Record keeping and reporting requirements.

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.
- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Refined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes with low VOC content are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps.

All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.

- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting. Use paper products with post-consumer recycled content and implement electric had dryers.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control, http://www.dtsc.ca.gov/PollutionPrevention/GreenTechnology/Index.cfm.

CalRecycle, http://www.calrecycle.ca.gov/Business/Regulated.htm.

City of Santa Monica Office of Sustainability and Environment, http://www.smgov.net/departments/ose/.

City of Palo Alto, http:// www.city.palo-alto.ca.us/cleanbay.

City and County of San Francisco, Department of the Environment, http://www.sfenvironment.org/toxics-health/greener-business-practices.

Green Business Program, http://www.greenbiz.ca.gov/GRlocal.html .

Product Stewardship Institute, http://www.productstewardship.us/index.cfm.

Sacramento Clean Water Business Partners. http://www.sacstormwater.org/CleanWaterBusinessPartners/CleanWaterBusinessPartners.html.

USEPA. National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges From Industrial Facilities, http://cfpub.epa.gov/npdes/stormwater/indust.cfm.

USEPA Region IX Pollution Prevention Program, http://www.epa.gov/region9/waste/p2/business.html.

Western Sustainability and Pollution Prevention Network, http://wsppn.org/.

Metals (mercury, copper)

National Electrical Manufacturers Association – Environmental Stewardship, http://www.nema.org/Policy/Environmental-Stewardship/pages/default.aspx.

Sustainable Conservation, http://www.suscon.org.

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center, http://www.birc.org.

California Department of Pesticide Regulation, http://www.cdpr.ca.gov/dprprograms.htm.

University of California Statewide IPM Program, http://www.ipm.ucdavis.edu/default.html.

Dioxins

Bay Area Dioxins Project, http://www.abag.ca.gov/bayarea/dioxin/project_materials.htm.

Building & Grounds Maintenance SC-41

Description

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

Approach

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

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

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

Mowing, Trimming, and Planting

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

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

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

Building & Grounds Maintenance SC-41

Spill Response and Prevention Procedures

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

Material Handling and Waste Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Employee Training Program

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

Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

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

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at:

http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Building Repair and Construction SC-42

Description

Site modifications are common, particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the Construction BMP Handbook should be followed.

Approach

The BMP approach is to reduce potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- ☐ Avoid outdoor repairs and construction during periods of wet weather.
- ☐ Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	✓
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Buy recycled products to the maximum extent practicable.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Good Housekeeping

Repair & Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediments and small debris.
- Cover raw materials of particular concern that must be left outside, particularly during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.
- Use equipment and tools such as bag sanders to reduce accumulation of debris.
- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.
- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100 percent effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose of the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Material Handling and Waste Management

- Post “No Littering” signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.
- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34, Waste Handling and Disposal for more information.

Sediment and Erosion Controls

- Limit disturbance to bare soils and preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.
- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.
- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

  There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.
- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.
- Refer to the supplemental information provided below for projects that involve more extensive soil disturbance activities.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly implement the source control BMPs described above. Detailed information for Sediment and Erosion Control BMPs is provided in the Construction BMP Handbook.
- Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about pollutant source control responsibilities.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb one or more acres of surface.
  - ✓ Refer to the companion "Construction Best Management Practice Handbook" which contains specific guidance and best management practices for larger-scale projects.

- Time constraints may require some outdoor repairs and construction during wet weather.
  - ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.
  - ✓ Inspect sediment and erosion control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
  - ✓ Minimize use of hazardous materials to the maximum extent practicable.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.
- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if adequate cover and containment facilities do not exist for construction materials and wastes.
- Purchase and installation of erosion and sediment controls, if needed will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

Building Repair and Construction SC-42

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

California Stormwater Quality Association, 2012. *Construction Stormwater Best Management Practice Handbook*. Available at http://www.casqa.org.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA. *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

Parking Area Maintenance SC-43

Description

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

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

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

General Pollution Prevention Protocols

- Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.
- Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- Post "No Littering" signs and enforce anti-litter laws.

Objectives
Cover
Contain
Educate
Reduce/Minimize
Product Substitution

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ☐ Provide an adequate number of litter receptacles.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

Inspection

Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.

- ☐ Inspect cleaning equipment/sweepers for leaks on a regular basis.

Surface Cleaning

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

Surface Repair

- ☐ Check local ordinance for SUSMP/LID ordinance.
- ☐ Preheat, transfer or load hot bituminous material away from storm drain inlets.
- ☐ Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- ☐ Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in

place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control during sweeping to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Spill Response and Prevention Procedures

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

Employee Training Program

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

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook*. Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Pollution from Surface Cleaning Folder, 1996, 2003. Bay Area Stormwater Management Agencies Association. Available online at: http://basmaa.org/Portals/0/documents/pdf/Pollution%20from%20Surface%20Cleaning.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

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

US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.
- ☐ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ☐ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- ✓ Eliminate the discharge once the origin of flow is established.

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

Illegal Dumping

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

Preventative Maintenance

Catch Basins/Inlet Structures

- ☐ Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

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

Storm Drain Conveyance System

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

Pump Stations

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

Open Channel

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

Spill Response and Prevention Procedures

- Keep your spill prevention control plan up-to-date.

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.

  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere onsite.

  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.

  - ✓ Cleanup spills immediately and properly dispose of wastes.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.

  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .

- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

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

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

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

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

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Knox County Tennessee *Stormwater Management Manual* Chapter 5 Drainage System Maintenance, 2008. Available online at: http://www.knoxcounty.org/stormwater/manual/Volume%201/knoxco_swmm_v1_chap5_jan2008.pdf.

US EPA. Storm Drain System Cleaning, 2012. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=102.

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

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

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. 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 the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

APPENDIX F

Infiltration Report

Updated Geotechnical Engineering Investigation

Proposed Industrial Warehouse Development
10941 W. Los Angeles Avenue
Moorpark, California

Amir Development Company
8730 Wilshire Boulevard, Suite 300
Beverly Hills, California 90211

Attn: Mr. Steven Juhnke

Project Number 21889-20
April 8, 2022

NorCal Engineering

NorCal Engineering

Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

April 8, 2022 Project Number 21889-20

Amir Development Company
8730 Wilshire Boulevard, Suite 300
Beverly Hills, California 90211

Attn: Mr. Steven Juhnke

RE: **Updated Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at 10941 W. Los Angeles Avenue, in the City of Moorpark, California

Dear Mr. Juhnke:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance with your approval of our proposals dated February 16, 2022 and March 8, 2022. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide updated recommendations for the proposed industrial warehouse development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) soil infiltration testing; 5) engineering analysis of field and laboratory data; 5) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial warehouse development consisting of 90,566 square feet building as shown on the attached Site Plan by HPA Architecture. The proposed structure will be supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will include asphalt and concrete pavement areas, retaining walls, hardscape and landscaping. It is assumed that the proposed grading for the development will consist of minor cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city/county approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The 5.65-acre subject property is located within the 10500 block and north side of Los Angeles Avenue, in the City of Moorpark. The generally rectangular-shaped parcel is elongated in a north to south direction with topography of the relatively level property descending slightly from back to front direction on the order of a few feet. The site is currently occupied an undeveloped parcel of land covered with a low vegetation growth of natural grasses and weeds.

3.0 Site Exploration

The investigation was initially performed on June 25, 2020 with additional exploratory work completed later on March 24 and 25, 2022. The field investigation consisted of the placement of two (2) recent electronic cone penetrometers (CPT) both to depths of 50 feet, six (6) subsurface exploratory borings by a truck mounted drill rig with eight-inch outside diameter hollow-stem, continuous flight augers and a hand operated auger to depths ranging between 5 and 50 feet and five (5) exploratory trenches by a backhoe to depths ranging between 10 and 20 feet below current ground elevations.

The CPT consists of advancing a cone-tipped cylindrical probe into the ground while simultaneously measuring the resulting resistance to penetration. An on-field computer generated CPT log measures the penetration resistance values and inferred soil description. The boring and trench explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached Site Plan.

The field explorations revealed the existing earth materials to consist of fill and natural soil. Detailed descriptions of the subsurface conditions are listed on the boring logs in Appendix A. It should be noted that the transition from one soil type to another as shown on the boring logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill: A fill soil classifying as a brown, fine to medium grained, silty SAND was encountered to a depth of one foot below ground surface. These soils were noted to be loose and dry.

Natural: A natural undisturbed soil classifying as a brown, fine to coarse grained, silty SAND was encountered beneath the fill soils to a depth of 12 to 14 feet. The native soils were observed to be medium dense and moist. Deeper soils consisted of sandy to clayey silts to sands which were noted to depths of 43 to 50 feet that are medium dense to dense and moist to wet.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. Groundwater was encountered at a depth of 23 feet below ground surface in Borings B-3 and B-6 and some caving of the cohesionless soils occurred to the depth of our borings. The subsurface conditions are shown graphically on Section A-A, Figure 2.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils.

Standard penetration tests were obtained by driving a steel sampler unlined with an inside diameter of 1.5 inches into the soils. This standard penetrometer sampler was driven a total of eighteen inches with blow counts tallied every six inches. Blow count data is given on the Boring Logs in Appendix A. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field Moisture Content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Sieve analyses** (ASTM: D 422-63) and the percent by weight of soil finer than the No. 200 sieve (ASTM: 1140) were performed on selected soil samples. These results are shown later within the body of this report.

4.3 **Maximum Density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.4 **Expansion Index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils to determine expansive characteristics. Results of these tests are provided on Table II.

4.5 **Atterberg Limits** (ASTM: D 4318) consisting of liquid limit, plastic limit and plasticity index were performed on representative soil samples. Results are shown on Table III.

4.6 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table IV.

4.7 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Results are provided within the pavement design section of the report.

4.8 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and/or remolded samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plate A.

4.9 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates B and C.

5.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely. The nearest fault is located less than 2 kilometers from the site and is capable of producing a Magnitude 6.7 earthquake. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults. The following seismic design acceleration parameters for the project site are provided below based on the American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/. The ASCE/SEI 7-22 report is attached is Appendix C.

Seismic Design Acceleration Parameters

Latitude	34.280
Longitude	-118.912
Site Class	D
Risk Category	II
Peak Ground Acceleration	PGA_M = 0.83
Adjusted Maximum Acceleration	S_{MS} = 2.15 S_{M1} = 1.69
Design Spectral Response Acceleration Parameters	S_{DS} = 1.44 S_{D1} = 1.13
Mapped Spectral Response Acceleration	S_S = 2.10 S_1 = 0.77

Use of these values is dependent on the latest requirements of the ASCE, 11-4.8, Exception 2 that requires the value of the seismic response coefficient C_s be determined by Equation 12.8.2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either 12.8-3 for $T_L \geq T \geq 1.5T_s$ or Equation 12.8-4 for $T > T_L$. Computations and verification of these conditions is referred to the structural engineer.

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. A review of the exploratory boring log and the laboratory test results on selected soil samples obtained indicate the following soil classifications, field blowcounts and amounts of fines passing through the No. 200 sieve.

Field Blowcount and Gradation Data

Boring No.	Classification	Blowcounts (blows/ft)	Relative Density	% Passing No. 200 Sieve
B-3 @ 5'	SM	7	Medium Dense	15
B-3 @ 10'	SM	9	Medium Dense	31
B-3 @ 15'	ML/CL	4	Firm	61
B-3 @ 20'	CL	10	Medium Stiff	66
B-3 @ 25'	SM/SW	16	Medium Dense	8
B-3 @ 30'	CL	12	Firm	66
B-3 @ 35'	SW	21	Dense	4
B-3 @ 40'	SW	21	Dense	4
B-3 @ 45'	SW	32	Dense	7
B-3 @ 50'	SW	30	Dense	8

Based upon information in the California Division of Mines and Geology "Seismic Hazard Zone Map – Moorpark Quadrangle", dated November 17, 2000, the subject site is situated in an area of historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions to indicate a potential for permanent ground displacement.

Based on the California Division of Mines and Geology Seismic Hazard Zone Report for the Moorpark 7.5 Minute Quadrangle, the site is mapped with a historic groundwater depth of 20 feet deep. Our liquefaction evaluation utilized the nearest mode of predominate Magnitude 6.7 Mw earthquake in our earthquake in our calculations. The analysis indicates the potential for liquefaction at this site to be moderate based upon a historic groundwater depth of 20 feet deep and a Peak Ground Acceleration (PGA_M) of 0.83g.

The associated seismic-induced settlements would be on the order of 3½ inches and would occur rather uniformly across the site, as shown on Section A-A. Differential settlements would be on the order of 1¾ inch over a 50-foot (horizontal) distance in the building pad area.

It is recommended that a stiffened foundation system be utilized for the proposed structure to mitigate for the seismic-induced settlements. The stiffened system shall consist of a mat foundation at least 12 inches thick to support the new structure. Our seismic settlement calculations are included in Appendix C.

7.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system field testing per Ventura County Technical Guidance Manual for Stormwater Quality Control Measures - Update 2011. A truck mounted Simco 2800 Drill Rig equipped with a hollow stem auger was used to excavate the exploratory borings to depths ranging between 5 and 11.5 below existing ground surface. The borings consisted of six-inch diameter test holes. A three-inch diameter perforated PVC casing with solid end cap was installed in the borings and then surrounded with gravel materials to prevent caving.

The infiltration holes were carefully filled with clean water and refilled after two initial readings. Based upon the initial rates of infiltration at each location, test measurements were measured at selected maximum intervals thereafter. Measurements were obtained by using an electronic tape measure with 1/16-inch divisions and timed with a stopwatch.

The field infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix D. Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates.

Boring/Test No.	Depth (feet)	Soil Classification	Field Infiltration Rate
B-1/TH-1	5.0'	Silty SAND	24.0 in/hr
B-2/TH-2	10.0	Silty SAND	16.4 in/hr
B-4/TH-3	11.0	Silty SAND	4.4 in/hr
B-5/TH-4	11.5	Silty SAND	9.4 in/hr

Groundwater was encountered at a depth of 23 feet below existing ground surface in Borings B-3 and B-6 across the subject site.

Based on the results of our field testing, the subsurface soils encountered in the proposed on-site drainage disposal system shall utilize the design infiltration rates based on the safety factor required by the county standard. All systems must meet the latest city and/or county specifications and the California Regional Water Quality Control Board (CRWQCB) requirements. .

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

8.1 Site Grading Recommendations

Any vegetation and/or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill.*

8.1.1 **Removal and Recompaction Recommendations**

All disturbed soils and/or fill (about one foot below ground surface) shall be removed to competent native material, the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

8.1.2 **Fill Blanket Recommendations**

Due to the potential for differential settlement of foundations placed on compacted fill and native materials, it is recommended that all foundations including floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

8.2 **Shrinkage and Subsidence**

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 10 to 20% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.2 feet die to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements, or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage, which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing the actual equipment and grading techniques should be conducted.

8.3 **Temporary Excavations**

Temporary unsurcharged excavations in the existing site materials may be made at vertical inclinations up to 4 feet in height unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring or flatter excavations may be required.

The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

It is recommended that a stiffened foundation system be utilized for the proposed structure to mitigate for the seismic-induced settlements. The stiffened system shall consist of a mat foundation throughout the new structure. The mat foundation should be at least 12 inches thick and may be designed utilizing an allowable bearing capacity of 2,000 psf placed on a two feet compacted fill blanket. A one-third increase may be used when considering short-term loading and seismic forces.

Foundations for smaller structures (site walls, trash enclosure, etc. may use an allowable bearing value of 2,000 psf for an embedded depth of 24 inches on a two feet thick blanket of compacted fill soils. Any foundations located along property line where lateral overexcavation is not possible may utilize an allowable bearing capacity of 1,500 psf embedded into competent native soils. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 Settlement Analysis

Resultant pressure curves for the consolidation tests are shown on Plates B and C. Computations utilizing these curves and the recommended allowable soil bearing capacity reveal that the mat foundations will experience settlements on the order of 1 inch and differential settlements of ½ inch over a 30 feet (horizontal) distance in the building pad area.

8.6 Lateral Resistance

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40

Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.

Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native materials.

8.7 **Retaining Wall Design Parameters**

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. An equivalent fluid pressure of 45 pcf may be utilized for the restrained wall condition with a level grade behind the wall.

The seismic-induced lateral soil pressure for walls greater than 6 feet may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls. Sliding resistance values and passive fluid pressure values may be increased by 1/3 during short-term wind and seismic loading conditions.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The subsurface drainage system shall consist of a four-inch diameter perforated PVC pipe encased with gravel and wrapped with filter fabric. The granular backfill to be utilized immediately adjacent to retaining walls shall consist of an approved select granular soil with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than ¾ to 1 (horizontal to vertical).

8.8 Slab Design

All concrete slabs shall be a minimum of six inches in thickness in the proposed service areas and four inches in office and hardscape and placed on approved subgrade soils. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade soils conditioned to near optimum moisture levels, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

8.9 Pavement Section Design

The table below provides a preliminary pavement design based upon an R-Value of 53 for the subgrade soils for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of site grading to assure that these soils are consistent with those assumed in this preliminary design.

Type of Traffic	Traffic Index	Asphalt (in.)	Base Material (in.)
Automobile Parking Stalls	4.0	3.0	3.0
Light Vehicle Circulation Areas	6.0	3.5	5.5
Heavy Truck Access	7.0	4.0	8.0

Any concrete slab-on-grade in pavement areas shall be a minimum of six inches in thickness and placed on approved subgrade soils. All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Moorpark. The base material; and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

8.10 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

8.11 Corrosion Design Criteria

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be severely corrosive to metals. The soil pH value was considered mildly acidic and may not have a significant effect on soil corrosivity. Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1 of ACI 318 Building Code and Commentary, these contents revealed negligible sulfate concentrations. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. It is recommended that additional sulfate tests be performed at the completion of site grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Corrosion test results may be found on the attached Table IV.

8.12 Expansive Soil

Granular soils were noted in the upper 12 feet with a very low expansion potential. Expansive clay soils were encountered from 12 to 26 feet deep. If any expansive soils are encountered, special attention should be given to the project design and maintenance.

9.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and geotechnical engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/2022
GEOTECHNICAL
STATE OF CALIFORNIA

Scott D. Spensiero
Project Manager

References

1. American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/

2. California Building Code, 2019.

3. California Department of Water Resources, Internet Website, http://www.water.ca.gov/waterdatalibrary/index.cfm.

4. California Division of Mines and Geology, 2000, Seismic Hazard Zone for the Moorpark 7.5-Minute Quadrangle, Ventura County, California - Seismic Hazard Zone Report 041.

5. California Division of Mines and Geology, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117A.

6. Earthquake Zones of Required Investigation, Seismic Hazard Zones, Moorpark Quadrangle, published by the California Geological Survey.

7. NorCal Engineering Inc. - Geotechnical Engineering Investigation – Proposed Industrial Warehouse - Located at 10951 Los Angeles Avenue, in the City of Moorpark ..... dated July 14, 2020.

8. Thomas W. Dibblee, Jr. - Geologic Map of the Moorpark Quadrangle, Ventura County, California 1992.

9. Ventura County Technical Guidance Manual for Stormwater Quality Control Measures - Update 2011.

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Geotechnical Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material for Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Geotechnical Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

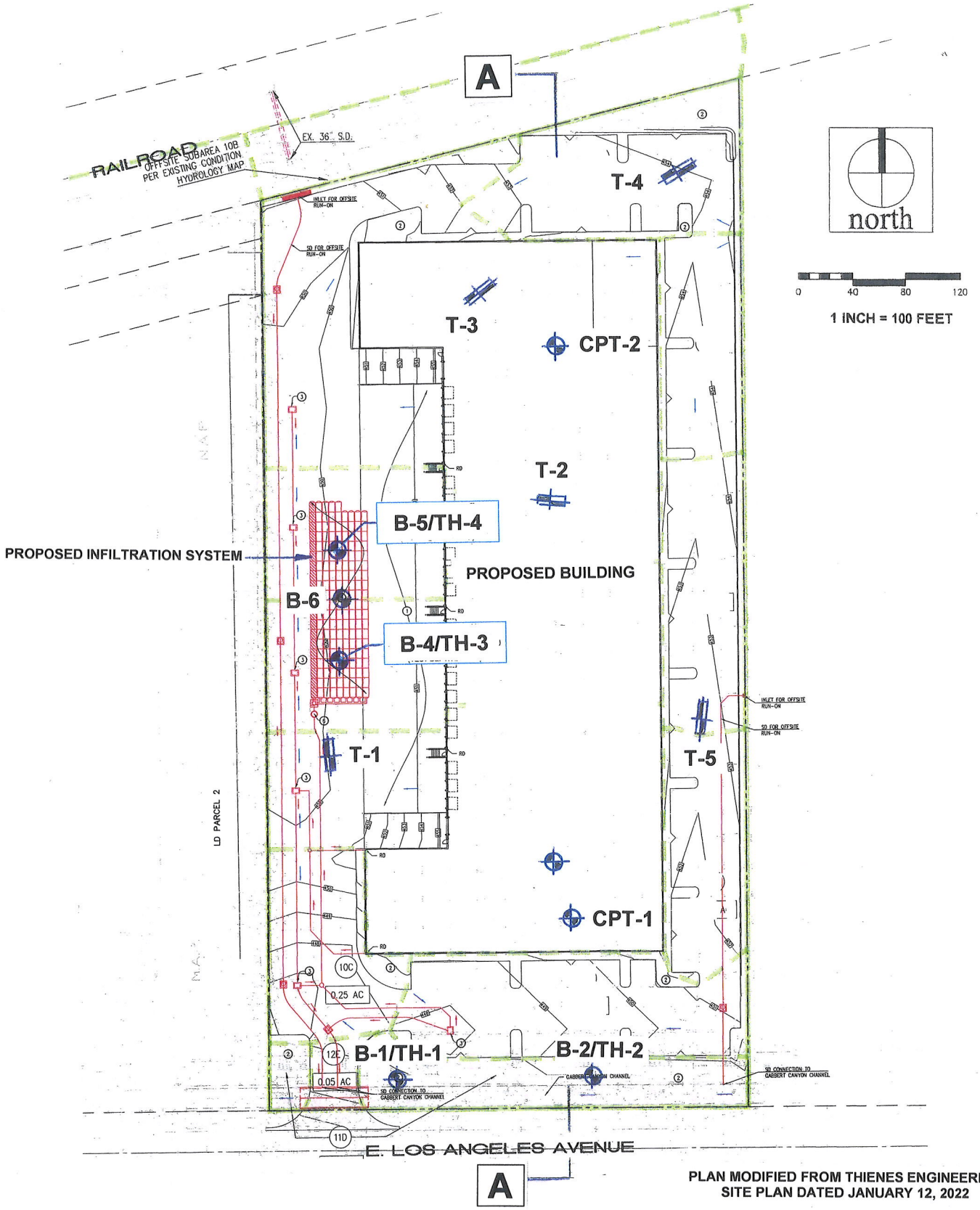
The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Geotechnical Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Geotechnical Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Geotechnical Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Geotechnical Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.



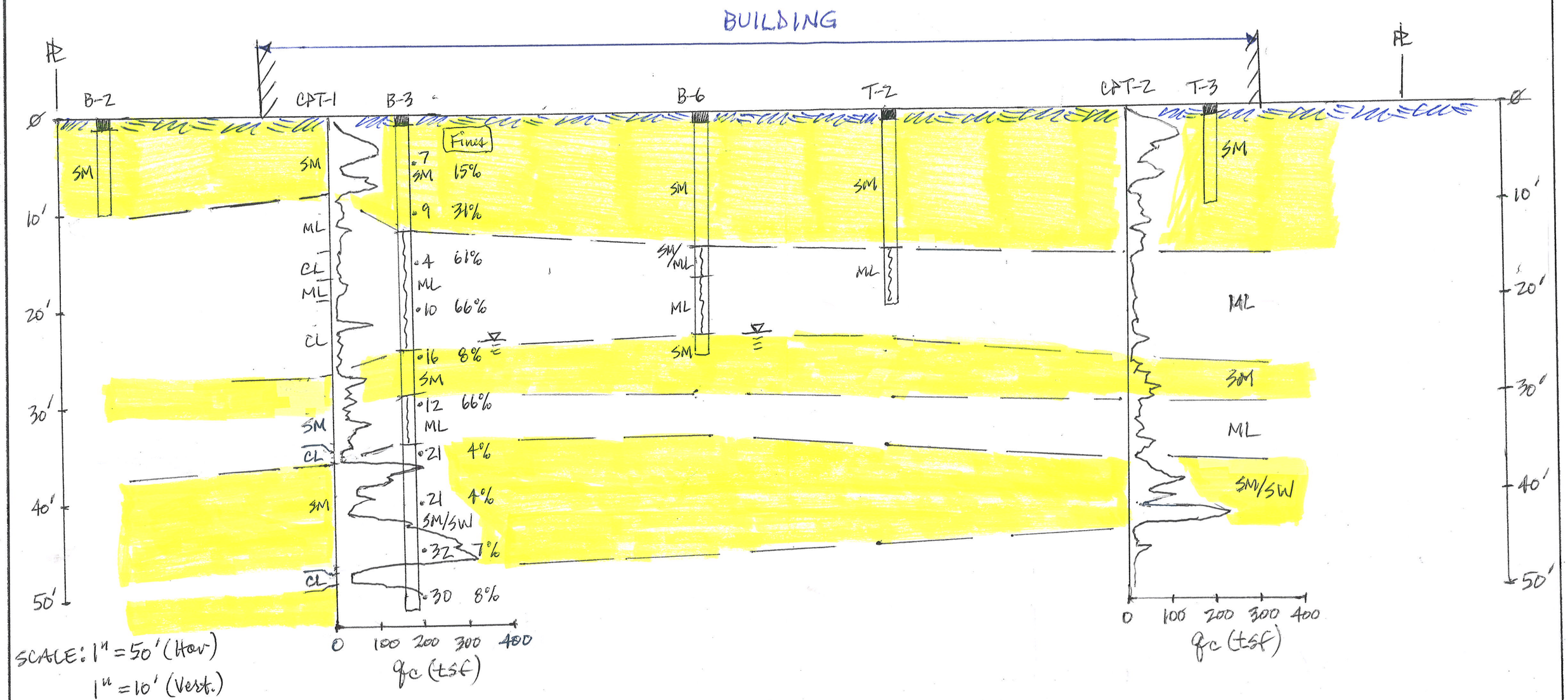
PLAN MODIFIED FROM THIENES ENGINEERING
SITE PLAN DATED JANUARY 12, 2022

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

SITE PLAN

PROJECT: **21889-20**

DATE: **APRIL 2022**



NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS	
PROJECT 21889-20	DATE APRIL 2022

SECTION A-A

List of Appendices
(in order of appearance)

Appendix A
Log of Excavations

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

 Indicates 2.5-inch Inside Diameter. Ring Sample.

 Indicates 2-inch OD Split Spoon Sample (SPT).

 Indicates Shelby Tube Sample.

 Indicates No Recovery.

 Indicates SPT with 140# Hammer 30 in. Drop.

 Indicates Bulk Sample.

 Indicates Small Bag Sample.

 Indicates Non-Standard

 Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Amir Development Company
21889-20

Log of Boring B-1

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5		Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Boring B-2

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5		GWT not encountered					
10		Boring completed at depth of 10'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

Amir Development Company
21889-20

Log of Boring B-3

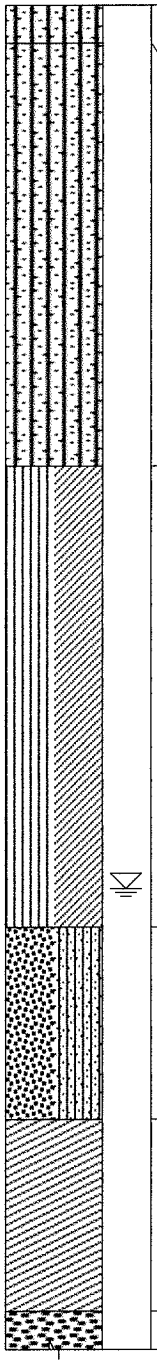
Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** 23'

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to medium grained) SAND Brown, loose, dry					
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5		X	3/3/4	8.2		15
10		X	3/4/5	10.3		31
	Sandy to Clayey SILT Brown, firm, moist to wet					
15		X	2/2/2	16.6		61
20		X	2/5/5	27.1		66
	Silty (fine to medium grained) SAND Light brown, medium dense, wet; slightly silty to silty					
25		X	4/7/9	18.5		8
	Clayey SILT Brown, firm, wet					
30		X	3/5/7	26.9		66
	SAND (fine to medium grained) Light brown, medium dense, wet					
35						

NorCal Engineering

Amir Development Company
21889-20

Log of Boring B-3

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** 23'

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
35		SAND (fine to medium grained) Light brown, medium dense, wet		8/9/12	19.5		4
40				8/9/12	19.5		4
45				9/13/19	17.8.		7
50				10/12/18	16.4		8
		Boring completed at depth of 51.5'					
55							
60							
65							
70							

SuperLog CiviliTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Trench T-1

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight: | Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel			5.2	102.8	
5					4.2	104.7	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Trench T-2

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight: | Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry	■		7.5	100.9	
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5			■		7.8	106.9	
10			■		8.5	107.2	
15		Sandy to Clayey SILT Brown, firm, moist	■		11.7	110.1	
20		Trench completed at depth of 20'	■		18.8	105.6	
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Trench T-3

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist; with occasional gravel	■		11.4	105.2	
5			■		5.9	103.2	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Trench T-4

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry	■		3.9	107.7	
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist; with occasional gravel	■		6.0	105.1	
5		GWT not encountered					
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

SuperLog CiviliTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Trench T-5

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 6/25/2020 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lithology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, dry					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist; with occasional gravel and cobble	■		4.3	108.1	
5			■		5.2	106.0	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Boring B-4

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 3/24/2022 | Groundwater Depth: None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5			☒	3/3/4	8.2		15
10			☒	3/4/5	10.3		31
		Boring completed at depth of 11'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Boring B-5

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 3/24/2022 | Groundwater Depth: None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5			☒	3/3/4	8.2		15
10			☒	3/4/5	10.3		31
		Boring completed at depth of 11.5'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

Amir Development Company
21889-20

Log of Boring B-6

Boring Location: 10941 W Los Angeles Ave, Moorpark

Date of Drilling: 3/24/2022 | **Groundwater Depth:** 23'

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to medium grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist; with occasional gravel					
5			X	3/3/4	8.2		15
10			X	3/4/5	10.3		31
15		Sandy SILT Brown, firm, moist	X	2/2/2	16.6		61
		Clayey SILT Brown, firm, moist to wet Groundwater @ 23' bgs					
20			X	2/5/5	27.1		66
		Silty (fine to coarse grained) SAND Light brown, medium dense, wet; slightly silty					
25		Boring completed at depth of 25'	X	4/7/9	18.5		8
30							
35							

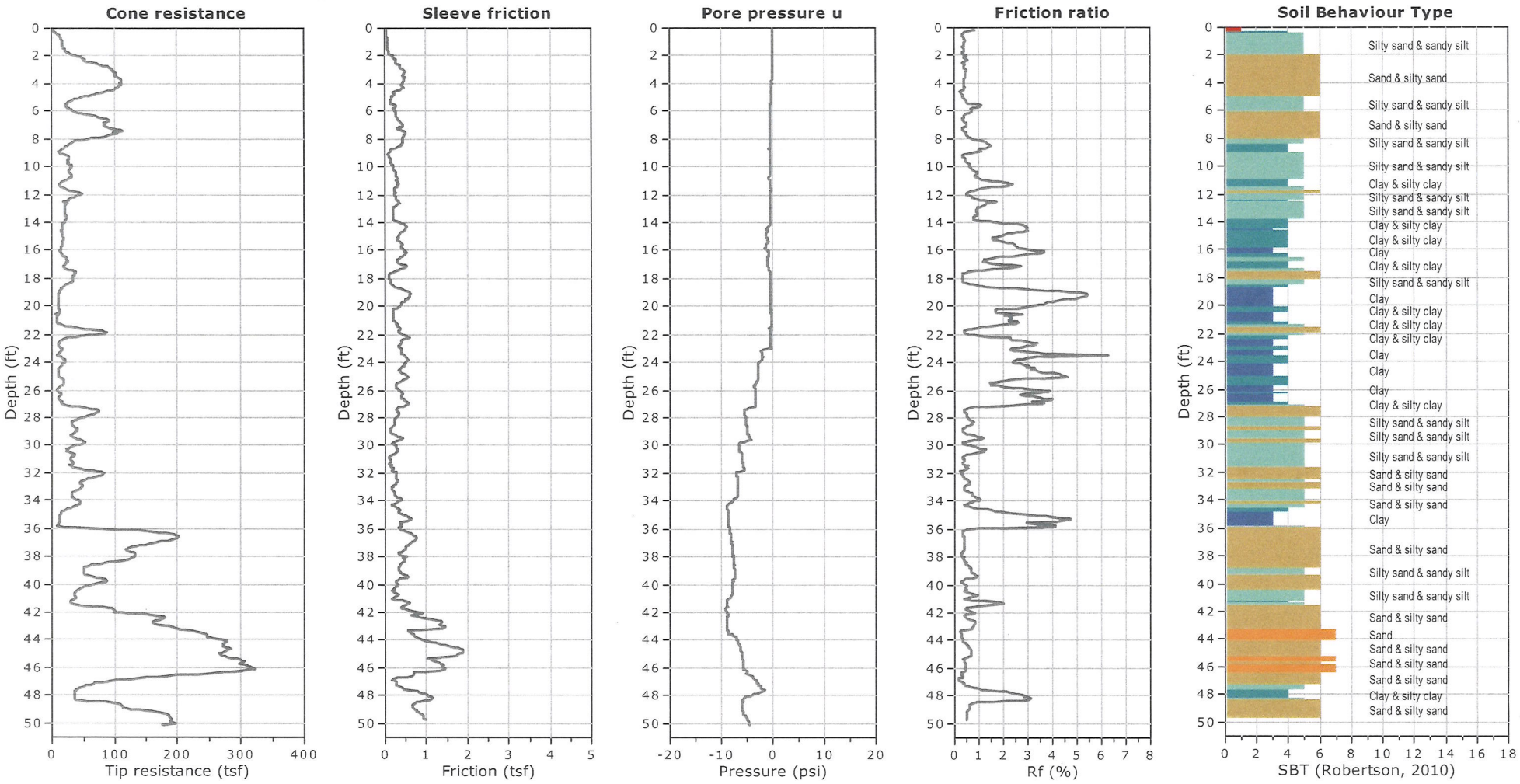
SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21889-20.log Date: 4/11/2022

NorCal Engineering

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

Project: **Amir Development Company**
Location: **10941 W. Los Angeles Avenue, Moorpark CA**

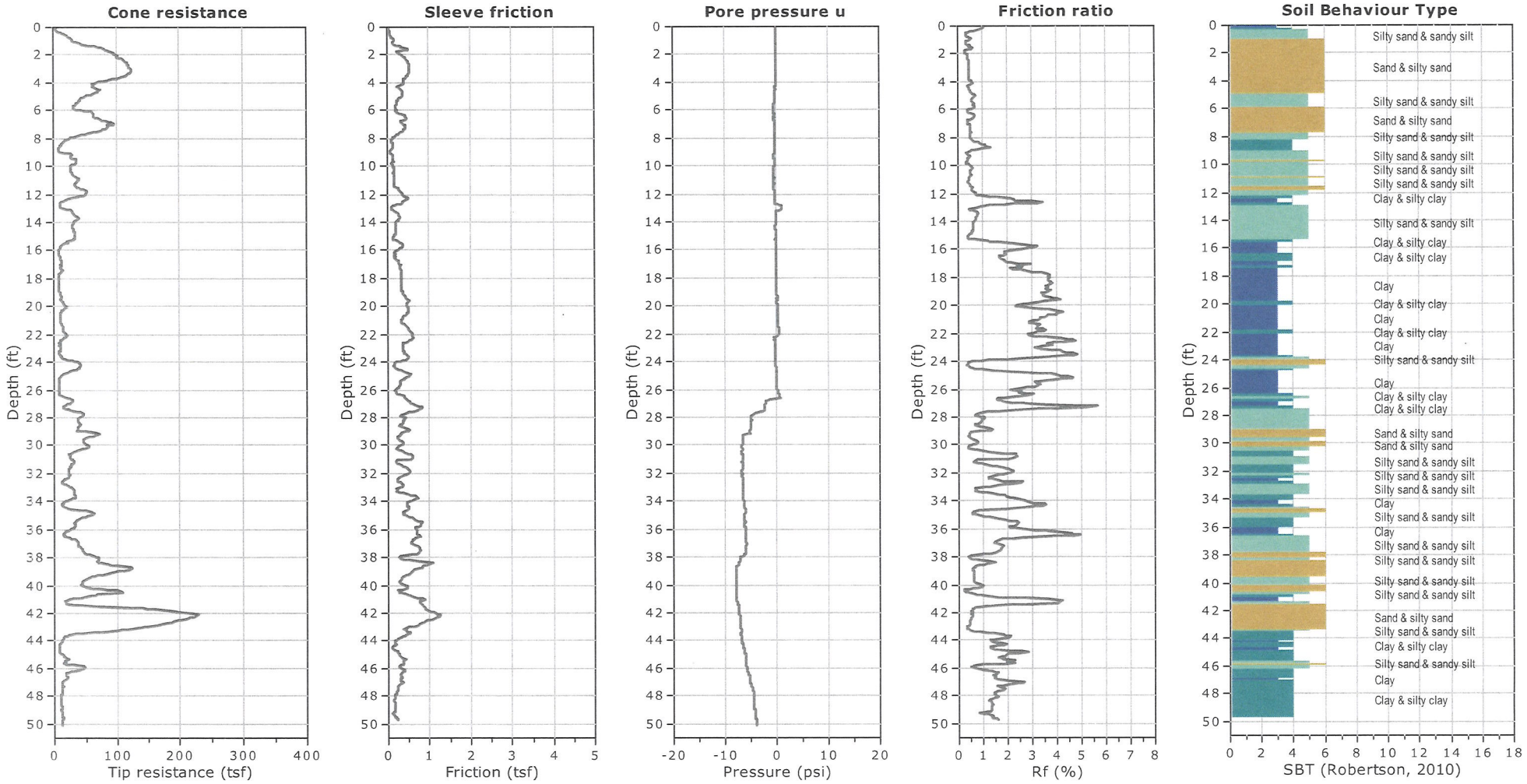
CPT-1
Total depth: 50.13 ft, Date: 3/25/2022



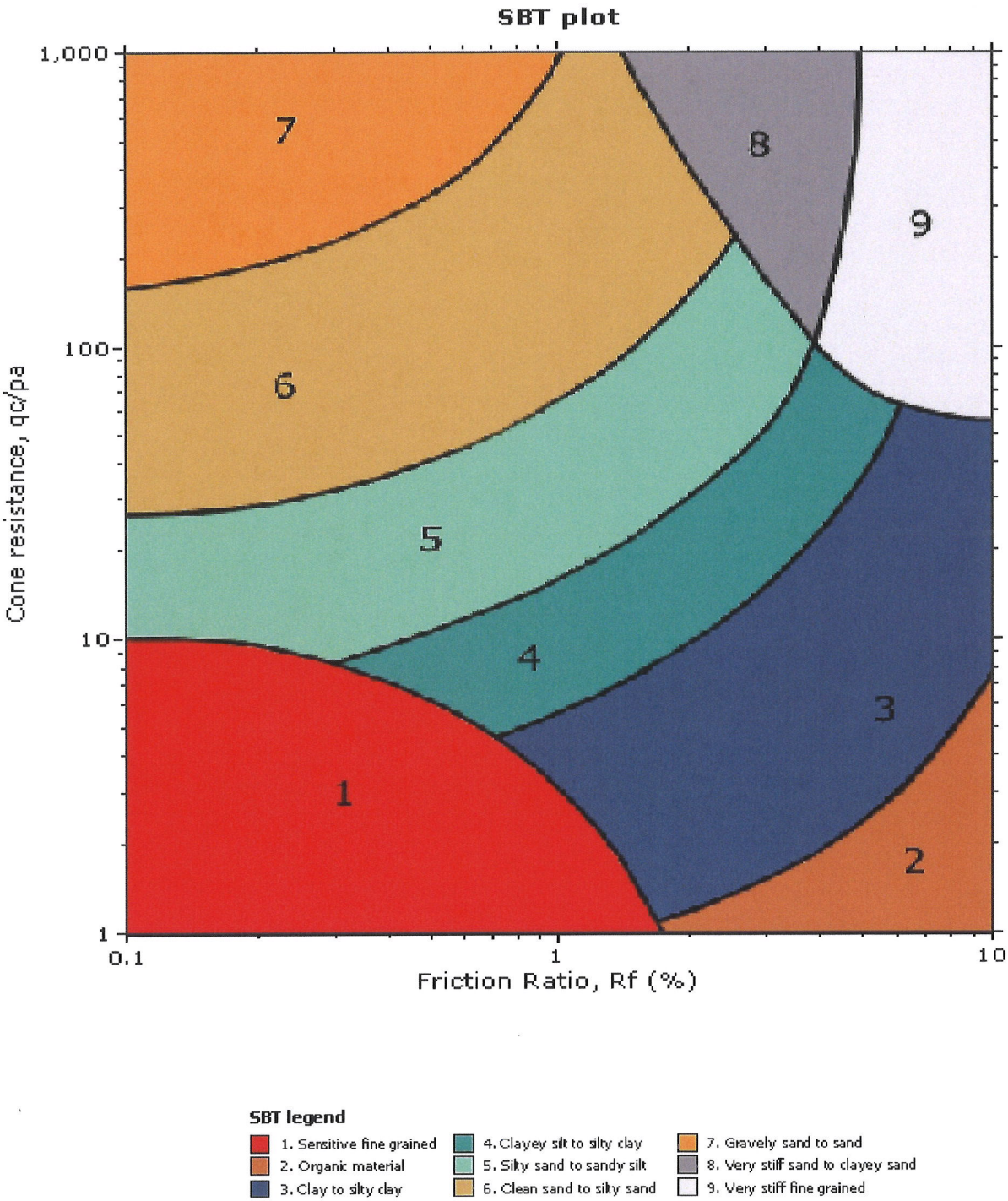
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Amir Development Company**
Location: **10941 W. Los Angeles Avenue, Moorpark CA**

CPT-2
Total depth: 50.13 ft, Date: 3/25/2022



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



Depth (ft)	Tip Stress (tsf)	Sleeve Stre (tsf)	Pore Pressı (psi)	Ratio (%)
0	0.37	0.0168	-0.094	4.581
0.081	2.29	0.0183	-0.094	0.799
0.155	2.84	0.024	-0.094	0.845
0.2	3.39	0.024	0	0.708
0.276	4.58	0.024	0	0.524
0.329	5.68	0.0258	-0.016	0.454
0.411	8.33	0.0328	0	0.394
0.468	10.34	0.0363	-0.016	0.351
0.526	11.9	0.0415	0	0.349
0.597	13.55	0.0481	0	0.355
0.665	14.37	0.0549	0	0.382
0.742	15.01	0.0601	0	0.4
0.796	15.56	0.0642	0	0.413
0.862	16.11	0.0726	0	0.451
0.929	16.38	0.0725	0	0.442
0.989	16.29	0.0688	0	0.422
1.051	16.48	0.066	0	0.4
1.136	16.93	0.066	0	0.39
1.197	17.12	0.066	0	0.385
1.258	17.94	0.066	0	0.368
1.324	18.67	0.0676	0	0.362
1.386	19.59	0.0704	0	0.359
1.45	19.95	0.0728	0	0.365
1.512	20.6	0.0747	0	0.363
1.577	21.6	0.0793	0	0.367
1.644	22.7	0.088	0	0.387
1.729	25.36	0.0934	0	0.369
1.778	27.09	0.0977	0	0.36
1.838	30.85	0.1088	0	0.353
1.913	35.61	0.1524	0	0.428
1.978	39.27	0.1932	0	0.492
2.042	42.38	0.2076	0	0.49
2.101	46.22	0.19	0	0.411
2.173	48.33	0.1921	0	0.398
2.245	52.45	0.2623	0	0.5
2.304	50.8	0.2795	0	0.55
2.369	53.91	0.2699	0	0.501
2.43	58.76	0.2699	0	0.459
2.496	62.34	0.2525	0	0.405
2.564	71.85	0.2542	0	0.354
2.63	76.8	0.347	0	0.452
2.699	83.94	0.3479	0	0.414
2.757	90.53	0.3479	0	0.384
2.827	92.45	0.3684	0	0.399

2.893	96.84	0.3967	-0.038	0.41
2.984	97.3	0.4366	0	0.449
3.025	96.57	0.4562	-0.062	0.472
3.087	100.14	0.4811	0	0.48
3.16	99.04	0.4793	-0.066	0.484
3.217	101.97	0.4469	-0.068	0.438
3.285	102.43	0.4455	-0.069	0.435
3.348	101.42	0.4525	-0.096	0.446
3.424	101.33	0.4421	-0.101	0.436
3.484	104.35	0.4633	-0.101	0.444
3.547	105.81	0.4812	-0.101	0.455
3.611	108.56	0.4758	-0.113	0.438
3.699	110.57	0.4598	-0.115	0.416
3.745	110.76	0.4541	-0.117	0.41
3.807	110.48	0.4465	-0.136	0.404
3.879	110.85	0.4416	-0.136	0.398
3.951	109.84	0.4348	-0.136	0.396
4.007	110.94	0.4232	-0.094	0.382
4.075	111.31	0.408	-0.165	0.367
4.139	110.02	0.4041	-0.159	0.367
4.209	107.64	0.4397	-0.159	0.409
4.274	105.63	0.447	-0.174	0.423
4.335	101.97	0.4117	-0.174	0.404
4.4	99.68	0.3959	-0.178	0.397
4.497	95.56	0.357	-0.178	0.374
4.533	90.62	0.2909	-0.198	0.321
4.597	82.47	0.1991	-0.198	0.241
4.666	77.9	0.2047	-0.198	0.263
4.727	73.5	0.2209	-0.255	0.301
4.791	67.92	0.2281	-0.282	0.336
4.861	60.96	0.1921	-0.309	0.315
4.925	53.18	0.1787	-0.328	0.336
4.987	47.69	0.1694	-0.328	0.355
5.054	43.2	0.1648	-0.348	0.381
5.13	36.06	0.1502	-0.348	0.417
5.19	33.5	0.1474	-0.348	0.44
5.259	30.11	0.1459	-0.374	0.485
5.332	27.92	0.1395	-0.374	0.5
5.404	26.09	0.1297	-0.374	0.497
5.454	24.81	0.1323	-0.374	0.533
5.524	23.71	0.2111	-0.468	0.89
5.599	23.71	0.2697	-0.468	1.138
5.648	23.71	0.2525	-0.468	1.065
5.729	25.45	0.2296	-0.468	0.902
5.779	27.64	0.2079	-0.468	0.752
5.845	30.85	0.2106	-0.468	0.683
5.914	31.12	0.223	-0.484	0.716

5.98	34.42	0.2411	-0.484	0.701
6.041	36.89	0.2574	-0.489	0.698
6.127	42.38	0.2596	-0.489	0.613
6.182	47.41	0.2534	-0.489	0.534
6.257	55.01	0.257	-0.478	0.467
6.307	60.14	0.2583	-0.468	0.429
6.404	70.21	0.2738	-0.468	0.39
6.447	75.24	0.2895	-0.468	0.385
6.521	83.66	0.3066	-0.468	0.367
6.579	87.32	0.3099	-0.468	0.355
6.649	91.35	0.3219	-0.468	0.352
6.717	90.98	0.347	-0.468	0.381
6.759	89.34	0.364	-0.468	0.407
6.851	84.49	0.3938	-0.468	0.466
6.89	83.57	0.4101	-0.468	0.491
6.975	84.67	0.4296	-0.468	0.507
7.024	82.84	0.4259	-0.468	0.514
7.117	84.85	0.4306	-0.468	0.507
7.166	87.69	0.3763	-0.468	0.429
7.233	94.37	0.3105	-0.468	0.329
7.3	103.89	0.344	-0.468	0.331
7.378	109.38	0.3945	-0.468	0.361
7.449	113.04	0.4371	-0.468	0.387
7.488	113.23	0.4571	-0.468	0.404
7.56	97.48	0.4811	-0.468	0.494
7.616	104.72	0.4917	-0.468	0.47
7.679	99.41	0.4852	-0.468	0.488
7.749	92.63	0.4693	-0.468	0.507
7.824	84.67	0.461	-0.468	0.544
7.885	76.98	0.4428	-0.468	0.575
7.97	63.52	0.4192	-0.562	0.66
8.011	57.21	0.4222	-0.468	0.738
8.084	46.41	0.429	-0.562	0.924
8.155	39.45	0.4229	-0.468	1.072
8.242	34.87	0.4393	-0.468	1.26
8.282	32.95	0.434	-0.468	1.317
8.334	31.3	0.423	-0.468	1.351
8.425	27.55	0.4015	-0.468	1.457
8.48	25.72	0.3892	-0.468	1.513
8.537	23.8	0.3626	-0.562	1.524
8.605	21.69	0.3066	-0.562	1.413
8.668	18.86	0.2424	-0.749	1.286
8.732	16.57	0.1705	-0.655	1.029
8.804	14.46	0.1447	-0.655	1.001
8.866	12.63	0.1371	-0.655	1.085
8.936	11.62	0.1208	-0.655	1.039
9.002	12.45	0.0981	-0.655	0.788

9.083	15.84	0.0789	-0.468	0.498
9.13	18.58	0.0794	-0.468	0.427
9.198	24.9	0.0885	-0.468	0.355
9.259	27.92	0.0976	-0.468	0.35
9.343	28.83	0.1095	-0.468	0.38
9.403	28.1	0.1198	-0.468	0.426
9.456	26.82	0.1218	-0.468	0.454
9.537	26.18	0.1153	-0.468	0.44
9.583	26.09	0.1179	-0.562	0.452
9.649	26.45	0.1252	-0.562	0.473
9.712	27.74	0.1349	-0.562	0.486
9.792	25.54	0.1629	-0.562	0.638
9.844	30.21	0.1786	-0.562	0.591
9.915	31.67	0.1866	-0.562	0.589
9.982	31.76	0.1944	-0.562	0.612
10.072	31.03	0.2019	-0.562	0.651
10.116	30.3	0.2024	-0.562	0.668
10.175	29.38	0.2125	-0.562	0.723
10.245	28.74	0.2309	-0.562	0.804
10.333	28.1	0.2517	-0.562	0.896
10.383	28.28	0.2693	-0.562	0.952
10.465	29.02	0.277	-0.562	0.955
10.511	29.66	0.2775	-0.562	0.936
10.572	31.76	0.2739	-0.655	0.862
10.643	32.59	0.2771	-0.655	0.85
10.731	31.85	0.2865	-0.749	0.899
10.765	30.66	0.2857	-0.749	0.932
10.858	26.82	0.2857	-0.749	1.065
10.923	24.07	0.2779	-0.655	1.154
10.961	22.43	0.2804	-0.655	1.25
11.05	18.49	0.3001	-0.655	1.623
11.095	17.12	0.3105	-0.655	1.814
11.183	14.55	0.3217	-0.655	2.21
11.222	13.64	0.3218	-0.655	2.359
11.287	12.91	0.308	-0.562	2.386
11.359	13.27	0.2971	-0.562	2.239
11.426	15.29	0.2889	-0.562	1.89
11.485	17.67	0.2691	-0.468	1.523
11.566	21.69	0.2414	-0.281	1.113
11.63	24.81	0.2359	-0.187	0.951
11.7	30.48	0.2359	-0.281	0.774
11.764	35.15	0.2384	-0.468	0.678
11.855	43.75	0.2496	-0.562	0.57
11.893	45.58	0.2446	-0.562	0.537
11.943	48.15	0.2399	-0.562	0.498
12.022	47.69	0.2399	-0.562	0.503
12.083	42.84	0.2399	-0.562	0.56

12.167	37.99	0.2675	-0.562	0.704
12.206	35.61	0.2603	-0.562	0.731
12.283	31.12	0.2503	-0.562	0.804
12.347	28.65	0.2619	-0.562	0.914
12.42	27.46	0.2849	-0.655	1.038
12.477	26.91	0.3323	-0.655	1.235
12.534	19.77	0.3439	-0.624	1.739
12.6	24.81	0.3487	-0.624	1.406
12.667	24.53	0.3334	-0.624	1.359
12.746	23.34	0.3043	-0.562	1.304
12.833	21.6	0.2549	-0.655	1.18
12.88	21.42	0.224	-0.655	1.046
12.927	21.24	0.2042	-0.655	0.962
13.011	21.33	0.1985	-0.655	0.931
13.071	21.33	0.1936	-0.655	0.908
13.144	21.51	0.1883	-0.655	0.876
13.192	21.51	0.1939	-0.655	0.901
13.263	21.51	0.1965	-0.655	0.913
13.324	21.51	0.2046	-0.655	0.951
13.413	21.51	0.2033	-0.655	0.945
13.46	21.05	0.197	-0.655	0.936
13.546	22.52	0.1868	-0.655	0.83
13.594	23.25	0.1885	-0.655	0.811
13.655	24.35	0.1916	-0.655	0.787
13.727	24.44	0.1852	-0.655	0.758
13.787	23.89	0.1905	-0.655	0.798
13.865	22.15	0.2525	-0.655	1.14
13.927	21.51	0.3101	-0.655	1.442
13.993	21.05	0.3567	-0.655	1.694
14.059	19.59	0.4025	-0.655	2.055
14.129	17.85	0.453	-0.655	2.538
14.173	17.39	0.49	-0.655	2.817
14.246	17.21	0.5111	-0.749	2.97
14.351	16.84	0.5022	-0.936	2.982
14.397	16.84	0.4993	-0.936	2.964
14.443	16.84	0.493	-0.936	2.927
14.519	16.57	0.4841	-1.216	2.922
14.578	16.02	0.4762	-1.17	2.973
14.66	15.84	0.4354	-1.17	2.75
14.721	16.2	0.4097	-1.17	2.529
14.788	16.38	0.3742	-1.31	2.284
14.83	16.57	0.3572	-1.216	2.156
14.935	17.48	0.3325	-1.216	1.902
14.977	17.94	0.3244	-1.216	1.808
15.033	18.49	0.313	-1.216	1.693
15.11	18.86	0.2978	-1.123	1.579
15.161	18.95	0.2965	-1.123	1.565

15.23	18.76	0.306	-1.03	1.631
15.291	18.4	0.3214	-0.936	1.747
15.378	17.76	0.359	-0.842	2.021
15.427	17.39	0.3842	-0.936	2.209
15.498	16.93	0.4066	-1.123	2.401
15.552	16.75	0.4113	-1.216	2.455
15.646	16.2	0.4071	-1.216	2.512
15.688	16.2	0.4058	-1.216	2.505
15.752	15.74	0.4058	-1.31	2.578
15.822	15.38	0.4058	-1.591	2.639
15.885	14.92	0.4147	-1.591	2.78
15.962	14.28	0.4449	-1.123	3.116
16.017	13.82	0.4728	-0.936	3.421
16.094	13.73	0.5035	-0.842	3.667
16.162	14	0.5125	-0.842	3.659
16.212	14.55	0.4983	-0.842	3.424
16.296	15.74	0.4774	-0.842	3.032
16.35	16.75	0.4581	-0.842	2.735
16.409	18.22	0.4312	-0.842	2.367
16.492	20.87	0.3879	-0.936	1.859
16.543	22.52	0.3601	-1.123	1.599
16.624	23.8	0.3204	-1.123	1.346
16.672	24.53	0.2984	-1.123	1.217
16.736	24.81	0.2971	-1.123	1.198
16.8	24.62	0.2909	-1.03	1.181
16.882	23.89	0.3115	-1.03	1.304
16.936	23.07	0.3365	-0.936	1.459
17.027	21.6	0.4289	-0.936	1.986
17.072	21.14	0.4854	-0.936	2.296
17.164	19.95	0.5416	-0.936	2.714
17.208	19.86	0.4778	-0.842	2.405
17.28	20.78	0.3826	-0.749	1.841
17.329	22.24	0.3593	-0.749	1.615
17.398	27.92	0.3318	-0.749	1.188
17.456	33.23	0.2885	-0.749	0.868
17.532	39.18	0.2233	-0.655	0.57
17.587	36.61	0.1712	-0.655	0.468
17.656	37.44	0.1311	-0.655	0.35
17.73	36.8	0.1137	-0.562	0.309
17.799	35.33	0.108	-0.562	0.306
17.857	34.69	0.108	-0.562	0.311
17.927	34.69	0.108	-0.562	0.311
17.995	34.69	0.1093	-0.562	0.315
18.048	34.97	0.1118	-0.562	0.32
18.133	35.24	0.1159	-0.562	0.329
18.181	34.87	0.1165	-0.562	0.334
18.259	32.49	0.1237	-0.562	0.381

18.32	29.66	0.1383	-0.562	0.466
18.405	26.54	0.1672	-0.562	0.63
18.448	24.16	0.1784	-0.562	0.738
18.519	20.87	0.2016	-0.562	0.966
18.581	18.86	0.2427	-0.562	1.287
18.658	16.38	0.3145	-0.562	1.92
18.716	14.92	0.3748	-0.562	2.512
18.769	13.91	0.4271	-0.562	3.07
18.847	13	0.496	-0.562	3.816
18.9	12.63	0.5354	-0.562	4.239
18.986	12.27	0.5877	-0.562	4.791
19.029	11.9	0.6053	-0.562	5.087
19.119	11.35	0.6118	-0.562	5.39
19.188	11.17	0.6074	-0.562	5.439
19.238	11.17	0.6019	-0.468	5.39
19.294	11.17	0.5944	-0.468	5.323
19.374	11.17	0.5709	-0.468	5.113
19.433	11.17	0.5479	-0.468	4.906
19.515	11.26	0.5075	-0.468	4.508
19.561	11.26	0.483	-0.468	4.29
19.642	11.08	0.4443	-0.468	4.011
19.699	10.98	0.4181	-0.468	3.806
19.761	10.98	0.4078	-0.468	3.713
19.832	10.98	0.3996	-0.468	3.638
19.888	11.26	0.3856	-0.468	3.425
19.962	11.62	0.3647	-0.468	3.138
20.054	11.72	0.3395	-0.468	2.898
20.1	11.62	0.3415	-0.468	2.938
20.149	11.62	0.2973	-0.468	2.557
20.212	11.53	0.2023	-0.468	1.754
20.277	12.08	0.2001	-0.374	1.656
20.368	12.36	0.2089	-0.468	1.691
20.414	12.36	0.2107	-0.468	1.705
20.48	11.35	0.2109	-0.374	1.858
20.549	7.32	0.205	-0.374	2.8
20.612	9.89	0.2011	-0.374	2.035
20.679	9.43	0.2058	-0.374	2.183
20.736	8.7	0.2017	-0.281	2.32
20.811	8.6	0.1991	-0.281	2.314
20.879	8.42	0.193	-0.281	2.292
20.947	8.51	0.1904	-0.281	2.237
21.007	8.79	0.1961	-0.281	2.231
21.081	9.24	0.2341	-0.281	2.533
21.16	9.61	0.2505	-0.187	2.607
21.196	10.16	0.2544	-0.187	2.503
21.275	12.63	0.284	-0.187	2.248
21.343	17.21	0.3056	-0.187	1.776

21.394	22.98	0.3078	-0.187	1.34
21.457	31.03	0.3425	-0.374	1.104
21.531	40.18	0.3719	-0.749	0.926
21.593	52.72	0.3532	-0.655	0.67
21.659	63.8	0.3542	-0.577	0.555
21.749	81.92	0.3229	-0.577	0.394
21.795	85.58	0.3273	-0.577	0.382
21.853	87.14	0.3445	-0.562	0.395
21.924	84.94	0.3943	-0.562	0.464
21.991	70.21	0.4229	-0.562	0.602
22.06	57.85	0.4759	-0.562	0.823
22.133	44.94	0.5311	-0.562	1.182
22.188	36.8	0.5672	-0.562	1.542
22.249	25.72	0.5902	-0.562	2.294
22.329	20.32	0.4651	-0.562	2.289
22.393	16.75	0.3927	-0.562	2.345
22.461	15.01	0.4108	-0.562	2.736
22.508	13.82	0.4102	-0.562	2.968
22.588	12.36	0.4004	-0.562	3.24
22.642	11.62	0.3946	-0.499	3.394
22.71	10.98	0.3643	-0.499	3.317
22.785	10.89	0.3417	-0.499	3.137
22.849	11.26	0.333	-0.468	2.958
22.91	12.36	0.3437	-0.374	2.781
23.003	15.38	0.3789	-0.374	2.464
23.037	16.75	0.3895	-0.842	2.325
23.116	17.48	0.3939	-1.965	2.253
23.191	15.74	0.3904	-2.246	2.48
23.233	14.83	0.3915	-2.246	2.64
23.32	11.81	0.3964	-2.152	3.357
23.369	10.8	0.4048	-2.059	3.748
23.427	10.44	0.4332	-2.09	4.151
23.493	7.6	0.4737	-2.09	6.235
23.557	13.55	0.4917	-2.09	3.63
23.63	15.29	0.5068	-1.965	3.315
23.699	17.67	0.5276	-2.059	2.987
23.76	19.59	0.5451	-2.059	2.783
23.821	21.33	0.5466	-2.059	2.563
23.901	21.42	0.5211	-2.433	2.433
23.981	20.69	0.4916	-2.714	2.377
24.034	19.31	0.4804	-2.901	2.487
24.092	17.67	0.4692	-2.995	2.656
24.15	16.48	0.4661	-2.995	2.829
24.245	15.01	0.4574	-2.995	3.047
24.285	14.28	0.4317	-2.995	3.023
24.348	13.55	0.3974	-2.995	2.934
24.423	11.99	0.393	-2.995	3.278

24.482	11.08	0.3639	-2.995	3.286
24.565	10.8	0.3331	-2.995	3.084
24.615	10.71	0.3559	-2.995	3.324
24.686	10.89	0.3755	-2.995	3.447
24.738	10.71	0.3875	-2.995	3.618
24.803	10.07	0.4096	-2.964	4.067
24.891	11.17	0.4845	-2.964	4.339
24.936	11.72	0.5164	-2.964	4.407
25.021	11.72	0.5405	-2.901	4.613
25.071	12.08	0.5434	-2.901	4.497
25.146	14.74	0.5136	-2.901	3.485
25.202	16.57	0.4776	-2.995	2.883
25.266	19.22	0.4351	-2.995	2.263
25.336	20.14	0.3799	-3.088	1.886
25.423	20.14	0.3104	-3.182	1.541
25.472	19.68	0.2812	-3.182	1.429
25.532	18.4	0.2722	-3.463	1.479
25.599	17.39	0.263	-3.557	1.512
25.692	14.65	0.2612	-3.463	1.784
25.745	12.91	0.2594	-3.557	2.01
25.807	11.17	0.2701	-3.463	2.419
25.865	10.44	0.2908	-3.463	2.786
25.923	9.52	0.313	-3.463	3.288
26.005	9.24	0.3423	-3.463	3.703
26.054	9.24	0.3562	-3.369	3.853
26.125	10.16	0.3852	-3.369	3.791
26.183	11.35	0.4064	-3.369	3.58
26.265	14.37	0.4139	-3.369	2.88
26.319	15.38	0.4049	-3.369	2.633
26.402	13.55	0.3952	-3.463	2.917
26.453	12.27	0.3948	-3.463	3.219
26.517	11.26	0.3944	-3.463	3.503
26.586	11.26	0.4109	-3.463	3.649
26.654	11.26	0.4458	-3.369	3.96
26.709	11.99	0.47	-3.401	3.919
26.782	15.93	0.5045	-3.432	3.168
26.839	16.2	0.5374	-3.432	3.317
26.91	15.74	0.574	-3.401	3.646
26.98	16.11	0.5719	-3.463	3.55
27.058	18.58	0.541	-3.369	2.911
27.101	22.61	0.5078	-3.369	2.246
27.175	34.23	0.426	-3.463	1.244
27.239	43.94	0.3449	-3.65	0.785
27.305	56.02	0.2974	-4.68	0.531
27.374	64.62	0.2715	-5.147	0.42
27.433	72.4	0.2703	-5.429	0.373
27.505	75.06	0.2854	-5.429	0.38

27.573	74.6	0.304	-5.429	0.407
27.628	73.04	0.3214	-5.429	0.44
27.699	69.2	0.3339	-5.429	0.482
27.763	66	0.3306	-5.429	0.501
27.828	61.05	0.3204	-5.429	0.525
27.909	56.66	0.2891	-5.335	0.51
27.969	51.08	0.2698	-5.335	0.528
28.027	47.14	0.2561	-5.335	0.543
28.09	42.75	0.2419	-5.335	0.566
28.173	37.9	0.2423	-5.335	0.639
28.219	35.33	0.2439	-5.335	0.69
28.297	32.4	0.243	-5.241	0.75
28.355	32.36	0.2411	-5.241	0.745
28.444	32.36	0.2307	-5.241	0.713
28.487	32.31	0.2236	-5.147	0.692
28.552	33.68	0.2094	-5.054	0.622
28.618	34.97	0.1833	-5.054	0.524
28.695	37.07	0.1556	-4.961	0.42
28.759	38.54	0.136	-5.054	0.353
28.813	39.73	0.1369	-5.054	0.345
28.891	40.28	0.1353	-5.054	0.336
28.955	39.63	0.1222	-5.054	0.308
29.021	38.54	0.1223	-5.054	0.317
29.072	36.71	0.142	-5.054	0.387
29.134	35.06	0.1738	-5.054	0.496
29.2	33.5	0.2044	-4.711	0.61
29.281	29.75	0.2538	-4.711	0.853
29.339	31.03	0.2872	-4.711	0.926
29.399	31.67	0.3599	-4.399	1.136
29.479	35.88	0.4197	-4.399	1.17
29.553	41.01	0.4043	-4.305	0.986
29.599	45.4	0.3792	-4.212	0.835
29.687	49.79	0.2639	-5.241	0.53
29.727	51.35	0.2289	-5.615	0.446
29.805	52.63	0.182	-6.364	0.346
29.863	50.62	0.1732	-6.551	0.342
29.948	43.94	0.2139	-6.458	0.487
29.999	39.36	0.249	-6.458	0.633
30.053	34.23	0.2779	-6.551	0.812
30.131	29.02	0.2796	-6.458	0.964
30.202	25.36	0.2878	-6.551	1.135
30.266	24.26	0.305	-6.458	1.257
30.315	25.4	0.3089	-6.458	1.216
30.399	24.16	0.3009	-6.458	1.245
30.449	25.45	0.2952	-6.271	1.16
30.533	30.66	0.2492	-6.177	0.813
30.594	36.43	0.215	-5.99	0.59

30.645	37.07	0.186	-6.083	0.502
30.711	36.06	0.139	-6.083	0.385
30.796	34.23	0.1104	-6.083	0.323
30.842	32.86	0.1109	-6.083	0.338
30.911	30.57	0.1063	-6.083	0.348
30.976	30.3	0.1146	-6.083	0.378
31.063	30.21	0.1253	-6.083	0.415
31.105	31.85	0.1244	-6.083	0.39
31.197	33.04	0.1159	-5.99	0.351
31.247	33.32	0.1159	-5.896	0.348
31.309	33.32	0.1132	-5.896	0.34
31.386	32.77	0.1396	-5.771	0.426
31.44	28.56	0.1613	-5.771	0.565
31.504	32.04	0.1461	-5.771	0.456
31.576	34.69	0.1751	-5.615	0.505
31.632	36.98	0.1986	-5.615	0.537
31.699	46.04	0.2135	-5.615	0.464
31.78	53.73	0.1658	-5.522	0.309
31.84	65.26	0.1596	-5.803	0.245
31.897	73.04	0.1941	-6.458	0.266
31.957	79.54	0.2473	-7.113	0.311
32.043	82.56	0.2519	-7.113	0.305
32.09	81.28	0.2519	-7.113	0.31
32.161	78.17	0.2519	-7.113	0.322
32.228	74.69	0.252	-6.926	0.337
32.295	69.29	0.2543	-6.926	0.367
32.363	63.52	0.2506	-6.926	0.394
32.444	57.21	0.2768	-6.926	0.484
32.491	52.91	0.2873	-6.926	0.543
32.581	47.6	0.2855	-6.926	0.6
32.625	46.22	0.2839	-6.832	0.614
32.713	44.49	0.2784	-6.832	0.626
32.757	45.13	0.2723	-6.739	0.603
32.817	46.59	0.2559	-6.739	0.549
32.895	48.42	0.2116	-6.739	0.437
32.95	49.43	0.1884	-6.739	0.381
33.011	48.79	0.1793	-6.832	0.367
33.072	47.69	0.178	-6.926	0.373
33.154	44.21	0.1691	-6.926	0.382
33.243	39.91	0.196	-6.926	0.491
33.29	37.44	0.2108	-6.926	0.563
33.336	35.97	0.2235	-6.926	0.621
33.427	33.5	0.2341	-6.926	0.699
33.474	32.68	0.2382	-6.832	0.729
33.54	32.49	0.241	-6.832	0.742
33.603	32.77	0.2346	-6.832	0.716
33.679	32.77	0.2646	-6.832	0.807

33.743	32.77	0.3124	-7.019	0.953
33.811	34.6	0.3545	-7.019	1.025
33.87	36.71	0.3863	-7.643	1.052
33.944	38.44	0.381	-7.643	0.991
33.993	42.29	0.3632	-7.643	0.859
34.082	45.95	0.2939	-7.768	0.64
34.125	45.86	0.2532	-8.423	0.552
34.219	44.39	0.1898	-8.798	0.427
34.261	43.3	0.1728	-8.798	0.399
34.327	40.55	0.1696	-8.891	0.418
34.39	38.26	0.2023	-8.891	0.529
34.472	33.23	0.2479	-8.891	0.746
34.528	30.11	0.29	-8.891	0.963
34.59	26.18	0.3409	-8.891	1.302
34.659	22.79	0.3548	-8.798	1.557
34.721	19.13	0.317	-8.798	1.657
34.796	16.75	0.3144	-8.798	1.877
34.845	15.65	0.3412	-8.798	2.18
34.931	14.1	0.4065	-8.798	2.884
34.998	13.73	0.4562	-8.798	3.323
35.048	13.55	0.5025	-8.798	3.709
35.108	13.64	0.5456	-8.798	4
35.198	13.36	0.5931	-8.704	4.438
35.241	13	0.6097	-8.704	4.691
35.326	13.09	0.6158	-8.704	4.705
35.378	13.27	0.6031	-8.704	4.544
35.434	13	0.5463	-8.704	4.203
35.508	12.17	0.3568	-8.704	2.931
35.589	10.98	0.3788	-8.704	3.449
35.643	10.34	0.3674	-8.704	3.552
35.726	9.98	0.406	-8.61	4.07
35.78	10.07	0.4094	-8.579	4.066
35.835	8.97	0.3589	-8.548	4.001
35.91	18.58	0.3406	-8.548	1.833
35.97	39.08	0.3684	-8.548	0.942
36.044	74.6	0.3596	-8.423	0.482
36.095	109.75	0.4059	-8.423	0.37
36.162	136.2	0.4626	-8.382	0.34
36.23	157.62	0.5177	-8.338	0.328
36.306	169.43	0.5762	-8.338	0.34
36.356	181.79	0.6188	-8.263	0.34
36.432	193.69	0.6653	-8.263	0.343
36.488	198.63	0.6918	-8.2	0.348
36.557	200.64	0.7316	-8.2	0.365
36.622	200.73	0.7579	-8.135	0.378
36.708	199.27	0.7657	-8.135	0.384
36.753	197.16	0.756	-8.087	0.383

36.824	191.12	0.7283	-8.087	0.381
36.886	184.44	0.6941	-8.087	0.376
36.947	172.91	0.6574	-7.955	0.38
37.011	164.76	0.6236	-8.049	0.378
37.077	153.96	0.6001	-7.955	0.39
37.157	147.64	0.5633	-7.862	0.382
37.212	139.59	0.5383	-7.862	0.386
37.279	133.37	0.5053	-7.862	0.379
37.34	128.42	0.4956	-7.862	0.386
37.424	122.56	0.4919	-7.862	0.401
37.471	119.91	0.4795	-7.768	0.4
37.539	116.8	0.4561	-7.768	0.39
37.602	118.9	0.4249	-7.862	0.357
37.666	125.58	0.3868	-7.768	0.308
37.733	129.98	0.3381	-7.862	0.26
37.808	132.82	0.34	-7.768	0.256
37.871	133.09	0.3648	-7.675	0.274
37.938	132.08	0.4608	-7.768	0.349
38	131.26	0.5144	-7.675	0.392
38.06	130.16	0.4194	-7.675	0.322
38.124	129.06	0.4262	-7.675	0.33
38.191	124.85	0.4536	-7.675	0.363
38.271	117.99	0.4627	-7.675	0.392
38.326	95.93	0.4534	-7.612	0.473
38.393	92.63	0.4306	-7.612	0.465
38.473	83.2	0.3793	-7.55	0.456
38.521	74.78	0.36	-7.55	0.481
38.596	65.17	0.3539	-7.487	0.543
38.651	59.31	0.3538	-7.581	0.596
38.723	53.73	0.3276	-7.581	0.61
38.799	50.89	0.3293	-7.581	0.647
38.846	50.44	0.3239	-7.394	0.642
38.92	50.89	0.3413	-7.394	0.671
39.005	50.53	0.3364	-7.394	0.666
39.051	50.89	0.3459	-7.3	0.68
39.113	50.71	0.3702	-7.394	0.73
39.18	50.44	0.3976	-7.394	0.788
39.249	51.53	0.4238	-7.394	0.822
39.307	53.46	0.4777	-7.394	0.894
39.376	56.84	0.5307	-7.394	0.934
39.45	64.9	0.5725	-7.44	0.882
39.514	73.68	0.5169	-7.487	0.702
39.587	79.82	0.3599	-7.487	0.451
39.64	85.4	0.3128	-7.768	0.366
39.718	88.15	0.2475	-7.675	0.281
39.792	86.41	0.2548	-7.862	0.295
39.848	81.1	0.2659	-7.862	0.328

39.941	71.12	0.2858	-7.862	0.402
39.965	71.12	0.2927	-7.862	0.411
40.027	63.52	0.3017	-7.862	0.475
40.113	58.67	0.2907	-7.893	0.495
40.167	54.19	0.2682	-7.924	0.495
40.23	48.51	0.2279	-7.924	0.47
40.307	45.77	0.2015	-7.924	0.44
40.364	44.03	0.2182	-7.862	0.496
40.441	41.28	0.1701	-7.955	0.412
40.49	39.45	0.2076	-7.955	0.526
40.581	37.35	0.2676	-7.955	0.717
40.634	36.61	0.2738	-7.955	0.748
40.714	37.35	0.3256	-7.955	0.872
40.761	35.7	0.342	-7.862	0.958
40.857	37.35	0.2719	-8.143	0.728
40.903	38.44	0.2176	-8.236	0.566
40.988	37.44	0.1503	-8.61	0.401
41.011	36.8	0.1662	-8.798	0.452
41.08	34.6	0.2394	-8.891	0.692
41.157	32.31	0.3959	-8.891	1.225
41.227	30.66	0.5423	-8.891	1.769
41.299	29.93	0.5983	-8.891	1.999
41.343	30.39	0.5976	-8.891	1.967
41.411	35.24	0.5394	-8.985	1.531
41.484	45.77	0.4478	-8.891	0.978
41.554	67.74	0.401	-8.798	0.592
41.609	80.46	0.3968	-8.891	0.493
41.684	91.81	0.3927	-9.172	0.428
41.747	96.94	0.4455	-9.172	0.46
41.803	98.67	0.5254	-9.172	0.532
41.876	99.77	0.6579	-8.954	0.659
41.955	99.04	0.8288	-8.954	0.837
41.997	108.56	0.8908	-8.954	0.821
42.065	127.23	0.8835	-8.704	0.694
42.134	145.36	0.7629	-8.704	0.525
42.194	158.81	0.6345	-8.704	0.4
42.263	173.18	0.7924	-8.798	0.458
42.326	178.31	0.7568	-8.985	0.424
42.389	178.86	0.8873	-9.078	0.496
42.464	175.84	1.1022	-9.078	0.627
42.551	168.79	1.2711	-9.078	0.753
42.596	165.49	1.336	-9.078	0.807
42.661	161.1	1.3708	-9.078	0.851
42.728	161.15	1.3764	-9.078	0.854
42.788	161.19	1.3351	-8.985	0.828
42.857	167.87	1.3141	-8.985	0.783
42.941	179.59	1.3931	-8.985	0.776

42.998	185.45	1.4507	-8.985	0.782
43.06	192.59	1.4382	-8.985	0.747
43.12	196.98	1.3858	-8.985	0.704
43.176	198.08	1.3247	-8.985	0.669
43.264	204.85	0.7962	-8.891	0.389
43.312	210.53	0.5433	-8.798	0.258
43.376	226.46	0.5595	-8.798	0.247
43.445	235.33	0.6183	-8.798	0.263
43.514	243.57	0.6738	-8.704	0.277
43.574	246.04	0.6932	-7.846	0.282
43.638	246.46	0.692	-7.846	0.281
43.704	246.46	0.693	-7.846	0.281
43.782	246.87	0.732	-7.019	0.297
43.838	253.55	0.783	-7.155	0.309
43.92	264.35	0.8876	-7.008	0.336
43.974	270.48	0.9046	-6.868	0.334
44.034	279.09	0.9809	-6.868	0.351
44.112	277.35	1.1455	-6.868	0.413
44.162	276.98	1.2217	-6.743	0.441
44.24	272.13	1.3168	-6.619	0.484
44.302	273.6	1.3528	-6.619	0.494
44.371	271.99	1.4594	-6.619	0.537
44.431	271.86	1.5767	-6.413	0.58
44.497	277.26	1.6773	-6.413	0.605
44.557	279.36	1.772	-6.314	0.634
44.624	283.48	1.837	-6.314	0.648
44.686	282.11	1.8816	-6.231	0.667
44.775	278.54	1.8832	-6.231	0.676
44.823	273.05	1.8845	-6.157	0.69
44.887	269.02	1.8625	-6.157	0.692
44.956	265.82	1.8066	-6.083	0.68
45.024	268.2	1.7549	-6.083	0.654
45.085	270.3	1.7346	-6.083	0.642
45.159	274.6	1.7233	-5.99	0.628
45.222	277.17	1.3472	-5.99	0.486
45.296	285.13	1.0103	-5.99	0.354
45.356	292.18	1.0766	-5.99	0.368
45.418	299.59	1.1103	-5.896	0.371
45.491	304.35	1.1687	-5.896	0.384
45.538	304.99	1.2256	-5.818	0.402
45.615	300.83	1.3073	-5.79	0.435
45.683	296.66	1.3385	-5.79	0.451
45.742	302.43	1.3744	-5.739	0.454
45.803	309.48	1.4285	-5.739	0.462
45.875	312.77	1.3854	-5.739	0.443
45.932	315.24	1.3961	-5.708	0.443
46.008	319.64	1.455	-5.708	0.455

46.063	322.29	1.4382	-5.68	0.446
46.151	314.6	1.4306	-5.651	0.455
46.206	302.8	1.3252	-5.128	0.438
46.276	285.95	0.8942	-5.128	0.313
46.335	271.67	0.6902	-5.128	0.254
46.402	256.66	0.6752	-5.335	0.263
46.465	230.21	0.6972	-4.424	0.303
46.531	196.98	0.6746	-4.424	0.342
46.599	187	0.6665	-4.048	0.356
46.655	169.34	0.5195	-4.048	0.307
46.736	150.67	0.2857	-4.048	0.19
46.802	132.91	0.1941	-3.557	0.146
46.858	120.64	0.1684	-3.369	0.14
46.921	102.52	0.1952	-3.182	0.19
47.002	89.7	0.2773	-3.182	0.309
47.052	78.17	0.2765	-3.088	0.354
47.128	68.65	0.2661	-2.995	0.388
47.182	66.82	0.2532	-2.995	0.379
47.261	60.23	0.2777	-2.808	0.461
47.313	52.91	0.2996	-2.34	0.566
47.382	52.07	0.3628	-2.34	0.697
47.448	43.11	0.4258	-2.34	0.988
47.53	40.09	0.4481	-1.778	1.118
47.582	38.99	0.5071	-1.684	1.3
47.667	37.62	0.7153	-1.778	1.901
47.712	36.98	0.7786	-1.872	2.105
47.775	36.43	0.8319	-2.527	2.283
47.842	35.79	0.9021	-3.088	2.521
47.914	36.43	0.9428	-3.65	2.588
47.98	35.33	1.0055	-3.931	2.846
48.04	36.43	1.0401	-4.586	2.855
48.101	36.71	1.1013	-5.147	3
48.172	36.98	1.1484	-5.615	3.105
48.253	36.61	1.1088	-5.896	3.028
48.319	38.35	1.05	-6.083	2.738
48.372	44.85	0.953	-5.896	2.125
48.425	56.93	0.8374	-5.803	1.471
48.497	86.5	0.7547	-5.896	0.873
48.56	99.5	0.7113	-5.99	0.715
48.629	108.38	0.6683	-5.99	0.617
48.692	109.2	0.6629	-5.99	0.607
48.773	111.21	0.6732	-6.083	0.605
48.823	112.31	0.6717	-6.083	0.598
48.902	113.96	0.683	-6.083	0.599
48.96	117.71	0.7071	-6.083	0.601
49.017	127.23	0.7324	-5.99	0.576
49.083	140.78	0.7437	-5.99	0.528

49.168	158.26	0.7569	-5.896	0.478
49.231	171.26	0.8142	-5.896	0.475
49.298	178.95	0.8502	-5.803	0.475
49.361	182.43	0.8881	-5.803	0.487
49.411	185.45	0.9076	-5.444	0.489
49.479	185.4	0.9076	-5.322	0.49
49.556	185.36	0.9068	-5.322	0.489
49.619	188.56	0.9196	-5.115	0.488
49.702	191.12	0.9391	-5.115	0.491
49.754	190.85	0.9997	-5.115	0.524
49.807	188.19	0	-4.867	0
49.888	188.38	0	-4.867	0
49.943	190.12	0	-4.867	0
50.012	193.78	0	-4.68	0
50.069	196.89	0	-4.68	0
50.133	174.92	0	-4.493	0

Depth (ft)	Tip Stress (tsf)	Sleeve Stress (tsf)	Pore Pressure (psi)	Ratio (%)
0	0	0.0201	0	0
0.077	2.84	0.0305	0	1.072
0.133	3.67	0.0382	0	1.043
0.207	5.32	0.0491	0.094	0.923
0.267	6.97	0.0552	0	0.792
0.353	9.81	0.0598	0	0.61
0.406	12.28	0.0647	0	0.527
0.463	15.21	0.0616	0	0.405
0.526	17.6	0.0588	0	0.334
0.594	21.9	0.0722	0	0.33
0.657	23.64	0.0837	0	0.354
0.743	27.4	0.1036	0	0.378
0.791	28.04	0.1211	0	0.432
0.86	29.14	0.1529	0	0.525
0.92	29.42	0.1635	0.094	0.556
0.989	30.79	0.1604	0.094	0.521
1.067	33.27	0.1342	0.094	0.404
1.121	36.47	0.1153	0.094	0.316
1.191	41.88	0.1287	0.094	0.307
1.25	48.02	0.155	0.094	0.323
1.324	57.37	0.2371	0.094	0.413
1.385	65.25	0.3232	0.094	0.495
1.45	73.13	0.3388	0.094	0.463
1.511	76.61	0.374	0.065	0.488
1.576	80.46	0.509	0.094	0.633
1.653	83.85	0.4849	0.051	0.578
1.71	86.24	0.3792	0.094	0.44
1.791	90.82	0.2387	0.094	0.263
1.843	96.04	0.2587	0.094	0.269
1.911	96.59	0.2847	0.094	0.295
1.975	97.6	0.3168	0.094	0.325
2.055	102	0.3721	0.094	0.365
2.106	101.63	0.3988	0.094	0.392
2.176	101.27	0.4155	0.094	0.41
2.235	104.57	0.4176	0.094	0.399
2.299	108.78	0.4298	0.094	0.395
2.366	111.99	0.4599	0.094	0.411
2.433	113.36	0.4909	0.094	0.433
2.504	114.74	0.4984	0.094	0.434
2.568	116.76	0.5022	0.094	0.43
2.643	117.95	0.5144	0.094	0.436
2.701	118.04	0.5227	0.094	0.443
2.756	119.23	0.5271	0.094	0.442
2.824	119.41	0.5368	0.094	0.45

2.893	120.24	0.5324	0.094	0.443
2.955	121.8	0.5286	0.094	0.434
3.021	123.35	0.5204	0	0.422
3.107	124.73	0.5217	0	0.418
3.158	124.45	0.5224	0	0.42
3.227	123.26	0.5224	0	0.424
3.285	122.35	0.5224	0	0.427
3.36	119.96	0.5171	0	0.431
3.419	118.13	0.5051	0	0.428
3.481	116.02	0.4898	0	0.422
3.548	112.72	0.4764	0	0.423
3.612	106.67	0.4536	0	0.425
3.681	101.45	0.4232	0	0.417
3.754	93.84	0.4037	-0.047	0.43
3.819	87.8	0.4023	-0.055	0.458
3.88	79.18	0.4056	-0.055	0.512
3.939	73.77	0.3979	-0.088	0.539
4.018	67.54	0.3934	-0.088	0.582
4.084	64.52	0.3979	-0.088	0.617
4.134	63.05	0.3925	-0.107	0.623
4.212	64.75	0.3084	-0.107	0.476
4.272	62.5	0.2418	-0.125	0.387
4.336	64.98	0.2672	-0.144	0.411
4.4	68.46	0.2983	-0.144	0.436
4.463	72.31	0.3235	-0.119	0.447
4.529	74.87	0.3293	-0.094	0.44
4.601	71.57	0.3454	-0.164	0.483
4.678	71.02	0.3511	-0.209	0.494
4.732	68.64	0.3534	-0.21	0.515
4.793	63.78	0.3596	-0.21	0.564
4.859	60.21	0.3643	-0.234	0.605
4.926	54.44	0.365	-0.246	0.67
5.001	50.31	0.3517	-0.257	0.699
5.075	46.56	0.315	-0.257	0.677
5.13	45.27	0.2942	-0.283	0.65
5.204	43.16	0.2687	-0.283	0.622
5.257	42.52	0.2469	-0.325	0.581
5.322	41.7	0.227	-0.325	0.544
5.39	40.23	0.2259	-0.325	0.562
5.452	39.04	0.2316	-0.375	0.593
5.515	37.21	0.2274	-0.375	0.611
5.584	35.74	0.2292	-0.398	0.641
5.645	33.91	0.2107	-0.398	0.621
5.715	31.89	0.2085	-0.398	0.654
5.784	31.25	0.2013	-0.408	0.644
5.854	32.44	0.2121	-0.408	0.654
5.93	37.39	0.2155	-0.418	0.576

5.984	43.16	0.2021	-0.423	0.468
6.042	48.94	0.2021	-0.428	0.413
6.115	58.93	0.2182	-0.402	0.37
6.172	62.23	0.2387	-0.402	0.384
6.255	63.69	0.2894	-0.375	0.454
6.305	64.24	0.3322	-0.468	0.517
6.368	64.61	0.4205	-0.375	0.651
6.44	64.88	0.4378	-0.468	0.675
6.525	66.17	0.4492	-0.375	0.679
6.576	70.11	0.4484	-0.468	0.64
6.64	74.6	0.4484	-0.468	0.601
6.712	77.71	0.3769	-0.468	0.485
6.785	84.04	0.3338	-0.281	0.397
6.83	86.97	0.3357	-0.281	0.386
6.893	91.92	0.3343	-0.281	0.364
6.978	97.05	0.3687	-0.281	0.38
7.026	96.04	0.3911	-0.265	0.407
7.093	86.05	0.4202	-0.265	0.488
7.159	87.89	0.4303	-0.265	0.49
7.25	85.87	0.4247	-0.226	0.495
7.309	83.58	0.4136	-0.226	0.495
7.379	79.91	0.3971	-0.187	0.497
7.418	76.34	0.3857	-0.187	0.505
7.495	69.01	0.3571	-0.187	0.517
7.565	63.14	0.3216	-0.187	0.509
7.619	56.64	0.3004	-0.281	0.53
7.689	50.5	0.2624	-0.281	0.52
7.743	44.81	0.2299	-0.281	0.513
7.83	37.57	0.1872	-0.281	0.498
7.89	32.35	0.1608	-0.281	0.497
7.961	27.95	0.1376	-0.281	0.492
8.006	25.29	0.1242	-0.281	0.491
8.1	20.34	0.1084	-0.281	0.533
8.146	18.79	0.1095	-0.281	0.583
8.227	16.77	0.107	-0.281	0.638
8.278	15.95	0.1082	-0.281	0.678
8.349	14.3	0.1163	-0.281	0.813
8.417	13.2	0.1201	-0.281	0.91
8.468	12.1	0.1209	-0.281	0.999
8.543	11.27	0.1222	-0.281	1.085
8.596	10.81	0.1206	-0.281	1.116
8.682	9.62	0.1243	-0.281	1.292
8.74	9.07	0.1201	-0.281	1.324
8.811	9.07	0.0858	-0.281	0.946
8.865	9.07	0.0599	-0.281	0.66
8.932	9.07	0.0496	-0.187	0.547
8.995	10.91	0.0546	-0.187	0.501

9.07	20.25	0.0672	-0.187	0.332
9.134	27.13	0.083	-0.281	0.306
9.188	28.96	0.1164	-0.468	0.402
9.265	28.32	0.1249	-0.468	0.441
9.346	26.76	0.1372	-0.468	0.513
9.392	27.58	0.1401	-0.468	0.508
9.477	32.44	0.1401	-0.468	0.432
9.538	35.65	0.1401	-0.375	0.393
9.581	36.38	0.1402	-0.375	0.385
9.659	36.84	0.1527	-0.375	0.415
9.716	36.84	0.1423	-0.375	0.386
9.803	35.47	0.1109	-0.375	0.313
9.852	33.63	0.1171	-0.375	0.348
9.931	29.33	0.1292	-0.375	0.44
9.985	27.58	0.1367	-0.375	0.496
10.044	27.45	0.1453	-0.422	0.529
10.112	27.45	0.1539	-0.422	0.561
10.187	27.31	0.1601	-0.422	0.586
10.249	27.95	0.161	-0.468	0.576
10.32	28.41	0.1584	-0.468	0.558
10.389	28.78	0.1487	-0.468	0.517
10.433	29.23	0.1461	-0.468	0.5
10.52	30.24	0.1487	-0.468	0.492
10.566	30.79	0.1522	-0.468	0.494
10.654	31.89	0.1709	-0.468	0.536
10.697	32.72	0.178	-0.468	0.544
10.764	35.74	0.1727	-0.468	0.483
10.837	38.49	0.1772	-0.468	0.46
10.894	40.05	0.1806	-0.375	0.451
10.969	39.87	0.1709	-0.468	0.429
11.032	38.67	0.1707	-0.468	0.441
11.102	37.48	0.1577	-0.468	0.421
11.16	36.29	0.1483	-0.468	0.409
11.241	35.1	0.1489	-0.468	0.424
11.287	35.01	0.1543	-0.375	0.441
11.379	35.01	0.1751	-0.468	0.5
11.42	35.65	0.1778	-0.468	0.499
11.508	38.12	0.239	-0.468	0.627
11.554	41.7	0.2662	-0.468	0.638
11.624	45.64	0.2533	-0.468	0.555
11.688	48.75	0.2665	-0.468	0.547
11.779	53.06	0.2938	-0.375	0.554
11.823	53.98	0.3343	-0.375	0.619
11.915	52.33	0.3704	-0.375	0.708
11.954	51.96	0.3698	-0.375	0.712
12.025	52.05	0.3716	-0.375	0.714
12.093	48.02	0.3859	-0.375	0.804

12.142	43.81	0.409	-0.375	0.934
12.231	35.01	0.4698	-0.375	1.342
12.274	31.43	0.5024	-0.281	1.598
12.362	23.55	0.491	-0.281	2.085
12.409	18.6	0.4187	-0.281	2.251
12.481	14.94	0.3507	-0.281	2.348
12.544	12.46	0.3758	-0.281	3.015
12.627	10.63	0.3651	-0.281	3.434
12.677	10.26	0.3223	-0.281	3.14
12.732	10.68	0.2369	0.359	2.219
12.802	9.99	0.1772	0.844	1.774
12.871	10.72	0.1385	0.937	1.292
12.935	11.27	0.1094	0.937	0.971
13.016	14.39	0.1081	1.031	0.751
13.073	20.8	0.1068	1.125	0.514
13.141	27.31	0.1233	1.031	0.451
13.205	29.51	0.1504	0.562	0.51
13.26	30.15	0.1769	0.094	0.587
13.344	30.61	0.236	0.094	0.771
13.386	31.07	0.2499	0	0.804
13.452	32.35	0.2617	-0.094	0.809
13.521	34.92	0.2693	-0.094	0.771
13.609	38.12	0.2862	-0.094	0.751
13.657	39.96	0.2922	-0.094	0.731
13.721	40.51	0.2896	-0.094	0.715
13.792	38.22	0.2719	-0.094	0.711
13.883	34.92	0.2506	-0.094	0.718
13.923	33.54	0.2352	-0.094	0.701
13.986	32.08	0.2101	-0.094	0.655
14.061	31.43	0.1958	-0.094	0.623
14.115	31.16	0.1915	-0.094	0.615
14.186	30.52	0.1902	-0.094	0.623
14.24	30.56	0.1902	-0.094	0.622
14.333	30.43	0.1921	-0.187	0.631
14.372	30.61	0.1939	-0.187	0.633
14.45	31.16	0.1922	-0.187	0.617
14.511	31.43	0.1934	-0.187	0.615
14.598	32.44	0.1962	-0.094	0.605
14.643	32.81	0.1979	-0.094	0.603
14.732	33.45	0.1942	-0.094	0.58
14.775	33.54	0.1882	-0.094	0.561
14.843	33.72	0.1845	-0.094	0.547
14.914	33.91	0.1711	-0.094	0.504
14.961	33.82	0.1545	-0.094	0.457
15.042	33.72	0.1301	-0.094	0.386
15.129	33.36	0.1301	-0.094	0.39
15.185	32.63	0.1301	-0.094	0.399

15.228	31.98	0.1418	-0.187	0.443
15.298	30.33	0.2053	-0.078	0.677
15.358	21.08	0.2545	0	1.207
15.43	23.09	0.2995	0	1.297
15.492	19.25	0.3225	0	1.676
15.57	15.95	0.3551	0	2.227
15.621	13.56	0.3678	0	2.712
15.716	11.46	0.3574	0	3.12
15.764	10.72	0.3454	0	3.221
15.83	10.26	0.312	0	3.039
15.881	9.99	0.2919	0	2.922
15.954	9.62	0.2576	0	2.677
16.032	9.44	0.2076	0	2.199
16.116	9.44	0.1805	0	1.912
16.152	9.44	0.1805	0	1.912
16.21	9.44	0.1811	0	1.919
16.293	9.35	0.179	0	1.915
16.344	9.35	0.1803	0	1.928
16.43	9.9	0.1819	0	1.838
16.479	10.63	0.1801	0	1.695
16.565	10.81	0.1801	0.094	1.666
16.612	11	0.1905	0.094	1.732
16.697	12.74	0.234	0.094	1.837
16.745	13.11	0.2491	0.094	1.901
16.814	13.65	0.2542	0.094	1.862
16.907	13.01	0.2604	-0.094	2.001
16.937	12.83	0.2682	-0.094	2.09
17.002	12.28	0.3001	-0.094	2.444
17.07	10.91	0.3238	-0.094	2.969
17.151	12.28	0.2932	0	2.387
17.194	10.63	0.2802	0	2.636
17.28	12.28	0.2813	0	2.291
17.333	13.75	0.2879	0	2.094
17.418	14.3	0.3158	0	2.209
17.47	13.29	0.3288	0	2.475
17.544	12.01	0.3363	0	2.801
17.597	11	0.3371	0	3.066
17.662	9.9	0.3362	0	3.397
17.73	9.07	0.3274	0	3.608
17.787	8.61	0.3202	0	3.717
17.866	8.61	0.3183	0	3.694
17.914	8.71	0.3183	0	3.655
18	8.71	0.3231	0	3.711
18.046	8.71	0.3223	0	3.701
18.138	8.8	0.3208	0	3.646
18.21	8.8	0.3229	0	3.67
18.269	8.71	0.3292	0	3.781

18.319	8.98	0.3323	0	3.7
18.38	8.61	0.3323	0.094	3.857
18.456	8.98	0.3323	0.094	3.7
18.505	8.89	0.3323	0.094	3.738
18.595	8.98	0.3229	0.094	3.595
18.64	8.98	0.3217	0.094	3.582
18.704	8.98	0.3301	0.094	3.675
18.77	9.16	0.3279	0.094	3.578
18.865	9.26	0.3429	0.094	3.704
18.907	9.35	0.3533	0.094	3.78
18.976	9.9	0.3607	0.094	3.644
19.043	10.36	0.3615	0.094	3.491
19.103	11	0.3708	0.094	3.372
19.179	11.64	0.4035	0.094	3.467
19.255	12.56	0.4371	0.187	3.481
19.307	12.65	0.4388	0.187	3.47
19.365	11.82	0.4347	0.187	3.677
19.444	11.55	0.4496	0.187	3.894
19.49	11.64	0.4678	0.094	4.019
19.579	12.37	0.5148	0.281	4.161
19.623	12.74	0.5227	0.281	4.103
19.709	14.2	0.4959	0	3.491
19.76	14.85	0.4768	0.094	3.212
19.839	16.68	0.4602	0.187	2.759
19.886	17.5	0.4658	0.187	2.661
19.962	19.8	0.4766	0.281	2.408
20.027	20.62	0.482	0.187	2.338
20.081	19.34	0.4864	0.187	2.515
20.166	16.22	0.485	0.187	2.99
20.225	14.2	0.4877	0.187	3.433
20.278	13.2	0.489	0.187	3.705
20.346	12.1	0.4845	0.187	4.005
20.422	11.27	0.4812	0.187	4.269
20.478	11	0.4726	0.187	4.297
20.54	11.09	0.4448	0.281	4.011
20.61	10.45	0.4191	0.281	4.011
20.701	10.45	0.386	0.281	3.695
20.744	10.45	0.3752	0.281	3.591
20.823	10.36	0.3632	0.281	3.507
20.889	10.45	0.3509	0.281	3.359
20.942	10.36	0.3451	0.281	3.333
21.013	10.45	0.3363	0.281	3.219
21.088	11	0.3363	0.281	3.058
21.156	11.55	0.3363	0.375	2.912
21.221	12.19	0.352	0.375	2.888
21.282	12.65	0.3862	0.375	3.053
21.332	12.37	0.4123	0.375	3.333

21.426	14.02	0.4494	0.375	3.205
21.466	14.2	0.4602	0.375	3.239
21.55	15.03	0.4821	0.468	3.208
21.598	15.76	0.4958	0.468	3.146
21.659	14.85	0.5082	0.468	3.423
21.733	14.94	0.5332	0.468	3.57
21.811	16.13	0.5543	0.468	3.436
21.869	17.5	0.5676	0.468	3.243
21.934	18.7	0.5783	0.468	3.093
22.009	20.16	0.5848	0.468	2.9
22.049	20.89	0.5884	0.468	2.816
22.117	20.99	0.608	0.281	2.897
22.186	19.8	0.6225	-0.375	3.145
22.247	17.23	0.6216	-0.468	3.608
22.316	14.2	0.5901	-0.375	4.154
22.396	12.28	0.5435	-0.468	4.426
22.458	11.09	0.5163	-0.375	4.656
22.51	10.26	0.4884	-0.375	4.758
22.585	9.71	0.416	-0.375	4.282
22.66	9.35	0.3628	-0.375	3.881
22.723	9.71	0.3492	-0.375	3.594
22.774	9.16	0.3495	-0.375	3.814
22.854	9.71	0.3628	-0.375	3.735
22.924	10.81	0.3655	-0.375	3.38
22.99	11.27	0.3598	-0.375	3.192
23.036	11.36	0.3521	-0.281	3.098
23.114	10.72	0.3596	-0.375	3.353
23.171	9.71	0.3761	-0.281	3.872
23.229	9.35	0.3873	-0.375	4.143
23.309	9.35	0.3972	-0.281	4.249
23.385	9.35	0.4111	-0.281	4.398
23.443	9.35	0.4363	-0.281	4.667
23.503	9.9	0.4766	-0.281	4.815
23.572	10.91	0.5077	-0.281	4.655
23.624	11.82	0.5024	-0.281	4.25
23.691	13.56	0.4891	-0.281	3.606
23.78	18.05	0.4661	-0.281	2.582
23.843	22.82	0.4257	-0.281	1.865
23.927	30.79	0.376	-0.281	1.221
23.968	34.92	0.3058	-0.281	0.876
24.024	39.04	0.2104	-0.281	0.539
24.114	41.61	0.1698	-0.281	0.408
24.156	42.25	0.1538	-0.281	0.364
24.228	43.26	0.1445	-0.281	0.334
24.292	43.62	0.1603	-0.141	0.368
24.364	41.51	0.1791	-0.094	0.431
24.431	40.51	0.1932	0	0.477

24.475	38.49	0.2039	0	0.53
24.543	36.47	0.2475	0	0.679
24.61	31.34	0.3067	0	0.979
24.676	25.84	0.3741	0	1.448
24.747	20.34	0.4645	0	2.283
24.83	15.85	0.5403	0	3.408
24.877	14.48	0.5492	0	3.793
24.948	13.11	0.5259	0	4.013
25.013	11.73	0.4912	0	4.187
25.071	10.17	0.4502	0	4.426
25.147	8.8	0.4098	0	4.658
25.208	8.25	0.3796	0.094	4.603
25.268	8.25	0.3476	0.094	4.215
25.346	8.34	0.3053	0.094	3.661
25.414	8.98	0.2854	0.094	3.177
25.463	9.16	0.2826	0.094	3.083
25.527	8.98	0.2843	0.094	3.165
25.599	8.89	0.2942	0.094	3.31
25.685	8.71	0.2833	0.094	3.254
25.737	8.52	0.2727	0.094	3.2
25.803	8.61	0.2608	0.094	3.027
25.88	8.61	0.2376	0.094	2.758
25.949	8.34	0.2058	0.094	2.468
25.997	8.25	0.1744	0.187	2.115
26.066	8.16	0.1711	0.281	2.098
26.136	8.16	0.2089	0.375	2.561
26.189	8.16	0.2105	0.375	2.581
26.262	8.16	0.1983	0.375	2.431
26.313	8.25	0.2339	0.468	2.835
26.38	9.26	0.2846	0.468	3.075
26.469	13.47	0.3843	0.656	2.852
26.511	17.5	0.4044	0.656	2.311
26.598	22.91	0.4123	0.75	1.8
26.644	25.84	0.4169	0.562	1.613
26.722	29.14	0.4511	-1.312	1.548
26.783	29.88	0.4889	-1.968	1.636
26.841	29.51	0.5119	-2.155	1.735
26.911	28.41	0.5304	-2.155	1.867
26.975	24.65	0.5539	-2.155	2.247
27.046	22.27	0.5931	-2.155	2.663
27.104	18.79	0.6567	-2.343	3.496
27.181	15.49	0.7605	-2.343	4.91
27.253	14.66	0.8259	-2.343	5.633
27.319	16.04	0.8218	-2.343	5.124
27.406	20.16	0.77	-2.343	3.819
27.432	23.37	0.7514	-2.343	3.215
27.496	28.78	0.705	-2.436	2.45

27.582	37.94	0.5843	-2.811	1.54
27.634	43.81	0.4992	-3.092	1.139
27.691	46.19	0.4164	-4.123	0.901
27.765	46.28	0.3368	-4.591	0.728
27.856	45.27	0.3051	-4.873	0.674
27.889	44.36	0.3126	-4.873	0.705
27.971	41.7	0.383	-4.873	0.919
28.035	39.87	0.4112	-4.873	1.032
28.117	39.41	0.4068	-4.873	1.032
28.151	39.41	0.3984	-4.779	1.011
28.234	38.58	0.3718	-4.873	0.964
28.301	38.86	0.3574	-4.873	0.92
28.347	40.23	0.3564	-4.967	0.886
28.44	41.42	0.3215	-4.967	0.776
28.485	41.88	0.2861	-4.967	0.683
28.577	41.06	0.2738	-4.967	0.667
28.617	40.05	0.2608	-4.967	0.651
28.705	38.03	0.3579	-4.967	0.941
28.755	38.03	0.4557	-4.967	1.198
28.844	38.03	0.5198	-4.967	1.367
28.886	38.95	0.5234	-4.967	1.344
28.943	36.84	0.4988	-5.326	1.354
29.006	49.12	0.4237	-5.326	0.863
29.093	67.36	0.3412	-5.326	0.506
29.137	73.22	0.3218	-4.873	0.439
29.204	72.86	0.3083	-5.622	0.423
29.276	66.08	0.2869	-6.559	0.434
29.341	61.77	0.2447	-6.559	0.396
29.408	57.28	0.2457	-6.559	0.429
29.463	51.69	0.2374	-6.559	0.459
29.538	47.75	0.2554	-6.465	0.535
29.632	46.1	0.2945	-6.465	0.639
29.682	46.28	0.3309	-6.465	0.715
29.754	47.38	0.3675	-6.465	0.776
29.813	48.75	0.371	-6.465	0.761
29.86	50.04	0.374	-6.465	0.747
29.945	51.87	0.3665	-6.465	0.707
29.991	54.53	0.3384	-6.653	0.621
30.085	55.99	0.2554	-6.747	0.456
30.124	54.62	0.2238	-6.747	0.41
30.219	49.85	0.1962	-6.559	0.393
30.262	47.56	0.1962	-6.559	0.412
30.355	41.15	0.2727	-6.559	0.663
30.384	39.77	0.2961	-6.653	0.744
30.449	34.18	0.3467	-6.747	1.014
30.518	30.33	0.3987	-6.747	1.314
30.599	26.3	0.484	-6.747	1.84

30.663	24.47	0.5721	-6.559	2.338
30.71	25.89	0.5976	-6.653	2.308
30.799	25.48	0.6045	-6.653	2.373
30.846	25.57	0.6038	-6.653	2.361
30.933	26.21	0.5813	-6.606	2.218
30.985	28.32	0.5607	-6.653	1.98
31.04	30.88	0.2335	-6.559	0.756
31.114	32.53	0.213	-6.559	0.655
31.191	32.35	0.193	-6.747	0.596
31.239	31.53	0.1957	-6.653	0.621
31.34	29.88	0.2434	-6.622	0.815
31.373	27.58	0.2664	-6.622	0.966
31.443	27.68	0.3165	-6.622	1.144
31.518	26.85	0.3741	-6.559	1.393
31.563	26.21	0.4096	-6.559	1.563
31.629	25.11	0.4561	-6.559	1.816
31.712	24.29	0.5031	-6.559	2.072
31.775	23.83	0.5194	-6.747	2.18
31.832	23.46	0.5224	-6.747	2.227
31.918	23	0.5133	-6.747	2.232
31.998	23.64	0.4949	-6.747	2.093
32.041	24.01	0.477	-6.653	1.987
32.105	24.56	0.4372	-6.653	1.78
32.154	24.74	0.4034	-6.653	1.63
32.228	24.19	0.3335	-6.747	1.378
32.285	22.82	0.2774	-6.559	1.216
32.37	19.7	0.2417	-6.559	1.227
32.421	17.14	0.2412	-6.559	1.407
32.499	14.85	0.2408	-6.559	1.622
32.548	13.47	0.2402	-6.559	1.783
32.614	11.82	0.3035	-6.559	2.568
32.682	12.83	0.3259	-6.559	2.54
32.774	16.77	0.3484	-6.465	2.078
32.82	18.97	0.3623	-6.559	1.91
32.906	23.55	0.361	-6.653	1.533
32.955	26.21	0.3271	-6.559	1.248
33.007	28.41	0.2804	-6.559	0.987
33.089	29.88	0.1967	-6.559	0.658
33.173	31.16	0.2277	-6.559	0.731
33.206	31.43	0.2335	-6.559	0.743
33.271	31.53	0.2106	-6.559	0.668
33.355	31.53	0.2896	-6.653	0.919
33.403	31.53	0.3605	-6.59	1.143
33.472	31.98	0.4578	-6.59	1.431
33.542	33.36	0.5542	-6.59	1.661
33.61	34.46	0.6454	-6.559	1.873
33.683	35.01	0.6823	-6.528	1.949

33.745	34	0.7109	-6.544	2.091
33.81	30.79	0.6828	-6.465	2.217
33.9	25.11	0.6319	-6.559	2.516
33.96	20.62	0.5604	-6.372	2.718
33.996	19.7	0.5198	-6.372	2.638
34.083	16.04	0.4582	-6.372	2.857
34.122	14.85	0.4492	-6.372	3.025
34.19	13.29	0.4649	-6.278	3.499
34.262	13.11	0.4626	-6.278	3.53
34.32	13.93	0.4734	-6.278	3.399
34.398	15.58	0.4853	-6.278	3.115
34.473	18.6	0.4991	-6.278	2.683
34.531	25.02	0.4783	-6.184	1.912
34.622	42.52	0.4351	-6.184	1.023
34.664	50.95	0.4142	-6.184	0.813
34.736	60.76	0.3717	-6.184	0.612
34.807	64.06	0.3852	-6.184	0.601
34.843	64.7	0.3751	-6.184	0.58
34.921	62.68	0.3554	-6.278	0.567
34.982	60.21	0.3961	-6.278	0.658
35.069	54.16	0.4692	-6.278	0.866
35.117	50.04	0.515	-6.372	1.029
35.171	45.82	0.5783	-6.278	1.262
35.25	41.24	0.6346	-6.372	1.539
35.339	36.02	0.6662	-6.278	1.85
35.387	34.55	0.7263	-6.184	2.102
35.467	34.37	0.8115	-6.184	2.361
35.499	34.64	0.8251	-6.184	2.382
35.582	32.72	0.79	-6.2	2.415
35.664	33.45	0.7888	-6.2	2.358
35.708	33.27	0.7771	-6.2	2.336
35.783	32.9	0.7239	-6.278	2.2
35.846	32.53	0.6637	-6.145	2.04
35.895	31.34	0.6517	-6.184	2.079
35.964	28.78	0.6679	-6.091	2.321
36.028	25.39	0.6922	-6.091	2.727
36.116	21.72	0.6936	-6.091	3.193
36.163	19.15	0.6938	-6.091	3.623
36.23	17.05	0.698	-6.091	4.095
36.299	15.49	0.7071	-6.091	4.565
36.383	17.05	0.7386	-6.091	4.333
36.418	15.4	0.7553	-6.091	4.906
36.499	17.05	0.7818	-6.091	4.587
36.559	19.89	0.7586	-6.091	3.815
36.646	25.48	0.6665	-5.997	2.616
36.699	28.68	0.6199	-5.997	2.161
36.753	34	0.5954	-5.997	1.751

36.811	36.38	0.5817	-5.997	1.599
36.879	38.49	0.5747	-6.091	1.493
36.968	38.4	0.5458	-5.903	1.421
37.026	37.67	0.5552	-5.903	1.474
37.092	38.03	0.6393	-5.903	1.681
37.149	39.13	0.7082	-6.091	1.81
37.208	41.61	0.7329	-6.091	1.762
37.283	42.25	0.7566	-5.997	1.791
37.344	43.07	0.7571	-5.997	1.758
37.414	43.9	0.7605	-5.997	1.732
37.484	44.81	0.7791	-5.997	1.739
37.534	45.18	0.7837	-5.997	1.735
37.614	46.74	0.7639	-6.091	1.634
37.678	49.49	0.7339	-6.091	1.483
37.761	53.52	0.6954	-6.184	1.299
37.8	57.55	0.565	-6.372	0.982
37.864	63.42	0.3064	-6.372	0.483
37.946	69.01	0.2788	-6.841	0.404
38.001	70.66	0.2664	-7.215	0.377
38.076	70.57	0.3112	-7.215	0.441
38.135	70.75	0.3904	-7.208	0.552
38.192	71.16	0.5111	-7.208	0.718
38.264	68.73	0.7885	-7.2	1.147
38.338	71.57	1.0823	-7.309	1.512
38.401	75.61	1.092	-7.309	1.444
38.492	85.41	0.972	-7.309	1.138
38.534	91.83	0.9122	-7.309	0.993
38.585	102.64	0.8443	-7.403	0.823
38.68	121.7	0.8084	-7.871	0.664
38.721	124.45	0.8072	-7.965	0.649
38.791	123.54	0.7497	-7.965	0.607
38.85	119.23	0.6402	-7.965	0.537
38.936	109.97	0.6057	-7.965	0.551
38.987	101.91	0.5971	-7.965	0.586
39.053	92.93	0.5684	-7.965	0.612
39.118	85.78	0.5298	-7.965	0.618
39.205	75.15	0.4639	-7.965	0.617
39.252	69.47	0.4287	-7.965	0.617
39.313	64.06	0.3904	-7.965	0.609
39.377	59.84	0.3646	-7.965	0.609
39.457	54.99	0.339	-7.965	0.617
39.522	51.69	0.3133	-7.965	0.606
39.597	47.75	0.2807	-7.965	0.588
39.657	46.74	0.281	-7.965	0.601
39.7	45.55	0.2794	-7.965	0.613
39.768	44.72	0.2664	-7.871	0.596
39.837	45.5	0.3027	-7.871	0.665

39.918	43.71	0.3765	-7.871	0.861
39.991	45.46	0.4238	-7.871	0.932
40.029	46.1	0.4473	-7.871	0.97
40.097	50.68	0.4639	-7.871	0.915
40.184	61.31	0.4546	-7.871	0.741
40.24	72.58	0.4161	-7.871	0.573
40.297	85.05	0.333	-7.871	0.392
40.379	100.9	0.2461	-7.871	0.244
40.425	106.77	0.2537	-7.871	0.238
40.5	109.97	0.2768	-7.871	0.252
40.554	102.28	0.3387	-7.871	0.331
40.623	69.19	0.4336	-7.84	0.627
40.695	67.18	0.4795	-7.84	0.714
40.749	59.57	0.5134	-7.84	0.862
40.833	48.39	0.6074	-7.777	1.255
40.881	43.71	0.7006	-7.777	1.603
40.965	30.88	0.8388	-7.777	2.716
41.018	24.19	0.8792	-7.777	3.634
41.104	19.06	0.7931	-7.777	4.161
41.152	18.05	0.7564	-7.777	4.19
41.232	18.42	0.7498	-7.684	4.071
41.285	19.34	0.7779	-7.59	4.023
41.376	29.69	0.8161	-7.59	2.748
41.419	41.7	0.8278	-7.403	1.985
41.47	70.66	0.8413	-7.403	1.191
41.554	117.12	0.8773	-7.403	0.749
41.616	138.48	0.8951	-7.403	0.646
41.681	148.19	0.8829	-7.403	0.596
41.733	159.28	0.8849	-7.403	0.556
41.804	179.26	0.9542	-7.309	0.532
41.873	195.29	1.0276	-7.309	0.526
41.93	192.09	1.0844	-7.293	0.565
41.996	219.21	1.1576	-7.291	0.528
42.07	227.83	1.1951	-7.291	0.525
42.136	228.2	1.2377	-7.253	0.542
42.198	225.08	1.2357	-7.231	0.549
42.259	222.42	1.2221	-7.209	0.549
42.334	216.1	1.1745	-7.209	0.544
42.399	211.24	1.114	-7.209	0.527
42.47	201.8	1.0393	-7.122	0.515
42.523	196.85	0.9679	-7.122	0.492
42.595	190.07	0.8757	-7.122	0.461
42.671	186.59	0.8523	-7.122	0.457
42.717	183.29	0.8241	-7.122	0.45
42.786	172.02	0.7447	-7.122	0.433
42.861	162.58	0.7194	-7.075	0.442
42.931	148.46	0.6126	-7.075	0.413

42.983	143.7	0.4849	-7.075	0.337
43.049	132.06	0.4152	-7.122	0.314
43.121	118.5	0.3682	-6.934	0.311
43.188	107.22	0.4254	-6.934	0.397
43.242	97.33	0.4172	-6.934	0.429
43.317	76.06	0.4717	-6.934	0.62
43.378	62.41	0.5221	-6.934	0.837
43.467	42.98	0.5297	-6.981	1.232
43.51	35.28	0.5022	-6.934	1.423
43.58	24.47	0.4429	-7.122	1.81
43.642	21.08	0.3916	-6.934	1.858
43.701	16.77	0.3558	-6.934	2.122
43.781	14.85	0.3033	-6.841	2.043
43.834	13.93	0.2383	-6.841	1.711
43.907	13.29	0.188	-6.841	1.414
43.971	12.65	0.1585	-6.841	1.253
44.045	12.19	0.1589	-6.841	1.304
44.137	10.72	0.1581	-6.653	1.475
44.166	10.17	0.169	-6.841	1.662
44.227	9.53	0.1848	-6.559	1.939
44.317	8.89	0.1563	-6.559	1.758
44.362	8.52	0.1315	-6.653	1.543
44.423	8.52	0.1101	-6.465	1.292
44.495	8.52	0.1101	-6.465	1.292
44.559	8.98	0.1115	-6.278	1.242
44.626	8.8	0.1262	-6.278	1.435
44.709	8.75	0.1858	-6.278	2.123
44.764	8.75	0.2217	-6.278	2.533
44.839	8.71	0.2462	-6.278	2.828
44.889	10.63	0.2508	-6.278	2.359
44.953	12.74	0.2531	-6.184	1.987
45.024	14.39	0.2791	-6.184	1.94
45.083	15.49	0.295	-6.184	1.905
45.159	17.6	0.3074	-6.184	1.747
45.215	20.07	0.3266	-6.184	1.627
45.305	22.64	0.4295	-6.184	1.897
45.35	22.91	0.4114	-6.184	1.795
45.414	16.13	0.3634	-6.161	2.253
45.483	18.33	0.3563	-6.138	1.944
45.551	16.59	0.3563	-6.138	2.148
45.619	15.85	0.3563	-6.091	2.247
45.672	19.8	0.3501	-6.091	1.769
45.747	31.89	0.3006	-5.997	0.943
45.816	46.1	0.277	-5.997	0.601
45.889	49.76	0.2858	-5.903	0.574
45.933	49.95	0.2543	-5.81	0.509
46.015	46.83	0.3439	-5.716	0.734

46.069	41.33	0.3898	-5.716	0.943
46.157	31.8	0.3811	-5.716	1.199
46.201	27.58	0.361	-5.716	1.309
46.286	22.09	0.3291	-5.622	1.49
46.333	20.07	0.3195	-5.529	1.592
46.414	20.07	0.3062	-5.529	1.526
46.471	20.07	0.3056	-5.435	1.523
46.535	20.07	0.2812	-5.341	1.401
46.605	22.09	0.3255	-5.341	1.474
46.693	22.09	0.3249	-5.341	1.471
46.722	21.35	0.3066	-5.341	1.436
46.789	18.79	0.2921	-5.248	1.555
46.885	15.4	0.3041	-5.248	1.975
46.96	13.56	0.3579	-5.154	2.639
47.005	13.01	0.3487	-5.154	2.679
47.058	12.56	0.3295	-5.154	2.624
47.128	12.56	0.2974	-5.06	2.368
47.191	13.2	0.2612	-4.919	1.98
47.244	13.2	0.2335	-4.919	1.77
47.319	14.57	0.2254	-4.919	1.547
47.389	13.2	0.2279	-4.685	1.727
47.452	12.19	0.2271	-4.685	1.864
47.543	13.24	0.2338	-4.685	1.765
47.592	12.37	0.2258	-4.685	1.825
47.684	13.29	0.2068	-4.591	1.556
47.724	13.75	0.201	-4.591	1.462
47.774	13.56	0.1942	-4.591	1.432
47.861	12.56	0.1823	-4.591	1.452
47.906	11.64	0.1716	-4.591	1.475
47.973	11.36	0.1701	-4.591	1.497
48.04	11.09	0.1774	-4.591	1.6
48.126	11.09	0.1673	-4.498	1.508
48.165	11.09	0.1587	-4.498	1.431
48.251	11.09	0.1408	-4.498	1.27
48.316	11.27	0.1401	-4.498	1.243
48.368	11.36	0.1436	-4.404	1.264
48.44	11.55	0.1534	-4.404	1.328
48.53	11.55	0.1561	-4.404	1.352
48.577	11.73	0.1582	-4.404	1.349
48.627	11.73	0.1601	-4.404	1.365
48.713	11.82	0.1601	-4.404	1.354
48.759	11.82	0.1601	-4.404	1.354
48.824	11.82	0.1587	-4.404	1.342
48.896	11.82	0.1546	-4.404	1.308
48.962	11.73	0.1529	-4.31	1.304
49.026	11.73	0.1533	-4.31	1.307
49.109	11.91	0.1521	-4.31	1.277

49.153	12.01	0.1394	-4.31	1.161
49.222	12.01	0.0965	-4.31	0.804
49.293	12.01	0.1243	-4.217	1.036
49.35	12.01	0.1437	-4.217	1.197
49.426	12.19	0.1669	-4.217	1.37
49.494	12.74	0.1786	-4.123	1.402
49.56	14.66	0.1985	-4.123	1.354
49.608	15.4	0.2127	-4.123	1.381
49.676	14.57	0.2226	-4.029	1.528
49.752	13.56	0.2164	-4.029	1.595
49.812	13.2	0	-3.936	0
49.88	12.74	0	-3.936	0
49.947	12.28	0	-3.936	0
50.019	12.37	0	-3.936	0
50.069	12.37	0	-3.936	0
50.135	12.56	0	-3.936	0

Appendix B
Laboratory Tests

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture (%)	Maximum Dry Density (lbs/cu.ft)
B-3 @ 2'	Silty SAND	9.0	124.0

TABLE II
EXPANSION TESTS

Sample	Classification	Expansion Index
B-3 @ 2'	Silty SAND	3

TABLE III
ATTERBERG LIMITS

Sample	Liquid Limit	Plastic Limit	Plasticity Index
B-3 @ 15'	25	17	8
B-3 @ 20'	33	18	15

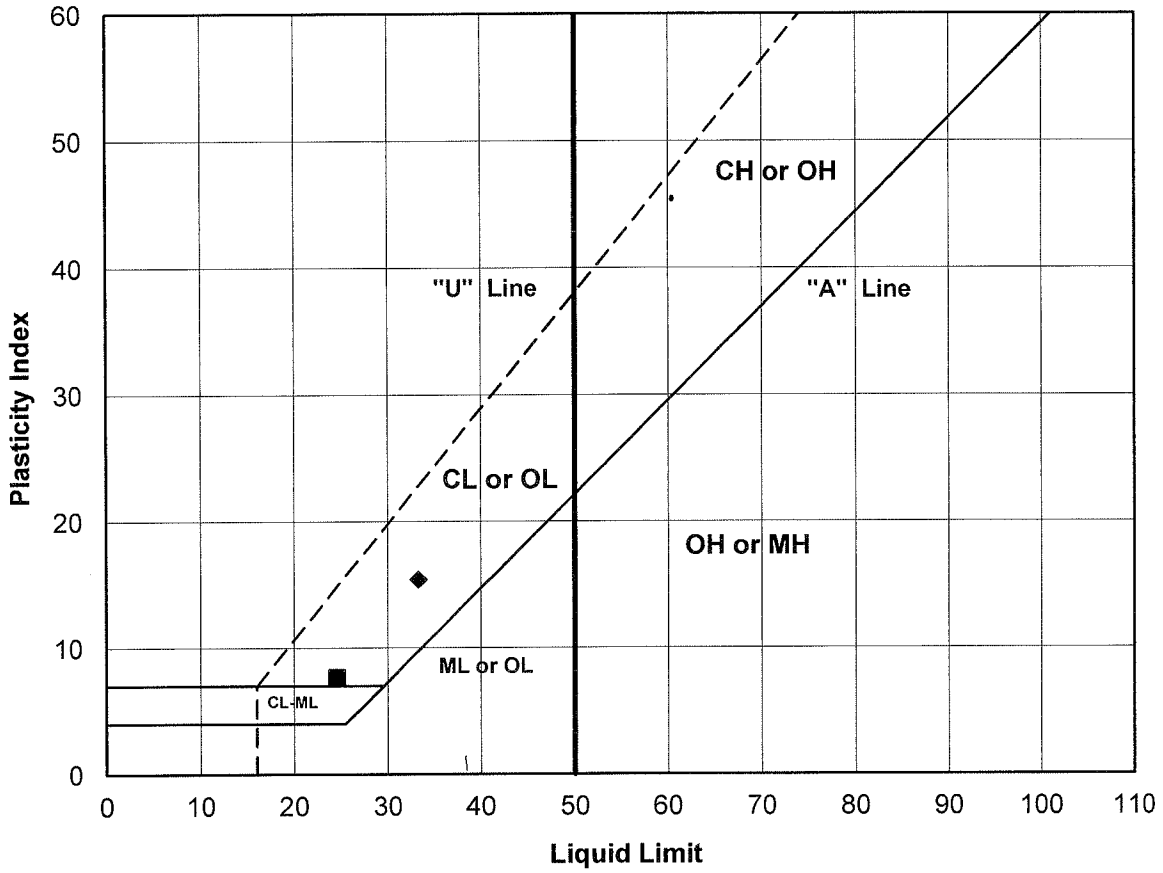
TABLE IV
CORROSION TESTS

Sample	pH	Electrical Resistivity	Sulfate (%)	Chloride (ppm)
B-3 @ 2'	7.2	26,722	0.004	303

% by weight
ppm – mg/kg

PLASTICITY INDEX

ASTM D4318



Symbol	Sample	Depth	LL	PL	PI	USCS	Soil Description
■	B3	15'	25	17	8	CL	Lean Clay
◆	B3	20'	33	18	15	CL	Lean Clay
▲							
□							
◇							
△							

NorCal Engineering

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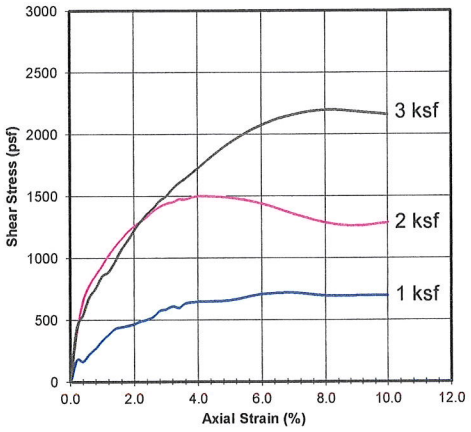
Amir Development Company

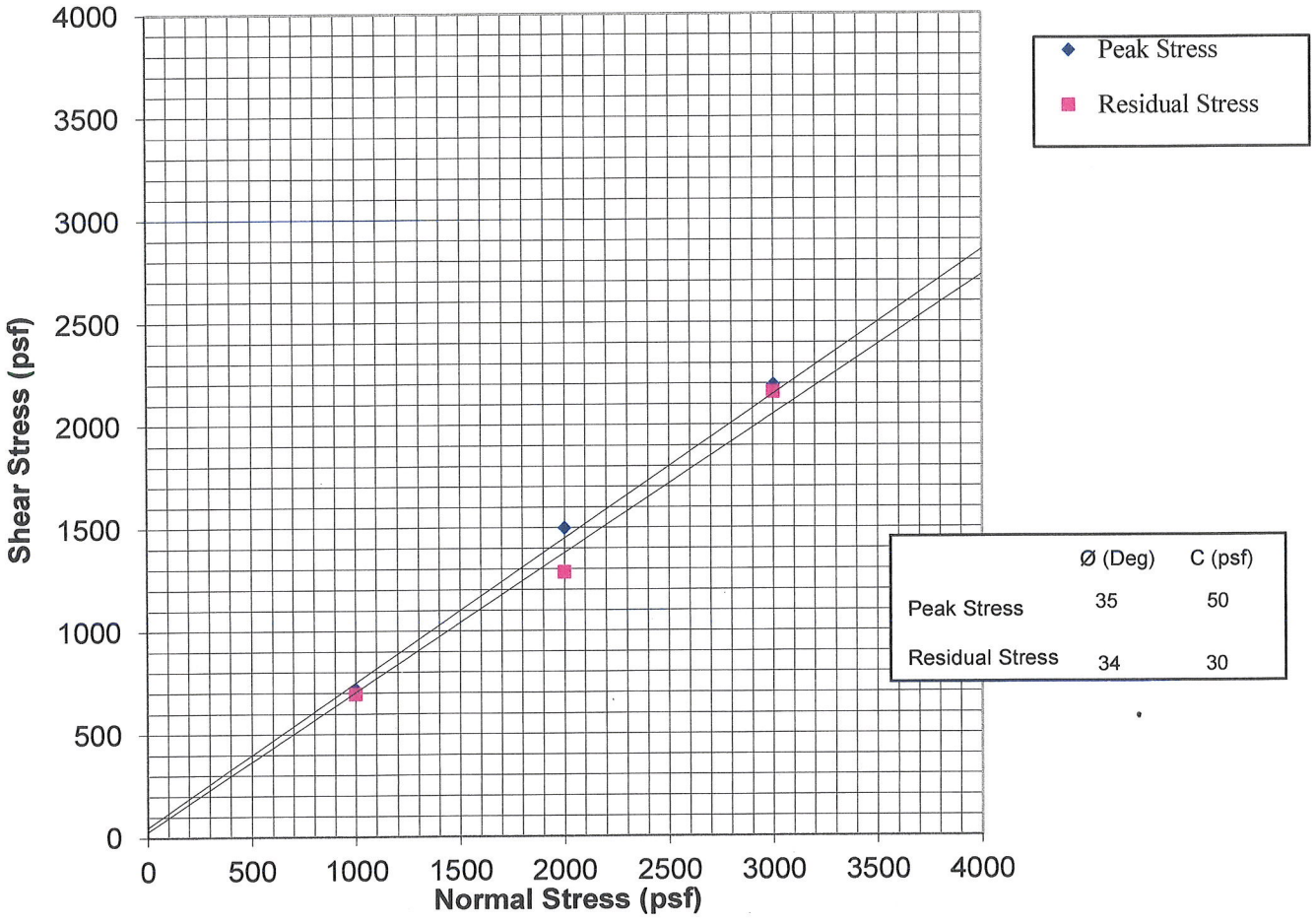
PROJECT NUMBER: 21889-20 DATE: 7/10/2020

PLASTICITY INDEX

ASTM D4318

Sample No.		T2@2'		
Sample Type:		Undisturbed-Saturated		
Soil Description:		Silty Fine-Medium Grained Sand w/ Some Small Gravel		
		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	720	1500	2196
Displacement	(in.)	0.175	0.100	0.200
Residual Stress	(psf)	696	1284	2160
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	100.9	100.9	100.9
Initial Water Content	(%)	7.5	7.5	7.5
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	35	50
Residual Stress	34	30

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

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DIRECT SHEAR TEST

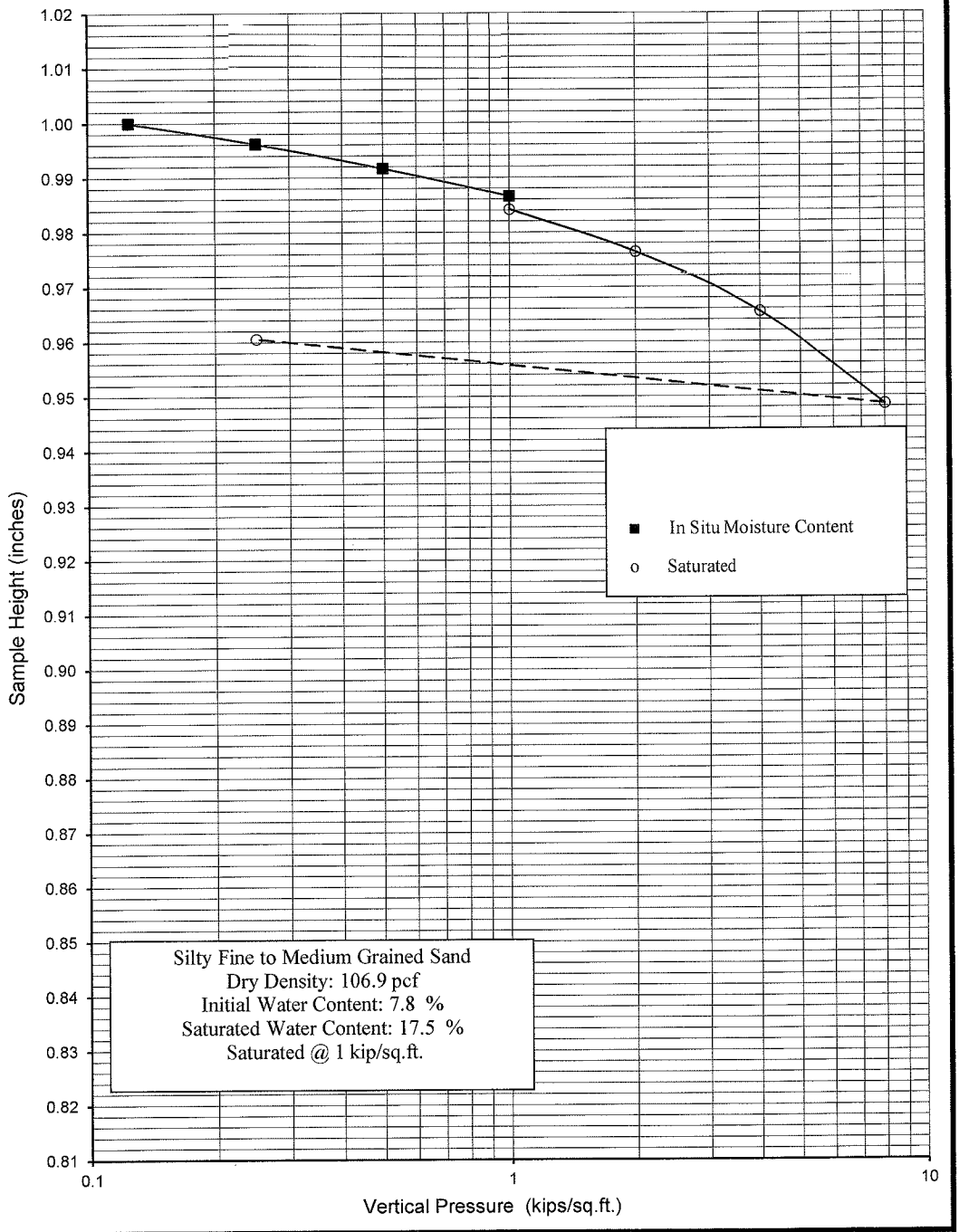
ASTM D3080

Plate A

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No. T2	Depth 5'	Date 7/14/2020
0.125	1.0000	0.0			
0.25	0.9962	0.4			
0.5	0.9917	0.8			
1	0.9866	1.3			
1	0.9842	1.6			
2	0.9764	2.4			
4	0.9655	3.5			
8	0.9485	5.2			
0.25	0.9606	3.9			

Saturated

Date Tested: 7/10/2020
Sample: T2
Depth: 5'



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Amir Development Company

PROJECT NUMBER: 21889-20 DATE: 7/14/2020

CONSOLIDATION TEST

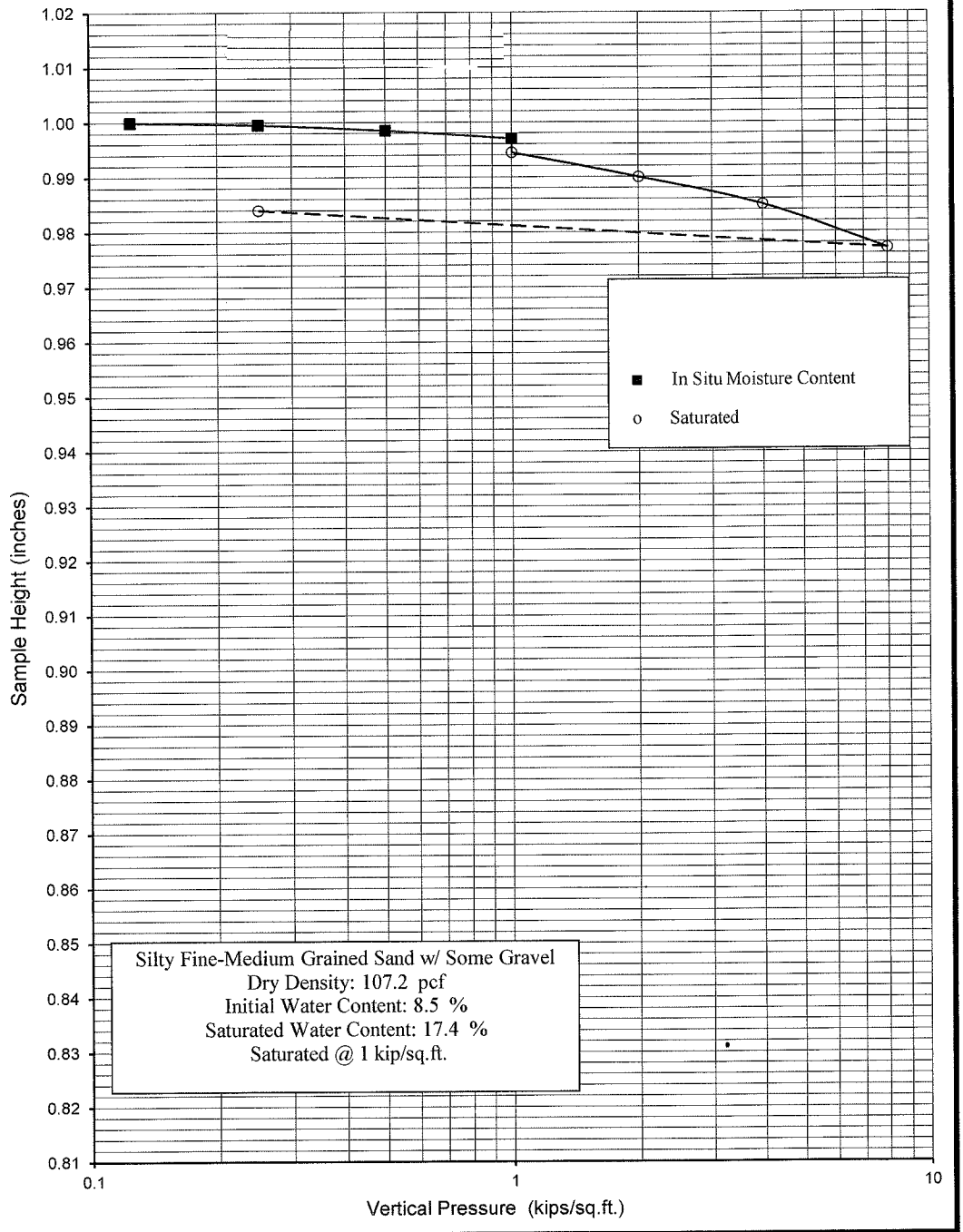
ASTM D2435

Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No. T2	Depth 10'	Date 7/14/2020
0.125	1.0000	0.0			
0.25	0.9995	0.0			
0.5	0.9985	0.2			
1	0.9970	0.3			
1	0.9945	0.6			
2	0.9900	1.0			
4	0.9850	1.5			
8	0.9770	2.3			
0.25	0.9840	1.6			

Saturated

Date Tested: 7/10/2020
Sample: T2
Depth: 10'



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Amir Development Company

PROJECT NUMBER: 21889-20 DATE: 7/14/2020

CONSOLIDATION TEST

ASTM D2435

Plate C

Appendix C
Liquefaction Analysis

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 451.22 ft (NAVD 88)
Latitude: 34.279805
Longitude: -118.912343

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

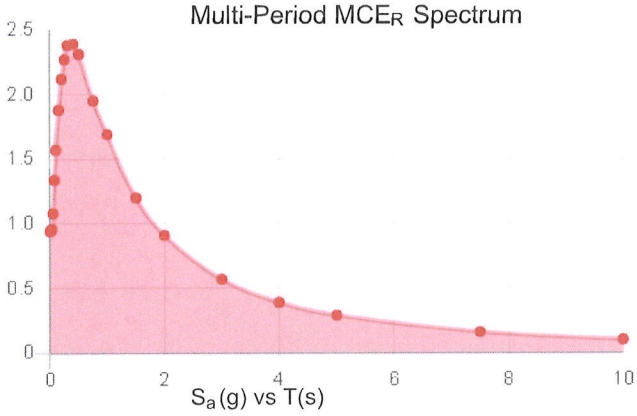
Seismic

Site Soil Class:

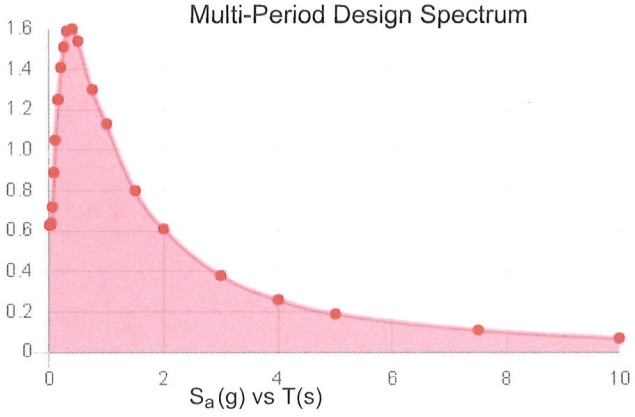
Results:

PGA_M :	0.83	T_L :	8
S_{MS} :	2.15	S_S :	2.1
S_{M1} :	1.69	S_1 :	0.77
S_{DS} :	1.44	S_{DC} :	
S_{D1} :	1.13	V_{S30} :	260

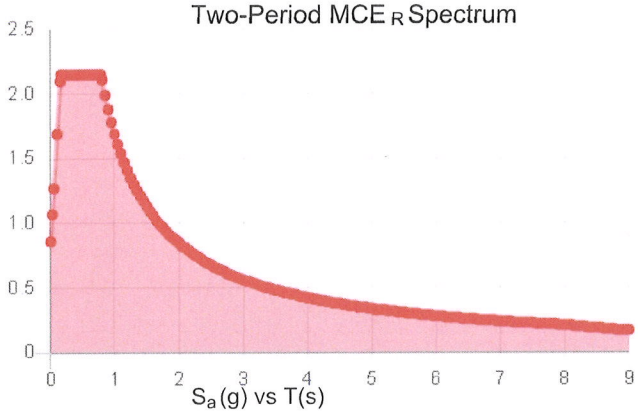
Multi-Period MCE_R Spectrum



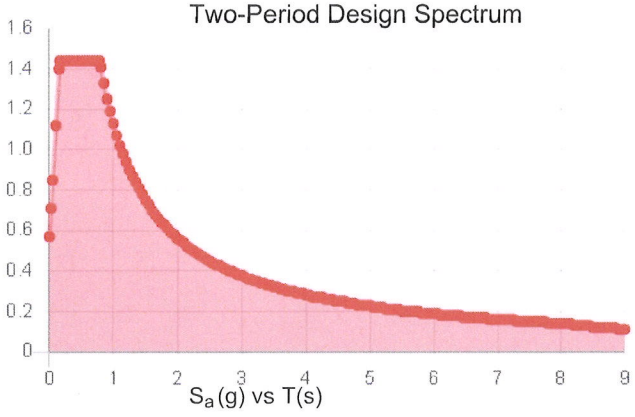
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

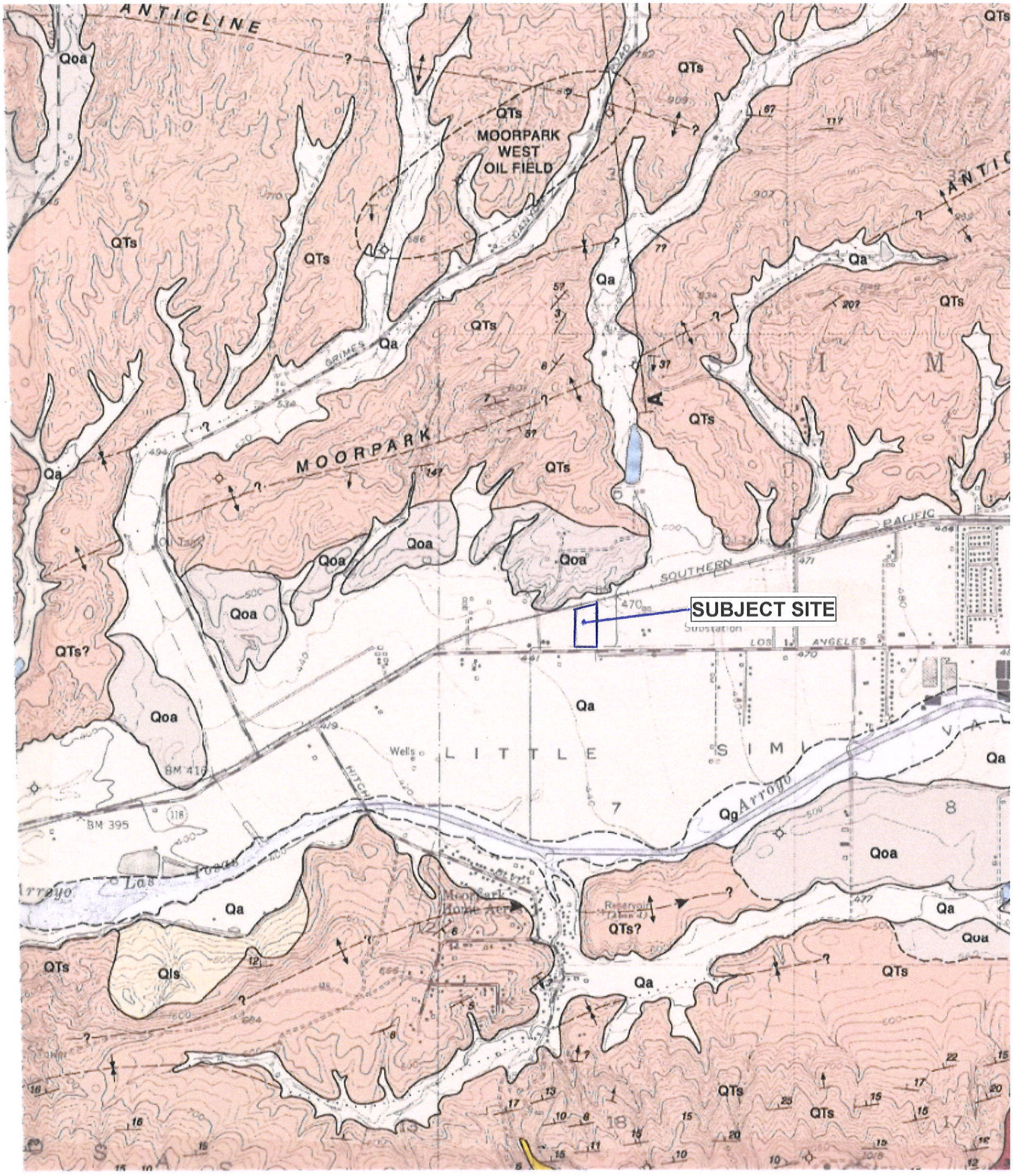
Data Accessed: Tue Mar 29 2022

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.



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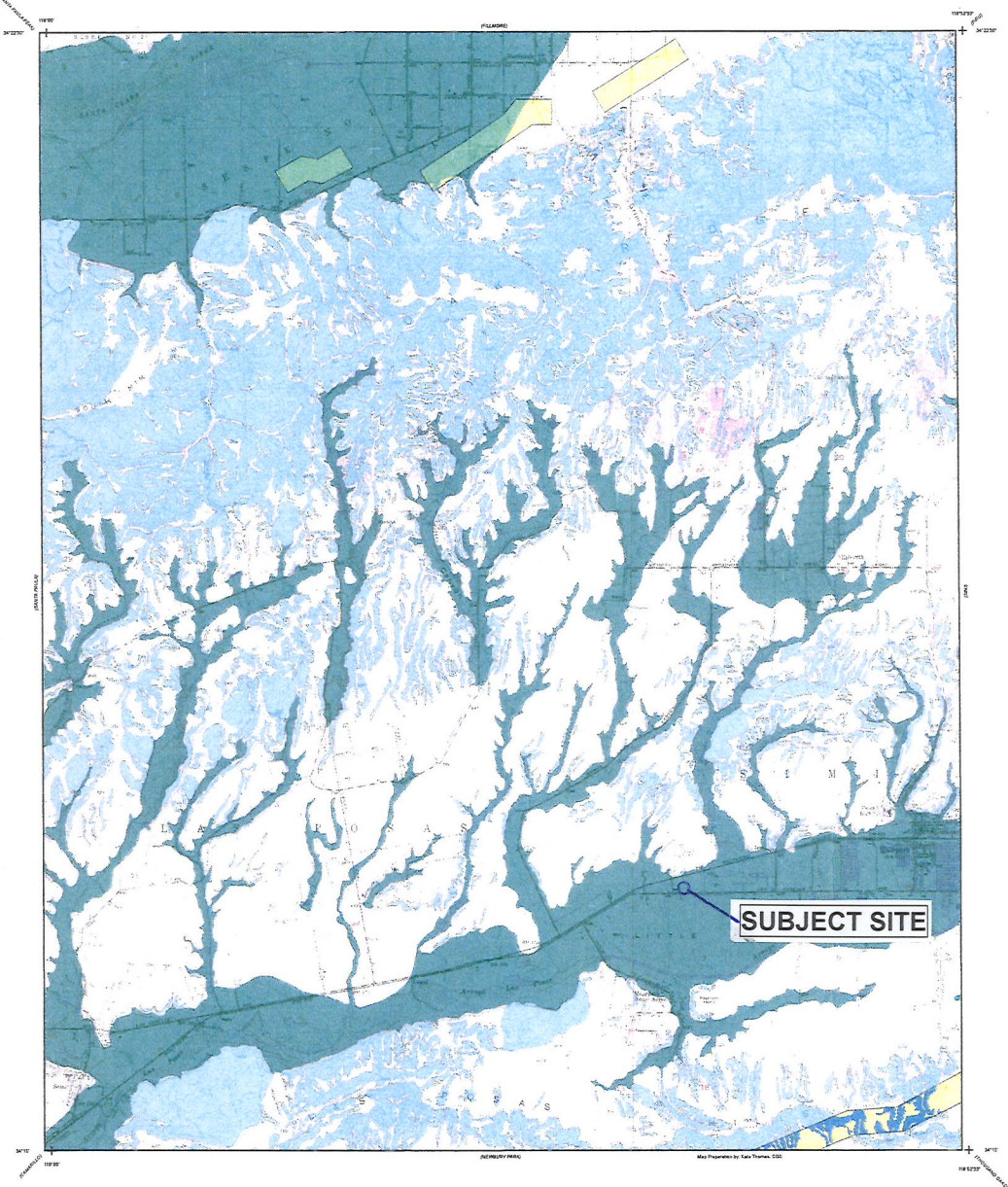
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT: 21889-20

DATE: MARCH 2022

GEOLOGIC MAP OF THE MOORPARK QUADRANGLE

THOMAS W. DIBBLEE JR. 1992



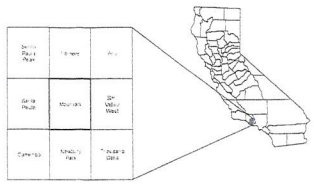
Study area defined by USGS quadrangle boundaries using NAD 27, represented by the visible map extent. Data are maintained and distributed in California Albers (metric), NAD 83, [EPSG:3310] as shown by tics and coordinates.
Shaded topographic relief derived from USGS 10 meter NED, 2013.
Topographic base map from USGS 1969, photorevised, 1974.
Street data from US Census Bureau TIGER/Line, 2016.

Scale 1: 24000

Contour Interval 20 Feet

12°
TRUE NORTH
MAGNETIC NORTH
Approximate Declination, 2013

N



California Geological Survey
Geologic Information and Publications
801 K Street, MS 14-34
Sacramento, CA 95814-3532
www.conservation.ca.gov/cgs

Earthquake Zones of Required Investigation
Moorpark Quadrangle

California Geological Survey

This Map Shows Both Alquist-Priolo Earthquake Fault Zones And Seismic Hazard Zones Issued For The Moorpark Quadrangle

This map shows the location of Alquist-Priolo (AP) Earthquake Fault Zones and Seismic Hazard Zones, collectively referred to here as Earthquake Zones of Required Investigation. The Geographic Information System (GIS) digital files of these regulatory zones released by the California Geological Survey (CGS) are the "Official Maps." GIS files are available at the CGS website http://maps.conservation.ca.gov/cgs/informationwarehouse/eqzones/. These zones will assist cities and counties in fulfilling their responsibilities for protecting the public from the effects of surface fault rupture and earthquake-triggered ground failure as required by the AP Earthquake Fault Zoning Act (Public Resources Code Sections 2621-2630) and the Seismic Hazards Mapping Act (Public Resources Code Sections 2690-2699.6). For information regarding the general approach and recommended methods for preparing these zones, see CGS Special Publication 42, *Earthquake Fault Zones, a Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California*, Appendix C, and CGS Special Publication 118, *Recommended Criteria for Delineating Seismic Hazard Zones in California*.

For information regarding the scope and recommended methods to be used in conducting required site investigations refer to CGS Special Publication 42, and CGS Special Publication 117A, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*. For a general description of the AP and Seismic Hazards Mapping acts, the zonation programs, and related information, please refer to the website at www.conservation.ca.ga.gov/cgs/.

MAP EXPLANATION

EARTHQUAKE FAULT ZONES

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query [?] indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

SEISMIC HAZARD ZONES

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

OVERLAPPING EARTHQUAKE FAULT AND SEISMIC HAZARD ZONES

Overlap of Earthquake Fault Zone and Liquefaction Zone
Areas that are covered by both Earthquake Fault Zone and Liquefaction Zone.

Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

Note: Mitigation methods differ for each zone – AP Act only allows avoidance; Seismic Hazard Mapping Act allows mitigation by engineering/geotechnical design as well as avoidance.

ADDITIONAL INFORMATION

For additional information on the zones of required investigation presented on this map, the data and methodology used to prepare them, and additional references consulted, please refer to the following:

The Simi-Santa Rosa Fault Zone, in the Moorpark, Newbury Park, Simi Valley East, Simi Valley West, and Thousand Oaks Quadrangles, Ventura County, California. California Geological Survey, Fault Evaluation Report FER-244.
http://gmw.conservation.ca.gov/SHP/EZRIM/Reports/FER/244/

The Oak Ridge and Related Faults Vicinity of Fillmore and Santa Paula, in the Moorpark Quadrangle, Ventura County, California. California Geological Survey, Fault Evaluation Report FER-219.
http://gmw.conservation.ca.gov/SHP/EZRIM/Reports/FER/219/

For more information on the Alquist-Priolo Earthquake Fault Zoning Act please refer to
http://www.conservation.ca.gov/cgs/rgm/ap/Pages/main.aspx

Seismic Hazard Zone Report for the Moorpark 7.5-minute Quadrangle, Ventura County, California. California Geological Survey, Seismic Hazard Zone Report 041.
http://gmw.conservation.ca.gov/SHP/EZRIM/Reports/SHZR/SHZR_041_Moorpark.pdf

For more information on the Seismic Hazards Mapping Act please refer to
http://www.conservation.ca.gov/cgs/shzp/Pages/SHZPprogram.aspx

Click the link below to learn how to take greater advantage of the GeoPDF format of this map after downloading.
http://gmw.conservation.ca.gov/SHP/EZRIM/Documents/MapGuideUserGuide.pdf

MOORPARK QUADRANGLE

EARTHQUAKE FAULT ZONES

Delineated in compliance with Chapter 7.5 Division 2 of the California Public Resources Code *(Alquist-Priolo Earthquake Fault Zoning Act)*

REVISED OFFICIAL MAP

Released: May 1, 1999

STATE GEOLOGIST

SEISMIC HAZARD ZONES

Delineated in compliance with Chapter 7.8 Division 2 of the California Public Resources Code *(Seismic Hazards Mapping Act)*

OFFICIAL MAP

Released: November 17, 2000

STATE GEOLOGIST

IMPORTANT

PLEASE NOTE THE FOLLOWING FOR ZONES SHOWN ON THIS MAP

1) This map may not show all faults that have the potential for surface fault rupture, either within the Earthquake Fault Zones or outside their boundaries. Additionally, this map may not show all areas that have the potential for liquefaction, landsliding, strong earthquake ground shaking or other earthquake and geologic hazards. Also, a single earthquake capable of causing liquefaction or triggering landslide failure will not uniformly affect the entire area zoned.

2) Boundaries of Earthquake Fault Zones, if included on this map, are based on interpreted Holocene-active fault traces.

3) The identification and location of these faults are based on the best available data. However, the quality of data used is varied. Traces have been depicted as accurately as possible at a map scale of 1:24,000.

4) Liquefaction zones may also contain areas susceptible to the effects of earthquake-induced landslides. This situation typically exists at or near the toes of existing landslides, downslope from rockfall or debris flow source areas, or adjacent to steep stream banks.

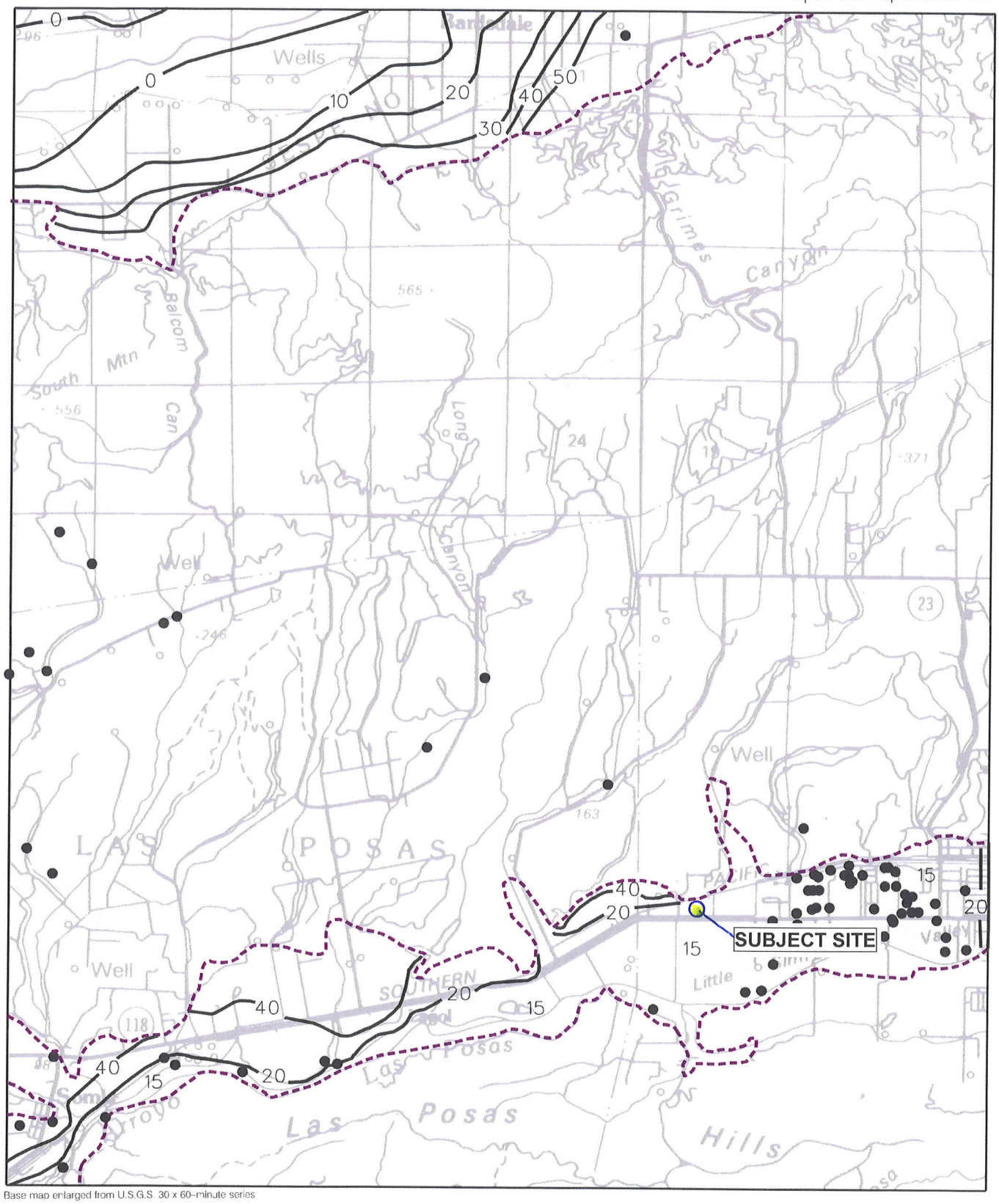
5) Landslide zones on this map were determined, in part, by adapting methods first developed by the U.S. Geological Survey (USGS). Landslide zones are based on maps prepared by the USGS typically use experimental approaches to assess earthquake-induced landslides and other types of landslide hazards. Although aspects of these new methodologies may be incorporated in future CGS seismic hazard zone maps, USGS maps should not be used as substitutes for these Official SEISMIC HAZARD ZONES maps.

6) USGS base map standards provide that 90 percent of cultural features be located within 40 feet (horizontal accuracy) at the scale of this map. The identification and location of liquefaction and earthquake-induced landslide zones are based on available data. However, the quality of data used is varied. The zone boundaries depicted have been drawn as accurately as possible at this scale.

7) Information on this map is not sufficient to serve as a substitute for the geologic and geotechnical site investigations required under Chapters 7.5 and 7.8 of Division 2 of the California Public Resources Code.

8) Seismic Hazard Zones identified on this map may include developed land where delineated hazards have already been mitigated to city or county standards. Check with your local building/planning department for information regarding the location of such mitigated areas.

9) DISCLAIMER: The State of California and the Department of Conservation make no representations or warranties regarding the accuracy of the data from which these maps were derived. Neither the State nor the Department shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of this map.



Base map enlarged from U.S.G.S. 30 x 60–minute series

Plate 1.2 Historically shallow ground–water depths and borehole data points in alluviated valley areas of the Moorpark Quadrangle.

Alluviated Valley

20 Historically shallow ground–water depth contours (in feet)

Borehole Site

15 Historically shallow ground–water depth where same value occurs over a broad area (in feet)

ONE MILE

Scale

SITE LOCATION: _____

GEOTECHNICAL REPORT: _____

GEOLOGY REPORT: _____

DEPTH TO WATER TABLE = 20'

EARTHQUAKE MAGNITUDE = 6.7

PEAK GROUND ACCELERATION = 0.87g

DEPTH BELOW FINAL GRADE (FEET)	MOIST DENSITY (PCF)	σ_o TOTAL STRESS (PSF)	$\bar{\sigma}_o$ EFFECTIVE STRESS (PSF)	$\sigma_o/\bar{\sigma}_o$ (-)	r_d (-)	① $\tau_h/\bar{\sigma}_o$ (-)	N VALUE (BLOWS/FT)	RELATIVE DENSITY (%)	C_N (-)	C_E (-)	C_B (-)	C_R (-)	C_S (-)	$(N_1)_{60}$ (BLOWS/FT)	FINES (%)	CRR M=7.5	MSF (-)	CRR M=7.0	LIQ. F.S.
5	110	550	Same	1.00	0.99	0.57	7	60	>1.6	1.00	1.05	0.70	1.20	>10	15	>0.16	1.5	>0.24	>0.5
10	115	1125			0.96	0.55	9	60	1.3			0.75		11	31	0.20		0.30	0.5
15	120	1725			0.92	0.53	4	40	1.1			0.85		5	61	>0.13		>0.20	>0.4
20	125	2350			0.87	0.50	10	55	0.92			0.90		10.5	66	>0.19		>0.30	>0.6
25		2975	2663	1.12	0.80	0.51	16	65	0.88			0.95		17	8	0.20		0.30	0.6
30		3600	2976	1.21	0.74	0.51	12	55	0.85			1.00		13	66	>0.22		>0.33	>0.6
35		4225	3289	1.28	0.68	0.50	21	65	0.81					21.5	4	0.24		0.36	0.7
40		4850	3602	1.35	0.64	0.49	21	65	0.78					20.5	4	0.22		0.33	0.7
45		5475	3915	1.40	0.61	0.49	32	75	0.76					30.5	7	>0.50		>0.75	>1.5
50		6100	4228	1.44	0.58	0.48	30	70	0.73					28	8	0.45		0.68	1.4

① INDUCED CYCLIC STRESS RATIO = $\tau_{ave}/\bar{\sigma}_o = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_o}{\bar{\sigma}_o} \cdot r_d$

- C_E = Corr. - Energy Ratio = Energy Ratio/60%
- C_B = Corr. - Borehole Dia. = 1.15 for 8" dia. borehole
- C_R = Corr. - Rod Length
- C_S = Corr. - Sampling Method

Actual Energy Ratio = 0.67-1.17 (Safety Hammer)
= 0.50-1.00 (Donut Hammer)

Sampling Method = 1.0 Standard sampler
= ~~1.2 Sampler W/o liners~~

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PROJECT 21889-20 | DATE JULY, 2020

EVALUATION OF LIQUEFACTION POTENTIAL

SEISMIC SETTLEMENT EVALUATION ⇒ GWT @ 20'

EQ Magnitude = 6.7, Hor. Ground Acceleration = 0.87 g

Depth (ft)	$N_{1,60}$ (Blows/ft)	Fines (%)	EQ CSR	M_{design} $M_{7.5}$	Design CSR	Vert. Strain	Seismic Settle	Liquefaction F.S.
				1.5				
20-25'	17	8	0.51		0.34	1.7%	1.0"	0.6
25-30'	13 (20)	66 (5)	0.51		0.34	1.5%	0.9"	>0.6
30-35'	21.5	4	0.50		0.33	1.4%	0.8"	0.7
35-40	20.5	4	0.49		0.32	1.5%	0.9"	0.7

$\Sigma S = 3.6"$

Say $\Delta_{EQ} = 3\frac{1}{2}"$

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20332-18 | DATE

Appendix D
Soil Infiltration Testing

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Amir Development Company	**Date:** 3/25/2022
Project No.: 21889-20	**Tested By:** J.S.
Test Hole: 1	**USCS Soil Classification:**
Depth of Test Hole: 11'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	10:00	10:23	23	114.0	132.0	18.0	
2	10:23	10:47	24	115.0	132.0	17.0	

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30-minute intervals) with a precision of at least 0.25".

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN)	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	10:47	10:57	10	117.0	117.5	4.5	
2	10:57	11:07	10	117.0	122.0	5.0	
3	11:07	11:17	10	112.0	117.0	5.0	
4	11:17	11:27	10	115.0	120.0	5.0	
5	11:27	11:37	10	117.0	122.5	4.5	
6	11:37	11:47	10	115.0	120.0	5.0	
7							
8							
9							
10							
11							
12							
13							
14							
15							
COMMENTS:							

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Amir Development Company	**Date:** 3/25/2022
Project No.: 21889-20	**Tested By:** J.S.
Test Hole: 2	**USCS Soil Classification:**
Depth of Test Hole: 11.5'	**Sides (if rectangular):**
Diameter of Test Hole: 6"	**Length:**
Sandy Soil Criteria Test*:	**Width:**

TRIAL NO.	START TIME	STOP TIME	TIME INTERVAL (MIN)	INITIAL DEPTH TO WATER (IN)	FINAL DEPTH TO WATER (IN)	CHANGE IN WATER LEVEL (IN)	GREATER THAN OR EQUAL TO 6"
1	10:03	10:16	13	122.0	138.0	16.0	
2	10:16	10:37	21	120.0	138.0	18.0	

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30-minute intervals) with a precision of at least 0.25".

TRIAL NO	START TIME	STOP TIME	ΔT TIME INTERVAL (MIN)	Do INITIAL DEPTH TO WATER (IN)	Df FINAL DEPTH TO WATER (IN)	ΔD CHANGE IN WATER LEVEL (IN)	PERCOLATION RATE (MIN/IN)
1	10:37	10:47	10	123.0	133.0	10.0	
2	10:47	10:57	10	121.0	131.0	10.0	
3	10:57	11:07	10	115.0	124.5	9.5	
4	11:07	11:17	10	115.0	125.0	10.0	
5	11:17	11:27	10	118.0	117.5	9.5	
6	11:27	11:37	10	123.0	132.0	9.0	
7							
8							
9							
10							
11							
12							
13							
14							
15							
COMMENTS:							

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SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Amir Development Company	**Tested By:** J.S. Jr.
Project No.: 21889-20	**Date Tested:** 6/25/2020
Test Hole: 1	**Caving:**
Depth of Test Hole: 5'	**Notes:**
Diameter of Test Hole: 6"	
Date Excavated: 6/25/2020	

PRE-SOAK

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
7:48	1	2	2	38.0	50.0	12.0
7:50						
7:50	2	3	5	38.0	50.0	12.0
7:53						

PERCOLATION TEST

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
7:53	1	5	5	38.0	50.0	12.0
7:58						
7:58	2	5	10	38.0	50.0	12.0
8:03						
8:03	3	6	16	38.0	50.0	12.0
8:09						
8:09	4	6	22	38.0	50.0	12.0
8:15						
8:15	5	7	29	38.0	50.0	12.0
8:22						
8:22	6	8	37	38.0	50.0	12.0
8:30						
8:30	7	7	44	38.0	50.0	12.0
8:37						
8:37	8	7	51	38.0	50.0	12.0
8:44						

NORCAL ENGINEERING
SOILS AND GEOTECHNICAL CONSULTANTS

PERCOLATION TEST DATA

Client: Amir Development Company	**Tested By:** J.S. Jr.
Project No.: 21889-20	**Date Tested:** 6/25/2020
Test Hole: 1	**Caving:**
Depth of Test Hole: 5'	**Notes:**
Diameter of Test Hole: 6"	
Date Excavated: 6/25/2020	

PRE-SOAK

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL

PERCOLATION TEST

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
8:44	9	8	59	48.0	60.0	12.0
8:52						
8:52	10	7	66	48.0	60.0	12.0
8:59						
8:59	11	8	74	48.0	60.0	12.0
9:07						
9:07	12	9	83	48.0	60.0	12.0
9:16						
9:16	13	8	91	48.0	60.0	12.0
9:24						
9:24	14	9	100	48.0	60.0	12.0
9:33						
9:33	15	10	110	48.0	60.0	12.0
9:43						
9:43	16	10	120	48.0	60.0	12.0
9:53						

NORCAL ENGINEERING
SOILS AND GEOTECHNICAL CONSULTANTS

Client: Amir Development Company	**Tested By:** J.S. Jr.
Project No.: 21889-20	**Date Tested:** 6/25/2020
Test Hole: 2	**Caving:**
Depth of Test Hole: 10'	**Notes:**
Diameter of Test Hole: 6"	
Date Excavated: 6/25/2020	

PRE-SOAK

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
8:10	1	5	5	108.0	120.0	12.0
8:15						
8:15	2	7	12	107.0	120.0	13.0
8:22						

PERCOLATION TEST

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
8:22	1	8	8	107.0	120.0	13.0
8:30						
8:30	2	9	17	107.0	120.0	13.0
8:39						
8:39	3	9	26	107.0	120.0	13.0
8:48						
8:48	4	8	34	108.0	120.0	12.0
8:56						
8:56	5	8	42	108.0	120.0	12.0
9:04						
9:04	6	10	52	107.0	120.0	12.0
9:14						
9:14	7	10	62	107.0	118.0	11.0
9:24						
9:24	8	10	72	108.0	119.0	11.0
9:34						

PERCOLATION TEST DATA

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Client: Amir Development Company	**Tested By:** J.S. Jr.
Project No.: 21889-20	**Date Tested:** 6/25/2020
Test Hole: 2	**Caving:**
Depth of Test Hole: 10'	**Notes:**
Diameter of Test Hole: 6"	
Date Excavated: 6/25/2020	

PRE-SOAK

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL

PERCOLATION TEST

TIME	PRE-SOAK NO.	TIME INTERVAL	TOTAL ELAPSED TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	CHANGE IN WATER LEVEL
9:34	9	10	82	108.0	119.0	11.0
9:44						
9:44	10	10	92	108.0	118.0	10.0
9:54						
9:54	11	10	102	107.0	118.0	11.0
10:04						
10:04	12	10	112	108.0	119.0	11.0
10:14						
10:14	13	10	122	107.0	117.0	10.0
10:24						

SOIL INFILTRATION RATE CALCS ⇒ Auger Boring

Location:	TH-1	TH-2
• Depth =	5.0'	10.0'
• Hole Dia. =	6"	6"
• Drop = Δd	12"	10"
• Time = Δt Interval	10 min	10 min
• Preadjusted Perc. Rate	72 in/hr	60 in/hr
• Initial Water Depth = d_1	12"	13"
• Reduction Factor = R_f	3.0	3.7
• INFILTRATION RATE	24 in/hr	16.4 in/hr

$$\text{Infiltration Rate} = \frac{\text{Pre adjusted Perc. Rate}}{\text{Reduction Factor}}$$

$$\text{Reduction Factor} = R_f = \left[\frac{2 \cdot d_1 - \Delta d}{\text{Dia.}}\right] + 1$$

NorCal Engineering
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JOB NO. 21889-20 DATE JULY, 2020

SOIL INFILTRATION RATE CALCS ⇒ Auger Boring

Location:	B-3	B-4
• Depth =	11.0'	11.5"
• Hole Dia. =	6"	6"
• Drop = Δd	5"	9.5"
• Time = Δt Interval	10 min	10 min
• Preadjusted Perc. Rate	30 in/hr	57 in/hr
• Initial Water depth = d_i	20"	20"
• Reduction Factor = R_f	6.83	6.08
• INFILTRATION RATE	4.4 in/hr	9.4 in/hr

$$\text{Infiltration Rate} = \frac{\text{Preadjusted Perc. Rate}}{\text{Reduction Factor}}$$

$$\text{Reduction Factor} = R_f = \left[\frac{2 \cdot d_i - \Delta d}{\text{Dia.}}\right] + 1$$

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DATE

SOIL INFILTRATION RATE CALCULATIONS