PRELIMINARY HYDROLOGY & LID REPORT

PREPARED FOR:

Beyond Foods Mart - Palmdale
4300 Edison Ave
Chino, CA 91710

FOR THE PROJECT:

Beyond Foods Mart Palmdale Development
NWC 25TH St. East & Ave R.
Palmdale
County of Los Angeles

PREPARED BY:

BLUE ENGINEERING AND CONSULTING, INC
RANCHO CUCAMONGA, CA 91701
(909) 248-6557

PREPARED UNDER THE SUPERVISION OF:

ANGEL CESAR, RCE 87222

Octoer 2023

INDEX:

VICINITY MAP 2

I. INTRODUCTION 3

II. DESCRIPTION OF OFFSITE CONDITIONS 3

III. HYDROLOGY DESIGN CRITERIA 3

IV. EXISTING DRAINAGE CONDITIONS 4

V. PROPOSED DRAINAGE CONDITIONS 4

VI. WATER QUALITY/LOW IMPACT DEVELOPMENT (LID) REVIEW 5

VII. CONCLUSION 6

APPENDIX 7



VICINITY MAP

I. INTRODUCTION

The Beyond Foods Mart Palmdale Development Project is an approximately 5.68-acre site located on the northwest corner of 25th Street and East Avenue R in the City of Palmdale within Los Angeles County, California (see attached vicinity map). The site is bordered to the north by an apartment complex, to the south by East Avenue R, to the east by 25th Street, and Palmdale High School to the west. The site is currently vacant land.

II. DESCRIPTION OF THE ONSITE CONDITIONS

Total site comprises of two drainage areas totaling 5.68 acres. The subject site consists of one rectangular shaped parcel on which the building, fueling station pumps and carwash is to be developed. There is no additional offsite flow from any adjacent properties.

Drainage Area 1 topography drains from the southeast corner of the site to the northwest corner. Drainage area 2 topography drains from the southwest corner of the area to the northeast corner. There is an estimated 5.28 feet of elevation differential across drainage area 1 and a 2 feet of elevation differential across drainage area 2.

The Drainage Area 1 site will be the future development of floodmark and retail stores. However, this study includes the area hydrology analysis. The Drainage Area 2 site will be developed with fueling stations, carwash, and convenience stores.

III. HYDROLOGY DESIGN CRITERIA

The following Hydrology Data criteria was provided by the LADPW online Hydrology Map 1-H1.4 provided at: http://dpw.lacounty.gov/wrd/hydrologygis/. These values are used as inputs into the HydroCalc as shown in the calculations in Appendices B and C.

Runoff Calculation: LADPW HydroCalc

Design 50-year 24-hour Isohyet: 3.3”

Soil Type: 120

85th Percentile Isohyet: 0.48” <0.75”, use 0.75” for LID

Pre-Development Imperviousness: 0%

Post-Development Imperviousness: 76%

IV. EXISTING DRAINAGE CONDITIONS

The project site currently is undeveloped and relatively flat with barren land surface. There is not have any sewer, water, storm drain and other utilities on site. The hydrologic soil classification is number 120 per L.A. County Hydrology GIS site information. The site is enclosed by the slump stone walls separating from adjacent neighbors. The site runoff will infiltrate to the ground or overflow to the 25th Street and Avenue R Street. There is no off-site runoff flowing onto the subject site. The existing site condition consists of two drainage areas. Drainage area 1 is 2.95-acres, it drains from the center towards the northwest corner; Drainage area 2 is 2.54-acres, it drains from the center towards the northeast corner. The following table summarizes the values:

Table-1, Pre-Development Condition Hydrology Summary Table:

Condition	Subarea number	Area (acres)	25-Year Peak Flowrate (Q25)	25-Year Clear Runoff Volume (cf)
Pre-Development	DA-1	3.03	0.37	3,530
Pre-Development	DA-2	2.54	0.32	2,959

V. PROPOSED DRAINAGE CONDITIONS

As previously described, the project site is comprised of two drainage areas and the total development area is approximately 5.49 acres. It will be developed into a commercial site with retail stores, gas station, carwash station, food marks, parking, driveways, and landscaped area. The project site will generally maintain the existing drainage patterns. The impervious surface will increase to around 80% of the existing condition, including the asphalt concrete pavement and rooftop areas.

To address stormwater management and mitigate potential runoff issues associated with the increased impervious surface, the project includes the proposed of two underground CMP detention/infiltration basins. These basins are designed to temporarily store stormwater runoff, allowing for infiltration into the ground and reducing peak flow rates downstream. These basins serve to attenuate peak flows, improve water quality, and mitigate potential flooding or erosion issues associated with the development.

Basin 1 will serve sub-drainage area DA-1 and Basin-2 will serve sub-drainage area DA-2. The locations of these basins are shown in the Post-Development Hydrology Exhibit in Appendix I of the report. Runoff from each sub-drainage area is directed to proposed catch basins equipped with filter inserts. From there, the runoff passes through the filter inserts into proposed storm drainpipes. Finally, the runoff is discharged into the underground CMP basins. The proposed underground CMP basins are designed to accommodate the increase in runoff due to the development. They are also sized to meet the requirements for Low Impact Development (LID) stormwater treatment volumes and the required mitigation volumes for the development.

The outlet pipe of the CMP basins is sized using orifice control. The outlet peak flow is designed to be equal to or less than the pre-development condition. This design satisfies the hydrology requirements of the L.A. County Hydrology Manual. In the event of excess flow, a babbler basin overflow is used. The overflow directs excess runoff to the parkway drains and ultimately to the public streets.

In summary, the project is taking comprehensive measures to manage stormwater runoff associated with the development, including the use of underground CMP basins, filter inserts, and other techniques to mitigate potential environmental impacts. These measures align with the requirements of the L.A. County Hydrology Manual and aim to minimize the impact of the project on local drainage systems and water quality.

For the Hydrology calculation that the 25-year 24-hour storm event design criteria is used for the project, based on the L.A. County Hydrology Manal. The following table summarizes the values of post-development condition hydrology calculation.

Table-2, Post-Development Condition Hydrology Summary Table:

Condition	Subarea number	Area (acres)	25-year Peak Flowrate (Q_{25})	25-year Runoff Volume (cf)
Post-Development	DA-1	3.03	0.37	3,530
	DA-2	2.54	1.80	17,801

VI. WATER QUALITY

This project falls under designated projects for LID purposes. The category is in redevelopment projects, which are developments that result in creation or additional or replacement of either 10,000 square feet or more of impervious surface area on a site.

Source control measures that will be implemented are as followed:

- Storm Drain Message and Signage (S-1)
- Landscape Irrigation Practices (S-8)
- Building Materials (S-9)

Non-Structural Source Control BMPs:

- Education for property owner
- Activity Restrictions
- Common Area Landscape Management
- Common Area Litter Control

The water quality design rainfall depth for the project was determined to be 0.75 inch (85th percentile 24-hour rainfall: 0.48” < 0.75”) for project site areas.

Table-3, LID Calculation Summary:

Subarea number	Area (Acres)	Storm Water Treatment Peak Flow Rate (cfs)	LID Runoff Volume (cf) V_{LID}	Required Mitigated Volume (cf) *	Underground System $V_{Provided}$ (cf)
DA-2	2.54	0.27	4,851	4,851	14,858
Total	2.54	0.27	4,851	4,851	14,858

VII. BASIN SIZE

As previously mentioned, the proposed underground basin size is to satisfy the LID and mitigation both purposes. The required volume must see which one is dominated.

Table-4, 25 Year, 24-Hour Storm Event Required Mitigation Volume:

Subarea number	Area (Acres)	Pre-Development Runoff Volume: (cf)	Post-Development Runoff Volume (cf)	Required Mitigated Volume (cf) *	Underground System $V_{Provided}$ (cf)	Basin ID
DA-2	2.54	2,959	17,801	14,842	14,858	Basin-B
Total	2.54	2,959	17,801	14,842	14,858	

***Mitigated volume was calculated with the sum of 25 Year Storm Event Clear Runoff Volume (cf) for DA-2 delta volume of the Pre-development Clear Runoff Volume (cf)**

Compared to Table-3 and Tabel-4 that the required LID volume is 4,851 cu-ft and the 25-year, 24-hours required mitigation volume is 14,842 cu-ft. It's noted that the mitigation volume for the 25-year, 24-hour storm event is the dominant factor influencing the basin sizes in the project's drainage design. This indicates the importance of mitigating stormwater runoff for larger storm events to prevent flooding and control downstream impacts.

Since this is a drainage concept study for the entitlement application, the basin final size and basin routing performance will be provided in the final engineering state.

Based on the results of the soil test, the project site is feasible for infiltration for LID BMP's. The infiltration rate is 1.50 to 1.92 in/hr. crossing the site based on the Preliminary Geotechnical Engineering and Infiltration Report from NTS Geotechnical, done on June 1,2022 in Appendix G of the report.

VIII. **CONCLUSION**

The calculations provided within this report and within the enclosed Hydrology Map provide an understanding that the post-development conditions will generally maintain similar drainage patterns to the pre-development drainage conditions. The increase in Q and volume from the development will be fully retained and infiltrated into the ground through the Underground Infiltration any overflow will be discharge onto 25th St East & Avenue R via parkway drains. It is asserted that the project's stormwater management strategies will prevent adverse effects on individuals, downstream properties, or existing drainage. The project's design and stormwater management approach are stated to be in accordance with the design criteria, guidelines, policies, and procedures outlined by L.A. County.

Appendix

A. Pre-development calculations, 25 year, 24-hr storm event
B. Post-development calculations, 25 year, 24-hr storm event
C. LID Volume Calculation, 85th Percentile 24-hour storm event.
D. LA County Hydrology Map 50-year 24-hr rainfall
E. LA County Hydrology 85th Percentile 24-hour rainfall Map
F. LA County Hydrology Map Soils Map
G. Soils Report
H. Pre-development Hydrology Exhibit
I. Post-development Hydrology Exhibit
J. Underground Infiltration System

Appendix A:

Pre-development calculations, 25 year, 24-hr storm event

Peak Flow Hydrologic Analysis

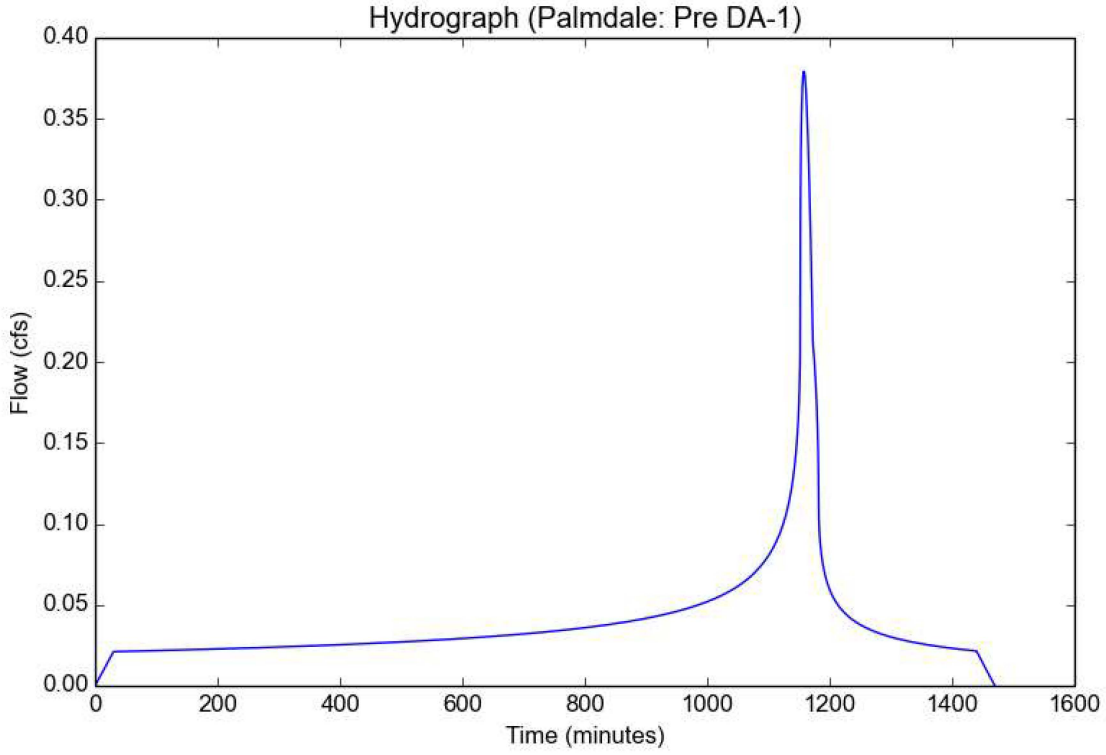
File location: C:/Users/BrandonMuse/Downloads/Palmdale - Pre DA-1 - 25yr PRE.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Palmdale
Subarea ID	Pre DA-1
Area (ac)	3.03
Flow Path Length (ft)	521.23
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	3.3
Percent Impervious	0.01
Soil Type	120
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	2.8974
Peak Intensity (in/hr)	0.7447
Undeveloped Runoff Coefficient (Cu)	0.1607
Developed Runoff Coefficient (Cd)	0.1681
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.3793
Burned Peak Flow Rate (cfs)	0.3793
24-Hr Clear Runoff Volume (ac-ft)	0.081
24-Hr Clear Runoff Volume (cu-ft)	3529.9094



Peak Flow Hydrologic Analysis

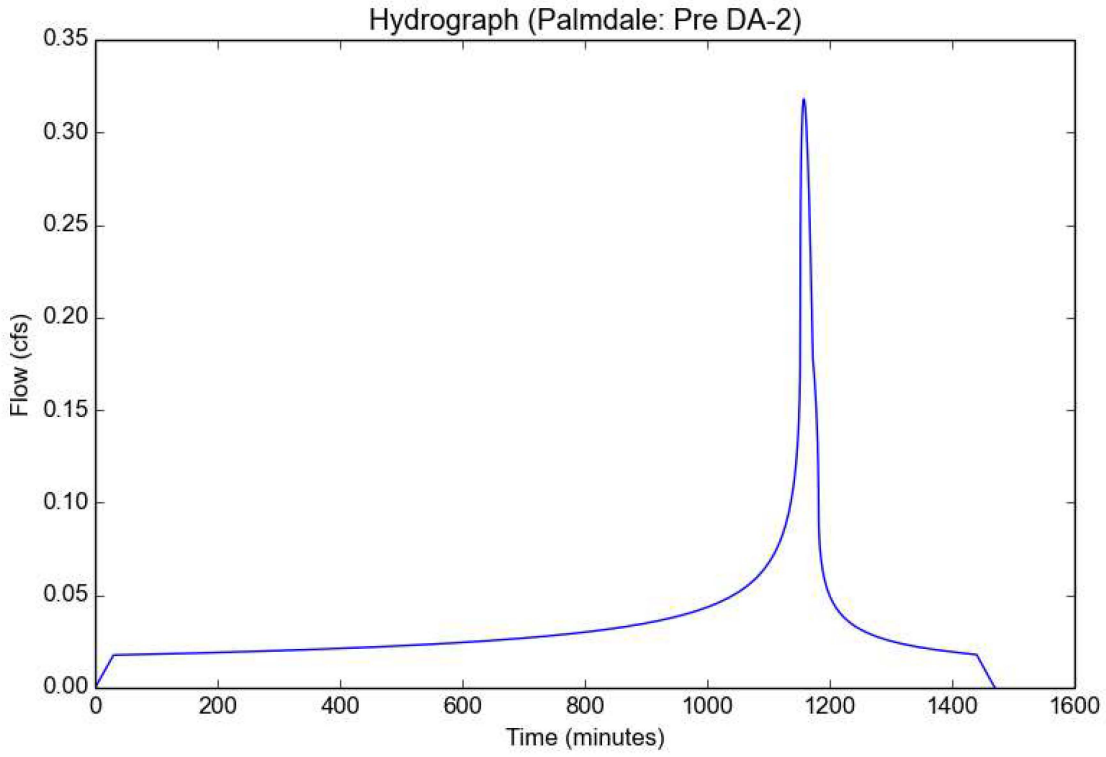
File location: Z:/Shared/Blue/2022145 - Palmdale - Beyond/_Reports/Hydrology/Pre-Development/Palmdale-Beyond - DA-2 - 25 yr PRE.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Palmdale
Subarea ID	Pre DA-2
Area (ac)	2.54
Flow Path Length (ft)	550.06
Flow Path Slope (vft/hft)	0.0036
50-yr Rainfall Depth (in)	3.3
Percent Impervious	0.01
Soil Type	120
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	2.8974
Peak Intensity (in/hr)	0.7447
Undeveloped Runoff Coefficient (Cu)	0.1607
Developed Runoff Coefficient (Cd)	0.1681
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.3179
Burned Peak Flow Rate (cfs)	0.3179
24-Hr Clear Runoff Volume (ac-ft)	0.0679
24-Hr Clear Runoff Volume (cu-ft)	2959.066



Appendix B:

Post-development calculations, 25 year, 24-hr storm event

Peak Flow Hydrologic Analysis

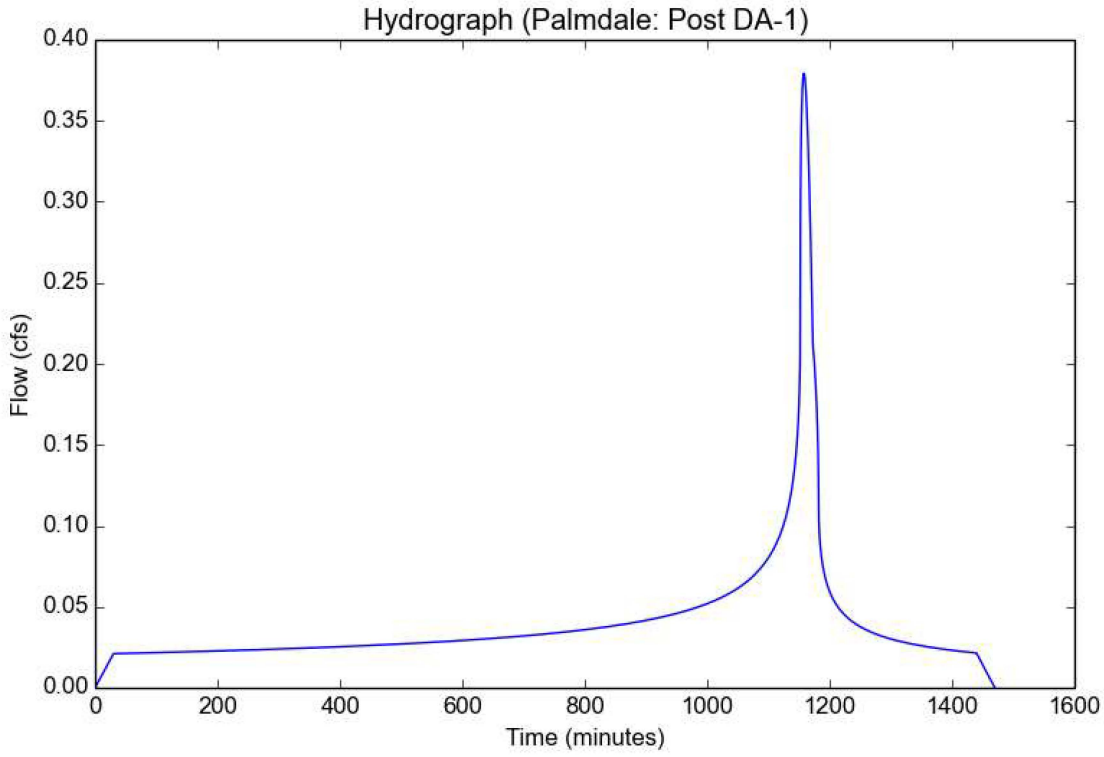
File location: C:/Users/BrandonMuse/Downloads/Palmdale - Post DA-1 - 25yr POST.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Palmdale
Subarea ID	Post DA-1
Area (ac)	3.03
Flow Path Length (ft)	521.23
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	3.3
Percent Impervious	0.01
Soil Type	120
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	2.8974
Peak Intensity (in/hr)	0.7447
Undeveloped Runoff Coefficient (Cu)	0.1607
Developed Runoff Coefficient (Cd)	0.1681
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.3793
Burned Peak Flow Rate (cfs)	0.3793
24-Hr Clear Runoff Volume (ac-ft)	0.081
24-Hr Clear Runoff Volume (cu-ft)	3529.9094



Peak Flow Hydrologic Analysis

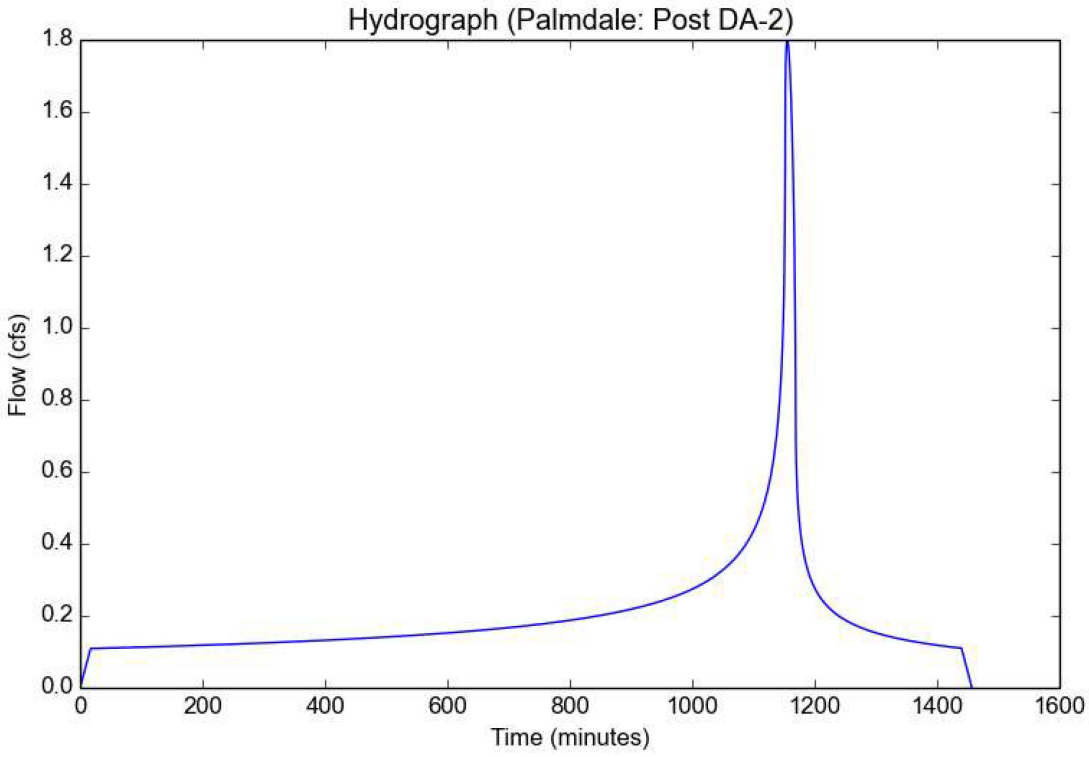
File location: Z:/Shared/Blue/2022145 - Palmdale - Beyond/_Reports/Hydrology/Post-Development/Palmdale - DA-2 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Palmdale
Subarea ID	Post DA-2
Area (ac)	2.54
Flow Path Length (ft)	631.75
Flow Path Slope (vft/hft)	0.005
50-yr Rainfall Depth (in)	3.3
Percent Impervious	0.71
Soil Type	120
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	2.8974
Peak Intensity (in/hr)	0.9726
Undeveloped Runoff Coefficient (Cu)	0.3067
Developed Runoff Coefficient (Cd)	0.728
Time of Concentration (min)	17.0
Clear Peak Flow Rate (cfs)	1.7983
Burned Peak Flow Rate (cfs)	1.7983
24-Hr Clear Runoff Volume (ac-ft)	0.4087
24-Hr Clear Runoff Volume (cu-ft)	17800.9052



Appendix C: LID Calculations

Peak Flow Hydrologic Analysis

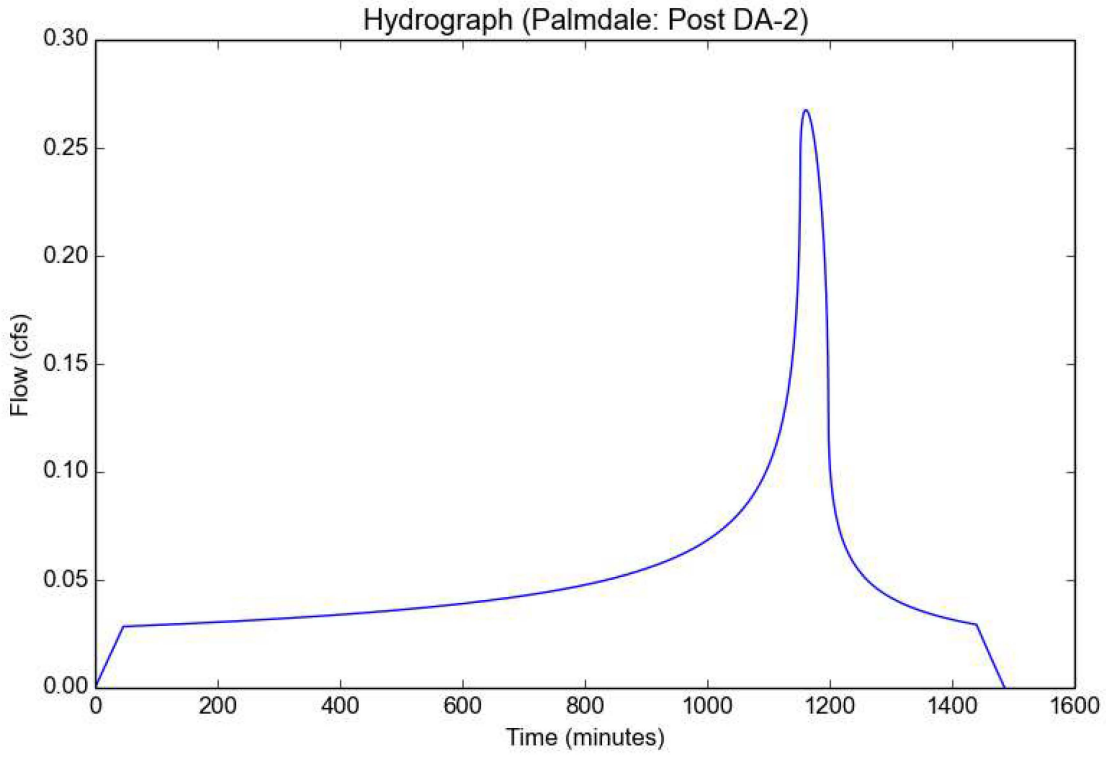
File location: Z:/Shared/Blue/2022145 - Palmdale - Beyond/_Reports/Hydrology/Hydro Calc/Palmdale Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Palmdale
Subarea ID	Post DA-2
Area (ac)	2.54
Flow Path Length (ft)	632.0
Flow Path Slope (vft/hft)	0.005
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.71
Soil Type	120
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

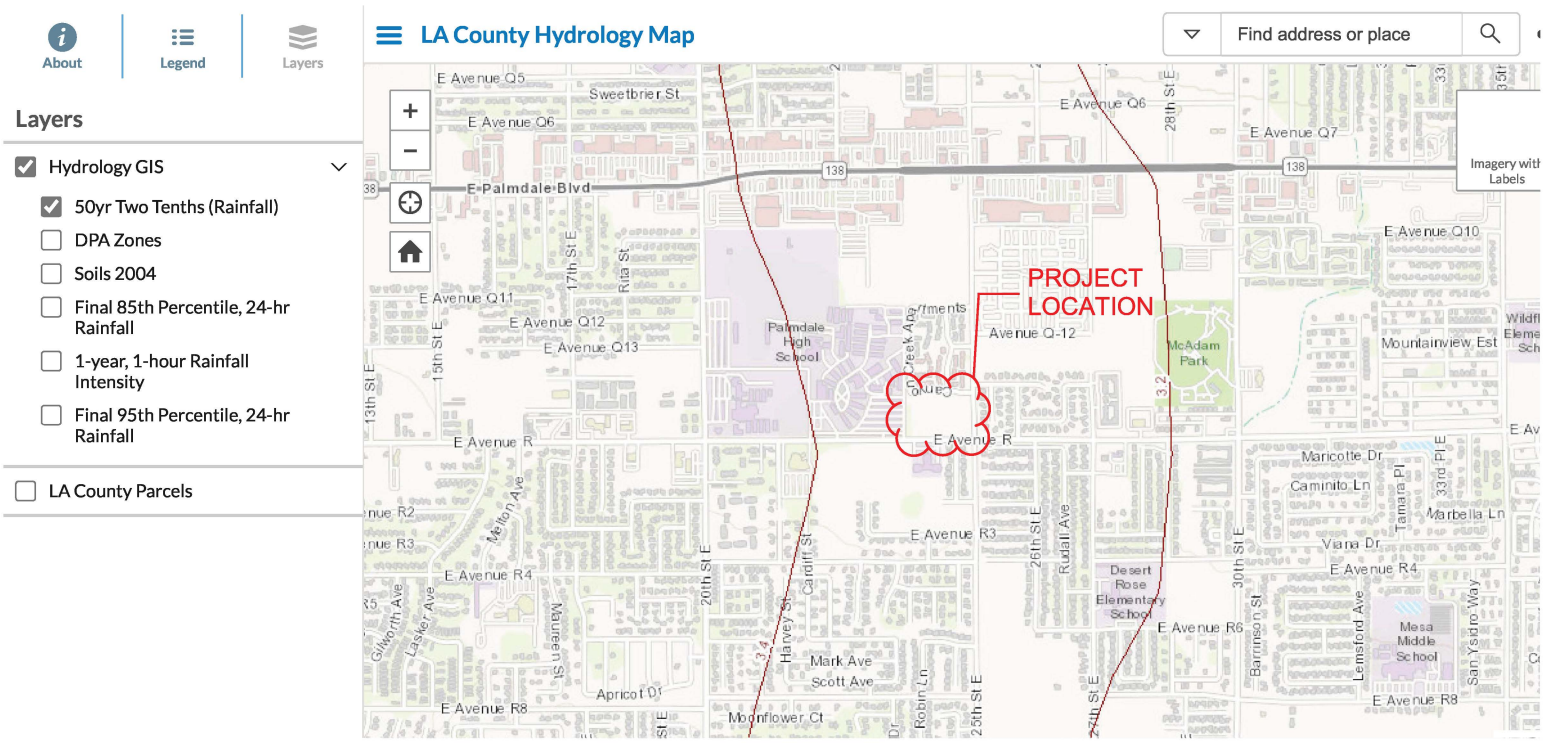
Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1577
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.668
Time of Concentration (min)	46.0
Clear Peak Flow Rate (cfs)	0.2675
Burned Peak Flow Rate (cfs)	0.2675
24-Hr Clear Runoff Volume (ac-ft)	0.1052
24-Hr Clear Runoff Volume (cu-ft)	4581.269



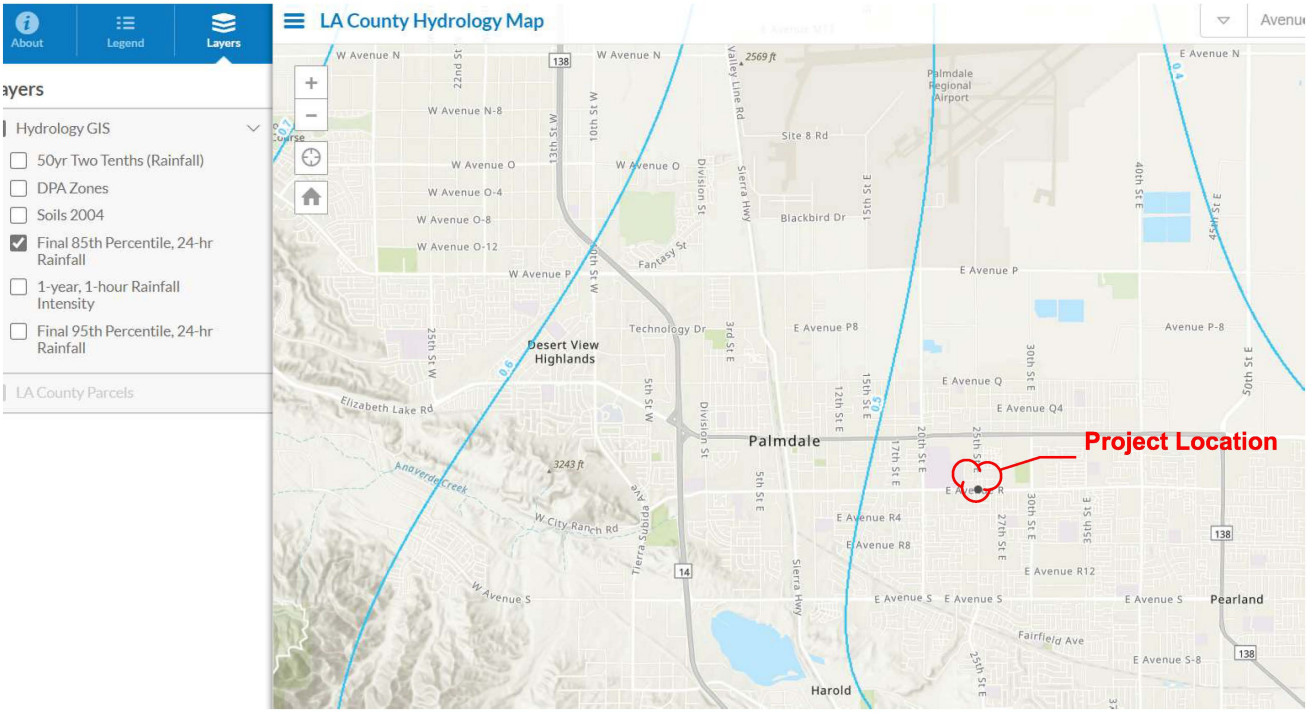
Appendix D:

LA County Hydrology Map 50-year 24-hr rainfall


About
Legend
Layers
Layers
Hydrology GIS
50yr Two Tenths (Rainfall)
DPA Zones
Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
LA County Hydrology Map
Find address or place
PROJECT LOCATION
E Avenue Q5
Sweetbrier St
E Avenue Q6
E Palmdale Blvd
E Avenue Q11
E Avenue Q12
E Avenue Q13
E Avenue R
E Avenue R2
E Avenue R3
E Avenue R4
E Avenue R8
Palmdale High School
Avenue Q-12
E Avenue Q7
E Avenue Q10
McAdam Park
Mountainview Est
Maricotte Dr
Caminito Ln
Marbella Ln
Viana Dr
Desert Rose Elementary School
Mesa Middle School
Mark Ave
Scott Ave
Moonflower Ct
Apricot Dr
Melton Ave
Gilworth Ave
Lasker Ave
Cardiff St
Harvey St
Rudall Ave
Barrinson St
Lemsford Ave
San Ysidro Way
Tamara Pl
13th St E
15th St E
17th St E
20th St E
25th St E
26th St E
28th St E
30th St E
33rd Pl E
Rita St
138

Appendix E:

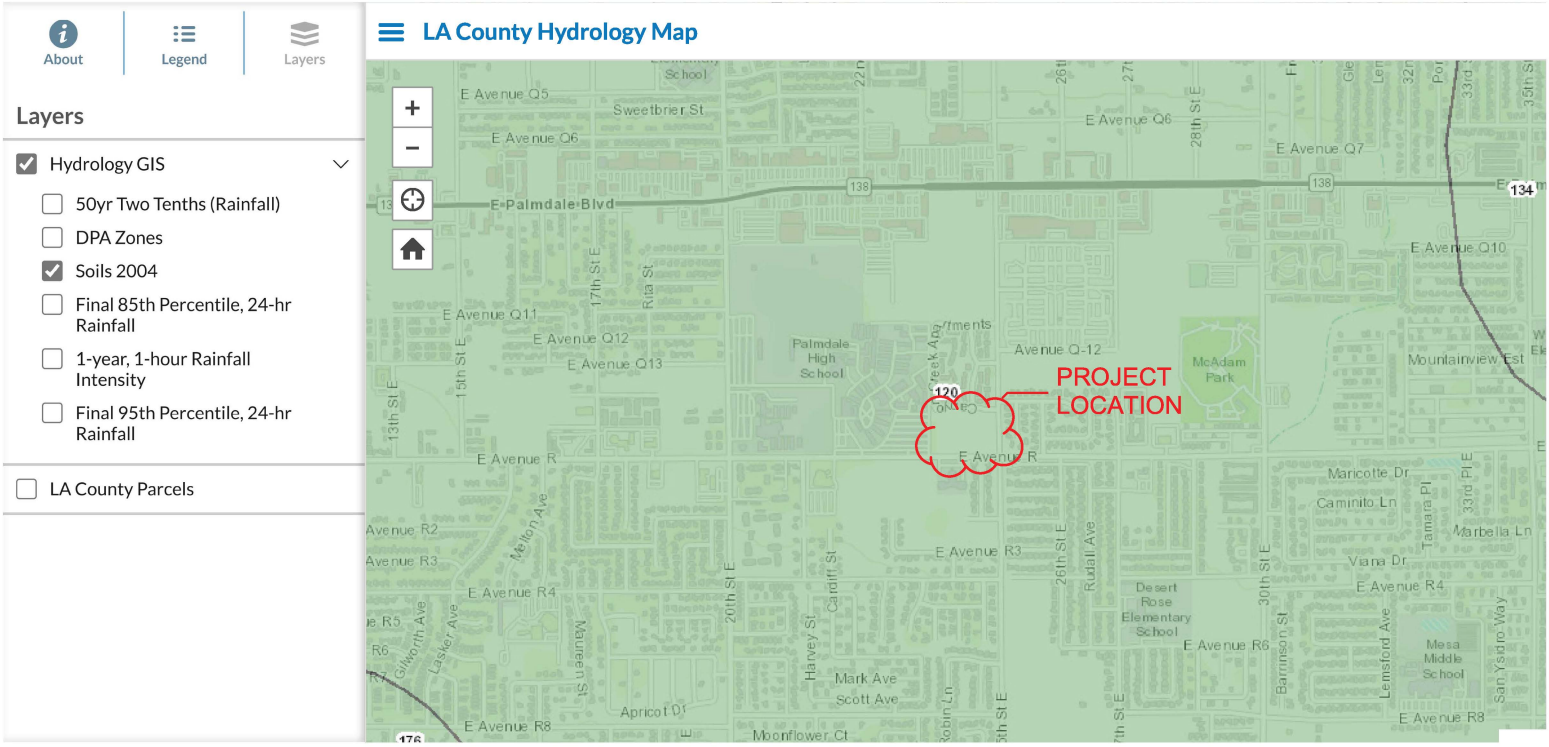
LA County Hydrology Map 85th Percentile 24-hr. rainfall



Project Location 85th Percentile, 24-Hr.
Rainfall: 0.48"

Appendix F:

LA County Hydrology Map Soils Map


About
Legend
Layers
Layers
Hydrology GIS
50yr Two Tenths (Rainfall)
DPA Zones
Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
LA County Hydrology Map
PROJECT LOCATION
E Avenue Q5
Sweetbrier St
E Avenue Q6
E Palmdale Blvd
E Avenue Q7
E Avenue Q10
E Avenue Q11
E Avenue Q12
E Avenue Q13
Palmdale High School
Avenue Q-12
McAdam Park
Mountainview Est
E Avenue R
Maricotte Dr
Caminito Ln
Marbella Ln
Viana Dr
Avenue R2
Avenue R3
E Avenue R3
E Avenue R4
Desert Rose Elementary School
E Avenue R6
Mesa Middle School
Mark Ave
Scott Ave
Apricot Dr
Moonflower Ct
E Avenue R8
17th St E
15th St E
13th St E
20th St E
26th St E
30th St E
Rudall Ave
Cardiff St
Harvey St
Barrinson St
Lemsford Ave
San Ysidro Way
Tamara Pl
33rd Pl E
Rita St
Meltan Ave
Gilworth Ave
Lasker Ave
Mauren St
Robin Ln
138
134
120
176

Appendix G:

Soils Report

NTS GEOTECHNICAL

June 1, 2022

Project No. 22224

Mr. Michael Ramirez
Beyond Food Mart
4300 Edison Avenue
Chino, CA 91710

Subject: Preliminary Geotechnical Engineering and Infiltration Report
Proposed Carwash and Gas Station
Northwest Corner of 25th Street East & Avenue R, Palmdale, California

Dear Mr. Ramirez:

In accordance with your request and authorization, we are presenting the results of our geotechnical investigation and infiltration testing for the proposed construction of new car wash and gas station located at the northwest corner of 25th Street East and Avenue R, in City of Palmdale, California. The purpose of this investigation has been to evaluate the subsurface conditions at the site and to provide geotechnical engineering recommendations for the proposed construction.

Based on our findings, the proposed project is geotechnically feasible, provided that the recommendations in this report are incorporated into the design and are implemented during construction of the project. This report was prepared in accordance with the requirements of the 2019 California Building Code and the City of Palmdale.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding this report or if we can be of further service, please do not hesitate to contact the undersigned at (657) 888-4608 or info@ntsgeo.com.

Respectfully submitted,
NTS GEOTECHNICAL, INC.

Nadim Sunna, MS, PE, GE 3172
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
NADIM T SUNNA
GE 3172
GEOTECHNICAL
STATE OF CALIFORNIA

Table of Contents

INTRODUCTION 3
SITE AND PROJECT DESCRIPTION 3
SCOPE OF WORK 3
Background Review 3
Field Exploration 3
Geotechnical Laboratory Testing 4
GEOLOGIC FINDINGS 4
Regional Geologic Setting 4
Subsurface Materials 4
Groundwater 4
GEOLOGIC HAZARDS 5
Faulting and Seismicity 5
Liquefaction and Seismic Settlement 5
Landslides 5
Flooding 5
Tsunami and Seiches 6
GEOTECHNICAL ENGINEERING FINDINGS 6
Expansive Soil 6
Preliminary Infiltration Testing 6
Excavation Characteristics 7
GEOTECHNICAL ENGINEERING CONLUSIONS AND RECOMMENDATIONS 7
Conclusions 7
Site Preparation 8
Remedial Grading 8
Materials for Fill 10
Compacted Fill 10
Temporary Excavations 10
Seismic Design 11
Foundation Design and Construction 13
Slab-On-Grade Design and Construction 13
Pole Foundation Design and Construction 14
Moisture Vapor Retarder 14
Drainage Control 15
Preliminary Infiltration Design and Construction Recommendations 16
Utility Trench Backfill Considerations 17
Asphalt Concrete Pavement Design 18
Exterior Flatwork/Hardscape Design Considerations 19
Planters and Trees 19
Review, Observation, and Testing 20
LIMITATIONS 20
REFERENCES 22

Attachment(s):

Plate 1 – Location Map
Plate 2 – Geotechnical Map

Appendix A – Field Exploration
Appendix B – Geotechnical Laboratory Test Result
Appendix C – Infiltration Test Result

INTRODUCTION

This report presents the results of our geotechnical engineering and infiltration evaluation performed for the proposed new carwash and gas station located at the northwest corner of 25th Street East and Avenue R, in the City of Palmdale, California. See (Plate 1, Location Map). The purpose of this study has been to evaluate the subsurface conditions at the site and to provide geotechnical recommendations related to the design and construction of the proposed improvements.

SITE AND PROJECT DESCRIPTION

The project site is located at northwest corner of Avenue R and 25th Street East in the City of Palmdale, California. The site is currently approximately 5.68 acres and is identified into two parcels. Parcel 1 consists of 2.6 acres and is on the corner of 25th Street East and Avenue R and Parcel 2 consists of 3.08 acres and encompasses the remaining portion of the lot. At this time, the plan is to develop the eastern half of the 5.68 acre lot, while the remaining half is planned for future multi-family development. This report is prepared only to address the carwash and gas station portion of the development. Future report will be required for the planned multi-family development on the wester half of the site.

It is our understanding that the project consists of construction of new carwash station that encompasses almost half of Parcel 2 and a gas station that is planned within Parcel 1 and encroaches into Parcel 2. The planned improvement consist of new carwash tunnel, vacuum station, new gas tanks with overhead canopy, and underground gas tanks. Additionally, site improvements such as new light poles, trash enclosures, and pavement are also planned.

SCOPE OF WORK

As part of the preparation of this report, we have performed the following tasks:

Background Review

We reviewed readily available background data including in-house geophysical data, geologic maps, topographic maps, and aerial photographs relevant to the subject site in preparation of this report. The list of documents reviewed is presented in the “References” section of this report.

Field Exploration

The subsurface conditions were evaluated on May 11, 2022 by advancing four (4) 8-inch diameter, hollow-stem-auger borings and five (5) hollow-stem-auger borings for the purpose of performing infiltration testing at various locations

throughout the site. The borings were advanced to depths ranging from 5 and 21.5 feet below the existing grade. The approximate locations of the borings are shown on Plate 2, Geotechnical Map. Detailed exploration information of soils borings is presented in Appendix A, Field Exploration.

Geotechnical Laboratory Testing

Laboratory tests were performed on selected samples obtained from the boring in order to aid in the soil classification and to evaluate the engineering properties of the foundation soils. The following tests were performed in general accordance with ASTM standards:

- In-situ moisture and density;
- #200 sieve wash;
- Sieve analysis;
- Direct shear; and
- Consolidation.

Laboratory test results are presented within Appendix B of this report.

GEOLOGIC FINDINGS

Regional Geologic Setting

According to the Geologic Map of the Pacifico Mountain and Palmdale (south half) Quadrangles, the project site is underlain by alluvium (Qal) that are typically comprised of alluvial gravel, sand and silt/clay of valleys and canyon flood plains.

Subsurface Materials

Earth materials encountered during our subsurface investigation consisted of alluvium to the total depth of the exploration. In general, the alluvium consists of light brown, damp to dry, loose to dense, sands. The upper approximately 4 of the site soils are considered loose and compressible and will require remedial grading.

Groundwater

Groundwater was not observed during our exploration to the total depth of the exploration (21.5 feet below existing grade). The historical high depth to groundwater is reportedly deeper than 40 feet below the existing grade at the project site (CDMG 1998). Groundwater conditions may vary across the site due to stratigraphic and hydrologic conditions, and may change over time as a consequence of seasonal and meteorological fluctuations, or activities by

humans at this site and nearby sites. However, based on the above findings, groundwater is unlikely to impact the proposed improvement.

GEOLOGIC HAZARDS

Faulting and Seismicity

The site is not located within an Alquist-Priolo Earthquake Fault Zone, and no known active faults are shown on the reviewed geologic maps crossing the site, however, the site is located in the seismically active region of Southern California. The nearest known active fault is the San Andreas fault system, which is located approximately 2.0 miles from the site.

Liquefaction and Seismic Settlement

Liquefaction occurs when the pore pressures generated within a soil mass approach the effective overburden pressure. Liquefaction of soils may be caused by cyclic loading such as that imposed by ground shaking during earthquakes. The increase in pore pressure results in a loss of strength, and the soil then can undergo both horizontal and vertical movements, depending on the site conditions. Other phenomena associated with soil liquefaction include sand boils, ground oscillation, and loss of foundation bearing capacity. Liquefaction is generally known to occur in loose, saturated, relatively clean, fine-grained cohesionless soils at depths shallower than approximately 50 feet. Factors to consider in the evaluation of soil liquefaction potential include groundwater conditions, soil type, grain size distribution, relative density, degree of saturation, and both the intensity and duration of ground motion.

Based on our review of the State of California Official Map of Seismic Hazard Zones for the Palmdale Quadrangle (California Department of Conservation, Division of Mines and Geology, 2003), the site is not located within a zone of required investigation for Liquefaction. Based on the lack of shallow groundwater and uniform soil stratum, it is our professional opinion that the potential for liquefaction to impact the planned improvements is considered low.

Landslides

Based on our review of the referenced geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the subject site. Due to the relatively level nature of the site and surrounding areas, the potential for landslides at the project site is considered negligible.

Flooding

The Federal Emergency Management Agency (FEMA) has prepared flood insurance rate maps (FIRMs) for use in administering the National Flood Insurance Program. Based on our review of the FEMA flood map, the site is located in an area of 0.2 PCT Annual Chance Flood Hazard (Zone X). The potential for flooding to impact the proposed development should be evaluated by the project designer.

Tsunami and Seiches

Tsunamis are waves generated by massive landslides near or under sea water. The site is not located on any State of California – County of Los Angeles Tsunami Inundation Map for Emergency Planning. The potential for the site to be adversely impacted by earthquake-induced tsunamis is considered to be negligible because the site is located several miles inland from the Pacific Ocean shore, at an elevation exceeding the maximum height of potential tsunami inundation.

Seiches are standing wave oscillations of an enclosed water body after the original driving force has dissipated. The potential for the site to be adversely impacted by earthquake-induced seiches is considered to be negligible due to the lack of any significant enclosed bodies of water located in the vicinity of the site.

GEOTECHNICAL ENGINEERING FINDINGS

Expansive Soil

Based on our evaluation, laboratory testing, and experience with similar material types, the soils encountered near the ground surface at the site exhibit a very low expansion potential.

Preliminary Infiltration Testing

Five (5) infiltration tests were performed in general conformance with the County of Los Angeles Guidelines for Geotechnical Investigation and Reporting, Low Impact Development Stormwater Infiltration, GS200.2 manual. The borings were excavated to a depth of 5 feet below the existing grade using a hollow-stem-auger drill rig. Following the drilling, the borings were set up and testing was performed in general accordance with the GS200.2 manual. The result of our infiltration testing is summarized in the table below, which includes a reduction factor in accordance with the County of Los Angeles manual. Our reduction factor including infiltration testing calculations are presented in Appendix C of this report.

Preliminary Infiltration Rates Summary

Boring No.	Depth Below Existing Grade (feet)	Design Infiltration Rate (inches/hour)
P-1	5	1.50
P-2	5	1.25
P-3	5	1.71
P-4	5	1.79
P-5	5	1.92

The infiltration test locations are shown on the attached Plate 2 –Geotechnical Map. Based on our infiltration testing, the design rates only within the upper 5 feet of the site soils have achieved the minimum requirement of 0.3 inches per hour per the County of Los Angeles GS200.2 manual. Therefore, infiltration of stormwater into the site soils is deemed feasible within the upper 5 feet of the site soils.

Excavation Characteristics

The majority of the soil materials underlying the site can be excavated with excavators and other conventional grading equipment.

GEOTECHNICAL ENGINEERING CONLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of our field exploration and engineering analyses, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided that the recommendations in this report are incorporated into the design plans and are implemented during construction. In addition, we conclude the following:

- Groundwater was not encountered at a depth of 21.5 feet below the existing and it is not anticipated to impact the proposed grading and development.
- There are no faults that cross the site and site is not located within an Alquist-Priolo Earthquake Fault Zone.
- The potential for liquefaction to impact the proposed development is considered low.
- The site soil is anticipated to have a very low expansion potential.

- Based on our field exploration and preliminary infiltration testing, infiltration of stormwater is feasible within the upper 5 feet of the site soils.

- The proposed improvement may be supported on shallow spread/continuous footings underlain engineered fill.

Our geotechnical engineering analyses performed for this report were based on the earth materials encountered during the subsurface exploration for the site. If the design substantially changes, then our geotechnical engineering recommendations would be subject to revision based on our evaluation of the changes. The following sections present our conclusions and recommendations pertaining to the engineering design for this project.

Site Preparation

Site preparation should begin with the removal of utility lines, asphalt, concrete, vegetation, and other deleterious debris from areas to be graded. Tree stumps and roots should be removed to such a depth that organic material is generally not present. Clearing and grubbing should extend to the outside edges of the proposed excavation and fill areas. We recommend that unsuitable materials such as organic matter or oversized material be selectively removed and disposed offsite. The debris and unsuitable material generated during clearing and grubbing should be removed from areas to be graded and disposed at a legal dump site away from the project area.

Remedial Grading

Remedial grading will serve to create a firm and workable platform for construction of the proposed development. The near-surface material encountered during our subsurface investigation will require some remedial grading in order to densify any disturbed soil and loose soil that may be encountered during the grading operation.

It should be noted that the recommendations provided herein are based on our subsurface exploration and knowledge of the on-site geology. Actual removals may vary in configuration and volume based on observations of geologic materials and conditions encountered during grading. The bottom of all corrective grading removals should be observed by a representative of NTS to verify the suitability of in-place soil prior to performing scarification and recompaction. Remedial grading recommendations are outlined below.

<u>Foundations and Slab-On-Grade</u>

Due to the presence of loose soil in the upper approximately 4 feet of the site soils that is not suitable for support of new foundations, we recommend that new

foundations and slab-on-grade be supported on a blanket of engineered fill as described below:

- New foundations and slab-on-grade should have the bottom of the foundations excavated to a depth of 2 feet below bottom of footing or 4 feet from existing grade, whichever is deeper. The excavation should extend laterally a minimum of 4 feet beyond the edge of new footings, where space is available.
- The bottom of the over excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to near optimum moisture content and recompacted to at least 90 percent relative compaction as determined in accordance with ASTM D1557.
- Following the approval of the over-excavation bottom by a representative of NTS, the onsite material may be used as fill material to achieve the planned slab subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to near optimum moisture content and compacted to achieve 90 percent relative compaction.

Pavement

New pavement and hardscape subgrade should be prepared in accordance with the following recommendations:

- New pavement and hardscape should be excavated to a depth of 2 feet below the pavement/hardscape section.
- The bottom of the over excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to near optimum moisture content and recompacted to at least 90 percent relative compaction as determined in accordance with ASTM D1557.
- Following the approval of the over-excavation bottom by a representative of NTS, the onsite material may be used as fill material to achieve the planned slab subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to near optimum moisture content and compacted to achieve 90 percent relative compaction.

If the existing loose fill materials are found to be disturbed to depths greater than the proposed remedial grading, then the depth of over-excavation and re-compaction should be increased accordingly in local areas as recommended by a representative of NTS.

Materials for Fill

On-site soils with an organic content of less than 3 percent by volume (or 1 percent by weight) are suitable for use as fill. Soil material to be used as fill should not contain contaminated materials, rocks, or lumps over 6 inches in largest dimension, and not more than 40 percent larger than ¾ inch. Utility trench backfill material should not contain rocks or lumps over 3 inches in largest dimension. Larger chunks, if generated during excavation, may be broken into acceptably sized pieces or may be disposed offsite.

Any imported fill material should consist of granular soil having a “low” expansion potential (that is, expansion index of 50 or less). Import material should also have low corrosion potential (that is, chloride content less than 500 parts per million [ppm], soluble sulfate content of less than 0.1 percent, and pH of 5.5 or higher). Materials to be used as fill should be evaluated by a representative of NTS prior to importing or filling.

Compacted Fill

Prior to placement of compacted fill, the contractor should request an evaluation of the exposed excavation bottom by NTS. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of at least 8 inches and watered or dried, as needed, to achieve generally consistent moisture contents that are near optimum moisture content. The scarified materials should then be compacted to 90 percent relative compaction in accordance with the latest version of ASTM Test Method D1557.

Compacted fill should be placed in horizontal lifts of approximately 6 to 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted by mechanical to a relative compaction of 90 percent. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

Personnel from NTS should observe the excavations so that any necessary modifications based on variations in the encountered soil conditions can be made. All applicable safety requirements and regulations, including CalOSHA requirements, should be met.

Temporary Excavations

Temporary excavations for the demolishing, earthwork, footing and utility trench are expected. We anticipate that unsurcharged excavations with vertical side slopes less than 4 feet high will generally be stable.

Where the space is available, temporary, unsurcharged excavation sides over 4 feet in height should be sloped no steeper than an inclination of 1H:1V

(horizontal:vertical). Where sloped excavations are created, the tops of the slopes should be barricaded so that vehicles and storage loads do not encroach within 10 feet of the top of the excavated slopes. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. NTS should be advised of such heavy vehicle loadings so that specific setback requirements can be established. If the temporary construction slopes are to be maintained during the rainy season, berms are recommended to be graded along the tops of the slopes in order to prevent runoff water from entering the excavation and eroding the slope faces. Where space for sloped excavations is not available, temporary shoring may be utilized.

Personnel from NTS should observe the excavation so that any necessary modifications based on variations in the encountered soil conditions can be made. All applicable safety requirements and regulations, including CalOSHA requirements, should be met.

Excavations shall not undermine the existing adjacent building footings. Where space for sloped excavations is not available, temporary shoring or A-B-C slot cuts should be utilized.

Our temporary excavation recommendations are provided only as **minimum** guidelines. All work associated with temporary slopes should meet the minimal requirements as set forth by CAL-OSHA. Temporary slope construction, maintenance, and safety are the responsibility of the contractor.

Seismic Design

Based on our subsurface investigation, the site is designated as Site Class D ("stiff" soil profile). The seismic design parameters based on ASCE 7-16 and 2019 CBC are listed in the following table:

2019 CBC and ASCE 7-16 Seismic Design Parameters
(To be utilized as per the requirements of Section 11.4.8 of ASCE 7-16)

Seismic Item	Design Value	2016 ASCE 7-16 or 2019 CBC Reference
Site Class based on soil profile (ASCE 7-16 Table 20.3-1)	D[(a)]	ASCE 7-16 Table 20.3-1
Short Period Spectral Acceleration S_s	2.174[(a)]	CBC Figures 1613.2.1 (1-8)
1-sec. Period Spectral Acceleration S_1	0.920[(a)]	CBC Figures 1613.2.1 (1-8)
Site Coefficient F_a (2019 CBC Table 1613.2.3(1))	1.000[(a)]	CBC Table 1613.2.3 (1)
Site Coefficient F_v (2019 CBC Table 1613.2.3(2))	1.700[(b)]	CBC Table 1613.2.3 (2)
Short Period MCE* Spectral Acceleration S_{MS} $S_{MS} = F_a S_s$	2.174[(a)]	CBC Equation 16-36
1-sec. Period MCE Spectral Acceleration S_{M1} $S_{M1} = F_v S_1$	1.564[(b)]	CBC Equation 16-37
Short Period Design Spectral Acceleration S_{DS} $S_{DS} = 2/3S_{Ms}$	1.449[a)]	CBC Equation 16-38
1-sec. Period Design Spectral Acceleration S_{D1} $S_{D1} = 2/3S_{M1}$	1.043[(b)]	CBC Equation 16-39
Short Period Transition Period T_S (sec) $T_S = S_{D1}/S_{DS}$	0.720[(b)]	ASCE 7-16 Section 11.4.6
Long Period Transition Period Tl (sec)	8[(b)]	ASCE 7-16 Figures 22-14 to 22-17
MCE[(c)] Peak Ground Acceleration (PGA)	0.937[(a)]	ASCE 7-16 Figures 22-9 to 22-13
Site Coefficient F_{PGA} (ASCE 7-16 Table 11.8-1)	1.100[(a)]	ASCE 7-16 Table 11.8-1
Modified MCE[(c)] Peak Ground Acceleration (PGA_M)	1.031[(a)]	ASCE 7-16 Equation 11.8-1

(a) Design Values Obtained from USGS Earthquake Hazards Program website that are based on the ASCE-7-16 and 2019 CBC and site coordinates of N34.573124° and W118.085419°.
(b) Design Values Determined per ASCE Table 11.4-2 and CBC Equations 16-36 through 16-39.
(c) MCE: Maximum Considered Earthquake.

Since the Site Class is designated as D and the S_1 value is greater than or equal to 0.2, the 2019 CBC requires either a site-specific seismic hazard analysis per Section 21.2 of ASCE 7-16 or the application of Exception 2 of Section 11.4.8 of ASCE 7-16. The project structural engineer should apply all requirements of Section 11.4.8 of ASCE 7-16 to determine if increases to the seismic response coefficient (i.e. increases to the loading of the structure) are required.

It should be recognized that much of southern California is subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. Design utilizing the 2019 CBC is not meant to completely protect against damage or loss of function. Therefore, the preceding parameters should be considered as minimum design criteria.

Foundation Design and Construction

A shallow foundation system may be used for support of the proposed improvements, provided that all the footings are placed on engineered fill prepared as described in the "**Remedial Grading**" section of this report. Our geotechnical foundation design parameters are presented in the table below:

Foundation Design Parameters

Bearing Material	▪ Engineered Fill ▪ 2 feet of compacted fill below bottom of footings
Minimum Footing Size	▪ Width: 18 inches ▪ Depth: 24 inches below the lowest adjacent soil grade
Allowable Bearing Capacity	▪ 2,500 psf for the minimum footing size given above. ▪ The above value may be increased by 1/3 for temporary loads such as wind or earthquake.
Settlement	▪ Total static settlement of 1 inch with differential settlement estimated to be approximately ½ inch over a span of 30 feet.
Allowable Lateral Passive Resistance	• 250 pcf (equivalent fluid pressure)
Allowable Coefficient of Friction	• 0.35

Slab-On-Grade Design and Construction

New and reconstructed slab-on-grade should be designed and constructed with the minimum recommendations presented below, however, final design of the slab should be determined by the project structural engineer.

Minimum Thickness: The minimum slab thickness should be 5 inches.

Minimum Slab Reinforcement: Minimum slab reinforcement shall not be less than No. 4 bars placed at 16 inches on center. Welded wire mesh is not recommended. Care should be taken to position the reinforcement bars in the center of the slab.

Slab Subgrade:

- The upper 24 inches of the slab subgrade should be moisture conditioned to near optimum moisture content and compacted to a minimum relative compaction of compacted to 90 percent relative compaction in accordance with the latest version of ASTM D1557.

Pole Foundation Design and Construction

Pole foundation may be used to support the proposed light poles. The following recommendations may be used by the structural engineer to design the proposed poles:

Pole Foundation Design Parameters

Pile Embedment	▪ To be determined by the wall structural engineer. A minimum embedment of 5 feet into competent alluvial soils.
Minimum Diameter	▪ 18 inches ▪ Final diameter should be determined by the structural engineer.
Allowable Skin Friction	▪ An allowable average unit skin friction of 250 psf may be used for the pile foundation vertical capacity.
Allowable Lateral Passive Resistance	• 250 psf/ft allowable passive resistance may be used. • Disregard the upper 3 feet resistance due to soil disturbance and artificial fill material. • Can be applied over 2 pile diameters provided piles are spaced at least 3 pile diameters, center to center (e.g., 500 psf/ft of pile diameters per foot of depth)

Moisture Vapor Retarder

A vapor retarder, such as a 15-mil-thick moisture vapor retarder that meets the requirements of ASTM E1745 Class C (Stego Wrap or equivalent) should be placed directly over the prepared soil subgrade to provide protection against vapor transmission through concrete floor slabs that are anticipated to receive carpet, tile or other moisture sensitive coverings. The use of moisture vapor retarder should be determined by the project architect. At minimum, the vapor retarder should be installed as follows:

- Per the manufacture's specifications as well as with the applicable recognized installation procedures such as ASTM E1643;

- Joints between the sheets and the openings for utility piping should be lapped and taped. If the barrier is not continuously placed across footings/ribs, the barrier should at minimum be lapped into the side of the footing/rib trenches down to the bottom of the trench; and,
- Punctures in the vapor retarder should be repaired prior to concrete placement.

It should be noted that the moisture retarder is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry in the building construction in Southern California. It is not intended to provide a “waterproof” or “vapor proof” barrier or reduce vapor transmission from sources above the retarder (i.e., concrete). The evaluation of water vapor from any source and its effect on any aspect of the proposed building space above the slab (i.e., floor covering applicability, mold growth, etc.) is beyond our purview and the scope of this report.

Drainage Control

The control of surface water is essential to the satisfactory performance of the building and site improvements. Surface water should be controlled so that conditions of uniform moisture are maintained beneath the improvements, even during periods of heavy rainfall. The following recommendations are considered minimal:

- Ponding and areas of low flow gradients should be avoided.
- If bare soil within 5 feet of the structure is not avoidable, then a gradient of 5 percent or more should be provided sloping away from the improvement. Corresponding paved surfaces should be provided with a gradient of at least 2 percent.
- The remainder of the unpaved areas should be provided with a drainage gradient of at least 2 percent.
- Positive drainage devices, such as graded swales, paved ditches, and/or catch basins should be employed to accumulate and to convey water to appropriate discharge points.
- Concrete walks and flatwork should not obstruct the free flow of surface water.
- Brick flatwork should be sealed by mortar or be placed over an impermeable membrane.
- Area drains should be recessed below grade to allow free flow of water into the basin.
- Enclosed raised planters should be sealed at the bottom and provided with an ample flow gradient to a drainage device. Recessed planters and landscaped areas should be provided with area inlet and subsurface drain pipes.
- Planters should not be located adjacent to the structures wherever possible. If planters are to be located adjacent to the structures, the

planters should be positively sealed, should incorporate a subdrain, and should be provided with free discharge capacity to a drainage device.

- Planting areas at grade should be provided with positive drainage. Wherever possible, the grade of exposed soil areas should be established above adjacent paved grades. Drainage devices and curbing should be provided to prevent runoff from adjacent pavement or walks into planted areas.
- Gutter and downspout systems should be provided to capture discharge from roof areas. The accumulated roof water should be conveyed to off-site disposal areas by a pipe or concrete swale system.
- Landscape watering should be performed judiciously to preclude either soaking or desiccation of soils. The watering should be such that it just sustains plant growth without excessive watering. Sprinkler systems should be checked.

Preliminary Infiltration Design and Construction Recommendations

Infiltration Design

Based on our preliminary infiltration testing and our evaluation, we note that the installation of infiltration system within the subject property is feasible from a geotechnical standpoint provided that the recommendations presented in this section is considered during design and implemented during construction. On this basis we recommend the following:

- We recommend that an average design infiltration rate of 1.63 inches per hour be used for design of the proposed infiltration system that is located within the upper 5 feet of the site soils.

- The selected infiltration BMP should be designed and constructed in accordance with the minimum requirements presented below, the requirements of the City of Palmdale.

Minimum Setback Requirements

Any foundation	• A minimum of 10 feet setback or within 1:1 plane drawn up from the bottom of foundation, whichever is greater.
Water wells used for drinking water	• A minimum of 100 feet setback.

- The final design and specification should be reviewed by the Geotechnical Engineer of Record prior to construction to verify compliance with the

recommendations of this report and/or provide additional recommendations/revisions, if needed.

Utility Trench Backfill Considerations

New utility line pipeline trenches should be backfilled with select bedding materials beneath and around the pipes (pipe zone) and compacted soil above the pipe bedding. Recommendations for the types of the materials to be used and the proper placement of these materials are provided in the following sections.

Pipe Zone (Bedding and Shading)

The pipe bedding and shading materials should extend from at least 6 inches below the pipes to at least 12 inches above the crown of the pipes. Pipe bedding and shading should consist of either clean sand with a sand equivalent (SE) of at least 30, or crushed rock. If crushed rock is used, it should consist of ¾-inch crushed rock that conforms to Table 200-1.2.1 (A) of the 2018 “Greenbook.” Pipe bedding and shading should also meet the minimum requirements of the City of Los Angeles. If the requirements of the City are more stringent, they should take precedence over the geotechnical recommendations. Sufficient laboratory testing should be performed to verify the bedding and shading meets the minimum requirements of the Greenbook and City of Palmdale grading codes.

Based on our subsurface exploration and knowledge of the onsite materials, the soils that will be excavated from the pipeline trenches will not meet the recommendations for pipe bedding and shading materials; therefore, imported materials will be required for pipe bedding and shading.

Granular pipe bedding and shading material should be properly placed in thicknesses not exceeding 3 feet, and then sufficiently flooded or jetted in place. Crushed rock, if used, should be capped with filter fabric (Mirafi 160N, or equivalent; Mirafi 140N filter fabric is suitable if available) to prevent the migration of fines into the rock.

Trench Backfill

All existing soil material within the limits of the site are considered suitable for use as trench backfill above the pipe bedding and shading zone if care is taken to remove all significant organic and other decomposable debris, moisture condition the soil materials as necessary, and separate and selectively place and/or stockpile any inert materials larger than 6 inches in maximum diameter.

Imported soils are not anticipated for backfill since the on-site soils are suitable. However, if imported soils are used, the soils should consist of clean, granular materials with physical and chemical characteristics similar to or better than

those described herein for on-site soils. Any imported soils to be used as backfill should be evaluated and approved by NTS prior to placement.

Soils to be used as trench backfill should be moistened, dried, or blended as necessary to achieve a minimum of 2 percent over optimum moisture content, placed in lifts which, prior to compaction shall not exceed the thickness specified in Section 306-12.3 of the 2018 “Greenbook” for various types of equipment, and mechanically compacted/densified to at least 90 percent relative compaction as determined by ASTM Test Method D 1557. Jetting is not permitted in this trench zone.

No rock or broken concrete greater than 6 inches in maximum diameter should be utilized in the trench backfills.

Asphalt Concrete Pavement Design

In accordance with Chapter 600 of the Caltrans Highway Design Manual, we have performed pavement structural design utilizing assumed traffic indices (TI) of 4, 5.5, and 6.0 and assumed R-value of 20. Based on our analysis, we have developed the pavement structural sections presented in the following table. We note that the assumed TI’s should be reviewed by a traffic engineer to confirm their applicability to the project. The subgrade R-value should be confirmed during construction and at the completion of rough grading.

Asphalt Concrete Pavement Structural Sections

Location	Traffic Index	Asphalt Concrete (in.)	Aggregate Base (in.)*
Driveways	5.5	4.0	7.0
Parking Stalls	4.5	3.0	6.0
Fire Lane	7.0	5.0	10.0

The planned pavement structural sections should consist of the following:

- Aggregate Base materials (AB) consisted of either Crushed Aggregate Base (CAB) or Crushed Miscellaneous Base (CMB).
- Asphalt Concrete (AC) material of a type meeting the minimum City of Palmdale standards.
- The subgrade soils should be moisture conditioned to near optimum moisture content to a depth of at least 18 inches and compacted to 90 percent relative compaction.

- The AB and AC should be compacted to at least 95 percent relative compaction.

Exterior Flatwork/Hardscape Design Considerations

For exterior flatwork and hardscape planned as part of the proposed development, the following design may be considered by the project civil engineer. These recommendations may be considered as minimal design based on the soils conditions encountered during our investigation. Final design of the proposed flatwork and hardscape area should be provided by the project civil engineer. Based on the conditions encountered, we recommend that the subgrade for the subject concrete flatwork and hardscape be moisture conditioned to near optimum to a depth of 18 inches below finish subgrade elevation and compacted to 90 percent relative compaction. A Type II/V cement may be used from a geotechnical perspective. Our flatwork and hardscape design considerations are presented in the table below.

Concrete Flatwork Table

Description	Subgrade Preparation (1)	Minimum Concrete Thickness	Cut-Off Barrier Or Edge Thickness	Joint Spacing (Maximum)	Concrete(3)
Concrete Sidewalks and Walkways (4)	1) 2 percent above optimum to 18"(1), 2) 2" of sand or well graded rock (i.e., Class II base or equiv.) above moisture conditioned subgrade.	4 inches	Not Required	5 feet	Type II/V

(1) The moisture content of the subgrade must be verified by the geotechnical consultant prior to sand/rock placement.
(2) Reinforcement to be placed at or above the mid-point of the slab (i.e., a minimum of 2.0 to 2.5 inches above the prepared subgrade).
(3) The site has negligible levels of sulfates as defined by the CBC. Concrete mix design is outside the geotechnical engineer's purview.
(4) Where flatwork is adjacent a stucco surface, a ¼" to ½" foam separation/expansion joint should be used.
(5) If dowels are placed in cored holes, the core holes shall be placed at alternating in-plane angles (i.e., not cored straight into slab).

Planters and Trees

Where new trees or large shrubs are to be located in close proximity to new concrete flatwork, rigid moisture/root barriers should be placed around the perimeter of the flatwork to at least 12 inches in depth in order to offer protection to the adjacent flatwork against potential root and moisture damage. Existing

mature trees near flatwork areas should also incorporate a rigid moisture/root barrier placed at least 2 feet in depth below the top of the flatwork.

Review, Observation, and Testing

The recommendations presented in this report are contingent upon review of final plans and specifications for the project by NTS. NTS Geotechnical, Inc. should review and verify in writing the compliance of the final grading plan and the final foundation plans with the recommendations presented in this report.

It is recommended that NTS be retained to provide continuous Geotechnical Consulting services during the earthwork operations (i.e., rough grading, utility trench backfill, subgrade preparation for slabs-on-grade, grading for new pavement and hardscape, finish grading, etc.) and foundation installation process. This is to observe compliance with the design concepts, specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated during our subsurface investigation.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgments. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and site construction will be identical to those observed, sampled, and interpreted during our study, or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the grading and use of the property.

Our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during construction and grading of the project to observe the actual conditions exposed, to verify our design concepts and the grading contractor's general compliance with the project geotechnical specifications, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report. Since our conclusions and recommendations are based on a limited

amount of current and previous geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during grading of the project.

It should be further noted that the recommendations presented herein are intended solely to minimize the effects of post-construction soil movements. Consequently, minor cracking and/or distortion of all on-site improvements should be anticipated.

This report has not been prepared for the use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

REFERENCES

American Concrete Institute, 2014, Building Code Requirements for Structural Concrete (ACI 318-14).

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

California Building Standards Commission, 2019, California Building Code, California Code of Regulations Title 24, Volume 2, dated July.

California Division of Mines and Geology [CDMG]), 1998, State of California Seismic Hazard Zone Report for the Palmdale 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 105.

California Geological Survey, Earthquake Zones of Required Investigation, Palmdale Quadrangle, dated October 17, 2003.

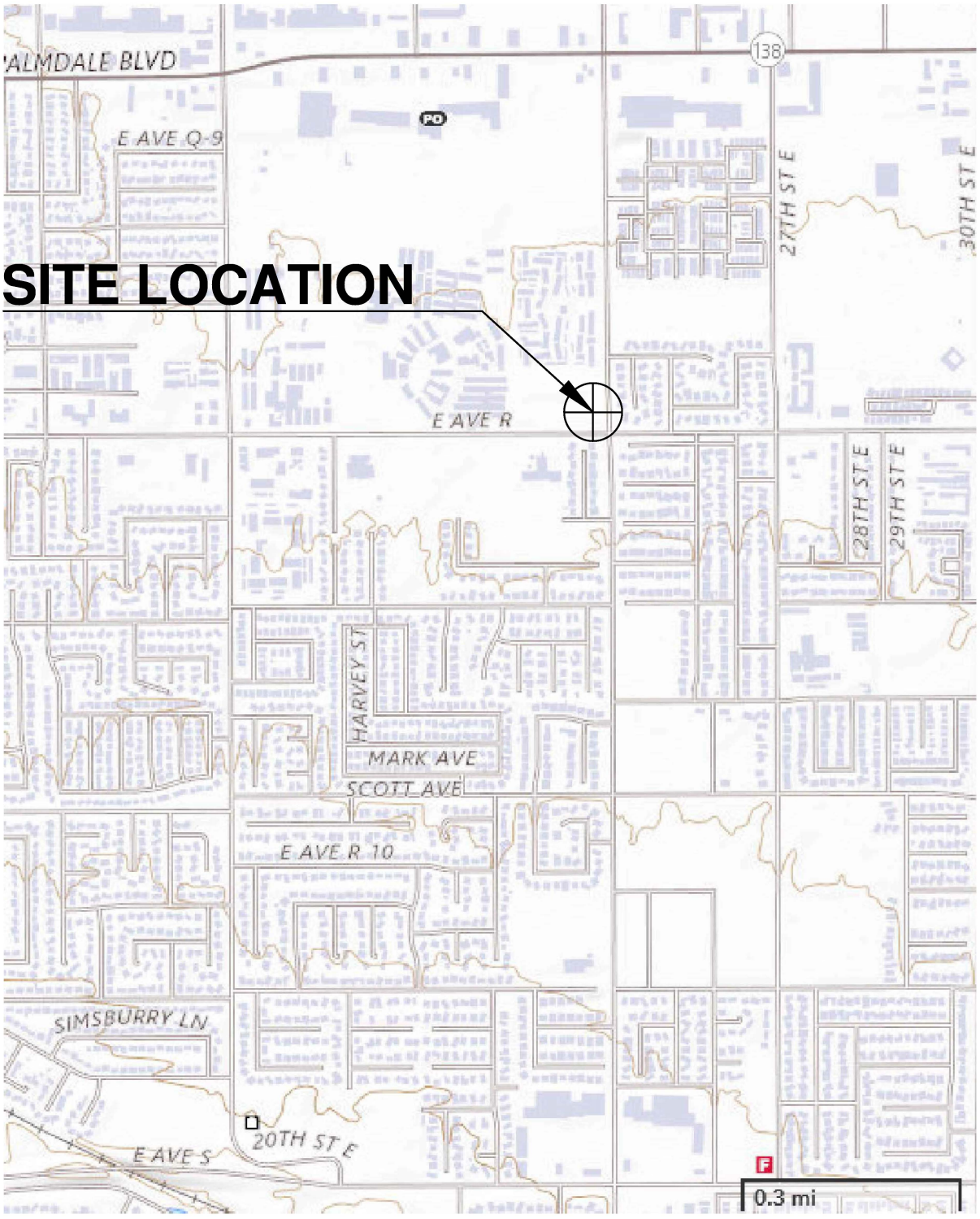
Coduto, Donald P., 1994, Foundation Design: Principles and Practices: Prentice-Hall, Inc, Englewood Cliffs, New Jersey.

Dibblee, T.W., and Ehrenspeck, H.E., Geologic Map of the Pacifico Mountain and Palmdale (south half) Quadrangles, Los Angeles County, California, dated 2001.

Lamar, D. L., 1970, Geology of the Elysian Park-Repetto Hills Area, Los Angeles County California: California Division of Mines and Geology, Special Report 10

Naval Facilities Engineering Command, 1986, NAVFAC Design Manual.

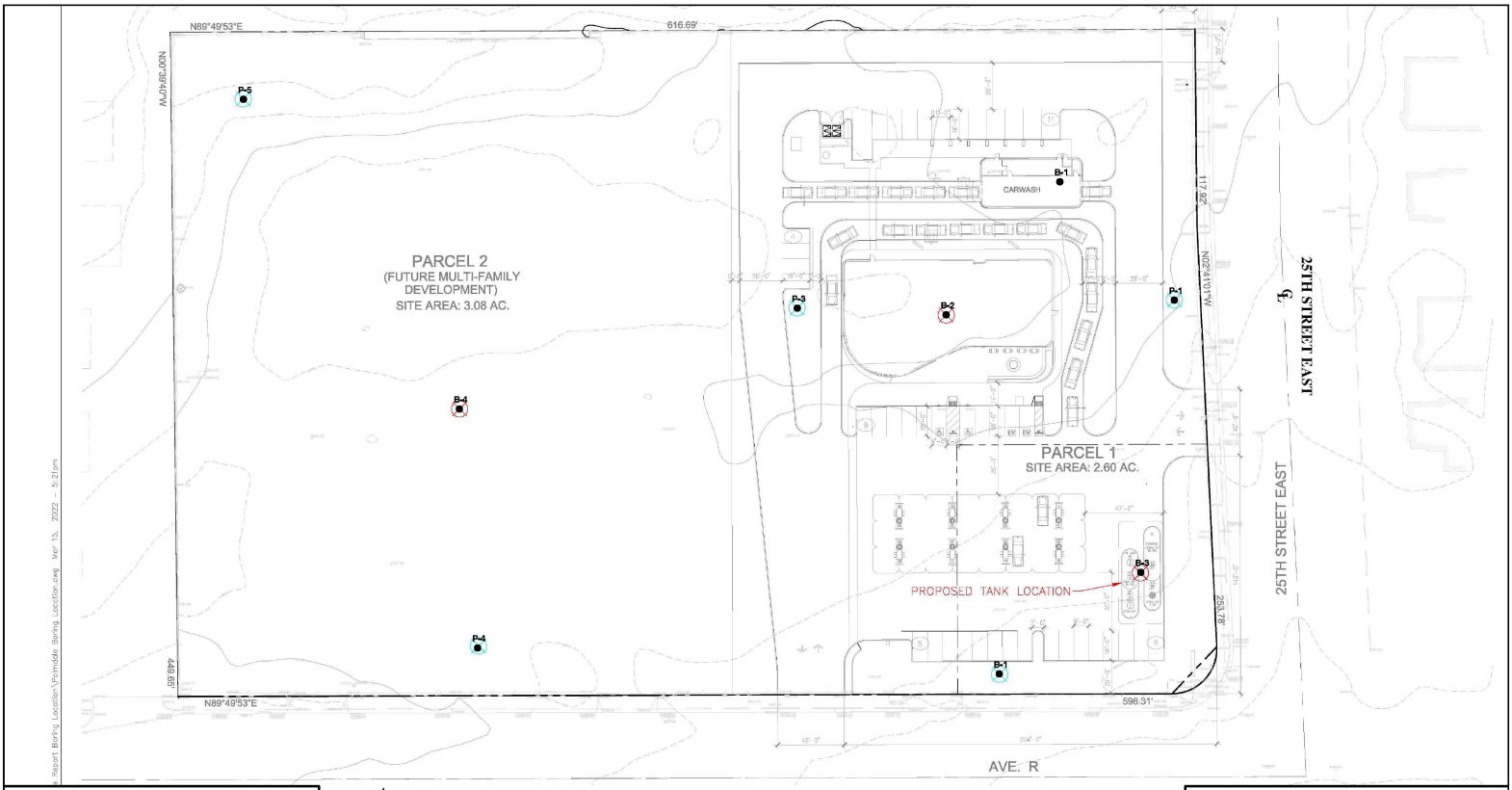
United States Geological Survey (USGS), 2008, Unified Hazard Tool, Dynamic: Conterminous U.S. 2014 (update) (v4.2.0), Retrieved May 14, 2020, from: https://earthquake.usgs.gov/hazards/interactive/



N

LOCATION MAP

NTS GEOTECHNICAL	Date: June 1, 2022	Plate 1
	Project No.: 22224	



NTS
GEOTECHNICAL

N

0 90'

GEOTECHNICAL LEGEND

B-1 ●	APPROXIMATE LOCATION OF BORING
P-1 ●	APPROXIMATE LOCATION OF PERCOLATION TEST

GEOTECHNICAL MAP

Date:	Project No.:	Plate:
06/01/2022	22224	2

NTS GEOTECHNICAL

APPENDIX A

Field Exploration

Appendix A
Field Exploration

The subsurface exploration program for the proposed project consisted of excavating four (4) hollow-stem-auger borings at the subject site. The borings were excavated to a maximum depth of 21.5 feet below the existing grade.

The Boring Logs are presented as Figures A-3 through A-6. The Logs describe the earth materials encountered, samples obtained, and show the field and laboratory tests performed. The log also shows the boring number, drilling date, and the name of the logger and drilling subcontractor. The borings were logged by an NTS engineer using the Unified Soil Classification System. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Grab samples of representative earth materials were obtained from the borings.

Upon completion of the borings, the excavations were backfilled with soil from the cuttings.

Project: **APN 3018-023, 28, 52, 53, 54** Project Location: **Palmdale, CA** Project Number: **22224**	NTS GEOTECHNICAL	Key to Log of Boring **Sheet 1 of 1**

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9

COLUMN DESCRIPTIONS

1. Depth (feet): Depth in feet below the ground surface.
2. Sample Type: Type of soil sample collected at the depth interval shown.
3. Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
4. Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
5. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6. Material Type: Type of material encountered.
7. Graphic Log: Graphic depiction of the subsurface material encountered.
8. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis
DS: Direct Shear
EI: Expansion Index
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Poorly graded SAND (SP)

Poorly graded SAND with Silt (SP-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting, AW)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-2

Project: **APN 3018-023, 28, 52, 53, 54** Project Location: **Palmdale, CA** Project Number: **22224**	NTS GEOTECHNICAL	Log of Boring B-1 **Sheet 1 of 2**

Date(s) Drilled **5/11/2022**	Logged By **WS**	Checked By **NS**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" diameter**	Total Depth of Borehole **21.5 feet**
Drill Rig Type **CME 75**	Drilling Contractor **Charlie's**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT, MC**	Hammer Data **140-lb autohammer**
Borehole Backfill **Native**	Location	

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0					SP		POORLY GRADED SAND, light brown, dry, moist, fine- to-coarse-grained sand, loose to medium dense	
5		7	108	38				
10				43	SP-SM		POORLY GRADED SAND WITH SILT, light brown, slightly moist,	
15								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-3

Project: **APN 3018-023, 28, 52, 53, 54**
Project Location: **Palmdale, CA**
Project Number: **22224**

NTS GEOTECHNICAL

Log of Boring B-1

Sheet 2 of 2

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
15		6	112	54	SP-SM		POORLY GRADED SAND WITH SILT, light brown, slightly moist,	
20				47				
							Total Depth = 21.5 feet Groundwater not encountered Backfilled with native	
25								
30								
35								
40								
45								
50								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-3

Project: **APN 3018-023, 28, 52, 53, 54** Project Location: **Palmdale, CA** Project Number: **22224**	NTS GEOTECHNICAL	Log of Boring B-2 **Sheet 1 of 1**

Date(s) Drilled **5/11/2022**	Logged By **WS**	Checked By **NS**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" diameter**	Total Depth of Borehole **11.5 feet**
Drill Rig Type **CME 75**	Drilling Contractor **Charlie's**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT, MC**	Hammer Data **140-lb autohammer**
Borehole Backfill **Native**	Location	

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0					SP		POORLY GRADED SAND, light brown, dry, moist, fine- to-coarse-grained sand, loose to medium dense	
5		5	110	22				
10				32				
							Total Depth = 11.5 feet Groundwater not encountered Backfilled with native	
15								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-4

Project: **APN 3018-023, 28, 52, 53, 54** Project Location: **Palmdale, CA** Project Number: **22224**	NTS GEOTECHNICAL	Log of Boring B-3 **Sheet 1 of 2**

Date(s) Drilled **5/11/2022**	Logged By **WS**	Checked By **NS**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" diameter**	Total Depth of Borehole **16.5 feet**
Drill Rig Type **CME 75**	Drilling Contractor **Charlie's**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT, MC**	Hammer Data **140-lb autohammer**
Borehole Backfill **Native**	Location	

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0					SP		POORLY GRADED SAND, light brown, dry, moist, fine- to-coarse-grained sand, loose to medium dense	
5				35				
10		4	111	44	SP-SM		POORLY GRADED SAND WITH SILT, light brown to brown, slightly moist to damp. fine- to- medium coarse-grained sand	
15								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-5

Project: **APN 3018-023, 28, 52, 53, 54**
Project Location: **Palmdale, CA**
Project Number: **22224**

NTS GEOTECHNICAL

Log of Boring B-3

Sheet 2 of 2

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
15				46	SP-SM		POORLY GRADED SAND WITH SILT, light brown to brown, slightly moist to damp. fine- to- medium coarse-grained sand	
							Total Depth = 16.5 feet Groundwater not encountered Backfilled with native	
20								
25								
30								
35								
40								
45								
50								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-5

Project: **APN 3018-023, 28, 52, 53, 54** Project Location: **Palmdale, CA** Project Number: **22224**	NTS GEOTECHNICAL	Log of Boring B-4 **Sheet 1 of 2**

Date(s) Drilled **5/11/2022**	Logged By **WS**	Checked By **NS**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8" diameter**	Total Depth of Borehole **16.5 feet**
Drill Rig Type **CME 75**	Drilling Contractor **Charlie's**	Approximate Surface Elevation **N/A**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT, MC**	Hammer Data **140-lb autohammer**
Borehole Backfill **Native**	Location	

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0					SP		POORLY GRADED SAND, light brown, dry, moist, fine- to-coarse-grained sand, loose to medium dense	
5		6	119	58				
10				63	SP-SM		POORLY GRADED SAND WITH SILT, light brown to brown, slightly moist to damp. fine- to- medium coarse-grained sand	
15								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-6

Project: **APN 3018-023, 28, 52, 53, 54**
Project Location: **Palmdale, CA**
Project Number: **22224**

NTS GEOTECHNICAL

Log of Boring B-4

Sheet 2 of 2

Depth (feet)	Sample Type	Water Content, %	Dry Unit Weight, pcf	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
15		5	116	45	SP-SM		POORLY GRADED SAND WITH SILT, light brown to brown, slightly moist to damp. fine- to- medium coarse-grained sand	
							Total Depth = 16.5 feet Groundwater not encountered Backfilled with native	
20								
25								
30								
35								
40								
45								
50								

C:\Users\info\AppData\Local\Temp\borings_temp\tmpfile.bgs[NTS Template_1-9-21.tpl]

Figure A-6

NTS GEOTECHNICAL

APPENDIX B

Geotechnical Laboratory Testing

PROJECT NO.: 22224

PROJECT ADDRESS: APN 3018-028-023, -052, -053, and -054, Palmdale, CA

LABORATORY RECAPITULATION 1

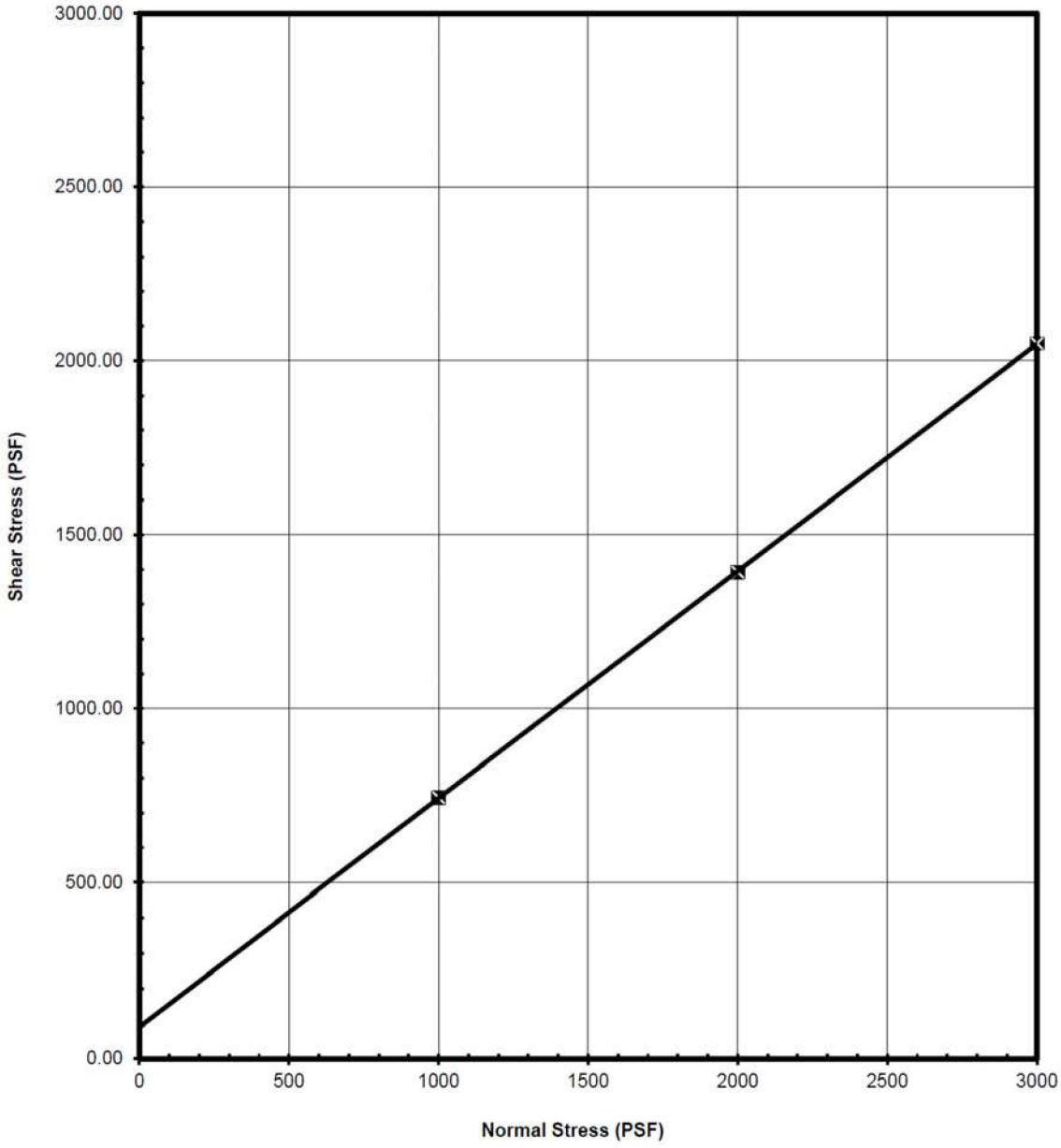
Explorations	Depth (ft)	Material	Dry Density (p.c.f.)	Moisture Content (%)
B-1	5.0	Qal	108	7
	15.0	Qal	112	6
B-2	5.0	Qal	110	5
B-3	10.0	Qal	111	4
B-4	5.0	Qal	119	6
	15.0	Qal	116	5

Direct Shear Test Diagram (D-3080)

PLATE: S-1
P.N. 22224

Sample Description	Sample Identification	Test Type	Sample Test State	Number of Passes
Qal	B-3 @ 10.0'	Ultimate	Saturated	1

Soil Dry Density (PCF)	111	Shear Strength Values:	
Soil Moisture Content (%)	18	Phi (Degrees)	33.1
Soil Saturation (%)	97.4	Cohesion (PSF)	89.3

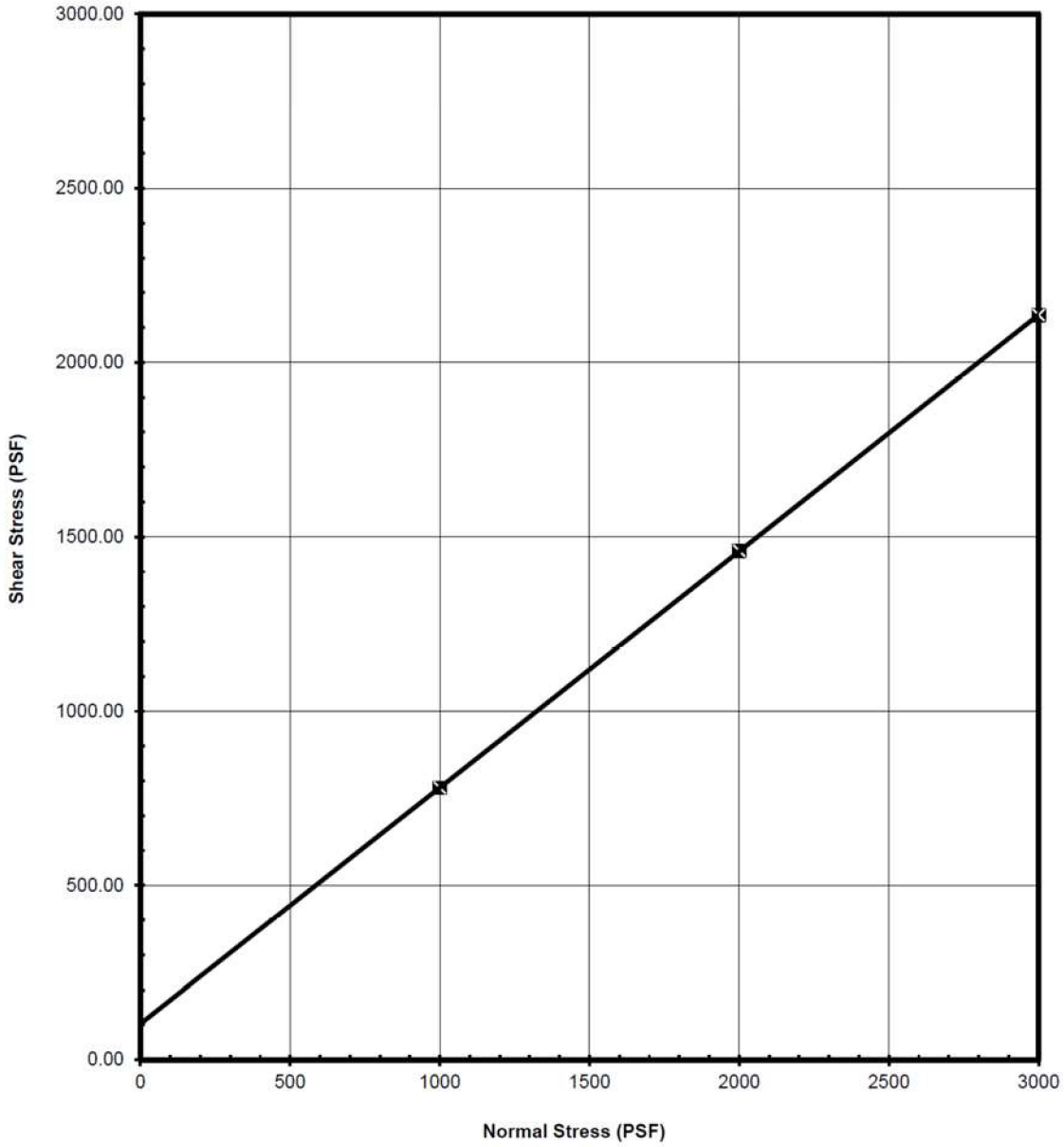


Direct Shear Test Diagram (D-3080)

PLATE: S-2
P.N. 22224

Sample Description	Sample Identification	Test Type	Sample Test State	Number of Passes
Qal	B-4 @ 5.0'	Ultimate	Saturated	1

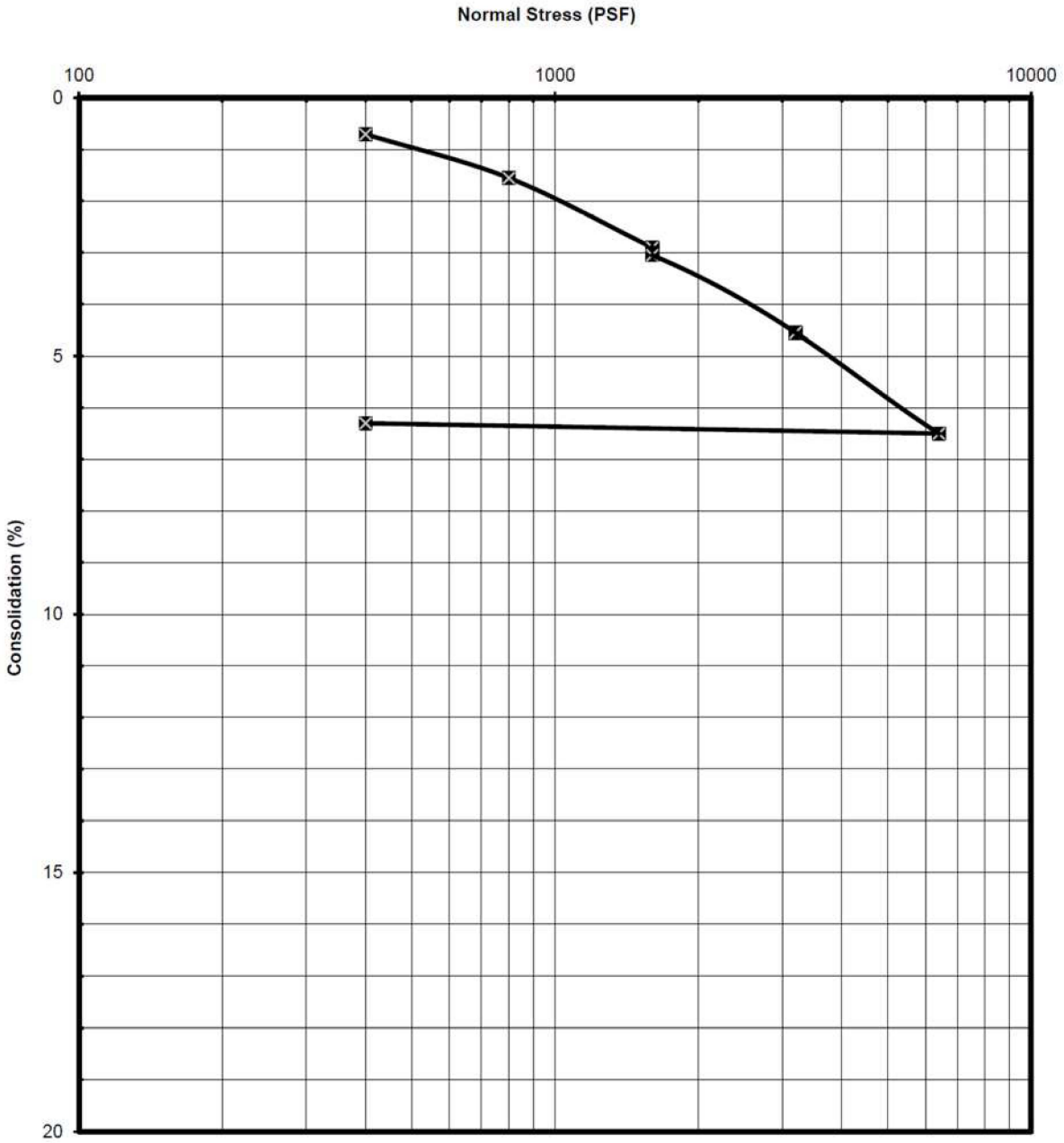
Soil Dry Density (PCF)	119	Shear Strength Values:	
Soil Moisture Content (%)	14	Phi (Degrees)	34.1
Soil Saturation (%)	95.2	Cohesion (PSF)	102.7



Consolidation Pressure Curve (D-2435)

Sample Identification	Sample Description
B-1 @ 5.0'	Qal

PLATE: C-1
P.N. 22224

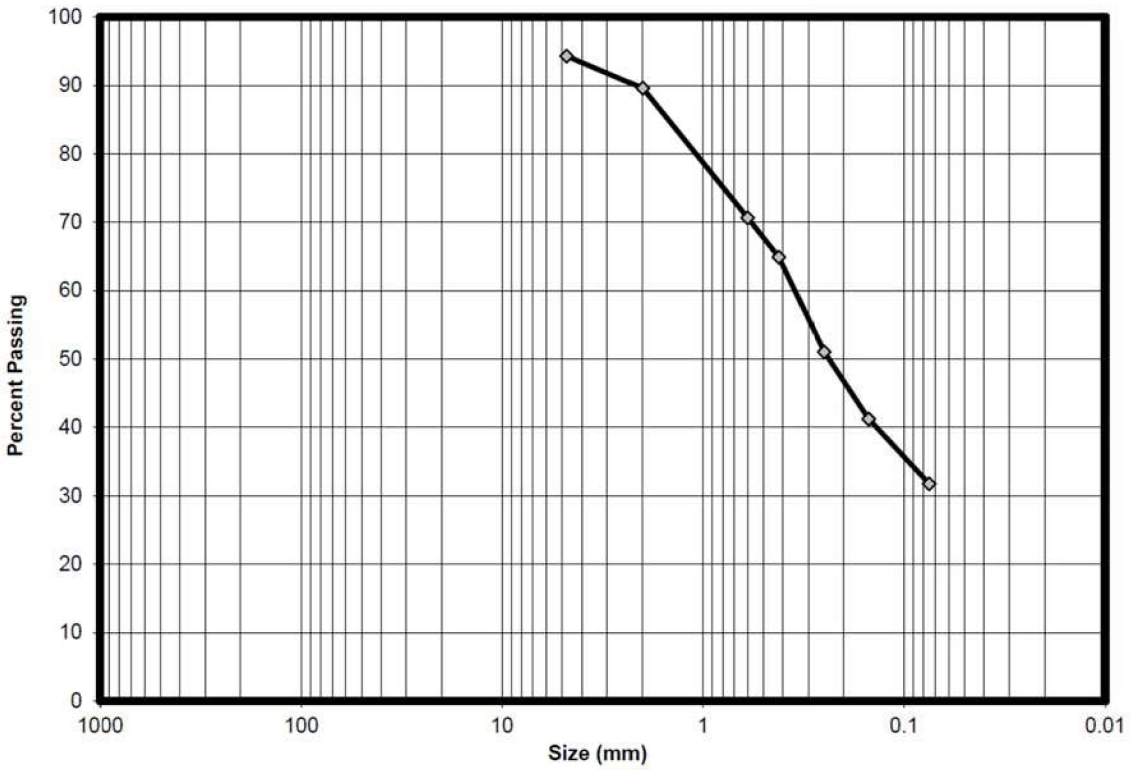


Grain Size Analysis (ASTM D422)

PLATE:	**SV-1**
P.N.	**22224**

Explorations	Sample Depth (ft)	Soil Description	% of Fines (-200)
B-1	10	Qal	9
B-2	5	Qal	6
B-3	5	Qal	5
B-3	15	Qal	8

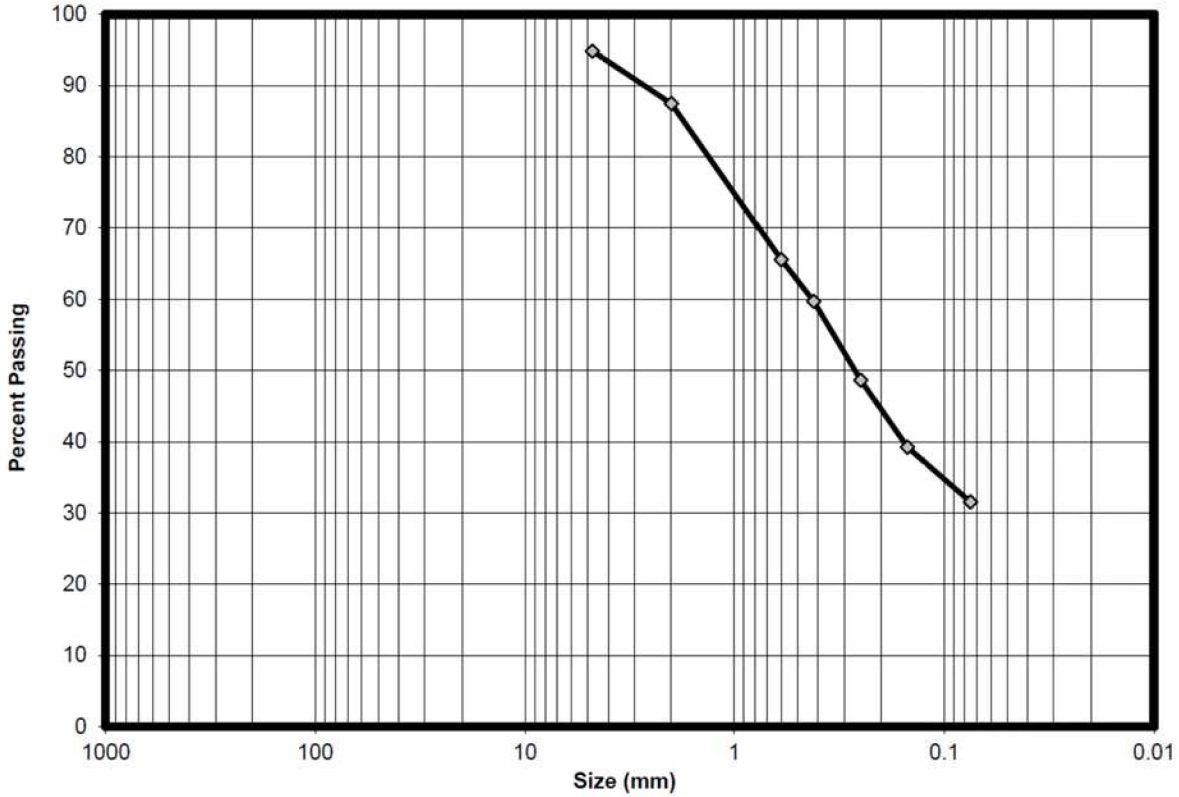
Sieve Size	Percent Passing
No. 4	94.29
No. 10	89.61
No. 30	70.64
No. 40	64.9
No. 60	51.03
No. 100	41.22
No. 200	31.75



Grain Size Analysis (ASTM D422)

Sample Identification	Sample Description	PLATE: G-1 P.N. 22224
P-1 @ 5.0'	Qal	

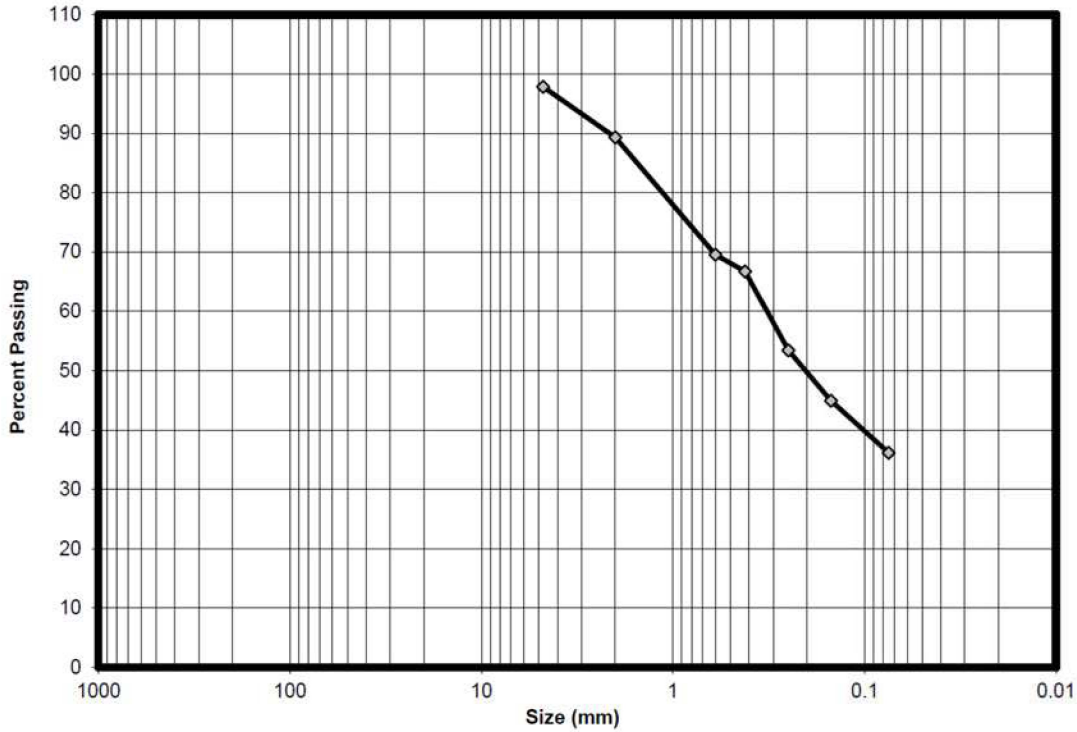
Sieve Size	Percent Passing
No. 4	94.83
No. 10	87.46
No. 30	65.56
No. 40	59.71
No. 60	48.64
No. 100	39.24
No. 200	31.54



Grain Size Analysis (ASTM D422)

Sample Identification	Sample Description	PLATE: G-2 P.N. 22224
P-3 @ 5.0'	Qal	

Sieve Size	Percent Passing
No. 4	97.83
No. 10	89.31
No. 30	69.54
No. 40	66.72
No. 60	53.42
No. 100	44.93
No. 200	36.16



Grain Size Analysis (ASTM D422)

Sample Identification	Sample Description	PLATE: G-3 P.N. 22224
P-5 @ 5.0'	Qal	

NTS GEOTECHNICAL

APPENDIX C

Infiltration Test Result

Los Angeles County - Infiltration Test in Boring

Project Name: R Avenue & 25th Street, Palmdale
Project Number: 22224

NTS GEOTECHNICAL

Boring Number: P-1
Total Depth : 5.00 feet
Boring Diameter: 8.00 inches
Initial Water Depth: 36.00 inches

Trial	Start Time	End Time	ΔT	Total Time	Final Depth of Water	ΔΔ	Preadjusted Percolation Rate	Infiltration Rate
			(min)	*(min)*	*(in)*	*(in)*	*(in/hour)*	*(in/hour)*
1	8:20	8:30	10.00	10.0	48.00	12.00	72.00	6.00
2	8:31	8:41	10.0	20.0	45.00	9.00	54.00	4.50
3	8:41	8:51	10.0	30.0	42.00	6.00	36.00	3.00
4	8:52	9:02	10.0	40.0	40.00	4.00	24.00	2.00
5	9:03	9:13	10.0	50.0	39.00	3.00	18.00	1.50
6	9:14	9:24	10.0	60.0	38.00	2.00	12.00	1.00
							Infiltration Rate (in/hr):	1.50

Note:
Infiltration Rate = (Preadjusted Percolation Rate)/(Reduction Factor)

Reduction Factor (RF_t)	2
Reduction Factor (RF_v)	3
Reduction Factor (RF_s)	2
Total Reduction Factor (RF)	12

Reduction Factors	
Double-ring infiltrometer	$RF_t = 2$
Well permeameter	$RF_t = 2$
Boring percolation	$RF_t = 2$
Excavation percolation	$RF_t = R_f$ from test procedure
High flow-rate percolation	$RF_t = 3$
Infiltration Basin Percolation Test	$RF_t = 2$
Dry Well Percolation Test	$RF_t = 2$
Site variability, number of tests, and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging and maintenance	RF_s = 1 to 3

Los Angeles County - Infiltration Test in Boring

Project Name: R Avenue & 25th Street, Palmdale
Project Number: 22224

NTS GEOTECHNICAL

Boring Number: P-2
Total Depth : 5.00 feet
Boring Diameter: 8.00 inches
Initial Water Depth: 36.00 inches

Trial	Start Time	End Time	ΔT	Total Time	Final Depth of Water	ΔΔ	Preadjusted Percolation Rate	Infiltration Rate
			(min)	*(min)*	*(in)*	*(in)*	*(in/hour)*	*(in/hour)*
1	8:25	8:35	10.0	10.0	48.00	12.00	72.00	6.00
2	8:36	8:46	10.0	20.0	43.00	7.00	42.00	3.50
3	8:47	8:57	10.0	30.0	39.00	3.00	18.00	1.50
4	8:58	9:08	10.0	40.0	38.50	2.50	15.00	1.25
5	9:09	9:19	10.0	50.0	38.50	2.50	15.00	1.25
6	9:20	9:30	10.0	60.0	38.50	2.50	15.00	1.25
							Infiltration Rate (in/hr):	1.25

Note:
Infiltration Rate = (Preadjusted Percolation Rate)/(Reduction Factor)

Reduction Factor (RF_t)	2
Reduction Factor (RF_v)	3
Reduction Factor (RF_s)	2
Total Reduction Factor (RF)	12

Reduction Factors	
Double-ring infiltrometer	$RF_t = 2$
Well permeameter	$RF_t = 2$
Boring percolation	$RF_t = 2$
Excavation percolation	$RF_t = R_f$ from test procedure
High flow-rate percolation	$RF_t = 3$
Infiltration Basin Percolation Test	$RF_t = 2$
Dry Well Percolation Test	$RF_t = 2$
Site variability, number of tests, and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging and maintenance	RF_s = 1 to 3

Los Angeles County - Infiltration Test in Boring

Project Name: R Avenue & 25th Street, Palmdale
Project Number: 22224

NTS GEOTECHNICAL

Boring Number: P-3
Total Depth : 5.00 feet
Boring Diameter: 8.00 inches
Initial Water Depth: 36.00 inches

Trial	Start Time	End Time	ΔT	Total Time	Final Depth of Water	ΔΔ	Preadjusted Percolation Rate	Infiltration Rate
			(min)	*(min)*	*(in)*	*(in)*	*(in/hour)*	*(in/hour)*
1	8:30	8:40	10.0	10.0	46.00	10.00	60.00	5.00
2	8:41	8:51	10.0	20.0	41.00	5.00	30.00	2.50
3	8:52	9:02	10.0	30.0	41.00	5.00	30.00	2.50
4	9:03	9:13	10.0	40.0	39.50	3.50	21.00	1.75
5	9:14	9:24	10.0	50.0	39.50	3.50	21.00	1.75
6	9:25	9:35	10.0	60.0	39.25	3.25	19.50	1.63
						Infiltration Rate (in/hr):		1.71

Note:
Infiltration Rate = (Preadjusted Percolation Rate)/(Reduction Factor)

Reduction Factor (RF_t)	2
Reduction Factor (RF_v)	3
Reduction Factor (RF_s)	2
Total Reduction Factor (RF)	12

Reduction Factors	
Double-ring infiltrometer	$RF_t = 2$
Well permeameter	$RF_t = 2$
Boring percolation	$RF_t = 2$
Excavation percolation	$RF_t = R_f$ from test procedure
High flow-rate percolation	$RF_t = 3$
Infiltration Basin Percolation Test	$RF_t = 2$
Dry Well Percolation Test	$RF_t = 2$
Site variability, number of tests, and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging and maintenance	RF_s = 1 to 3

Los Angeles County - Infiltration Test in Boring

Project Name: R Avenue & 25th Street, Palmdale
Project Number: 22224

NTS GEOTECHNICAL

Boring Number: P-4
Total Depth : 5.00 feet
Boring Diameter: 8.00 inches
Initial Water Depth: 36.00 inches

Trial	Start Time	End Time	ΔT	Total Time	Final Depth of Water	ΔΔ	Preadjusted Percolation Rate	Infiltration Rate
			(min)	*(min)*	*(in)*	*(in)*	*(in/hour)*	*(in/hour)*
1	8:35	8:45	10.0	10.0	45.00	9.00	54.00	4.50
2	8:46	8:56	10.0	20.0	42.00	6.00	36.00	3.00
3	8:57	9:07	10.0	30.0	42.00	6.00	36.00	3.00
4	9:08	9:18	10.0	40.0	39.75	3.75	22.50	1.88
5	9:19	9:29	10.0	50.0	39.50	3.50	21.00	1.75
6	9:30	9:40	10.0	60.0	39.50	3.50	21.00	1.75
							Infiltration Rate (in/hr):	1.79

Note:
Infiltration Rate = (Preadjusted Percolation Rate)/(Reduction Factor)

Reduction Factor (RF_t)	2
Reduction Factor (RF_v)	3
Reduction Factor (RF_s)	2
Total Reduction Factor (RF)	12

Reduction Factors	
Double-ring infiltrometer	$RF_t = 2$
Well permeameter	$RF_t = 2$
Boring percolation	$RF_t = 2$
Excavation percolation	$RF_t = R_f$ from test procedure
High flow-rate percolation	$RF_t = 3$
Infiltration Basin Percolation Test	$RF_t = 2$
Dry Well Percolation Test	$RF_t = 2$
Site variability, number of tests, and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging and maintenance	RF_s = 1 to 3

Los Angeles County - Infiltration Test in Boring

Project Name: R Avenue & 25th Street, Palmdale
Project Number: 22224

NTS GEOTECHNICAL

Boring Number: P-5
Total Depth : 5.00 feet
Boring Diameter: 8.00 inches
Initial Water Depth: 36.00 inches

Trial	Start Time	End Time	ΔT	Total Time	Final Depth of Water	ΔΔ	Preadjusted Percolation Rate	Infiltration Rate
			(min)	*(min)*	*(in)*	*(in)*	*(in/hour)*	*(in/hour)*
1	8:40	8:50	10.0	10.0	48.00	12.00	72.00	6.00
2	8:51	9:01	10.0	20.0	40.00	4.00	24.00	2.00
3	9:02	9:12	10.0	30.0	40.00	4.00	24.00	2.00
4	9:13	9:23	10.0	40.0	40.00	4.00	24.00	2.00
5	9:24	9:34	10.0	50.0	39.75	3.75	22.50	1.88
6	9:35	9:45	10.0	60.0	39.75	3.75	22.50	1.88
							Infiltration Rate (in/hr):	1.92

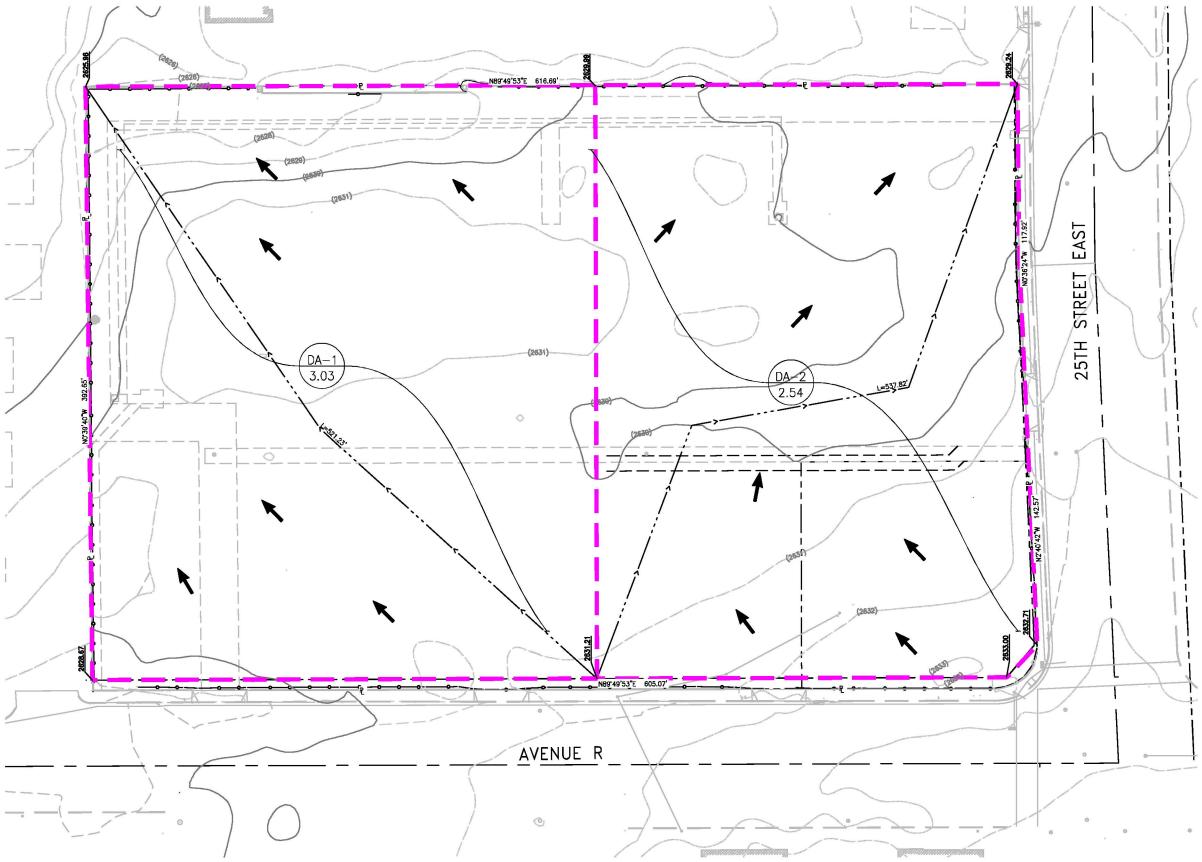
Note:
Infiltration Rate = (Preadjusted Percolation Rate)/(Reduction Factor)

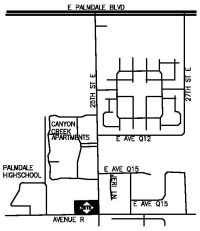
Reduction Factor (RF_t)	2
Reduction Factor (RF_v)	3
Reduction Factor (RF_s)	2
Total Reduction Factor (RF)	12

Reduction Factors	
Double-ring infiltrometer	$RF_t = 2$
Well permeameter	$RF_t = 2$
Boring percolation	$RF_t = 2$
Excavation percolation	$RF_t = R_f$ from test procedure
High flow-rate percolation	$RF_t = 3$
Infiltration Basin Percolation Test	$RF_t = 2$
Dry Well Percolation Test	$RF_t = 2$
Site variability, number of tests, and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging and maintenance	RF_s = 1 to 3

Appendix H:

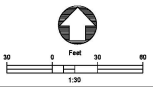
Pre-development Hydrology Exhibit





LEGEND

- FLOW LINE
- FLOW DIRECTION
- DRAINAGE AREA BOUNDARY
- # / X.XX — DRAINAGE AREA DESIGNATION / DRAINAGE AREA



DESIGNED BY: MG
DRAWN BY: JO
CHECKED BY: AC

BLUE Engineering & Consulting, Inc
18301 BARDEEN AVE, STE. D - IRVINE, CA 92612
PHONE: 949.266.4567 - INFO@BLUEENG.COM
WWW.BLUEENG.COM

PLANS PREPARED UNDER THE SUPERVISION OF:
ANGEL CRUZ, P.E. 87222 EXP. 9/30/23
DATE

REV.	REVISION DESCRIPTION	BY	DATE

CITY OF PALMDALE
NWC 25TH ST. EAST & AVE R.

REVIEWED BY:

DATE

XXXXXXXXXX
P.E. NO. C-XXXXX
EXP. DATE XX-XX-XXXX

PRE-DEVELOPMENT HYDROLOGY

NEW BEYOND MARKET & CARWASH DEVELOPMENT
CONDITIONAL USE PERMIT

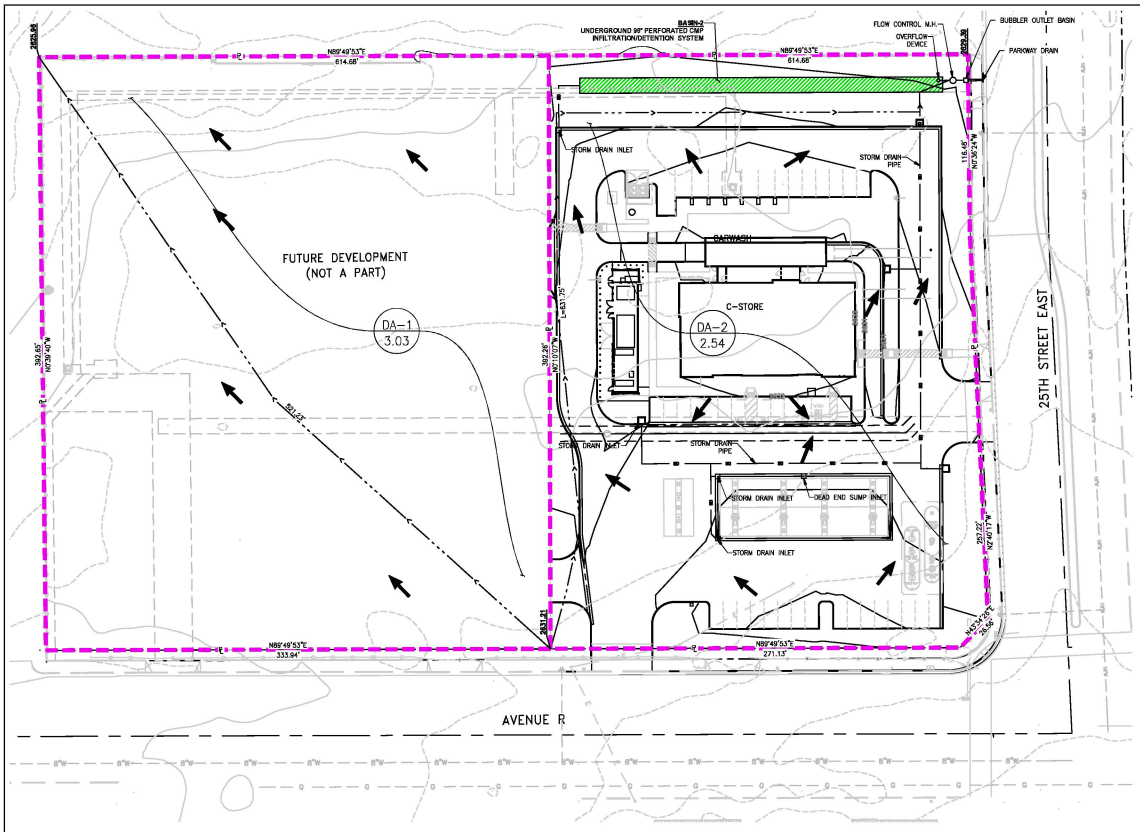
CUP:
LDP:
DATE: May 15, 2024
SHEET 4 OF 5 SHEETS
PROJECT NUMBER:

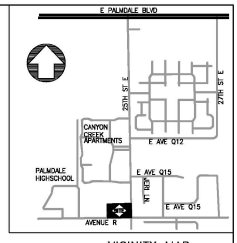
Plans Prepared On: 5/15/2024

J:\Drawn\Blue\2022-145 - Permits - Report_Sheet Set\Entitlement Package\2022145 - PRE HYDRO.dwg - LAST PLOTTED ON Wed 05/15/24 - 05:11PM BY Brandonkam

Appendix I:

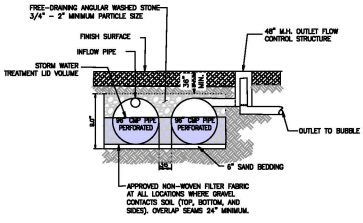
Post-development Hydrology Exhibit



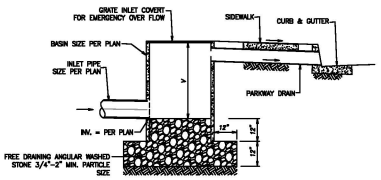


VICINITY MAP
N.T.S.

LEGEND
- FLOW LINE
- FLOW DIRECTION
- DRAINAGE AREA BOUNDARY
- # X.XX — DRAINAGE AREA DESIGNATION
- DRAINAGE AREA
- BEST MANAGEMENT PRACTICES (BMP)



96" CMP INFILTRATION/DETENTION SYSTEM SECTION
NOT TO SCALE



BUBBLE OUT BASIN SECTION DETAILS
N.T.S.

DESIGNED BY: MG
DRAWN BY: JD
CHECKED BY: AC

BLUE Engineering & Consulting, Inc
18301 BASELINE RD, STE. D - RANCHO CUCAMONGA, CA 91701
PHONE: 909.296.6557 - INFO@BLUEENG.COM
WWW.BLUEENG.COM

PLANS PREPARED UNDER THE SUPERVISION OF:
ANGEL CRUZ, P.E. 87222 EXP. 9/30/23
DATE

REV.	REVISION DESCRIPTION	BY	DATE

CITY OF PALMDALE
NWC 25TH ST. EAST & AVE R.

REVIEWED BY:

DATE

XXXXXXXXXX
P.D. NO. D-XXXX
EXP. DATE XX-XX-XXXX

POST-DEVELOPMENT HYDROLOGY

NEW BEYOND MARKET & CARWASH DEVELOPMENT
CONDITIONAL USE PERMIT

CUP:
LDP:
DATE: May 15, 2024
SHEET 5 OF 5 SHEETS
PROJECT NUMBER:

Plans Prepared On: 5/15/2024

J:\Drawn\Blue\2021145 - Permits - Report_Sheet Set\Entitlement Package\2021145 - POST HYDRO.dwg - LAST PLOTTED ON Wed 05/15/24 - 05:11PM BY Brandonlee

Appendix J: Underground Infiltration System Details

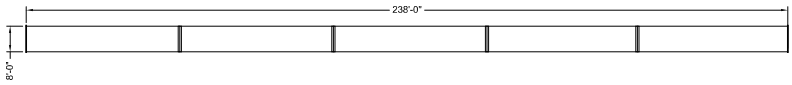
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 238 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 15,450 CF
- PIPE STORAGE VOLUME = 11,963 CF
- BACKFILL STORAGE VOLUME = 2,895 CF
- TOTAL STORAGE PROVIDED = 14,858 CF

PIPE DETAILS
- DIAMETER = 96"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 0"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 0"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN. QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 30'

C:\DYO\PROJ\TEMPLATES\CMP_V8.DWG 9/19/2019 10:02 AM

This design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part hereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

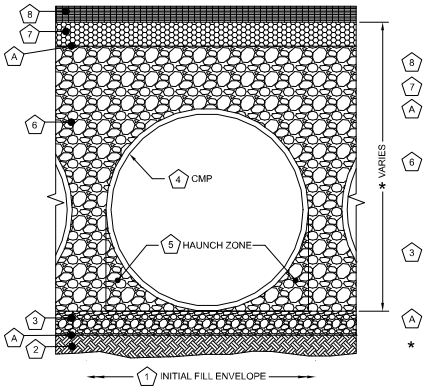
DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO38763 145-Palmdale
Underground -CMP Basin-2
Palmdale, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
26419	38763	10/2/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (if applicable)			
7 Road Base (if applicable)			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6 Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145- A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3 Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of infiltration systems due to the propensity for geotextiles to clog over time.
* Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

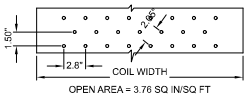
BACKFILL

MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

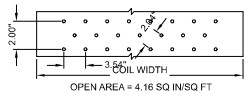
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2" CORRUGATION - STEEL AND ALUMINUM CMP EDGE SPACING EQUAL ON BOTH SIDES



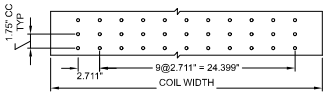
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION - STEEL AND ALUMINUM CMP (COIL PROVIDED FROM CONTECH LANTANA, FL PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY EDGE SPACING EQUAL ON BOTH SIDES



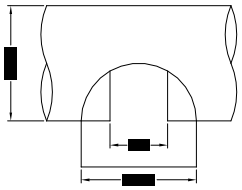
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES.

1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES =3/8".

TYPICAL PERFORATION DETAIL

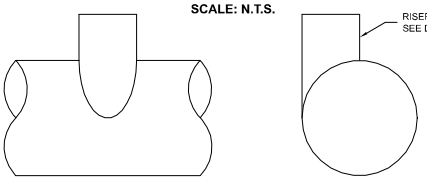
SCALE: N.T.S.



NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

TYPICAL MANWAY DETAIL

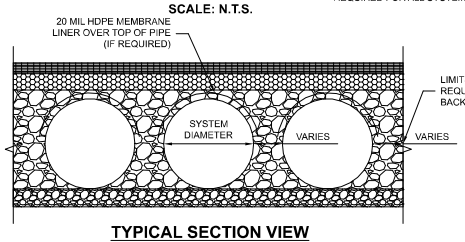
SCALE: N.T.S.



NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

© CONTECH ENGINEERED SOLUTIONS LLC
This design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.
If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

DATE	REVISION DESCRIPTION	BY

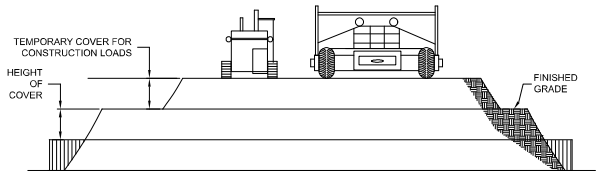
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO38763 145-Palmdale
Underground -CMP Basin-2
Palmdale, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
26419	38763	10/2/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

C:\CONTECH\TEMPLATES\CMP_V8.DWG 10/19/2016 10:02 AM



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

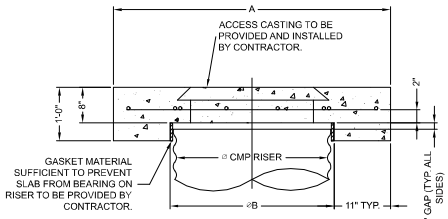
APPLICABLE POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

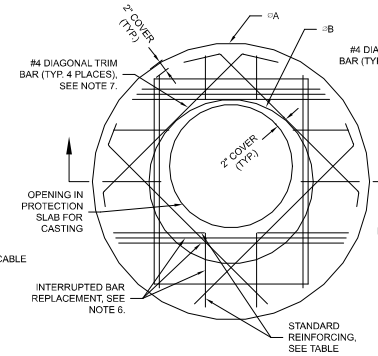
IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.



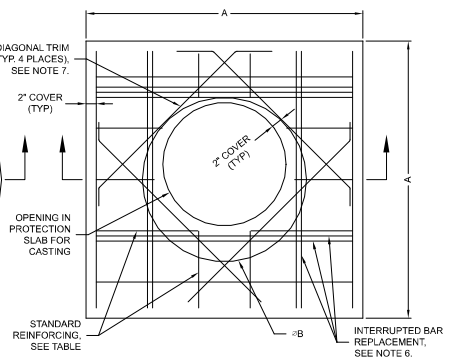
SECTION VIEW

REINFORCING TABLE				
∅ CMP RISER	A	∅ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	∅ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	∅ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part hereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO38763 145-Palmdale
Underground -CMP Basin-2
Palmdale, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
26419	38763	10/2/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

C:\CONTECH TEMPLATES\CMP_M.DWG, 9/19/2019 10:02 AM

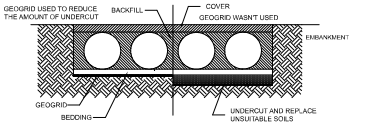
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

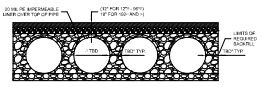


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

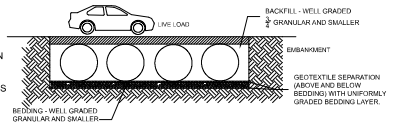
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

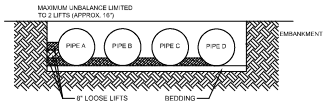
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



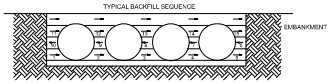
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

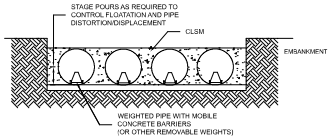


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

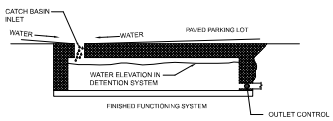


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

This design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr, Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO38763 145-Palmdale
Underground -CMP Basin-2
Palmdale, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
26419	38763	10/2/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

C:\CONTECH TEMPLATES\CMP_V8.DWG 9/19/2019 10:02 AM