LID / DRAINAGE REPORT

for

Brand Boulevard Apartments
1815 – 1821 S. Brand Boulevard
Glendale, CA 91204

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1815 – 1821 S. Brand Boulevard
Glendale, CA 91204

Date:	August 17, 2020
Project Manager:	Randy Chapman, P.E. RCE No. 69614
Project Engineer:	Ben Bourne
CCE Job Number:	C20.0217

Prepared By: _____

Randy Chapman, P.E. Date
CCE Design Associates, Inc

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2. Introduction

INTRODUCTION AND PROJECT DESCRIPTION

This report has been prepared to validate the design of proposed drainage systems for the development of the Brand Boulevard Apartment project, within the City of Glendale, CA. The site consists of two adjacent lots that will be developed as one project. Once developed, the project will contain 38-unit residential apartment building.

SITE LOCATION

The project is located on Brand Boulevard in Glendale, which is part of Los Angeles County. Located within the Los Angeles County Flood Control District, this project is subject to the drainage design and LID requirements that have been published by the County.

The project includes the following addresses and APNs:

Address	APN
1815 Brand Boulevard	5640-033-027
1821 Brand Boulevard	5640-033-032

3. Objectives

The objective of this report is to determine proposed stormwater flow rates for this project based on existing topography and infrastructure, and then changes resulting from the development of this project. This report will address the following items:

- Drainage Concept – This report will discuss the proposed drainage concept for the site in further detail and will demonstrate compliance with criteria pursuant to the City of Glendale and the County of Los Angeles.
- Low Impact Development (LID) – This project will be designed in a manner to meet LID criteria. Specifically, LID provides mitigation of increased peak flow and volume generated by site improvements and also provides water quality treatment to address pollutants generated by the site use and identified in downstream receiving waters.

4. Methodology

This hydrology study was prepared using the design criteria and methodology developed by the Los Angeles County Department of Public Works and is in accordance with the 2006 Hydrology Manual. Calculations presented within this study were determined using the LA County Hydrocalc program to determine time of concentration (TC) and onsite flows. The 50-year, 24-hour rainfall depth for the site is approximately 6.3 inches and the 85th Percentile runoff depth is 0.98 inches. The site consists of soil ID number 006. The existing site is 95% impervious. Due to this project existing in a suburban area, burning and bulking calculations will not apply for pervious areas.

5. Hydrology Calculations

DRAINAGE CONCEPT

The roof drainage will be collected by a series of roof drains that are conveyed by downspouts and discharged to raised planters within the landscape area on the first level patio.

HYDROLOGY

This property is calculated to generate a peak flow of 1.3 cfs in a 50-year design storm and a peak flow of 0.11 cfs in the 85th percentile LID storm event. As the site is fully developed, burned calculations will not apply. Calculations are prepared pursuant to the Los Angeles County Hydrology Manual (using HydroCalc) with soil type and rainfall depth per the GIS server available on the County website.

The hydrology for this site was calculated using a proportional approach. The overall site was calculated using the HydroCalc and then the individual subareas were parceled out based on their area. The site was calculated as being 95% impervious. Calculations have been developed using a conservative approach and observations will likely result in values less than calculated.

6. LID Plan

PROJECT BACKGROUND

The proposed project is a redevelopment of the lots locate at 1815 – 1821 Brand Blvd. Once developed, the project will contain a 38-unit residential apartment building.

INFILTRATION FEASIBILITY

Per County of Los Angeles Department of Public Works GS200.2 Administrative Manual, a site-specific Infiltration Report is required. On March 11, 2016, MTC Engineering, Inc. prepared a geotechnical report of the site. The soils report is included within this report as Attachment I.

SOURCE CONTROL MEASURES

Table 5-1 of the LID Manual requires the following for designated projects (which this project falls under):

- Storm Drain Message and Signage (S-1)
- Outdoor Material Storage Areas (S-2)
- Outdoor Trash Storage / Waste Handling Area (S-3)
- Outdoor Loading / Unloading Dock Area (S-4)
- Outdoor Vehicle / Equipment Repair / Maintenance Area (S-5)
- Outdoor Vehicle / Equipment / Accessory Wash Area (S-6)
- Fuel & Maintenance Area (S-7)
- Landscape Irrigation Practices(S-8)
- Building Materials (S-9)
- Animal Care & Handling Facilities (S-10)
- Outdoor Horticulture Areas (S-11)

The above fact sheets have been included as an attachment to this report. While some of these uses are not anticipated to be included in the project, the possibility exists that they could be added in the future. As a result, these fact sheets have been included in the report. The owner is responsible for ensuring that the requirements outlined in the included fact sheets are adhered to at all times.

CALCULATION OF THE SWQDV

The SQDV was calculated to be 1,073 cubic feet. The disposition of the SQDV is outlined in the below section.

In addition, the SWQD flow was calculated to be 0.11 cfs. The flow and the corresponding volume were calculated using HydroCalc, using the rainfall depth of 0.98 inches and an 95% impervious ration along with Soil Type 006. Burned flow rate calculations do not apply as the site and surrounding areas are fully developed. Additionally, run-on offsite flow is not anticipated

LID IMPLEMENTATION

This project is required to capture and mitigate the entire SQDV volume. Pursuant to the Los Angeles County LID manual, the following is anticipated for the site treatment train:

- Filterra FTIBP0806-10" –The specific product proposed is capable of treating 0.15 cfs which is greater than 0.11 cfs. Details of the system are included within the attachments of this report.

TMDL AND HYDROMODIFICATION

The LID regulations require discussion of how TMDLs will be addressed for off-site mitigation projects only. Additionally, proposed hydromodification controls and calculations are required, only if necessary. As hydromodification is not a requirement of this project and as this site does not require off-site mitigation, neither of these two items are included.

PROPOSED MAINTENANCE PLAN

The maintenance plan and covenant are included for reference as an attachment to this report. The plan itself will be signed and recorded pursuant to County of Los Angeles LID requirements.

7. Summary and Conclusions

The development of this site will not have adverse impact to downstream treatment systems. Additionally, the project will implement LID BMPs, which will improve water quality and mitigate volume beyond that which was originally anticipated.

The grading design and drainage system are designed in a manner to convey stormwater flows away from structures in a manner to provide protection from flooding pursuant to County of Los Angeles, City of Glendale and FEMA requirements.

8. Attachments

Attachment 1	Hydrology Input Data (Los Angeles County Supporting Data)
Attachment 2	Q50 Hydrology Calculations
Attachment 3	LID Hydrology Calculations
Attachment 4	LID Design Details
Attachment 5	LID BMP Fact Sheets
Attachment 6	LID Maintenance Plan
Attachment 7	Hydrology / LID Plan
Attachment 8	Soils Report

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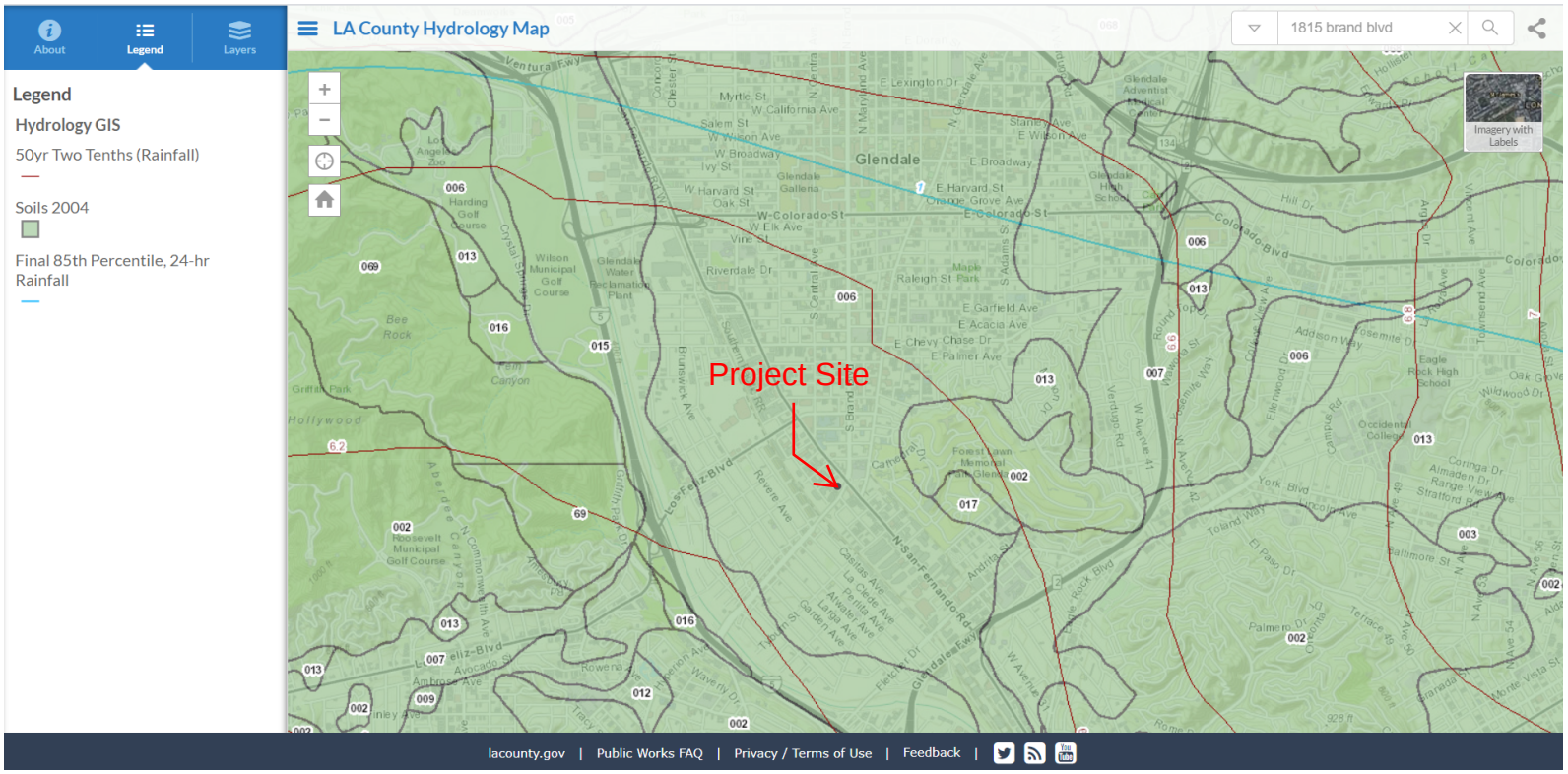
Attachment 1

Hydrology Input Data (Los Angeles County Supporting Data)


About
Legend
Layers
LA County Hydrology Map
1815 brand blvd
Legend
Hydrology GIS
50yr Two Tenths (Rainfall)
Soils 2004
Final 85th Percentile, 24-hr Rainfall
Project Site
Imagery with Labels
Glendale
lacounty.gov | Public Works FAQ | Privacy / Terms of Use | Feedback

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Attachment 2

Q50 Hydrology Calculations

Peak Flow Hydrologic Analysis

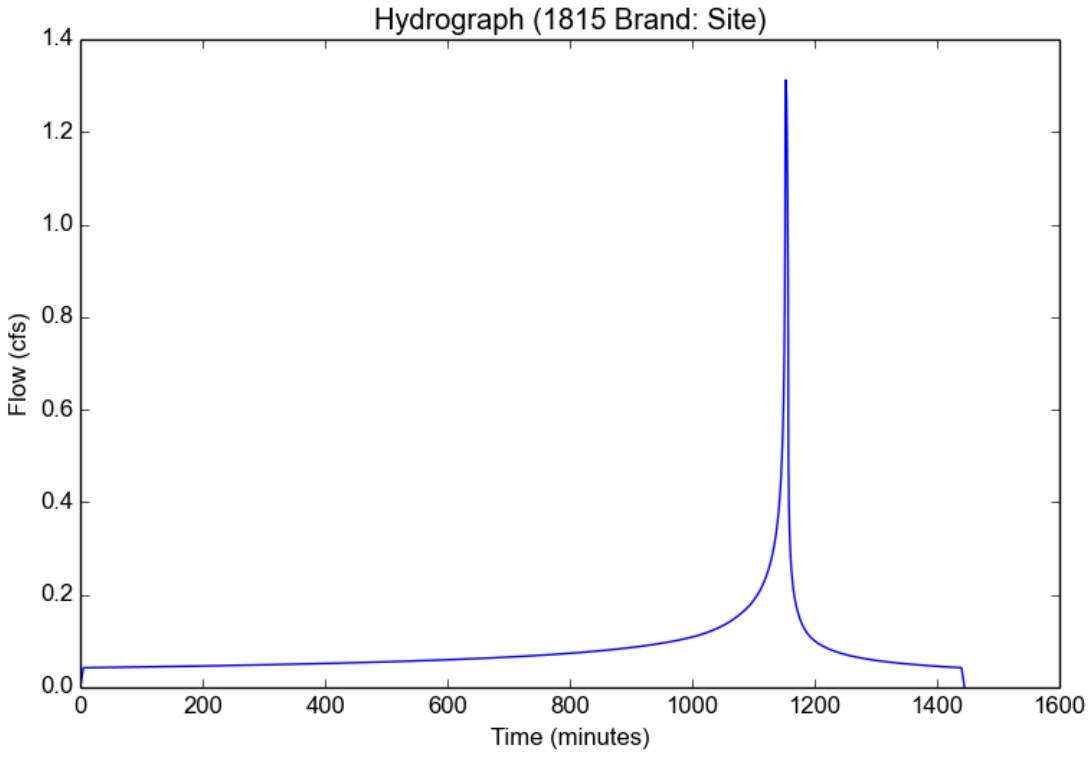
File location: C:/Users/BenBourne/Dropbox (CCE Design)/02.Engineering/Projects/C20.0217 Brand Blvd Apartments/02.Documents/01.Reports-Studies/
Version: HydroCalc 1.0.3

Input Parameters

Project Name	1815 Brand
Subarea ID	Site
Area (ac)	0.39
Flow Path Length (ft)	165.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	6.3
Percent Impervious	0.85
Soil Type	6
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.3
Peak Intensity (in/hr)	3.7588
Undeveloped Runoff Coefficient (Cu)	0.8673
Developed Runoff Coefficient (Cd)	0.8951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.3121
Burned Peak Flow Rate (cfs)	1.3121
24-Hr Clear Runoff Volume (ac-ft)	0.1621
24-Hr Clear Runoff Volume (cu-ft)	7062.9128



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Attachment 3

LID Hydrology Calculations

Peak Flow Hydrologic Analysis

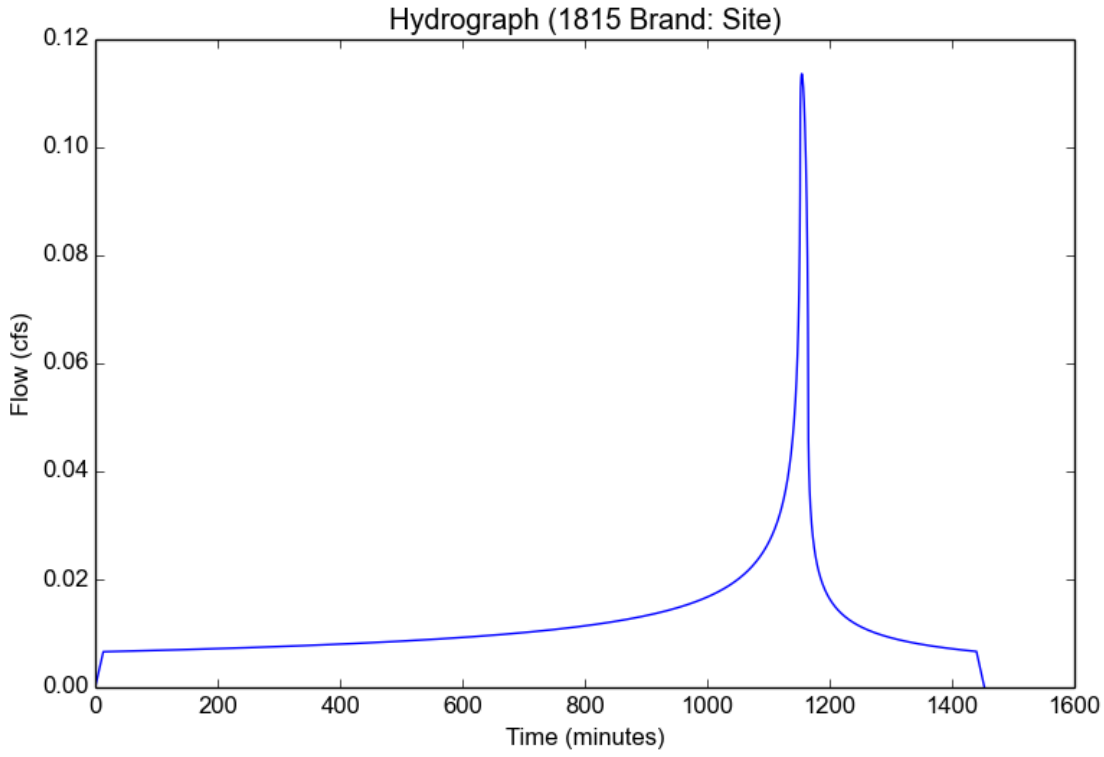
File location: C:/Users/BenBourne/Dropbox (CCE Design)/02.Engineering/Projects/C20.0217 Brand Blvd Apartments/02.Documents/01.Reports-Studies/
Version: HydroCalc 1.0.3

Input Parameters

Project Name	1815 Brand
Subarea ID	Site
Area (ac)	0.39
Flow Path Length (ft)	165.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.98
Percent Impervious	0.85
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.98
Peak Intensity (in/hr)	0.3732
Undeveloped Runoff Coefficient (Cu)	0.1054
Developed Runoff Coefficient (Cd)	0.7808
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	0.1136
Burned Peak Flow Rate (cfs)	0.1136
24-Hr Clear Runoff Volume (ac-ft)	0.0246
24-Hr Clear Runoff Volume (cu-ft)	1073.2326



Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		**Project Information**	
Engineer of Record Name	Randy Chapman, P.E.	Project Name	1815 S. Brand Blvd
Engineer of Record Company Name	CCE Design Associates, Inc.	Project Location	Glendale, CA
Engineer of Record Office Zip Code	93010	Catchment Name	Site

Drainage Area Inputs		
Drainage Area	**16867**	ft²
Runoff coefficient	**0.9**	-
Time of concentration	**5**	min
Long term reliable infiltration rate	**0.00**	in/hr
85th percentile, 24-hour depth (see hyperlink below)	**0.98**	in

LA County Rainfall Depth Analysis

Filterra Configuration (Select from Drop-Down)	**Internal Bypass Curb - Chamber**

Refer to "Filterra Configurations" tab for descriptions and standard details for download.

Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft²
Outputs		
Stormwater Quality Design Volume	1,240	ft³
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.96	-
Stormwater Quality Design Flow Rate	0.14	cfs
Design Alternatives Available	**Stand Alone Filterra Permitted**	

Design Recommendations

Primary Recommendation - Stand Alone Filterra

Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.15	cfs
Required Filterra Area	46	ft²
Filterra Model ID	**FTIBC-C 6x8 / 8x6**	

Alternative Recommendation - Filterra + Infiltration Storage

Required Filterra Area	43	ft²
Filterra Model ID	**FTIBC-C 6x8 / 8x6**	
ChamberMaxx volume	0	ft³
ChamberMaxx count	**0**	chambers

To be constent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:

1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

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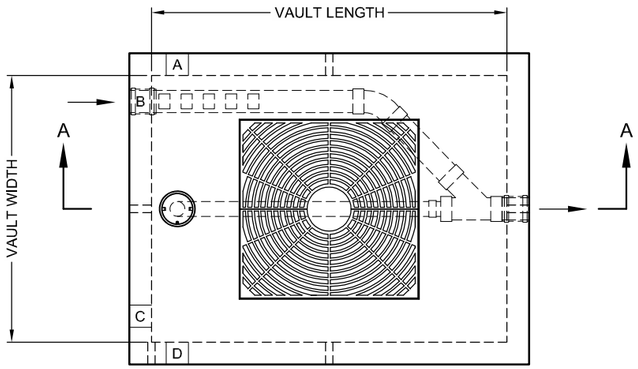
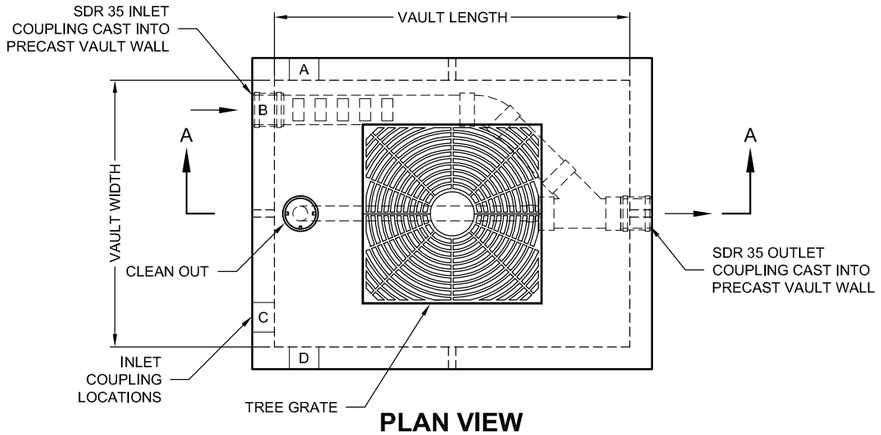
Attachment 4

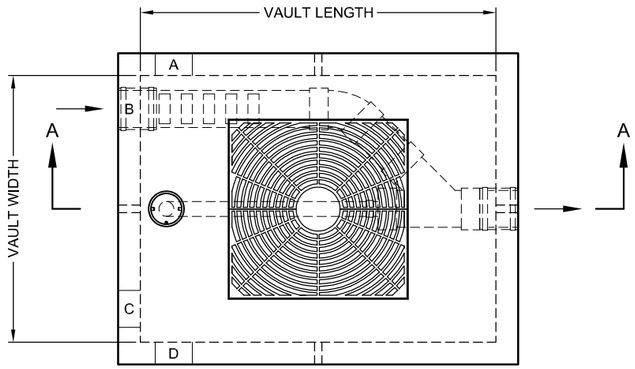
LID Design Details



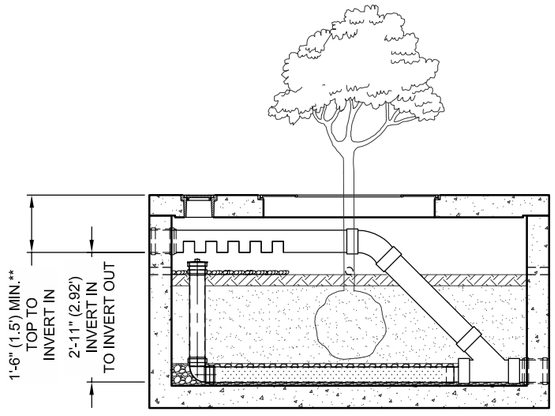
PLAN VIEW



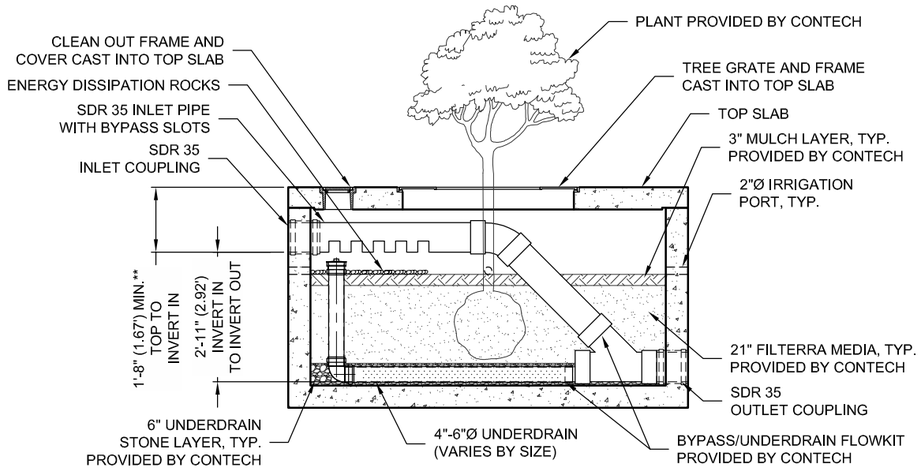
PLAN VIEW



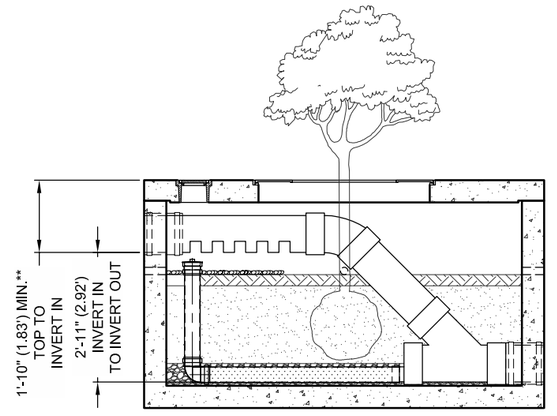
PLAN VIEW



SECTION A-A



SECTION A-A



SECTION A-A

FTIBP-6" BYPASS INLET/OUTLET PIPE CONFIGURATION

APPROXIMATE MAXIMUM BYPASS = 0.6 CFS

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	INLET/ OUTLET PIPE DIA.	UNDER-DRAIN PIPE DIA. (PERF.)	TREE GRATE QTY. & SIZE
FTIBP0404-6	ALL	4 x 4	4 x 4	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0604-6	N/A CA	6 x 4	6 x 4	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0606-6	ALL	6 x 6	6 x 6	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP06504-6	CA ONLY	6.5 x 4	6.5 x 4	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP078045-6	MID-ATL ONLY	7.83 x 4.5	7.83 x 4.5	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0804-6	N/A MID-ATL	8 x 4	8 x 4	6" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0806-6	ALL	8 x 6	8 x 6	6" SDR 35	4" SDR 35	(1) 4' x 4'
FTIBP1006-6	ALL	10 x 6	10 x 6	6" SDR 35	6" SDR 35	(1) 4' x 4'
FTIBP1206-6	ALL	12 x 6	12 x 6	6" SDR 35	6" SDR 35	(2) 4' x 4'
FTIBP1307-6	ALL	13 x 7	13 x 7	6" SDR 35	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

MAXIMUM TOP TO INVERT OUT = 5'-5"

** MAXIMUM TOP TO INVERT IN = 2'-6"

FTIBP-8" BYPASS INLET/OUTLET PIPE CONFIGURATION

APPROXIMATE MAXIMUM BYPASS = 1.2 CFS

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	INLET/ OUTLET PIPE DIA.	UNDER-DRAIN PIPE DIA. (PERF.)	TREE GRATE QTY. & SIZE
FTIBP0604-8	N/A CA	6 x 4	6 x 4	8" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0606-8	ALL	6 x 6	6 x 6	8" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP06504-8	CA ONLY	6.5 x 4	6.5 x 4	8" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP078045-8	MID-ATL ONLY	7.83 x 4.5	7.83 x 4.5	8" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0804-8	N/A MID-ATL	8 x 4	8 x 4	8" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0806-8	ALL	8 x 6	8 x 6	8" SDR 35	4" SDR 35	(1) 4' x 4'
FTIBP1006-8	ALL	10 x 6	10 x 6	8" SDR 35	6" SDR 35	(1) 4' x 4'
FTIBP1206-8	ALL	12 x 6	12 x 6	8" SDR 35	6" SDR 35	(2) 4' x 4'
FTIBP1307-8	ALL	13 x 7	13 x 7	8" SDR 35	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

MAXIMUM TOP TO INVERT OUT = 5'-5"

** MAXIMUM TOP TO INVERT IN = 2'-6"

FTIBP-10" BYPASS INLET/OUTLET PIPE CONFIGURATION

APPROXIMATE MAXIMUM BYPASS = 2.2 CFS

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	INLET/ OUTLET PIPE DIA.	UNDER-DRAIN PIPE DIA. (PERF.)	TREE GRATE QTY. & SIZE
FTIBP0606-10	ALL	6 x 6	6 x 6	10" SDR 35	4" SDR 35	(1) 3' x 3'
FTIBP0806-10	ALL	8 x 6	8 x 6	10" SDR 35	4" SDR 35	(1) 4' x 4'
FTIBP1006-10	ALL	10 x 6	10 x 6	10" SDR 35	6" SDR 35	(1) 4' x 4'
FTIBP1206-10	ALL	12 x 6	12 x 6	10" SDR 35	6" SDR 35	(2) 4' x 4'
FTIBP1307-10	ALL	13 x 7	13 x 7	10" SDR 35	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

MAXIMUM TOP TO INVERT OUT = 5'-5"

** MAXIMUM TOP TO INVERT IN = 2'-6"

* INTERNAL PIPING MAY VARY DEPENDING UPON INFLUENT LOCATION.

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FILTERRA INTERNAL BYPASS PIPE (FTIBP) CONFIGURATION DETAIL

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Attachment 5

LID BMP Fact Sheets

S-1: Storm Drain Message and Signage

Purpose

Waste material dumped into storm drain inlets can adversely impact surface and ground waters. In fact, any material discharged into the storm drain system has the potential to significantly impact downstream receiving waters. Storm drain messages have become a popular method of alerting and reminding the public about the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message simply informs the public that dumping of wastes into storm drain inlets is prohibited and/or that the drain ultimately discharges into receiving waters.

General Guidance

- The signs must be placed so they are easily visible to the public.
- Be aware that signs placed on sidewalk will be worn by foot traffic.

Design Specifications

- Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.
- Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., “No Dumping – Drains to the Ocean”) are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.

Maintenance Requirements

Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaced as necessary). If required by LACDPW, the owner/operator or homeowner’s association shall enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards and signs.

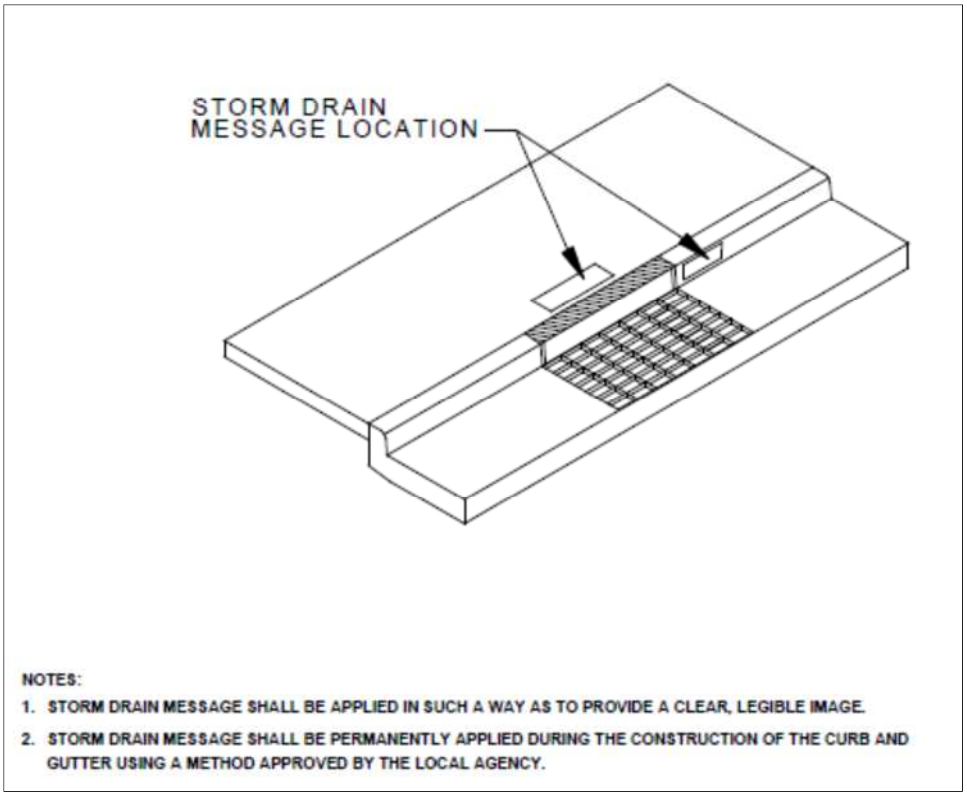

Figure D-1. Storm Drain Message Location – Curb Type Inlet

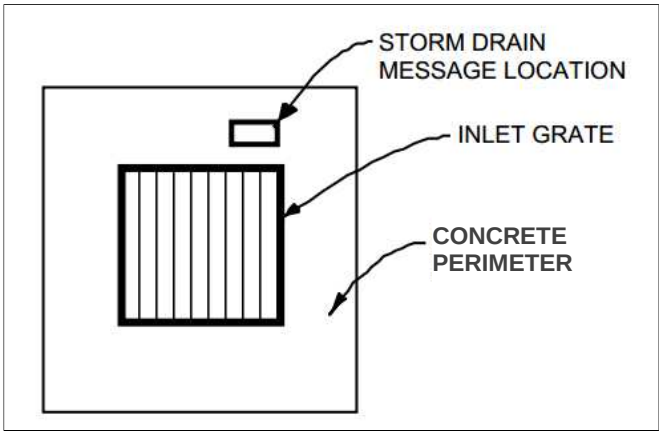

Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-2: Outdoor Material Storage Area

Purpose

The County defines outdoor material storage areas as areas or facilities whose sole purpose is the storage of materials. Materials, including raw materials, by-products, finished products, and waste products, stored outdoors can become sources of pollutants in stormwater runoff if not handled or stored properly. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity present.

Materials may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Contamination of stormwater runoff may be prevented by eliminating the possibility of stormwater runoff contact with the material storage areas either through diversion, cover, or capture of the stormwater runoff. Design considerations may also include minimizing the storage area. The source control measures presented in this fact sheet must meet local permitting requirements.

Some materials, such as those containing heavy metals or toxic compounds, are of more concern than other materials. Toxic and hazardous materials must be prevented from coming in contact with stormwater runoff. Non-toxic or non-hazardous materials, such as debris and sediment, can also have significant impacts on receiving waters. Contact between non-toxic or non-hazardous materials and stormwater runoff should be limited, and such materials prevented from being discharged with stormwater runoff.

Materials are classified into three categories based on the potential risk of pollutant release associated with stormwater runoff contact – high risk, medium risk, and low risk. General types of materials under each category are presented in Table D-1. The categorization of the potential pollutant risk is used to determine the design specifications, which are presented in Table D-2, for design features at the project site.

Table D-1. Classification of Materials for Potential Pollutant Risk

High Risk Materials	Medium Risk Materials	Low Risk Materials
• Recycled materials with discharge potential • Corrosives • Food items • Chalk/gypsum products • Scrap or salvage goods • Feedstock/grain • Fertilizers • Pesticides • Compost • Asphalt • Lime/lye/soda ash • Animal/human wastes • Rubber and plastic pellets or other small pieces • Uncured concrete/cement • Lead and copper, and any metals with oil/grease coating	• Clean recycled materials without discharge potential • Metal (excluding lead and copper, and any metals with oil/grease coating) • Sawdust/bark chips • Sand/soil • Unwashed gravel/rock	• Washed gravel/rock • Finished lumber (non-pressure treated) • Rubber or plastic products (excluding small pieces) • Clean, precast concrete products • Glass products (new) • Inert products • Gaseous products • Products in containers that prevent contact with stormwater (fertilizers and pesticides excluded)

Design Specifications

Design specifications for material storage areas are regulated by local building and fire codes, ordinances, and zoning requirements. Source control measures presented in this fact sheet are intended to enhance and be consistent with local code and ordinance requirements while addressing stormwater runoff concerns. The design specifications, presented in Table D-2, must be incorporated into the design of outdoor material storage areas when stored materials could contribute pollutants to the storm drain system. The level of controls required varies relative to the risk category of the material stored.

As general guidance, downspouts and roofs should be directed away from outdoor materials storage areas, and such storage areas should slope towards a dead-end sump to collect stormwater runoff, non-stormwater runoff, and spills. Stormwater runoff, non-stormwater runoff, and spills must be disposed of in accordance with local, state, and federal laws. Locations of design features, including the features presented in Table D-2, must be included on site maps or plans. Additionally, site maps or plans must show all storage areas for chemicals and/or waste materials, with a tank/drum schedule indicating tank capacities, materials of construction, and contents.

Table D-2. Design Specifications for Outdoor Material Storage Areas

Design Feature	Design Specifications
Surfacing	• High-Risk Materials: o Construct/pave outdoor material storage areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to the materials being stored. • Medium-Risk Materials: o Construct/pave outdoor material storage areas with Portland cement concrete. • Low-Risk Materials: o There are no requirements for surfacing.
Enclosures and Covers	• High-Risk Materials: o Place materials in an enclosure such as a shed, cabinet, or other structure that prevents contact with stormwater runoff; or o Cover entire storage area with a permanent canopy, roof, or awning to prevent precipitation from making direct contact with and collecting within the storage area. Direct stormwater runoff from the cover away from the storage area to a stormwater runoff disposal point that meets all applicable code, ordinance, and LID Standards Manual requirements. For cover structures that do not include sidewalls, include a roof overhang that extends beyond the grade break. o Covers 10 feet high or less should extend a minimum of 3 feet beyond the perimeter of the hydraulically-isolated storage area. o Covers higher than 10 feet should extend a minimum of either 20 percent of the cover's height or 5 feet beyond the perimeter of the hydraulically-isolated storage area, whichever is greater. o LACDPW may grant waivers for covers on a case-by-case basis. • Medium-Risk Materials: o At a minimum, completely cover material with temporary plastic sheeting during storm events. • Low-Risk Materials: o There are no requirements for enclosures or covers.

Table D-2. Design Specifications for Outdoor Material Storage Areas (continued)

Hydraulic Isolation and Drainage	• High-Risk Materials: o Hydraulically-isolate storage area with grading, berms, drains, dikes, or curbs to prevent stormwater run-on from surrounding areas or roof drains. o Direct stormwater runoff from surrounding areas away from the hydraulically-isolated storage area to a stormwater runoff disposal point that meets all applicable LID Standards Manual requirements. o Drainage facilities are not required for the hydraulically-isolated storage area. However, if drainage facilities are provided, drainage from the hydraulically-isolated storage area must be directed to a stormwater runoff disposal point as determined by LACDPW. • Medium-Risk Materials: o Drainage from storage area may be allowed, on a case-by-case basis with approval from LACDPW, to a treatment control measure or standard storm drain(s). o For erodible material, provide grading and a structural containment barrier on at least three sides of each stockpile to prevent stormwater run-on from surrounding areas and migration of material due to wind erosion. • Low-Risk Materials: o Provide appropriate drainage from the storage area to minimize contact with materials.
Spill Containment	• All Materials: o Implement spill containment measures where materials are stored in tanks, drums, or similar containers and that may potentially enter the storm drain system, sanitary sewer system, or contaminate the soil. Spill containment must be designed for the volume of the largest tank/drum or 10 percent of the tank/drum total (whichever is greater). o Separate spill containment systems for all tanks containing incompatible materials such as acids, bases, reactive or flammable materials. o Clean, repair, and seal (using epoxy or equivalent sealant compatible with the stored materials) the interior wall and floors within all spill containment areas. Identify the areas to be sealed on the site maps. o Bond the contact joint for spill containment walls or dikes constructed on existing concrete, masonry or asphalt to the existing surface. Identify the areas to be bonded on the site maps. o Cover the spill containment areas with a roof or awning to minimize collection of stormwater runoff within. o Store materials collected in spill containment areas until its quality and an appropriate approved disposal method have been determined.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate

permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor material storage areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Any enclosures and secondary/spill containment areas should be checked periodically to ensure spills are contained efficiently. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-3: Outdoor Trash Storage and Waste Handling Area

Purpose

Stormwater runoff from areas where trash is stored or handled can be polluted. Loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or receiving waters. Waste handling operations (i.e., dumpsters, litter control, waste piles) may be sources of stormwater pollution.

Design Specifications

Wastes from commercial and industrial sites are typically hauled away for disposal by either public or commercial carriers that may have design or access requirements for waste storage areas. Design specifications for waste handling areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications, listed below in Table D-3, are recommendations and are not intended to conflict with requirements established by the waste hauler. The design specifications are intended to enhance local codes and ordinances while addressing stormwater runoff concerns. The waste hauler should be contacted prior to the design of trash storage and collection areas to determine established and accepted guidelines for designing trash collection areas. All hazardous waste must be handled in accordance with the legal requirements established in Title 22 of the California Code of Regulations. Conflicts or issues should be discussed with LACDPW staff.

Table D-3. Design Specifications for Outdoor Trash Storage and Waste Handling Area

Design Feature	Design Specifications
Surfacing	• Construct/pave outdoor trash storage and waste handling area with Portland cement concrete or an equivalent impervious surface.
Screens/Covers	• Install a screen or wall around trash storage area to prevent off-site transport of loose trash. • Use lined bins or dumpsters to reduce leaking of liquid wastes. • Use waterproof lids on bins/dumpsters or provide a roof to cover storage area enclosure (LACDPW discretion) to prevent precipitation from entering containers.
Grading/Drainage	• Berm and/or grade waste handling area to prevent stormwater run-on. • Locate waste handling area at least 35 feet from storm drains. • Divert drainage from adjoining roofs and pavement away from adjacent trash storage areas.
Signs	• Post signs on all dumpsters and/or inside enclosures prohibiting disposal of liquids and hazardous materials in accordance with any waste disposal ordinance.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor trash storage and waste handling areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-4: Outdoor Loading/Unloading Dock Area

Purpose

Materials spilled, leaked, or lost during loading or unloading may collect on impervious surfaces or in the soil and be carried away by stormwater runoff or when the area is cleaned. Precipitation may also wash pollutants from machinery used to load or unload materials. In particular, loading docks have the potential to contribute heavy metals, nutrients, suspended solids, oils, and grease to stormwater runoff due to the heavy truck traffic and loading and unloading activities. Depressed loading docks (e.g., truck wells) are contained areas that can also accumulate water.

Design Specifications

Design specifications for outdoor loading/unloading dock areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. Additionally, individual businesses may have their own design or access requirements for loading docks. Design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications presented in Table D-4 are not intended to conflict with requirements established by individual businesses, but should be followed to the maximum extent practicable.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces, such as depressed loading docks. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. If a water quality inlet or infiltration system is installed, it must be maintained as indicated by the manufacturer or installer. Outdoor loading/unloading dock areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

Table D-4. Design Specifications for Outdoor Loading/Unloading Dock Area

Design Feature	Design Specifications
Surfacing	• Construct/pave outdoor loading/unloading dock areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to materials being handled in the loading/unloading dock area.
Covers	• Cover outdoor loading/unloading dock areas to a distance of at least 10 feet beyond the loading dock or building face if there is no raised dock. If the cover or roof structure does not include sidewalls, then the roof overhang must extend beyond the grade break. The overhang must extend a minimum of 20 percent of the roof height. • For interior transfer bays, provide a minimum 10-foot "No Obstruction Zone" to allow trucks or trailers to extend at least 5 feet inside the building. Identify "No Obstruction Zone" clearly on site plans and paint zone with high visibility floor paint. • If covers or interior transfer bays are not feasible, install a seal or door skirt and provide a cover to shield all material transfers between trailers and building. • LACDPW may grant waivers for covers on a case-by-case basis.
Hydraulic Isolation/Drainage	• For outdoor loading/unloading dock areas, hydraulically-isolate the first six feet of paved area measured from the building or dock face with grading, berms, or drains to prevent stormwater run-on from surrounding areas or roof drains. Direct stormwater runoff (e.g., from downspouts/roofs) and drainage from surrounding areas away from hydraulically-isolated areas to a stormwater runoff discharge point that meets all applicable LID Standards Manual requirements. • For interior transfer bays or bay doors, prevent stormwater runoff from surrounding areas from entering the building with grading or drains. Do not install interior floor drains in the "No Obstruction Zone". Hydraulically-isolate the "No Obstruction Zone" from any interior floor drains. • Do not install direct connections to storm drains from depressed loading docks. Connect drains or direct drainage from hydraulically-isolated loading/unloading dock area to an approved sediment/oil/water separator system connected a discharge location as determined by LACDPW. Provide a manual emergency spill diversion valve upstream of separator system to direct flow, in the event of a spill, to an approved spill containment vault sized to contain a volume equal to 125% of largest container handled at the facility. Provide additional emergency means, such as drain plugs or drain covers, to prevent spills or contaminated stormwater runoff from entering the storm drain system.

S-5: Outdoor Vehicle/Equipment Repair/Maintenance Area

Purpose

Activities in vehicle and equipment repair/maintenance areas that can contaminate stormwater runoff include engine repair, service, and parking (i.e., leaking engines or parts). Pollutants of concern from these facilities include oil and grease, solvents, car battery acid, coolant, and gasoline as well as heavy metals and suspended solids.

Design Specifications

Design specifications for vehicle and equipment repair/maintenance areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications required for vehicle and equipment repair/maintenance areas are presented in Table D-5. All wash water and hazardous and toxic wastes must be prevented from entering the storm drain system.

Table D-5. Design Specifications for Outdoor Vehicle and Equipment Repair/Maintenance Areas

Design Feature	Design Specifications
Surfacing	• Construct/pave vehicle and equipment repair/maintenance area with Portland cement concrete or an equivalent impervious surface. Where possible, conduct vehicle repair and maintenance activities indoors.
Screens/Covers	• Cover areas where parts and fluids are stored. • Cover or enclose all repair/maintenance areas.
Grading/Drainage	• Berm or grade vehicle and equipment repair/maintenance areas to prevent stormwater run-on and runoff and contain spills. • Direct stormwater runoff from downspouts/roofs and pavement away from vehicle and equipment repair/maintenance areas. • Grade the vehicle and equipment repair/maintenance area to drain to a dead-end sump for collection of all wash water, leaks, and spills. Connect drains to a sump for collection and disposal at a discharge location approved by LACDPW. Direct connection of repair/maintenance area to storm drain system is prohibited. If required by LACDPW, obtain an Industrial Waste Disposal Permit. • Do not locate storm drains in the immediate vicinity of vehicle and equipment repair/maintenance area.
Emergency Storm Drain Seal	• Provide means, such as isolation valves, drain plugs, or drain covers, to prevent spills or accumulated water from entering the storm drain system.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Vehicle and equipment repair/maintenance areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-6: Outdoor Vehicle/Equipment/Accessory Washing Area

Purpose

Washing vehicles, equipment, and accessories in areas where wash water flows onto the ground can pollute stormwater runoff and adversely impact receiving waters. Pollutants of concern in wash water include oil and grease, heavy metals, solvents, phosphates, and suspended solids. By containing, collecting, diverting, and properly disposing of wash water from outdoor vehicle, equipment, and accessory washing areas to the sanitary sewer system, transport of these potential pollutants is limited.

Design Specifications

Design specifications for vehicle/equipment/accessory washing areas are regulated by local building and fire codes and current County ordinances and zoning requirements. The design specifications presented in Table D-6 are intended to enhance and be consistent with these requirements while addressing stormwater runoff concerns. All wash water and hazardous and toxic wastes must be prevented from entering the storm drain system.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor vehicle/equipment/accessory washing areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

Table D-6. Design Specifications for Outdoor Vehicle/Equipment/Accessory Washing Areas

Design Feature	Design Specifications
Surfacing	• Construct/pave vehicle/equipment/accessory washing areas with Portland cement concrete or an equivalent impervious surface.
Covers	• Provide a cover that extends over the entire washing area. For covers that do not include sidewalls, include an overhang that extends beyond the grade break. o Covers 10 feet high or less should extend a minimum of 3feet beyond the perimeter of the hydraulically-isolated area. o Covers higher than 10 feet should extend a minimum of either 20 percent of the cover's height or 5 feet beyond the hydraulically-isolated area, whichever is greater. o If a cover is not feasible, provide an approved stormwater runoff diversion system along with a clarifier and sample box (County Standard Plan 2043-0). Diverted stormwater runoff may require pretreatment and verification of pollutant concentrations. o LACDPW may grant waivers for covers on a case-by-case basis.
Grading/Drainage	• Hydraulically-isolate vehicle/equipment/accessory washing area using berms or grading to prevent stormwater run-on and runoff and contain spills. • Grade or berm washing area to contain wash water within the covered area. • Direct wash water to treatment and recycle or pretreatment (e.g., clarifier) and proper connection to the sanitary sewer system. Obtain approval from the governing agency (e.g., Industrial Waste Management Division) before discharging to the sanitary sewer system. • Direct stormwater runoff from downspouts/roofs and pavement away from washing areas. • Do not locate storm drains in the immediate vicinity of washing area.
Emergency Storm Drain Seal	• Provide means, such as isolation valves, drain plugs, or drain covers, to prevent spills or accumulated water from entering the storm drain system.

S-7: Fuel and Maintenance Area

Purpose

Spills at vehicle and equipment fueling areas can be a significant source of pollution because fuels contain toxic materials and heavy metals that are not easily removed by stormwater quality control measures. When stormwater runoff mixes with fuel spilled or leaked onto the ground, it becomes contaminated with petroleum-based materials that are harmful to humans, fish, and wildlife. Contamination can occur at large industrial sites or at small commercial sites such as retail gas outlets and convenience stores. Materials such as oil and grease, car battery acid, and coolant also have the potential to contribute to stormwater pollution due to spills at fueling and maintenance areas.

Design Specifications

Design specifications for fuel and maintenance areas are regulated by local building and fire codes and current County ordinances and zoning requirements. The design specifications presented in Table D-7 are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Fuel and maintenance areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

Table D-7. Design Specifications for Fuel and Maintenance Areas

Design Feature	Design Criteria
Surfacing	• Construct/pave fuel dispensing/maintenance area with Portland cement concrete, or an equivalent smooth impervious surface. Do not use asphalt concrete to construct/pave the fuel dispensing/maintenance area. The fuel dispensing/maintenance area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is greater. • Paving around the fuel dispensing/maintenance area may exceed the minimum dimensions of the "fuel dispensing/maintenance area" stated above. • Use asphalt sealant to protect asphalt-paved areas surrounding the fuel dispensing/maintenance area.
Covers	• Cover the entire fuel dispensing/maintenance area with a permanent canopy, roof, or awning to prevent precipitation from directly contacting the fuel dispensing/maintenance area. Direct stormwater runoff from the cover and downspouts away from the area to a stormwater runoff disposal point that meets all applicable code, ordinance, and LID Standards Manual requirements. o Covers 10 feet high or less should extend a minimum of 3 feet beyond the perimeter of the hydraulically-isolated fuel dispensing/maintenance area. o Covers higher than 10 feet should extend a minimum of 5 feet beyond the hydraulically-isolated fuel dispensing/maintenance area. • For facilities designed to accommodate very large vehicles or equipment that would prohibit the use of covers, hydraulically-isolate the uncovered fuel dispensing/maintenance area and direct stormwater runoff from the area through upstream control measures to the sanitary sewer system (see Hydraulic Isolation/Drainage section below).
Hydraulic Isolation/Drainage	• Design fuel dispensing/maintenance area pad with a 2-4 percent slope to prevent ponding, and include a grade break that separates the area from the rest of the site and prevents stormwater run-on to the maximum extent practicable. Grade the fuel dispensing/maintenance area to an approved location. • Hydraulically-isolate the fuel dispensing/maintenance area to prevent stormwater run-on from surrounding areas or roof drains by one or more of the following methods: o Perimeter trench drains: Locate trench drains around the fuel dispensing/maintenance area pad perimeter. Direct stormwater runoff from the perimeter drains to one of the following: ▪ Sanitary sewer system, upon proper approval. Provide an automatic shut-off valve installed upstream of the sanitary sewer system connection and below grade in a manhole or similar concrete containment structure. The valve must be designed to close automatically when the maximum oil/fuel storage capacity of the structure is reached. ▪ An approved below-grade containment vault with at least 60 ft^3 of storage capacity. The vault must be emptied, as required, and contents disposed of in accordance with applicable laws.

Table D-7. Design Specifications for Fuel and Maintenance Areas (continued)

Design Feature	Design Criteria
Hydraulic Isolation/Drainage (continued)	o Fueling pad: Elevate the entire fuel dispensing/maintenance area pad and provide a perimeter drain to isolate the pad. The pad should be graded level such that any spills will stay on the pad for dry clean-up. • Direct stormwater runoff from surrounding areas away from hydraulically-isolated areas to a stormwater runoff discharge point that meets all applicable LID Standards Manual requirements. Locate storm drains for surrounding areas at least 10 feet from the hydraulically-isolated fuel dispensing/maintenance area.
Emergency Storm Drain Seal	• Provide means, such as isolation valves, drain plugs, or drain covers, to prevent spills or accumulated from entering the storm drain system. Propose a spill collection and cleanup maintenance plan for the fueling area. When possible and appropriate, encourage use of proper clean-up methods, which are dry clean-up methods, such as sweeping for removal of litter and debris and use of absorbents for liquid spills and leaks.

S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system.[1] The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

[1] If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.

- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.[2]
- Implement Integrated Pest Management practices.

For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

Maintenance Requirements

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

[2] As determined by the City of Los Angeles, Building and Safety Division

S-9: Building Materials Selection

Purpose

Building materials can potentially contribute pollutants of concern to stormwater runoff through leaching. For example, metal buildings, roofing, and fencing materials may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. The use of alternative building materials can reduce pollutant sources in stormwater runoff by eliminating compounds that can leach into stormwater runoff. Alternative building materials may also reduce the need to perform maintenance activities (i.e., painting) that involve pollutants of concern, and may reduce the volume of stormwater runoff. Alternative materials are available to replace lumber and paving.

Design Specifications

Lumber

Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.

Roofs, Fencing, and Metals

Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:

- Metal roofs;
- Chain-link fencing and siding; and
- Metal downspouts, vents, flashing, and trim on roofs.

Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic.

Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET-7) in Appendix E.

Pesticides

The use of pesticides around foundations can be reduced through the use of alternative barriers. Sand barriers can be applied around foundations to deter termites, as they cannot tunnel through sand. Metal shields also block termites from tunneling. Additionally, diatomaceous earth can be used to repel or kill a wide variety of other pests.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., signs) must be maintained by the owner/operator as required by local codes and ordinances. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-10: Animal Care and Handling Facilities

Purpose

Animal care, confinement, and slaughter may potentially contribute nutrients, bacteria and viruses, and other pollutants to stormwater runoff. Implementing source control measures, such as preventing stormwater runoff in animal care and confinement areas and good housekeeping, reduces the potential for pollutant mobilization from animal care and handling facilities into stormwater runoff.

It should be noted that this fact sheet does not address concentrated animal feeding operations, as defined by the USEPA.

Design Specifications

General Specifications

- Site barns, corrals, and pastures on property that drains away from the storm drain system and receiving waters.
- Locate animal washing areas, pastures, horse riding areas, stalls, or cages at least 50 feet away from storm drains, domestic wells, septic tank or leach field sites, and receiving waters.
- Design berms, gutters, or grassed ditches to divert stormwater runoff away from animal area, storm drain system, and receiving waters.
- Cover animal enclosures (i.e., stables) to protect them from precipitation.
- Prevent animals from entering sensitive environmental areas.
- Regularly sweep or shovel animal holding areas.

Grazing Management

- Focus on protecting the pasture's soil and vegetative cover. Prevent bare areas from forming.
- Clip tall weeds and old grass to control weeds and stimulate grass growth.
- Establish healthy and vigorous pastures with at least three inches of leafy material present.
- Subdivide grazing areas into three or more units of equal size, which can be grazed in rotation.
- Allow pastures to grow to 8-10 inches before allowing grazing.
- Rotate animals to clean pastures when grass is grazed down to 3-4 inches.
- Manage grazing so that a cover of dry residual vegetation protects soil from the first storm event of the season.
- Keep animals away from wet fields when possible.

- During periods of heavy precipitation, consider indoor feeding.
- Use manure and soiled bedding sparingly to fertilize pastures and croplands.
- Use turnout paddocks as "sacrifice areas" to preserve pastures.

Horse Access to Waterways

- Prevent trampling of streamside vegetation.
- Design stream crossings to minimize erosion.

Horse Waste Management

- Collect manure to prevent it from entering the storm drain system or receiving waters.
- Store collected manure on high ground to reduce contact with stormwater runoff.
- After clean-up during the summer, water the areas where horses frequently deposit manure to promote decomposition.
- Store horse waste in sturdy, insect-resistant, and seepage-free units that have an impervious surface bottom and a cover to prevent leaching and runoff, such as:
    - Plastic garbage cans with lids;
    - Fly-tight wooden or concrete storage sheds;
    - Composters; or
    - Pits or trenches lined with an impermeable layer.
- Remove accumulated manure from the site frequently using the following methods:
    - Composting. Keep compost piles moist and well-aerated to promote decomposition;
    - Give away composted material to local greenhouses, nurseries and botanical gardens;
    - Transport manure to topsoil companies or composting centers; or
    - Fertilize pastures, cropland, and lawns with manure and soiled bedding. Do not apply fertilizer just before or during storm events and apply these materials sparingly.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., enclosures) must be maintained by the owner/operator as required by local codes and ordinances. Manure must be collected from site frequently and covered until properly disposed of. Enclosures must be checked periodically to ensure roof is leak-free. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-11: Outdoor Horticulture Areas

Purpose

Horticulture areas may potentially contribute nutrients, bacteria, organics, sediment, and other pollutants to the stormwater runoff. Irrigation runoff provides a pathway for pollutants to enter the storm drain system. Implementation of source control measures can reduce the potential for pollutant mobilization from outdoor horticulture areas into stormwater runoff.

General Guidance

- Do not allow wash water from the horticulture area to drain directly to the storm drain system or receiving waters.

Maintenance Requirements

Preventative maintenance includes weeding, pruning back excess plant growth, and removing leaf and other debris. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

DESIGN ASSOCIATES INC

Attachment 6

LID Maintenance Plan

Filterra Owner's Manual

filterra®

Bioretention Systems

CONTECH®

ENGINEERED SOLUTIONS

filterra®
Bioretention Systems

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Enclosed

Local Area Filterra Plant List

CONTECH®
ENGINEERED SOLUTIONS

Introduction

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

The Filterra system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra system.

Included with your purchase is Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

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

Activation Overview

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

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra systems.

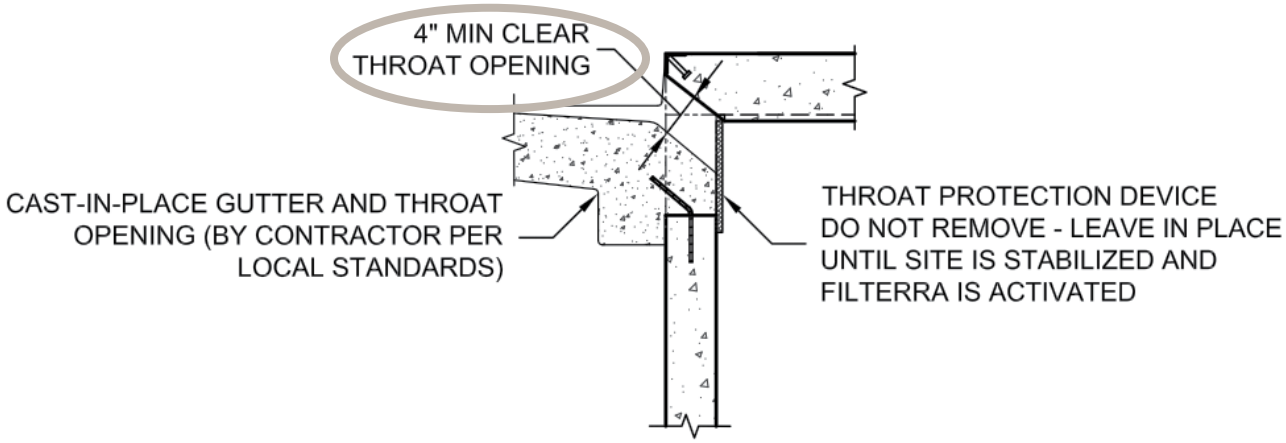
Minimum Requirements

The minimum requirements for Filterra Activation are as follows:

1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.

2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.

3. Filterra throat opening should be at least 4" in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra Plant Selection Overview

A Plant List has been enclosed with this packet highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra system. Plants installed in the Filterra system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra system.

The "Planting Requirements for Filterra Systems" document is included as an appendix and discusses proper selection and care of the plants within Filterra systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra system's warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra system or runoff protection devices
- Removal of any Filterra system components
- Failure to prevent construction related runoff from entering the Filterra system
- Failure to properly store and protect any Filterra components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

With proper routine maintenance, the biofiltration media within the Filterra system should last as long as traditional bioretention media. Routine maintenance is included by the manufacturer on all Filterra systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra systems also contain pretreatment or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance, and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

Why Maintain?

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

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

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

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

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

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

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

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.

Exclusion of Services

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

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation and pruning or replacement as necessary
6. Clean area around Filterra
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media available from the Supplier.

Box Length	Box Width	Filter Surface Area (ft^2)	Volume at 3" (ft^3)	# of 2 ft^3 Mulch Bags
4	4	16	4	2
6	4	24	6	3
8	4	32	8	4
6	6	36	9	5
8	6	48	12	6
10	6	60	15	8
12	6	72	18	9
13	7	91	23	12

Maintenance Visit Procedure

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

1. Inspection of Filterra and surrounding area

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

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

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

2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	_____

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

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____

4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra inlet to allow for entry of trash during a storm event.
- Replace Filterra grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.

5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no

6. Clean area around Filterra

- Clean area around unit and remove all refuse to be disposed of appropriately.

7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra Inspection & Maintenance Log

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

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3″*	*Lowe's Premium Brown Mulch*	*4′*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

Appendix 1 – Filterra® Activation Checklist

Project Name:________________________ Company:________________________

Site Contact Name: ________________________ Site Contact Phone/Email: ________________

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

Preferred Activation Date: ________________(provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

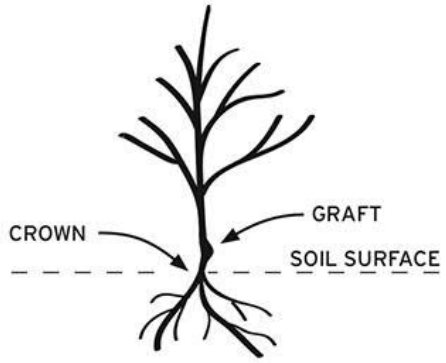
NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

____ ________________

Signature Date

Appendix 2 – Planting Requirements for Filterra® Systems

Plant Material Selection



- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25 feet.
- For standard 21" media depth, a 7 – 15 gallon container size shall be used. Media less than 21" (Filterra boxes only) will require smaller container plants.
- For precast Filterra systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some of the faster growing species, or species known to produce basal sprouts.

Plant Installation

- During transport protect the plant leaves from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that has been meeting Contech Engineered Solutions' mulch specifications can be used in the Filterra system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

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

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

Notes

filterra®
Bioretention Systems

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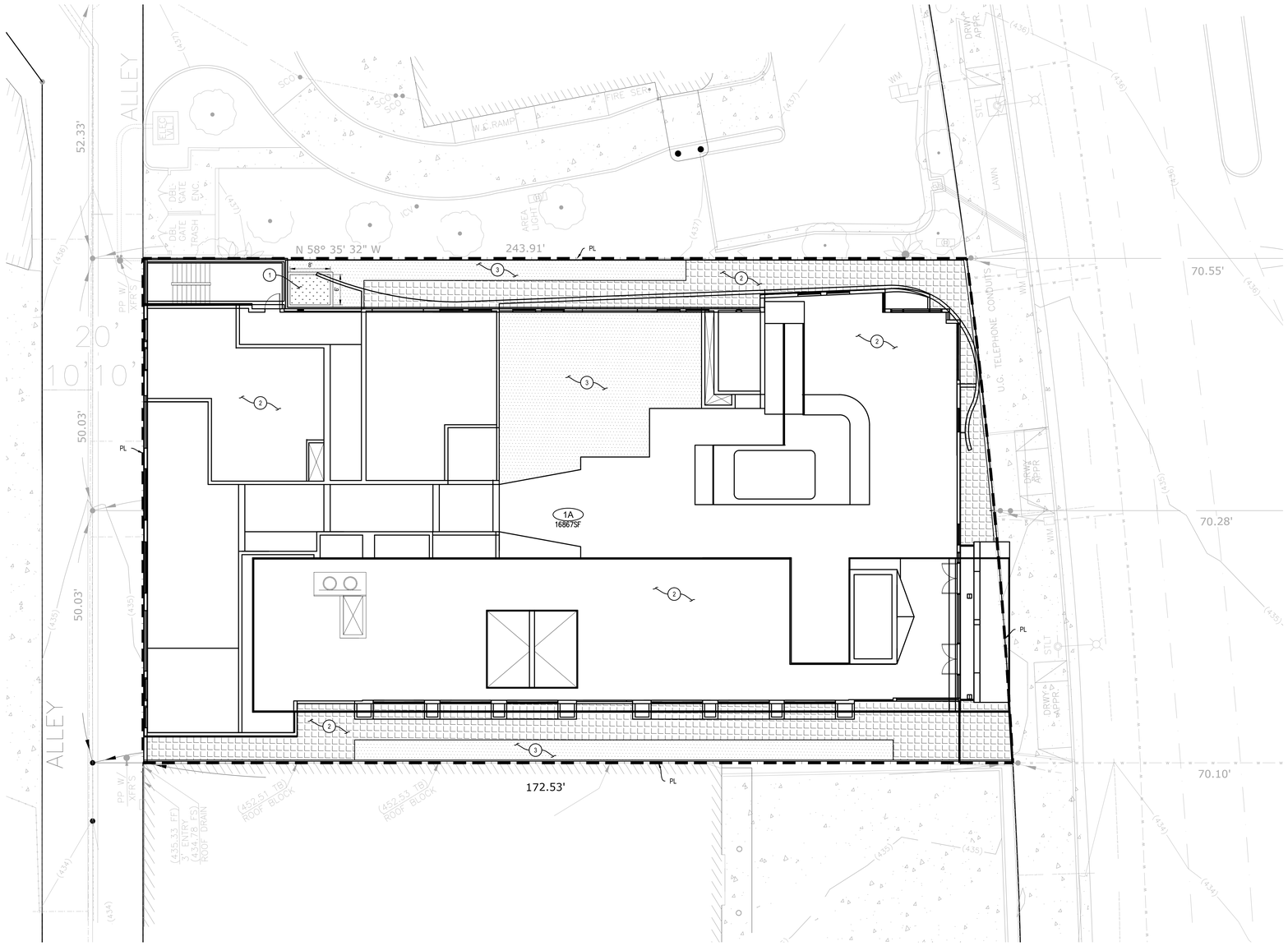
9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
info@conteches.com | 800-338-1122
www.ContechES.com

PDF 6/20

DESIGN ASSOCIATES INC

Attachment 7

Hydrology / LID Plan



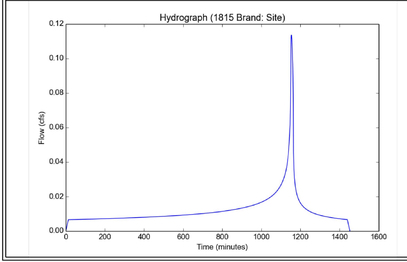
LID CALCULATIONS

Peak Flow Hydrologic Analysis

File location: C:/Users/BenBourne/Dropbox (CCE Design)/02.Engineering/Projects/C20.0217 Brand Blvd Apartments/02.Documents/01.Reports-Studies/
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	1815 Brand
Subarea ID	Site
Area (ac)	0.39
Flow Path Length (ft)	165.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.98
Percent Impervious	0.85
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results	
Modeled (85th percentile storm) Rainfall Depth (in)	0.98
Peak Intensity (in/hr)	0.3732
Undeveloped Runoff Coefficient (Cu)	0.1054
Developed Runoff Coefficient (Cd)	0.7808
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	0.1136
Burned Peak Flow Rate (cfs)	0.1136
24-Hr Clear Runoff Volume (ac-ft)	0.0246
24-Hr Clear Runoff Volume (cu-ft)	1073.2326



BMP SUMMARY TABLE

CONTECH ENGINEERED SOLUTIONS — filterra

Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		Project Information	
Engineer of Record Name	Randy Chapman, P.E.	Project Name	1815 S. Brand Blvd
Engineer of Record Company Name	CCE Design Associates, Inc.	Project Location	Glendale, CA
Engineer of Record Office Zip Code	93010	Catchment Name	Site

Drainage Area Inputs		
Drainage Area	16867	ft²
Runoff coefficient	0.9	-
Time of concentration	5	min
Long term reliable infiltration rate	0.00	in/hr
85th percentile, 24-hour depth (see hyperlink below)	0.98	in
LA County Rainfall Depth Analysis		
Filterra Configuration (Select from Drop-Down)	Internal Bypass Curb - Chamber	
Refer to "Filterra Configurations" tab for descriptions and standard details for download.		
Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft²
Outputs		
Stormwater Quality Design Volume	1,240	ft³
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.96	-
Stormwater Quality Design Flow Rate	0.14	cfs
Design Alternatives Available	Stand Alone Filterra Permitted	
Design Recommendations		
Primary Recommendation - Stand Alone Filterra		
Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.15	cfs
Required Filterra Area	46	ft²
Filterra Model ID	FTIBC-C 6x8 / 8x6	
Alternative Recommendation - Filterra + Infiltration Storage		
Required Filterra Area	43	ft²
Filterra Model ID	FTIBC-C 6x8 / 8x6	
ChamberMaxx volume	0	ft³
ChamberMaxx count	0	chambers

To be consitent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:
1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent o' the SWQDv on site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

LID CONSTRUCTION NOTES / LEGEND

1. CONTECH FILTERRA MODEL FTIBP0806-10.
2. IMPERVIOUS AREA TO BE TREATED, AREA=14,337 SF.
3. PERVIOUS AREA TO BE TREATED, AREA=2,530 SF.

1A / 1424 SF — HYDROLOGY TRIBUTARY AREA IDENTIFICATION / AREA OF TRIBUTARY AREA

TRIBUTARY AREA BOUNDARY

LID NOTES

1. TOTAL SITE AREA = 16,867 SF, TOTAL IMPERVIOUS AREA = 14,337 SF, TOTAL PERVIOUS AREA = 2,530 SF, IMPERVIOUS PERCENTAGE = 85%.
2. ALL DOWNSPOUTS TO DRAIN TO BIOFILTRATION PLANTER (FILTERRA).

Know what's below. Call before you dig.

0 5 10 20 30
Scale 1" = 10 FT

NOTICE TO CONTRACTORS

CONTRACTOR TO NOTIFY USA (UNDERGROUND SERVICE ALERT) AT 811 A MINIMUM OF 48 HOURS BEFORE BEGINNING UNDERGROUND WORK FOR VERIFICATION OF THE LOCATION OF UNDERGROUND UTILITIES

NO.	REVISION	BY

NO.	REVISION	BY

PLAN DATE	08/2020
PLOTTED	8/14/2020
SCALE	1"=10'
DESIGNER	RC
JOB NO	C20.0217

KCE MATRIX CONSULTING ENGINEERS STRUCTURAL, CIVIL & ENVIRONMENTAL
1112 W. Burbank Blvd, Suite 301 Burbank, CA 91506
Tel (818) 559-5500 Fax (818) 559-5511

CCE DESIGN ASSOCIATES, INC.
CAMARILLO: 711 E. Daily Drive, Suite 107; Camarillo, CA 93010
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www.ccedesignassociates.com
RANDY CHAPMAN, P.E.

REGISTERED PROFESSIONAL ENGINEER — RANDY CHAPMAN — No. 69614 EXP. 6/30/22 — CIVIL — STATE OF CALIFORNIA

BRAND BOULEVARD APARTMENTS

LID PLAN

1815 - 1821 S. BRAND BOULEVARD
GLENDALE, CA 91204

SHEET C5
OF 6 SHEETS

DESIGN ASSOCIATES INC

Attachment 8

Soils Report

MTC ENGINEERING, INC. Geotechnical & Environmental Consultants

5924 Temple City Blvd. • City of Temple City, CA 91780
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PRELIMINARY GEOTECHNICAL ENGINEERING INVESTIGATION

Proposed Six Levels of Mixed-Use Commercial/Residential Building
With Three Levels of Subterraneous Parking
1815-1821 South Brand Boulevard, Glendale, CA 91204

For
South Brand Development, LLC
The Developer

March 11, 2016
Project No. 1432-2-1S

South Brand Development, LLC, the Developer
1815-1821 South Brand Boulevard,
Glendale, CA 91204
Attn.: Mr. Joseph Kassounian and Manuel Kassounian

C/O: McClellan, Badiyi & Associates
38 N. Lotus Avenue,
Pasadena, CA 91107
Attn.: Bahram Badiyi, the Project Architech

SUBJECT: PRELIMINARY GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Six Levels of Mixed-Use Commercial/Residential Building with Three Level Subterraneous Parking
1815-1821 South Brand Boulevard, Glendale, CA 91204

Gentlemen:
Per your request, MTC Engineering, Inc. (MTC) has performed the preliminary geotechnical engineering investigation for the proposed mixed use commercial/residential building. The purpose of this investigation is to evaluate the onsite soil conditions, and to provide recommendations for the design and construction of the proposed development. The accompanying geotechnical report presents the findings and conclusions of this investigation and our recommendations.

Based upon the findings of our investigation, the proposed development at the subject site is feasible from the geotechnical engineering viewpoint provided the recommendations of this report are properly incorporated into design and are implemented during construction.

We appreciate the opportunity for providing the professional service. If you have any questions regarding this report, please do not hesitate to contact us.

Respectfully submitted,
MTC ENGINEERING, INC.

H. Mark Lai
President

S. Mack Chen, PE, 76834
Soils Engineer

Encl.: Appendix A, Boring Logs and Laboratory Testing
Cc: (5) Addressee

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1. SCOPE OF WORK

The following scope of work has been performed for this investigation:

a) Site check and review of pertinent soils data of the general study. A vicinity map is shown on **Figure 1**.

b) Drilling, excavating, logging, and sampling of four (4) borings at the selected locations as shown on **Figure 2**. The boring logs are shown in **Appendix A.**

c) Laboratory testing of earth samples to determine their engineering properties. The results of laboratory tests are shown in **Appendix A.**

d) Performing engineering analyses and evaluations.

e) Preparation of this geotechnical engineering report to present the findings and conclusions of this investigation and the recommendations for design and construction.

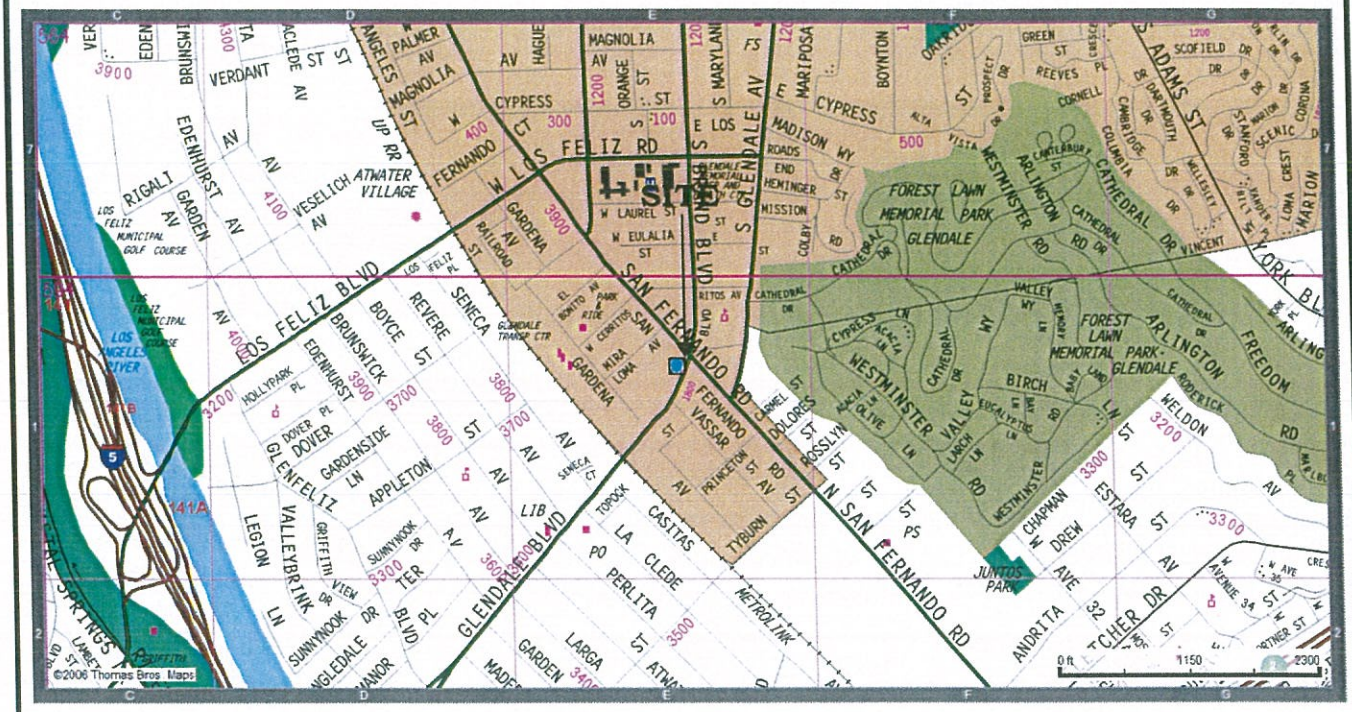
2. SITE CONDITIONS AND PROPOSED DEVELOPMENT

The subject property is located at 1815-1821 South Brand Blvd., Glendale, California 91204. The site is currently occupied by two one-story buildings used for auto repair shops and is surrounded by commercial properties. A mixed use six-level commercial/residential building with two levels of subterraneous parking is proposed for the project. The building consists of five-level residential units on top and commercial units and parking on the ground level and two levels of underground parking, as shown in the attached Plot Plans, and Cross Sections on **Figure 2** and **Figures 2A.**

Shoring would be required for construction of the underground parking to approximately 32 feet below grade. Based on the findings of our investigation, the proposed structure may be supported by conventional spread and continuous footings embedded into competent native soils.

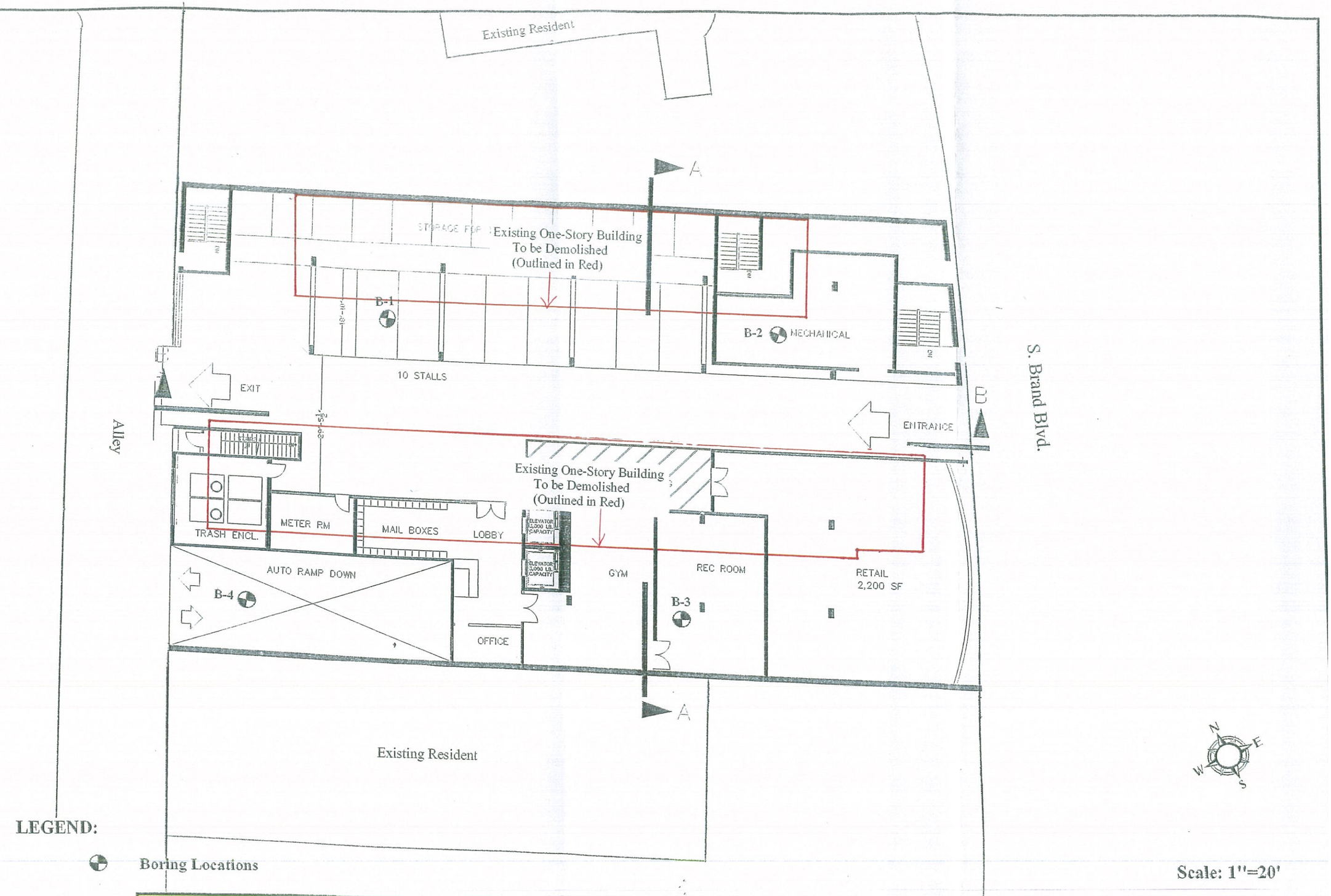
3. FIELD EXPLORATIONS

A total of four (4) borings with depths to 41.5 to 71.5 feet below the ground surface (bgs) were excavated and drilled during our field exploration on January 4, 2016. Undisturbed soil samples were obtained using California modified split spoon samplers. The samples were placed in moisture-tight bags and containers, and transported to the laboratory for testing.



SITE LOCATION MAP 1815-1821 South Brand Boulevard, Glendale, CA 91204	T.G. Page: **594-E1**	Figure No: 1

MTC Engineering, Inc.
5924 Temple City Boulevard, Temple City, CA 91780 /Toll Free 888-MTC-ENGR



LEGEND:

Boring Locations

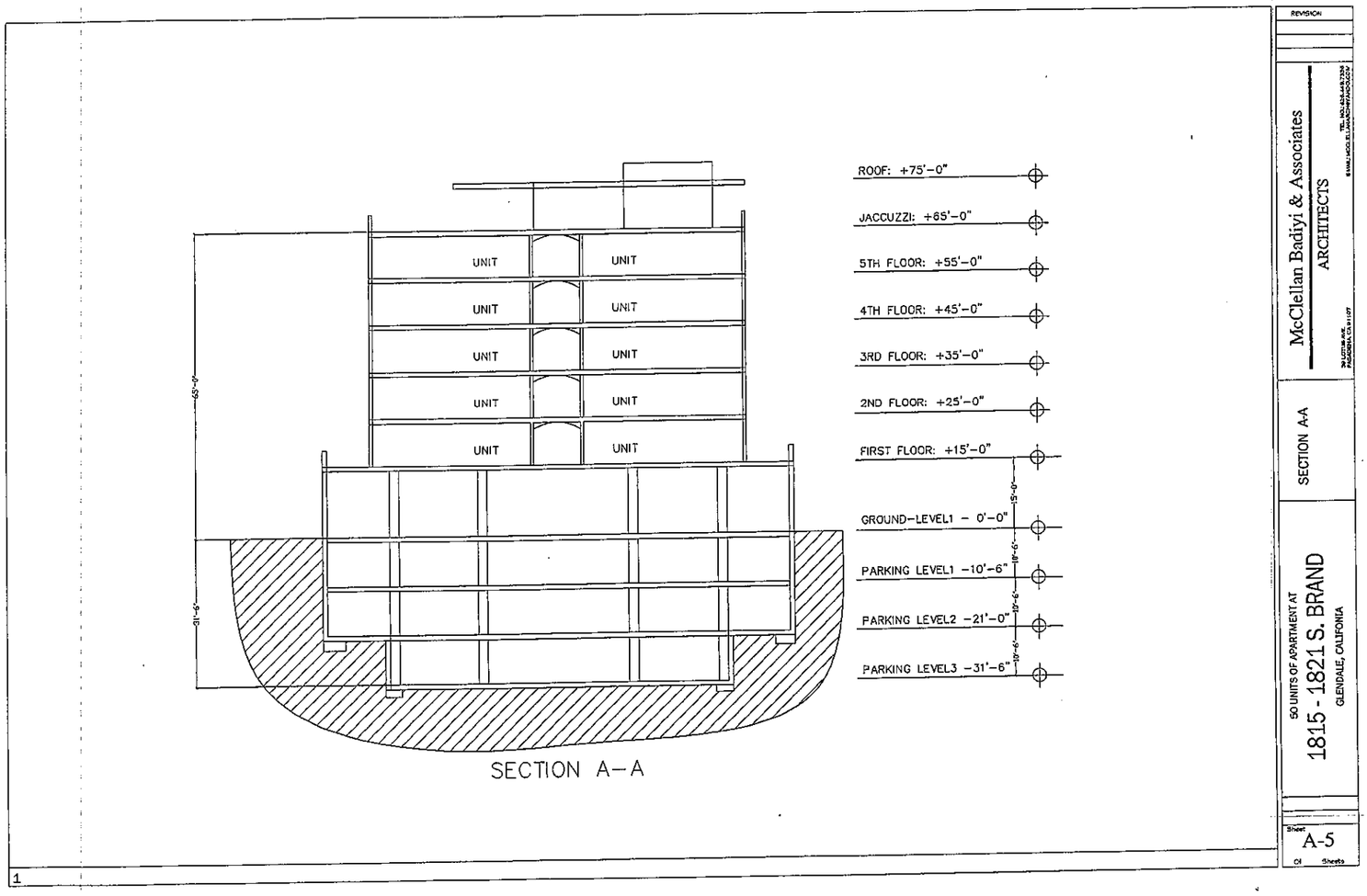
Scale: 1"=20'

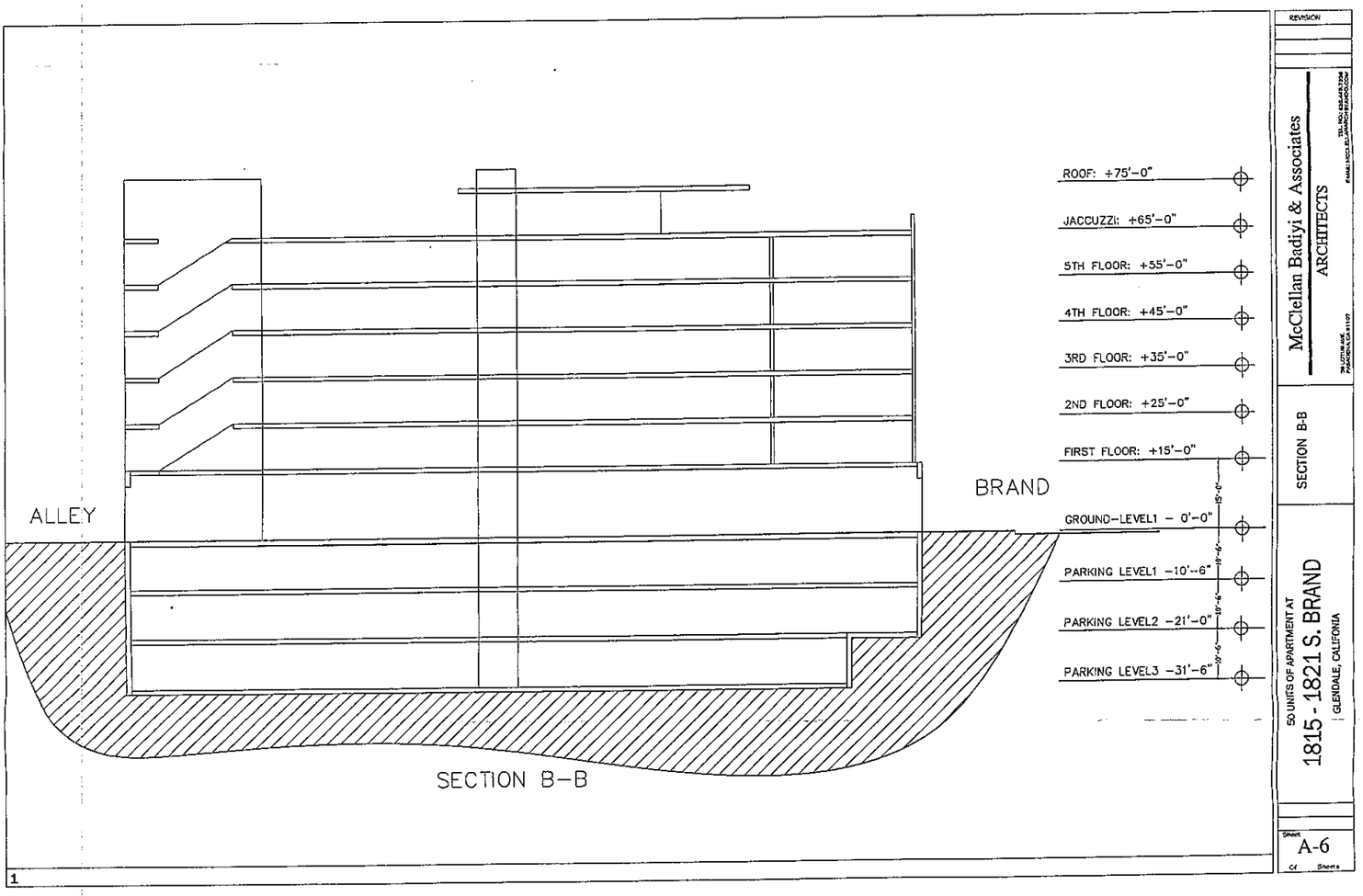
MTC ENGINEERING, INC.
Geotechnical Engineering,
Engineering Geology, Environmental Assessment

PLOT PLAN SHOWING BORING LOCATIONS AND PROPOSED DEVELOPMENT

1815 to 1821 S. Brand Blvd., Glendale, CA 91204

Project Number	Figure
1432-2-1S	2





Scale 1"=30'

MTC ENGINEERING, INC.

Geotechnical Engineering,
Engineering Geology, Environmental Assessment

PLOT PLAN SHOWING CROSS SECTION A-A' and B-B'

1815 to 1821 S. Brand Blvd., Glendale, CA 91204

Project Number	Figure
1432-2-1S	2A

Y:\Lab\New Forms\ 11x17\0206 B11

Laboratory tests including moisture-density tests, direct shear test, consolidation test, and corrosivity test were performed. The test results are presented in **Appendix A.**

4. EARTH MATERIALS

The earth materials encountered during subsurface exploration consisted of fill and native soils.

4.1. Fill (Af)

Fill soils encountered from 3" below the existing asphalt pavement to 2.5 feet bgs below the ground surface (bgs) consist of light brown mottled, fine to medium, silty to slightly silty sand, in moist and moderately dense condition.

4.2. Native Soils (Ns)

Native soils encountered below the fill soils to the depths explored consist of brown to light brown to gray brown, fine to coarse, slightly silty sand, few gravels to 1.5" in diameter, in moist to slightly moist and moderately dense to very dense condition.

4.3. Groundwater

Groundwater was encountered at dept of 59 feet below the grade in boring B-1 during our field exploration.

5. ENGINEERING PROPERTIES

The engineering properties of on-site earth material samples determined from laboratory tests are summarized below:

Field Dry Density:	85.4 to 115.8 pcf
Field Moisture Content:	1.6 to 35.0 %
Cohesion:	70 to 180 psf
Friction Angle:	28 to 40.5 degrees
Shear Strength:	Plates DS-1 through DS-4
Compressibility:	Plates CS-1 through CS-3
Sulfate:	24.0 ppm.
Chloride:	84.0 ppm

Resistivity:	2700 ohm-cm
pH:	7.3

6. FAULTING AND SEISMICITY

Data search of historical earthquake events which have been occurred in the general study area were performed to evaluate the deterministic seismicity parameters of potential on site ground motion. The seismicity study indicated that no known active or potentially active faults pass through the site. However, the site, as all of the Southern California areas, is located in a seismically active region, and will experience slight to very intense ground shaking as a result of movement along various active faults in the region. Per Campbell & Bozorgnia (2005) by using Blake's computer program of the EQFAULT Version 3.0, the most significant fault system near the site is the **Hollywood Fault**.

The findings of the faulting and seismicity study are as follows:

a) There are 66 fault systems in a search radius of 100 miles.

b) The most significant fault system near the site is the **Hollywood** Fault, and is about 0.2 miles (0.32 km) from the subject site.

c) The maximum site acceleration during the time period of 1900 to 2015 was 0.5465 g (gravity).

d) The maximum site intensity during the time period of 1900 to 2015 was X of the Mercali Scale.

e) The earthquake closest to the site is about 3.0 mile (4.8 km) away.

f) The maximum site magnitude encountered during the time period of 1900 to 2015 was 7.7.

g) The peak ground acceleration which may impact the site is 1.114 g based on USGS Seismic Design Maps Detailed Report.

6.1. SEISMICITY

6.1.1. Earthquake Effects

Based on our studies, no active or potentially active fault passes through the site. However, the site lies within a seismically active area and may subject to very strong ground shaking. If a strong earthquake occurs in the vicinity

of the subject site, structural stress and minor foundation disturbance caused by earthquake induced ground shaking will be the major cause of damage. The potential of earthquake effects are discussed as follow.

6.1.2. Lurching and Shallow Ground Rupture

As no active or potentially active faults pass through the site and no known ground ruptures have occurred in the local area surrounding the site, the potential of ground cracking due to shaking and seismic events is low.

6.1.3. Liquefaction Potential

Liquefaction describes a phenomenon in which cyclic stresses produced by ground shaking induced excess pore water pressures in the cohesionless soils. These soils may thereby acquire a high degree of mobility leading to damaging deformations. In general, this phenomenon only occurs below the water table, but after liquefaction has developed, it can propagate upward into overlying non-saturated soil as excess pore water pressure. Liquefaction susceptibility under a given earthquake is related to the gradation and relative density characteristics of the soil, the in-situ stresses prior to ground motion, and the depth to the water table, as well as other factors.

Based on the California Liquefaction Map, the site is not located in the potential liquefaction zone. Therefore, the potential of liquefaction is low.

6.1.4. Seismic Design Parameters

Based on the aforementioned information, field investigation, and the California Building Code (CBC) 2013, the site could be designated as **Site Class "D"** per Table 20.3 of ASCE 7-10. Other required seismic design parameters may be obtained from Section 1613 of the 2013 CBC or could be obtained from the USGS current website below by entering the Longitude and Latitude of the project site, the output are presented in the following table:

http://earthquake.usgs.gov/hazards/designmaps/usdesign.php

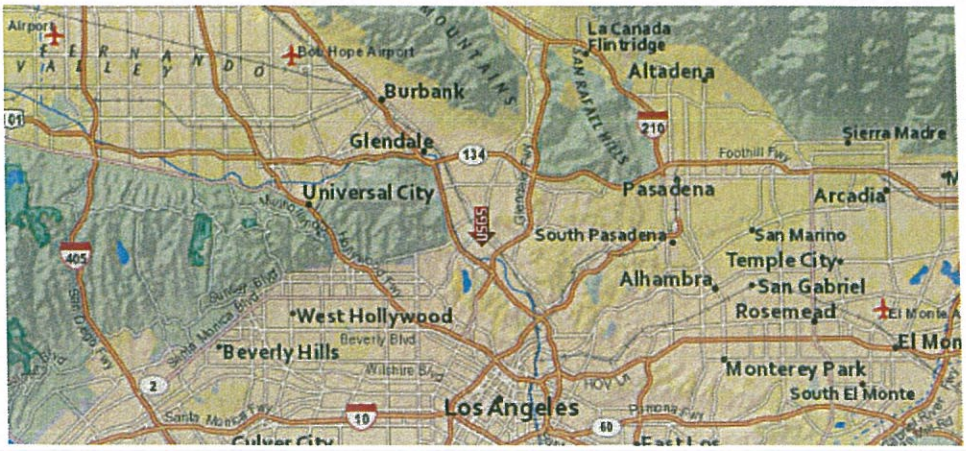
Latitude: 34.123619, Longitude: -118.255741

Spectral Response Accelerations S_{MS} and S_{M1}	
Ss = 2.889, S_{MS} = Fa x Ss	S_1 = 1.021 S_{M1} = Fv x S_1
Site Class D: Fa = 1.0, Fv = 1.5	
Period (Sec.)	Sa (g)
0.2	2.889 (S_{MS}, Site Class D)
1.0	1.531 (S_{M1}, Site Class D)

USGS Design Maps Summary Report

User–Specified Input

Report Title	McClellan/Brand Tue February 9, 2016 21:40:20 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.12362°N, 118.25574°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

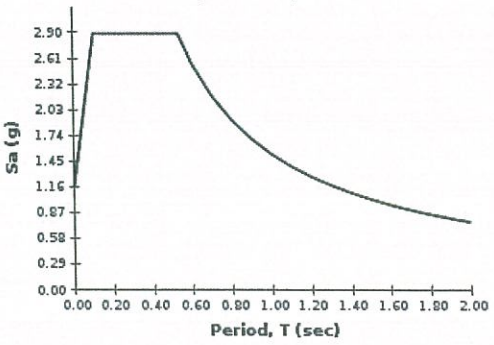


USGS–Provided Output

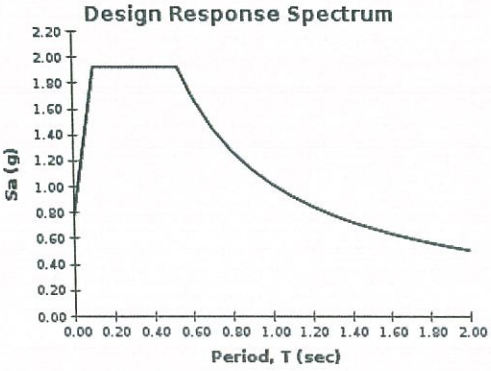
S_S =	2.889 g	S_{MS} =	2.889 g	S_{DS} =	1.926 g
S_1 =	1.021 g	S_{M1} =	1.531 g	S_{D1} =	1.021 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.12362°N, 118.25574°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 2.889$ g

From Figure 22-2 [2] $S_1 = 1.021$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 2.889 g, F_a = 1.000

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 1.021 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_a S_S = 1.000 \times 2.889 = 2.889$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.500 \times 1.021 = 1.531$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

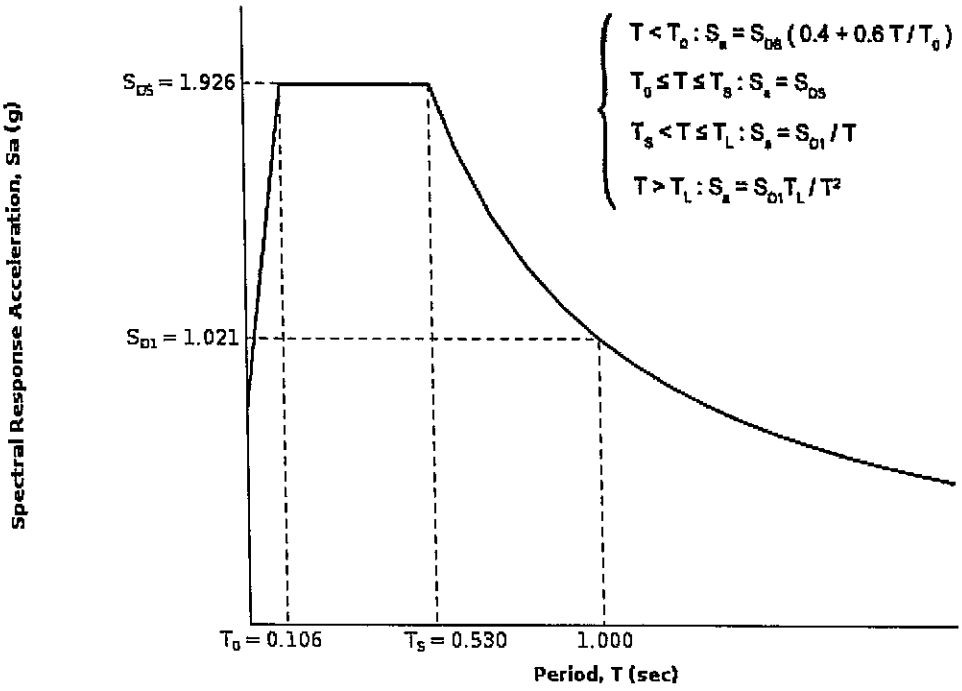
Equation (11.4–3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 2.889 = 1.926$ g

Equation (11.4–4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.531 = 1.021$ g

Section 11.4.5 — Design Response Spectrum

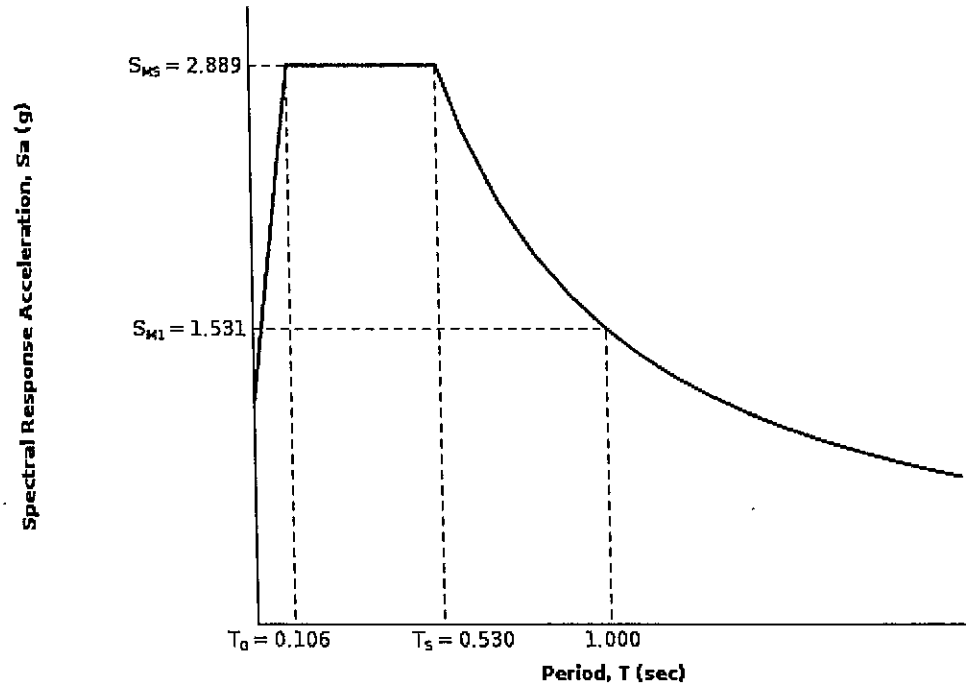
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 1.114

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.000 \times 1.114 = 1.114$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 1.114 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 - Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.938

From Figure 22-18 [6] C_{R1} = 0.942

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.926 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 1.021 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡"the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Design Spectral Response Accelerations S_{DS} and S_{D1}	
$S_{DS} = 2/3 \times S_{MS}$	$S_{D1} = 2/3 \times S_{M1}$
Site Class D: Fa = 1.0, Fv = 1.5	
Period (Sec.)	Sa(g)
0.2	1.926 (S_{DS}, Site Class D)
1.0	1.021 (S_{D1}, Site Class D)

7. CONCLUSIONS AND RECOMMENDATIONS

Based upon the findings of our investigation, the proposed development at the subject site is feasible from a geotechnical engineering viewpoint provided the recommendations of this geotechnical report are properly incorporated into design and are implemented during construction.

The following recommendations should be incorporated into the final design and construction practice for the proposed development.

7.1. Site Preparation

Upon completion of the shoring, the following guidelines should be incorporated into the subgrade preparation and used as a basis for quality control during grading and fill placement.

a) Remove all fill, loose soils, vegetation, and other deleterious materials that conflict with the proposed development.

b) The finished grade is at approximately 31.5 feet below grade. For proposed the driveway and slab-on-grade beyond the basement area, a minimum of 2 feet of subgrade soils should be overexcavated and re-compacted to a minimum of 90 percent of maximum dry density as the current standard of the ASTM D 1557. **For proposed slab-on-grade or mat foundation at the basement area, the surface of the subgrade should be recompacted, tested and approved by this office prior to placing steel and pouring concrete.** The bottom to receive fills, if any, should be scarified 6 to 8 inches at the bottom of the excavation, moistened to near the optimum moisture content, and recompacted to a minimum of 90 percent of maximum dry density in accordance with the current standard of the ASTM D-1557.

c) Any loose spots, if found, should be overexcavated and recompacted to a minimum of 90 percent of the maximum dry density in accordance with current standard of the ASTM D 1557.

d) All structural fill should be compacted to a minimum of 90 percent of the maximum dry density in accordance with current standard of the ASTM D 1557.

e) Compacted fill should be placed in controlled layers, not exceed 8 inches in thickness.

f) Field density tests should be performed in accordance with the current standard of the ASTM D 1556 or D 2992. Field density tests should be taken at no more than 2-foot intervals of the fill placed. Field moisture content should be performed in accordance with the current standard of the ASTM D 4959 or D 3017. Field density tests shall be made for each 2-foot interval and no less than one test per 250 cubic yards.

g) The excavated on-site soils, cleaned of deleterious materials, can be reused for fill.

h) All fill placements should be performed in accordance with the current grading ordinances of the City and the recommendations of this report.

i) All removal areas, fill placements, and footing excavations should be observed, tested, and approved by the representative of this firm prior to placing any fill, steel or concrete.

7.2. Temporary Excavation

Prior to the start of excavation, all utilities in the project area should be located and either rerouted or protected. Any existing vegetation and other structure/deleterious materials that conflicted with the proposed development should be cleared from the site. Most of the soils encountered at the site generally can be used for fill, and excavated with conventional grading equipment. Temporary excavation may be cut vertically up to 5 feet and 1:1 (Horizontal : Vertical) slope upward over 5 feet. The vertical cut calculation are attached in Appendix B.

To facilitate the underground parking excavation, temporary shoring should be installed.

Soldier Piles

For the design of shoring piles spaced at least 3 times of the diameters of the piles on center, the allowable lateral bearing pressure of the soils below the excavation can be assumed as 600 pcf to a maximum of 6000 pcf. Care should be taken to make sure firm contact between the shoring piles and the undisturbed soils, lean concrete can be used in the shoring piles.

The frictional resistance between the shoring piles and the retained earth may be assumed as 0.35, which is based on the assumption that uniform full bearing will be

developed between the shoring pile and the retained earth. The shoring piles below the excavation level can be used to resist downward loads. The friction resistance between the shoring piles and the soil below the excavation level may be taken as equal to 350 pounds per square foot (psf). Continuous lagging will be required between the shoring piles, if used.

Tieback Anchors

Tieback anchors may be used to resist lateral loads. Conventional, drilled friction anchors or pressure grouted anchors may be used. The active wedge adjacent to the shoring is defined by a plane drawn at 35 degrees with the vertical through the bottom of the excavation. The friction anchors should extend at least 15 feet beyond the active wedge or to a greater depth if necessary to develop the desired resistance. For design purpose, it is estimated that drilled friction anchors advanced a minimum of 10 feet beyond the active wedge will develop an average friction value of 500 psf. For pressure-grouted anchors, the average friction may be increased to 2,000 psf. Only the friction resistance developed beyond the active wedge will be effective in resisting lateral loads. If anchors are spaced no closer than six feet, on center, no reduction in the capacity of the anchors is necessary. The anchors may be installed at angles of 20 to 40 degrees below the horizontal. Tieback anchors should be tested during installation in accordance with the specifications of the shoring engineer.

Rakers

Rakers may be used to internally brace the soldier piles. The raker bracing could be supported laterally by temporary concrete footings (deadmen) or by the permanent interior footings. For design of temporary concrete footings or deadmen, poured with the bearing surface normal to rakers inclined at 45 degrees, a bearing value of 4,000 psf may be used, provided the shallowest point of the footing is at least one foot below the lowest adjacent grade.

Lateral Design for Shoring

For the temporary shoring design of cantilever type, an active equivalent fluid pressure of 32 pounds per cubic foot (PCF) can be used. The temporary braced wall in restrained condition can be designed with the pressure of 27H (psf), where H is the height of the wall and should be considered as a uniform pressure distribution.

Any anticipated superimposed loading within a 45-degree plane projected from the excavation bottom, such as driveway, parking or adjacent structures but not limited to, should be considered as surcharge for shoring design.

To minimize the potential of claims against the proposed development associated to the excavation, it is our recommended that the conditions of the existing neighbors' properties be recorded via photos, videos and surveys before and during construction.

7.3. Foundation Systems

Conventional footings may be embedded into competent native soils disclosed near the bottom of the proposed basement excavation. All footings should be a minimum of 2 feet in width and founded a minimum of 2.5 feet below the lowest adjacent grade. Footings may be designed for an allowable net bearing pressure of 3,000 (psf) and increased 500 psf for each additional foot of depth or footing size (> 2.5 feet) to a maximum of 6,000 psf. The bearing capacity may be increased by one third when considered short duration wind or seismic loads.

A friction coefficient of 0.35 and a lateral bearing of 350 pounds per square foot (psf) per foot of depth, to a maximum of 5,000 psf, can be used to resist lateral loads. When combining passive earth pressure and frictional resistance, the passive earth pressure should be reduced by one third.

Prior to the placement of concrete or steel in the footing excavations, an inspection should be made by the representative of this firm to ensure that the footing excavations are free of loose and disturbed soils.

Continuous footings should be reinforced with a minimum of two No. 4 rebars near the top and two No. 4 rebars near the bottom.

Alternatively, mat foundation may be designed for the proposed building. An allowable bearing value of 3,000 psf is recommended for mat foundation, placed at a depth of at least 2 feet below the final grade, bearing on the native soil at the proposed basement garage floor level. For an elastic method of design, a modulus of subgrade reaction of 150 pounds per cubic inch may be used.

Foundations designed and installed in accordance with the recommendations outlined in this report are anticipated to undergo a total static settlement of less than one inch. Differential settlement will be less than 1/2 inch within 30 feet of radius.

7.4. Walls Below Grade and Retaining Walls

Walls (restrained) below grade will be required for the subterraneous parking. The walls below grade can be designed with a pressure of 32H (psf) for level backfill, where H is the height of the wall and should be considered as a uniform pressure distribution. Any surcharge from adjacent properties or adjacent street should be combined into the design of lateral load.

Conventional retaining walls may be required along the proposed driveway and other locations. For freestanding walls, equivalent fluid pressure (EFP) of 35 pounds per cubic foot of triangular shape is recommended for level backfill.

Any anticipated superimposed loading within a 45-degree plane projected from the wall bottom, such as driveway, parking or adjacent structures but not limited to, should be considered as surcharge for wall design.

The proposed walls below grade and retaining walls can be supported by continuous footings as recommended in **section 7.3.** The lateral bearing capacity may be assumed as 350 pcf for level backfill to a maximum of 3,500 pcf to resist lateral loads. When combining passive earth pressure and frictional resistance, the passive earth pressure can be combined without deduction

The walls should be constructed with perforated drain pipes wrapped in a gravel package at the bottom and behind the wall. A one-foot thick zone of clean, granular, free-draining material should be placed behind the wall to not more than two feet to the surface. The upper two feet should be backfilled with relative impermeable soil.

Increase in Lateral Earth Pressure for Seismic Dynamic Loading

The increase in lateral earth pressure on retaining walls from earthquake loading may be estimated using the Mononobe-Okabe method as described by Seed and Whitman (1970). Based on the theory, the total earth pressure can be divided into static and dynamic components. For the proposed project, the estimated dynamic lateral force increase for level backfill may be taken as:

$P_{seismic} = 3/8 K_h \gamma_s * H^2 = 3/8 \times 0.3713 \times 125 \times H^2 = 17.4H^2$ (pound, Level Backfill), or

$P_{seismic}$ may be redistributed as a reversed EFP(reversed triangle) of 35 pcf /foot width

where, K_h=PGAm*1/2*2/3, H= wall height, PGAm=1.114 g.

The centroid of the "$P_{seismic}$" dynamic lateral force (pound) should be applied at a distance of 0.6H above the base of the wall. The resulted dynamic load may be considered as optimum load in the designs. The safety factor for sliding and overturning may be reduced to 1.0.

7.5. Slab-on-Grade

Onsite earth materials are mainly silty sand, the expansion potential is considered be low. Conventional slab-on-grade may be used for the parking or other hardscape if subgrade soils be prepared per **Section 7.1** above. The concrete slabs should be a minimum thickness of 6 inches for the lowest parking floor or 4 inches for outside

hardscape, respectively, and be reinforced with a minimum of No. 4 rebars at spacing of 16 inches placed at midheight. Heavily loaded floors should be engineered separately. Interior slab on grade should be underlain by a minimum of 10-mil. polyethylene moisture barrier. 2-inch of clean sand should be placed above the moisture barrier, and 4-inch layer of ½-inch diameter gravel should be placed below the moisture barrier for capillary breaks to comply with the current CALGreen requirements.

7.6. Corrosivity Test

Chemical laboratory tests were conducted to evaluate the soil corrosion potential and the attack on concrete by sulfate soils. Based on the test results, sulfate test result is 24.0 parts per million (ppm), Type I or II cement can be used. Chloride value is 84.0 ppm, pH value is 7.3, and the resistivity value is 2,700 ohm-cm (saturated condition). It is our opinion that a potential corrosion problem from on-site soil is moderate; all the underground pipes and devices should have appropriate corrosion protection.

7.7. Drainage

The subdrains, outlets, and inlets constructed during rough grading should be maintained and kept clear of soil cover or other potential blockage. All subdrain outlets and area drain inlets should be located and observed for proper functioning after precise grading and postgrading construction have been completed. Subdrains, outlets, area drains, and inlets damaged during fine grading, landscaping, and/or other construction should be properly repaired. Subdrains outlets and area drain inlets should be periodically inspected for blockage and proper functioning.

8. PLAN REVIEW, OBSERVATION, TESTING, AND PERFORMANCE

We recommend that **MTC** be present to perform the required geotechnical observations and testing during the construction, otherwise, the qualities and performance of the recommended geotechnical works for the project may not meet your needs, and therefore **MTC** is automatically released from the liabilities for the project by our client. Any other geotechnical engineer takes over the project needs to reevaluate the whole situation and assume the responsibility and liability for the project as the **Geotechnical Engineer of Record**. In case another geotechnical engineer does take over the project, it will be the project owner and the take over engineer's responsibility to pay any attorney fees resulting from the change of engineer. **MTC** reserves the rights to claim any damages due to mishandling of the project by others. To avoid unnecessary law suits, a certificate of merit is required for any law suit against MTC.

a) Review of shoring, grading, wall, shoring, foundation, and drainage plans.

b) Observe and advise during all grading activities including site preparation, footing excavation, subdrain installation, and placement of fill.

c) Test all fills placed for engineering purpose.

9. LIABILITY AND LIMITATION

The conclusions and recommendations submitted in this report are based on our data research, subsurface exploration, laboratory testing, and engineering evaluation and analyses. The nature and extent of variations in subsurface conditions may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report. Please be aware that the contracted fees for our services to prepare this report do not include additional work which may be required such as grading observation and testing, footing observations, and etc. Where additional services are required and requested, you will be billed for any equipment costs and on an hourly basis for consultation or analysis. This report is issued with the understanding that it is the responsibility of the **owner** or **owner's representative** to ensure that the information of the project is incorporated into the plans and that the necessary steps are taken to see that the contractor carry out such recommendations in the field. MTC has prepared this report for the exclusive use of the client and authorized agent. This report has been prepared in accordance with generally accepted Geotechnical Engineering practices. No other warranties either expressed or implied are made as to the professional advice provided under the terms of this agreement. To prevent unnecessary law suit, it is required a certificate of merit for any law suit against MTC.

APPENDIX A

BORING LOGS AND LABORATORY TEST RESULTS

APPENDIX A
BORING LOGS AND LABORATORY TESTING

1.0 BORING LOGS

The boring logs are presented on Plates B-1 through B-4

2.0 LABORATORY TESTING

Laboratory tests include moisture-density tests, direct shear tests, consolidation test, and corrosivity test.

2.1 Moisture-Density Test

Site soil samples were classified in the laboratory in accordance with the Unified Soil Classification System (USCS). Field moisture content and dry unit weights were determined for the ring samples obtained in the field. Field moisture contents and dry unit weight are shown on Plates B-1 through B-4.

2.2 Direct Shear Test

Direct shear tests were performed to determine the shear strength parameters of undisturbed samples. The samples were tested in an artificially saturated condition. The results are plotted and linear approximations are drawn of the failure curve to determine the angle of internal friction and cohesion. The results of direct shear tests are shown on the Plates DS-1 through DS-4.

2.3 Consolidation Test

The apparatus used for the consolidation test is designed to receive the brass ring of soils without removing the sample from the brass ring. Loads were applied to the sample in several increments, and the resulting deformations were recorded at selected time intervals.
Porous stones were placed in contact with the top and bottom of the samples to permit the ready addition or release of water. Sample was tested at the field and increased moisture contents. The test results are shown on the Plates CS-1 through CS-3.

2.4 Corrosivity Test

The sulfate test, chloride content, and minimum resistivity are tested per Caltrans Test Methods: 417- Methods of Testing Soils and Water for Sulfate Content, 422- Methods of Testing Soils and Water for Chloride Content, and 532- Method for Estimating the Time to Corrosion of Reinforced Concrete Substructures, respectively.

Soil Classification System Used by MTC Engineering, Inc.

Major Division			Group Symbols	Typical Names
COARSE GRAINED SOILS (more than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (more than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	well graded gravels, gravel-sand mixtures, little or fine
			GP	poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES (appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	clayey gravels, gravel-sand-clay mixtures
	SANDS (more than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	well graded sands, gravelly sands, little or no fines
			SP	poorly graded sands, gravelly sands, little or no fines
		SANDS WITH FINES (appreciable amt. of fines)	SM	silty sands, sand-silt mixtures
			SC	clayey sands, sand-clay mixtures
COARSE GRAINEDS OILS (less than 50% of material is SMALLER than the No. 200 sieve size)	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 clay
			OL	organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS (liquid limit GREATER than 50)		MH	inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	inorganic clays of high plasticity, fat clays
			OH	organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			Pt	peat and other highly organic soils.
SEDIMENTARY BEDROCK				SANDSTONE
				SILTSTONE
				CLAYSTONE
IGNEOUS BEDROCK				GRANITIC ROCK
METAMORPHIC BEDROCK				METAMORPHIC ROCK

PARTICLE SIZE LIMITS

SILT or CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
No.200	No. 40	No.10	No. 4	¾ in.	3 in.	(12 in.)	

LABORATORY TESTING ABBREVIATIONS

AL Atterberg Limits	**MC** Moisture Content & Dry Density	**TCD** Consolidated Drained (Outside Lab)
CP Collapse Potential	**MD** Maximum Dry Density	**TCU** Consolidated Undrained (Outside Lab)
CS Consolidation	**PP** Pocket Penetrometer	**TUU** Unconsolidated Undrained (Outside Lab)
DS Direct Shear	**PR** Permeability (Outside Lab)	
EI Expansion Index	**RS** Resistivity, pH, and Chlorides	
GD Gradation Analysis	**RV** R-Value	

BORING LOG

PROJECT NAME	McClellan/ Brand			BORING DESIGN	**B-1**
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R)	Blows Per 12 inches (SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	Surface description: / Location of Excavation: See plot plan (Figure 2). / GEOTECHNICAL DESCRIPTION	Soil Lab Test
				R	SPT				3" of asphalt concrete paving	
2									**Fill (3" to 2.5'): SAND**	
	2.5	R	1	11		105.6	9.8	SM	Light brown mottled, fine to medium, silty to slightly silty, moist, moderately dense.	
4								SM	**Native Soils (2.5' to 51.5')**	
6									**SAND**	
	6.5	R	2	14		105.4	3.1		Brown, fine to few medium sand, slightly silty, moist, moderately dense.	
8								SM	**SAND**	
10									Light brown to light olive brown, fine to medium, few coarse sand and few gravel, moist, moderately dense.	
12	11.5	R	3	19		102.2	3.4			
14									**SAND**	
								SM	Light yellow brown, fine to medium, near clean, some gravel to 2.5 " in diameter, moist, dense to very dense.	
16	16.5	R	4	24						
18										
20										
22	21.5	R	5	40			3.5			
24										
26										
	26.5	SPT	6		31	99.0	2.9			
28										
30										
32	31.5	SPT	7		36	106.2	4.0			
34										
36										
	36.5	SPT	8		58	104.1	4.2			

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST
[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/Brand			BORING DESIGN	B-1 Continue.
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description:

Location of Excavation: See plot plan (Figure 2).

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R / SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	GEOTECHNICAL DESCRIPTION	Soil Lab Test
36				R / SPT					
38									
40									
42	41.5	SPT	9	50(5")	105.5	3.5	SM	**SAND** Light gray brown to light brown, fine to coarse, slight silty, few gravels to 1.5" in diameter, moist, very dense.	
44									
46									
48	46.5	SPT	10	50(4")	108.3	5.8			
50									
52	51.5	SPT	11	36	90.3	19.8	SM	**SAND** light olive brown, fine to medium, slightly silty, very moist to wet, very dense.	
54									
56									
58	56.5	SPT	12	33	92.2	16.7			
60									
62	61.5	SPT	13	19 / 50(5")	96.2	19.9	SM	**SAND** light gray, fine to coarse, some gravel to 1" in diameter, slightly silty-near clean, wet, very dense.	
64									
66									
68	66.5	SPT	14				SM	**SAND** Light brown, fine to medium, trace of coarse sand and few gravel-near clean, wet, very dense.	
70								End of boring at 71.5' Groundwater @60' No cave-in	
	71.5	SPT	15	81	105.1	17.5			

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE

[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST

[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/ Brand			BORING DESIGN	B-2
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description:
3" of asphalt concrete on surface, near level.

Location of Excavation: See plot plan (Figure 2).

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R)	Blows Per 12 inches (SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	GEOTECHNICAL DESCRIPTION	Soil Lab Test
2									3" of asphalt concrete paving **Fill (3" to 2.5'): SAND**	
4	3.5	R	1	17		108.6	9.0	SM	Dark brown, fine, few medium sand, slightly silty, moist, moderately dense.	
6								SM	**Native Soils (2.5' to 51.5')** **SAND**	
8	6.5	R	2	6		101.8	3.1	SM	Dark brown to brown, fine to few medium sand, silty, moist, moderately dense.	
10								SM	**SAND** Light brown, fine near clean, moist, moderately dense.	
12	11.5	R	3	36		113.8	1.8	SM	**SAND** Light brown to light gray brwon, a few gravel to 1" in diameter, moist, dense.	
14								SM	**SAND** Light brown, fine, slightly silty, moist, dense to moderately dense.	
16										
18	16.5	R	4	18		97.7	5.7			
20								SM	**SAND** Light brown, fine to medium, trace of coarse sand, slightly silty-near clean, moist, dense.	
22	21.5	R	5	27		114.3	6.9			
24										
26	26.5	SPT	6		13	88.0	10.3	SM	**SAND** Light brown, fine to medium, slightly silty, moist, moderately dense.	
28										
30								SM	**SAND** Light brown, fine to coarse near clean, trace of fine gravel, moist, dense to very dense.	
32	31.5	SPT	7		29	97.6	3.7			
34										
36	36.5	SPT	8		28	100.2	4.4			

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST
[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/Brand				
PROJECT NO.	1432-2-1S			BORING DESIGN	B-2 Continue.
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description:

Location of Excavation: See plot plan (Figure 2).

GEOTECHNICAL DESCRIPTION

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R / SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	Soil Lab Test
36								
38								
40								
42	41.5	SPT	9	28	99.5	5.0		
44								
46								
48								
50								
52								
54								
56								
58								
60								
62								
64								
66								
68								
70								

End of Boring at 41.5'
No Groundwater Encountered
No Cave-in

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST
[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/ Brand			BORING DESIGN	B-3
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description: 3" of asphalt concrete on surface, near level.

Location of Excavation: See plot plan (Figure 2).

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R)	Blows Per 12 inches (SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	GEOTECHNICAL DESCRIPTION	Soil Lab Test
2									3" of asphalt concrete paving	
									Fill (3" to 2.5'): SAND	
								SM	Brown, fine, silty to silightly silty, slightly clayey,	
4	3.5	R	1	11		103.1	8.3		moist to very moist, slightly dense to moderately dense.	
									Native Soils (2.5' to 51.5')	
6									**SAND**	
	6.5	R	2	10		85.4	35.0	SM	Brown, fine, silty to slightly silty, slightly clayey,	
8									moist to very moist, moderately dense.	
									SAND	
10								SM	Light brown to light yellow brown, fine to medium,	
									slightly silty-near clean, few coarse sand, moist,	
12	11.5	R	3	16		108.1	1.9		moderately dense to dense.	
14									**SAND**	
								SM	Light brown to yellow brown, fine to medium, slightly	
16									silty-near clean, few coarse sand and fine gravel, moist,	
	16.5	R	4	48		106.2	1.6		dense to very dense.	
18									**SAND**	
20								SM	Light brown, fine, silty to slightly silty, moist, dense.	
22	21.5	R	5	20		104.8	8.8			
24										
26										
	26.5	SPT	6		13	90.8	6.3		**SAND**	
28								SM	Light brown, fine, slightly silty, moist, moderately	
									dense.	
30									**SAND**	
32	31.5	SPT	7		38	100.9	1.7		light brown to light yellow brown, fine to medium, some coarse sand, few fine gravel, near clean, moist, dense to very dense.	
34										
36										
	36.5	SPT	8		36	108.5	2.6			

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE
[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST
[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/Brand			BORING DESIGN	B-3 Continue.
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description:

Location of Excavation: See plot plan (Figure 2).

GEOTECHNICAL DESCRIPTION

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R / SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	Soil Lab Test
36								
38								
40							SM	
42	41.5	SPT	9	68	103.2	2.9		
44								
46	46.0	SPT	10	50(5")	107.9	3.9		
48								
50							CL	
52	51.5	SPT	11	69	115.8	8.3		
54								
56								
58								
60								
62								
64								
66								
68								
70								

SAND
Light brown to light gray brown, fine to medium, near clean to slightly silty, some coarse sand, slightly gravelly to 1" in diameter, moist, very dense.

CLAY
4" thick of silty clay@51'-51'4", brown, silty, very moist to wet, firm

End of Boring at 51.5'
No Groundwater Encountered
No Cave-in

C ROCK CORE B BULK SAMPLE R RING SAMPLE
S SPLIT SPOON T TUBE SAMPLE SPT STANDARD PENETRATION TEST
D DRIVE SAMPLE b SMALL BAG

BORING LOG

PROJECT NAME	McClellan/ Brand			BORING DESIGN	**B-4**
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

Surface description: 3" of asphalt concrete on surface, near level.

Location of Excavation: See plot plan (Figure 2).

Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R)	Blows Per 12 inches (SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	GEOTECHNICAL DESCRIPTION	Soil Lab Test
									3" of asphalt concrete paving	
2									**Fill (3" to 2.5'): SAND**	
								ML	Gray brown, slightly clayey to clayey, very moist,	
4	3.5	R	1	5		103.1	8.3		slightly firm to moderately firm.	
6									**Native Soils (2.5' to 41.5')**	
									SAND	
	6.5	R	2	12		85.4	35.0	SM	light creamy brown, fine to medium, slightly silty	
8									near clean, moist, moderately dense.	
									SAND	
10								SM	Light brown to light yellow brown, fine to medium,	
									few coarse sand, slightly gravelly to 1 " in diameter,	
12	11.5	R	3	21		108.1	1.9		moist, dense.	
14										
16									**SAND**	
	16.5	R	4	6		106.2	1.6		Brown, fine, very silty, very moist, moderately dense.	
18										
									SAND	
20								SM	Light brown to light yellow brown, fine to medium,	
									few coarse sand and fine gravel, moist, dense to very	
22	21.5	R	5	27		104.8	8.8		dense.	
24										
									SAND	
26								SM	Light brown to light yellow brown, fine, slightly silty,	
	26.5	SPT	6		10	90.8	6.3		moist, moderately dense.	
28									**SAND**	
								SM	light brown to light yellow brown, fine to medium,	
30									few coarse sand & fine gravel, moist, dense to very	
32	31.5	SPT	7		32	100.9	1.7		dense.	
34										
									SAND	
36									Light brown to light yellow brown, fine to medium,	
	36.5	SPT	8		32	108.5	2.6		few coarse sand & fine gravel, moist, dense to	
									very dense.	

[C] ROCK CORE [B] BULK SAMPLE [R] RING SAMPLE

[S] SPLIT SPOON [T] TUBE SAMPLE [SPT] STANDARD PENETRATION TEST

[D] DRIVE SAMPLE [b] SMALL BAG

BORING LOG

PROJECT NAME	McClellan/Brand			BORING DESIGN	**B-4 Continue.**
PROJECT NO.	1432-2-1S				
DATE DRILLED	1/4/2016	DRAFTED BY	MC	STATION	---
DRILLER	ABC Liovin Drilling	LOGGED BY	ML	OFFSET (FT)	---
GROUND-WATER ELEV	N/A	SAMPLER SIZE	2.5"	GSE	---
TYPE OF DRILLING	8" Φ Hollow Stem Auger	DRIVE WT	140 lbs	DROP	30"

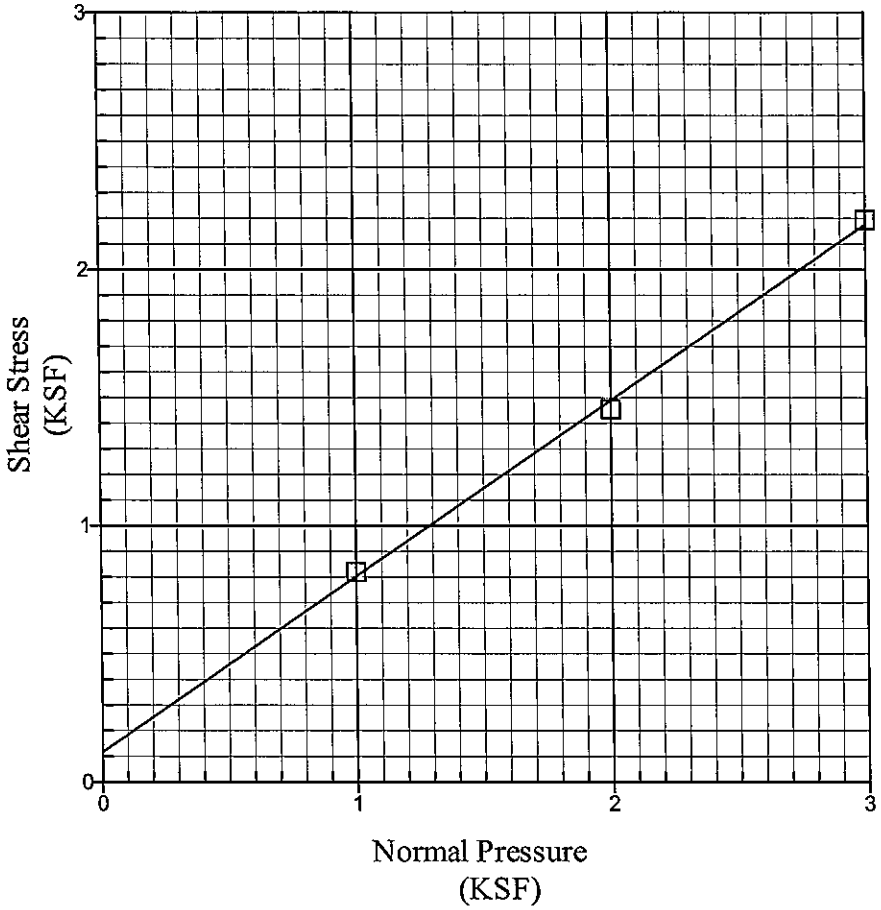
Depth in Feet	Sample Depth	Sample Type	Sample No.	Blows Per 12 inches (R / SPT)	Dry Density (pcf)	Moisture Content(%)	USCS Symbols	Surface description: / Location of Excavation: See plot plan (Figure 2). / GEOTECHNICAL DESCRIPTION	Soil Lab Test
36				R / SPT					
38									
40								**SAND** Light gray brown, fine to coarse,	
42	41.5	SPT	9	28	109.1	4.8			
44								End of Boring at 41.5' No Groundwater Encountered No Cave-in	
46									
48									
50									
52									
54									
56									
58									
60									
62									
64									
66									
68									
70									

C ROCK CORE B BULK SAMPLE R RING SAMPLE
S SPLIT SPOON T TUBE SAMPLE SPT STANDARD PENETRATION TEST
D DRIVE SAMPLE b SMALL BAG

TC
The Most Trustworthy Company

DIRECT SHEAR

(ASTM D 3080)



☐ Residual Value Cohesion (psf) = 120 Friction Angle (degree) = 34

Location:	B-2
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	6.9
Dry Density (pcf):	114.3

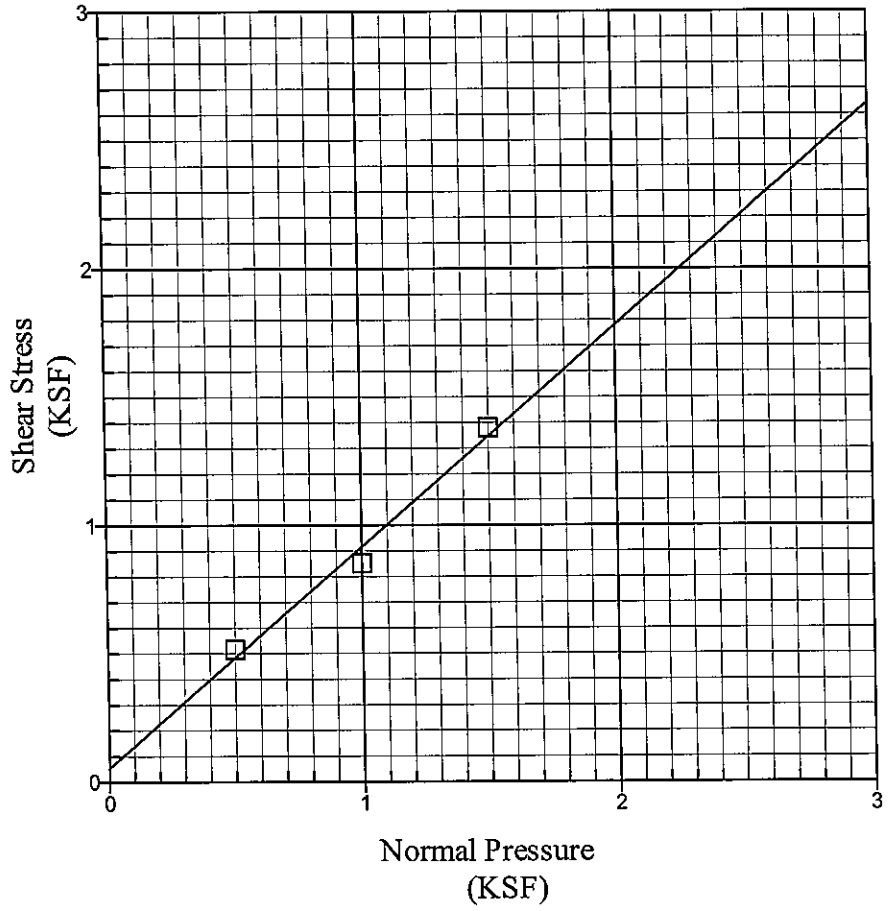
Date: 02/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/Brand	1432-2-1S	DS-1

DIRECT SHEAR

(ASTM D 3080)



□ Residual Value Cohesion (psf) = 70 Friction Angle (degree) = 40.5

Location:	B-3
Depth (ft):	11.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	1.9
Dry Density (pcf):	108.1

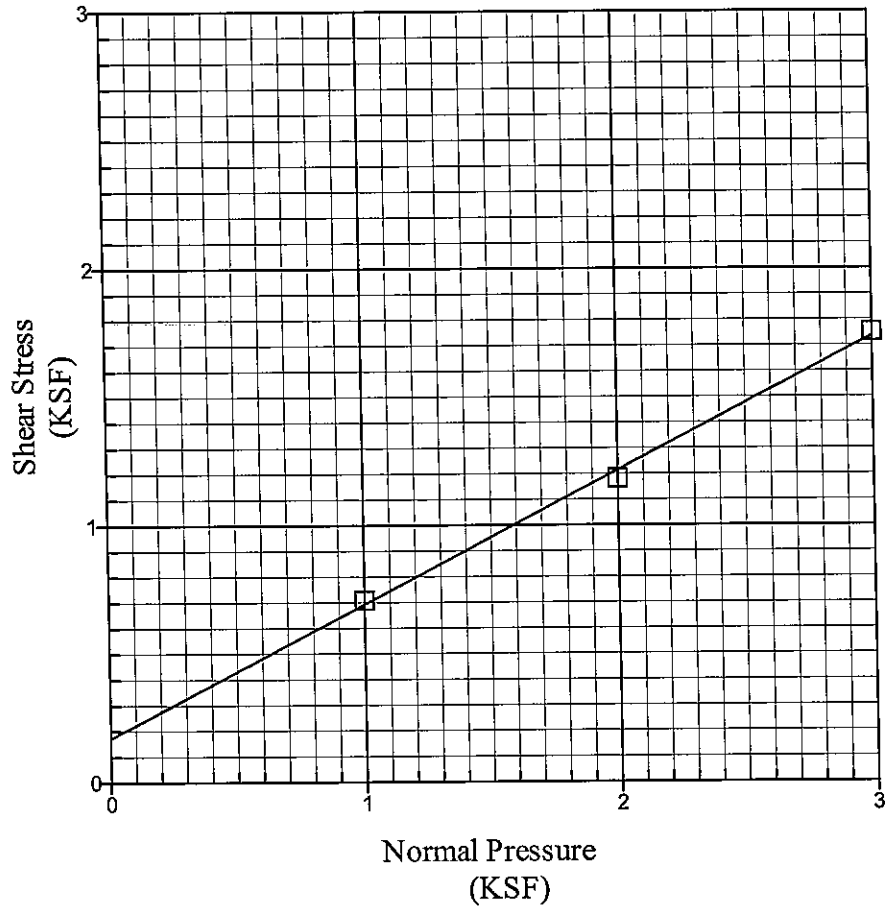
Date: 02/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/Brand	1432-2-1S	DS-2

DIRECT SHEAR

(ASTM D 3080)



☐ Residual Value Cohesion (psf) = 180 Friction Angle (degree) = 28

Location:	B-3
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	8.8
Dry Density (pcf):	104.8

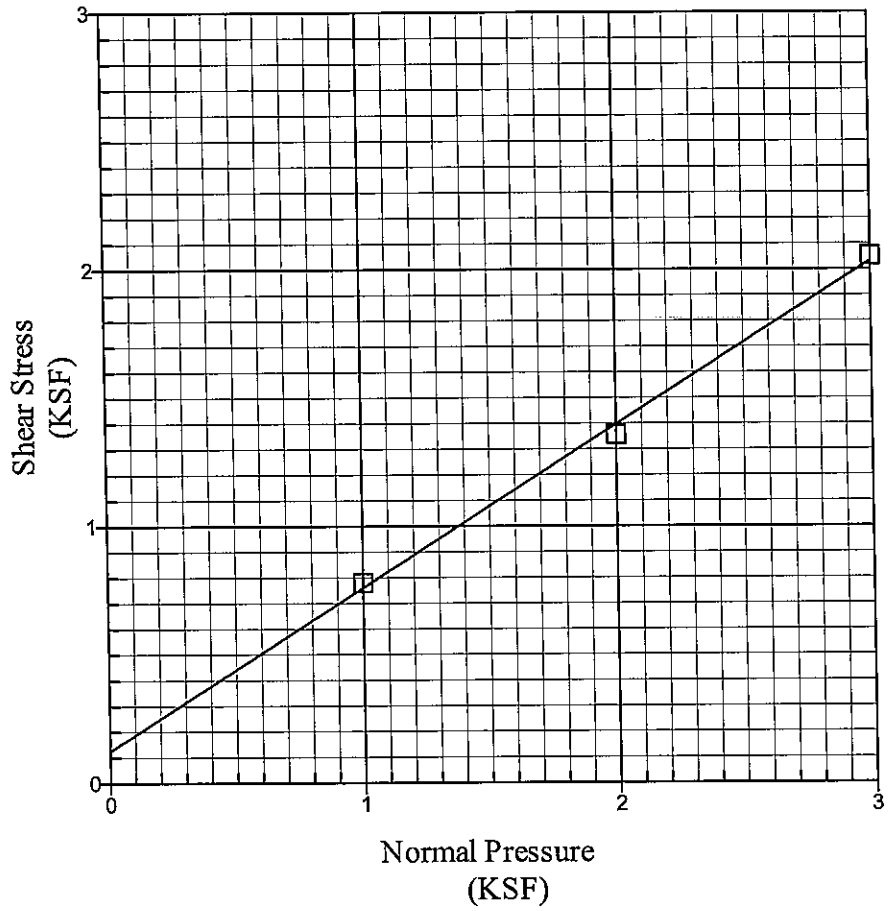
Date: 02/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/Brand	1432-2-1S	DS-3

DIRECT SHEAR

(ASTM D 3080)



☐ Residual Value Cohesion (psf) = 120 Friction Angle (degree) = 32.5

Location:	B-4
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	3.5
Dry Density (pcf):	112.2

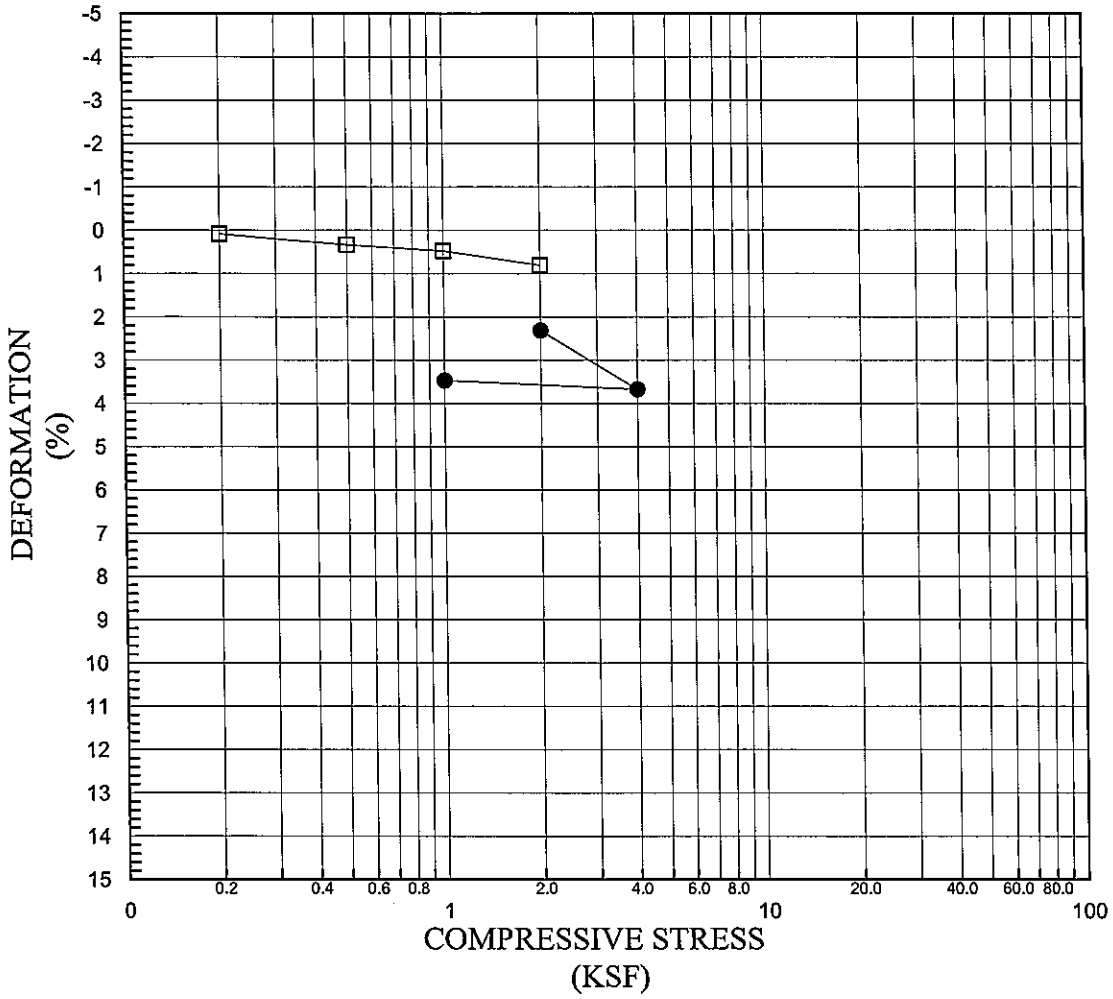
Date: 02/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/Brand	1432-2-1S	DS-4

CONSOLIDATION

(ASTM D 2435)



□ Field Moisture

● Saturated

Location:	B-2
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	6.9
Dry Density (pcf):	114.3
Void Ratio:	-

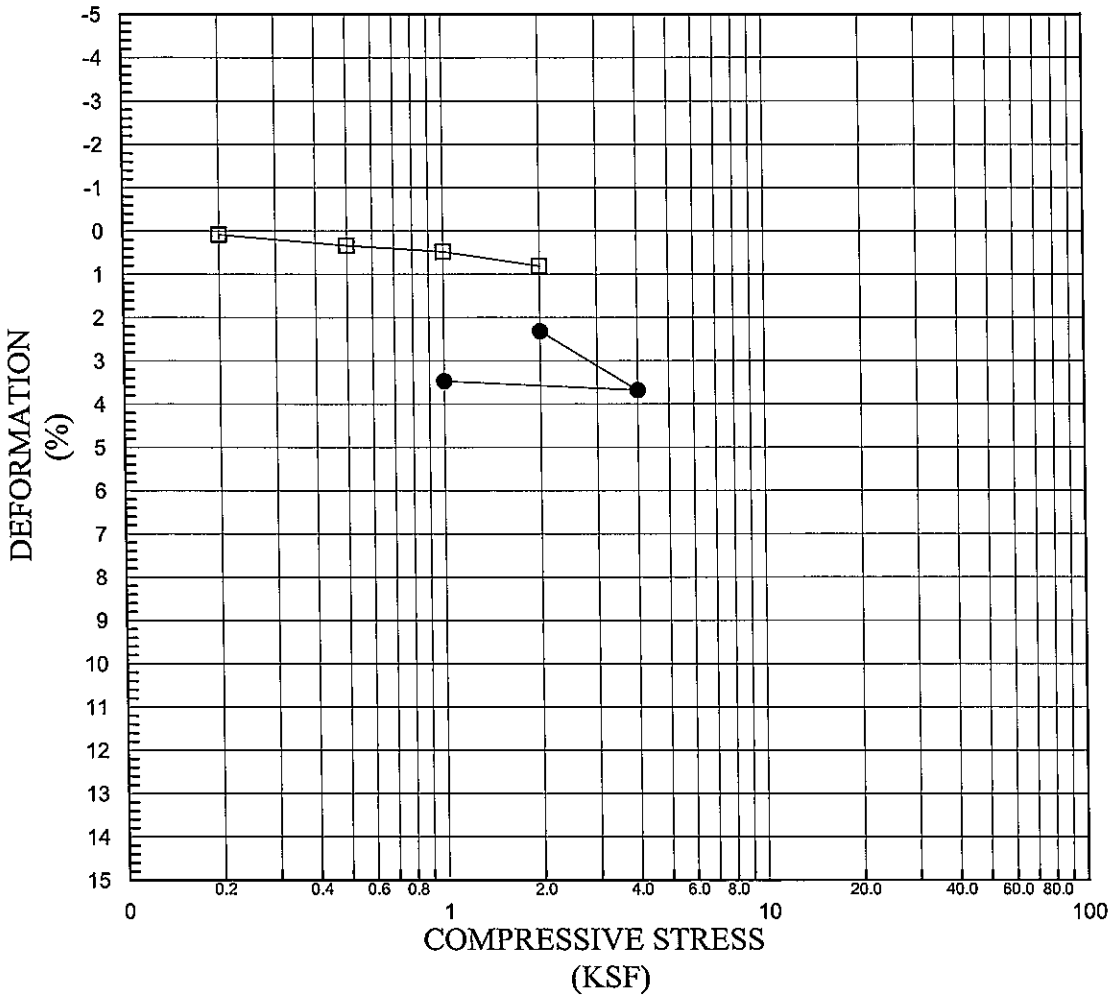
Date: 2/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/ Brand	1432-2-1S	CS-1

CONSOLIDATION

(ASTM D 2435)



□ Field Moisture

● Saturated

Location:	B-3
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	8.8
Dry Density (pcf):	104.8
Void Ratio:	-

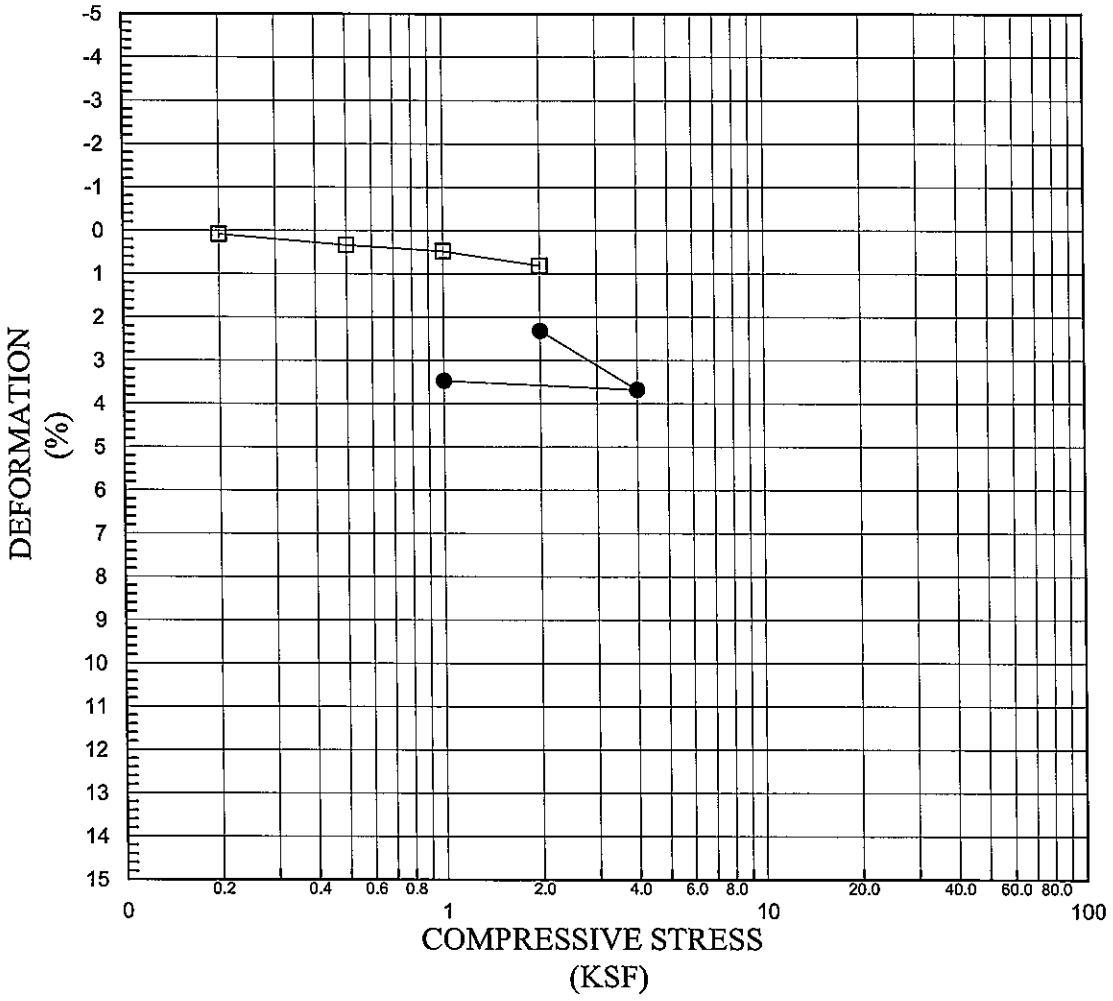
Date: 2/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/ Brand	1432-2-1S	CS-2

CONSOLIDATION

(ASTM D 2435)



□ Field Moisture

● Saturated

Location:	B-4
Depth (ft):	21.5'
Soil Type:	Sand (SM)
Initial Moisture Content (%):	3.5
Dry Density (pcf):	112.2
Void Ratio:	-

Date: 2/16

Prepared by: MC

MTC ENGINEERING, INC.	Project Name	Project Number	Plate
5924 Temple City Blvd. Temple City, CA 91780 Tel: (626)287-6416 Fax: (626)287-0560	McClellan/ Brand	1432-2-1S	CS-3

APPENDIX B

VERTICAL TEMPORARY CALCULATION

MTC Engineering, Inc.
5924 Temple City Boulevard, Temple City, CA 91780 /Toll Free 888-MTC-ENGR

Vertical Temporary Excavation

Unit Weight r_s =	116	pcf				
Cohesion C=	120	psf	DS-4	C'=	C/1.25=	96 psf
Friction Angle Ø=	32.5	degrees	DS-4	Ø'=	Ø/1.25=	26 degrees
Safety Factor S=	1.25					

*Hc=(4.0C'/rs)Xtan(45+Ø'/2) = 5.2976591 feet

5.25>5 feet (recommend vertical cut up to 5 feet, 1:1 (H:V) slope upward over feet).

*Hc formula from Terzagi, K. (1943) Theoretical Soil Mechanics, John Wiley & Sons, New York.