



170 North Maple Street, Suite 108
Corona, CA 92880
www.altageotechnical.com

WARMINGTON RESIDENTIAL

3090 Pullman Street
Costa Mesa, CA 92626

January 20, 2025
Project No. 1-0571

Attention: Mr. Bret Ilich

Subject: **GEOTECHNICAL INVESTIGATION**
North Maple Way & West Arrow Highway
City of Upland, San Bernardino County, California

References: See Appendix A

Dear Mr. Ilich:

Alta California Geotechnical, Inc. (Alta) is pleased to present this Geotechnical Investigation for the vacant lot located northeast of the intersection of North Maple Way and West Arrow highway in the City of Upland, San Bernardino County, California. This report is based on Alta's recent subsurface investigation, laboratory testing, engineering analyses, a review of the referenced reports, and Alta's staff's experience with similar projects in this vicinity.

Alta's review of the geotechnical data indicates that the proposed development is feasible, from a geotechnical perspective, provided that the recommendations presented in this report are incorporated into the grading and improvement plans and implemented during site development.

Included in this report are:

- Discussion of the site geotechnical conditions.
- Recommendations for remedial and site grading, including unsuitable soil removals.
- Geotechnical site construction recommendations.
- Foundation design parameters.

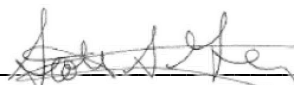
If you have any questions or should you require any additional information, please contact the undersigned at (951) 509-7090. Alta appreciates the opportunity to provide geotechnical consulting services for your project.

Sincerely,
Alta California Geotechnical, Inc.



NATHAN M. LANKEY
Engineering Geology Associate

Reviewed By:

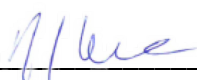


SCOTT A. GRAY/RGE 2857
Reg. Exp.: 12-31-26
Registered Geotechnical Engineer
President





LOGAN A. MARQUETTE
Civil Engineering Associate



FRANK J. ECHENIQUE/CEG 2134
Reg. Exp.: 7-31-26
Engineering Geologist
Manager of Geologic Services



Distribution: (1) Addressee

JBC:SAG 1-0571, January 20, 2025 (Geotechnical Investigation, N Maple Way & W Arrow Hwy, Upland)

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1.0 INTRODUCTION

This report presents Alta's findings, conclusions, and geotechnical recommendations for the proposed development located northeast of the intersection of North Maple Way and West Arrow Highway in the City of Upland, San Bernardino County, California.

1.1 Purpose

The purpose of this report is to examine the existing onsite geotechnical conditions and assess the impacts that the geotechnical conditions may have on the proposed development. This report is suitable for use in developing grading plans and engineer's cost estimates.

1.2 Scope of Work

Alta's Scope of Work for this geotechnical investigation included the following:

- Reviewing the referenced reports and air photos (Appendix A).
- Site geologic mapping.
- Excavating, logging, and sampling six (6) hollow-stem auger borings to a maximum depth of 51.5-feet below the existing ground surface (Appendix B).
- Conducting laboratory testing on samples obtained during our investigation (Appendix C).
- Conducting two (2) infiltration tests in two (2) additional borings at depths of 10.0-feet below the ground surface.
- Evaluating engineering geologic and geotechnical engineering data, including laboratory data, to develop recommendations for site remedial grading including specialized grading techniques for unsuitable soil removals along the property boundary, import soil, foundations and utilities.
- Preparing this report and accompanying exhibits.

1.3 Report Limitations

The conclusions and recommendations presented in this report are based on the field and laboratory information generated during this investigation, and a review of the referenced reports. The information contained in this report is intended to be used for development of grading plans and preliminary construction cost estimates.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Existing Conditions

The irregular-shaped, approximately 6.1-acre site is bounded to the north, east, and west by existing developments, and to the south by West Arrow Highway. The site is currently occupied by two single family homes in the southern portion of the site, with paved portions along the southwestern and southeastern edges. Historic aerial images are available as far back as 1938 and indicate the property was originally occupied by groves. By 1948, the groves were removed in the northern portion of the site and two structures were constructed in the southern portion of the site. By 1959, all groves were removed and the two structures in the south were further developed. By 1964, concrete blocks were constructed along the southwestern and southeastern edges. The site has remained largely unchanged since. (Historic Aerials, 2023).

2.2 Proposed Development

It is our understanding that the site will be developed to support 132 multi-family residential units with a park, separate open spaces, and associated improvements. We anticipate that conventional cut-and fill-grading techniques will be used to develop the site. It is Alta's understanding that conventional cut-and-fill grading techniques will be used to develop the site for the support of wood-frame and stucco construction with shallow foundations and reinforced concrete slabs-on-grade, and associated improvements.

3.0 SITE INVESTIGATION

3.1 Subsurface Investigation and Laboratory Testing

Alta conducted a subsurface investigation on December 20th, 2024, consisting of the excavation, logging, and select sampling of six (6) hollow-stem auger borings to a maximum depth of 51.5-feet below the existing ground surface. The locations of the borings are shown on Plate 1 and the boring logs are presented in Appendix B.

Laboratory testing was performed on bulk and ring samples obtained during the field investigation. A brief description of the laboratory test procedures and the test results are presented in Appendix C.

3.2 Infiltration Testing

It is Alta's understanding that the site may utilize infiltration systems for storm water disposal. Details of the systems are not known at this time.

Infiltration testing was undertaken using two ten (10) foot-deep borings (P-1 and P-2) as shown on Plate 1. The testing was performed on December 23rd, 2024, in general conformance with the County of San Bernardino Technical Guidance Document Standards. The test wells were presoaked for 24 hours, and then water level readings were recorded every 10 minutes until the readings stabilized.

The data was then adjusted to provide an infiltration rate utilizing the Porchet Method. The resulting infiltration rate is presented in Table 3-1. The results do not include a Factor of Safety. Recommendations for infiltration BMP design are presented in Section 6.3.

Plate-1

1-0571

Legend

- B-6
- P-2



Table 3-1-Summary of Infiltration Testing (No Factor of Safety)		
Test Designation	P-1	P-2
Approximate Depth of Test	10 ft	10 ft
Time Interval	10 minutes	10 minutes
Radius of Test Hole	4 inches	4 inches
Tested Infiltration Rate	2.4 (in/hr)	2.3 (in/hr)

4.0 GEOLOGIC CONDITIONS

4.1 Geologic and Geomorphic Setting

Regionally, the subject site is located in the Peninsular Ranges geomorphic province, which characterizes the southwest portion of southern California where major right lateral major active fault zones predominately trend northwest-southeast. The Peninsular Ranges province is composed of plutonic and metamorphic rock, with lesser amounts of Tertiary volcanic and sedimentary rock, Quaternary drainage in-fills and sedimentary veneers.

4.2 Stratigraphy

Based on our literature review and subsurface investigation, the site is underlain by undocumented artificial fill and young alluvial fan deposits. These geologic units are briefly described below.

4.2.1 Undocumented Artificial Fill (Map symbol afu)

The undocumented artificial fill encountered at the site consists primarily of gray and brown silty sand in a dry to slightly moist and medium dense condition. The unit was logged to depths of one (1) foot below the ground surface.

4.2.2 Young Alluvial Fan Deposits (Map symbol Qyf)

The artificial fill is underlain by young alluvial fan deposits consisting of light yellowish brown to gray gravelly sand and sandy gravel in a dry to slightly moist, medium dense to dense condition. The unit was logged to a depth of 12.0 feet below the ground surface.

4.3 Geologic Structure

4.3.1 Tectonic Framework

Jennings (1985) defined eight structural provinces within California that have been classified by predominant regional fault trends and similar fold structure. These provinces are in turn divided into blocks and sub-blocks that are defined by “major Quaternary faults.” These blocks and sub-blocks exhibit similar structural features. Within this framework, the subject site is located within Structural Province I, which is controlled by the dominant northwest trend of the San Andreas Fault and is divided into two blocks, the Coast Range Block and the Peninsular Range Block. The Peninsular Range Block, on which this site is located, is characterized by a series of parallel, northwest trending faults that exhibit right lateral strike-slip movement. These faults are terminated by the Transverse Range block to the north and extend southward into the Baja Peninsula. These northwest trending faults divide the Peninsular Range block into eight sub-blocks. The site is located in the northern portion of the Santa Ana Sub-block, one of the eight sub-blocks, which is bound on the east by the Elsinore fault zone and on the west by the Newport-Inglewood fault zone.

4.3.2 Regionally Mapped Active Faults

Several large, active fault systems including the Whittier- Elsinore Newport-Inglewood, and the San Andreas occur in the region surrounding the site. These fault systems have been studied extensively and in a large part control the geologic structure of southern California.

4.3.3 Geologic Structure

Based upon our site investigation and literature review, the onsite alluvial sediments are of Holocene age and are not folded or faulted.

4.4 Groundwater

Our subsurface investigation did not encounter groundwater to the depth of twelve (12) feet below the ground surface. Groundwater data available from the nearest well (State Well # 341006N1177096W001) located 2.6 mile west of the property indicates that the groundwater depth has been approximately 128-feet below the ground surface from 2024. (WDL, 2024).

4.5 Earthquake Hazards

The subject site is located in southern California, which is a tectonically active area. The type and magnitude of seismic hazards affecting a site are dependent on the distance to the causative fault and the intensity and magnitude of the seismic event. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction and/or ground lurching.

4.5.1 Local and Regional Faulting

The site is located on the northern portion of the Santa Ana sub-block, where the San Jose, Cucamonga, Sierra Madre, Chino, San Jacinto, Elsinore, and San Andreas fault located 1.8, 3, 4.7, 6.7, 13.8, 15.3 and 16.1 miles from the site (USGS, 2008).

4.5.2 Seismicity

Ground shaking hazards caused by earthquakes along other active regional faults exist. The 2022 California Building Code requires use-modified spectral accelerations and velocities for most structural designs. Seismic design parameters using soil profile types identified in the 2022 California Building Code are presented in Section 7.3.

4.5.3 Surface Rupture

Active faults are not known to exist within the project and a review of Special Publication 42 indicates the site is not within a California State designated earthquake fault zone. Accordingly, the potential for fault surface rupture on the subject site is very low.

4.5.4 Liquefaction

Seismic agitation of relatively loose saturated sands, silty sands, and some silts can result in a buildup of pore pressure. If the pore pressure exceeds the overburden stresses, a temporary quick condition known as liquefaction can occur. Liquefaction effects can manifest in several ways including: 1) loss of bearing; 2) lateral spread; 3) dynamic settlement; and 4) flow failure. Lateral spreading has typically been the most damaging mode of failure.

In general, the more recent that a sediment has been deposited, the more likely it will be susceptible to liquefaction. Other factors that must

be considered are: groundwater, confining stresses, relative density, and the intensity and duration of seismically-induced ground shaking.

The site is not within a State-identified zone of required investigation for liquefaction (CDMG, 2000). The nearest groundwater well indicates that groundwater is 128-ft. below the ground surface. Based on the depth of groundwater, it is our opinion that the potential for liquefaction is minimal at the site.

4.5.5 Dry Sand Settlement

Dry sand settlement is the process of non-uniform settlement of the ground surface during a seismic event. Based on our subsurface investigation and our removal/recompaction recommendations, the potential for dry sand settlement is anticipated to be low and within foundation design tolerances.

5.0 ENGINEERING PROPERTIES AND ANALYSIS

5.1 Materials Properties

Presented herein is a general discussion of the engineering properties of the onsite materials that will be encountered during construction of the proposed project. Descriptions of the soil (Unified Soil Classification System) are presented on the boring logs in Appendix B.

5.1.1 Excavation Characteristics

Based on the data provided from the subsurface investigation, it is our opinion that the onsite materials possess favorable excavation characteristics such that conventional earth moving equipment can be utilized. Gravel and cobbles will be encountered during the excavations.

5.1.2 Compressibility

The undocumented artificial fill and upper portions of young alluvial fan deposits onsite are considered compressible and unsuitable to support the proposed improvements. Recommended removal depths are presented in Section 6.1.2.

5.1.3 Moisture

The moisture content of the undocumented artificial fill and young alluvial fan deposits that will require removal and recompaction as discussed in Section 6.1.2 are typically under-optimum and will require moisture conditioning for compaction.

5.1.4 Hydro-Consolidation

Hydro-consolidation is the effect of introducing water into soil that is prone to collapse. Upon loading and initial wetting, the soil structure and apparent strength are altered resulting in almost immediate settlement. That settlement can have adverse impacts on engineered structures, particularly in areas where it is manifested differentially. Differential settlements are typically associated with differential wetting, irregularities in the subsurface soil conditions, or irregular loading patterns.

Based on soil type and gravel content of the soils encountered, the potential for hydro-collapse in the underlying young alluvial fan deposits is minimal and should be within foundation tolerances upon the completion of the recommended unsuitable soil removals.

5.1.5 Expansion Potential

Expansion index testing was performed on samples taken during our subsurface investigation. Based on the results, it is anticipated that the majority of materials onsite are “very low” to “low” in expansion potential ($0 \leq EI \leq 50$, Appendix C) when tested per ASTM D: 4829.

5.1.6 Earthwork Adjustments

The values presented in Table 5-1 are deemed appropriate for estimating purposes and may be used in an effort to balance earthwork quantities. As is the case with every project, contingencies should be made to adjust the earthwork balance when grading is in-progress and actual conditions are better defined.

TABLE 5-1 Earthwork Adjustment Factors		
Geologic Unit	Adjustment Factor Range	Average
Undocumented Artificial Fill/Alluvium	Shrink 9% to 13%	11%

5.1.7 Chemical Analyses

Chemical testing was performed on samples of material underlying the proposed site. Soluble sulfate test results indicate that the soluble sulfate concentrations of the soils tested are classified as negligible (Category S0) per ACI 318-14.

Negligible chloride levels were detected in the onsite soils. Based on laboratory results of soluble sulfate, chloride, and pH testing as presented in Appendix C, the onsite soils are classified as “non-corrosive” to buried metals and concrete (Caltrans, 2022). Additional discussions on corrosion are presented in Section 7.9. Corrosion tests results are presented in Appendix C.

5.2 Engineering Analysis

Presented below is a general discussion of the engineering analysis methods that were utilized to develop the conclusions and recommendations presented in this report.

5.2.1 Bearing Capacity and Lateral Earth Pressures

Ultimate bearing capacity values were obtained using the graphs and formula presented in NAVFAC DM-7.1. Allowable bearing was determined by applying a factor of safety of at least 3 to the ultimate bearing capacity. Static lateral earth pressures were calculated using Rankine methods for active and passive cases. If it is desired to use Coulomb forces, a separate analysis specific to the application can be conducted.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on Alta's findings during our subsurface investigation, the laboratory test results, and our staff's previous experience in the area, it is Alta's opinion that the development of the site is feasible from a geotechnical perspective. Presented below are Alta's recommendations that should be incorporated into site development and construction plans.

6.1 General Earthwork Recommendations

All grading shall be accomplished under the observation and testing of the project geotechnical consultant in accordance with the recommendations contained herein and the City of Upland criteria.

6.1.1 Site Preparation

Vegetation, construction debris, and other deleterious materials are unsuitable as structural fill material and should be disposed of offsite prior to commencing grading/construction. Any septic tanks, seepage pits or wells should be abandoned as per the County of San Bernardino Department of Health Services.

Existing concrete should be removed prior to the placement of engineered fill. The demolished concrete may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. Prior to placement as engineered fill any protruding steel rebar should be cut from the concrete pieces and disposed of offsite.

Existing asphaltic concrete should be removed prior to the placement of engineered fill. From a geotechnical perspective, this material may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. The crushed asphalt should not be placed under residential structures, but rather, it can be placed in approved non-residential areas, such as streets, parking areas or open space. These recommendations should be verified by the environmental consultant.

6.1.2 Unsuitable Soil Removals

The artificial fill and the upper portions of the young alluvial fan deposits near the surface are compressible and as such, are not suitable to support the proposed structures. Accordingly, it is recommended to completely remove the undocumented artificial fills and highly weathered portions of the underlying young alluvial fan deposits across the site and as close to the property boundaries as possible.

As such, it is anticipated that, on average, the upper three (3) to five (5) feet of existing soils will require removal and recompaction, extending at a minimum 1:1 projection horizontally outside the structures. This recommended removal combined with the foundation recommendations presented in Section 7.1 should provide suitable support for the proposed structures.

The Project Geotechnical Consultant should observe the removal bottom prior to placing fill. If unsuitable soils such as undocumented artificial fill are exposed upon the completion of the removals recommended above, additional removals may be required.

For streets, in general, a minimum removal and recompaction of the upper two (2) feet of soil is recommended, although deeper removals may be required if undocumented fill is exposed at that depth.

Material removed as part of the unsuitable soil removals can be used as artificial fill, provided it is free of deleterious materials.

6.1.3 Over-excavation of Building Pads

Footings for structures should be underlain by a minimum of two (2) feet of compacted fill. As such, for building pads where unsuitable soil removals do not provide the minimum depth of compacted fill, or where design grades and/or remedial grading activities create cut/fill transitions, the cut and shallow fill portions of the building pads should be over-excavated to provide the required depth of fill below the footings.

6.2 General Earthwork Recommendations

6.2.1 Compaction Standards

All fill and processed natural ground shall be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557. Fill material should be moisture conditioned to optimum moisture or above, and as generally discussed in Alta's Earthwork Specification Section presented in Appendix E. Compaction shall be achieved with the use of sheepsfoot rollers or similar kneading type equipment.

6.2.2 Groundwater/Seepage

It is anticipated that groundwater will not be encountered during construction. It is possible that perched water conditions could be encountered depending on the time of year construction occurs.

6.2.3 Documentation of Removals

All removal/over-excavation bottoms should be observed and approved by the project Geotechnical Consultant prior to fill placement. Consideration should be given to surveying the removal bottoms and undercuts after approval by the geotechnical consultant and prior to the placement of fill. Staking should be provided in order to verify undercut locations and depths.

6.2.4 Treatment of Removal Bottoms

At the completion of removals/over-excavation, the exposed removal bottom should be ripped to a minimum depth of eight (8) inches, moisture-conditioned to above optimum moisture content and compacted in-place to the project standards.

6.2.5 Fill Placement

After removals, scarification, and compaction of in-place materials are completed, additional fill may be placed. Fill should be placed in eight-inch bulk maximum lifts, moisture conditioned to optimum moisture content or above, compacted and tested as grading/construction progresses until final grades are attained.

6.2.6 Moisture Content

The moisture content of the upper in-situ soils is primarily below optimum, as shown on the boring logs in Appendix B. These soils will require moisture conditioning prior to placement as engineered fill.

6.2.7 Mixing

Mixing of materials may be necessary to prevent layering of different soil types and/or different moisture contents. Mixing should be accomplished prior to and as part of the compaction of each fill lift.

6.2.8 Import Soils

Import soils, if necessary, should consist of clean, low expansive, structural quality, compactable materials similar to the on-site soils and should be free of trash, debris or other objectionable materials. The project Geotechnical Consultant should be notified not less than 72 hours in advance of the locations of any soils proposed for import. Import sources should be sampled, tested, and approved by the project Geotechnical Consultant at the source prior to the importation of the soils to the site. The project Civil Engineer should include these requirements on plans and specifications for the project.

6.2.9 Utility Trenches

6.2.9.1 Excavation

Utility trenches should be supported, either by laying back excavations or shoring, in accordance with applicable OSHA standards. In general, existing site soils are classified as Soil Types "B" and "C" per OSHA standards. Upon completion of the recommended removals and re-compaction, the artificial fill will be classified as Soil Type "B". The Project Geotechnical Consulting should be consulted if geologic conditions vary from what is presented in this report.

6.2.9.2 Backfill

Trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D-1557.

Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks, or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

Under-slab trenches should also be compacted to project specifications. If select granular backfill ($SE > 30$) is used, compaction by flooding will be acceptable.

6.2.10 Backcut Stability

Temporary backcuts, if required during unsuitable soil removals, should be made no steeper than 1:1 without review and approval of the geotechnical consultant. Flatter backcuts may be necessary where geologic conditions dictate and where minimum width dimensions are to be maintained.

Care should be taken during remedial grading operations in order to minimize risk of failure. Should failure occur, complete removal of the disturbed material will be required.

In consideration of the inherent instability created by temporary construction backcuts for removals, it is imperative that grading schedules are coordinated to minimize the unsupported exposure time of these excavations. Once started, these excavations and subsequent fill operations should be maintained to completion without intervening delays imposed by avoidable circumstances. In cases where five-day workweeks comprise a normal schedule, grading should be planned to avoid exposing at-grade or near-grade excavations through a non-work weekend. Where improvements may be affected by temporary instability, either on or offsite, further restrictions such as slot cutting, extending workdays, implementing weekend schedules, and/or other requirements considered critical to serving specific circumstances may be imposed.

6.3 Storm Water Infiltration Systems

From a geotechnical perspective, allowing storm water to infiltrate the onsite soil in concentrated areas increases the potential for settlement, liquefaction, and water-related damage to structures/improvements, such as wet slabs or pumping subgrade, and should be avoided where possible. If infiltration systems are required on this site, care should be taken in designing systems that control the storm water as much as possible.

Preliminary infiltration testing was conducted at the site as part of this investigation, and the methodology is discussed in 3.2. The resulting infiltration rates for P-1 and P-2 was calculated to be 2.4 and 2.3-inches per hour, respectively. The results do not include a factor of safety.

Groundwater was not encountered during our investigation. Data from nearby wells indicates that recent groundwater is below 128 feet below the ground surface in 2024. (WDL, 2024)

The Project Geotechnical Consultant should review the final WQMP design prior to construction.

6.4 Boundary Conditions

Construction of retaining/screen walls along site boundaries will require additional geotechnical recommendations concerning unsuitable soil removals and foundation design parameters. Boundary conditions for the project should be reviewed by the Project Geotechnical Consultant as the design progresses.

7.0 DESIGN CONSIDERATIONS

7.1 Structural Design

It is anticipated that multi-story, wood-frame residential structures with slab on-grade and shallow foundations will be constructed. Upon the completion of rough grading, finish grade samples should be collected and tested in order to provide specific recommendations as they relate to the individual building pads. These test results and corresponding design recommendations should be presented in a final rough grading report. Final slab and foundation design recommendations should be made based upon specific structure sitings, loading conditions, and as-graded soil conditions.

It is anticipated that the majority of onsite soils will possess “very low” to “low” expansion potential when tested in general accordance with ASTM Test Method D: 4829. For budgeting purposes, the following foundation design requirements for a range of potential expansion characteristics are presented.

7.1.1 Foundations

Foundations may be preliminary designed based on the values presented in Table 7-1 below.

Table 7-1	
Foundation Design Parameters*	
Allowable Bearing	2000 lbs/ft ² assuming a minimum footing width and embedment of 12 inches.
Lateral Bearing	250 lbs/ft ² at a depth of 12 inches plus 250 lbs/ft ² for each additional 12 inches of embedment to a maximum of 2000 lbs/ft ²
Sliding Coefficient	0.35
Differential Settlement	Dynamic: 0.5-inches in 40 feet Static: 0.5-inch in 40 feet

*These values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern depth and reinforcement requirements and should be evaluated.

7.1.2 Conventional Foundation Systems

Based on the onsite soils conditions and information supplied by the 2022 CBC, conventional foundation systems may be designed in accordance with Tables 7-1 and 7-2.

TABLE 7-2 CONVENTIONAL FOUNDATION DESIGN PARAMETERS	
Expansion Potential	<i>Very Low to Low</i>
Soil Category	I
Design Plasticity Index	10
Minimum Footing Embedment	12 inches*
*The minimum footing embedments presented herein are based on expansion indexes. The structural engineer should determine minimum embedments based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code.	
Minimum Footing Width	12-inches-The structural engineer should determine the minimum footing width based on loading and the latest California Building Code.
Footing Reinforcement	No. 4 rebar, one (1) on top, one (1) on bottom
Slab Thickness	4 inches (actual)
Slab Reinforcement	No. 3 rebar spaced 18 inches on center, each way
Under-Slab Requirement	See Section 7.2
Slab Subgrade Moisture	Minimum of 110 percent of optimum moisture to a depth of 12 inches prior to placing concrete.
Footing Embedment Adjacent to Swales and Slopes	If exterior footings adjacent to drainage swales are to exist within five (5) feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that at least five- (5) feet is provided horizontally from edge of the footing to the face of the slope.
Garages	A grade beam reinforced continuously with the garage footings shall be constructed across the garage entrance, tying together the ends of the perimeter footings and between individual spread footings. This grade beam should be embedded at the same depth as the adjacent perimeter footings. A thickened slab, separated by a cold joint from the garage beam, should be provided at the garage entrance. Minimum dimensions of the thickened edge shall be six (6) inches deep. Footing depth, width and reinforcement should be the same as the structure. Slab thickness, reinforcement and under-slab treatment should be the same as the structure.

7.1.3 Post-Tensioned Slabs/Foundation Design Recommendations

Post-tensioned slabs for the project may be preliminarily designed utilizing the parameters presented in Tables 7-1 and 7-3. The parameters presented herein are based on methodology provided in the Design of Post-Tensioned Slabs-On-Ground, Third Edition, by the Post-Tensioning Institute, in accordance with the 2022 CBC.

TABLE 7-3 POST-TENSION SLAB DESIGN PARAMETERS						
Category	Expansion Potential	Minimum Embedment	Edge Lift		Center Lift	
			Em (ft)	Ym (inch)	Em (ft)	Ym (inch)
I	Very Low to Low	12 inches*	5.4	0.61	9.0	0.26
Slab Subgrade Moisture						
Category I	Minimum 110% of optimum moisture to a depth of 12 inches prior to pouring concrete					
Embedment*						
The minimum outer footing embedment presented herein are based on expansion indexes. The structural engineer should verify the minimum embedment based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code. If mat slabs are utilized, alternate embedment depths can be provided.						
Moisture Barrier						
A moisture barrier should be provided in accordance with the recommendations presented in Section 7.2						
The parameters presented herein are based on procedures presented in the <u>Design of Post-Tensioned Slabs-On-Ground, Third Edition</u> . No corrections for vertical barriers at the edge of the slab, or for adjacent vegetation have been assumed. The design parameters are based on a Constant Suction Value of 3.9 pF.						

7.2 Moisture Barrier

A moisture and vapor retarding system should be placed below the slabs-on-grade in portions of the structure considered to be moisture sensitive and should be capable of effectively preventing the migration of water and reducing the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as Visqueen, placed between one to four inches of clean sand, has been used for this purpose. The use of this system or other systems can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

7.3 Seismic Design

The site classes were determined based on the referenced reports and published geologic maps in the area in general conformance with Chapter 20 of ASCE 7-16. Based on the density of the underlying soils, a Site Class of D (shear wave velocity of 259 m/s) was selected. The seismic design parameters were calculated using a program based on the USGS website and ASCE 7-16 procedures. The resulting values are presented in Table 7-3. These values are applicable providing the exceptions presented in Supplements 2 and 3 of ASCE 7-16 are utilized in the design of the structure. If the design does not include the exception methodology, then a site-specific analysis shall be conducted.

TABLE 7-4 Seismic Ground Motion Values 2022 CBC and ASCE 7-16	
<i>Parameter</i>	<i>Value</i>
Site Class	D
Site Latitude	34.1010
Site Longitude	-117.6636
Spectral Response Acceleration Parameter, S_s	1.662
Spectral Response Acceleration Parameter, S_1	0.600
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.7
MCE Spectral Response Acceleration Parameter, S_{MS}	1.662
MCE Spectral Response Acceleration Parameter, S_{M1}	1.02
Design Spectral Response Acceleration Parameter, S_{DS}	1.108
Design Spectral Response Acceleration Parameter, S_{D1}	0.680
Peak Ground Acceleration, PGA_M	0.773

7.4 Block Walls

Block walls, if used, should be embedded a minimum of 2 feet below the lowest adjacent grade. Construction joints (not more than 20 feet apart) should be included in the block wall construction. Side yard walls should be structurally separated from the rear yard wall.

7.5 Footing Excavations

Soils from the footing excavations should not be placed in slab-on-grade areas unless properly compacted and tested. The excavations should be cleaned of all loose/sloughed materials and be neatly trimmed at the time of concrete placement. The Project Geotechnical Consultant should observe the footing excavations prior to the placement of concrete to determine that the excavations are founded in suitably compacted material.

7.6 Retaining Walls

Retaining walls should be founded on engineered fill and should be backfilled with granular soils that allow for drainage behind the wall. Foundations may be designed in accordance with the recommendations presented in Table 7-1, above. Unrestrained walls, free to horizontally move $0.0005H$ (for dense cohesionless backfill), may be designed to resist lateral pressures imposed by a fluid with a unit weight determined in accordance with the Table 7-5 below. The table also presents design parameters for restrained (at-rest) retaining walls. These parameters may be used to design retaining walls that may be considered as restrained due to the method of construction or location (corner sections of unrestrained retaining walls).

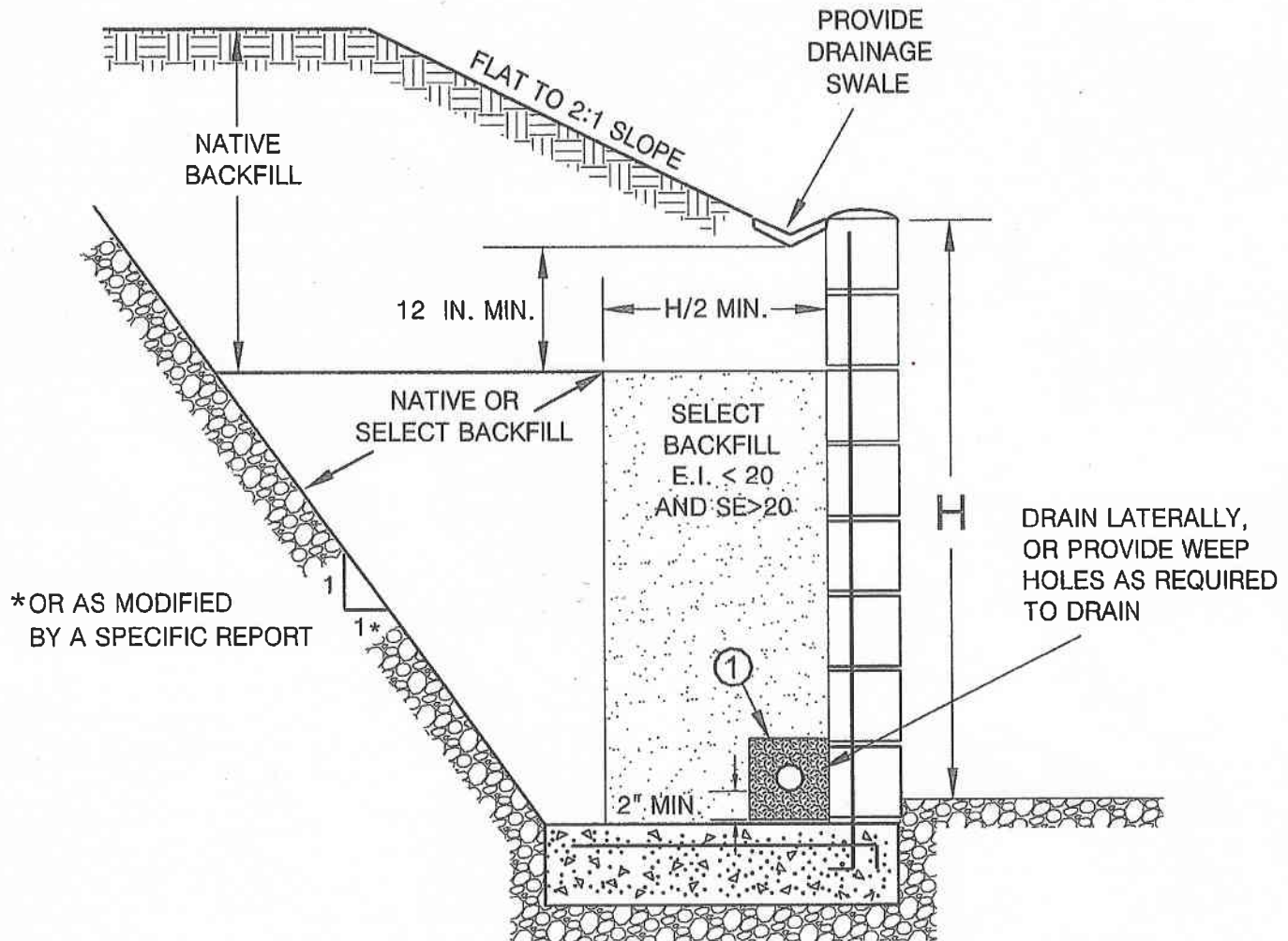
TABLE 7-5 Equivalent Fluid Pressures for 90% Compacted Fill (Select Material)		
Backfill	Active Pressure (psf/ft)	At-Rest Pressure (psf/ft)
Level	35	55

Per the requirements of the 2022 CBC, the seismic force acting on the retaining walls with backfill exceeding 6-feet in height may be resolved utilizing the formula $15.5H^2$ lb/lineal ft (H =height of the wall). This force acts at approximately $0.6H$ above the base of the wall (inverted triangle). The seismic value can be converted as required by the retaining wall engineer. Retaining walls should be designed in general accordance with Section 1807A.2 of the 2022 CBC.

- Restrained retaining walls should be designed for “at-rest” conditions.
- The design loads presented in the above table are to be applied on the retaining wall in a horizontal fashion and as such friction between wall and retained soils should not be allowed in the retaining wall analyses.
- Additional allowances should be made in the retaining wall design to account for the influence of construction loads, temporary loads, and possible nearby structural footing loads.
- Select backfill should be granular, structural quality backfill with a Sand Equivalent of 20 or better and an ASCE Expansion Index of 20 or less. The backfill must encompass the full active wedge area. The upper one foot of backfill should be comprised of native on-site soils (see Plate A).
- The wall design should include waterproofing (where appropriate) and backdrains or weep holes for relieving possible hydrostatic pressures. The backdrain should be comprised of a 4-inch perforated PVC pipe in a 1 ft. by 1 ft., $\frac{3}{4}$ -inch gravel matrix, wrapped with a geofabric. The backdrain should be installed with a minimum gradient of 2 percent and should be outletted to an appropriate location. For subterranean walls this may include drainage by sump pumps.
- No backfill should be placed against concrete until minimum design strengths are achieved.

It should be noted that the allowable bearing and lateral bearing values presented in Table 7-1 are based on level conditions at the toe. Modified design parameters can be presented for retaining walls with sloping condition at the toe. Other conditions should be evaluated on a case-by-case basis.

RETAINING WALL BACKFILL DETAIL



①

PIPE: 4-INCH PERFORATED PVC, SCHEDULE 40, SDR35 OR APPROVED ALTERNATE
MINIMUM 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FT. IN BOTTOM HALF OF PIPE

ROCK: MINIMUM VOLUME OF 1 CU. FT. OF 3/4-IN. MAX. ROCK PER. LINEAL FOOT OF PIPE, OR APPROVED ALTERNATE

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT



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VER. 1/10

PLATE A

7.7 Exterior Slabs and Walkways

Exterior concrete slabs and walkways should be designed and constructed in consideration of the following recommendations.

7.7.1 Subgrade Compaction

The subgrade below exterior concrete slabs should be compacted to a minimum of 90 percent relative compaction as determined by ASTM Test Method: D 1557.

7.7.2 Subgrade Moisture

The subgrade below concrete slabs should be moisture conditioned to a minimum of 110 percent of optimum moisture (low expansion) prior to concrete placement.

7.7.3 Concrete Slab Thickness

Concrete flatwork and driveways should be designed utilizing four-inch minimum thickness.

7.7.4 Concrete Slab Reinforcement

Utilization of reinforcement for flatwork and driveways is subject to a cost/benefit analysis. Reinforcement will decrease the amount of cracking that may occur in flatwork, however, planning for occasional repairs may be more cost effective. Utilizing closely spaced control joints is likely more cost-effective than utilizing reinforcement. The majority of the soils onsite are classified as very low in expansion potential. Consideration should be given to reinforcing flatwork with irregular (non-square/rectangular) shapes.

7.7.5 Control Joints

Weakened plane joints should be installed on walkways at intervals of approximately eight feet (maximum) or less. Exterior slabs should be designed to withstand shrinkage of the concrete.

7.8 Concrete Design

As stated in Section 5.1.7, negligible concentrations of sulfates were detected in the onsite soils. Therefore, the use of sulfate resistant concrete is not required per ACI 318-14 at this time. Post-grading conditions should be evaluated, and final recommendations made at that time.

7.9 Corrosion

Based on preliminary testing, the onsite soils are mildly corrosive to buried metal objects. Consideration should be given to protecting buried metals from corrosion. Typical measures may include using non-corrosive backfill, protective coatings, wrapping, plastic pipes, or a combination of these methods. A corrosion engineer should be consulted if specific design recommendations are required by the improvement designer.

Per ACI 318-14, an exposure class of C1 would be applicable to metals encased in concrete (rebar in footings) due to being exposed to moisture from surrounding soils. Per Table 19.3.2.1 of ACI 318-14, the requirements for concrete with an exposure class of C1 are a minimum compressive strength of 2500 psi and a maximum water-soluble chloride ion content in concrete of 0.30 (percent by weight of cement).

7.10 Site Drainage

Positive drainage away from the proposed structures should be provided and maintained. Roof, pad and lot drainage should be collected and directed away from the structures toward approved disposal areas through drainage terraces, gutters, down drains, and other devices. Design fine grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures. Residents or Homeowner Associations should be made aware that they are responsible for maintenance and cleaning of

all drainage terraces, down drains, and other devices that have been installed to promote site and structure drainage.

7.11 Pavement Design

Pavement sections for the proposed streets shall be designed based on laboratory testing conducted on samples taken from the soil subgrade. Preliminarily, based on an assumed R-Value of 30, the pavement may be designed utilizing the sections presented in Table 7-6. These sections should be verified upon the completion of grading, based on R-Value testing.

Table 7-6		
Preliminary Pavement Sections		
Traffic Index	Pavement Section Options OR	
5.0	3-inch AC on 5.5-inch AB	4-inch AC on 4-inch AB
5.5	3-inch AC on 7-inch AB	4-inch AC on 5-inch AB
6.0	3.5-inch AC on 7.5-inch AB	4-inch AC on 6.5-inch AB
AC-Asphalt Concrete AB-Caltrans Class II Base		

The underlying subgrade soil should be suitably moisture conditioned, processed and compacted to a minimum 90 percent of the laboratory maximum density (ASTM: D 1557) to at least twelve (12) inches below subgrade. After subgrade compaction, the exposed grade should then be "proof"-rolled with heavy equipment to ensure the grade does not "pump" and is verified as non-yielding. Aggregate base should consist of Class 2 (Caltrans) aggregate base and should be compacted to at least 95 percent of the maximum laboratory dry density as determined in accordance with ASTM Test Method: D 1557.

Preparation for compaction operations and pavement construction operations should be accomplished in accordance with the current requirements of the City of Upland and under the observation and testing of the project geotechnical consultant.

8.0 LOT MAINTENANCE

Ongoing maintenance of the improvements is essential to the long-term performance of structures. As such, the owners must implement certain maintenance procedures. The attached "Maintenance and Improvement Considerations" presented in the Appendix E may be included as part of the sales packet to educate the owners in issues related to drainage, maintenance, backyard improvements, etc. The following recommendations should also be implemented.

8.1 Lot Drainage

Roof, pad and lot drainage should be collected and directed away from structures and slopes and toward approved disposal areas. Design fine grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures and slopes. Residents should be made aware that they are responsible for maintenance and cleaning of all drainage terraces, down drains, and other devices that have been installed to promote structure and slope stability.

8.2 Burrowing Animals

Residents or owners should undertake a program for the elimination of burrowing animals.

9.0 FUTURE PLAN REVIEWS

This report represents a geotechnical review of the site. As the project design for the project progresses, site specific geologic and geotechnical issues should be considered in the design and construction of the project. Consequently, future plan reviews may be necessary. These reviews may include reviews of:

- Grading Plans
- Foundation Plans
- Utility Plans

These plans should be forwarded to the project Geotechnical Consultant for review.

10.0 CLOSURE

10.1 Geotechnical Review

For the purposes of this report, multiple working hypotheses were established for the project, utilizing the available data and the most probable model is used for the analysis. Future information collected during the proposed grading operations is intended to evaluate the hypothesis and as such, some of the assumptions summarized in this report may need to be changed. Some modifications of the grading recommendations may become necessary, should the conditions encountered in the field differ from the conditions hypothesized in this report.

Plans and sections of the project specifications should be reviewed by Alta to evaluate conformance with the intent of the recommendations contained in this report. If the project description or final design varies from that described in herein, Alta must be consulted regarding the applicability of the recommendations contained herein and whether any changes are required. Alta accepts no liability for any use of its recommendations if the project description or final design varies and Alta is not consulted regarding the alterations.

10.2 Limitations

This report is based on the following: 1) the project as presented on the attached plan; 2) the information obtained from Alta's laboratory testing included herein; and 3) from the information presented in the referenced reports. The findings and recommendations are based on the results of the subsurface investigation, laboratory testing, and office analysis combined with an interpolation and extrapolation of conditions between and beyond the subsurface excavation locations. However, the materials adjacent to or beneath those observed may have different characteristics than those observed, and no precise

representations are made as to the quality or extent of the materials not observed. The results reflect an interpretation of the direct evidence obtained. Work performed by Alta has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality under similar conditions. The methods used to develop the recommendations do not comprise an exact science and are not a guarantee that the interaction between the soils and proposed structures shall perform as planned. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by a geotechnical consultant who is familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report.

The conclusions and recommendations included in this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Alta.

Alta has no responsibility for construction means, methods, techniques, sequences, procedures, safety precautions, programs in connection with the construction, acts or omissions of the CONTRACTOR or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

APPENDIX A

Selected References

- California Geological Survey, 2018, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, Special Publication 42, Revised 2018.
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APPENDIX B

Subsurface Investigation

APPENDIX B
Subsurface Investigation

Alta's subsurface investigation consisted of excavating, logging, and sampling six (6) hollow-stem auger borings. Details of the subsurface investigation are presented in Table B. The approximate location of the exploratory excavation is shown on the accompanying Plate 1 and the Geotechnical Logs are attached.

TABLE B <i>SURFACE INVESTIGATION DETAILS</i>			
Equipment	Range of Depths	Sampling Methods	Sample Locations
Hollow-stem auger	Up to 12 feet	1. Bulk 2. Ring Samples	1. Bulk-Select Depth 2. Every 2.5 to 5-feet

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		grf	ltr	Description	Major Divisions	grf	ltr	Description
Coarse Grained Soils	Gravel and Gravelly Soils		GW	Well-graded gravels or gravel sand mixtures, little or no fines	Fine Grained Soils		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			GM	Silty gravels, gravel-sand-silt mixtures			OL	Organic silts and organic silt-clays of low plasticity
			GC	Clayey gravels, gravel-sand-clay mixtures			MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts
	Sand and Sandy Soils		SW	Well-graded sands or gravelly sands, little or no fines	More than 50% passes on No. 200 sieve		VH	Inorganic clays of high plasticity, fat clays
			SP	Poorly-graded sands or gravelly sands, little or no fines			OH	Organic clays of medium to high plasticity
			SM	Silty sands, sand-silt mixtures			PT	Peat and other highly organic soils
			SC	Clayey sands, and-clay mixtures				

BOUNDARY CLASSIFICATION: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

U.S. STANDARD SERIES SIEVE					CLEAR SQUARE SIEVE OPENINGS		
200	40	10	4		3/4"	3"	12"
Sils and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

RELATIVE DENSITY

Sands and Gravels	Blows/Foot (SPT)
Very Loose	<4
Loose	4-10
Medium Dense	11-30
Dense	31-50
Very Dense	>50

CONSISTENCY CLASSIFICATION

Sils and Clays	Criteria
Very Soft	Thumb penetrates soil >1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Very Stiff	Thumbnail will not indent soil

HARDNESS

Bedrock
Soft
Moderately Hard
Hard
Very Hard

LABORATORY TESTS

Symbol	Test
DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Sieve Analysis
SA	Maximum Density
MAX	Resistance (R) Value
RV	Expansion Index
EI	Sand Equivalent
SE	Atterberg Limits
AL	Chemical Analysis
CHEM	Hydrometer Analysis
HY	

SOIL MOISTURE

Increasing Visual Moisture Content
Dry - Dry to touch
Moist - Damp, but no visible free water
wet - Visible free water

SIZE PROPORTIONS

Trace - <5%
Few - 5 to 10%
Some - 15 to 25%



GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1280
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. B-1
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1280					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
		R	30				2.6			
5	1275	R	54				0.6			
		R	24, 50 for 6"							
10	1270	R	55							
						REFUSAL @ 11 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
☒ RING (DRIVE) SAMPLE
☐ SPT (SPLIT SPOON) SAMPLE
☐ BULK SAMPLE ☐ TUBE SAMPLE

GROUNDWATER
 SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.
P.N. 1-0571 PLATE B-1

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1290
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. B-2
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1290					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
		R	72							
5	1285	R	50 for 6"				0.3			
		R	50 for 5"				1.2			
						REFUSAL @ 8.5 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:

☒ RING (DRIVE) SAMPLE

☐ SPT (SPLIT SPOON) SAMPLE

☐ BULK SAMPLE ☐ TUBE SAMPLE

GROUNDWATER

SEEPAGE

J: JOINTING C: CONTACT

B: BEDDING F: FAULT

S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0571 PLATE B-2

SHEET 1 OF 1

BORING DESIG.	B-3
LOGGED BY	NL
NOTE	

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
	1280				SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.	2.7			
		R	43							
5	1275	R	28			@5.0 ft. brown, slightly moist.	2.7	3	0	
		R	52				2.7	1	0	
						REFUSAL @ 8.5 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0571

PLATE B-3

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1270
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. B-4
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1270					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
		R	25							
5	1265	R	32, 50 for 4"			REFUSAL @ 6 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED	0.2	130	2	

SAMPLE TYPES:

☒ RING (DRIVE) SAMPLE

☒ SPT (SPLIT SPOON) SAMPLE

☒ BULK SAMPLE ☐ TUBE SAMPLE

▼ GROUNDWATER

▶ SEEPAGE

J: JOINTING C: CONTACT

B: BEDDING F: FAULT

S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0571

PLATE B-4

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1270
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. B-5
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1270					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
		R	34				2.3			
5	1265	R	18			@5.0 ft. slightly moist.	5.0			
		R	16			@7.0 ft. brown, moist.	5.8			
10	1260	R	51			@10.0 ft. yellowish brown.	2.5			
		R	40, 50 for 5"			REFUSAL @ 12 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED	2.2			
SAMPLE TYPES: ☒ RING (DRIVE) SAMPLE ☒ SPT (SPLIT SPOON) SAMPLE ☒ BULK SAMPLE ☐ TUBE SAMPLE						☒ GROUNDWATER ☒ SEEPAGE J: JOINTING C: CONTACT B: BEDDING F: FAULT S: SHEAR RS: RUPTURE SURFACE	Alta California Geotechnical, Inc. P.N. 1-0571 PLATE B-5			

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1290
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. B-6
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1290					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
		R	41				1.7			
5	1285	R	70			REFUSAL @ 6 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED	2.3			
SAMPLE TYPES: ☒ RING (DRIVE) SAMPLE ☐ SPT (SPLIT SPOON) SAMPLE ☐ BULK SAMPLE ☐ TUBE SAMPLE						☒ GROUNDWATER ☒ SEEPAGE J: JOINTING C: CONTACT B: BEDDING F: FAULT S: SHEAR RS: RUPTURE SURFACE				
Alta California Geotechnical, Inc.						P.N. 1-0571 PLATE B-6				

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1280
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. P-1
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1280					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
5	1275									
10	1270					TOTAL DEPTH @ 10 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:

☒ RING (DRIVE) SAMPLE

☒ SPT (SPLIT SPOON) SAMPLE

☒ BULK SAMPLE ☐ TUBE SAMPLE

GROUNDWATER

SEEPAGE

J: JOINTING C: CONTACT

B: BEDDING F: FAULT

S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0571 PLATE P-1

GEOTECHNICAL BORING LOG

SHEET 1 OF 1

PROJECT NO. 1-0571
 DATE STARTED 12/20/24
 DATE FINISHED 12/20/24
 DRILLER 2R Drilling Inc.
 TYPE OF DRILL RIG 8" Hollow Stem Auger

PROJECT NAME N Maple Way & W Arrow Hwy
 GROUND ELEV. 1280
 GW DEPTH (FT)
 DRIVE WT. VARIES*
 DROP 30 in.

BORING DESIG. P-2
 LOGGED BY NL
 NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT- URATION (%)	OTHER TESTS
1280					SM	YOUNGER ALLUVIUM (Qyf): SILTY SAND, fine to coarse, yellowish brown, dry, some gravel.				
5	1275					@5.0 ft. brown, slightly moist.				
10	1270					TOTAL DEPTH @ 10 FEET NO GROUNDWATER ENCOUNTERED NO CAVING OBSERVED				

SAMPLE TYPES:

☒ RING (DRIVE) SAMPLE

☒ SPT (SPLIT SPOON) SAMPLE

☒ BULK SAMPLE ☐ TUBE SAMPLE

GROUNDWATER

SEEPAGE

J: JOINTING C: CONTACT

B: BEDDING F: FAULT

S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0571 PLATE P-2

APPENDIX C

Laboratory Testing

LABORATORY TESTING

The following laboratory tests were performed on a representative sample in accordance with the applicable latest standards or methods from the ASTM, California Building Code (CBC) and California Department of Transportation.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

Particle Size Analysis

Modified hydrometer testing was conducted to aid in classification of the soil. The results of the particle size analysis are presented in Table C.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of one representative bulk sample was evaluated in accordance with ASTM D-1557. The results are summarized in Table C.

Expansion Index Tests

One (1) expansion index tests were performed to evaluate the expansion potential of typical on-site soil. Testing was carried out in general conformance with ASTM Test Method D-4829. The results are presented in Table C.

Chemical Analyses

Chemical testing was performed on one select samples by Alta. The results of these tests (sulfate content, resistivity, chloride content and pH) are presented on Table C.

TABLE C
SUMMARY OF LABORATORY TEST DATA
P.N. 1-0571

BORING	DEPTH (FEET)	SOIL DESCRIPTION	GROUP SYMBOL	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	DIRECT SHEAR	PLUS NO.4 SEIVE (plus 4.76mm) (%)	SAND (4.76mm-0.075mm) (%)	SILT (0.075mm-0.005mm) (%)	CLAY (minus 0.005mm) (%)	EXPANSION INDEX UBC 18-2	CONSOL	OTHER TESTS REMARKS
B-1	2.5	Gravelly Silt (Qyf)	ML	132.6	7.7		34	14	46	6	0		MinResist:5263-Ohmcm pH:8.3,Chl:330ppm,So4:<0.01%

APPENDIX D

Maintenance and Improvement Considerations

MAINTENANCE AND IMPROVEMENT CONSIDERATIONS

General

Owners purchasing property must assume a certain degree of responsibility for improvements and for maintaining conditions around their home. Of primary importance from a geotechnical standpoint are maintaining drainage patterns and minimizing the soil moisture variation below all improvements. Such design, construction and owner maintenance provisions may include:

- Employing contractors for improvements who design and build in recognition of local building codes and specific site soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other improvements.
- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Watering should be done in a uniform manner, as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts that are designed to carry roof runoff directly into area drains or discharged well away from the foundation areas.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively uniform moisture conditions.

Sulfates

Owners should be cautioned against the import and use of certain inorganic fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils and increase the sulfate concentrations to potentially detrimental levels.

Site Drainage

- The owners should be made aware of the potential problems that may develop when drainage is altered through construction of hardscape improvements. Ponded water, drainage over the slope face, leaking irrigation systems, overwatering, or other conditions which could lead to ground saturation must be avoided.
- No water should be allowed to flow over the slopes. No alteration of pad gradients should be allowed that would prevent pad and roof runoff from being directed to approved disposal areas.
- Drainage patterns have been established at the time of the fine grading should be maintained throughout the life of the structure. No alterations to these drainage patterns should be made unless designed by qualified professionals in compliance with local code requirements and site-specific soils conditions.

Slope Drainage

- Residents should be made aware of the importance of maintaining and cleaning all interceptor ditches, drainage terraces, down drains, and any other drainage devices, which have been installed to promote slope stability.
- Subsurface drainage pipe outlets may protrude through slope surfaces and/or wall faces. These pipes, in conjunction with the graded features, are essential to slope and wall stability and must be protected in-place. They should not be altered or damaged in any way.

Planting and Irrigation of Slopes

- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It is the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately.

- Sprinklers should be adjusted to provide maximum uniform coverage with a minimum of water usage and overlap. Overwatering with consequent wasteful runoff and serious ground saturation must be avoided.
- If automatic sprinkler systems are installed, their use must be adjusted to account for seasonal and natural rainfall conditions.

Burrowing Animals

- Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability.

Owner Improvement

Owner improvements (pools, spas, patio slabs, retaining walls, planters, etc.) should be designed to account for the terrain of the project, as well as expansive soil conditions and chemical characteristics. Design considerations on any given lot may need to include provisions for differential bearing materials, ascending/descending slope conditions, bedrock structure, perched (irrigation) water, special geologic surcharge loading conditions, expansive soil stresses, and long-term creep/settlement.

All owner improvements should be designed and constructed by qualified professionals utilizing appropriate design methodologies, which account for the on-site soils and geologic conditions. Each lot and proposed improvement should be evaluated on an individual basis.

Setback Zones

Manufactured slopes maybe subject to long-term settlement and creep that can manifest itself in the form of both horizontal and vertical movement. These movements typically are produced as a result of weathering, erosion, gravity forces, and other natural phenomenon. A setback adjacent to slopes is required by most building codes, including the California Building Code. This zone is intended to locate and support the residential structures away from these slopes and onto soils that are not subject to the potential adverse effects of these natural phenomena.

The owner may wish to construct patios, walls, walkways, planters, swimming pools, spas, etc. within this zone. Such facilities may be sensitive to settlement and creep and should not be

constructed within the setback zone unless properly engineered. It is suggested that plans for such improvements be designed by a professional engineer who is familiar with grading ordinances and design and construction requirements. In addition, we recommend that the designer and contractor familiarize themselves with the site specific geologic and geotechnical conditions on the specific lot.

APPENDIX E

Earthwork Specifications

ALTA CALIFORNIA GEOTECHNICAL, INC.
EARTHWORK SPECIFICATIONS

These specifications present the generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superseded in preliminary geology and soils reports, grading plan review reports or by the prevailing grading codes or ordinances of the controlling agency.

A. GENERAL

1. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.
2. The project Geotechnical Engineer and Engineering Geologist, or their representatives, shall provide observation and testing services, and Geotechnical consultation for the duration of the project.
3. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Geotechnical Engineer/Engineering Geologist.
4. It is the Contractor's responsibility to prepare the ground surface to receive fill to the satisfaction of the Geotechnical Engineer and to place, spread, mix, moisture condition, and compact the fill in accordance with the job specifications and as required by the Geotechnical Engineer. The Contractor shall also remove all material considered by the Geotechnical Engineer to be unsuitable for use in the construction of engineered fills.
5. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit the proper preparation of fills.

B. PREPARATION OF FILL AREAS

1. Excessive vegetation and all deleterious material should be disposed of offsite as required by the Geotechnical Engineer.

Existing fill, soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and hauled from the site. Where applicable, the Contractor may obtain the

approval of the Soils Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removal of the deleterious materials have been accomplished, earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Geotechnical Engineer/Engineering Geologist.

2. Upon achieving a suitable bottom for fill placement, the exposed removal bottom shall be disced or bladed by the Contractor to the satisfaction of the Geotechnical Engineer. The prepared ground surfaces shall then be brought to the specified moisture content mixed as required, and compacted and tested as specified. In localities where it is necessary to obtain the approval of the controlling agency prior to placing fill, it will be the Contractor's responsibility to contact the proper authorities to visit the site.
3. Any underground structure such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or other structures not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer and/or the controlling agency for the project.

C. ENGINEERED FILLS

1. Any material imported or excavated on the property may be utilized as fill, provided the material has been determined to be suitable by the Geotechnical Engineer. Deleterious materials shall be removed from the fill as directed by the Geotechnical Engineer.
2. Rock or rock fragments less than twelve inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Geotechnical Engineer.
3. Rocks greater than twelve inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal.
4. All materials to be used as fill, shall be tested in the laboratory by the Geotechnical Engineer. Proposed import materials shall be approved by the Geotechnical Engineer 48 hours prior to importation.
5. The fill materials shall be placed by the Contractor in lifts, that when compacted, shall not exceed six inches. Each lift shall be spread evenly and shall be

thoroughly mixed to achieve a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at or above the optimum moisture content, as determined by the applicable laboratory standard. The Contractor will be notified if the fill materials are too wet or too dry to achieve the required compaction standard.

6. When the moisture content of the fill material is below the limit specified by the Geotechnical Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. When the moisture content of the fill material is above the limits specified by the Geotechnical Engineer, the fill materials shall be aerated by discing, blading, mixed with dryer fill materials, or other satisfactory methods until the moisture content is within the specified limits.
7. Each fill lift shall be compacted to the minimum project standards, in compliance with the testing methods specified by the controlling governmental agency, and in accordance with recommendations of the Geotechnical Engineer.

In the absence of specific recommendations by the Geotechnical Engineer to the contrary, the compaction standard shall be the most recent version of ASTM:D 1557.

8. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable materials into sound bedrock or firm material, in accordance with the recommendations and approval of the Geotechnical Engineer.
9. Side hill fills shall have a minimum key width of 15 feet into bedrock or firm materials, unless otherwise specified in the soil report and approved by the Geotechnical Engineer in the field.
10. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Geotechnical Engineer and Engineering Geologist.
11. The Contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as directed by the Geotechnical Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting

back to the compacted core; by direct compaction of the slope face with suitable equipment; or by any other procedure which produces the required result.

12. The fill portion of fill-over-cut slopes shall be properly keyed into rock or firm material; and the fill area shall be stripped of all soil or unsuitable materials prior to placing fill.

The design cut portion of the slope should be made first and evaluated for suitability by the Engineering Geologist prior to placement of fill in the keyway above the cut slope.

13. Pad areas in cut or natural ground shall be approved by the Geotechnical Engineer. Finished surfaces of these pads may require scarification and recompaction, or over excavation as determined by the Geotechnical Engineer.

D. CUT SLOPES

1. The Engineering Geologist shall observe all cut slopes and shall be notified by the Contractor when cut slopes are to be started.
2. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soil Engineer shall investigate, analyze and make recommendations to remediate these problems.
3. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the superjacent, prevailing drainage.
4. Unless otherwise specified in specific geotechnical reports, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.
5. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Geotechnical Engineer or Engineering Geologist.

E. GRADING CONTROL

1. Fill placement shall be observed and tested by the Geotechnical Engineer and/or his representative during grading.

Field density tests shall be made by the Geotechnical Engineer and/or his representative to evaluate the compaction and moisture compliance of each fill lift. Density tests shall be conducted at intervals not to exceed two feet of fill

height. Where sheepsfoot rollers are used, the fill may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Geotechnical Engineer or his representative.

2. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture content is in evidence, that particular layer or portion thereof shall be reworked until the required density and/or moisture content has been attained. Additional fills shall not be placed over an area until the previous lift of fill has been tested and found to meet the density and moisture requirements for the project and the previous lift is approved by the Geotechnical Engineer.
3. When grading activities are interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Geotechnical Engineer indicate the moisture content and density of the fill are within the specified limits.
4. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent the ponding of water. The Contractor shall take remedial action to control surface water and to prevent erosion of graded areas until such time as a permanent drainage and erosion devices have been installed.
5. Observation and testing by the Geotechnical Engineer and/or his representative shall be conducted during filling and compacting operations in order that he will be able to state in his opinion that all cut and filled areas are graded in accordance with the approved specifications.
6. Upon the completion of grading activities and after the Geotechnical Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or fill placement shall be undertaken without prior notification of the Geotechnical Engineer and/or Engineering Geologist.

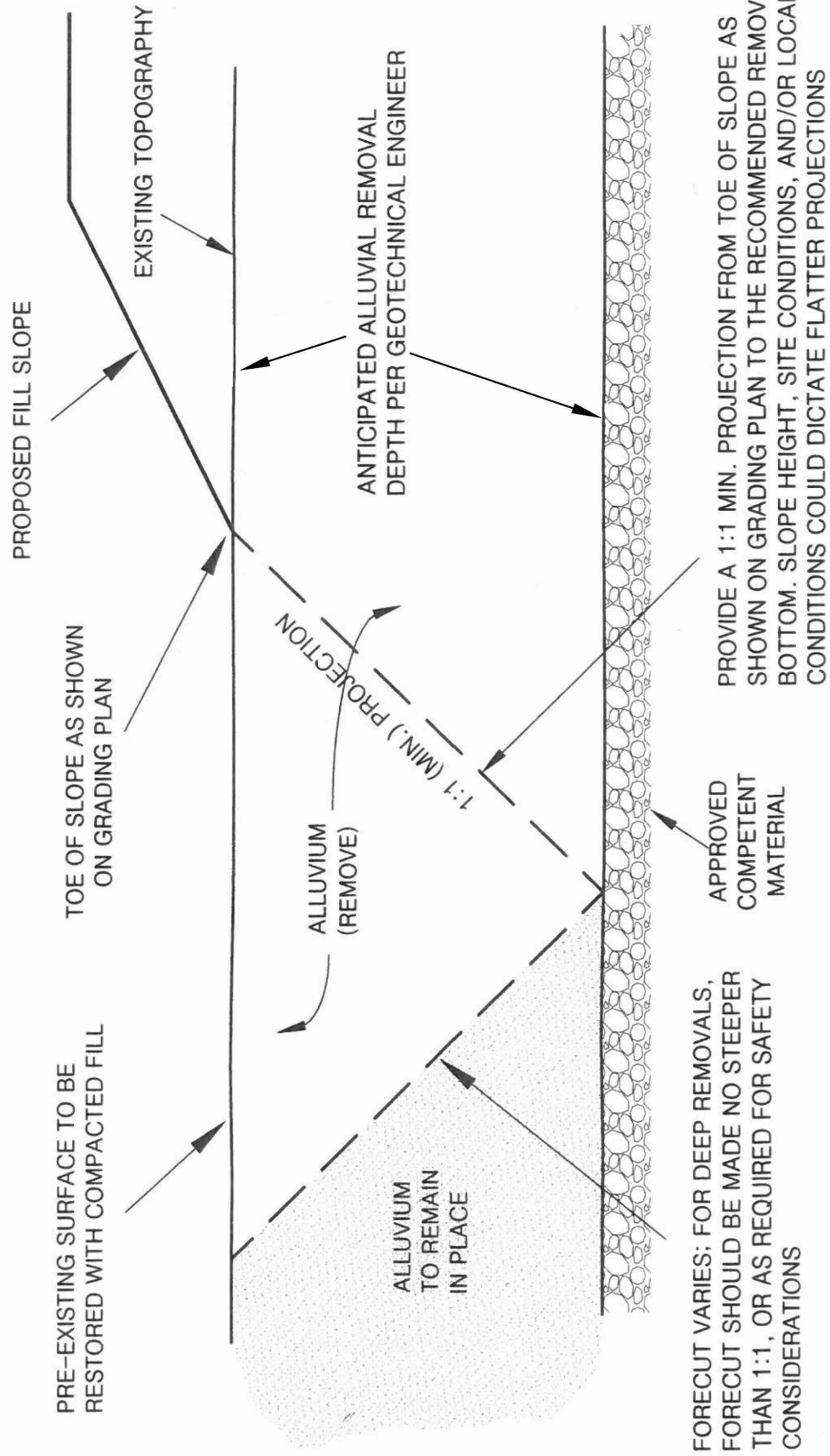
F. FINISHED SLOPES

All finished cut and fill slopes shall be planted and irrigated and/or protected from erosion in accordance with the project specifications, governing agencies, and/or as recommended by a landscape architect.

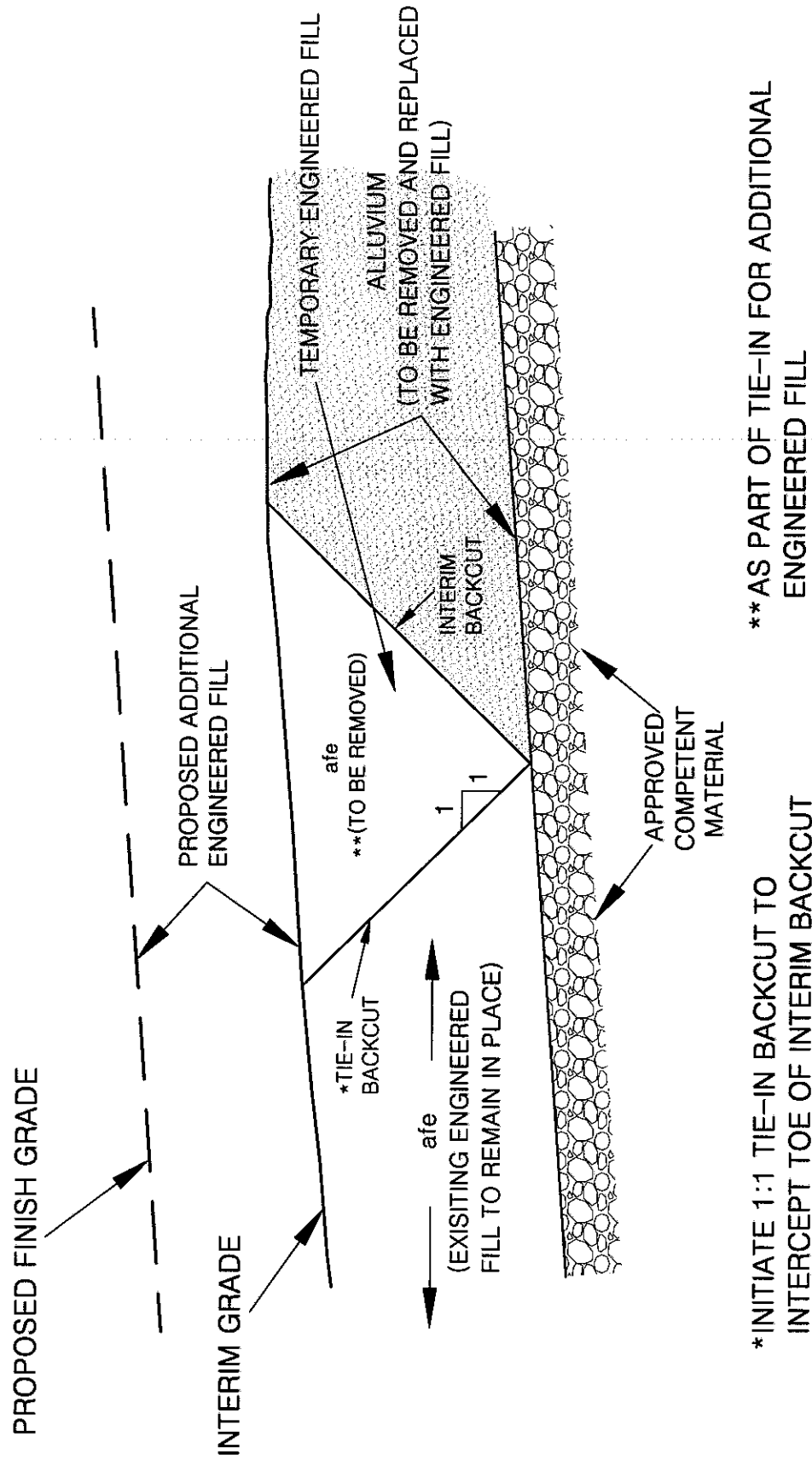
APPENDIX F

Grading Details

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON

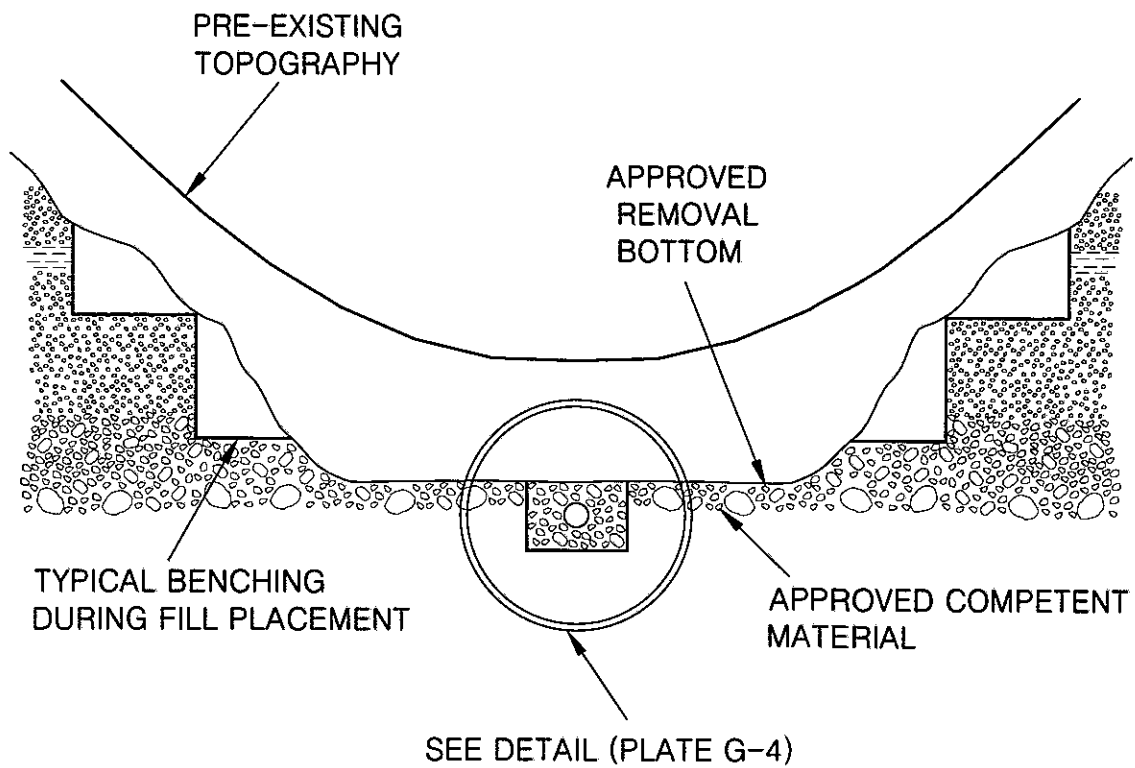


REMOVAL ADJACENT TO EXISTING FILL



*INITIATE 1:1 TIE-IN BACKCUT TO INTERCEPT TOE OF INTERIM BACKCUT

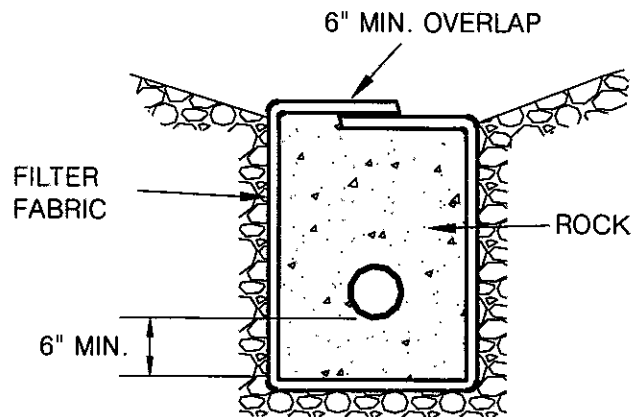
CANYON SUBDRAIN



ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-3

CANYON SUBDRAIN DETAIL



PERFORATED PIPE SURROUNDED WITH ROCK AND FILTER FABRIC

ROCK: MIN. VOLUME OF 9 CU.FT. PER LINEAL FT. OF 3/4 IN. MAX. ROCK

PIPE: 6 IN. ABS OR PVC PIPE WITH A MINIMUM OF 8 PERFORATIONS

(1/4-IN. DIA.) PER LINEAL FT. IN BOTTOM HALF OF PIPE

ASTM D2751, SDR 35, OR ASTM D3034 OR ASTM D1527,

SCHD. 40 ASTM D1785, SCHD. 40

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

NOTES:

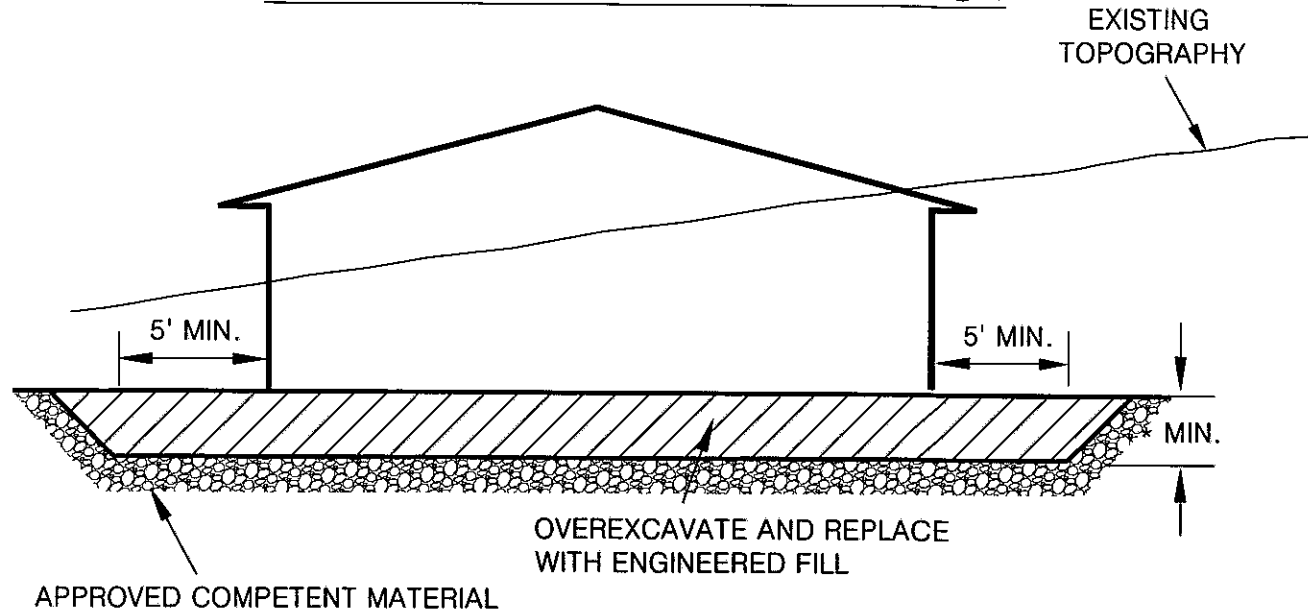
1. FOR CONTINUOUS RUN IN EXCESS OF 500. FT USE 8 IN. DIA. PIPE
2. ENGINEERED FILL PLACED BELOW DRAINS SHALL BE COMPACTED TO 93% OF THE LABORATORY MAXIMUM DRY DENSITY (ASTM:D1557)



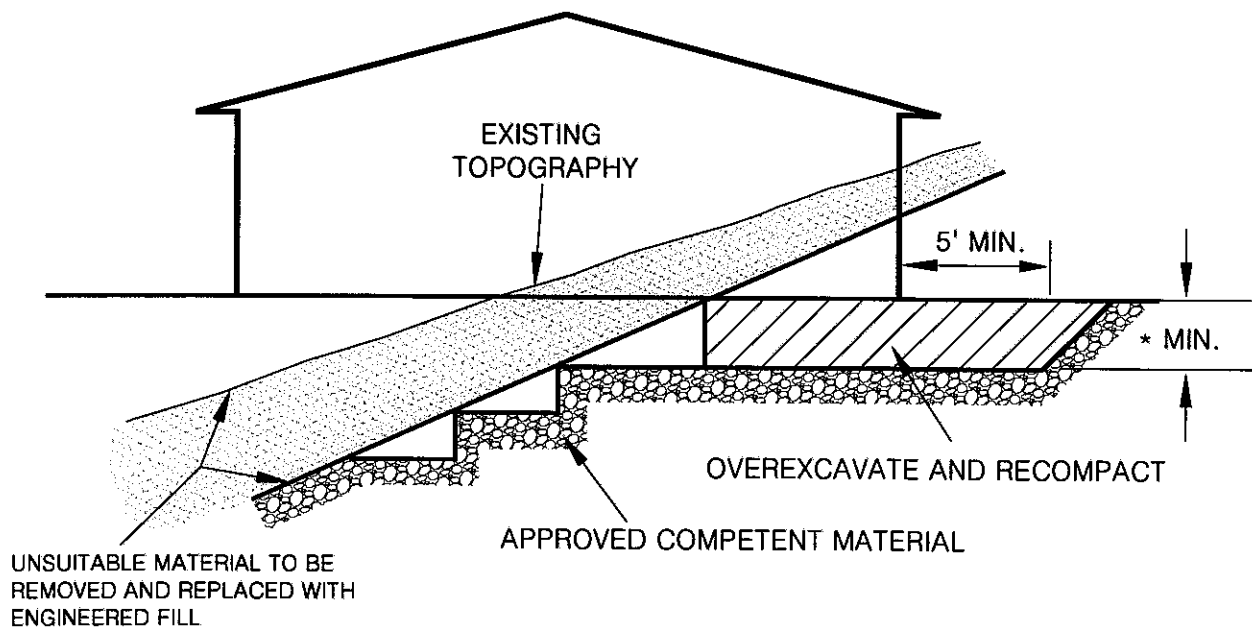
ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-4

OVEREXCAVATION CUT LOT



CUT-FILL LOT (TRANSITION)



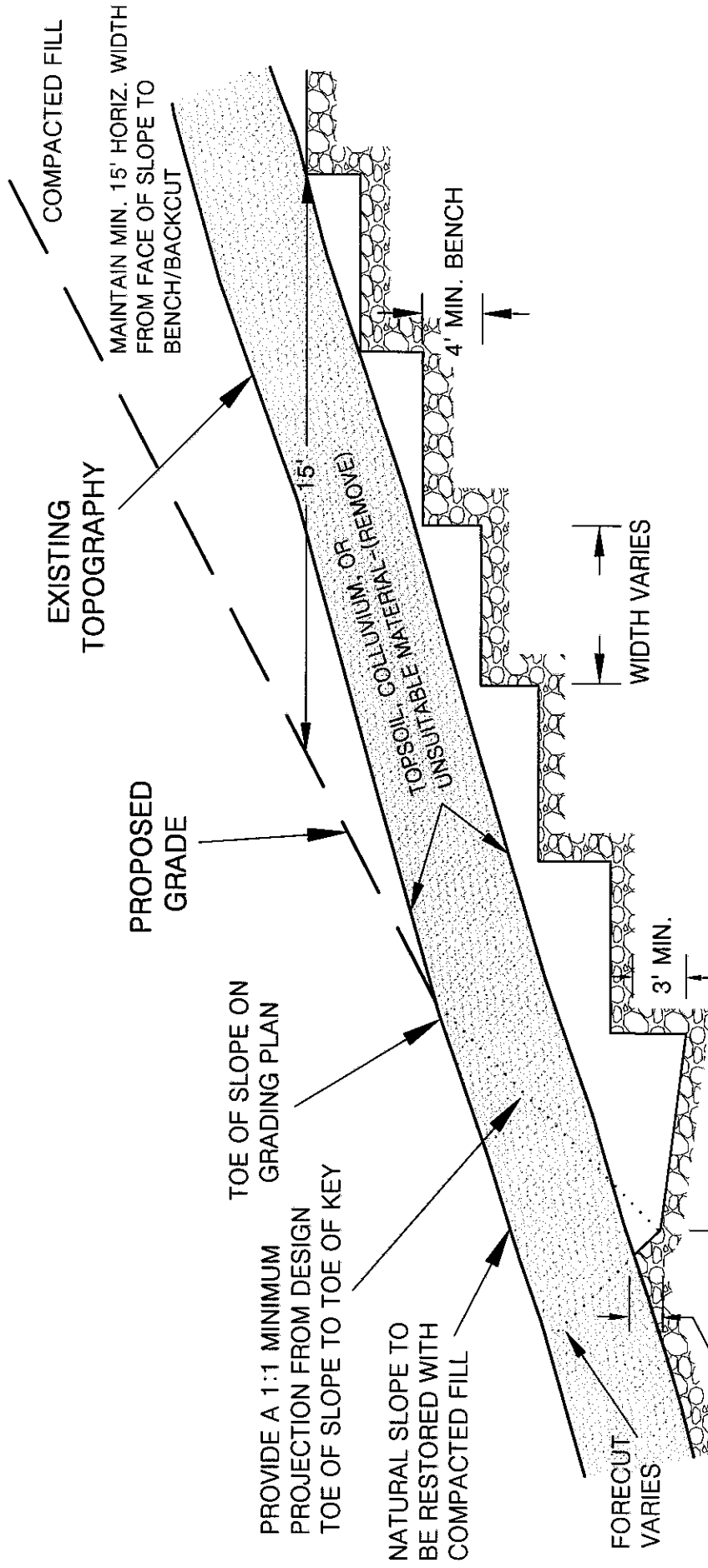
***NOTE** ALL BUILDING PADS SHALL BE OVER EXCAVATED TO A MINIMUM OF $\frac{1}{3}$ OF THE MAXIMUM DEPTH OF FILL BELOW THE BUILDING PAD TO A MAXIMUM OF 17 FEET (SEE PLATE G-16)



ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-5

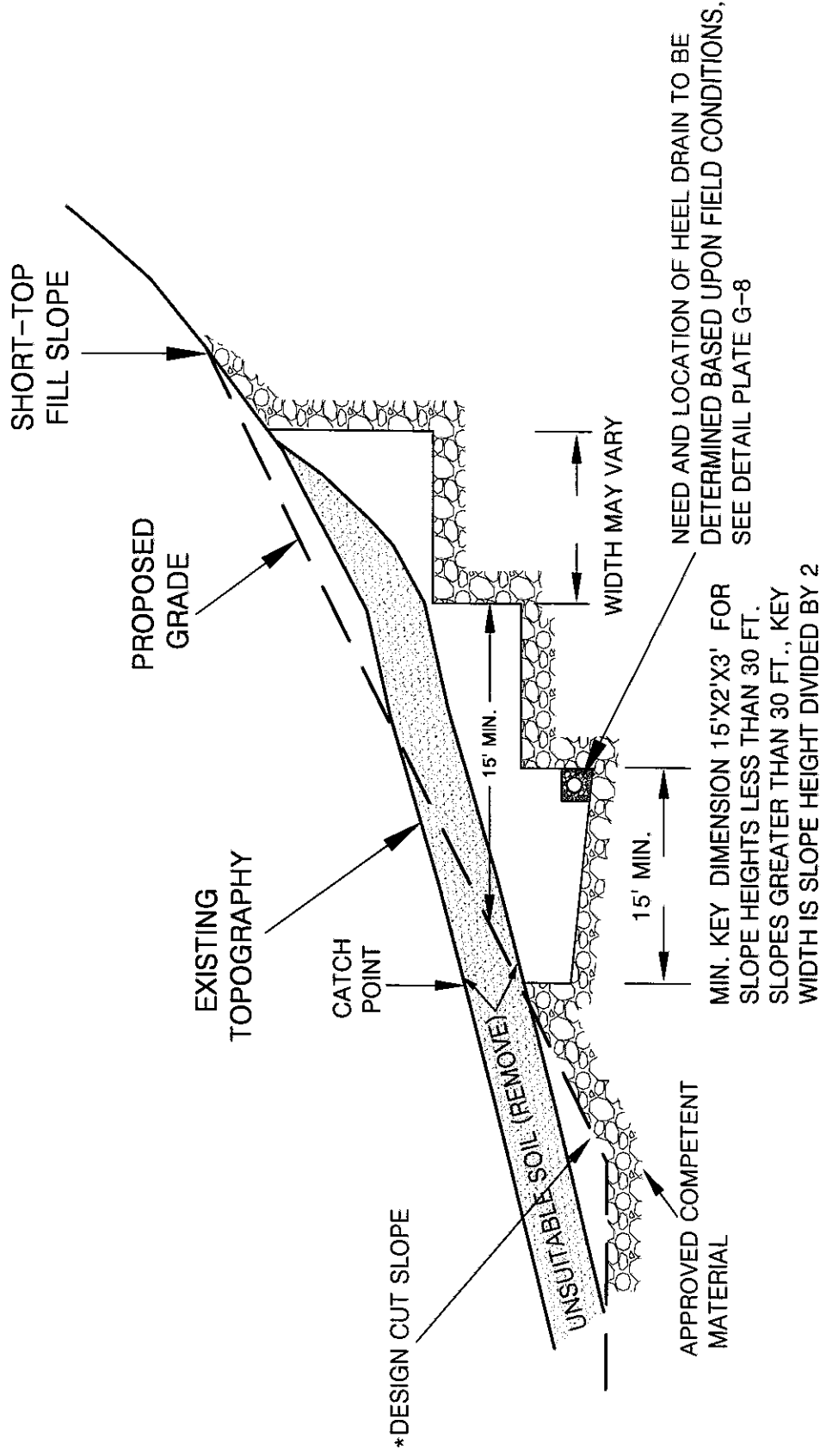
SIDE HILL SLOPE FILL DETAIL (NATURAL SLOPES 5:1 OR STEEPER)



NOTES: 1. WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, SEE PLATE G-1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WILL BE PROVIDED BY THE GEOTECHNICAL ENGINEER.

2. THE NEED FOR AND PLACEMENT OF DRAINS WILL BE DETERMINED BY THE GEOTECHNICAL ENGINEER OR GEOLOGIST BASED UPON EXPOSED FIELD CONDITIONS.

FILL OVER CUT SLOPE DETAIL



*THE CUT PORTION OF THE SLOPE SHOULD BE EXCAVATED AND EVALUATED BY THE ENGINEERING GEOLOGIST/GEO TECHNICAL ENGINEER PRIOR TO CONSTRUCTING THE FILL SLOPE

STABILIZATION/BUTTRESS FILL BACKDRAIN

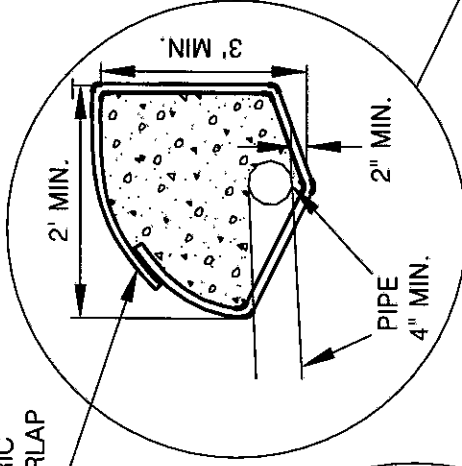
NOTE:

1. ASTM D2751, SDR 35, OR ASTM D3034 OR ASTM D1527, SCHD. 40 ASTM D1785, SCHD. 40
2. SOLID PIPE OUTLETS TO BE PROVIDED EVERY 100 FT. AND JOINED TO PERFORATED BACKDRAIN PIPE WITH "L" OR "T"s. MIN. 2% GRADIENT.

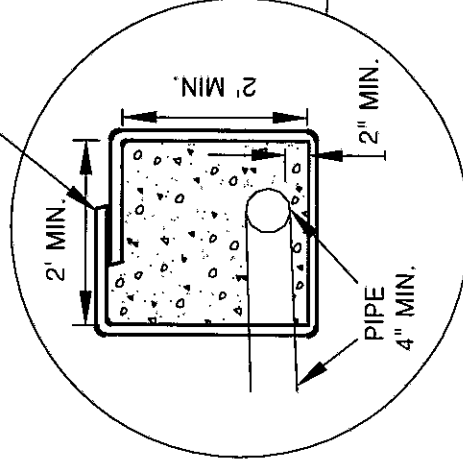
3. GRAVEL TRENCH TO BE FILLED WITH 3/4 IN. MAXIMUM ROCK
4. THE NECESSITY FOR UPPER TIER BACKDRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL ENGINEER OR GEOLOGIST. UPPER TIER OUTLETS SHOULD DRAIN INTO PAVED TERRACE DRAINS.
5. ENGINEERED FILL PLACED BELOW DRAINS SHALL BE COMPACTED TO 93% OF THE LABORATORY MAXIMUM DRY DENSITY (ASTM:D1557)

ALTERNATIVE NO. 1

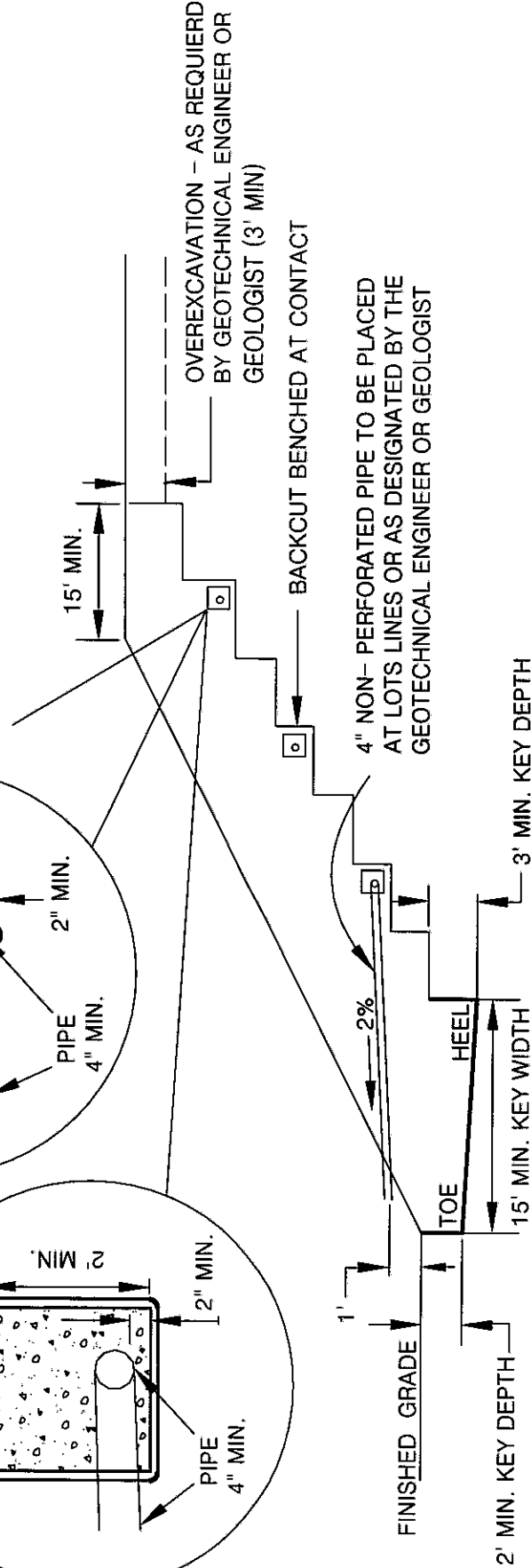
FILTER FABRIC
MIN. 6" OVERLAP



ALTERNATIVE NO. 2



TYPICAL 2 FT. X 2 FT. 3/4 IN. MAX. ROCK FILLED TRENCH WITH 4 IN. DIA. ABS OR PVC PIPE OR APPROVED SUBSTITUTE. PROVIDE MINIMUM 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FOOT IN BOTTOM HALF OF PIPE. PIPE IS TO EXTEND FULL LENGTH OF BUTTRESS OR STABILIZATION FILL WITH A MINIMUM GRADIENT OF 2% TO OUTLET PIPES.

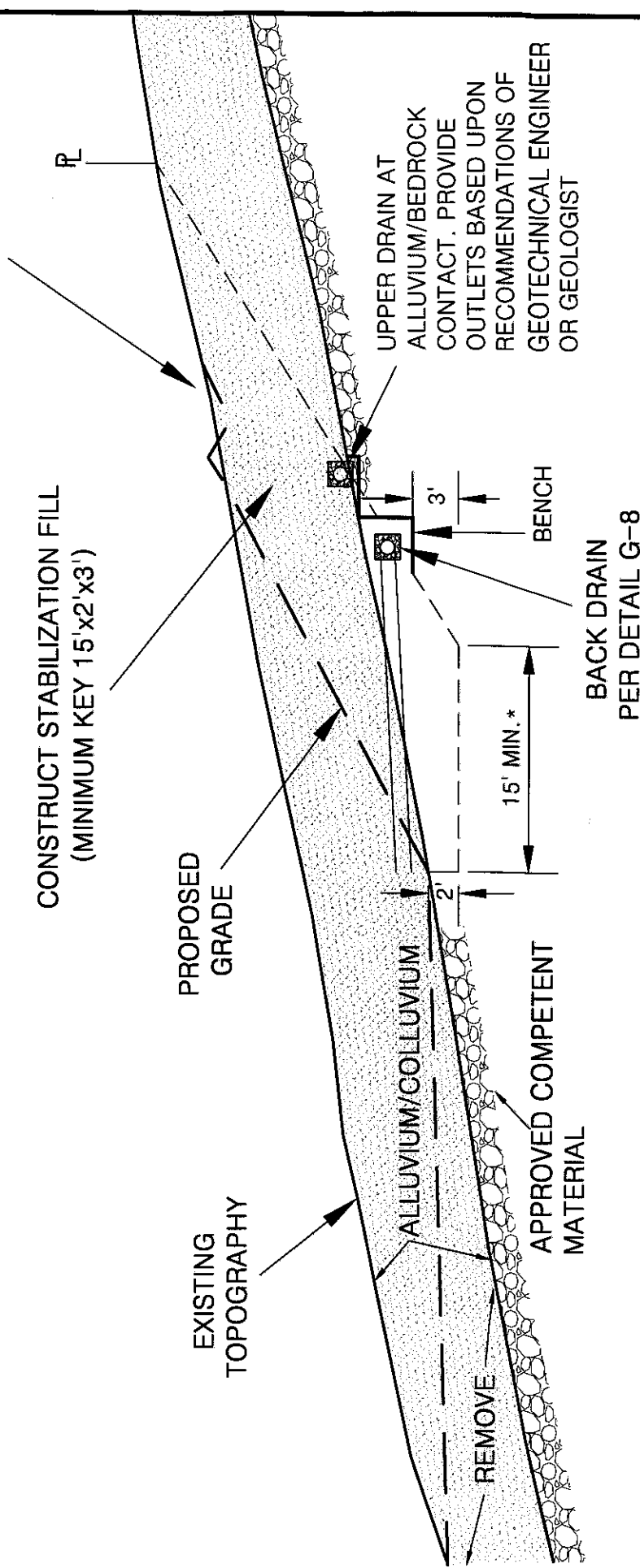


ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-8

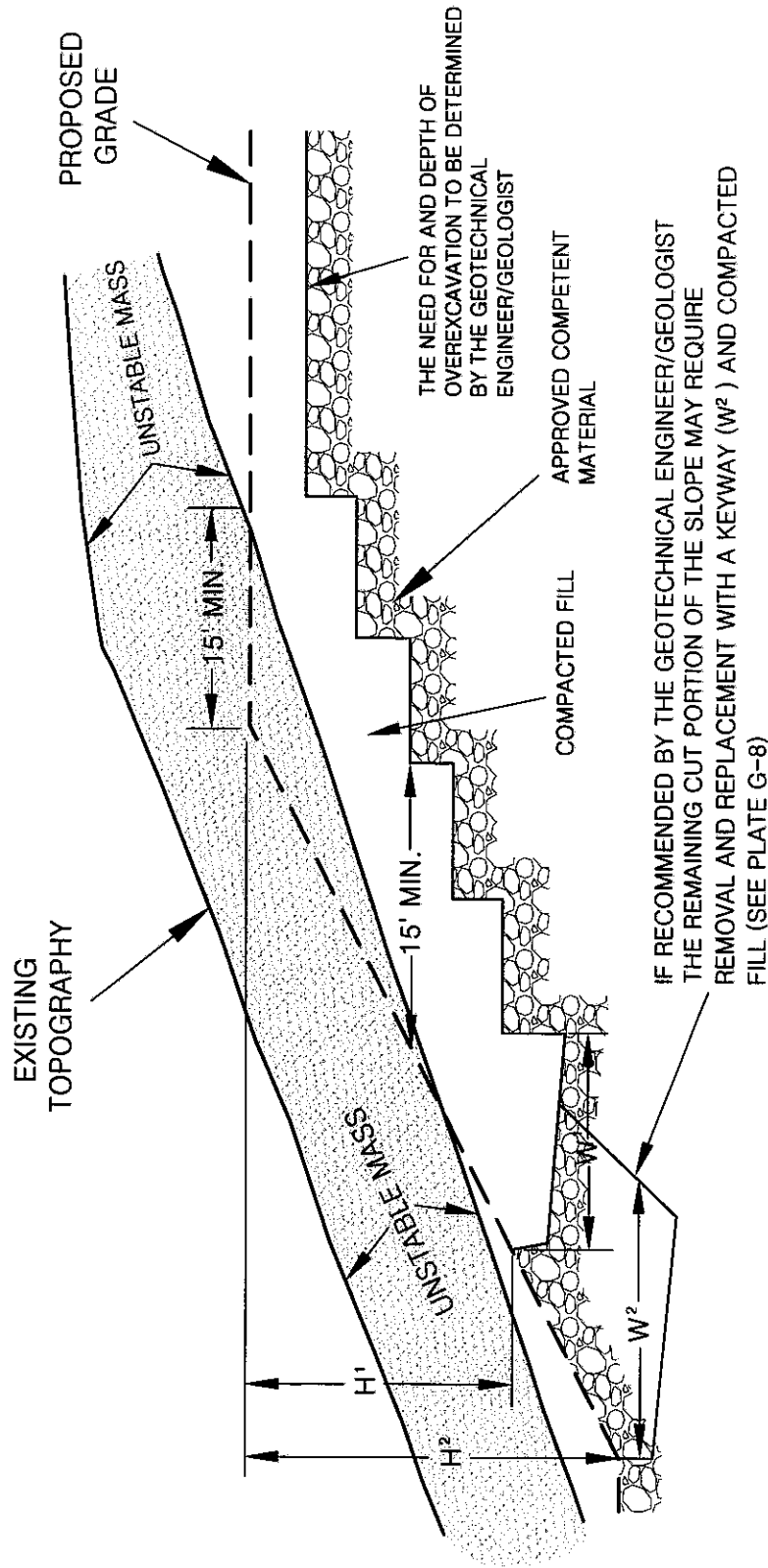
STABILIZATION FILL (UPSLOPE ALLUVIATED AREA)

PROVIDE BERM, PAVED SWALE,
AND/OR STORM DRAIN PER
CIVIL ENGINEER



* FOR SLOPE HEIGHTS LESS THAN 30 FT.
SLOPES GREATER THAN 30 FT., KEY
WIDTH IS SLOPE HEIGHT DIVIDED BY 2

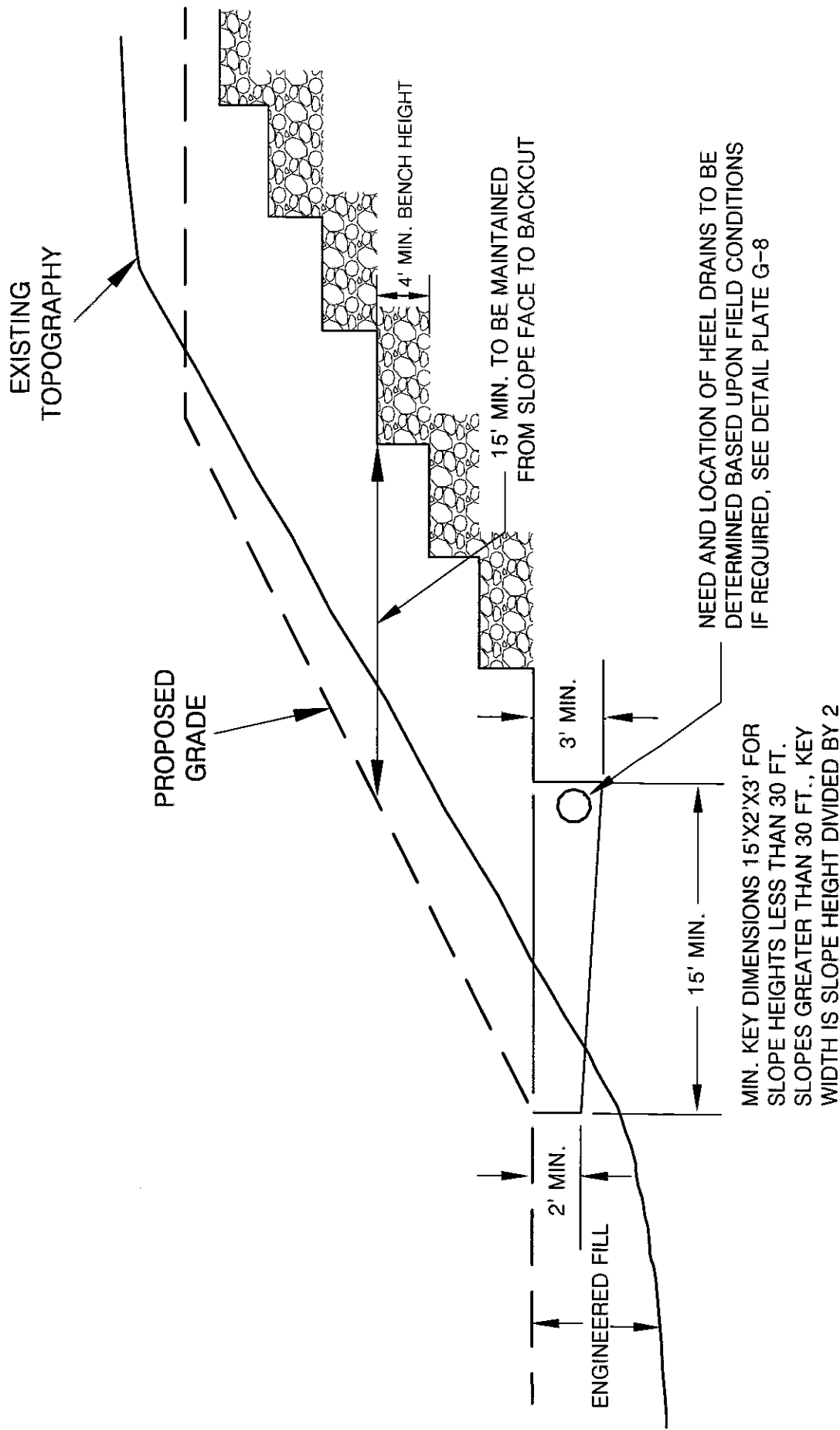
SELECTIVE GRADING DETAIL FOR STABILIZATION FILL UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



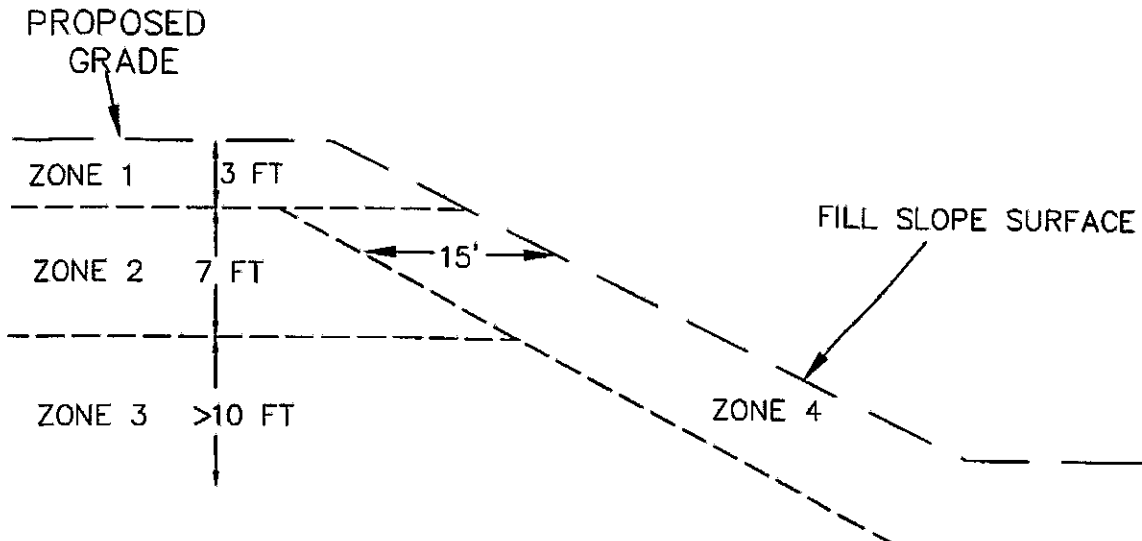
NOTES: 1. BACKDRAINS ARE NOT REQUIRED UNLESS SPECIFIED.

2. "W" SHALL BE EQUIPMENT WIDTH (15') FOR SLOPE HEIGHT LESS THAN 25 FEET. FOR SLOPES GREATER THAN 25 FEET, "W" SHALL BE DETERMINED BY THE PROJECT GEOTECHNICAL ENGINEER/GEOLOGIST. AT NO TIME SHALL "W" BE LESS THAN H/2.

SKIN FILL SLOPE OVER NATURAL GROUND



DETAIL FOR MAXIMUM PARTICLE DIMENSION



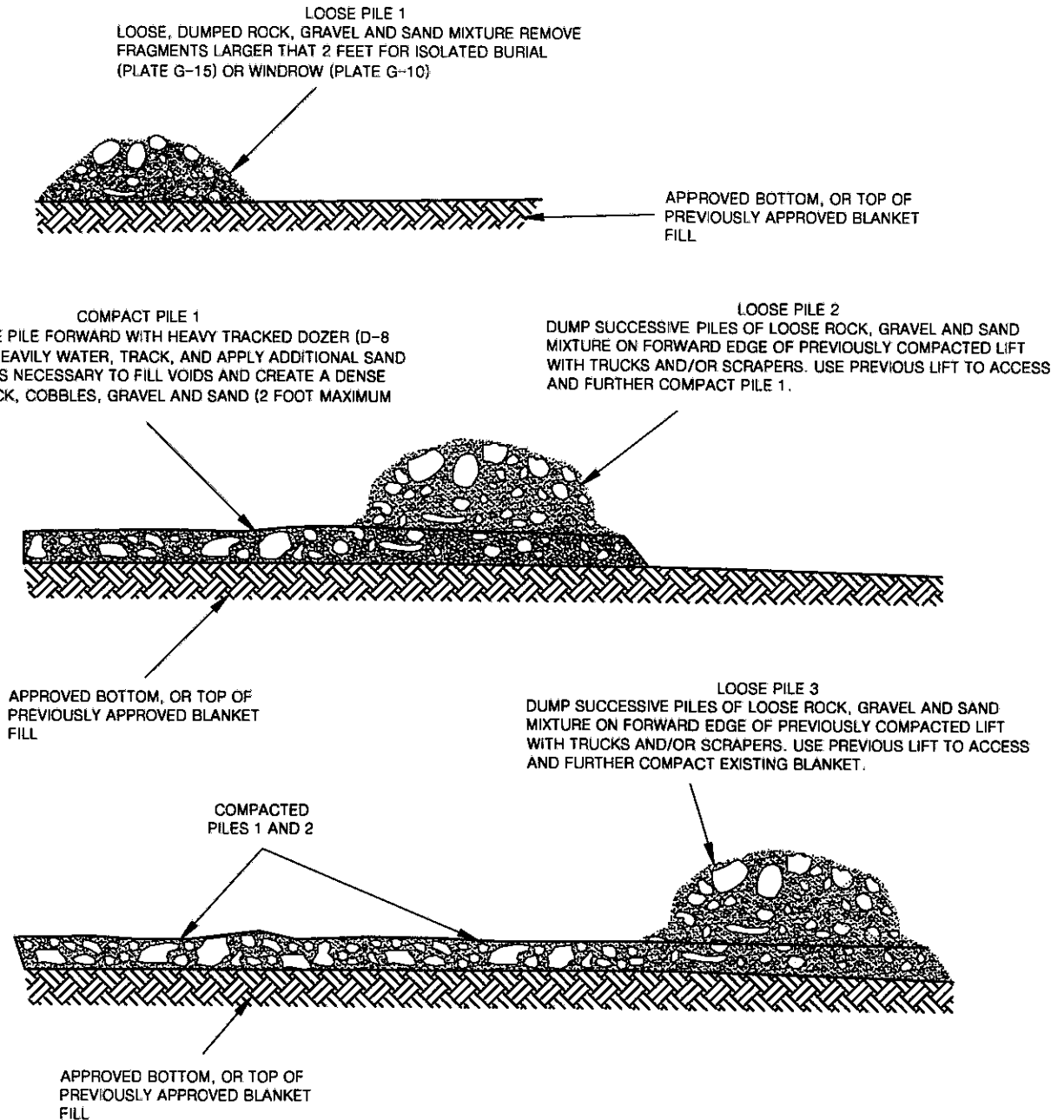
ZONE	DEPTH	PARTICLE MAX. DIMENSION	PLACEMENT METHOD
1	0-3 ft.	≤ 1.0 ft.	STANDARD OR CONVENTIONAL COMPACTION METHODS (SEE EARTHWORK SPECIFICATIONS)
2	3-10 ft.	≤ 2.0 ft.	ROCK BLANKETS (SEE PLATE G-13)
3	>10 ft.	≤ 8.0 ft.	ROCK BLANKETS (PLATE G-13) ROCK WINDROW (PLATE G-14) INDIVIDUAL ROCK BURIED (PLATE G-15)
4	15 HORIZONTAL FEET FROM FILL SLOPE FACE	≤ 1.0 ft.	STANDARD OR CONVENTIONAL COMPACTION METHODS (SEE EARTHWORK SPECIFICATIONS)



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PLATE G-12

ROCK BLANKET DETAILS

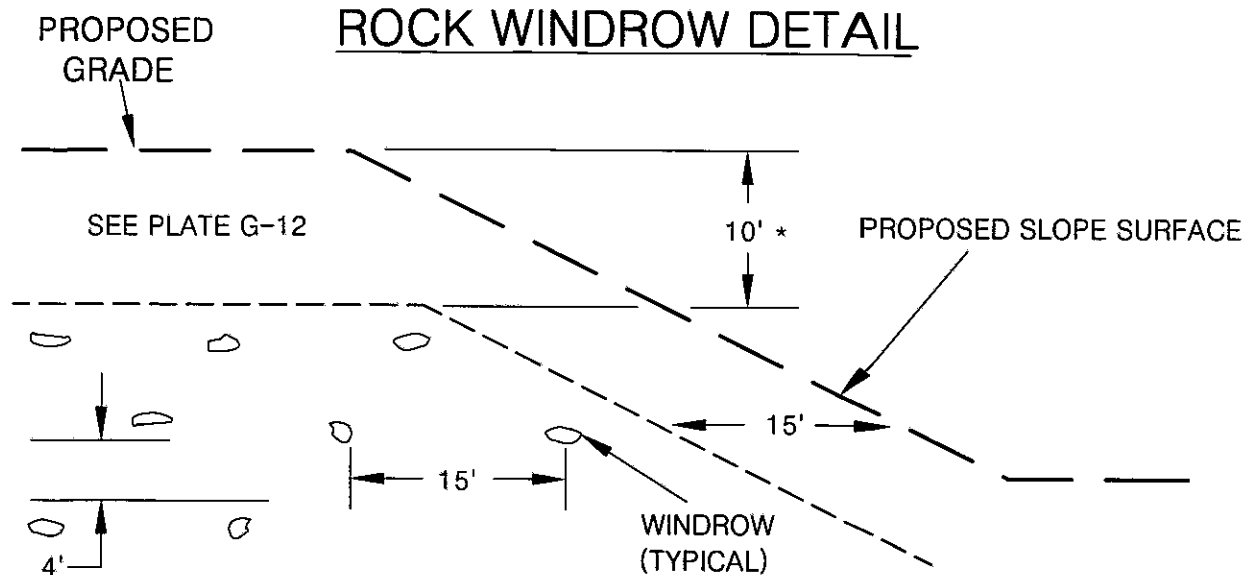


OBSERVATION TESTING AND APPROVAL PROCEDURES
OBSERVE EQUIPMENT. SCRAPERS AND TRUCKS SHOULD BE FULLY SUPPORTED ON BLANKET WITHOUT SIGNIFICANT YIELDING. EXCAVATE TEST/OBSERVATION PITS TO CONFIRM EXISTENCE OF MIXTURE OF VARIOUS PARTICLE SIZES, WITHOUT SIGNIFICANT VOIDS, AND FORMING A DENSE, COMPACTED FILL MATRIX. TEST BY ASTM D1556, D2922 AND/OR D3017 WHEN APPROPRIATE. RECORD LIMITS AND ELEVATION OF BLANKET. ALL FILL AND COMPACTION OPERATIONS TO BE CONDUCTED UNDER THE OBSERVATION OF THE GEOTECHNICAL ENGINEER. SUBSEQUENT LIFTS TO BE APPLIED ONLY AFTER OBSERVATION AND CONFIRMATION OF SUITABILITY OF FILL AND RELEASE BY THE GEOTECHNICAL ENGINEER. BLANKETS TO BE CONSTRUCTED IN ACCORDANCE WITH PLATE G-12.



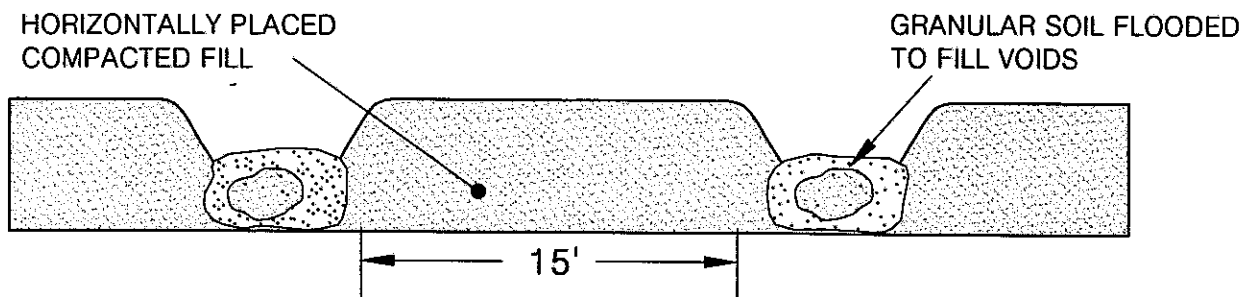
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PLATE G-13



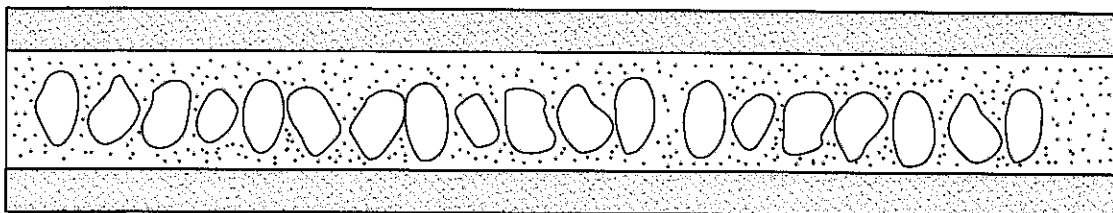
NOTE: OVERSIZED MATERIAL SHOULD BE REMOVED FROM THE 15' CLEAR ZONES WITH SPECIAL EQUIPMENT, SUCH AS A ROCK RAKE, PRIOR TO PLACING THE NEXT FILL LIFT.
 *VARIANCES TO THE ABOVE ROCK HOLD DOWN MAY BE GRANTED SUBJECT TO APPROVAL BY THE OWNER, GEOTECHNICAL ENGINEER, AND GOVERNING AGENCY

TYPICAL WINDROW DETAIL (END VIEW)



NOTE: COMPACTED FILL SHALL BE BROUGHT UP TO A HIGHER ELEVATION ALONG EACH WINDROW SO GRANULAR SOIL CAN BE FLOODED IN A "TRENCH CONDITION".

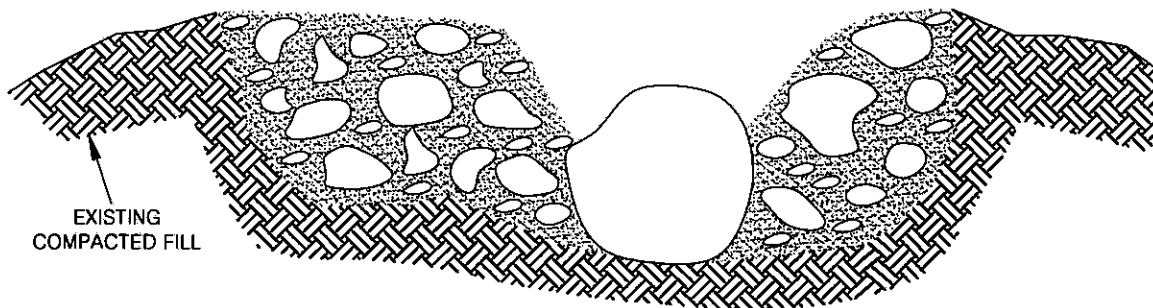
PROFILE VIEW



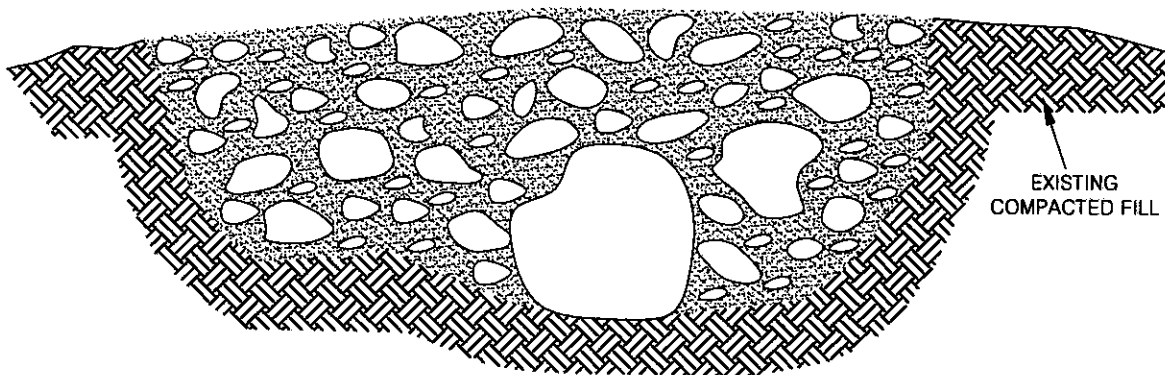
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PLATE G-14

ISOLATED ROCK BURIAL DETAILS



EXCAVATE HOLE INTO EXISTING FILL PRISM, PLACE BOULDER (< 8 feet in maximum dimension) INTO EXISTING COMPACTED FILL. SURROUND WITH SAND, GRAVEL, COBBLES AND WATER HEAVILY. TRACK WITH D8 OR LARGER EQUIPMENT UNTIL RESULTING FILL FULLY SUPPORTS EQUIPMENT. OBSERVE AND/OR TEST IN ACCORDANCE WITH ASTM D1556, D2922 OR D3017. ROCKS LARGER THAN 8 FEET SHALL BE FURTHER REDUCED IN SIZE BY SECONDARY BREAKING.

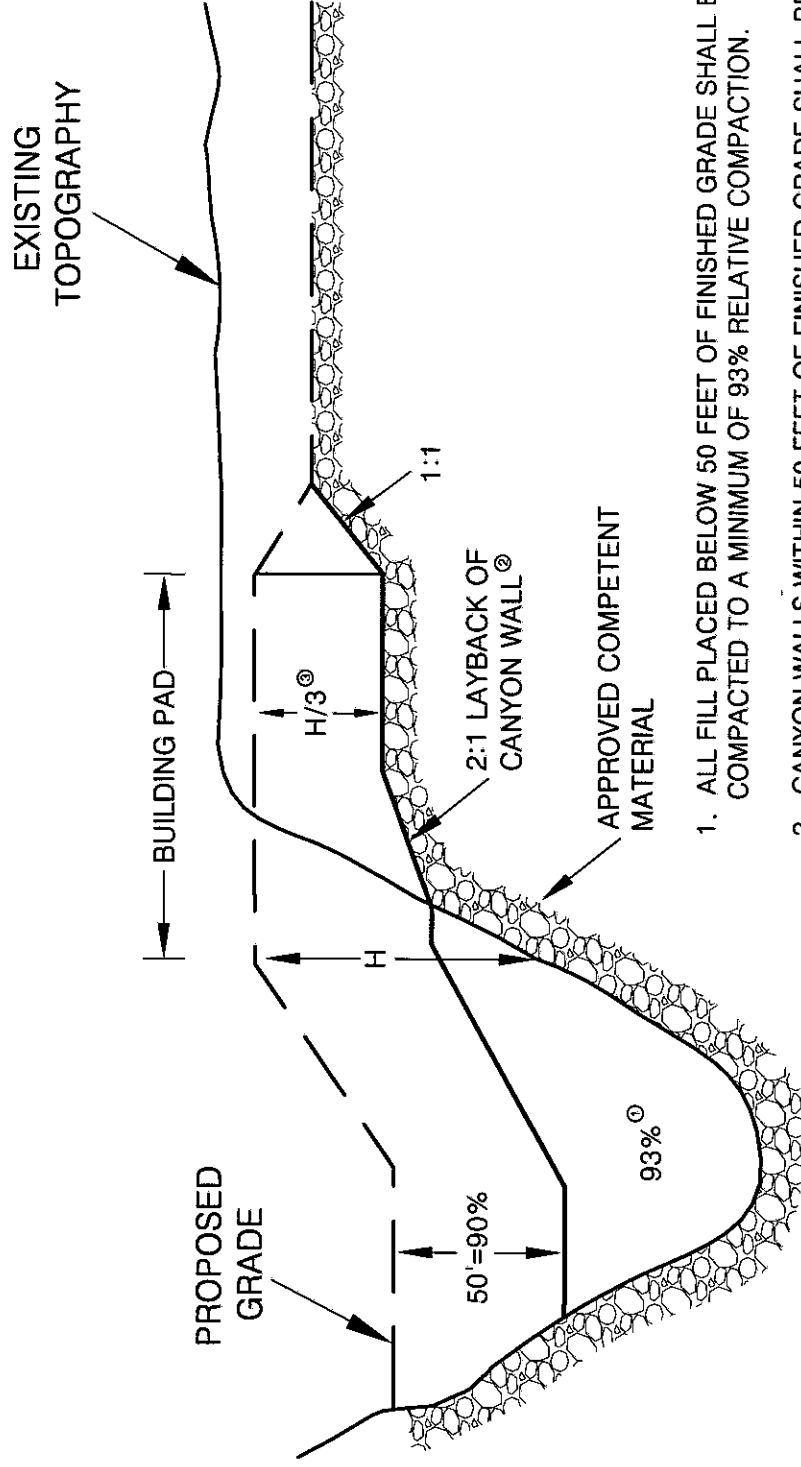


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PLATE G-15

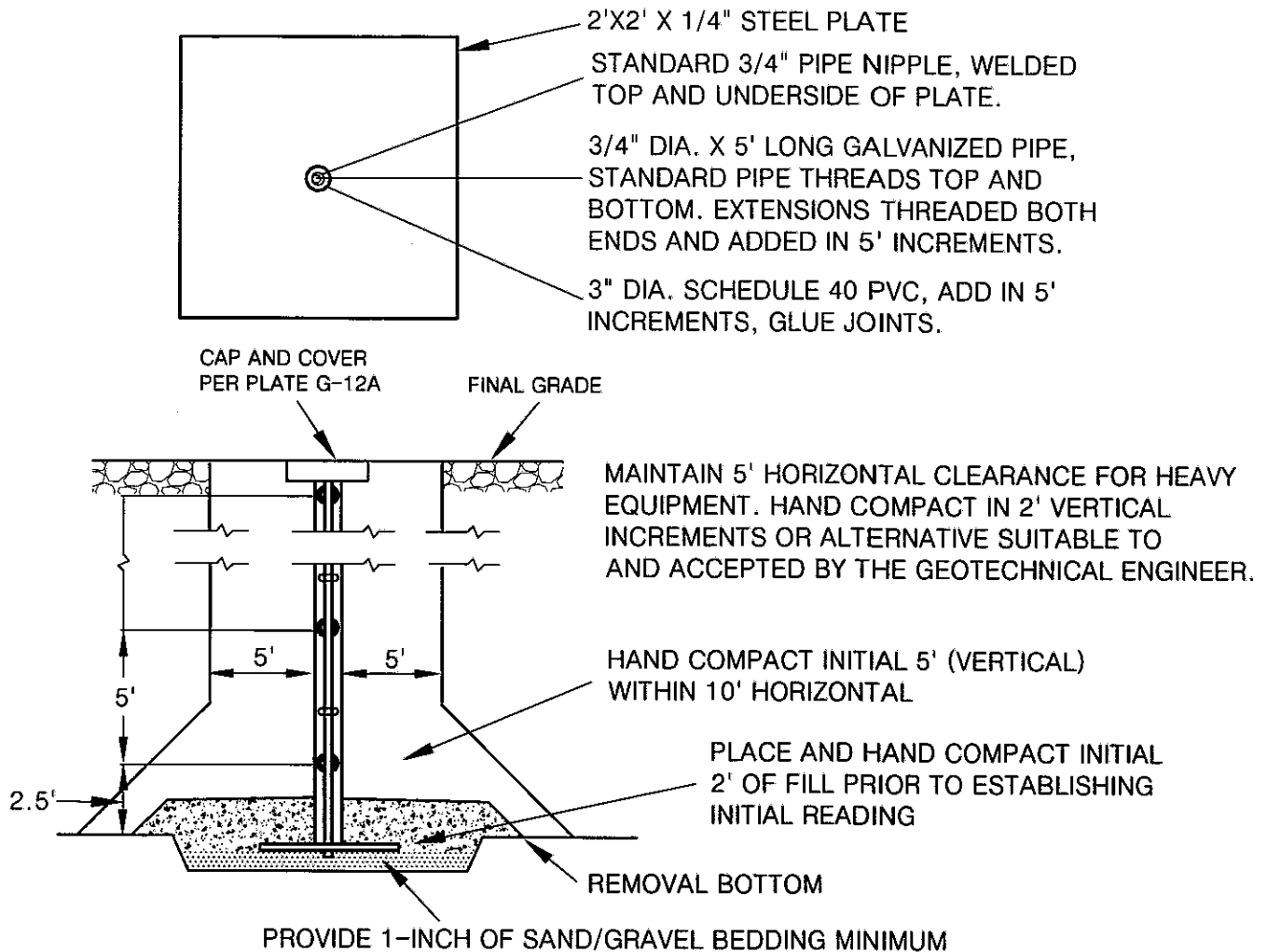
RELATIVE COMPACTION VS. DEPTH

CANYON WALL LAY BACK DIFFERENTIAL FILL OVEREXCAVATION DETAILS



1. ALL FILL PLACED BELOW 50 FEET OF FINISHED GRADE SHALL BE COMPACTED TO A MINIMUM OF 93% RELATIVE COMPACTION.
2. CANYON WALLS WITHIN 50 FEET OF FINISHED GRADE SHALL BE LAID BACK TO A SLOPE RATIO OF 2:1 OR FLATTER.
3. ALL BUILDING PADS SHALL BE OVER EXCAVATED TO A MINIMUM OF 1/3 OF THE MAXIMUM DEPTH OF FILL BELOW THE BUILDING PAD TO A MAXIMUM OF 17 FEET.
4. IF THE 2:1 LAY BACK OF THE CANYON WALL IS IMPRACTICAL, THEN AS AN ALTERNATIVE THE INCREASED COMPACTION STANDARDS IN NOTE 1 SHOULD BE EXTENDED UP TO H/3 AND THE LAY BACK WILL NOT BE REQUIRED.

SETTLEMENT PLATE DETAIL



NOTES:

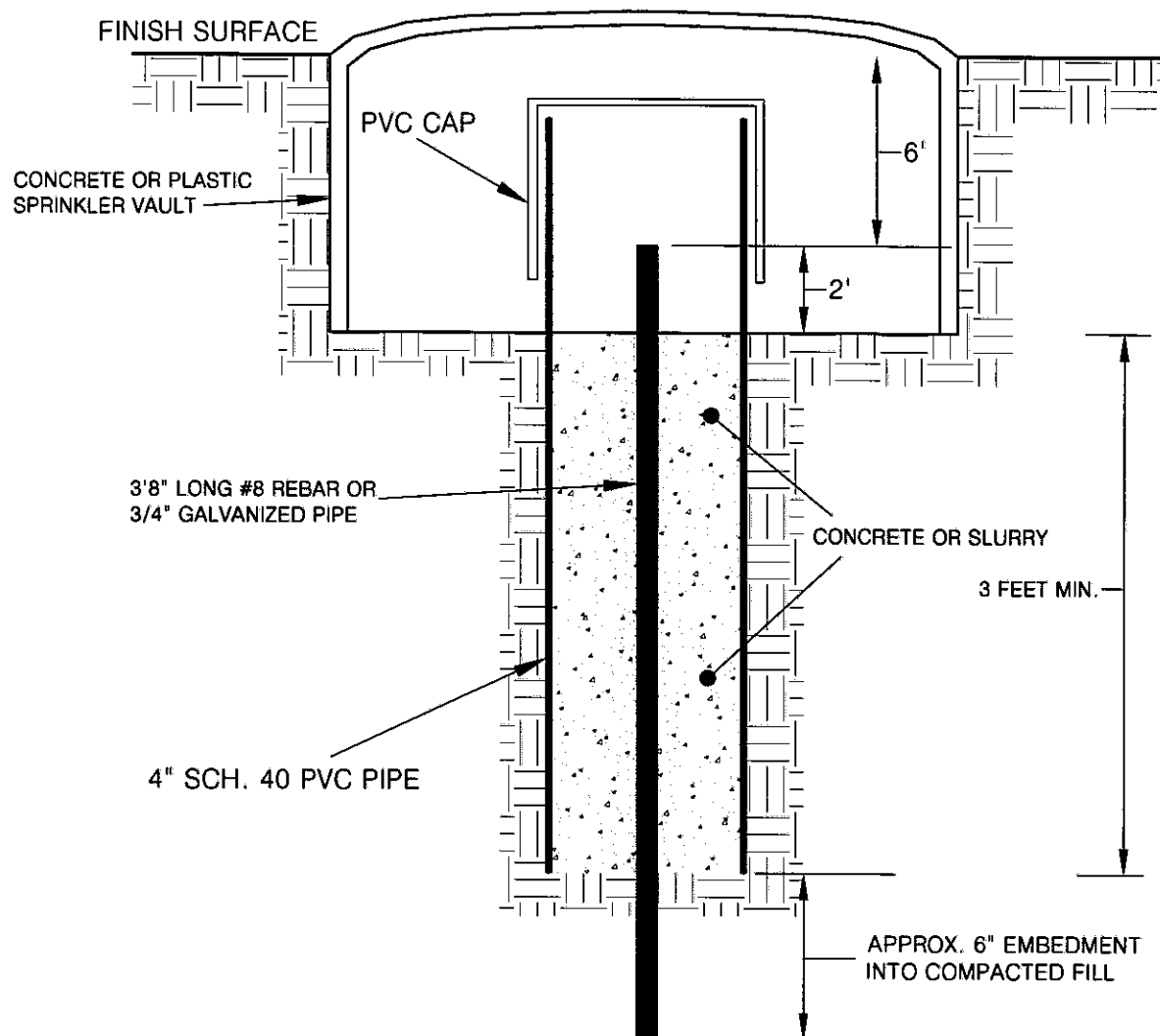
- 1) LOCATIONS OF SETTLEMENT PLATES SHALL BE CLEARLY MARKED AND READILY VISIBLE (RED FLAGGED) TO EQUIPMENT OPERATORS.
- 2) CONTRACTOR SHALL MAINTAIN 10' HORIZONTAL CLEARANCE FOR HEAVY EQUIPMENT WITHIN 5' (VERTICAL) OF PLATE BASE. FILL WITHIN CLEARANCE AREA SHALL BE HAND COMPACTED TO PROJECT SPECIFICATIONS OR COMPACTED BY ALTERNATIVE APPROVED BY THE GEOTECHNICAL ENGINEER.
- 3) AFTER 5' (VERTICAL) OF FILL IS IN PLACE, CONTRACTOR SHALL MAINTAIN 5' HORIZONTAL EQUIPMENT CLEARANCE. FILL IN CLEARANCE AREA SHALL BE HAND COMPACTED (OR APPROVED ALTERNATIVE) IN VERTICAL INCREMENTS NOT TO EXCEED 2 FEET.
- 4) IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE OR EXTENSION RESULTING FROM EQUIPMENT OPERATING WITHIN PRESCRIBED CLEARANCE AREA, CONTRACTOR SHALL IMMEDIATELY NOTIFY GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATE AND EXTENSION RODS TO WORKING ORDER.



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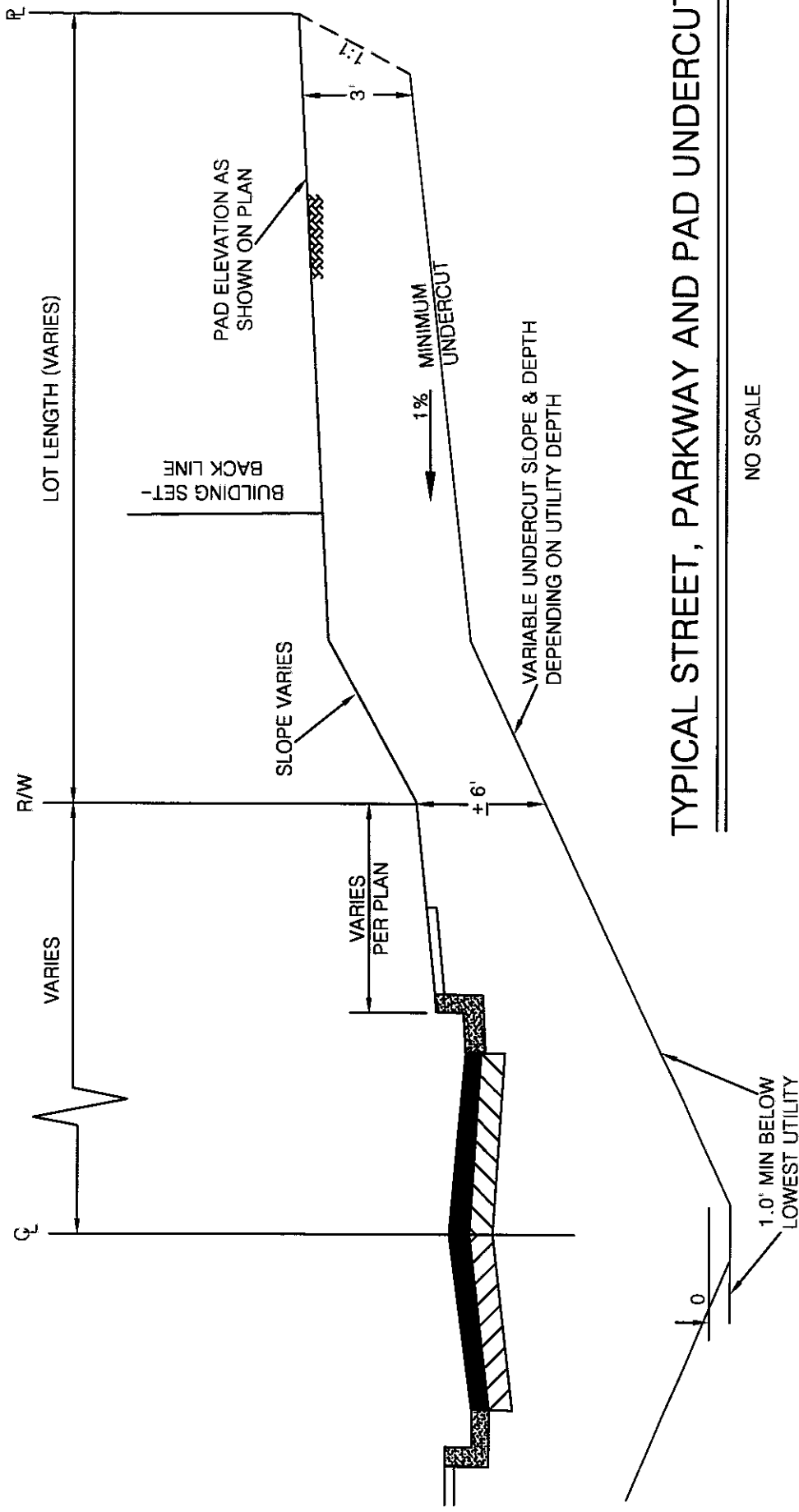
PLATE G-17

SURFACE SETTLEMENT MONUMENT DETAIL



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PLATE G-18



TYPICAL STREET, PARKWAY AND PAD UNDERCUT