Appendix D

Preliminary Low Impact Development Plan

Preliminary Low Impact Development (LID) Plan

Prepared for:
Crestfield Townhomes, LLC
27702 Crown Valley Parkway, Suite D-4-197
Ladera Ranch, CA 92694
Matthew Waken
(626) 710-6377

Property:
Crestfield Townhomes
1433 Crestfield Drive
Duarte, CA 91010
APN: 8604-017-903
TPM 84544

Prepared by:
C&V Consulting, Inc.
9830 Irvine Center Drive
Irvine, CA 92618
(949) 916-3800
Dane McDougall, P.E

Preparation Date:
August 2024

Receipt of WDID

REPLACE THIS SHEET

To be provided prior to final approval

Notice of Intent

REPLACE THIS SHEET

To be provided prior during final engineering

Table of Contents

SECTION PAGE

List of Figures

List of Appendices

Owner/Developer
Approval and Certification
of the
Preliminary Low Impact Development (LID) Plan

Project Name: ***Crestfield Apartments***

Project Number: **TPM 84544**
APN 8604-017-903

Project Address: **1433 Crestfield Drive, Duarte, CA 91010**

This Preliminary Low Impact Development (LID) Plan for the ***TPM 84544, Duarte*** project has been prepared for Crestfield Townhomes, LLC by C&V Consulting, Inc. It is intended to comply with the requirements of the City of Duarte's Conditions of Approval.

The undersigned is authorized to approve implementation of provisions of this plan as appropriate and will strive to have the plan carried out by successors consistent with the County of Los Angeles LID Manual and the intent of the NPDES storm water requirements.

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

Owner/Developer Signature	Date
Mathew Waken, Managing Member	**(626) 710-6377**
Owner/Developer's Name and Title	Telephone Number

Section 200

A. Contact Information/List of Responsible Parties

The property contact information is:

Matthew Waken
(626) 710-6377
Crestfield Townhomes, LLC
27702 Crown Valley Parkway, Suite D-4-197
Ladera Ranch, CA 92694

The property owner shall have primary responsibility and significant authority for the implementation, maintenance, and inspection of the property BMPs. Duties of the Owner include but are not limited to:

- Implementing all elements of the LID, including but not limited to:
  - Implementation of prompt and effective erosion and sediment control measures
  - Implementing all non-storm water management, and materials and waste management activities, such as: monitoring, discharges, general site clean-up; vehicle and equipment cleaning, spill control; good construction housekeeping to ensure that no materials other than storm water are discharged which may have an adverse effect on receiving waters or storm drain systems, etc.
- Pre-storm inspections
- Storm event inspections
- Post-storm inspections
- Routine inspections as described in the LID
- Ensuring elimination of all unauthorized discharges
- The Owner shall be assigned authority to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate all of the necessary corrections/repairs are made immediately, and that the project complies with the LID at all times.
- Managing and report any Illicit Connections or Illegal Discharges.

Section 300

A. References

The following documents are made a part of this LID by reference:

- Project plans and specifications for the City of El Duarte to support the ***TPM 84544, Duarte*** project, prepared by C&V Consulting, Inc., 9830 Irvine Center Drive, Irvine, CA 92630

- County of Los Angeles Department of Public Works, Low Impact Development Standards Manual dated February 2014

- State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002 dated July 1, 2010

- California Stormwater BMP Handbook – Construction, January 2009.

- California Stormwater BMP Handbook – New Development and Redevelopment, January 2003.

- Los Angeles County Municipal Stormwater/ NPDES Permit Order R4-2012-0175

Section 400 – Body of LID

A. Objectives

This Preliminary Low Impact Development (LID) Plan has four main objectives:

1) Identify all pollutant sources, including sources of sediment that may affect the quality of storm water discharges associated with daily use / activity (storm water discharges) from the property site.
2) Identify non-storm water discharges.
3) Identify, construct, implement and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the property site.
4) Develop a maintenance schedule for BMPs designed to reduce or eliminate pollutants.

B. Project Background and Description

The proposed project is located at 1433 Crestfield Drive, in the City of Duarte, California. The site is bounded by the existing single family to the north, existing single family and Crestfield Drive to the east, existing commercial and Central Avenue to the south, and the Otis Gordan Sports Park to the west. The proposed development includes the construction of twenty-five (25) buildings consisting of 169 attached 3-story apartment units. The proposed 7.04-acre site will include private drive aisles, private garages, sidewalks, guest parking, and associated landscaping, recreational/ leasing office building with pool, and public open space area. The proposed site will be accessible via two (2) driveway entrances along Central Avenue and Crestfield Drive. Primary site access will be provided from Central Avenue. The site will be subdivided into two (2) parcels with the residential development on Parcel 1. The remaining parcel, Parcel 2, will be utilized as a public park which will be redeveloped for the City of Duarte.

The site is currently occupied by the Duarte Preschool and Andres Duarte Campus Facility with many buildings, playground areas, sports courts and associated parking lot. The elevation within the site generally varies from approximately 554.1 to 542.3 with surface runoff flowing in the in the southwesterly directions. There is an existing drainage inlet located on Central Avenue, approximately 500’ west of the proposed property line. Drainage from the site generally surface flows in the southwesterly direction towards a few grate inlet catch basins at the center of the site. It is assumed the flows captured here are conveyed directly to Bradbury Channel. Any additional flows outside of the grate inlet capture range continue to flow southwest towards Central Avenue, then continue westerly to the existing catch basins and ultimately enter the Bradbury Channel as well.

C. Vicinity Map

The proposed project is located at 1433 Crestfield Drive, in the City of Duarte. The site is bounded by the existing single family to the north, existing single family and Crestfield Drive to the east, existing commercial and Central Avenue to the south, and the Otis Gordan Sports Park to the west.

Refer to Figures 1 & 2 for Vicinity and Location Maps.

D. Existing Site Drainage Condition

Drainage at the site is generally directed as sheet flow overland towards the southwest corner of the site. There is no evidence of existing storm drain facilities located onsite. Stormwater runoff sheet flows into the southerly parking lot and onto the adjacent public park facility to the west, before entering the public right-of-way of Central Avenue. Stormwater continues flowing westerly into an existing catch basin, approximately 500' west of the site. The existing catch basin collects and conveys stormwater runoff to the Bradbury Channel (LACFCD Facility) which discharges to the Santa Fe Spreading Grounds/ Santa Fe Dam.

Water bodies to which site runoff is tributary to are listed on the most current 303(d) list for the following:

- Sante Fe Dam
    - PCBs
    - pH (TMDL)

Surface runoff from the site drains through only engineered facilities to the Sante Fe Spreading Grounds/ Sante Fe Dam, therefore Hydromodification Control requirements are not applicable for this project.

E. Proposed Site Drainage Conditions

The proposed development includes the construction of twenty-five (25) buildings consisting of 169 attached 3-story apartment units. The proposed 7.04-acre site will include private drive aisles, private garages, sidewalks, guest parking, and associated landscaping, recreational/ leasing office building with pool, and public open space area. The proposed residential development has been designed to collect and convey stormwater runoff within the proposed drive aisles within the proposed curb and gutter to proposed catch basins and an underground private storm drain system. The storm drain system will direct stormwater runoff to a proposed ADS StormTech Detention/ Infiltration to promote subsurface infiltration of the entire Storm Water Quality Design Volume (SWQDv).

The ADS StormTech System has been designed to capture 100% of the Storm Water Quality Design Volume (SWQDv) and infiltrate that volume over a maximum drawdown time of 72 hours. Once the system has reached capacity, stormwater runoff will overflow within a proposed junction structure and discharge stormwater runoff through a parkway drain on Central Avenue. Proposed site has been designed to match the historic drainage pattern. The proposed ADS StormTech System will be located within the public park area under the proposed parking lot. It has been oversized to accommodate the design SWQDv for both the residential and future park development.

Refer to Figure 3, Preliminary DMA Exhibit for additional information.

F. LID Project Types, Characteristics, & Activities

Per the Los Angeles Department of Public Works (LACDPW), *Low Impact Development Standards Manual*, dated February 2014, the proposed project is classified as a "Designated Project." A "Designated Project" is defined by the LACDPW as follows:

> "Redevelopment projects, which are developments that result in creation or addition or replacement of either: (1) 5,000 square feet or more of impervious surface on a site that was previously developed as described in the above bullets; or (2) 10,000 square feet or more of impervious surface area on a site that was previous developed as a single-family home."

G. Pollutant Source Identification and BMP Selection

The following is a list of materials to be used in the daily construction activities at the project site, which will potentially contribute to pollutants, other than sediment, to storm water runoff. Control Practices for each activity are identified below:

- Vehicle fluids, including oil, grease, petroleum, and coolants from personal vehicles
- Landscaping materials and wastes (topsoil, plant materials, herbicides, fertilizers, mulch, pesticides)
- General trash debris and litter

- Pet waste (bacteria/ fecal coliforms)

The Best Management Practices (BMPs) that have been selected for implementation on this project are detailed in the following sections.

H. Source Control BMPs

Project proponents shall implement Site Design concepts that achieve each of the following:

- Minimize Urban Runoff
- Minimize Impervious Footprint
- Conserve Natural Areas
- Minimize Directly Connected Impervious Areas (DCIAs)

Table-1 identifies the source control and treatment BMPs and how each is implemented to achieve each Site Design concept. BMP fact sheets are provided by the LACDPW *Low Impact Development Standards Manual* and the California Stormwater Quality Association.

Table-1: Source Control BMPs

BMP	BMP DESCRIPTION	CHECK ONE		IF NOT APPLICABLE, STATE BRIEF REASON
		INCLUDED?	NOT APPLICABLE	
	Non-Structural Source Control BMPs:			
	Education for Leasers,' Operators, Occupants, or Employees	X		
	Activity Restrictions (CC&Rs)	X		
S-8	Landscape Irrigation Practices	X		
SD-32	Common Area Litter Control		X	No proposed trash enclosures.
SE-7	Street Sweeping Private Streets and Parking Lots	X		
	Drainage Facility Inspection and Maintenance	X		

BMP	BMP DESCRIPTION	CHECK ONE		IF NOT APPLICABLE, STATE BRIEF REASON
		INCLUDED?	NOT APPLICABLE	
	Structural Source Control BMPs:			
S-1	Storm Drain Message and Signage	X		
S-8	Landscape Irrigation Practices	X		
SD-11	Roof Runoff Controls	X		
	Protect Slopes and Channels		X	No proposed slopes and channels.
S-6	Outdoor Vehicle/Equipment/ Accessory Washing Area		X	Car Wash Racks are not permitted within the proposed development – Not Applicable.
	Proper Site Design:			
S-7	Fuel and Maintenance Area		X	No Fueling Areas
SD-33	Air/Water Supply Area Drainage		X	No Air/Water Supply
S-3	Outdoor Trash Storage and Waste Handling Area	X		
S-4	Outdoor Loading/ Unloading Dock Area		X	Not Applicable
S-5	Outdoor Vehicle/Equipment Repair/Maintenance Area		X	No Maintenance Bays
S-6	Outdoor Vehicle/Equipment/ Accessory Washing Area		X	No Wash Areas
S-2	Outdoor Material Storage Area		X	No Material Storage
SD-36	Outdoor Work Areas or Processing Areas		X	No Work Areas
	Provide Wash Water Controls for Food Preparation Areas		X	No Food Prep Areas

Non-Structural Measures

Non-structural BMPs are generally managerial, educational, inspection and/ or maintenance oriented. These items consist of educating employees and occupants, developing, and implementing PMC guidelines, implementing BMPs and enforcing Code requirements. Non-structural BMPs used for this project are summarized below:

Education for Employees and Occupants

Practical informational materials will be provided to homeowners, PMC and employees on general good housekeeping practices that contribute to protection of storm water quality. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Initially, the Owner will provide these materials. Thereafter, such materials will be available through the PMC education program.

This program must be maintained, enforced, and updated periodically by the PMC. Educational materials including, but not limited to, the materials included in Appendix F of this plan will be made available to the employees and contractors of the PMC.

Activity Restrictions

Activities on this site will be limited to activities related to residential living. The project's Conditions, Covenants, and Restrictions (CC&Rs) will outline the activities that are restricted on the property. Such activities related to the LID include car washing, car maintenance and disposal of used motor fluids, pet waste cleanup, and trash container areas.

Efficient Landscape System & Landscape Maintenance

Management programs will be designed and established by the PMC, who will maintain the communal areas within the project site. These programs will include how to mitigate the potential dangers of fertilizer and pesticide usage (refer to the Maintenance and Frequency Table). Ongoing maintenance will be consistent with the State of California Model- Water Efficient Landscape Ordinance. Fertilizer and pesticide usage shall be consistent with County Management Guidelines for use of Fertilizers and Pesticides.

Common Area Litter Control

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

Street Sweeping in Private Streets and Parking Lots

The PMC shall have all streets and parking lots swept on a weekly basis. This procedure will be intensified around October 15th of each year prior to and throughout rain storm period.

Drainage Facility Inspection & Maintenance
The PMC will be responsible for implementing each of the BMPs detailed in this plan. The PMC will also be responsible for cleaning and maintaining the BMPs on a regular basis. Refer to Appendix G for the Operation and Maintenance Plan. Refer to Appendix C for site specific drainage BMP information.

Storm Drain Stenciling/ Signage
Phrase "No Dumping – Drains to Ocean" or equally effective phrase to be stenciled on catch basins to alert the public to the destination of pollutants discharged into storm water. This stenciling will be inspected and re-stenciled on a periodic basis by the PMC. Refer to Table 4 for maintenance frequency.

Landscape & Irrigation System Design
As part of the design of all common area landscape irrigation shall employ water conservation principles, including, but not limited to, such provisions as water sensors, programmable irrigation times (for short cycles), etc. will be used. Such common areas will be maintained by the PMC.

Title 22 CC&R Compliance
The PMC will comply with this Regulation as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney.

Uniform Fire Code Implementation
The PMC will comply with this Code as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney.

Employee Training
A training program will be established as it would apply to future employees, contractors, and homeowners of the PMC to inform and train in maintenance activities regarding the impact of dumping oil, paints, solvents, or other potentially harmful chemicals into storm drains; the proper use of fertilizers and pesticides in landscaping maintenance practices; and the impacts of littering and improper water disposal.

The PMC (or a hired firm) will conduct the training program which will include targeted training sessions with specific construction disciplines (landscaping, concrete finishers, painters, etc.). See Appendix F for examples of educational materials that will be provided to the Employees.

The project's CC&Rs will include provisions for future employee training programs conducted on a yearly basis prior to the rainy season.

I. Structural BMPs

Structural BMPs shall be installed by the developer, through the construction and development of the project, for instance; landscaping and irrigation systems shall be designed by licensed landscape architects and installed by qualified contractors to specifications and standards of the City of Duarte. The structural BMPs used for this project are summarized below:

Expected pollutants associated with this development include vehicle discharge fluids, landscaping materials and waste, litter, and pet waste. To mitigate these pollutants, the structural best management practices summarized in Table-2 are proposed.

Table-2: Design BMPs

BMP	TECHNIQUE	INCLUDED?		BRIEF DESCRIPTION OF METHOD
		YES	NO	
SD-10	Minimize Impervious Area/Maximize Permeability (C-Factor Reduction)	X		We have incorporated landscape areas wherever possible within the project site. See Appendix B for details.
	Minimize Directly Connected Impervious Areas (DCIAs) (C-Factor Reduction)	X		We minimize DCIAs by limiting sidewalks and parking areas to the minimum necessary for proper use. Stepping stones are used in areas with minimal foot traffic.
	Create Reduced or "Zero Discharge" Areas (Runoff Volume Reduction)	X		The entire SWQDv will be retained onsite through infiltration.

Table-3: Treatment BMPs

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
VEG-1	Green Roof		X	
VEG-2	Stormwater Planter		X	
VEG-3	Tree-Well Filter		X	
VEG-4	Vegetated Swale		X	Space not available for BMP
VEG-5	Vegetated Filter Strip		X	Space not available for BMP
T-1	Sand Filter		X	Space not available for BMP

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
T-2	Consulted Wetland		X	
T-3	Extended Detention Basin		X	Space not available for BMP
T-4	Wet Pond		X	This is not a wetland area/ development
T-5	Permeable Pavement with an Underdrain		X	This is not a wetland area/ development.
T-6	Proprietary Treatment Control Measures		X	Space not available for BMP
RET-1	Bioretention		X	Alternative BMP utilized
RET-2	Infiltration Basin		X	Alternative BMP utilized
RET-3	Infiltration Trench	X		ADS StormTech System
RET-4	Drywell		X	Alternative BMP utilized
RET-5	Permeable Pavement without an Underdrain		X	Alternative BMP utilized
RET-6	Rain Barrel/ Cistern		X	Alternative BMP utilized
TC-40	Media Filter		X	Alternative BMP utilized
BIO-1	Biofiltration		X	Alternative BMP utilized

Drainage Management Area (DMA)	Size (ac)	Storm Water Quality Design Volume (SWQDv) (cf)	System Detention Capacity (cf)	Treatment Capacity over 72 hrs (cf)
A1 (residential)	7.04	24,711	35,210	45,649
A2 (park)	5.95	6,962		
--	12.99	31,673	--	--

The proposed residential site, approximately 7.04 acres will generate a Storm Water Quality Design Volume (SWQDv) of approximately 24,711 cf. The proposed future park site, approximately 5.95 acres will generate a Storm Water Quality Design Volume (SWQDv) of approximately 6,962 cf. Stormwater runoff will be collected and conveyed to an ADS StormTech System that has a total detention capacity of approximately 35,210 cf and provides approximately 45,649 cf of infiltrated volume over 72 hours. The Infiltration/ Detention System as designed will provide more than enough treatment and storage capacity for the site.

The ADS StormTech System will be installed within the future park area within the proposed parking lot area near the southern property line. Drainage from roof tops and landscape areas will be collected through area drains and piped to the proposed underground storm drain/ detention pipe. Runoff from these areas is pretreated through landscaping. Street runoff will be collected via a proposed curb inlet catch basin and conveyed directly to the detention/ infiltration system via underground storm drain piping. The ADS StormTech system is equipped with an Isolator Row which provides pretreatment and allows for settlement of the silt/ sediment, trash capture and absorption of hydrocarbons prior to discharging runoff into the drywell. Once the detention/ infiltration system reaches capacity, stormwater runoff will overflow through the upstream junction structure to a proposed parkway drain and discharge to Central Avenue. Emergency overflow will convey stormwater runoff through the proposed driveways and westerly into the future park area.

Biofiltration
The project does not propose biofiltration because the entire SWQDv will be retained onsite and will infiltrate within 72 hours.

Catch Basin Inspection
The PMC will maintain the drainage systems, including catch basins and culverts. The PMC is required to have catch basins inspected and, if necessary, cleaned prior to the storm season, no later than October 15th each year or prior to the first 24-hour storm event, whichever occurs first. These duties may be contracted out to the landscape maintenance firm hired by the PMC. Please see Appendix E for maintenance program. Refer to Appendix G for the Operation and Maintenance Plan.

Runoff-Minimizing Landscape Design
As part of the design of all common area landscape areas, similar planting material with similar water requirements will be used in order to reduce excess irrigation runoff and promote surface filtration. Such common areas will be maintained by the PMC.

Community Car Wash Racks
No community car wash rack or area will be provided, therefore, washing of vehicles by residents on the property will not be allow per the CC&Rs.

Wash Water Controls for Food Preparation Areas
A sign will be posted indicating that discharge of wash water to the municipal storm drain system is prohibited. All wash water should be disposed of to the sanitary sewer system. Restrictions will be enforced per the CC&Rs.

Self-Contained Washing
Self-contained washing of vehicles by residents or owners on the property will not be allowed per the CC&Rs.

Outdoor Material Storage Areas
Outdoor material storage areas refer to storage areas or storage facilities solely for the storage of materials. Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the storm water conveyance system. Outdoor Storage by residents or owners on the property will not be allowed per the CC&Rs.

J. BMP Maintenance, Inspection, and Repair

Inspections will be conducted as follows:

- Annually and prior to the start of the rainy season
- Every (1) month during rainy season
- At any other time(s) or intervals of time specified in the contract documents

Repairs and/ or maintenance procedures shall be carried out at the soonest possible time.

K. Inspection, Maintenance, and Responsibility for BMPs

Table-4 and Table-5 show the lists of the post-construction BMPs (routine non-structural and structural), the required ongoing maintenance, the inspection and maintenance frequency, the inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection.

Table-4: Non-Structural BMP Maintenance Responsibility/Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Homeowner/ Business owner Education, Activity Restrictions	PMC (Property Management Company) will provide educational materials. Those materials and responsibilities must be passed onto subsequent property owners.	Continuous. CC&Rs to be provided to homeowners at the time they purchase the property and updates provided by the PMC as they occur.
Common Area Landscape Management	PMC will appoint a landscape maintenance contractor	Monthly during regular maintenance and use with management guidelines for use of fertilizers and pesticides.

BMP	RESPONSIBILITY	FREQUENCY
Parking Areas and Drives Management	PMC will appoint a landscape maintenance contractor	The Drives Aisles are to be swept on a routine scheduled basis to facilitate the pickup of trash and debris (plant or otherwise) and to remove excessive oil, grease, and build-up. During sweeping, debris is to be removed from the parking areas and drives and then scrubbed and rinsed. This sweeping schedule will be at a minimum occurrence of once a week and as necessary to rid / reduce active pollutants from the pavement areas. This maintenance requirement will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the final Title report of these properties.
Litter Control by Sweeping	PMC will appoint a landscape maintenance contractor.	Weekly inspection of trash receptacles to ensure that lids are closed and pick up any excess trash on the ground, noting trash disposal violations to the PMC for remediation.
Employee Training	PMC will appoint a landscape contractor after construction.	Monthly for maintenance personnel and employees to include the educational materials contained in the approved LID.
Common Area Catch Basin Inspection & Cleaning	PMC will appoint a landscape maintenance contractor for common areas and storm drain facilities.	Inspect basins once a month. Clean debris and silt in bottom of catch basins as needed. Intensified on or about October 15th each year or prior to the first 24-hour storm event, whichever occurs first. Refer to Appendix E.

Table-5: Structural BMP Maintenance Responsibility/ Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Common Area Efficient Irrigation	PMC will appoint a landscape contractor after construction	Once a week, in conjunction with maintenance activities. Verify that runoff minimizing landscape design continues to function by checking that water sensors are functioning properly, that irrigation heads are adjusted properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance

BMP	RESPONSIBILITY	FREQUENCY
		with water demands, given time of year, weather and day or night time temperatures.
Common Area Runoff Efficient Landscape Design	PMC will appoint a landscaping contractor	Once a week in conjunction with maintenance activities and prior to finalizing any replanting schemes. Verify that plants continue to be grouped according to similar water requirements in order to reduce excess irrigation runoff.
ADS StormTech Detention/ Infiltration System	PMC	Inspect and service all screens and filters, replace the floating absorbent blankets/ pillows and geotextile fabric at the bottom of chambers. Repair any portion of drywell as needed per manufacturer's recommendations. Record inspection observations and maintenances operations. Inspections shall occur 2 times per year and prior to any major rain event. Cleanings and replacements shall occur every 12 months, and prior to start of rainy season. Refer to manufacturer's specifications for specific system maintenance requirements.

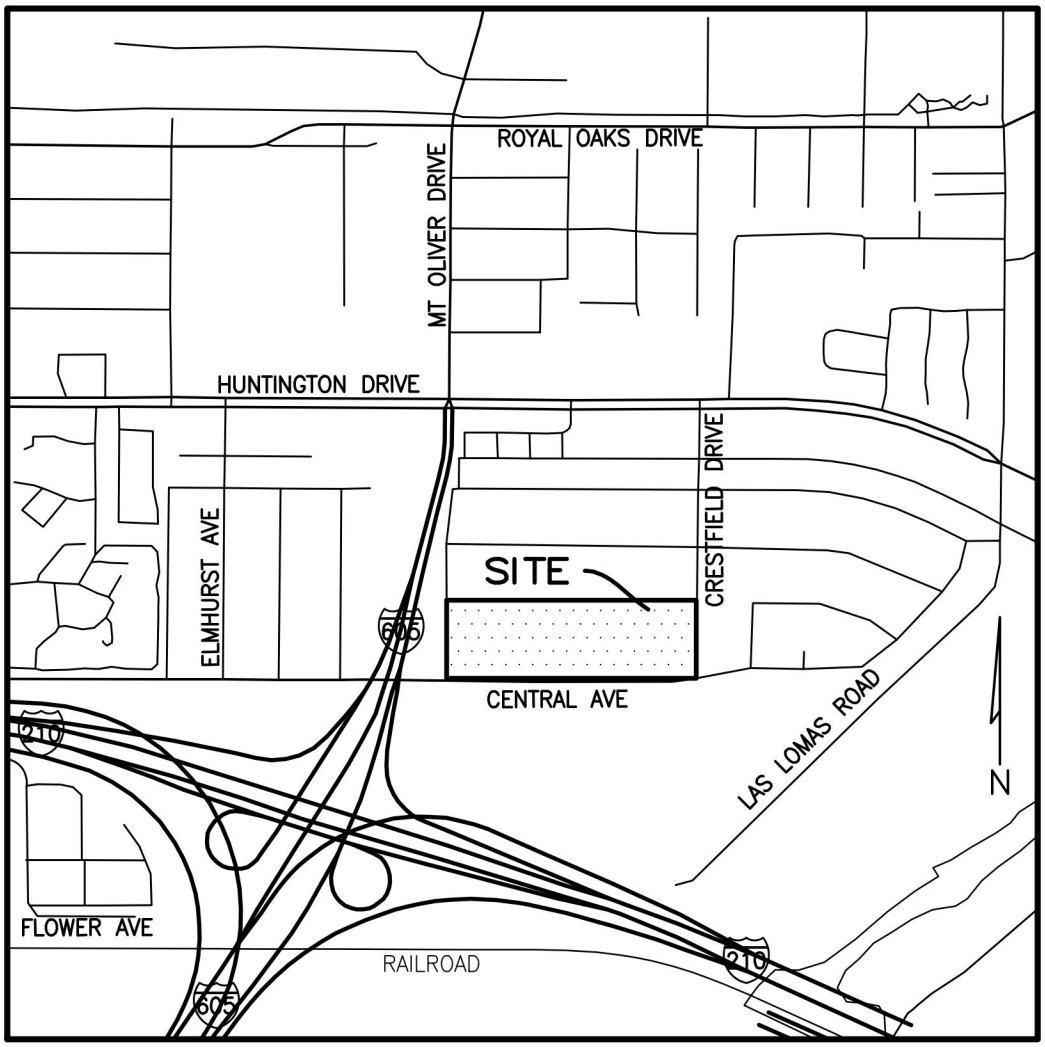
L. Operation/Maintenance Funding after Project Completion

The post-construction BMPs as described above will be funded and maintained by:

Matthew Waken
(626) 710-6377
Crestfield Townhomes, LLC
27702 Crown Valley Parkway, Suite D-4-197
Ladera Ranch, CA 92694

Maintenance and requirements of the maintenance for the properties will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project and will be the responsibility of the property owner at all times. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the Title report of these properties.

Figure -1:
Project Vicinity Map



VICINITY MAP

NTS

Figure -2:
Project Location Map

MWIG-007

1433 Crestfield Drive, Duarte, CA 91010

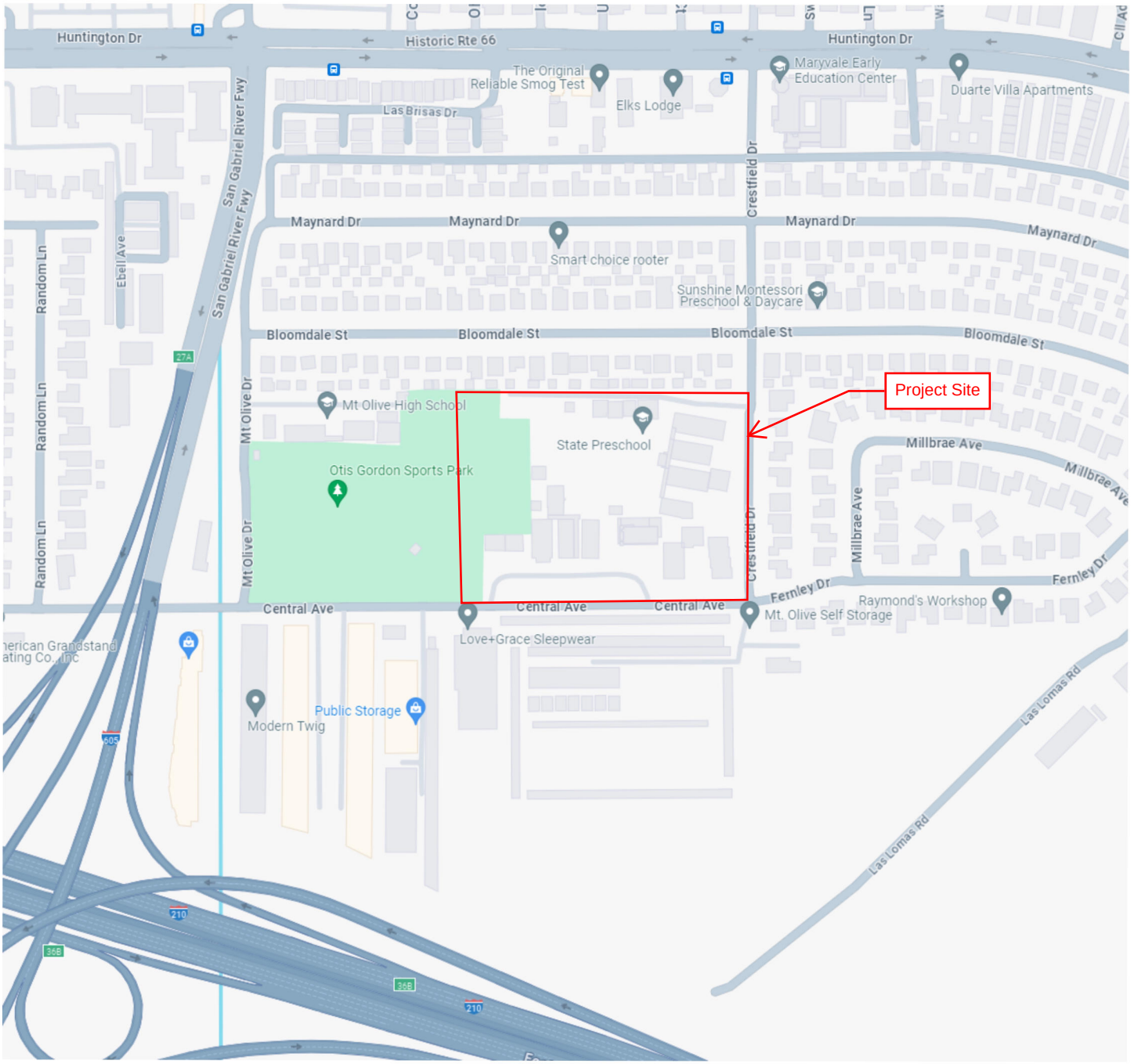


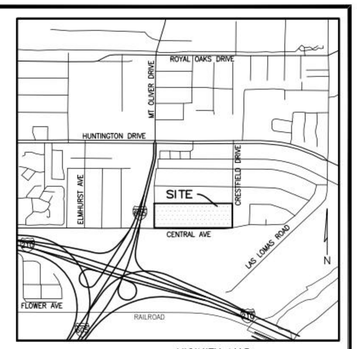
Figure -3:
Preliminary DMA Exhibit

PRELIMINARY LID EXHIBIT

TPM 84544

1433 CRESTFIELD DRIVE

CITY OF DUARTE, COUNTY OF LOS ANGELES



VICINITY MAP
NOT TO SCALE

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- PROPOSED PROPERTY LINE
- DRAINAGE MANAGEMENT AREA (DMA)
- PROPOSED STORM DRAIN
- DRAINAGE FLOW ARROWS
- PROPOSED CATCH BASIN
- DMA X / X.XX AC — DRAINAGE MANAGEMENT AREA (DMA)
- PERVIOUS AREA

BEST MANGEMENT PRACTICES (BMPS)

S-3	OUTDOOR TRASH STORAGE AREA
S-8	SITE DESIGN & LANDSCAPE PLANNING
SD-11	ROOF RUNOFF CONTROLS
SD-12	EFFICIENT IRRIGATION
S-1	STORM DRAIN SIGNAGE
SE-7	STREET SWEEPING & VACUUMING
RET-3	ADS STORMTECH DETENTION/ INFILTRATION SYSTEM

SCALE: 1" = 40'

0 20 40 80

REGISTERED PROFESSIONAL ENGINEER — CRAIG P. MCDONALD — C 80705 — CIVIL — STATE OF CALIFORNIA

REVISIONS		
REV	DATE	DESCRIPTION

PREPARED FOR:

MW INVESTMENT GROUP, LLC
27702 CROWN VALLEY PARKWAY,
STE. D-4-197
LADERA RANCH, CA 92694
(626) 710-6377
MW INVESTMENT GROUP

PREPARED BY:

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

CITY OF DUARTE
PUBLIC WORKS/ ENGINEERING DEPARTMENT

TENTATIVE PARCEL MAP NO. 84544
1433 CRESTFIELD DRIVE
DUARTE, CALIFORNIA
PRELIMINARY LID EXHIBIT

SHEET 1 OF 1

JOB NO. 1654-2021
DATE: 6/29/24

Figure -4:
Impaired Waters

COUNTY OF LOS ANGELES

LOS ANGELES RIVER WATERSHED

Los Angeles River Watershed

PACIFIC OCEAN

Project Site

PROJECT SITE

MILES
0 1 2 4

LEGEND

- LOS ANGELES RIVER WATERSHED
- UNINCORPORATED AREA
- DAM / LAKE / RESERVOIR
- MAJOR RIVER
- MAJOR CHANNEL

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

REF: \\pwgis02\mpmgis$\MPMGIS\projects\mpm\gismaps\wk_2627\lariver_wtrsheds.mxd DATE: 08/22/07

Mapping & Property Management Division, Mapping & GIS Services Section

Appendix A:
Volume and Flow Rate Calculations & Hydrologic Report

DMA A1 (residential)
A = 7.04 ac
% Imp = 85%
$V_{0.75\ inch}$ = 14,827 cf
$V_{85th\ Percentile}$ = 24,711 cf ✓

DMA A2 (park)
A = 5.95 ac
% Imp = 20%
$V_{0.75\ inch}$ = 4,177 cf
$V_{85th\ Percentile}$ = 6,962 cf ✓

ADS StormTech Detention & Infiltration Calculations:
Total DCV = 31,673 cf
K_{DESIGN} = 2.8 in/hr *
Factor of Safety = 3.0
K_{DESIGN} = 0.93 in/hr *

Surface Area of ADS StormTech System = 8,181 sf
Total Storage of ADS StormTech System = 35,211 cf

$V_{INFIL-72\ HRS}$ = (1 ft/ 12 in)(0.93 in/hr)(8,181 sf)(72 hrs) = **45,649 cf > DCV = 31,673 cf ✓**

Refer to HydroCalc output calculations hereon.

* Refer to Geotechnical Investigation prepared by LGC Geotechnical, Inc. dated May 29, 2024, for percolation testing information and groundwater depth information.

Peak Flow Hydrologic Analysis

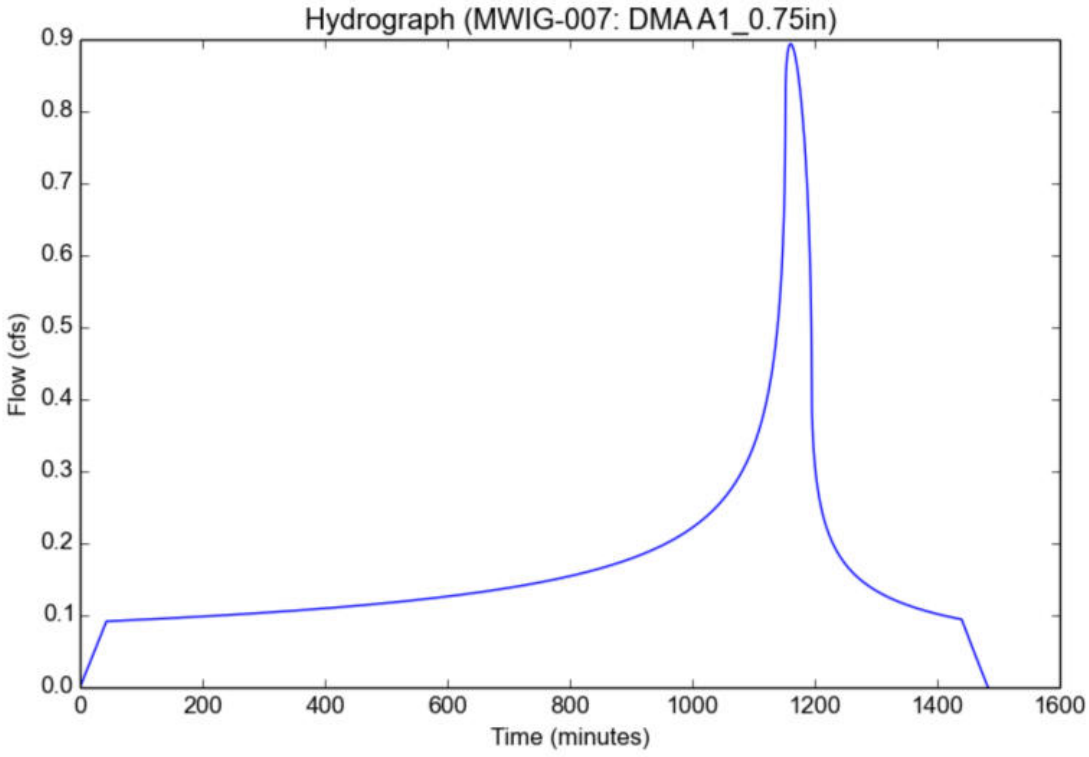
File location: P:/M/MWIG-007/Admin/Reports/LID/Preliminary/Appendix A - Calcs/MWIG-007 - DMA A1_0.75in.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MWIG-007
Subarea ID	DMA A1_0.75in
Area (ac)	7.04
Flow Path Length (ft)	896.0
Flow Path Slope (vft/hft)	0.0145
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.85
Soil Type	7
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1628
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.78
Time of Concentration (min)	43.0
Clear Peak Flow Rate (cfs)	0.8938
Burned Peak Flow Rate (cfs)	0.8938
24-Hr Clear Runoff Volume (ac-ft)	0.3404
24-Hr Clear Runoff Volume (cu-ft)	14826.5927



Peak Flow Hydrologic Analysis

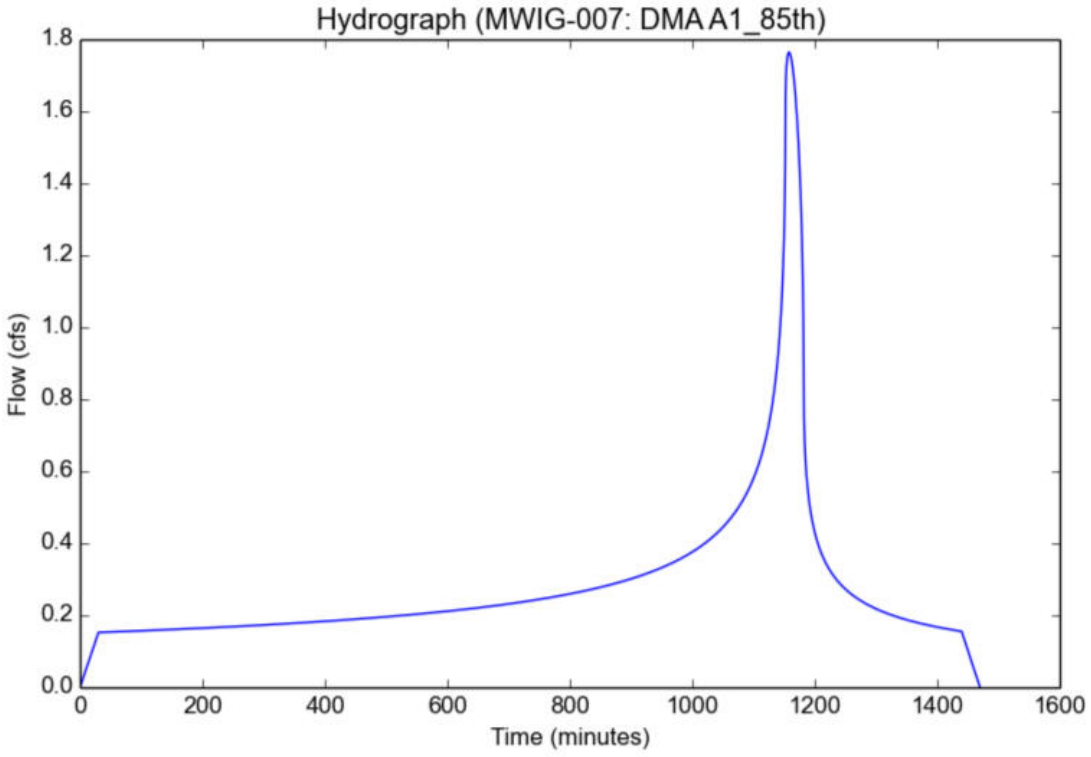
File location: P:/M/MWIG-007/Admin/Reports/LID/Preliminary/Appendix A - Calcs/MWIG-007 - DMA A1_85th.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MWIG-007
Subarea ID	DMA A1_85th
Area (ac)	7.04
Flow Path Length (ft)	896.0
Flow Path Slope (vft/hft)	0.0145
85th Percentile Rainfall Depth (in)	1.25
Percent Impervious	0.85
Soil Type	7
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.25
Peak Intensity (in/hr)	0.3213
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.78
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	1.7642
Burned Peak Flow Rate (cfs)	1.7642
24-Hr Clear Runoff Volume (ac-ft)	0.5673
24-Hr Clear Runoff Volume (cu-ft)	24710.6837



Peak Flow Hydrologic Analysis

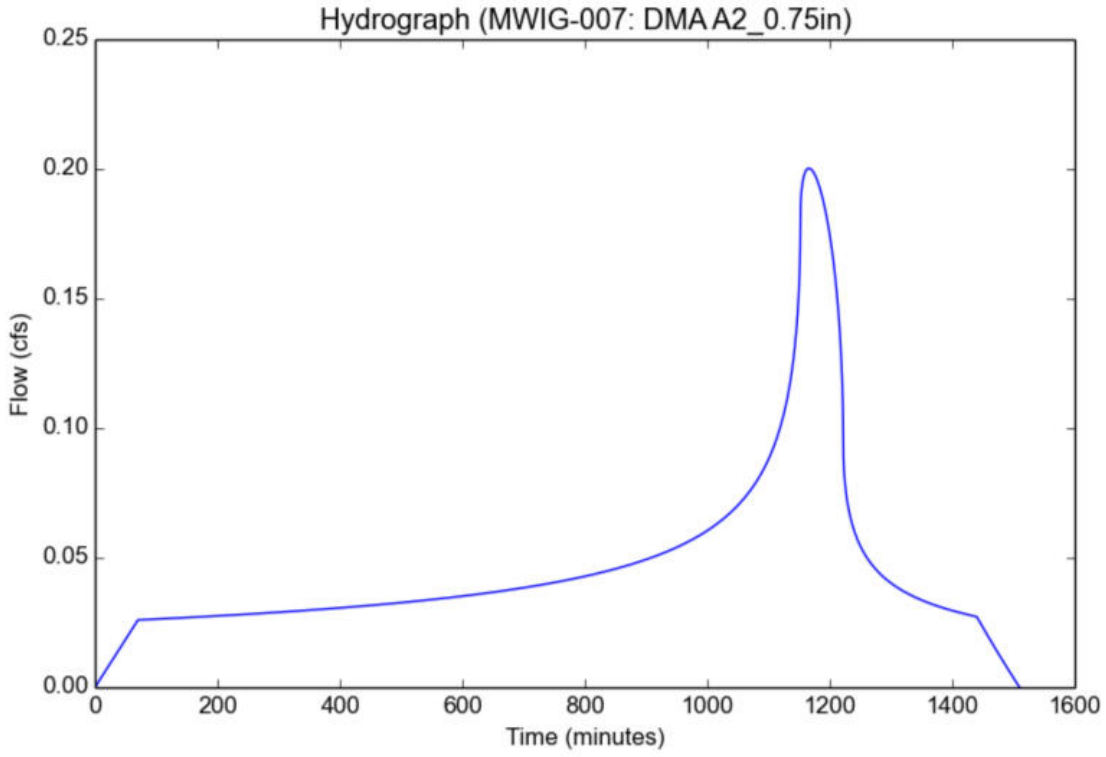
File location: P:/M/MWIG-007/Admin/Reports/LID/Preliminary/Appendix A - Calcs/MWIG-007 - DMA A2_0.75in.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MWIG-007
Subarea ID	DMA A2_0.75in
Area (ac)	5.95
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.02
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.2
Soil Type	7
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1294
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.26
Time of Concentration (min)	70.0
Clear Peak Flow Rate (cfs)	0.2003
Burned Peak Flow Rate (cfs)	0.2003
24-Hr Clear Runoff Volume (ac-ft)	0.0959
24-Hr Clear Runoff Volume (cu-ft)	4177.1681



Peak Flow Hydrologic Analysis

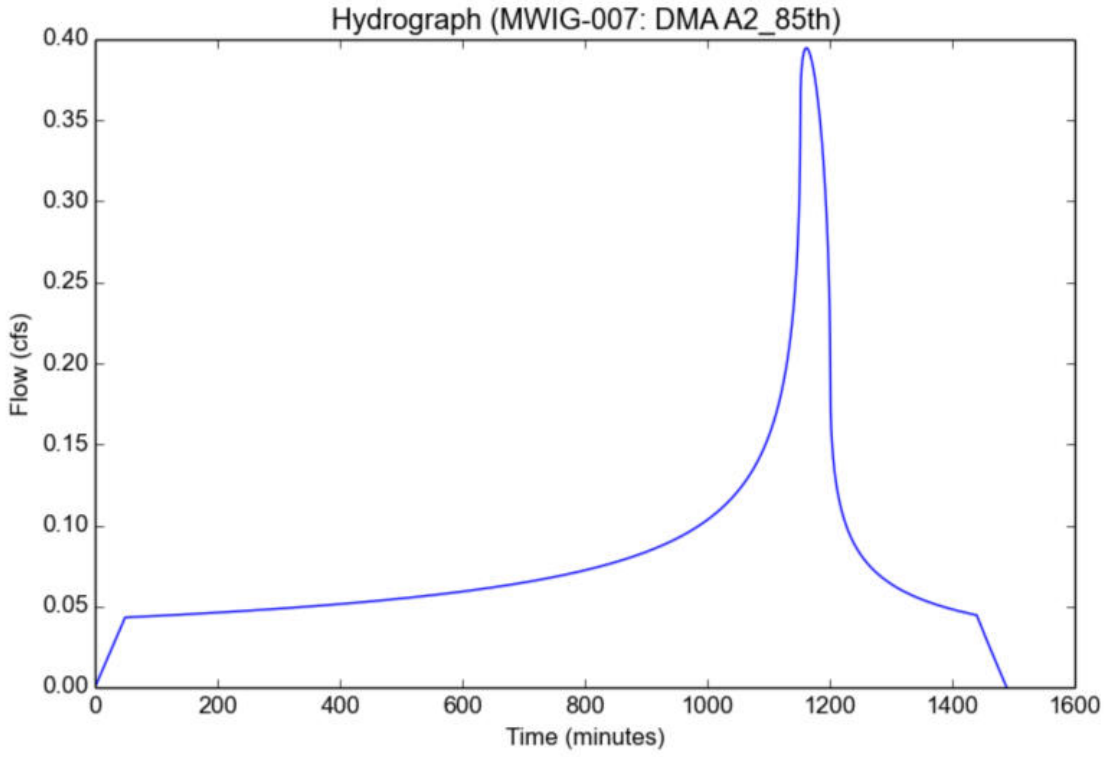
File location: P:/M/MWIG-007/Admin/Reports/LID/Preliminary/Appendix A - Calcs/MWIG-007 - DMA A2_85th.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MWIG-007
Subarea ID	DMA A2_85th
Area (ac)	5.95
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.25
Percent Impervious	0.2
Soil Type	7
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.25
Peak Intensity (in/hr)	0.2551
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.26
Time of Concentration (min)	49.0
Clear Peak Flow Rate (cfs)	0.3947
Burned Peak Flow Rate (cfs)	0.3947
24-Hr Clear Runoff Volume (ac-ft)	0.1598
24-Hr Clear Runoff Volume (cu-ft)	6961.7159



Appendix B:
Site BMPs

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.

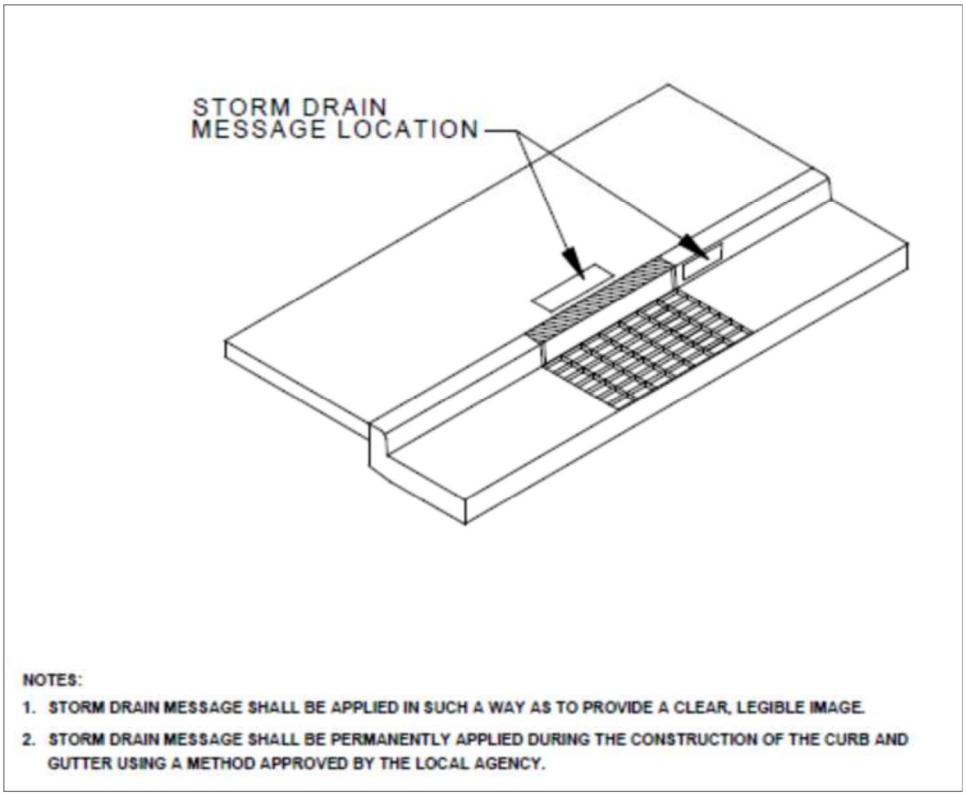


Figure D-1. Storm Drain Message Location – Curb Type Inlet

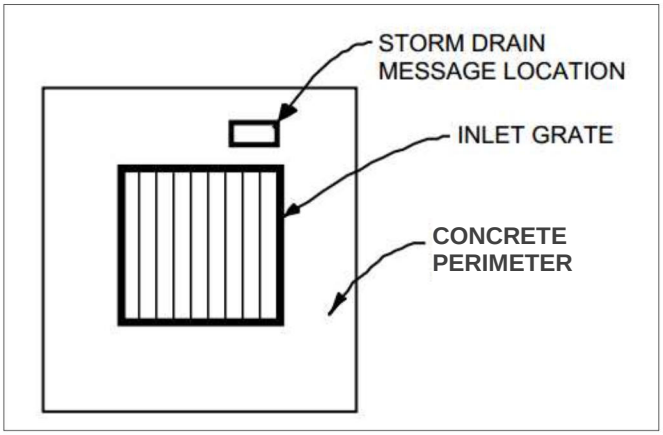


Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-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-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.

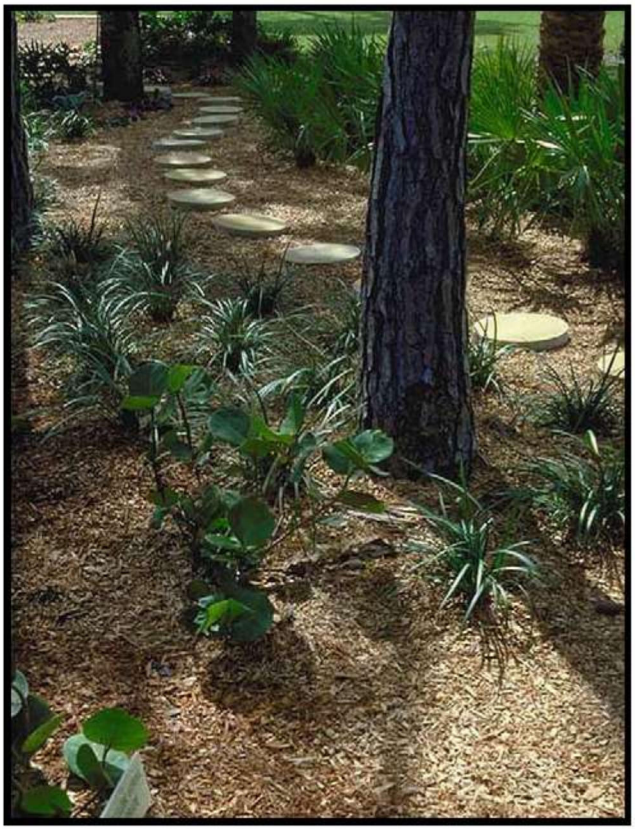
For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

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

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

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

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Street Sweeping and Vacuuming SE-7

Objectives

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

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

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

Potential Alternatives

None

Description and Purpose

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

Suitable Applications

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

Limitations

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

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Appendix C:
ADS StormTech System

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	MWIG-007
Engineer:	Samyam Manandhar Manandhar
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	34840 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Design Constraint Dimensions:	(60 ft. x 320 ft.)

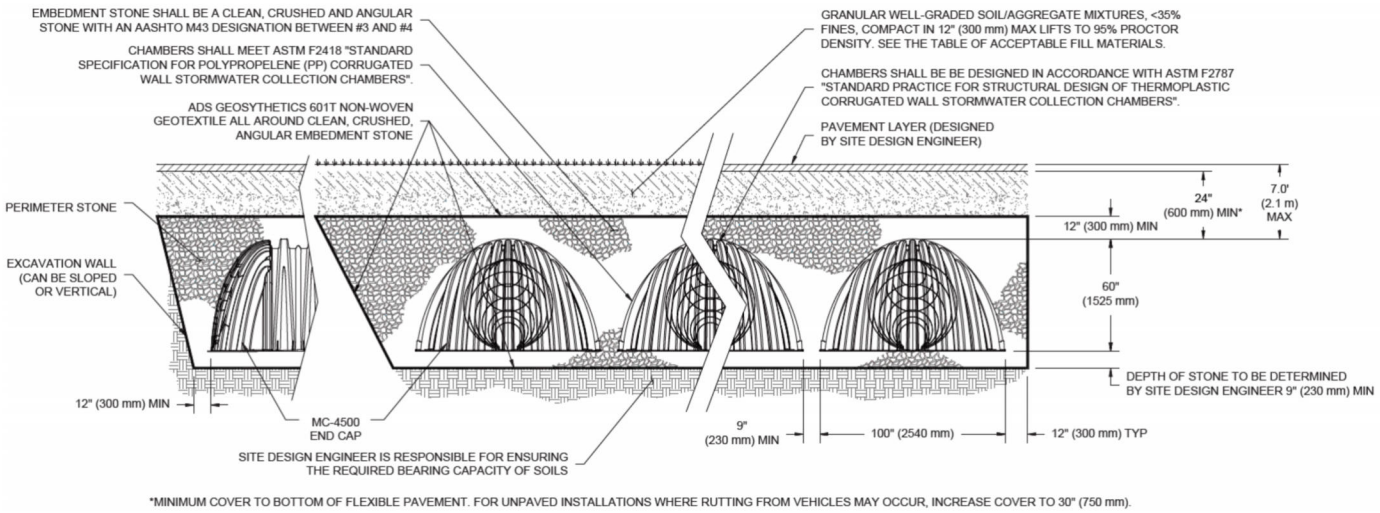
Results

System Volume and Bed Size

Installed Storage Volume:	35210.10 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	123
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	287.02 ft.
Maximum Width:	28.50 ft.
Approx. Bed Size Required:	8180.18 square ft.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	1235 cubic yards
Volume Of Excavation (Not Including Fill):	2046 cubic yards
Total Non-woven Geotextile Required:	2750 square yards
Woven Geotextile Required (excluding Isolator Row):	117 square yards
Woven Geotextile Required (Isolator Row):	644 square yards
Total Woven Geotextile Required:	761 square yards
Impervious Liner Required:	0 square yards



PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

ADS SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

MWIG-007

DUARTE, CA, USA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.
10. MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE. DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
11. ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS. TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

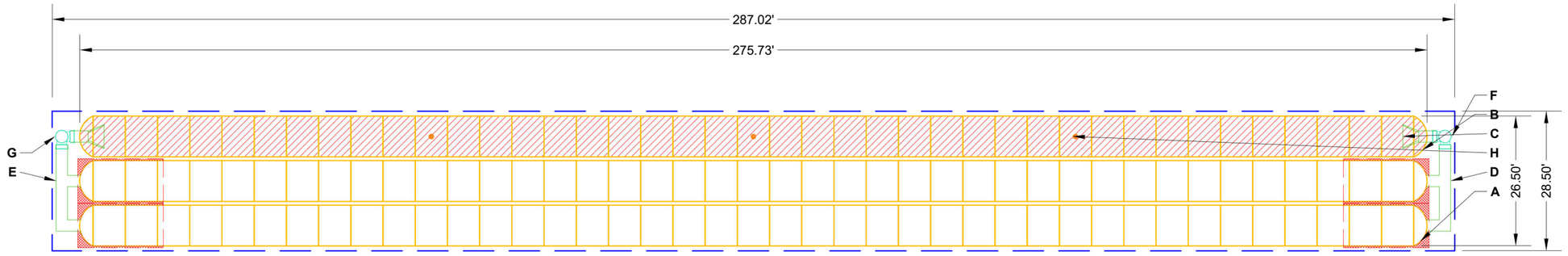
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-800-821-6710 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS:	
123	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
6	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
35210	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-7200 CHAMBER:	5.75
		24" x 24" TOP MANIFOLD INVERT:	2.67
		24" x 24" TOP MANIFOLD INVERT:	2.67
8180	SYSTEM AREA (SF)	24" ISOLATOR ROW PLUS INVERT:	0.94
631.0	SYSTEM PERIMETER (ft)	24" ISOLATOR ROW PLUS INVERT:	0.94
		BOTTOM OF MC-7200 CHAMBER:	0.75
		BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" TOP PARTIAL CUT END CAP, PART#: MC7200IEPP24T / TYP OF ALL 24" TOP CONNECTIONS	23.05"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP (TYP 2 PLACES)		
MANIFOLD	D	24" x 24" TOP MANIFOLD, ADS N-12	23.05"	
MANIFOLD	E	24" x 24" TOP MANIFOLD, ADS N-12	23.05"	
NYLOPLAST (INLET W/ ISO PLUS ROW)	F	30" DIAMETER (24.00" SUMP MIN)		19.0 CFS IN
NYLOPLAST (INLET W/ ISO PLUS ROW)	G	30" DIAMETER (24.00" SUMP MIN)		
INSPECTION PORT	H	4" SEE DETAIL (TYP 3 PLACES)		



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

MWIG-007
DUARTE, CA, USA
DATE: 08/26/2024 | PROJECT #: | DRAWN: SM | CHECKED: N/A

DESCRIPTION | DATE | DRW | CHK

StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

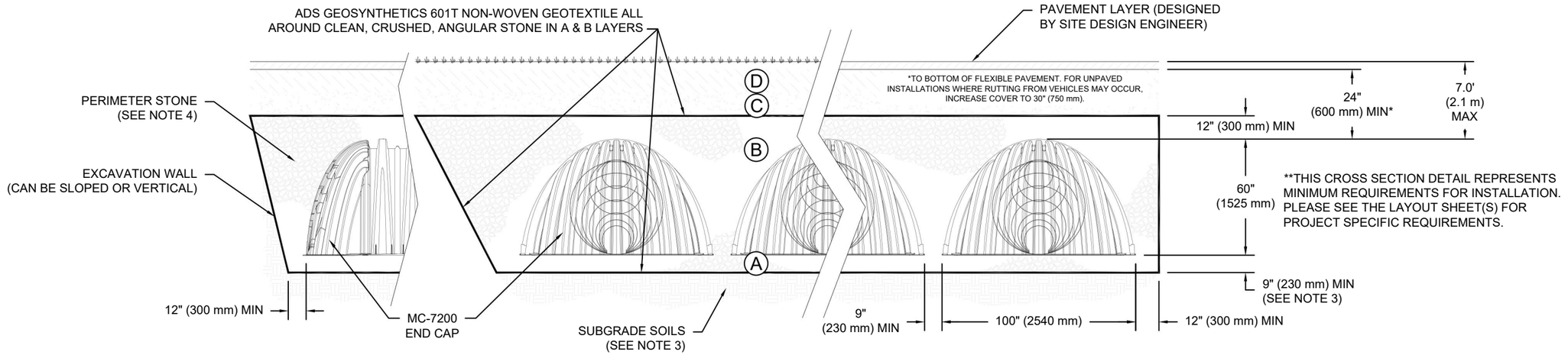
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 25 50

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

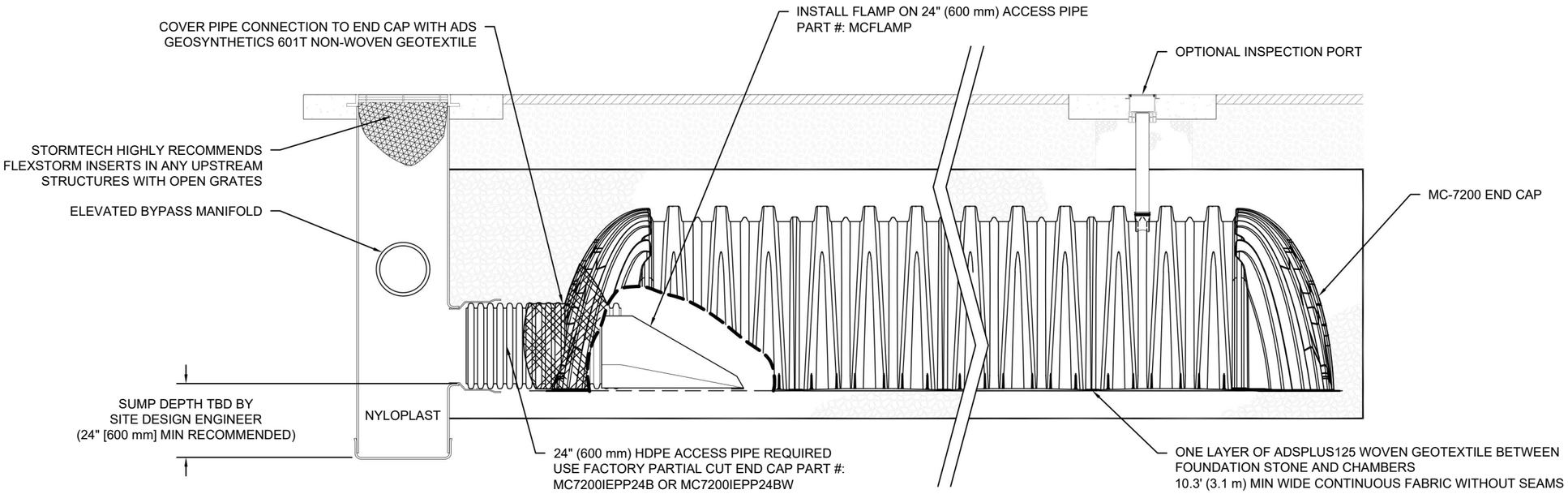
1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

MWIG-007
DUARTE, CA, USA
DATE: 08/26/2024 DRAWN: SM
PROJECT #: CHECKED: N/A

DATE DRW CHK DESCRIPTION

StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



MC-7200 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

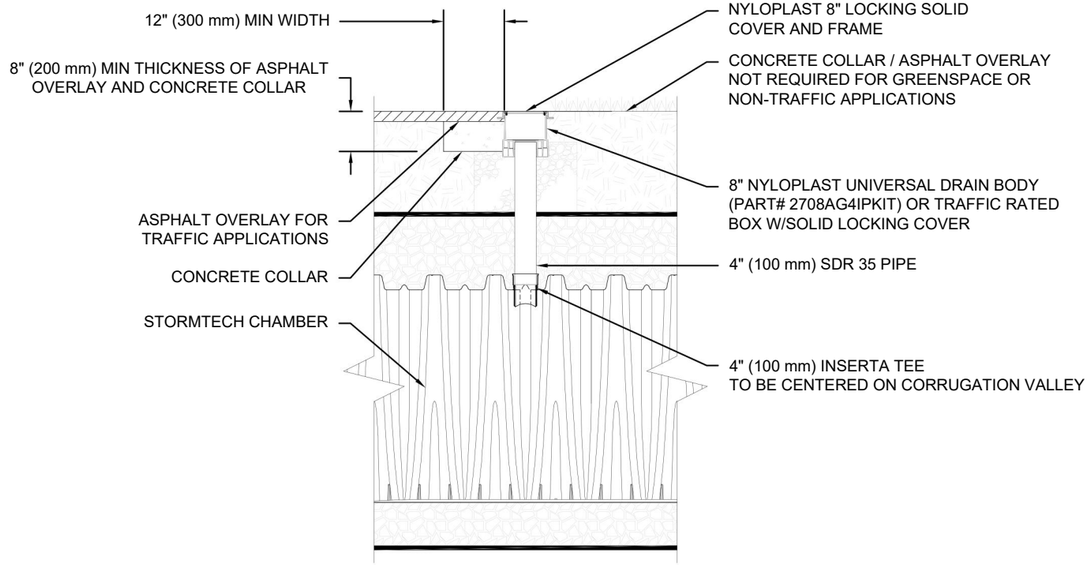
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)
NTS

MWIG-007
DUARTE, CA, USA
DATE: 08/26/2024 DRAWN: SM
PROJECT #: CHECKED: N/A

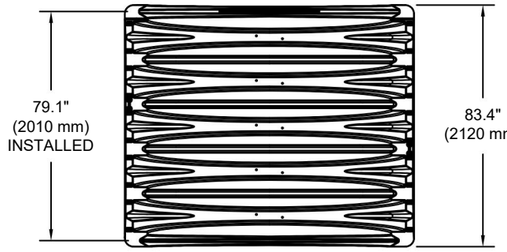
DATE	DRW	CHK	DESCRIPTION

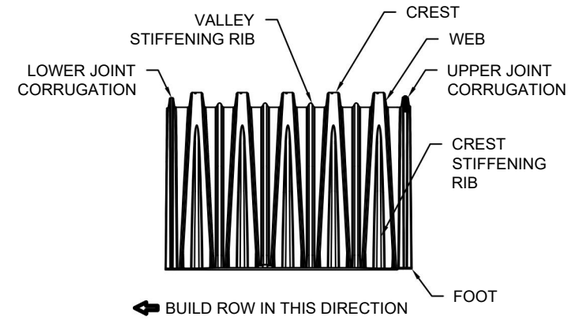
StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

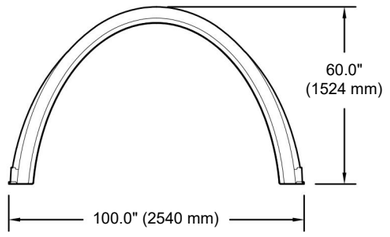
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

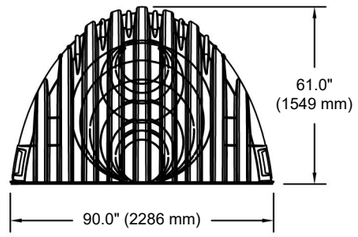
MC-7200 TECHNICAL SPECIFICATION

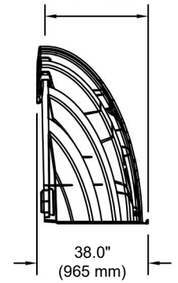
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

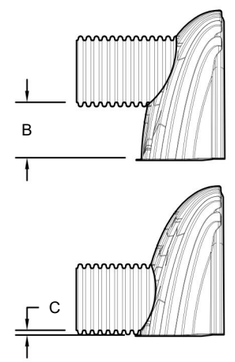
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

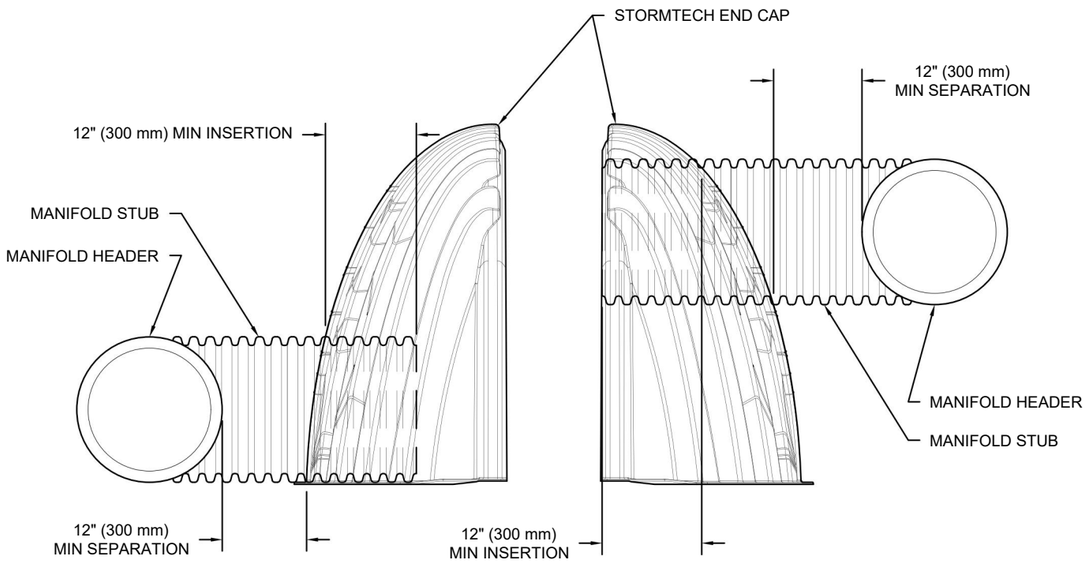
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

MWIG-007
DUARTE, CA, USA
DATE: 08/26/2024 | DRAWN: SM | CHECKED: N/A
PROJECT #:

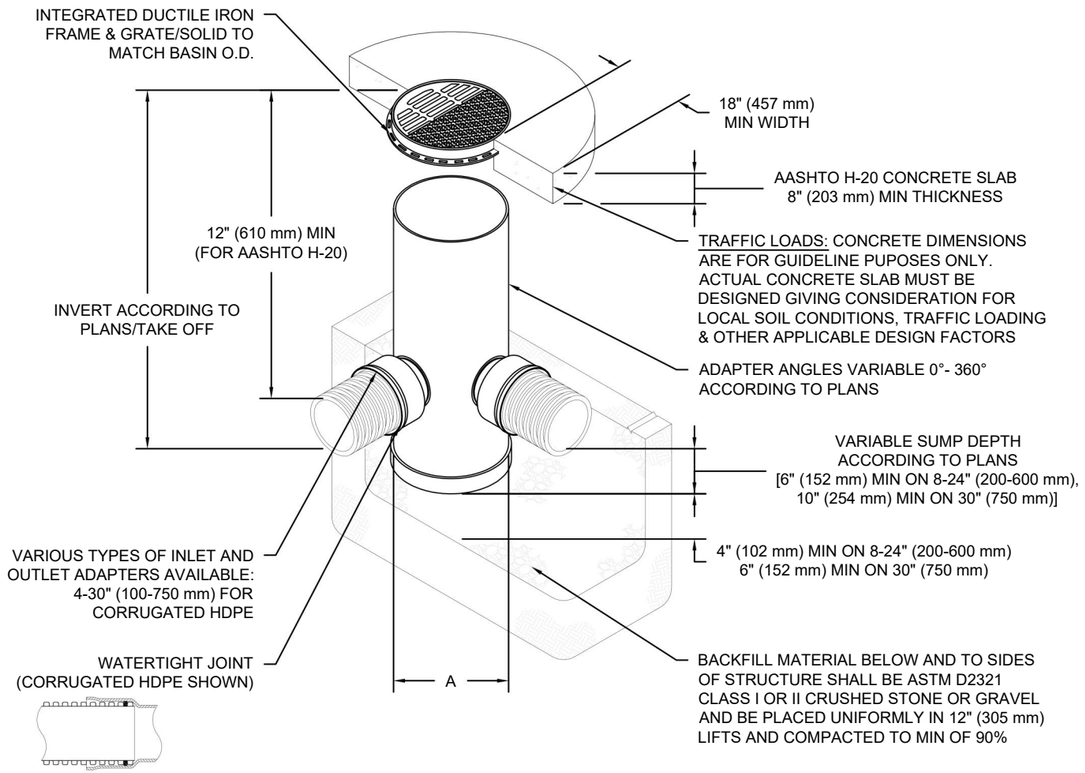
DATE | DRW | CHK | DESCRIPTION

StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

MWIG-007

DUARTE, CA, USA

DATE: 08/26/2024 | DRAWN: SM | CHECKED: N/A

PROJECT #:

DESCRIPTION	CHK	DRW	DATE

Nyloplast®

770-932-2443 | WWW.NYLOPLAST-US.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

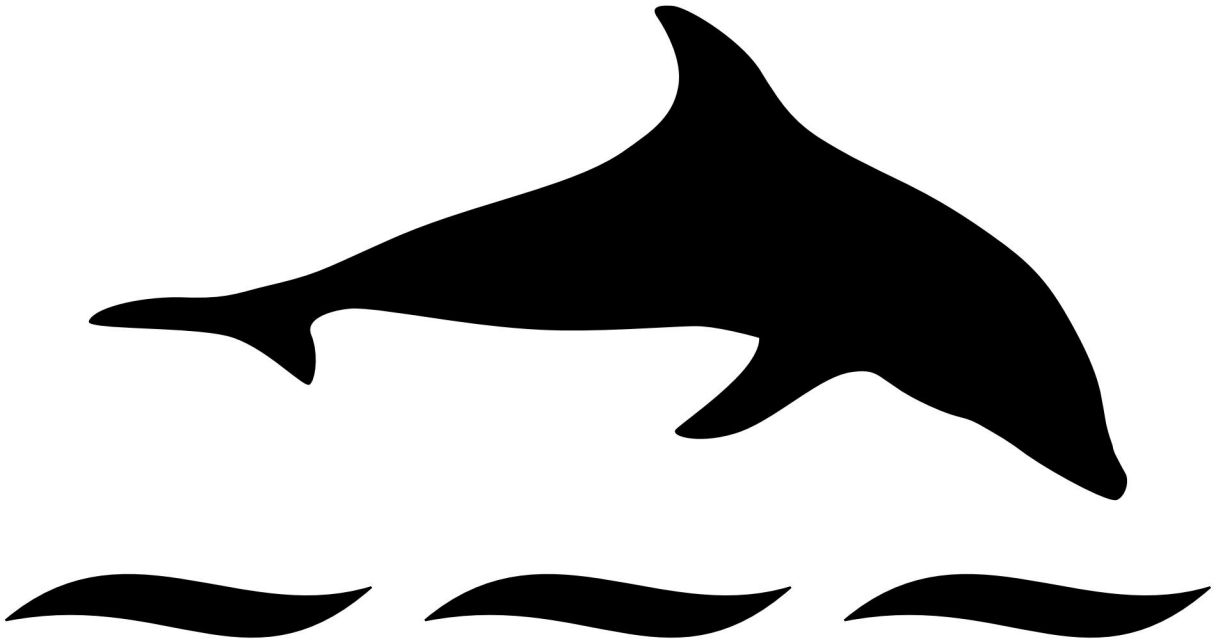
SHEET

6 OF 6

Appendix D:
"NO DUMPING – DRAINS TO OCEAN" Stencil Examples

Sample Stencil 1

NO DUMPING



DRAINS TO OCEAN

Sample Stencil 2

Appendix E:
Catch Basin Cleaning

OPERATION & MAINTENANCE PLAN
FOR FILTER INSERT

The maintenance program will include the following key components:

1. **REGULAR SWEEPING AND REMOVAL OF DEBRIS:**
   Vehicle parking lot will be swept on a regular basis. Sediment and debris (litter, leaves, papers and cans, etc.) within the area, especially around the drainage inlet, will be collected and removed. The frequency of sweeping will be based on the amount of sediment and debris generated.

2. **REGULAR INSPECTIONS:**
   The catch basin, downspout, or trench drain filter insert will be inspected on a regular basis. The frequency of inspection will be based on pollutant loading, amount of debris, leaves, etc., and amount of runoff. At a minimum, there will be three inspections per year.

3. **CONDUCT OF THE VISUAL INSPECTION:**
   a. Broom sweep around the inlet and remove the inlet grate.
   b. Inspect the filter liner for serviceability. If called for, the filter body will be replaced.
   c. Check the condition of the adsorbent pouches and visually check the condition of the enclosed adsorbent. If the surface of the granules is more than 50% coated with a dark gray or black substance, the pouches will be replaced with new ones.
   d. Check for loose or missing nuts (on some models) and gaps between the filter and the inlet wall, which would allow bypass of the filter during low flows.
   e. The filter components will be replaced in the inlet and the grate replaced.

4. **CLEANING OUT THE FILTER INSERT:**
   Regardless of the model of filter insert, the devices must be cleaned out on a recurring basis. The manufacturer recommends at least three cleanings per year – more in high exposure areas. For the Flo-Gard+Plus filters, the filter must be cleaned when the solids level reaches close to the fullel tip.
   a. The Standard Filter, in most cases, can be cleaned out by removing the device from the inlet and dumping the contents into a DOT approved drum for later disposal. If the oil-absorbant pouches need to be changed, the time to change them is immediately after dumping and before the filter is replaced in the inlet.
   b. Because of weight, method of installation and so forth, some filter inserts will be cleaned with the aid of a vactor truck. If necessary, the oil-absorbant pouches will be changed after the pollutants have been removed and as the filter is being returned to service.

5. **MAINTENANCE LOG:**
   Keep a log of all inspections and maintenance performed on the catch basins, trench drains, and filter inserts. Keep this log on-site.

CATCH BASIN MAINTENANCE RECORD

SITE INFORMATION	
Contact:	Phone: ( )
Project Name:	
Address:	
Filter No. & Model:	

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

SITE INFORMATION	
Contact:	Phone: ( )
Project Name:	
Address:	
Filter No. & Model:	

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

CATCH BASIN MAINTENANCE RECORD

SITE INFORMATION		
Contact:	Phone: ( )	
Project Name:		
Address:		
Filter No. & Model:		

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

SITE INFORMATION		
Contact:	Phone: ( )	
Project Name:		
Address:		
Filter No. & Model:		

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

Appendix F:
Operation & Maintenance Plan

StormTech®

Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

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

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

1.2 THE ISOLATOR ROW

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

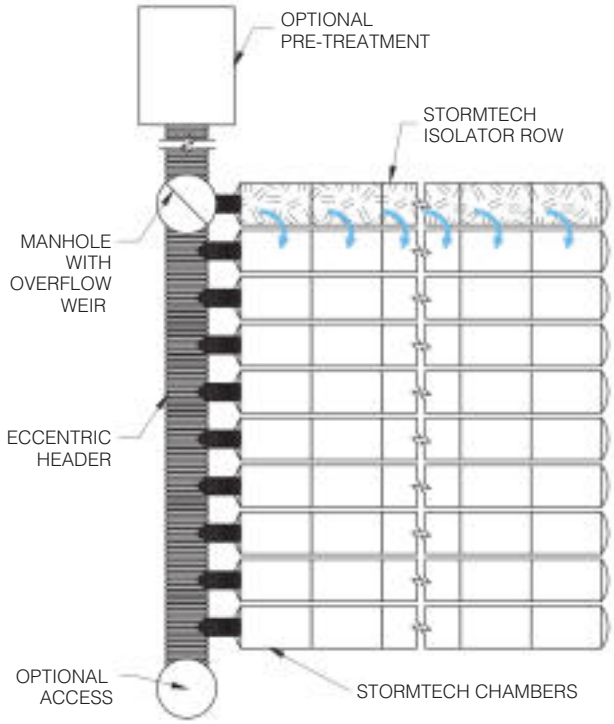
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of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

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

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

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

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

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

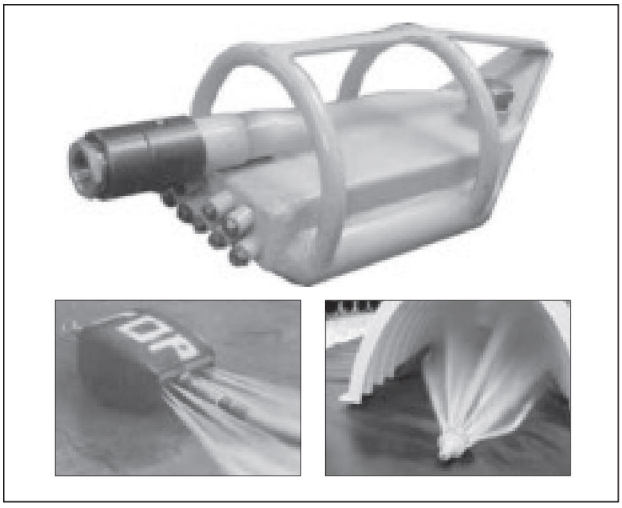
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

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

2.2 MAINTENANCE

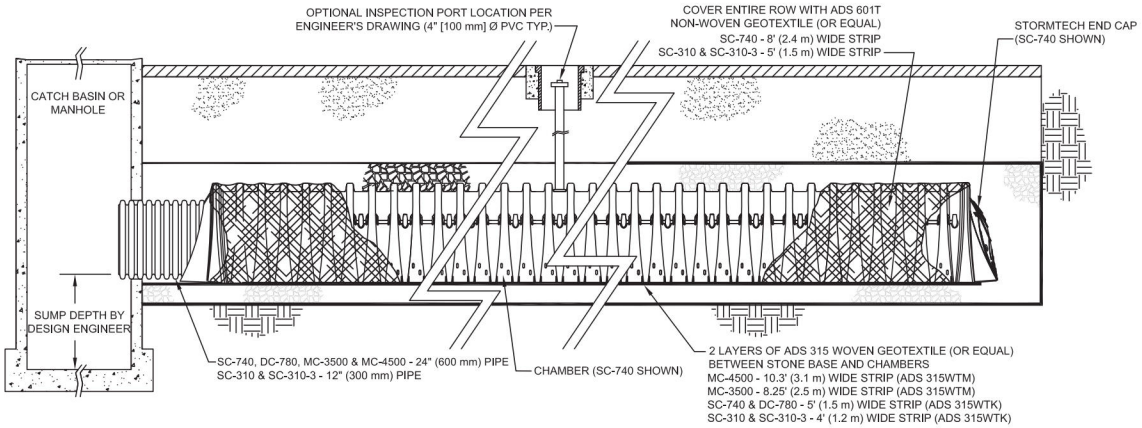
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via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



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

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

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

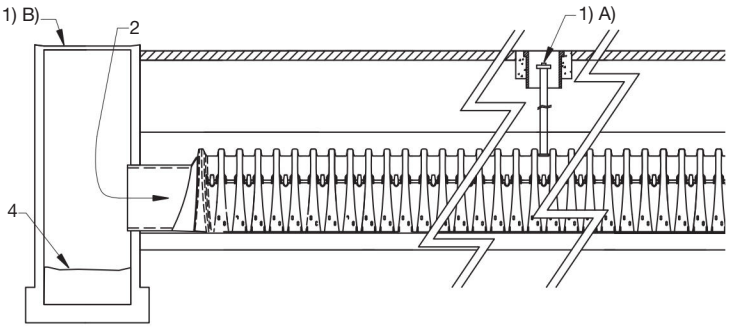
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

StormTech®

Detention • Retention • Water Quality

A division of ADS

70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067

860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

#11011 03/16

Appendix G:
Soils Report

May 29, 2024 Project No. 23218-01

Mr. Matthew J. Waken
Crestfield Townhomes, LLC
27702 Crown Valley Parkway, Suite D-4-197
Ladera Ranch, CA 92694

Subject: ***Preliminary Geotechnical Evaluation and Recommendations, Proposed Residential Development and Sports Park, 1433 Crestfield Drive, Duarte, California***

In accordance with your request and authorization, LGC Geotechnical, Inc. has performed a preliminary geotechnical evaluation for the proposed residential development and sports park, located at 1433 Crestfield Drive, in the City of Duarte, County of Los Angeles, California. The purpose of our study was to evaluate the existing onsite geotechnical conditions and to provide geotechnical recommendations relative to the proposed residential development.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully Submitted,

LGC Geotechnical, Inc.

Ryan Douglas, PE, GE 3147
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
RYAN L. DOUGLAS
No. 3147
GEOTECHNICAL
STATE OF CALIFORNIA

Katie Maes, CEG 2216
Project Geologist

CERTIFIED ENGINEERING GEOLOGIST
KATHERIN M. MAES
No. 2216
STATE OF CALIFORNIA

RLD/JMN/amm

Distribution: (1) Addressee (electronic copy)

TABLE OF CONTENTS

Section ***Page***

LIST OF ILLUSTRATIONS, TABLES, AND APPENDICES

Figures

Tables

Appendices

1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of our preliminary geotechnical evaluation for the proposed residential development, located at 1433 Crestfield Drive, in the City of Duarte, County of Los Angeles, California. Refer to the Site Location Map (Figure 1).

The purpose of our study was to provide a geotechnical evaluation relative to the proposed residential development. As part of our scope of work, we have: 1) reviewed available geotechnical information and in-house geologic maps pertinent to the site (Appendix A); 2) performed a subsurface geotechnical evaluation of the site consisting of the excavation and sampling of twelve small-diameter borings ranging from approximately 1 to 15 feet below existing ground surface, 3) performed six falling head infiltration tests within the borings; 4) performed laboratory testing of select soil samples obtained during our subsurface evaluation; and 5) prepared this preliminary geotechnical summary report presenting our findings and preliminary conclusions and recommendations for the development of the proposed project.

It should be noted that our evaluation and this report only address geotechnical issues associated with the site and do not address any environmental issues.

1.2 Background

Review of historical aerials indicates that the site was primarily used as school and park grounds. In 1948, the site did not appear to have any development. Between 1948 to 1952, the current elementary school buildings located in the southeast portion of the site were constructed. By 1972, the school buildings were constructed on the northwest portion of the site. Between 1952 and 1992 the school and park grounds were further developed and have remained relatively unchanged since about 1992 (Historic Aerials, 2024).

1.3 Project Description

The overall site is approximately 13 acres with approximately 7-acres expected for multi-family residential development and the remaining approximately 5 acres to be a future public park and sports facility. The overall site is bound to the north by existing residential lots on Bloomdale Street, to the east by Crestfield Drive, to the south by Central Avenue, and to the west by Mount Olive Drive. The site is currently occupied by the vacant Andres Duarte Elementary School buildings in the east, Otis Gordan Sports Park in west corner, Mount Olive High School in the northwest corner, and the currently active Andress Duarte Preschool and parking lot in the southeast portion.

The proposed development includes 169 multi-family apartment units, a recreation center and pool, internal streets, a water quality system, public park, and sports facility (KTGY, 2024). The proposed development is expected to be on-grade with cuts and fills on the order 2 to 3 feet. The proposed residential development is anticipated to consist of relatively light building loads (column and wall loads maximum of 25 kips and 2 kips per linear foot, respectively).

The recommendations given in this report are based upon at-grade structures with estimated structural loads and grading information indicated above. LGC Geotechnical should be provided with any updated project information, plans and/or any structural loads when they become available, in order to either confirm or modify the recommendations provided herein.

PROJECT NAME	MWIG - Duarte School
PROJECT NO.	23218-01
ENG. / GEOL.	RLD
SCALE	Not to Scale
DATE	May 2024

LGC Geotechnical, Inc.

FIGURE 1
Site Location Map

1.4 Subsurface Geotechnical Evaluation

A limited subsurface geotechnical evaluation of the site was performed by LGC Geotechnical. Our exploration program consisted of drilling and sampling twelve small-diameter exploratory hollow-stem borings (HS-1 through HS-4, and I-1 through I-8) for the purpose of obtaining samples for evaluation and laboratory testing of site soils and performing infiltration testing.

The borings were drilled by Choice Drilling under subcontract to LGC Geotechnical. The depths of the borings ranged from approximately 1 to 15 feet below existing grade. An LGC Geotechnical representative observed the drilling operations, logged the borings, and collected soil samples for laboratory testing. The borings were performed using a CME 75 & CME 95 truck-mounted drill rig equipped with 8-inch-diameter hollow-stem augers. Bulk samples of the near-surface soils were logged and collected for laboratory testing from select borings. Driven soil samples were collected by means of the Standard Penetration Test (SPT) and Modified California Drive (MCD) sampler generally obtained at 2.5 and 5-foot vertical increments. The MCD is a split-barrel sampler with a tapered cutting tip and lined with a series of 1-inch-tall brass rings. The SPT sampler (1.4-inch ID) and MCD sampler (2.4-inch ID, 3.0-inch OD) were driven using a 140-pound automatic hammer falling 30 inches to advance the sampler a total depth of 18 inches or until refusal. The raw blow counts for each 6-inch increment of penetration were recorded on the boring logs. The borings were subsequently backfilled with soil cuttings and tamped. Some settlement of the backfill soils may occur over time.

Infiltration testing was performed within six borings (I-1 and I-4 through I-8) to depths ranging from approximately 3 to 15 feet below existing grade. An LGC Geotechnical engineer installed standpipes, backfilled the borings with crushed rock and pre-soaked the infiltration holes prior to testing. Infiltration testing was performed per the County of Los Angeles testing guidelines (2021). Standpipes were removed and the locations were subsequently backfilled with native soils at the completion of testing. Some settlement of the backfill soils may occur over time.

The approximate locations of our subsurface explorations are provided on the Boring Location Map (Figure 2). The boring and infiltration boring logs are provided in Appendix B.

1.5 Field Infiltration Testing

Six shallow infiltration test wells were installed in Borings I-1 and I-4 through I-8 to depths that range from approximately 3 of 15 feet below existing grade. The approximate infiltration boring locations are shown on the Boring Location Map (Figure 2). Estimation of infiltration rates was performed in general accordance with the "Boring Percolation Test Procedure" guidelines set forth by the County of Los Angeles testing guidelines (2021). The borings for the infiltration tests were excavated using a drill rig equipped with 8-inch diameter hollow-stem augers. A 3-inch diameter perforated PVC pipe was placed in the borehole above a thin layer of gravel and the annulus was backfilled with gravel. Infiltration tests were performed using relatively clean water free of particulates, silt, etc. The infiltration wells were pre-soaked during the day of drilling and a 30-minute pre-test was performed during the day of testing. Subsequently, readings were taken a minimum of 6 times or until a "stabilized rate" was established. A "stabilized rate" is when the highest and lowest readings are within 10 percent of each other over three consecutive readings. At the completion of infiltration testing, the pipe was removed, and the holes were backfilled and tamped.

Based on the County of Los Angeles testing guidelines (2021), the infiltration rate is calculated by dividing the volume of water discharged by the surface area of the test section (including the sidewalls and bottom of the boring) over a specific time period. The measured infiltration rate is taken as the average of the last three readings during which a "stabilized rate" is achieved. The measured infiltration rates are provided in Table 1 below.

TABLE 1

Summary of Field Infiltration Testing

Infiltration Test Location	Approximate Infiltration Test Depth (ft)	Measured Infiltration Rate* (inch/hr.)
I-1	3.5	3.6
I-4	3.0	4.9
I-5	15.0	1.3
I-6	12.0	2.8
I-7	10.0	0.4
I-8	12.0	2.7

*Does Not Include Required Reduction Factors for Design.

Please note that the values provided in Table 1 do not include reduction factors associated with the test procedure, site variability, and long-term siltation plugging that are used to calculate the design infiltration rate. Infiltration test data is presented in Appendix D. Refer to Section 4.6 for recommendations regarding infiltration of stormwater.

1.6 Laboratory Testing

Representative bulk, grab, and driven (relatively undisturbed) samples were retained for laboratory testing during our field evaluation. Laboratory testing included in-situ moisture content and in-situ dry density, expansion index, fines content, direct shear, laboratory compaction, R-value, and corrosion (sulfate, chloride, pH and minimum resistivity).

The following is a summary of the laboratory test results:

- Dry density of the samples collected ranged from approximately 74.5 pounds per cubic foot (pcf) to 128.5 pcf, with an average of 110.5 pcf. Field moisture contents ranged from approximately 1 to 16.2 percent, with an average of approximately 4.7 percent.
- Expansion potential testing indicated an expansion index of 0 to 16, corresponding to "Very Low" expansion potential.
- Seven sieve particle size analyses test were performed and indicated fines contents (passing No. 200 sieve) ranging from 11 and 34 percent.
- One direct shear test performed. Results are provided in Appendix C.
- Laboratory compaction of a near-surface bulk sample resulted in a maximum dry density of 133.0 pcf at an optimum moisture content of 7.0 percent.
- One R-value test was performed and resulted in an R-value of 48. Results are provided in

Appendix C.

- Corrosion testing indicated soluble sulfate content of less than 0.01 percent, a chloride content of 50 parts per million (ppm), pH of 7.89 and a minimum resistivity of 13,700 ohm-centimeters.

A summary of the laboratory test results is presented in Appendix C. The moisture and dry density results are presented on the boring logs in Appendix B.

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is generally located within the Peninsular Ranges Geomorphic Province of California, more specifically within the valley located just south of the foothills of the San Gabriel Mountains. The San Gabriel Mountains of today are the result of ancient crystalline rocks thrust upwards and toward the south along range-bounding faults belonging to the Sierra Madre Fault system (CDMG, 1998). The nearest known fault in the zone trends approximately east-west and passes approximately 1800 feet north of the subject site, within the foothills of the range front (CGS, 2024). Regional topography was further shaped by streams draining from the mountains to deposit alluvial fans across the valley. Within the area of the subject site, alluvial deposits dissected by southwest trending erosion rills created a broad area of low relief with gentle swales. The San Gabriel River, the largest watershed and alluvial fan in the area, trends southwest approximately 1,500 feet east of the site.

2.2 Site-Specific Geology and Generalized Subsurface Conditions

Based on review of available geologic maps (Morton & Miller, 2003), the primary geologic unit underlying the site is late Holocene-age, young alluvial fan deposit. The site is specifically on the western flank of the series of large alluvial fan deposits emanating from the San Gabriel River at the base of the San Gabriel Mountains.

The field explorations (borings) indicate the native alluvial fan deposits generally consist of variable amounts of silty to gravelly sand with cobbles that are grayish brown to dark brown, dry to moist, and generally very dense to the maximum explored depth of approximately 15 feet below existing grade. Difficult drilling conditions due to rocky materials resulted in refusal for the majority of borings. Minor amounts of undocumented fill may exist throughout the site.

It should be noted that borings are only representative of the location and time where/when they are performed and varying subsurface conditions may exist outside of the performed location. In addition, subsurface conditions can change over time. The soil descriptions provided above should not be construed to mean that the subsurface profile is uniform, and that soil is homogeneous within the project area. For details on the stratigraphy at the exploration locations, refer to Appendix B.

2.3 Groundwater

Groundwater was not encountered to the maximum depth of approximately 15 feet below existing ground surface during our subsurface evaluation. Historic high groundwater is approximately 150 feet below current grade per the Seismic Hazard Report for the Azusa 7.5-Minute Quadrangle (CDMG, 1998). Groundwater is not expected to impact the proposed development.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be

present due to local seepage caused by irrigation and/or recent precipitation. Local perched groundwater conditions or surface seepage may develop once site development is completed.

2.4 Seismic Design Criteria

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2022 California Building Code (CBC) and applicable portions of ASCE 7-16 which has been adopted by the CBC. Please note that the following seismic parameters are only applicable for code-based acceleration response spectra and are not applicable for where site-specific ground motion procedures are required by ASCE 7-16. Representative site coordinates of latitude 34.13744 degrees north and longitude -117.95336 degrees west were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class C are provided in Table 2 below. The structural designer should contact the geotechnical consultant if structural conditions (e.g., number of stories, seismically isolated structures, etc.) require site-specific ground motions.

TABLE 2

Seismic Design Parameters

Selected Parameters from 2022 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**	**Notes/Exceptions**
Distance to applicable faults classifies the site as a "Near-Fault" site.		Section 11.4.1 of ASCE 7
Site Class	C	Chapter 20 of ASCE 7
Ss (Risk-Targeted Spectral Acceleration for Short Periods)	1.751g	From SEAOC, 2024
S_1 (Risk-Targeted Spectral Accelerations for 1-Second Periods)	0.663g	From SEAOC, 2024
F_a (per Table 1613.2.3(1))	1.200	For Simplified Design Procedure of Section 12.14 of ASCE 7, F_a shall be taken as 1.4 (Section 12.14.8.1)
F_v (per Table 1613.2.3(2))	1.400	-
S_{MS} for Site Class C [Note: $S_{MS} = F_a S_S$]	2.101g	-
S_{M1} for Site Class C [Note: $S_{M1} = F_v S_1$]	0.928g	-
S_{DS} for Site Class C [Note: $S_{DS} = (^2/_3) S_{MS}$]	1.400g	-
S_{D1} for Site Class C [Note: $S_{D1} = (^2/_3) S_{M1}$]	0.619g	-
C_{RS} (Mapped Risk Coefficient at 0.2 sec)	0.911	ASCE 7 Chapter 22
C_{R1}(Mapped Risk Coefficient at 1 sec)	0.904	ASCE 7 Chapter 22

A deaggregation of the PGA based on a 2,475-year average return period (MCE) indicates that an earthquake magnitude of 6.82 at a distance of approximately 5.2 km from the site would contribute the most to this ground motion (USGS, 2014).

Section 1803.5.12 of the 2022 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.905g (SEAOC, 2024).

2.5 Faulting

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. Their purpose was to prevent the construction of urban developments across the trace of active faults, resulting in the Alquist-Priolo Earthquake Fault Zoning Act. Earthquake Fault Zones have been delineated along the traces of active faults within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault evaluations be performed so that engineering geologists can mitigate the hazards associated with active faulting by identifying the location of active faults and allowing for a setback from the zone of previous ground rupture.

The subject site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo) and no active faults are identified on the site (CGS, 2024; CDMG, 1999). The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site. The closest major active faults that could produce these secondary effects include the Sierra Madre, Raymond, Elsinore, Newport-Inglewood, and San Andreas Fault Zones, among others.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching and shallow ground rupture, soil liquefaction, and dynamic settlement. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault and the onsite geology. A discussion of these secondary effects is provided in the following sections.

2.5.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose near-surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction, depending on their plasticity and moisture content (Bray & Sancio, 2006). Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity

failures below structures. Dynamic settlement of dry loose sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Based on our review of the State of California Seismic Hazard Zone for liquefaction potential (CDMG, 1999), the subject site is not within a liquefaction hazard zone. Based on the proposed development and remedial grading, the site will primarily consist of compacted fill over very dense native soils without the presence of shallow groundwater. Therefore, the potential for post construction liquefaction and liquefaction-induced dynamic settlement is considered very low.

2.5.2 Lateral Spreading

Lateral spreading is a type of liquefaction-induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

Due to the lack of nearby "free face" conditions, lack of groundwater in the upper 50 feet, and very low potential for liquefaction, the potential for lateral spreading is considered very low.

2.6 Oversized Material

Oversized material (material larger than 8 inches in maximum dimension) will be encountered within the undocumented fills and native alluvial materials. These oversized materials may include construction debris, concrete, and native cobble. Significant amounts of gravel, cobble, and the occasional boulder were encountered in our limited field evaluation and should be expected during construction. Recommendations are provided for appropriate handling of oversized materials in Section 4.1.6.1 and Appendix E.

2.7 Expansion Potential

Based on the results of our preliminary laboratory testing, site soils are anticipated to have a "Very Low" expansion potential. Final expansion potential of site soils should be determined at the completion of grading. Results of expansion testing at finish grades will be utilized to confirm final foundation design.

3.0 CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are implemented.

The following is a summary of the primary geotechnical factors that may affect future development of the site:

- In general, field explorations (borings) indicate primarily native soils consisting of variable amounts of silty sand, gravel, and cobbles that are grayish brown dark brown, dry to moist, and generally very dense, to the maximum explored depth of approximately 15 feet below existing grade. The near-surface soils are not suitable for the planned improvements in their present condition (refer to Section 4.1).
- Groundwater was not encountered during our subsurface evaluation to the maximum explored depth of approximately 15 feet below current grade. Historic high groundwater is approximately 150 feet below current grade (CDM, 1998).
- The subject site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo). The main seismic hazard that may affect the site is ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life.
- The site is not located within a State of California Seismic Hazard Zone for liquefaction potential (CDMG, 1999). The potential for liquefaction and liquefaction induced seismic settlement is considered very low due to the very dense materials encountered and lack of groundwater in the upper 50 feet.
- Based on the results of preliminary laboratory testing, site soils are anticipated to have "Very Low" expansion potential. Final design expansion potential must be determined at the completion of grading.
- Based on the corrosion test results, soils are not considered corrosive per the Caltrans criteria (Caltrans, 2021).
- Much of the onsite soils may not be suitable for retaining wall backfill due to the material size (greater than 3 inches in maximum dimension). Therefore, select grading, screening, and stockpiling of the onsite sandy soils or import of sandy soils meeting the project requirements should be anticipated by the contractor.
- Excavations into the existing site soils should be feasible with heavy construction equipment in good working order. From a geotechnical perspective, the existing onsite soils are suitable material for use as fill, provided that they are relatively free from oversized material (larger than 8 inches in maximum dimension), construction debris, and significant organic material.
- Oversized material (material larger than 8 inches in maximum dimension) will be encountered within the undocumented fills and native alluvial materials. These oversized materials may include construction debris, concrete, or native cobble. The oversized materials should be crushed to acceptable size or exported from the site. Incorporating the oversized material into "rock fills" is likely not feasible due to the limited depth of grading.

4.0 PRELIMINARY RECOMMENDATIONS

The following recommendations are to be considered preliminary and should be confirmed upon completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the owner.

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2022 CBC requirements. With regard to the potential occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvements may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable protection against the potential damaging effects of geotechnical phenomena such as expansive soils, fill settlement, groundwater seepage, etc. It should be understood, however, that although our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions, they cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

The geotechnical recommendations contained herein must be confirmed to be suitable or modified based on the actual as-graded conditions.

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of the removal of existing improvements associated with the former land use followed by the required earthwork removals, precise grading, and construction of the proposed new improvements, including the residential structures, subsurface utilities, interior streets, etc.

We recommend that earthwork onsite be performed in accordance with the following recommendations, future grading plan review report(s), the 2022 CBC/City of Duarte grading requirements, and the General Earthwork and Grading Specifications included in Appendix E. In case of conflict, the following recommendations shall supersede those included in Appendix E. The following recommendations should be considered preliminary and may be revised based upon future evaluation and review of the project plans and/or based on the actual conditions encountered during site grading/construction.

4.1.1 Site Preparation

Prior to grading of areas to receive structural fill or engineered improvements, the areas should be cleared of existing asphalt, surface obstructions, and demolition debris.

Vegetation and debris should be removed and properly disposed of off-site. Holes resulting from the removal of buried obstructions, which extend below proposed finish grades, should be replaced with suitable compacted fill material. Any abandoned sewer or storm drain lines should be completely removed and replaced with properly placed compacted fill. Deeper demolition may be required in order to remove existing foundations. We recommend the trenches associated with demolition which extend below the remedial grading depth be backfilled and properly compacted prior to the demolition contractor leaving the site.

If cesspools or septic systems are encountered, they should be removed in their entirety. The resulting excavation should be backfilled with properly compacted fill soils. As an alternative, cesspools can be backfilled with lean sand-cement slurry. Any encountered wells should be properly abandoned in accordance with regulatory requirements. At the conclusion of the clearing operations, a representative of LGC Geotechnical should observe and accept the site prior to further grading.

4.1.2 Removal and Recompaction Depths and Limits

In order to provide a relatively uniform bearing condition for the planned building structures, upper loose/compressible soils are to be temporarily removed and recompacted as properly compacted fills. Existing undocumented artificial fill within the influence of the proposed structural improvements should be removed to suitable, competent native materials prior to placement of artificial fill to design grades. For preliminary planning purposes, the depth of recommended removals and recompaction may be estimated as indicated below. It should be noted that updated recommendations may be required based on changes to building layouts and/or grading plan.

Building Structures: We recommend that soils within building pads be removed and recompacted to a minimum depth of 5 feet below existing grade or 2 feet below the base of the foundations, whichever is deeper. Where space is available, the envelope for removal and recompaction should extend laterally a minimum distance equal to the depth of removal and recompaction below finish grade or 5 feet beyond the edges of the proposed building improvements, whichever is larger.

Minor Site Structures: For minor site structures such as free-standing walls, retaining walls, etc., temporary removal and recompaction should extend a minimum of 3 feet below existing grade or 2 feet below proposed footings, whichever is greater. Where space is available, the envelope for removal and recompaction should extend laterally a minimum distance of 3 feet beyond the edges of the proposed minor site structure improvements.

Pavement and Hardscape Areas: Within pavement and hardscape areas, temporary removal and recompaction should extend to a depth of at least 2 feet below existing grade or 1 foot below the bottom of the pavement section, whichever is deeper. Pavement areas encountering undocumented fill materials may require deeper removal and recompaction and should be determined based on the conditions exposed during grading. In general, the envelope for removal and recompaction should extend laterally a minimum lateral

distance of 2 feet beyond the edges of the proposed pavement or hardscape improvements.

Local conditions may be encountered during excavation that could require additional over-excavation beyond the above noted minimum in order to obtain an acceptable subgrade. The actual depths and lateral extents of grading will be determined by the geotechnical consultant, based on subsurface conditions encountered during grading. Removal areas and areas to be over-excavated should be accurately staked in the field by the Project Surveyor.

4.1.3 Temporary Excavations

Temporary excavations should be performed in accordance with project plans, specifications, and all Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter.

Based on our field evaluation, site soils are anticipated to be OSHA Type "C" soils (refer to the attached boring logs). Sandy soils are present and should be considered susceptible to caving. Soil conditions should be regularly evaluated during construction to verify conditions are as anticipated. The contractor shall be responsible for providing the "competent person," required by OSHA standards, to evaluate soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Where proposed improvements will be adjacent to property lines, the potential for impacting existing offsite improvements may be reduced by performing "ABC" slot cuts while performing earthwork removal and recompaction. "ABC" slot cuts are defined as excavations perpendicular to sensitive property boundaries that are divided into multiple "slots" of equal width. If slots are labeled A, B, C, A, B, C, etc., then all "A" slots can be excavated at the same time but must be backfilled before all "B" slots can be excavated, etc. Any given slot should be backfilled immediately with properly compacted fill to finish grade prior to excavation of the adjacent two slots. Please note sands susceptible to caving are present at the site. Recommendations for slot cut dimensions should be evaluated during grading. Protection of the existing offsite improvements during grading is the responsibility of the contractor.

Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of excavations a distance equivalent to a 1:1 projection from the bottom of the excavation. Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

It should be noted that any excavation that extends below a 1:1 (horizontal to vertical) projection of an existing foundation will remove existing support of the structure foundation. Temporary shoring recommendations can be provided upon request.

4.1.4 Removal Bottoms and Subgrade Preparation

In general, removal bottom areas and any areas to receive compacted fill should be scarified to a minimum depth of 6 inches, brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content), and re-compacted per project recommendations.

Removal bottoms, over-excavation bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement. Soil subgrade for planned footings and improvements (e.g., slabs, etc.) should be firm and competent.

4.1.5 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill, provided they are screened of organic materials, construction debris, and oversized material (8 inches in greatest dimension).

From a geotechnical viewpoint, any required import soils for general fill (i.e., non-retaining wall backfill) should consist of clean, granular soils of "Very Low" expansion potential (expansion index 20 or less based on ASTM D 4829), and generally free of organic materials, construction debris and material greater than 3 inches in maximum dimension. Import for required retaining wall backfill should meet the criteria outlined in the following paragraph. Source samples should be provided to the geotechnical consultant for laboratory testing a minimum of four working days prior to planned importation.

Retaining wall backfill should consist of sandy soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a "Very Low" expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris, and any material greater than 3 inches in maximum dimension. Much of the onsite soils may not be suitable for retaining wall backfill due to the material size (greater than 3 inches in maximum dimension). Therefore, select grading, screening, and stockpiling of the onsite sandy soils or import of sandy soils meeting the project requirements should be anticipated by the contractor for obtaining suitable retaining wall backfill soil.

Aggregate base (crushed aggregate base or crushed miscellaneous base) should conform to the requirements of Section 200-2 of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials (except processed miscellaneous base) or Caltrans Class 2 aggregate base.

The placement of demolition materials in compacted fill is acceptable from a geotechnical viewpoint provided the demolition material is broken up into pieces not larger than approximately 1 to 3-inches in maximum dimension, and well blended into fill soils with essentially no resulting voids. Demolition material placed in fills must be free of construction debris (wood, brick, etc.) and reinforcing steel. If asphalt concrete fragments will be incorporated into the demolition materials, approval from an environmental

viewpoint may be required and is not the purview of the geotechnical consultant. From our previous experience, we recommend that asphalt concrete fragments be limited to fill areas within planned streets, alleys, or non-structural areas (i.e., not within building pad areas).

4.1.6 Placement and Compaction of Fills

Material to be placed as fill should be brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. Soils will generally require additional moisture in order to achieve the required compaction. Drying and/or mixing the very moist soils may also be required prior to reusing the materials in compacted fills.

The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and with observation and testing performed by the geotechnical consultant. Oversized material as previously defined should be removed from site fills. During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts.

Aggregate base material should be compacted to at least 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to at least 90 percent relative compaction per ASTM D1557 at or slightly above optimum moisture content (generally within optimum and 2 percent above optimum moisture content).

If gap-graded ¾-inch rock is used for backfill (around storm drain storage chambers, retaining wall backfill, etc.) it will require compaction. Rock shall be placed in thin lifts (typically not exceeding 6 inches) and mechanically compacted with observation by geotechnical consultant. Backfill rock shall meet the requirements of ASTM D2321. Gap-graded rock is required to be wrapped in filter fabric (Mirafi 140N or approved alternative) or at the very minimum to be vertically separated from the trench backfill with filter fabric to prevent the migration of fines into the rock backfill.

4.1.6.1 Oversized Placement

Significant amounts of oversized material (material larger than 8 inches in maximum dimension for general fill) should be expected during site grading.

Oversized materials encountered during grading should be exported from the site. If feasible, crushing oversized materials onsite and incorporating the smaller materials (less than 8 inches in maximum dimension) into the

general fill may be considered. Incorporating oversized materials into "rock fills" (windrows, rock blankets or individual rock burial) is likely not feasible due to the limited depth of grading. Special handling recommendations should be provided on a case-by-case basis, if necessary. Additional recommendations are provided for appropriate handling of oversized materials in General Earthwork & Grading Specifications, Appendix E.

4.1.7 Trench and Retaining Wall Backfill and Compaction

Bedding material used within the pipe zone should conform to the requirements of the current Greenbook and the pipe manufacturer. Where applicable, sand having a sand equivalent (SE) of 20 or greater (per Caltrans Test Method [CTM] 217) may be used to bed and shade the pipes within the bedding zone. Sand backfill should be densified by jetting or flooding and then tamped to ensure adequate compaction. Bedding sand should be from a natural source, manufactured sand from recycled material is not suitable for jetting. The onsite soils may generally be considered suitable as trench backfill (zone defined as 12 inches above the pipe to subgrade), provided the soils are screened of rocks greater than 6 inches in maximum dimension, construction debris and organic material. Trench backfill should be compacted in uniform lifts (as outlined above in Section "Material for Fill") by mechanical means to at least 90 percent relative compaction (per ASTM D1557). If gap-graded rock is used for trench backfill, refer to the above Section.

Retaining wall backfill should consist of sandy soils as outlined in preceding Section 4.1.5. The limits of select sandy backfill should extend at minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater (Figure 3). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

In backfill areas where mechanical compaction of soil backfill is impractical due to space constraints, typically sand-cement slurry may be substituted for compacted backfill. The slurry should contain about one sack of cement per cubic yard. When set, such a mix typically has the consistency of compacted soil. Sand cement slurry placed near the surface within landscape areas should be evaluated for potential impacts on planned improvements.

A representative from LGC Geotechnical should observe, probe, and test the backfill to verify compliance with the project recommendations.

4.1.8 Shrinkage and Subsidence

Allowance in the earthwork volumes budget should be made for an estimated 0 to 10 percent reduction (shrink) in volume of near-surface (upper approximate 5 feet) soils. It should be stressed that these values are only estimates and that an actual shrinkage factor would be extremely difficult to predetermine. Subsidence, due to earthwork operations, is expected to be on the order of 0.1 feet. These values are estimates only and exclude losses due to removal of vegetation or debris. The effective shrinkage of onsite

soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor and accuracy of the topographic survey.

4.2 Preliminary Foundation Recommendations

Provided that the remedial grading recommendations provided herein are implemented, the site may be considered suitable for the support of the residential structures using a conventional foundation system. Site soils are anticipated to be "Very Low" expansion potential (EI of 20 or less per ASTM D4829) and special design considerations from a geotechnical perspective is not anticipated, however, this must be verified based on as-graded conditions. Please note that the following foundation recommendations are preliminary and must be confirmed by LGC Geotechnical.

Preliminary foundation recommendations are provided in the following sections. Recommended soil bearing and estimated settlement due to structural loads are provided in Section 4.3.

4.2.1 Provisional Conventional Foundation Design Parameters

The required slab thickness and reinforcement should be determined by the structural designer. The moisture content of near surface fill soils should be kept at optimum moisture content to a minimum depth of 12 inches prior to trenching and concrete placement.

The foundation designer may use a modulus of vertical subgrade reaction (k) of 200 pounds per cubic inch (pounds per square inch per inch of deflection). This value is for a 1-foot by 1-foot square loaded area and should be adjusted by the structural designer for the area of the proposed foundation using the following formula:

$k = 200 \times [(B+1)/2B]^2$
k = modulus of vertical subgrade reaction, pounds per cubic inch (pci)
B = foundation width (feet)

4.2.2 Foundation Subgrade Preparation and Maintenance

Moisture conditioning of the subgrade soils is recommended prior to trenching the foundation. The recommendations specific to the anticipated site soil conditions are presented herein. The subgrade moisture condition of the building pad soils should be maintained at near-optimum moisture content up to the time of concrete placement. This moisture content should be maintained around the immediate perimeter of the slab during construction and up to occupancy of the homes.

The geotechnical parameters provided herein assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage and adequately maintained so that ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Plants should only be provided

with sufficient irrigation for life and not overwatered to saturate subgrade soils. Sunken planters placed adjacent to the foundation should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

In addition to the factors mentioned above, the owner should be made aware of the potential negative influences of trees and/or other large vegetation. Roots that extend near the vicinity of foundations can cause distress to foundations. The owner (and the owner's landscape architect) should not plant trees/large shrubs closer to the foundations than a distance equal to half the mature height of the tree or 20 feet, whichever is more conservative unless specifically provided with root barriers to prevent root growth below the house foundation.

It is the owner's responsibility to perform periodic maintenance during hot and dry periods to ensure that adequate watering has been provided to keep soils from separating or pulling back from the foundation. The owner should be informed and educated regarding the importance of maintaining a constant level of soil-moisture. The owner should be made aware of the potential negative consequences of both excessive watering, as well as allowing potentially expansive soils to become too dry. Expansive soils can undergo shrinkage during drying and swelling during the rainy winter season or when irrigation is resumed. This can result in distress to building structures and hardscape improvements.

4.2.3 Slab Underlayment Guidelines

The following recommendations are for informational purposes since they are unrelated to the geotechnical performance of the foundation. Some post-construction moisture migration should be expected below the foundation; the foundation engineer must assume soil moisture to be present below the slab. The following recommendations may be superseded by the foundation engineer and/or owner.

In general, interior floor slabs with moisture sensitive floor coverings should be underlain by a minimum 10-15 mil thick vapor retarder, which has a water vapor transmission rate (permeance) of less than 0.3 perms, as determined by ASTM E 96, and meets the applicable code requirements (ASTM E 1745).

It is the responsibility of the contractor to ensure that the moisture/vapor retarder systems are properly installed in accordance with the project plans and manufacturer's specifications, and that the moisture/vapor retarder materials are free of tears and punctures prior to and as a result of concrete placement. Additional moisture reduction and/or prevention measures may be needed, depending on the performance requirements of future interior floor coverings.

The foundation engineer/architect should determine whether the use of a capillary break (sand or gravel layer) in conjunction with the vapor retarder is necessary or required by code. Sand layer thickness and location (above and/or below vapor retarder) should also be determined by the foundation engineer/architect. However, we

often observe the membrane to be sandwiched between a layer of sand, 1 inch above and 1 inch below. Sand layers should be installed, where applicable, in accordance with ACI Publication 302 – "Guide for Concrete Floor and Slab Construction."

4.3 Soil Bearing and Lateral Resistance

Provided our earthwork recommendations are implemented, an allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used for the design of footings having a minimum width of 12 inches and minimum embedment of 12 inches below lowest adjacent ground surface. This value may be increased by 300 psf for each additional foot of embedment of 150 psf for each additional foot of foundation width to a maximum value of 3,000 psf. A mat foundation a minimum of 6 inches below lowest adjacent grade may be designed for an allowable soil bearing pressure of 1,200 psf. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. Bearing values indicated are for total dead loads and frequently applied live loads and may be increased by ⅓ for short duration loading (i.e., wind or seismic loads).

In utilizing the above-mentioned allowable bearing capacity, and provided our earthwork recommendations are implemented, foundation settlement due to structural loads is anticipated to be 1-inch or less. Differential settlement may be taken as half of the total settlement (i.e., ½-inch over a horizontal span of 40 feet).

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.35 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 250 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for the sides of footings poured against properly compacted fill. Allowable passive pressure may be increased to 340 pcf (maximum of 3,400 psf) for short duration seismic loading. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions. Frictional resistance and passive pressure may be used in combination without reduction. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt. The provided allowable passive pressures are based on a factor of safety of 1.5 and 1.1 for static and seismic loading conditions, respectively.

4.4 Lateral Earth Pressures for Retaining Walls

Lateral earth pressures for approved native sandy soil or imported soils meeting indicated project requirements are provided below. Lateral earth pressures are provided as equivalent fluid unit weights, in psf per foot of depth (or pcf). These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil over the wall footing.

The following lateral earth pressures are presented in Table 3 below for approved granular soils with a maximum of 35 percent fines (passing the No. 200 sieve per ASTM D-421/422) and a "Very Low" expansion potential (EI of 20 or less per ASTM D4829). Some of the onsite soils may not be suitable for retaining wall backfill due to the material size (greater than 3 inches in

maximum dimension) and fines content. Therefore, select grading, screening, and stockpiling of the onsite soils or import of soils meeting the criteria outlined above should be anticipated by the contractor for obtaining suitable retaining wall backfill soil. The wall designer should clearly indicate on the retaining wall plans the required select sandy soil backfill criteria. These preliminary findings should be confirmed during grading.

TABLE 3

Lateral Earth Pressures – Approved Onsite or Imported Sandy Soils

Conditions	**Equivalent Fluid Unit Weight (pcf)**	**Equivalent Fluid Unit Weight (pcf)**
	Level Backfill	**2:1 Sloped Backfill**
	Approved Sandy Soils	**Approved Sandy Soils**
Active	35	55
At-Rest	55	70

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. This would include 90-degree corners of retaining walls. Such walls should be designed for "at-rest." The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, saturation of near-surface (upper approximate 1-foot) soils in front of the retaining walls, the perforated subdrain pipe should be located as low as possible behind the retaining wall. The outlet pipe should be sloped to drain to a suitable outlet. In general, we do not recommend retaining wall outlet pipes be connected to area drains. If subdrains are connected to area drains, special care and information should be provided to homeowners to maintain these drains. Typical retaining wall drainage is illustrated in Figure 3. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water containing soluble salts migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential. Please note that waterproofing and outlet systems are not the purview of the geotechnical consultant.

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining wall. In addition to the recommended earth pressure, retaining walls adjacent to streets should be designed to resist a uniform lateral pressure of 80 pounds per square foot

(psf) due to normal street vehicle traffic if applicable. Uniform lateral surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.45 and 0.3 may be used for at-rest and active conditions, respectively. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use a seismic lateral earth pressure increment of 10 pcf for level backfill conditions. This increment should be applied in addition to the provided static lateral earth pressure using a triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). For the restrained, at-rest condition, the seismic increment may be added to the applicable active lateral earth pressure (in lieu of the at-rest lateral earth pressure) when analyzing short duration seismic loading. Per Section 1803.5.12 of the 2022 CBC, the seismic lateral earth pressure is applicable to structures assigned to Seismic Design Category D through F for retaining wall structures supporting more than 6 feet of backfill height. The provided seismic lateral earth pressure should not be used for retaining walls exceeding 10 feet in height. This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010).

Soil bearing and lateral resistance (friction coefficient and passive resistance) are provided in Section 4.3. Earthwork considerations (temporary backcuts, backfill, compaction, etc.) for retaining walls are provided in Section 4.1 (Site Earthwork) and the subsequent earthwork related sub-sections.

4.5 Control of Surface Water and Drainage Control

From a geotechnical perspective, we recommend that compacted finished grade soils adjacent to proposed residences be sloped away from the proposed residence and towards an approved drainage device or unobstructed swale. Drainage swales, wherever feasible, should not be constructed within 5 feet of buildings. Where lot and building geometry necessitates that the side yard drainage swales be routed closer than 5 feet to structural foundations, we recommend the use of area drains together with drainage swales. Drainage swales used in conjunction with area drains should be designed by the project civil engineer so that a properly constructed and maintained system will prevent ponding within 5 feet of the foundation. Code compliance of grades is not the purview of the geotechnical consultant.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.6 Subsurface Water Infiltration

It should be noted that intentionally infiltrating storm water conflicts with the geotechnical engineering objective of directing surface water away from structures and improvements. The geotechnical stability and integrity of a site is reliant upon appropriately handling surface water. In general, the vast majority of geotechnical distress issues are directly related to improper drainage. Distress in the form of movement of foundations and other improvements could occur

as a result of soil saturation and loss of soil support of foundations and pavements, settlement, collapse, internal soil erosion, and/or expansion. Additionally, off-site properties and improvements may be subjected to seepage, springs, instability, movements of foundations or other impacts as a result of water infiltration and migration. Infiltrated water may enter underground utility pipe zones or other highly permeable layers and migrate laterally along these layers, potentially impacting other improvements located far away from the point of infiltration. Any proposed infiltration system should not be located near slopes or settlement sensitive existing/proposed improvements in order to reduce the potential for slope failures and geotechnical distress issues related to infiltration.

If water must be infiltrated due to regulatory requirements, we recommend the absolute minimum amount of water be infiltrated and that the infiltration areas not be located near settlement-sensitive existing/proposed improvements, basement/retaining walls, or any slopes. As with all systems that are designed to concentrate surface flow and direct the water into the subsurface soils, some minor settlement, nuisance type localized saturation and/or other water related issues should be expected. Due to variability in geologic and hydraulic conductivity characteristics, these effects may be experienced at the onsite location and/or potentially at other locations beyond the physical limits of the subject site. Infiltrated water may enter underground utility pipe zones or flow along heterogeneous soil layers or geologic structure and migrate laterally impacting other improvements which may be located far away or at an elevation much lower than the infiltration source. Recommendations for subsurface water infiltration are provided below.

The design infiltration rate is determined by dividing the measured infiltration rate by total reduction factor. The total reduction factor is calculated from a series of reduction factors, including; test procedure (RF_t), site variability (RF_v) and long-term siltation plugging and maintenance (RF_s). Based on the Los Angeles County testing guidelines (2021), the reduction factor for long-term siltation plugging and maintenance (RF_s) is the purview of the infiltration system designer. The reduction factors are provided in Table 4 below. The total reduction factor is calculated as the product of the series of reduction factors listed in Table 4 below (RF_t + RF_v + RF_s).

TABLE 4

Shallow Surface Infiltration - Reduction Factors Applied to Measured Infiltration Rate

Consideration	Reduction Factor
Test procedure, boring percolation, RF_t	1.0
Site variability, number of tests, etc., RF_v	1.0
Long-term siltation plugging and maintenance, RF_s	1.0*
Total Reduction Factor, RF = RF_t + RF_v + RF_s	**3.0***

*Reduction Factor for long-term siltation plugging and maintenance provided by the civil engineer.

Per the requirements of the Los Angeles County testing guidelines (2021), subsurface materials shall have a design infiltration rate equal to or greater than 0.3 inches per hour. The Total

Reduction Factor for test procedure, site variability considerations, and long-term siltation plugging and maintenance (RF_t, RF_v, and RF_s) should be confirmed by the civil engineer. Results of infiltration testing are provided in Appendix D.

The following should be considered for the design of any expected infiltration system.

- We recommend the design of any infiltration system include at least one redundancy or overflow system. It may be prudent to provide an overflow system directly connected to the storm drain system in order to prevent failure of the infiltration system, either as a result of lower than anticipated infiltration and/or very high flow volumes.
- Water discharge from any infiltration systems should not occur within the zone of influence of foundation footings (column and load bearing wall locations). From a geotechnical perspective we recommend a minimum infiltration system setback of 15 feet from the structural improvements. The county may have more stringent setback requirements.
- An adequate setback distance between any infiltration facility and adjacent property lines should be maintained.
- The infiltration values provided are based on clean water and this requires the removal of trash, debris, soil particles, etc., and on-going maintenance. Over time, siltation and plugging may reduce the infiltration rate and subsequent effectiveness of the infiltration system. It should be noted that methods to prevent this shall be the responsibility of the infiltration designer and are not the purview of the geotechnical consultant. If adequate measures cannot be incorporated into the design and maintenance of the system, then the infiltration rates may need to be further reduced. These and other factors should be considered in selecting a design infiltration rate.
- Any designed infiltration system will require routine periodic maintenance.
- Contamination and environmental suitability of the site for infiltration was not evaluated by us and should be evaluated by others (environmental consultant). We only addressed the geotechnical issues associated with stormwater infiltration.

LGC Geotechnical should be provided with details for any planned required infiltration system early in the design process for geotechnical input.

4.7 Preliminary Asphalt Pavement Sections

For the purpose of these preliminary recommendations, we have selected a preliminary design R-value of 40 (assumed) and calculated pavement sections for assumed Traffic Indices (TI) of 5.0 (or less) and 6.0. These recommendations must be confirmed with R-Value testing of representative near-surface soils at the completion of grading and after underground utilities have been installed and backfilled. Final street sections should be confirmed by the project civil engineer based upon the final design Traffic Index. Determination of the TI is not the purview of the geotechnical consultant. If requested, LGC Geotechnical will provide sections for alternate TI values.

TABLE 5

Preliminary Pavement Sections

Assumed Traffic Index	5.0 or less	6.0
R -Value Subgrade	40	40
AC Thickness	4.0 inches	4.0 inches
Base Thickness	4.0 inches	6.0 inches

The thicknesses shown are for minimum thicknesses. Increasing the thickness of any or all of the above layers will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Earthwork recommendations regarding aggregate base and subgrade are provided in Section 4.1 "Site Earthwork" and the related sub-sections of this report.

4.8 Soil Corrosivity

Although not corrosion engineers (LGC Geotechnical is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the results of our testing with regard to corrosion for the use of the client and other consultants, as they determine necessary.

Results of the corrosion testing indicated a soluble sulfate content less than approximately 0.01 percent, chloride content of 50 parts per million (ppm), pH value of 7.89, and minimum resistivity value of 13,700 ohm-cm. Based on Caltrans Corrosion Guidelines (2021), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 1,500 ppm (0.15 percent) or greater.

Based on our laboratory test results of representative site soil samples, onsite soils have a designated sulfate exposure class of "S0" per ACI 318-19, Table 19.3.1.1. As a result, per ACI 318 Table 19.3.2.1, the minimum compressive strength of structural concrete shall be 2,500 psi.

Laboratory testing may need to be performed at the completion of grading by the project corrosion engineer to further evaluate the as-graded soil corrosivity characteristics. Accordingly, revision of the corrosion potential may be needed, should future test results differ substantially from the conditions reported herein. The client and/or other members of the development team should consider this during the design and planning phase of the project and formulate an appropriate course of action.

4.9 Nonstructural Concrete Flatwork

Nonstructural concrete flatwork (such as walkways, bicycle trails, patio slabs, etc.) has a potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete may be designed in accordance with the minimum guidelines outlined in Table 6 below. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 6

Nonstructural Concrete Flatwork for Very Low Expansion Potential

	Community Sidewalks (≤4 feet wide)	**Patios/ Walkways** (adjacent to homes or flatwork >4 feet wide)	**Private Vehicular Driveways**	**City Sidewalk Curb and Gutters**
Minimum Thickness (in.)	4 (full)	4 (full)	4 (full)	City/Agency Standard
Presoaking	Wet down prior to placing	Wet down prior to placing	Wet down prior to placing	City/Agency Standard
Reinforcement	No. 3 Placed Longitudinally at 24 inches on center	No. 3 at 24 inches on centers	No. 3 at 24 inches on centers	City/Agency Standard
Thickened Edge (in.)	—	—	8 x 8	City/Agency Standard
Crack Control Joints	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	City/Agency Standard
Maximum Joint Spacing	5 feet	6 feet	10 feet or quarter cut whichever is closer	City/Agency Standard
Aggregate Base Thickness (in.)	—	—	—	City/Agency Standard

To reduce the potential for driveways to separate from the garage slab, the builder may elect to install dowels to tie these two elements together. Similarly, future homeowners should consider the use of dowels to connect flatwork to the foundation.

4.10 Geotechnical Plan Review

When available, project plans (grading, foundation, retaining wall, etc.) should be reviewed by LGC Geotechnical in order to verify our geotechnical recommendations are implemented. Updated recommendations and/or additional fieldwork may be necessary.

4.11 Geotechnical Observation and Testing During Construction

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC Geotechnical. Geotechnical observation and testing is required per Section 1705 of the 2022 CBC.

Geotechnical observation and/or testing should be performed by LGC Geotechnical at the following stages:

- During grading (removal bottoms, fill placement, etc.);
- During retaining wall backfill and compaction;
- During utility trench backfill and compaction;
- After presoaking building pads and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;
- Preparation of pavement subgrade and placement of aggregate base;
- After building and wall footing excavation and prior to placing reinforcement and/or concrete; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

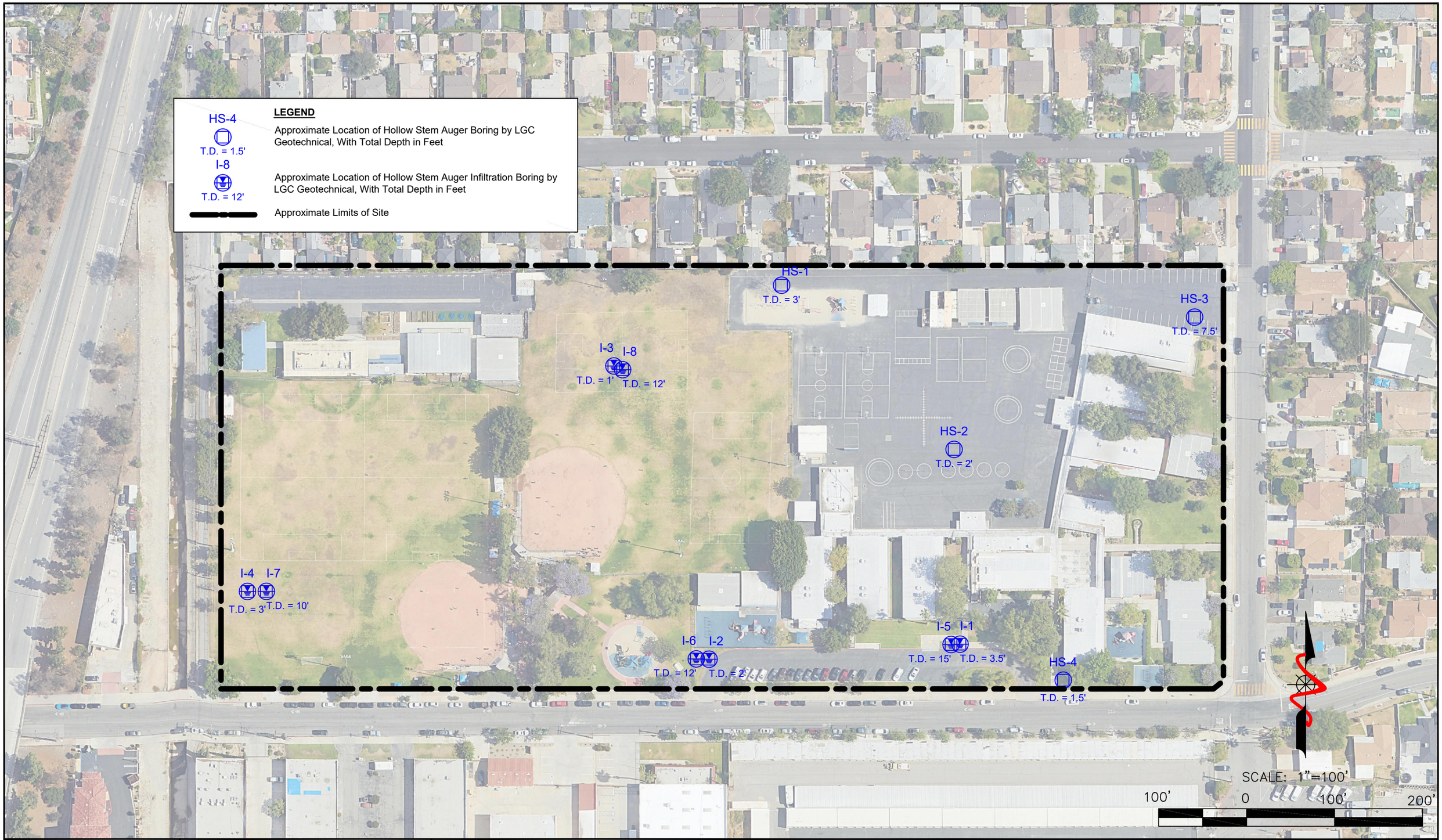
Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical evaluation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during grading and construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants (at a minimum the civil engineer, structural engineer, landscape architect) and incorporated into their plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.

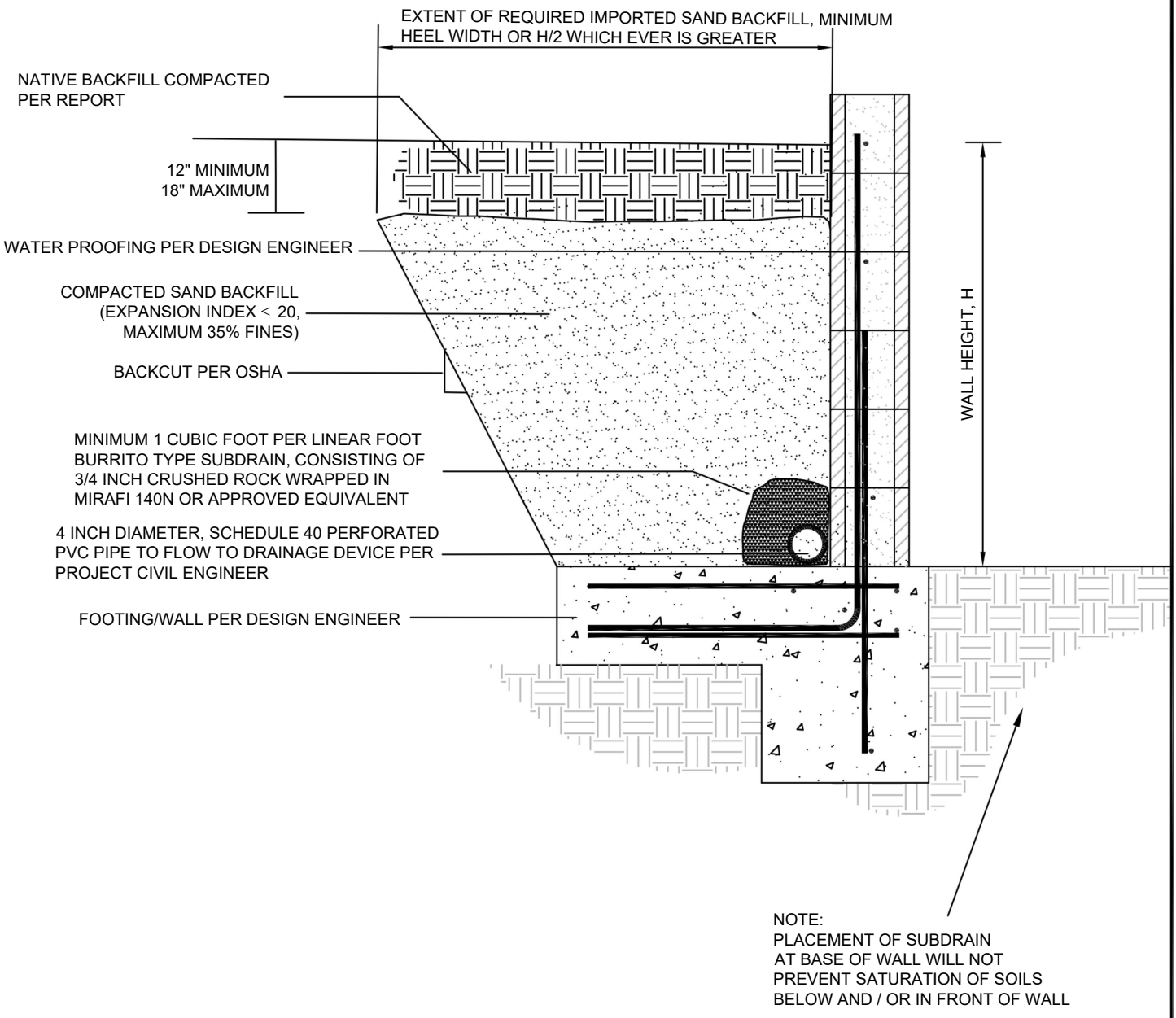


LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

FIGURE 2
Boring Location Map

PROJECT NAME	MWIG - Duarte School Site
PROJECT NO.	23218-01
ENG. / GEOL.	RLD
SCALE	1" = 100'
DATE	May 2024



LGC Geotechnical, Inc.

FIGURE 3
Retaining Wall Backfill Detail

PROJECT NAME	MWIG - Duarte School Site
PROJECT NO.	23218-01
ENG. / GEOL.	RLD
SCALE	Not to Scale
DATE	May 2024

Appendix A
References

APPENDIX A

References

American Concrete Institute, 2019, Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary (ACI 318R-19).

American Society of Civil Engineers (ASCE), 2017, Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-16, 2017.

_____, 2018, Standard 7-16, Minimum Design Loads for Buildings and Associated Criteria for Buildings and Other Structures, Supplement 1, effective: December 12, 2018.

American Society for Testing and Materials (ASTM), Volume 04.08 Soil and Rock (I): D420 – D5876.

Bray, J.D., and Sancio, R. B., 2006, Assessment of Liquefaction Susceptibility of Fine-Grained Soils, *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, pp. 1165-1177, dated September 2006.

California Building Standards Commission, 2022, California Building Code, California Code of Regulations Title 24, Volumes 1 and 2, dated July 2022.

California Department of Transportation (Caltrans), 2020, Highway Design Manual, Updated March 20, 2020.

_____, 2021, Corrosion Guidelines, Version 3.2, dated May 2021.

California Department of Conservation, Division of Mines and Geology (CDMG), 1998, Seismic Hazard Zone Report for the Azusa 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 98-12, dated 1998.

_____, 1999, State of California Seismic Hazard Zones, Azusa Quadrangle, Official Map, scale: 1:24,000, dated March 25, 1999.

California Geological Survey (CGS), 2008, California Geological Survey Special Publication 117A: Guidelines for Evaluating and Mitigating Seismic Hazards in California.

_____, 2018, Special Publication 42: Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, Revised 2018.

_____, 2024, California Department of Conservation, Earthquake Zones of Required Investigation website: CGS Earthquake Zones (ca.gov); retrieved May 28, 2024

County of Los Angeles, 2021, Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, GS200.1, dated June 30, 2021.

Historic Aerials, 2024, viewed May 28, 2024, Aerial Maps from 1948 to 2020 https://www.historicaerials.com/

KTGY, 2024, 1433 Crestfield, Duarte, CA, Site Plan, dated April 12, 2024.

Lew, et al, 2010, Seismic Earth Pressures on Deep Basements, Structural Engineers Association of California (SEAOC) Convention Proceedings.

Morton & Miller, 2003, Preliminary Digital Geologic Map of the San Bernardino 30' by 60' Quadrangle, Southern California, Open File Report 03-293, USGS Publication, Version 1.0 prepared 2003.

NCEER, 1997, "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", T. L. Youd and I. M. Idriss Editors, Technical Report NCEER-97-0022, NCEER, Buffalo, NY.

Post-Tensioning Institute (PTI), 2012, Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils, PTI DC10.5-12.

Pradel, Daniel, 1998, Procedure to evaluate earthquake-induced settlement in dry sandy soils, *Journal of Geotechnical and Geoenvironmental Engineering*, Volume 124(4), pp. 364-368, dated April and October 1998.

Structural Engineers Association of California (SEAOC), 2024, Seismic Design Maps, Retrieved May 23, 2024, from https://seismicmaps.org/

Tokimatsu, K., and Seed, H. B., 1987, "Evaluation of Settlements in Sands Due to Earthquake Shaking", Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, pp. 861-878.

United States Geological Survey (USGS), 2014, Unified Hazard Tool, Dynamic: Conterminous U.S. 2014 (update)(v4.2.0), Retrieved May 23, 2024, from: https://earthquake.usgs.gov/hazards/interactive/

Appendix B
Field Exploration Logs

Geotechnical Boring Log Borehole HS-1

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~550' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1				4.9	SM	@ 0' - 2.5" Asphalt Concrete / No Aggregate Base; Silty SAND with Gravel: dark brown, slightly moist	-#200 MD DS EI CR
			R-1	50/1"	104.0	3.2		@ 2.5' - Silty SAND with Gravel: brown, dry, very dense Auger Refusal at 2 feet	
545	5							Total Depth = 3' Groundwater Not Encountered Backfilled with Cuttings and Capped with AC Cold Patch on 4/23/2024	
540	10								
535	15								
530	20								
525	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole HS-2

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~549' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
549	0	B-1				4.4	SM	@ 0' - 2.5" Asphalt Concrete / No Aggregate Base @ 1' - Silty SAND with Gravel: dark brown, dry Auger Refusal at 2 feet	
545	5							Total Depth = 2' Groundwater Not Encountered Backfilled with Cuttings and Capped with AC to 3 inches on 4/23/2024	
540	10								
535	15								
530	20								
525	25								
520	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole HS-3

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~553' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map |

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1				2.3	GM	@ 0' - 2.5" Asphalt Concrete / No Aggregate Base; Silty GRAVEL with Sand: grayish brown, dry	
550			R-1	50/5.5"	119.9	4.9	SM GM	@ 2.5' - Silty SAND with Gravel to Silty GRAVEL with Sand: brown, slightly moist, very dense	
	5		R-2	43 50/4"	128.2	4.7	SM	@ 5' - Silty SAND with Gravel: grayish brown, slightly moist, very dense	-#200
545			R-3	50/3"				@ 7.5' - No Recovery Auger Refusal at 8 feet	
	10							Total Depth = 8' Groundwater Not Encountered Backfilled with Cuttings and Capped with AC Cold Patch on 4/23/2024	
540									
	15								
535									
	20								
530									
	25								
525									
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole HS-4

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~547' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
545	0	B-1				11.7	SM	@ 0' - Grass / Topsoil @ 1' - Silty SAND with Gravel: dark brown, moist @ 1.5' - Auger Refusal	-#200 EI RV
540	5							Total Depth = 1.5' Groundwater Not Encountered Backfilled with Cuttings on 4/23/2024	
535	10								
530	15								
525	20								
520	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-1

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~548' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
545	0		R-1	15 50/5"	106.6	8.6	SM	@ 0' - 2.5" Asphalt Concrete / No Aggregate Base @ 2.5' - Silty SAND with Gravel: dark brown, moist, very dense	-#200 EI RV
540	5							Total Depth = 3.5' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 4/23/2024 Backfilled with Cuttings on 4/24/2024	
535	10								
530	15								
525	20								
520	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-2

Date: 4/23/2024	**Drilling Company:** Choice Drilling
Project Name: MWIG - Duarte School	**Type of Rig:** CME 75
Project Number: 23218-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~544' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							@ 0' - Grass / Topsoil over Silty SAND with Gravel and Cobbles Auger Refusal at 2 feet	
540	5							Total Depth = 2' Groundwater Not Encountered Backfilled with Cuttings on 4/23/2024	
535	10								
530	15								
525	20								
520	25								
515	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-3

Date: 4/23/2024	**Drilling Company:** Choice Drilling
Project Name: MWIG - Duarte School	**Type of Rig:** CME 75
Project Number: 23218-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~546' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
545	0	B-1				2.5	SM	@ 0' - Grass @ 1' - Silty SAND with Gravel: brown, dry Auger Refusal at 1 foot	
								Total Depth = 1' Groundwater Not Encountered Backfilled with Cuttings on 4/23/2024	
540	5								
535	10								
530	15								
525	20								
520	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-4

Date: 4/23/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 75

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~540' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							@ 0' - Grass / Topsoil	
			R-1	50/5"	74.5	16.2		@ 2.5' - Silty SAND: brown, very moist, very dense	
535	5							Total Depth = 3' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 4/23/2024 Backfilled with Cuttings on 4/24/2024	
530	10								
525	15								
520	20								
515	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-5

Date: 5/7/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 95

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~548' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							@ 0' - Grass / Topsoil	
545			R-1	50/5"	82.5	3.9	SM	@ 2.5' - Silty SAND: grayish brown, dry, very dense	-#200
	5		R-2	30 50/4"	120.7	2.4	SC	@ 5' - Clayey SAND with Gravel: brownish gray, dry, very dense	
540			R-3	47 50/2"		2.6	SC-SM	@ 7.5' - Clayey Silty SAND: grayish brown, dry, very dense	
	10		R-4	45 50/3"	128.5	1.0	SP-SM	@ 10' - SAND with Silt: brownish gray, dry, very dense	-#200
535									
	15							Total Depth = 15' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 5/7/2024 Backfilled with Cuttings on 5/8/2024	
530									
	20								
525									
	25								
520									
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-6

Date: 5/7/2024	**Drilling Company:** Choice Drilling
Project Name: MWIG - Duarte School	**Type of Rig:** CME 95
Project Number: 23218-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~544' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
540	0							@ 0' - Grass / Topsoil over Silty SAND with Gravel and Cobble	
	5		R-1	50/5"				@ 5' - No Recovery	
535	10		R-2	50/5"				@ 10' - No Recovery	
530	15							Total Depth = 12' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 5/7/2024 Backfilled with Cuttings on 5/8/2024	
525	20								
520	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-7

Date: 5/7/2024 | **Drilling Company:** Choice Drilling

Project Name: MWIG - Duarte School | **Type of Rig:** CME 95

Project Number: 23218-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~546' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
545	0							@ 0' - Grass / Topsoil	
	5		R-1	50/5"	117.6	2.4	SM	@ 5' - Silty SAND: grayish brown, dry, very dense	
540			R-1	50/5"	120.3	2.9		@ 8.5' - Silty SAND with Gravel: grayish olive, dry, very dense	-#200
	10							Total Depth = 10' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 5/7/2024 Backfilled with Cuttings on 5/8/2024	
535									
	15								
530									
	20								
525									
	25								
520									
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Geotechnical Boring Log Borehole I-8

Date: 5/7/2024	**Drilling Company:** Choice Drilling
Project Name: MWIG - Duarte School	**Type of Rig:** CME 95
Project Number: 23218-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~539' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By JMN
Sampled By JMN
Checked By RLD

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							@ 0' - Grass/Topsoil	
535	5		R-1	50/5"	113.2	2.4	SM	@ 2.5' - Silty SAND: brownish gray, dry, very dense	
530	10		R-2	50/5"	128.5	4.5		@ 7.5' - Silty SAND: brownish gray, slightly moist, very dense	
525	15							Total Depth = 12' Groundwater Not Encountered 3" Perforated Pipe with Filter Sock Installed Surrounded by Gravel, and Presoaked on 5/7/2024 Backfilled with Cuttings on 5/8/2024	
520	20								
515	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 5/13/2024

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Testing Procedures and Test Results

The laboratory testing program was formulated towards providing data relating to the relevant engineering properties of the soils with respect to residential construction. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Expansion Index: The expansion potential of selected samples was evaluated by the Expansion Index Test, Standard ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch-thick by 4-inch-diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below.

Sample Location	Expansion Index	Expansion Potential*
HS-1 @ 1-3 ft	0	Very Low
HS-4 @ 0-1.5 ft	16	Very Low

* ASTM D4829

Grain Size Distribution/Fines Content: Representative samples were dried, weighed and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve (ASTM D1140). Where applicable, the portion retained on the No. 200 sieve and dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D6913 (sieve).

Sample Location	Description	% Passing # 200 Sieve
HS-1 @ 1-3 ft	Silty SAND with Gravel	15
HS-3 @ 5 ft	Silty SAND with Gravel	13
HS-4 @ 0-1.5 ft	Silty SAND with Gravel	21
I-1 @ 2.5 ft	Silty SAND with Gravel	18
I-5 @ 2.5 ft	Silty SAND	34
I-5 @ 10 ft	SAND with Silt	11
I-7 @ 8.5 ft	Silty SAND with Gravel	28

Laboratory Testing Procedures and Test Results

Direct Shear: Direct shear test was performed on a selected remolded sample (90% relative compaction), which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of less than 0.05 inch per minute (for sandy soil). The direct shear plot is presented in Appendix C.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
HS-1 @ 1-3 ft	Dark Brown Silty SAND with Gravel	133.0	7.0

R-Value: The resistance R-value was determined by the ASTM D2844 for base, subbase, and basement soils. The samples were prepared and exudation pressure and R-value were determined. The graphically determined R-values at exudation pressure of 300 psi are reported in this appendix. These results were used for pavement design purposes. The results of these tests are presented in the following table.

Sample Location	R-Value
HS-4 @ 0-1.5 ft	48

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below.

Sample Location	Sulfate Content (ppm)	Sulfate Exposure Class *
HS-1 @ 1-3 ft	82	S0

*Based on ACI 318R-14, Table 19.3.1.1

Laboratory Testing Procedures and Test Results

Chloride Content: Chloride content was tested in accordance with Caltrans Test Method (CTM) 422. The results are presented below.

Sample Location	Chloride Content, ppm
HS-1 @ 1-3 ft	50

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The results are presented in the table below.

Sample Location	pH	Minimum Resistivity (ohms-cm)
HS-1 @ 1-3 ft	7.89	13,700

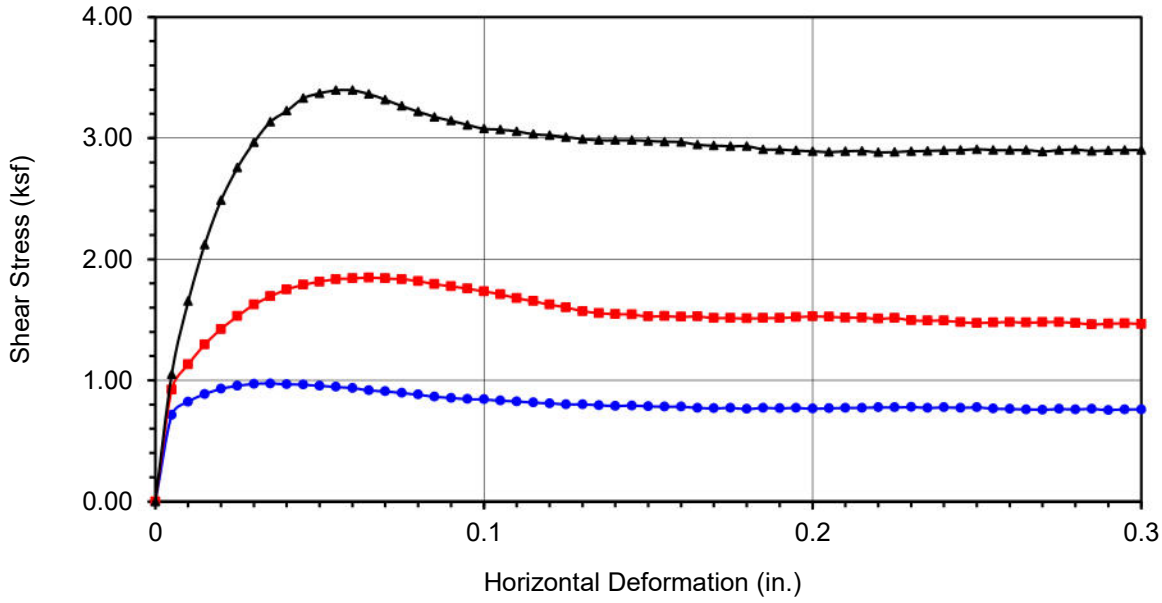
DIRECT SHEAR TEST

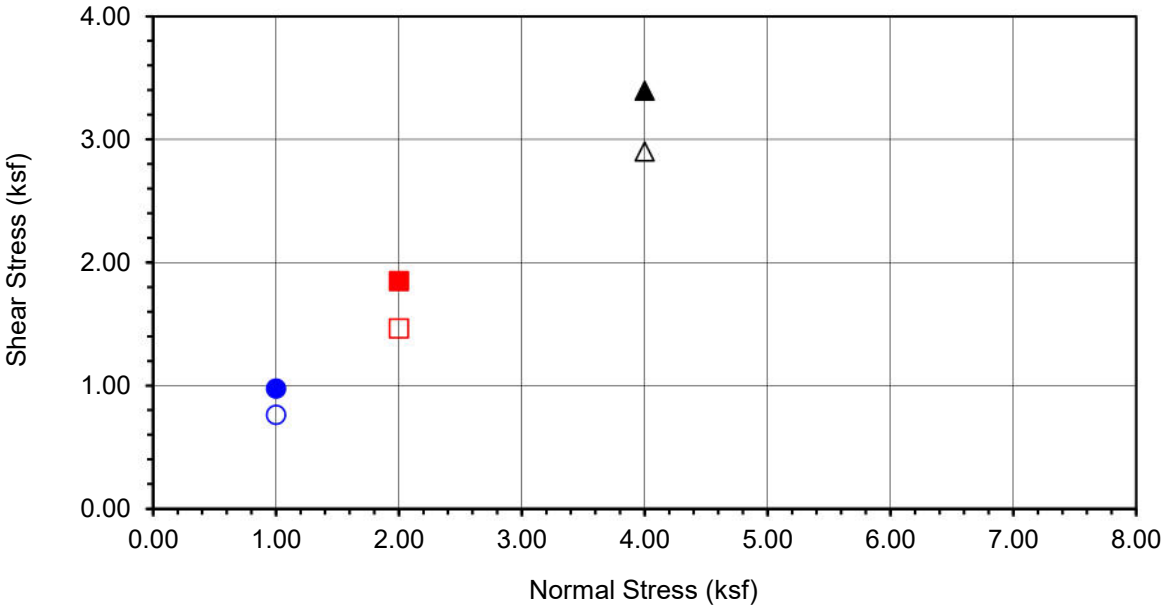
Consolidated Drained - ASTM D 3080

Project Name:	Duarte School	Tested By:	G. Bathala	Date:	05/03/24
Project No.:	23218-01	Checked By:	J. Ward	Date:	05/09/24
Boring No.:	HS-1	Sample Type:	90% Remold		
Sample No.:	B-1	Depth (ft.):	1-3		

Soil Identification: Dark brown silty sand with gravel (SM)g

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	198.79	199.67	197.17
Weight of Ring(gm):	44.41	45.18	42.47
Before Shearing			
Weight of Wet Sample+Cont.(gm):	157.70	157.70	157.70
Weight of Dry Sample+Cont.(gm):	150.07	150.07	150.07
Weight of Container(gm):	38.29	38.29	38.29
Vertical Rdg.(in): Initial	0.2703	0.2617	0.0000
Vertical Rdg.(in): Final	0.2787	0.2773	-0.0217
After Shearing			
Weight of Wet Sample+Cont.(gm):	221.08	214.12	227.18
Weight of Dry Sample+Cont.(gm):	203.87	197.13	210.21
Weight of Container(gm):	63.20	55.46	67.61
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HS-1**
Sample No.	**B-1**
Depth (ft)	**1-3**
Sample Type: 90% Remold	
Soil Identification: Dark brown silty sand with gravel (SM)g	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.975	■ 1.849	▲ 3.395
Shear Stress @ End of Test (ksf)	○ 0.761	□ 1.465	△ 2.902
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	6.83	6.83	6.83
Dry Density (pcf)	120.2	120.3	120.4
Saturation (%)	45.8	45.9	46.1
Soil Height Before Shearing (in.)	0.9916	0.9844	0.9783
Final Moisture Content (%)	12.2	12.0	11.9

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 23218-01

Duarte School

05-24

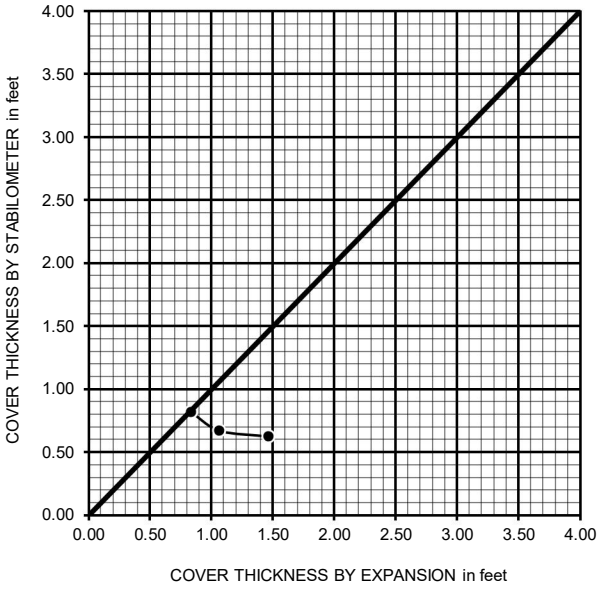
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	Duarte School	PROJECT NUMBER:	23218-01
BORING NUMBER:	HS-4	DEPTH (FT.):	0-1.5
SAMPLE NUMBER:	B-1	TECHNICIAN:	O. Figueroa
SAMPLE DESCRIPTION:	Very dark brown silty sand (SM)	DATE COMPLETED:	5/3/2024

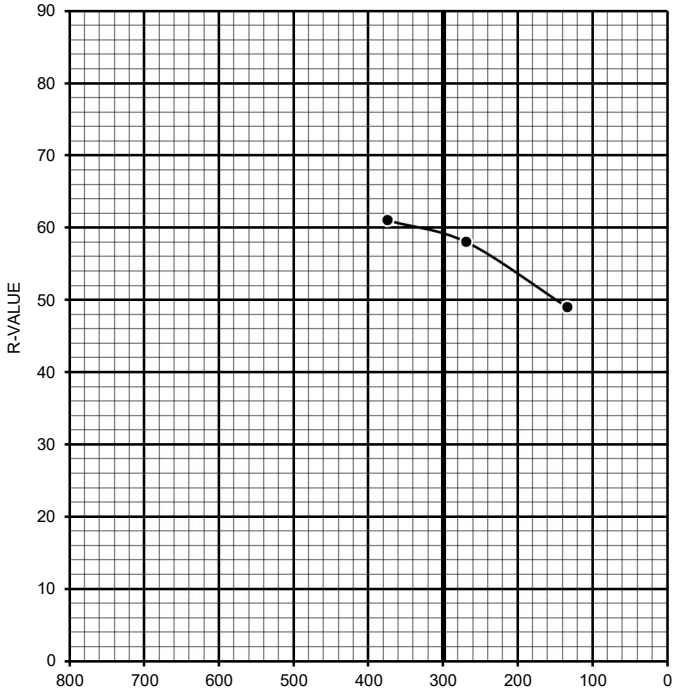
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	13.6	14.4	15.3
HEIGHT OF SAMPLE, Inches	2.44	2.48	2.52
DRY DENSITY, pcf	116.1	113.5	111.8
COMPACTOR PRESSURE, psi	175	130	100
EXUDATION PRESSURE, psi	374	269	134
EXPANSION, Inches x 10exp-4	44	32	25
STABILITY Ph 2,000 lbs (160 psi)	34	37	48
TURNS DISPLACEMENT	5.55	6.00	6.18
R-VALUE UNCORRECTED	63	58	49
R-VALUE CORRECTED	61	58	49

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.62	0.67	0.82
EXPANSION PRESSURE THICKNESS, ft.	1.47	1.07	0.83

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	48
R-VALUE BY EXUDATION:	59
EQUILIBRIUM R-VALUE:	48

Appendix D
Infiltration Test Results

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 4/24/2024
Location: I-1

Test hole dimensions (if circular)	
Boring Depth (feet)*:	3.5
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	8:03	8:33	30.0	3.21	3.65	0.44	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	8:37	9:07	30.0	2.61	3.71	1.10	2.21	4.2
2	9:10	9:40	30.0	2.55	3.61	1.06	2.34	3.8
3	9:44	10:14	30.0	2.58	3.57	0.99	2.28	3.6
4	10:16	10:46	30.0	2.44	3.54	1.10	2.57	3.6
5	10:49	11:19	30.0	2.42	3.57	1.15	2.61	3.7
6	11:22	11:52	30.0	2.42	3.53	1.11	2.61	3.6
						Measured Infiltration Rate		**3.6**
						Feasibility Factor of Safety		N/A
						Feasibility Infiltration Rate		

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 4/24/2024
Location: I-4

Test hole dimensions (if circular)	
Boring Depth (feet)*:	3
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	7:45	8:15	30.0	2.06	3.79	1.73	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	8:18	8:48	30.0	1.89	3.55	1.66	2.67	5.2
2	8:50	9:20	30.0	2.01	3.57	1.56	2.42	5.4
3	9:24	9:54	30.0	1.99	3.55	1.56	2.46	5.3
4	9:57	10:27	30.0	1.96	3.38	1.42	2.53	4.7
5	10:28	10:58	30.0	2.05	3.44	1.39	2.34	5.0
6	11:00	11:30	30.0	2.02	3.42	1.40	2.40	4.9
						Measured Infiltration Rate		**4.9**
						Feasibility Factor of Safety		N/A
						Feasibility Infiltration Rate		

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 5/8/2024
Location: I-5

Test hole dimensions (if circular)	
Boring Depth (feet)*:	15
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	9:22	9:52	30.0	13.22	13.89	0.67	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	9:55	10:25	30.0	13.06	13.72	0.66	4.41	1.3
2	10:27	10:57	30.0	13.10	13.74	0.64	4.33	1.2
3	10:59	11:30	31.0	12.86	13.63	0.77	4.83	1.3
4	11:32	12:02	30.0	12.68	13.53	0.85	5.21	1.4
5	12:04	12:34	30.0	12.65	13.48	0.83	5.27	1.3
6	12:38	13:08	30.0	12.63	13.47	0.84	5.31	1.3

Measured Infiltration Rate	**1.3**
Feasibility Factor of Safety	N/A
Feasibility Infiltration Rate	

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 5/8/2024
Location: I-6

Test hole dimensions (if circular)	
Boring Depth (feet)*:	12
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	8:12	8:42	30.0	9.37	11.03	1.66	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	8:45	9:15	30.0	9.42	11.01	1.59	5.75	2.3
2	9:17	9:47	30.0	9.35	11.06	1.71	5.90	2.4
3	9:49	10:17	28.0	9.36	11.22	1.86	5.88	2.8
4	10:21	10:51	30.0	9.35	11.28	1.93	5.90	2.7
5	10:54	11:24	30.0	9.30	11.24	1.94	6.00	2.7
6	11:27	11:57	30.0	9.36	11.35	1.99	5.88	2.8

Measured Infiltration Rate	**2.8**
Feasibility Factor of Safety	N/A
Feasibility Infiltration Rate	

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 5/8/2024
Location: I-7

Test hole dimensions (if circular)	
Boring Depth (feet)*:	10
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	8:00	8:30	30.0	4.63	5.34	0.71	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	8:30	9:00	30.0	5.34	6.43	1.09	10.11	0.9
2	9:01	9:31	30.0	5.42	6.66	1.24	9.94	1.0
3	9:35	10:05	30.0	5.21	5.97	0.76	10.38	0.6
4	10:07	10:37	30.0	5.23	6.05	0.82	10.34	0.7
5	10:40	11:14	34.0	5.16	5.92	0.76	10.49	0.5
6	11:16	11:49	33.0	5.05	5.63	0.58	10.72	0.4
7	11:51	12:23	32.0	5.02	5.58	0.56	10.78	0.4
8	12:26	12:56	30.0	5.05	5.58	0.53	10.72	0.4
						Measured Infiltration Rate		**0.4**
						Feasibility Factor of Safety		N/A
						Feasibility Infiltration Rate		

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite A, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: Duarte School
Project Number: 23218-01
Date: 5/8/2024
Location: I-8

Test hole dimensions (if circular)	
Boring Depth (feet)*:	12
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Soak /Pre-Test

No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Comments
Pre-Test	10:00	10:33	33.0	8.9	10.95	2.05	

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Surface Area of Test Section (feet ^2)	Raw Percolation Rate (in/hr)
1	10:35	11:08	33.0	8.75	10.99	2.24	7.16	2.4
2	11:10	11:43	33.0	8.74	10.98	2.24	7.18	2.4
3	11:46	12:16	30.0	8.78	10.97	2.19	7.09	2.6
4	12:19	12:49	30.0	8.58	11.06	2.48	7.51	2.8
5	12:51	13:24	33.0	8.56	11.08	2.52	7.55	2.5
6	13:34	14:04	30.0	8.57	11.09	2.52	7.53	2.8
						Measured Infiltration Rate		**2.7**
						Feasibility Factor of Safety		N/A
						Feasibility Infiltration Rate		

Sketch:

Notes:

Based on Guidelines from: LA County dated 06/2021
Spreadsheet Revised on: 6/22/2023

LGC Geotechnical, Inc.

Appendix E
General Earthwork & Grading Specifications for Rough Grading

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of “equipment” of work and the estimated quantities of daily earthwork

contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the
Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be over-excavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Over-excavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than
5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over

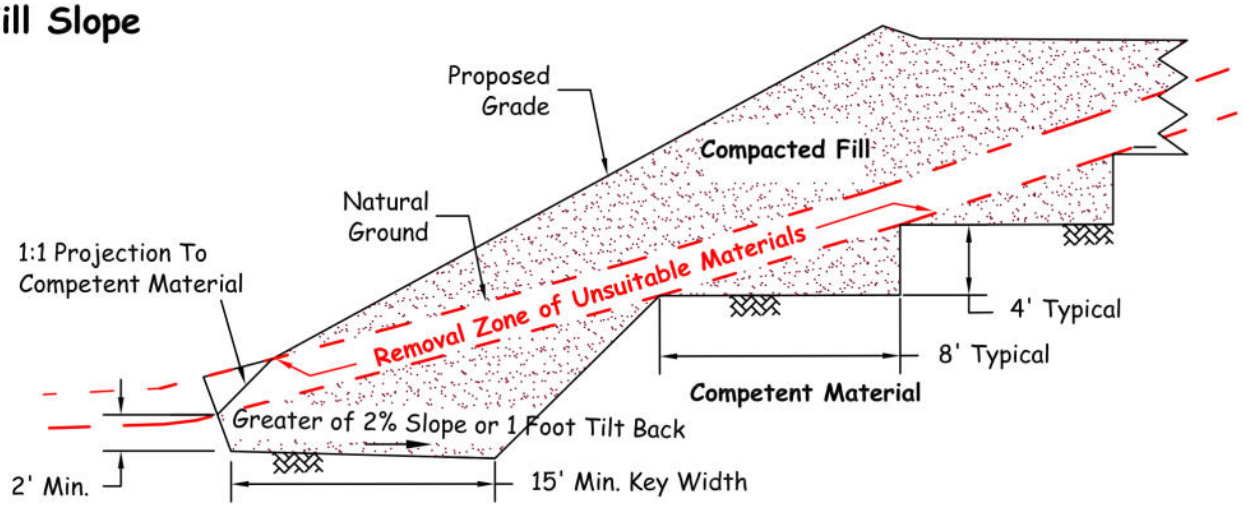
the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

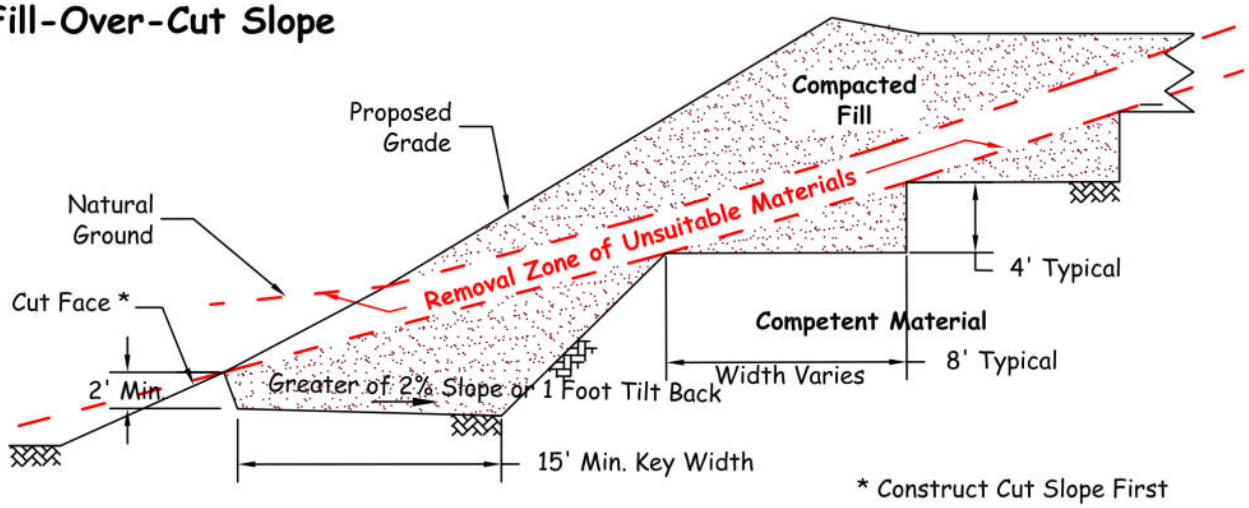
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

Fill Slope

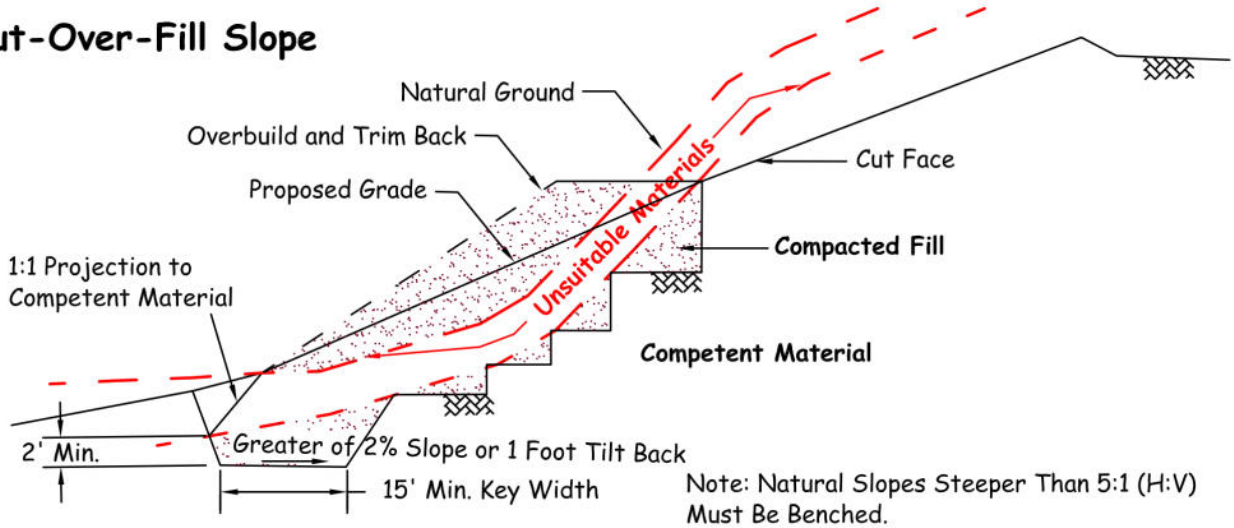


Fill-Over-Cut Slope



* Construct Cut Slope First

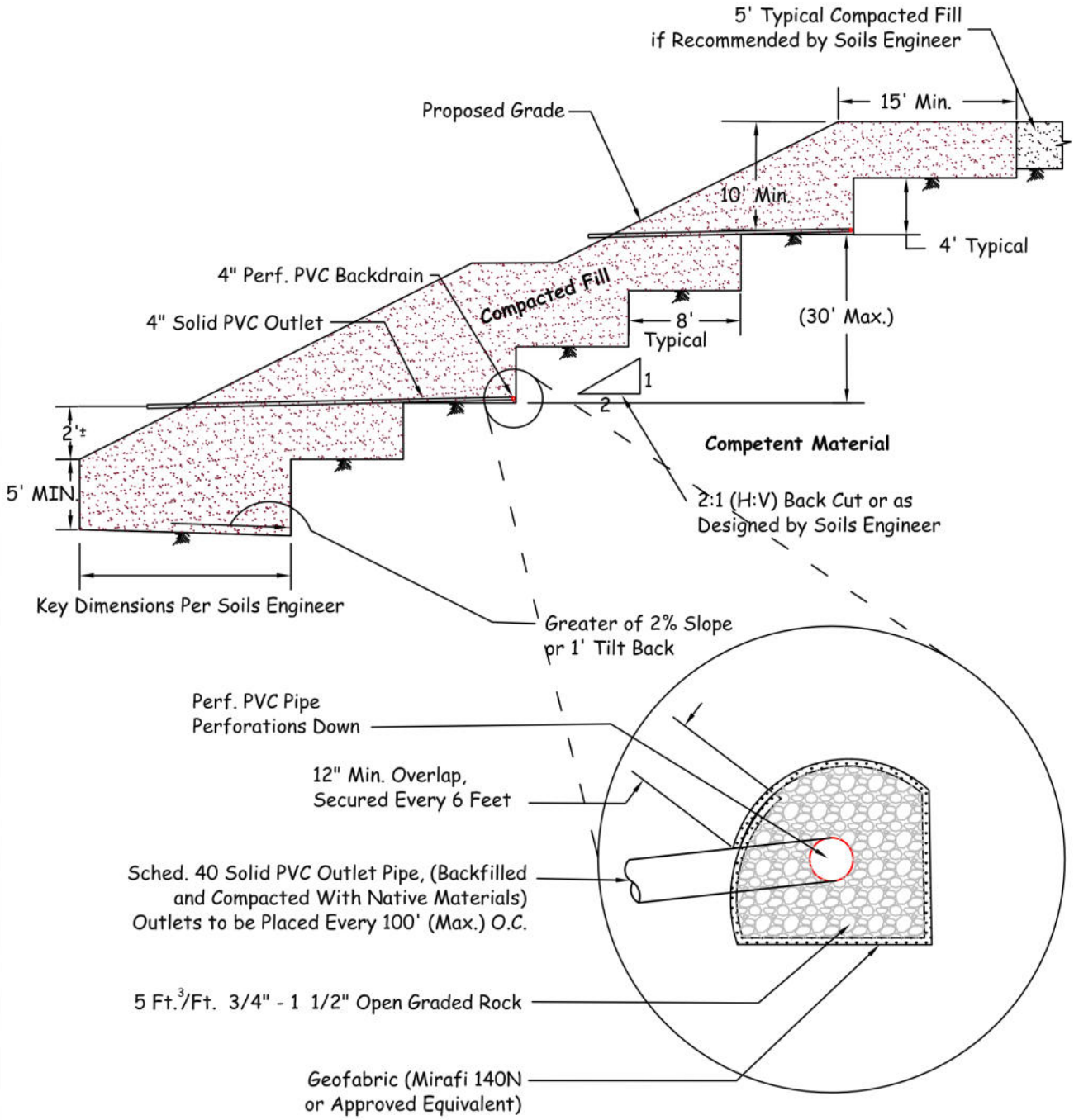
Cut-Over-Fill Slope



Note: Natural Slopes Steeper Than 5:1 (H:V) Must Be Benched.

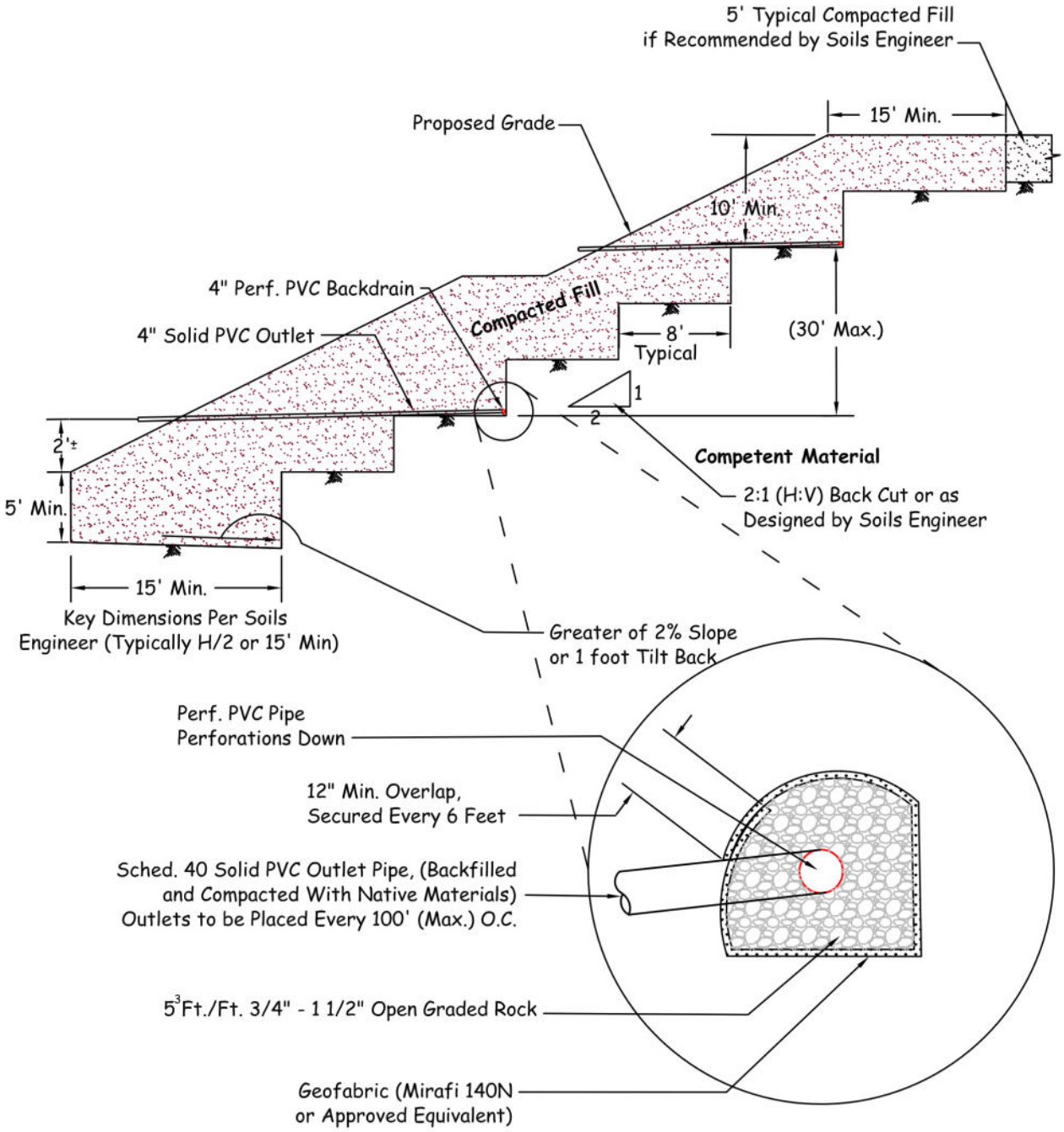
LGC Geotechnical, Inc.

KEYING AND BENCHING



LGC Geotechnical, Inc.

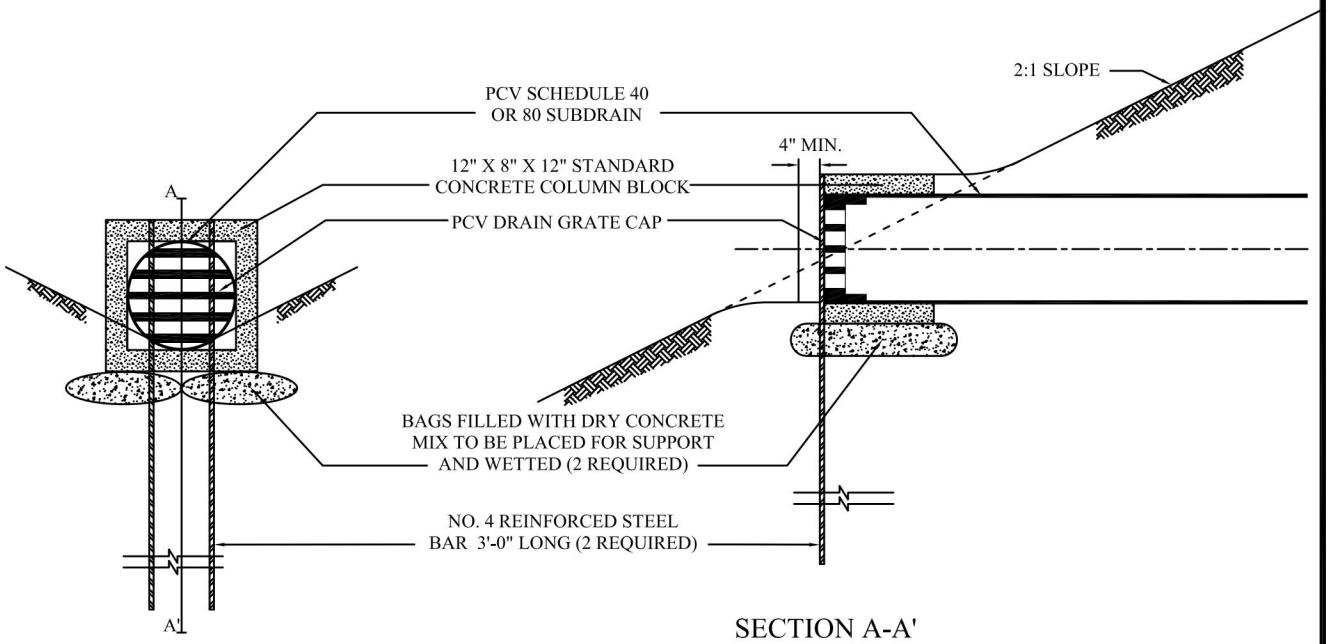
TYPICAL BUTTRESS DETAIL



LGC Geotechnical, Inc.

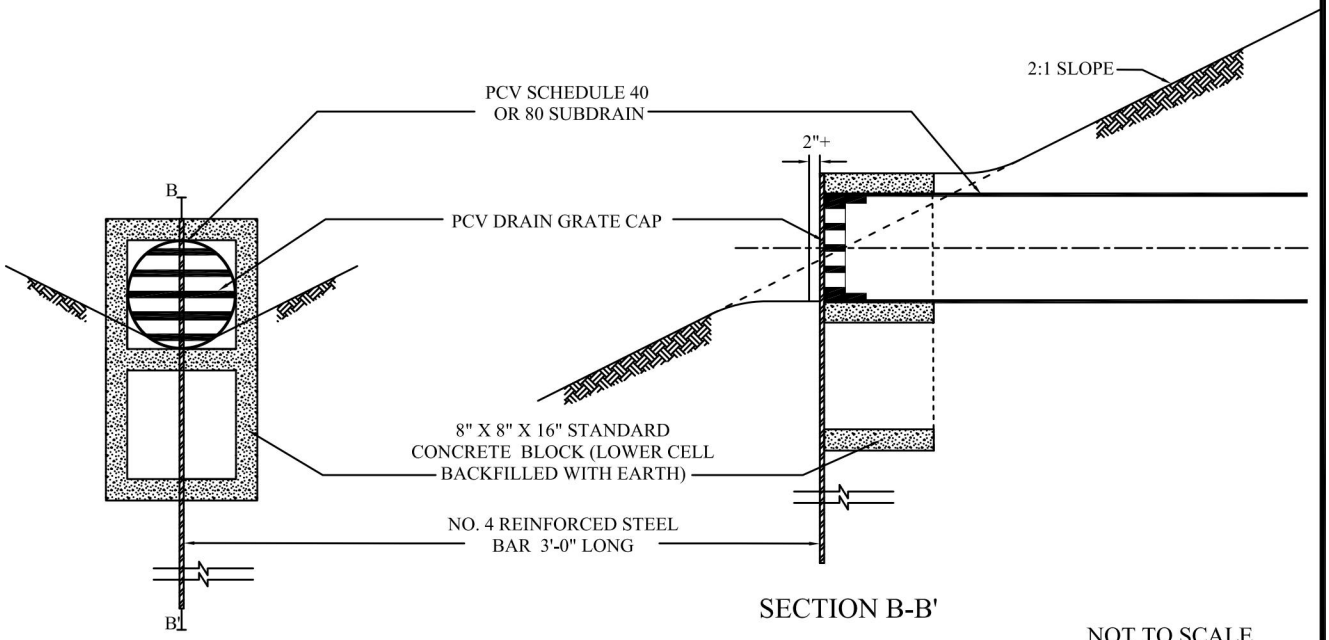
TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SECTION A-A'

SUBDRAIN OUTLET MARKER -4" PIPE



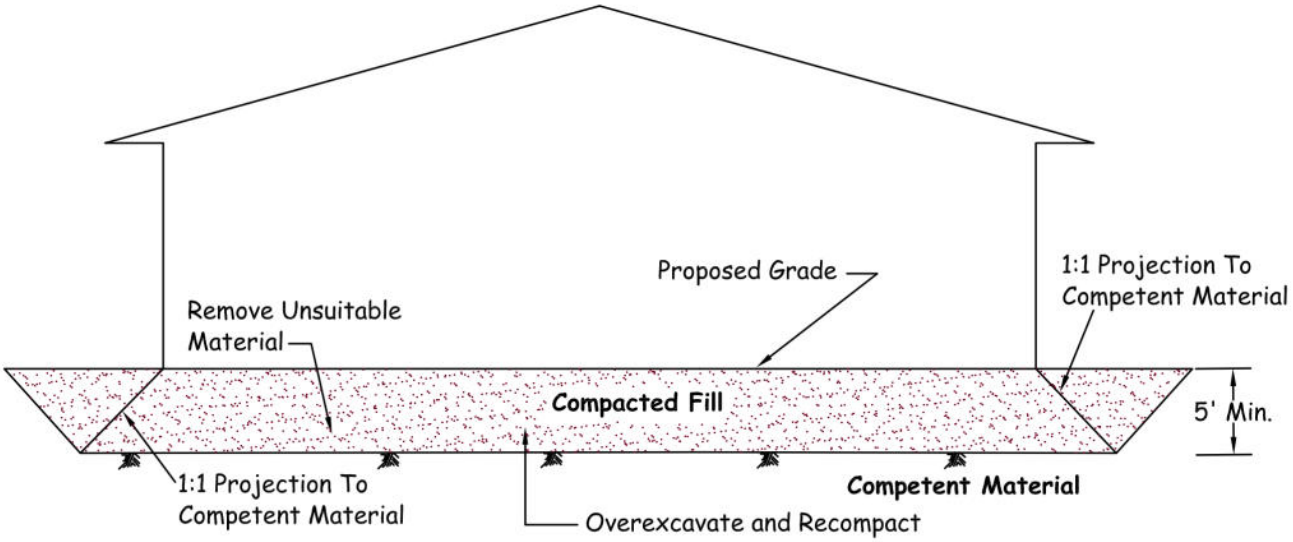
SECTION B-B'

NOT TO SCALE

LGC Geotechnical, Inc.

SUBDRAIN OUTLET MARKER DETAIL

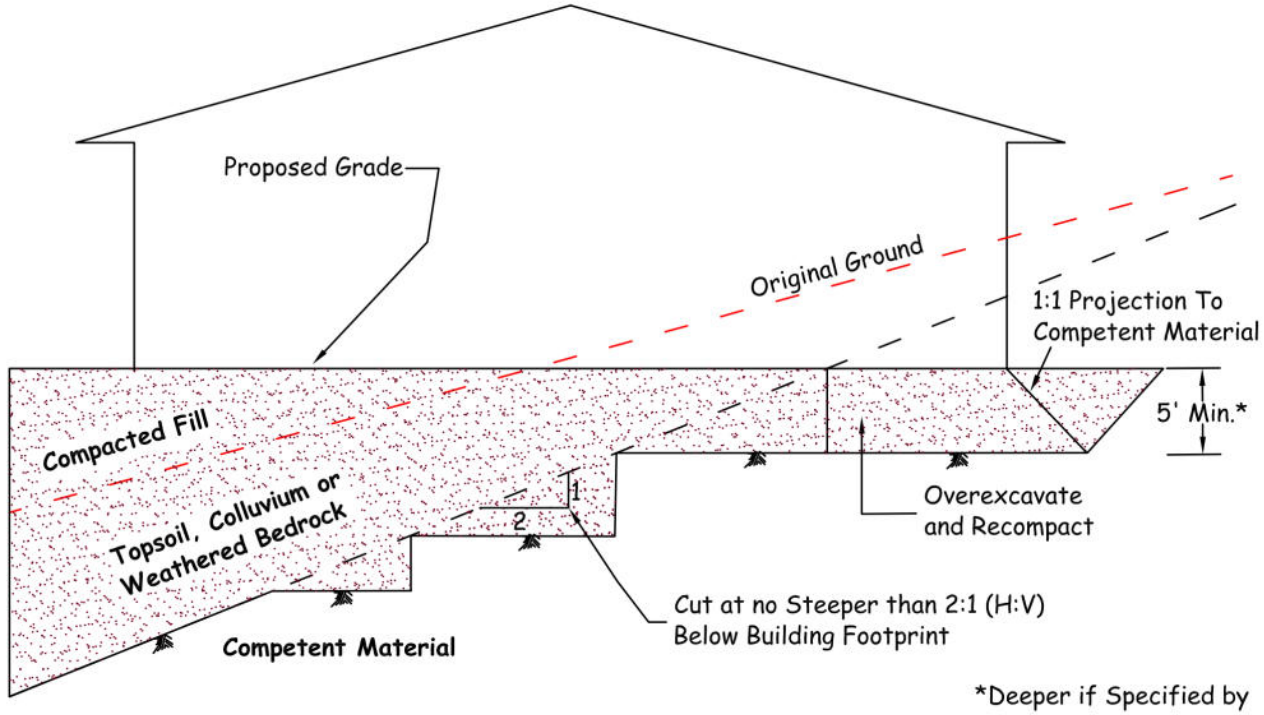
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

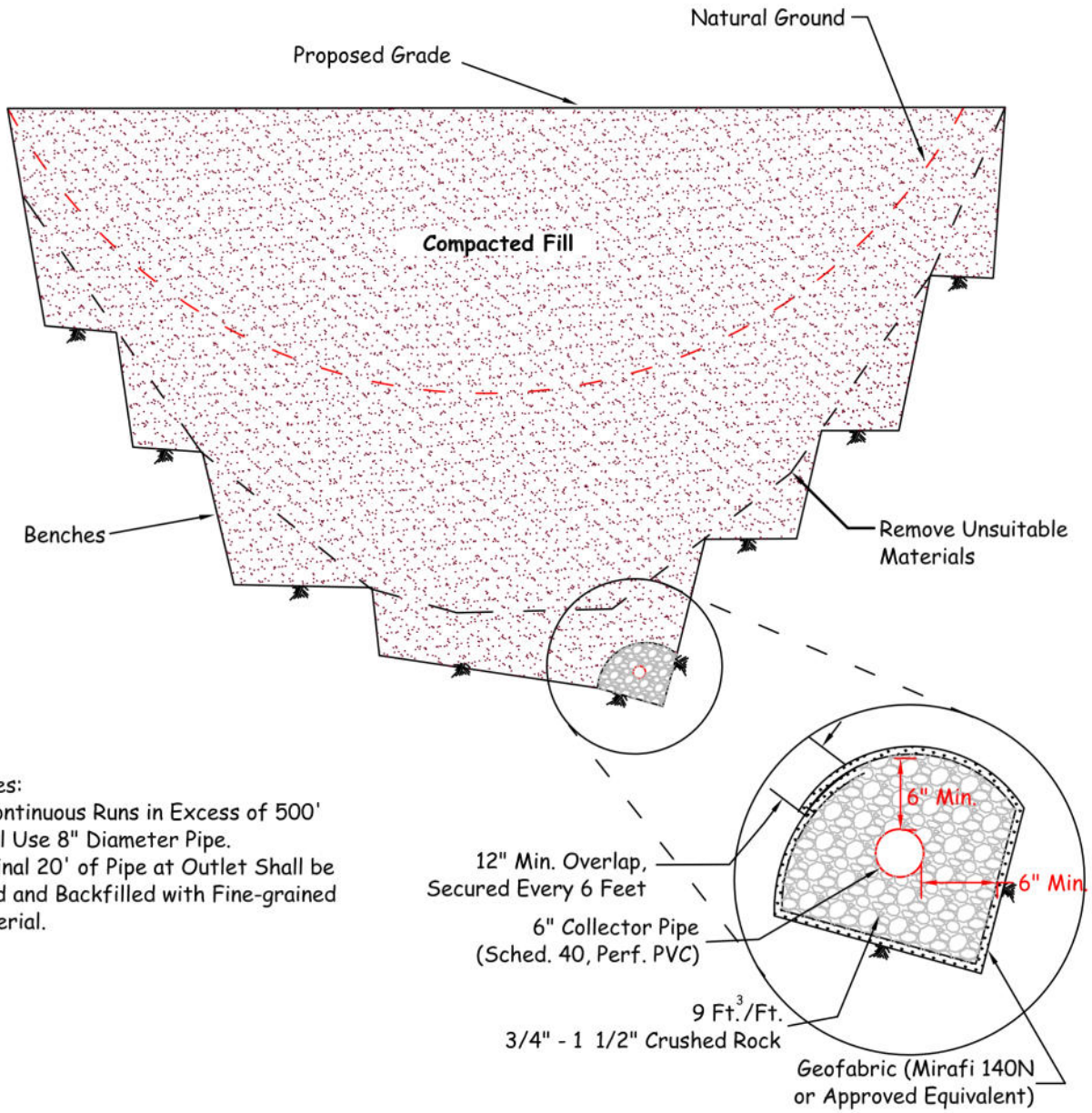
Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

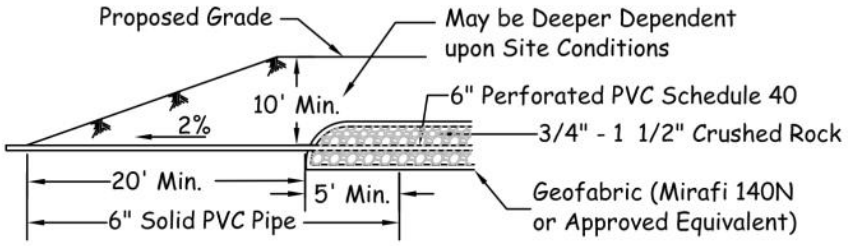
LGC Geotechnical, Inc.

CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



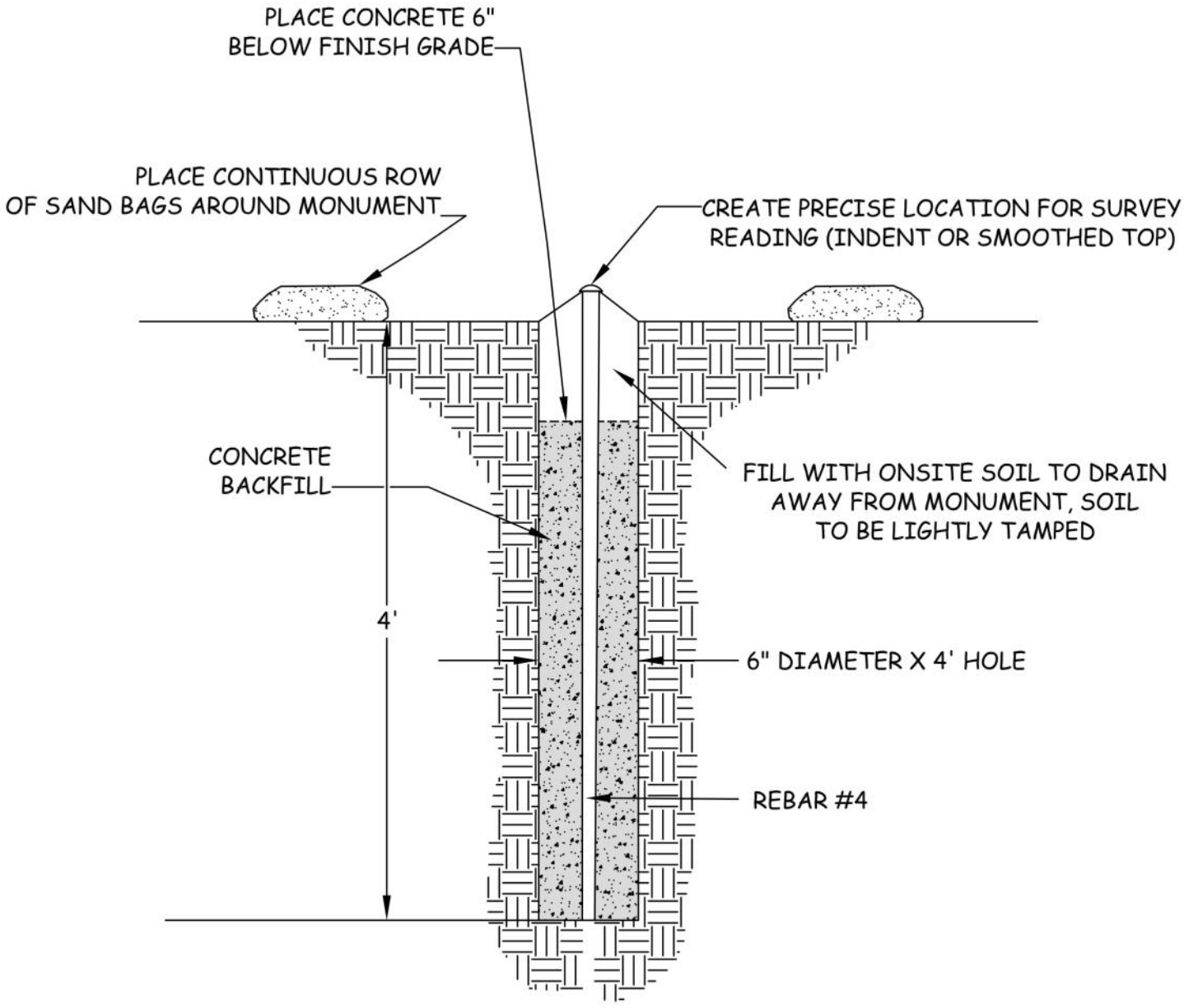
Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



LGC Geotechnical, Inc.

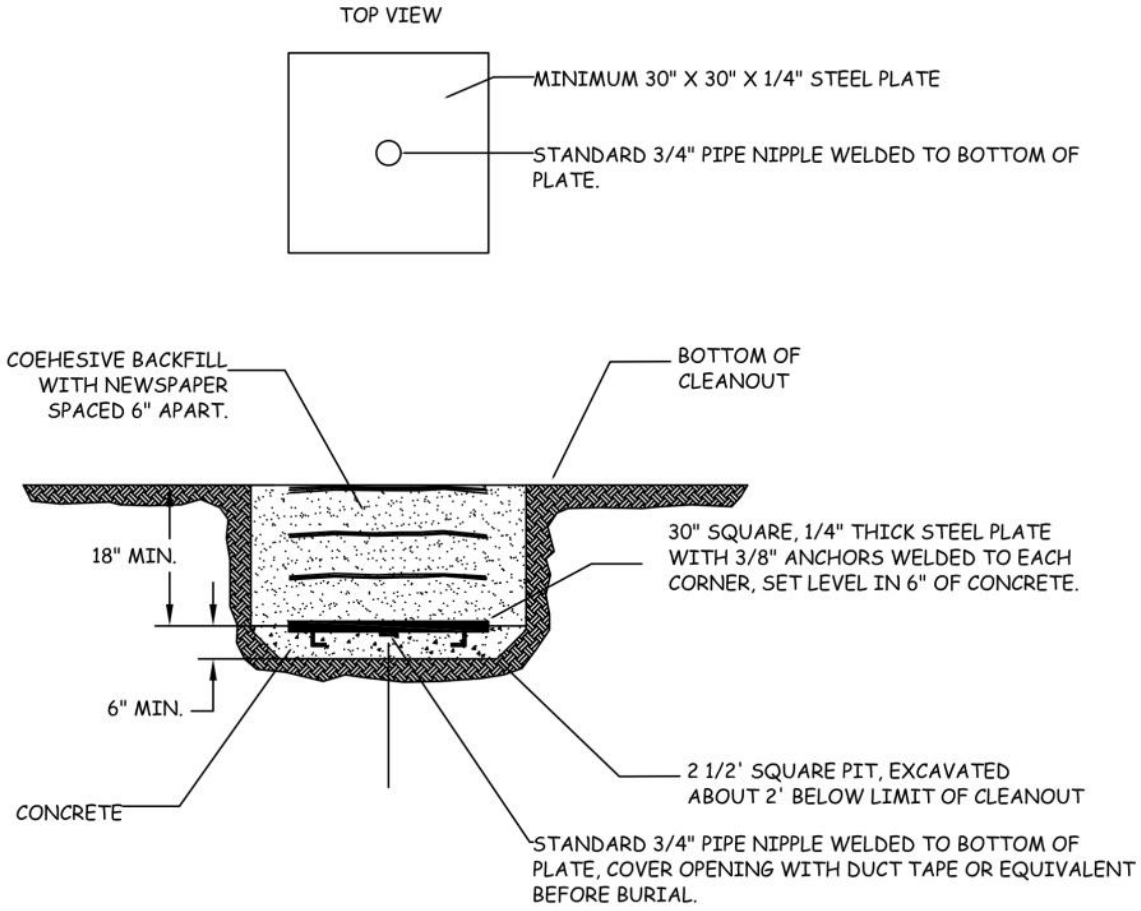
CANYON SUBDRAINS



NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

LGC Geotechnical, Inc.

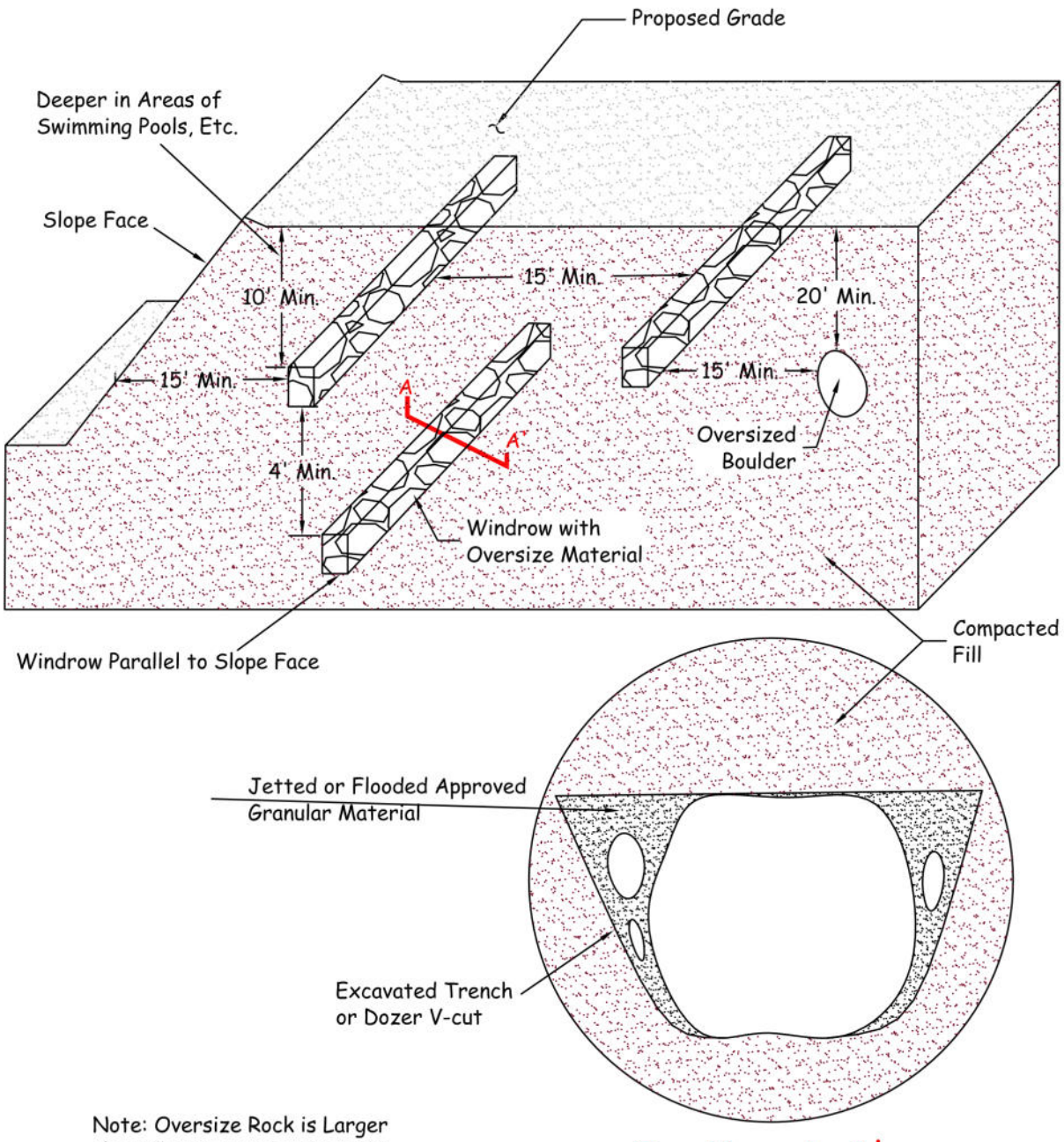
TYPICAL SURFACE SETTLEMENT MONUMENT



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

LGC Geotechnical, Inc.

TYPICAL SETTLEMENT PLATE AND RISER



Note: Oversize Rock is Larger than 8" in Maximum Dimension.

Section A-A'

LGC Geotechnical, Inc.

OVERSIZE ROCK DISPOSAL DETAIL

Appendix H:
Educational Materials

To be provided during final engineering