LGC Geotechnical, Inc.

July 22, 2019 Project No. 19080-01

Mr. Glen Powles
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5780 Fleet Street, Suite 225
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Subject: ***Preliminary Geotechnical Evaluation for Proposed Bedford Marketplace, Tracts 37030, 36294, and 37644, Corona, California***

In accordance with your request, LGC Geotechnical, Inc. has prepared this preliminary geotechnical evaluation report for the proposed Bedford Marketplace, Tracts 37030, 36294, and 37644, located in the City of Corona, California. This report summarizes our findings, conclusions, and preliminary recommendations with regards to the proposed development.

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

Respectfully,

LGC Geotechnical, Inc.

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1.0 INTRODUCTION

1.1 Site Description

The entire Bedford development includes Tracts 37030, 36294, and 37644 and encompasses approximately 275 acres of land at the foothills of the Santa Ana Mountains near the southern boundary of the City of Corona, Riverside County, California. In general, the site is bound by the Eagle Glen Specific Plan development on the north and west, by the existing residential lots to the south, and by Interstate 15 to the east.

Ascending slopes up to approximately 90 feet in height with varying slope ratios ranging from approximately 1.25:1 to 3:1 (horizontal to vertical) are present near the northern boundary of the site. In addition, steep bluffs associated with the Bedford Canyon Wash with varying slope ratios ranging from approximately 1:1 (horizontal to vertical) to near vertical are generally located near the southern boundary of the site. In general, the site can be divided into two basic regions based on topography. The lower-lying Bedford Canyon Wash area in the central and northern portion of the site and the elevated regions above the bluffs in the southern and eastern portions of the site.

The proposed Bedford Marketplace site is located in the lower-lying Bedford Canyon Wash area at the eastern boundary of the Bedford development and includes an additional parcel owned by the Riverside County Transportation Commission (RCTC). The proposed Bedford Marketplace combines the approximately 10-acre Bedford commercial parcel with the 17.85-acre RCTC parcel resulting in an approximately 27.85-acre area for commercial development. In general, Bedford Marketplace is bound by Eagle Glen Parkway/Cajalco Road to the north, Interstate 15 to the east, a flood control channel to the south, and Bedford Canyon Road to the west (Figure 1 – Site Location Map).

1.2 Background

Recommendations regarding remedial grading for the entire Bedford development, previously known as Arantine Hills, were provided by LGC Geotechnical (2014 & 2015). These recommendations were based on mass grading and stockpile plans prepared by CASC (2014 & 2015) and preliminary rough grading plans for Phase 1 prepared by Hunsaker & Associates (2015). Rough grading of Phase 1 began in October 2016 and was essentially completed in May 2017. Subsequent postgrading and construction operations for the backbone streets including Clementine Way, Hudson House Drive, and Bedford Canyon Road have also been completed.

Remedial removals and fill placement for portions of the Bedford Marketplace area were completed as a part of the Phase 1 rough grading operations. This was performed in order to facilitate the construction of backbone utilities, roadways, a basin, and a pump station adjacent to the subject commercial site. In general, remedial removals and fill placement to near design grades were completed for the Bedford commercial area and the RCTC parcel remains undeveloped (Sheet 1 – Geotechnical Map).

1.3 Project Description

The conceptual grading plan (Hunsaker, 2019) indicates relatively shallow cuts and fills with intermediate slopes on the order of approximately 20 feet in height to achieve design grades. Based on our review of the Bedford Marketplace conceptual site plan (MCG, 2019) the development will consist of restaurant and retail buildings, a gas station, a hotel, and associated parking improvements.

The conceptual grading plan prepared by Hunsaker & Associates (2019) is utilized as the base map for our Geotechnical Map (Sheet 1). It is our understanding that the provided grading plan is preliminary and changes to design grades are anticipated. The recommendations provided herein are to be based on the ultimate rough grade design. The rough grading plan should be reviewed by this office in order to verify or adjust the geotechnical recommendations provided herein.

PROJECT NAME	Bedford Marketplace
PROJECT NO.	19080-01
ENG. / GEOL.	TJL / KAD
SCALE	Not to Scale
DATE	July 2019

FIGURE 1
Site Location Map

LGC Geotechnical, Inc.

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is located along the northeastern flank of the Santa Ana Mountains, just north of the Elsinore-Temecula basin, within the Peninsular Ranges Geomorphic Province. In this area, the Santa Ana Mountains are composed of a core of metamorphic rocks of the Bedford Canyon Formation with lesser amounts of volcanic rock. Erosion has led to a series of sub-parallel canyons travelling out of the mountains. The material eroded from the mountains has formed a series of coalescing older alluvial fans, also referred to as older alluvial deposits. Subsequently these older fan deposits have been eroded by a series of younger drainage courses. The subject site is located in one of these younger drainages known as the "Bedford Canyon Wash". Additionally, the Elsinore Fault Zone located at the base of the eastern flank of the Santa Ana Mountains is considered a major active fault zone and is regionally part of the San Andreas Fault system. The San Andreas Fault system distributes right-lateral movement across the North American and Pacific Plates.

2.2 Site-Specific Geology

The majority of the site is located on alluvial deposits of the Bedford Canyon Wash with isolated zones of undocumented artificial fill associated with existing dirt roads from previous site operations. Some areas within the Bedford Marketplace commercial area have been subject to remedial grading resulting in the presence of compacted artificial fill.

2.2.1 Artificial Fill, Undocumented (Not Mapped)

Undocumented fill soils were encountered in localized areas within the subject site. These fill soils are presumed to be related to agricultural activities and the grading of dirt roads throughout the site. Undocumented fill is considered to have variable lateral extents and is anticipated to only extend approximately 2 feet below the existing ground surface. Undocumented fill soils were not mapped.

2.2.2 Artificial Fill (Symbol - Af)

Phase 1 rough grading operations included remedial removals and fill placement to near design grades within the Bedford commercial parcel. As a result, compacted artificial fill is present adjacent to Bedford Canyon Road and the existing detention basin. These fill materials were derived from onsite alluvial soils and consist of a mixture of gravel, sand, and minor amounts of silt and clay. These materials were placed with geotechnical observation and testing provided by LGC Geotechnical and are considered suitable to support proposed structures and/or additional fill soils.

2.2.3 *Quaternary Alluvial Deposits (Symbol – Qal)*

The alluvial deposits encountered during previous subsurface exploration (Appendix A) and Phase 1 rough grading generally consisted of interbedded layers of predominately sand and gravel with varying amounts of silt, cobbles and minor amounts of clay. Apparent density of these materials generally ranged from medium dense to very dense, increasing in depth. The alluvial deposits are present in the area of the RCTC parcel and are underlying the previously placed artificial fill (Af).

2.3 *Groundwater*

Groundwater and/or seepage was not encountered during rough grading of Phase 1 or during previous subsurface eploration (Appendix A). Groundwater is not considered to be an issue during site grading and development.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present due to local seepage caused by irrigation and/or recent precipitation. Local perched groundwater conditions or surface seepage may develop once site development is completed.

2.4 *Seismic Design Criteria*

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2016 California Building Code (CBC). Representative site coordinates of latitude 33.8191 degrees north and longitude -117.5199 degrees west were utilized in our analyses. Please note that these coordinates are considered representative of the site for preliminary planning purposes. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 1 on the following page.

TABLE 1

Seismic Design Parameters

Selected Parameters from 2016 CBC, Section 1613 - Earthquake Loads	Seismic Design Values
Site Class per Chapter 20 of ASCE 7	D
Risk-Targeted Spectral Acceleration for Short Periods (S_S)*	2.352g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)*	0.918g
Site Coefficient F_a per Table 1613.3.3(1)	1.0
Site Coefficient F_v per Table 1613.3.3(2)	1.5
Site Modified Spectral Acceleration for Short Periods (S_{MS}) for Site Class D [Note: $S_{MS} = F_aS_S$]	2.352
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) for Site Class D [Note: $S_{M1} = F_vS_1$]	1.378g
Design Spectral Acceleration for Short Periods (S_{DS}) for Site Class D [Note: $S_{DS} = (^2/_3)S_{MS}$]	1.568g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) for Site Class D [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.918g
Mapped Risk Coefficient at 0.2 sec Spectral Response Period, C_{RS} (per ASCE 7)	0.948
Mapped Risk Coefficient at 1 sec Spectral Response Period, C_{R1} (per ASCE 7)	0.937

* From SEAOC, 2018

Section 1803.5.12 of the 2016 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.892g.

2.5 Faulting and Seismic Hazards

The subject site is not located within a State of California Earthquake Fault Zone (i.e., Alquist-Priolo Earthquake Fault Act Zone) and no active faults are known to cross the site (CDMG, 2000). A fault is considered "active" if evidence of surface rupture in Holocene time (the last approximately 11,650 years) is present. The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching and shallow ground rupture, soil liquefaction, and dynamic settlement. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault and the onsite geology. The closest major active faults that could produce these secondary effects include the Elsinore, San Jacinto, and San Andreas Faults, among others. A discussion of theses secondary effects is provided in the following sections.

2.5.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that loose, saturated, near-surface, cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils, and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction. Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Furthermore, dynamic settlement of dry sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Based on the lack of shallow groundwater (greater than 65 feet below ground surface) and anticipated geotechnical conditions subsequent to rough grading (compacted artificial fill overlying dense alluvial deposits) the potential for liquefaction to impact the site is considered very low.

2.5.2 Lateral Spreading

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

Due to the low potential for liquefaction, the potential for lateral spreading is considered very low.

2.6 Landslides

Review of readily available geologic resources and field observations of the surficial conditions do not indicate the presence of landslides on the site or in the immediate vicinity. In general, the site consists of relatively flat-lying alluvial deposits which are not considered susceptible to landslides, seismically-induced landslides, or other mass wasting processes (debris flows, rockfalls, etc.).

2.7 Expansion Potential

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

2.8 Oversized Material

Minor amounts of oversized material (material larger than 12 inches in maximum dimension) were encountered during previous subsurface exploration (Appendix A) and Phase 1 rough grading operations. Recommendations for the appropriate handling of oversized material are provided in our General Earthwork & Grading Specifications for Rough Grading (Appendix D).

2.9 Rippability

In general, the undocumented fill, artificial fill, and Quaternary Alluvial soils are anticipated to be rippable with heavy equipment (Caterpillar D-9 or equivalent).

3.0 CONCLUSIONS

Based on the results of our knowledge of the subject site, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided that the recommendations contained in the following sections are incorporated during site grading and development. A summary of our geotechnical conclusions are as follows:

- The near-surface onsite soils are not considered suitable for support of the planned development and will need to be removed and replaced with compacted fill materials. Removal recommendations are provided below in Section 4.1.
- Artificial fill soils placed with geotechnical observation and testing provided by LGC Geotechnical and are considered suitable to support proposed structures and/or additional fill soils. Minor reprocessing recommendations for these soils are provided below in Section 4.1.
- Groundwater and/or seepage was not encountered during rough grading of Phase 1 or during previous subsurface evaluations (Appendix A). Groundwater is not considered to be an issue during site grading and development.
- The subject site is not located within a State of California Earthquake Fault Zone (i.e., Alquist-Priolo Earthquake Fault Act Zone) and no active faults are known to cross the site (CDMG, 2000). Therefore, the possibility of damage due to ground rupture is considered low.
- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life.
- Based on the lack of shallow groundwater (greater than 65 feet below ground surface) and geotechnical conditions subsequent to rough grading (compacted artificial fill overlying dense alluvium) the potential for liquefaction to impact the site is considered very low.
- Review of readily available geologic resources and field observations of the surficial conditions do not indicate the presence of landslides on the site or in the immediate vicinity. Topographically, the site is relatively flat-lying and is not considered susceptible to landslides, seismically-induced landslides, or other mass wasting processes (debris flows, rock falls, etc.).
- Based on the results of laboratory testing, site soils are anticipated to have "Very Low" to "Medium" expansion potential. Final design expansion potential must be determined at the completion of grading operations.
- In general, the undocumented fill, artificial fill, and Quaternary Alluvial soils are anticipated to be rippable with heavy equipment (Caterpillar D-9 or equivalent).
- We anticipate that the onsite soils generated from excavations will be generally suitable for re-use as compacted fill, provided they are relatively free of rocks larger than 12 inches in maximum dimension, construction debris, and significant organic material.
- It is our understanding that the conceptual grading plan (Hunsaker, 2019) is preliminary and changes to design grades are anticipated. The rough grading plan should be reviewed by this office in order to verify or adjust the geotechnical recommendations provided herein.
- Proposed slopes are to be constructed in accordance with recommendations provided herein. Subsequent to construction, the proposed slopes are anticipated to be both grossly and surficially stable.

4.0 RECOMMENDATIONS

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

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2016 CBC requirements. With regard to the possible occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvement may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable protection against the potential damaging effects of geotechnical phenomena such as expansive soils, fill settlement, groundwater seepage, etc. It should be understood, however, that our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions but cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

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

4.1 Site Earthwork

Rough grading is anticipated to include remedial earthwork, excavation of cut areas, and placement of compacted fill to design grades. We recommend that earthwork onsite be performed in accordance with the following recommendations, the 2016 CBC/City of Corona requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix D. In case of conflict, the following recommendations shall supersede those included in Appendix D.

4.1.1 Site Preparation

Prior to the grading of areas to receive structural fill or engineered structures, these areas should be cleared of surface obstructions and unsuitable material (such as undocumented fill, colluvium, and topsoil). Vegetation and debris should be removed and properly disposed of offsite. Holes resulting from the removal of buried obstructions, which extend below proposed removal bottoms, should be replaced with suitable compacted fill material.

4.1.2 Removal Depths

All unsuitable and potentially compressible materials not removed by design cuts should be excavated to competent materials and replaced with compacted fill soils. In general, this includes all existing undocumented artificial fill, residual soil, and upper portions of the previously placed compacted fill and alluvial deposits. Removals specific to the differing types of soils are summarized below.

Previously Placed Artificial Fill: Portions of the Bedford Marketplace area were partially graded during Phase 1 rough grading operations in order to facilitate the construction of the backbone roadways and improvements. LGC Geotechnical provided observation and testing services during the Phase 1 rough grading operations. Removal bottoms achieved during Phase 1 grading were observed and accepted prior to the placement of compacted fill soils. The previously placed compacted fill (Map Symbol – Af) are considered suitable to support proposed structures and/or additional fill placement. It is recommended that the upper 1-foot of the previously placed fill soils be removed and replaced with compacted fill soils in order to remove any weathered or desiccated materials.

Alluvial Deposits: Alluvial deposits (Map Symbol – Qal) are generally located in the area of the RCTC parcel in the eastern portion of the subject site. It is anticipated that the upper approximately 5 feet of the alluvial deposits will be loose, weathered, and/or desiccated and should be removed and replaced with compacted artificial fill soils.

In general, removal depths are estimated to range between approximately 1 to 5 feet below existing grade as outline above. Estimated removal depths are depicted on the Geotechnical Map (Sheet 1). Localized areas of deeper removals should be anticipated during grading. Removal bottoms should be extended laterally in order to support a 1:1 (horizontal to vertical) projection away from proposed structures or improvements. The actual depths and lateral extents of removals will be determined by the geotechnical consultant during grading based on the actual subsurface conditions encountered.

Several methods will be utilized in determining the suitability of the material observed in the removal bottom excavations. Observation of material, proof rolling, probing, and occasional field density testing of the removal bottoms shall be performed by a field technician and/or field geologist to verify removal bottom suitability. When field density test data is utilized for the approval of a removal bottom, an in-place relative compaction of 85 percent or greater and/or a degree of saturation of 85 percent or greater will be considered suitable.

4.1.3 Over-Excavation

In order to provide a uniform fill blanket beneath proposed structures, it is recommended that design cut and cut/fill transition pads be over-excavated a minimum of 3 feet below ultimate finish pad grade based on the future rough grading design. A maximum 3:1 differential fill thickness underneath individual lots should be maintained in order to reduce the potential for future differential settlement. Over-excavation should extend laterally a minimum of 5 feet beyond proposed building footprints.

Streets in design cut areas should be over-excavated a minimum of 2 feet below design subgrade elevations. In addition, retaining wall footings located on cut or a cut/fill transition should be over-excavated a minimum of 2 feet below and 2 feet beyond the edges of the proposed footings.

It is our opinion that utility excavations may be completed utilizing typical heavy machinery. The native soils at the site are generally uncemented alluvial soils (Class “C” per Cal OSHA) and are anticipated to be unstable when excavated vertically, see Section 4.1.5. At the owner’s discretion the streets could be overexcavated, such that utility trenches will then be excavated through compacted fill soils. If desired, it is recommended that the street overexcavation extend approximately 2-foot below the lowest utility.

Over-excavations/undercuts must be confirmed and mapped by the geotechnical consultant prior to subsequent fill placement. The actual depth and lateral extents of over-excavation should be determined by the geotechnical consultant during grading based on the actual subsurface conditions encountered. Please note that some estimated removals in the western portion of the site may extend deeper than the recommended over-excavation in order to remove unsuitable materials.

4.1.4 Removal Bottoms and Subgrade Preparation

In general, removal bottoms, over-excavation bottoms, and areas to receive compacted fill should be scarified to a minimum depth of 6 to 8 inches, brought to a near-optimum moisture condition (generally within optimum and 2 percent above optimum moisture content) and re-compacted per project requirements.

Removal bottoms, over-excavation/undercut bottoms, and areas to receive fill should be observed and accepted by the geotechnical consultant prior to fill placement.

4.1.5 Temporary Excavations

Temporary excavations should be performed in accordance with project plans, specifications, and applicable Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. The majority of site alluvial soils are anticipated to be OSHA Type “C” soils. Soil conditions should be regularly evaluated during construction to verify conditions are as anticipated. The contractor shall be responsible for providing the “competent person” required by OSHA standards to evaluate the soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of excavations a minimum distance equivalent to a 1:1 projection from the bottom of the excavation or 5 feet, whichever is greater. Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

4.1.6 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill, provided they are screened of construction debris, any oversized material (12 inches in greatest dimension), and significant organic content. From a geotechnical perspective, compacted fill with an average organic content less than 2 percent is generally not considered significant. Any oversized material (greater than 12 inches in maximum dimension) encountered must be appropriately handled as outlined in Appendix D.

From a geotechnical viewpoint, any required import soils (excluding retaining wall backfill import) should consist of clean, relatively granular soils of Low expansion potential (expansion index 50 or less based on ASTM D4829) and no particles larger than 3 inches in greatest dimension. Source samples of planned importation should be provided to the geotechnical consultant for laboratory testing a minimum of 10 working days prior to any planned importation.

Retaining wall backfill should consist of sandy soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a Very Low expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris, and any material greater than 3 inches in maximum dimension. Portions of the onsite soil may not be suitable for retaining wall backfill due to their fines content (i.e., silt and clay content) and expansion potential. Therefore, either select grading and stockpiling and/or import of suitable soils meeting the criteria outlined above will be required.

Aggregate base should conform to the requirements of Section 200-2 of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials, Caltrans Class 2 aggregate base and/or the County of Riverside requirements.

4.1.7 Fill Placement and Compaction

Material to be placed as fill should be brought to near optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and compacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. Due to the granular nature of the site soils, pre-watering the site prior to grading may be beneficial. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances with observation and testing performed by the geotechnical consultant.

Fill placed on any slopes greater than 5:1 (horizontal to vertical) inclination should be properly keyed and benched into firm and competent soils as it is placed in lifts. During backfill of temporary excavations, fill should be properly benched into firm and competent soils as it is placed in lifts and compacted.

Slope face compaction must be achieved by the contractor by overfilling the slope face a minimum of 2 feet and cutting back to design finish grades or by other acceptable methods.

Aggregate base material should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction at or slightly above optimum moisture content per ASTM D1557.

4.1.8 Shrinkage and Bulking

Volumetric changes in earth quantities will occur when excavated onsite earth materials are replaced as properly compacted fill. The following is an estimate of shrinkage factors for the various geologic units found onsite. These estimates are based on in-place densities of the various materials and on the estimated average degree of relative compaction that will be achieved during grading.

TABLE 2

Estimated Shrinkage

Soil Type	Allowance	Estimated Range
Artificial Fill (Af)	Shrinkage/Bulk	+/- 5%
Alluvial Deposits (Qal) – Upper 4 Feet	Shrinkage	10 to 15%
Alluvial Deposits (Qal) – Below 4 Feet	Shrinkage	0 to 10%

Subsidence due to earthwork equipment is expected to be on the order of 0.1-foot. It should be stressed that these values are only estimates and that actual shrinkage factors are extremely difficult to predict. The effective shrinkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor. The above shrinkage estimates are intended as an aid for others in determining preliminary earthwork quantities. However, these estimates should be used with some caution since they are not absolute values.

If importing/exporting a large volume of soils is <u>not</u> considered feasible or economical, we recommend a balance area be designated onsite that can fluctuate up or down based on the actual volume of soil. We recommend a "balance" area that can accommodate on the order of 5 to 10 percent (plus or minus) of the total grading volume be considered.

Volumetric changes based on quantities from previous grading activities (Phase 1, Channel, etc.) should also be reviewed and taken into consideration.

4.1.9 Trench and Retaining Wall Backfill and Compaction

The onsite soils may generally be suitable as trench backfill, provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, sand having a sand equivalent (SE) of 30 or greater (per California Test Method [CTM] 217) may be used to bed and shade the pipes. Sand backfill within the pipe bedding zone may be densified by jetting or flooding and then tamped to ensure adequate compaction. Subsequent trench backfill should be compacted in uniform thin lifts by mechanical means to at least a minimum 90 percent relative compaction (per ASTM D1557). It is our understanding that the upper 3 feet of trench backfill below proposed street subgrade is to be compacted to a minimum 95-percent relative compaction in accordance with requirements set forth by the City of Corona.

Retaining wall backfill should consist of sandy soils as outlined in the preceding Section 4.1.6. The limits of select sandy backfill should extend at minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater, refer to Figure 2 (rear of text). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

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

4.2 Slope Stability

4.2.1 Cut Slopes

Stabilization fills should be constructed on proposed cut slopes over 5 feet in height in accordance with the detail provided in Appendix D. Keyway widths should be a minimum of 15 feet wide. Keyways should be a minimum of 2 feet deep, determined from the lowest toe-of-slope elevation, and tilted back towards the heel a minimum 2 percent or 1-foot (whichever is greater).

Stabilization fill backcuts should be excavated so that at least a minimum 15-foot fill width is maintained for the entire height of the stability fill slope. In general, backcuts should be excavated at a maximum 1.5:1 (horizontal to vertical) inclination. Properly outletted back drains should be constructed along stabilization fill backcuts in accordance with the General Earthwork and Grading Specifications for Rough Grading included in Appendix D. Flatter backcut inclinations may be required based on observed conditions during grading. The backcuts should not be initiated prior to forecasted rain or be left open for extended periods of time.

Backcuts and keyway excavations must be geologically mapped by the geotechnical consultant during excavation to confirm the anticipated conditions. If adverse conditions are exposed, additional analysis and/or remediation measures may be required. The grading contractor must trim the backcuts with a slope board to remove loose material to allow for confirmational mapping. Updated and/or revised geotechnical recommendations may be required based on observed conditions.

4.2.2 Fill Slopes

Design fill slopes depicted on the grading study (Hunsaker, 2019) are anticipated to be both grossly and surficially stable as designed provided they are constructed in accordance with the General Earthwork and Grading Specifications for Rough Grading included in Appendix D and properly maintained subsequent to construction (Section 4.2.3). Fill slopes should be constructed with a maximum slope ratio of 2:1 (horizontal to vertical). Slope faces should also be compacted to project recommendations. To improve surficial stability, vegetation specified by the landscape architect should be established on the slope face as soon as it is practical.

4.2.3 Slope Maintenance Guidelines

It is recommended that any graded slopes be planted with groundcover vegetation as soon as practical to protect against erosion by reducing runoff velocity. Deep-rooted vegetation that requires little water and is able to survive local climate conditions should also be established to protect against surficial slumping. Under no circumstances should slopes be allowed to be bare of vegetation. Landscape vegetation must not be "trimmed" to root structures leaving no protection of the slopes. Irrigation levels should be kept to the minimum level necessary to establish healthy plant growth. Slopes must not be overwatered. If automatic sprinklers are used, they must be adjusted during periods of rainfall. A landscape professional must be consulted for landscape recommendations.

A program for the elimination of burrowing animals in both native and graded slope areas must be established to protect slope stability by reducing the potential for surface water to penetrate into the slope face. Continuous erosion control, rodent control, and maintenance are essential to the long-term stability of all slopes. Trenches excavated on a slope face for utility or irrigation lines and/or for any purpose must be properly backfilled and compacted to project recommendations to the slope face. Observation/testing and acceptance by the geotechnical consultant during trench backfill are recommended. V-ditches should be inspected and cleared of loose soil and/or debris on a routine basis, especially prior to and during the rainy season.

4.3 ***Subdrains***

If unanticipated groundwater or areas of potential future groundwater seepage and/or accumulation are encountered during grading subdrain systems may be recommended by the geotechnical consultant. Subdrains are to be properly outletted and connected to a suitable discharge point.

A representative of the project civil engineer should survey the installed subdrains for alignment and grade prior to fill placement above the subdrains. The location and elevations of subdrains and subdrain outlets should be recorded on as-built plans and made available to future homeowners and/or homeowner associations. It is the responsibility of the contractor to locate and protect subdrain outlets prior to the completion of work.

4.4 ***Provisional Soil Bearing and Lateral Resistance***

An allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used for the design of footings having a minimum width of 12 inches and a minimum embedment of 24 inches below lowest adjacent ground surface. This value may be increased by 300 psf for each additional foot of embedment or 100 psf for each additional foot of foundation width to a maximum value of 2,500 psf. In addition, an allowable soil bearing pressure of 1,200 psf may be used for a mat post-tensioned slab a minimum of 6 inches below lowest adjacent grade. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. Bearing values indicated are for total dead loads and frequently applied live loads and may be increased by ⅓ for short duration loading (i.e., wind or seismic loads). These values are presented under the assumption that the soils surrounding the foundation will remain intact. For shallow foundations with less than approximately 24 inches of embedment, we recommend that homeowners be advised not to excavate adjacent to their foundations. In addition, shallow foundations with less than approximately 24 inches of embedment have a greater potential of moisture migrating beneath the slab from outside sources.

In utilizing the above-mentioned allowable bearing capacity and provided our earthwork recommendations are implemented, total foundation settlement due to soil and structural loads is anticipated to be on the order of 2 inches. Differential settlement may be taken as half of the total settlement (i.e., 1-inch over a horizontal span of 40 feet).

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.35 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 300 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for the sides of footings poured against properly compacted fill. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. The passive pressure may be increased by one-third due to wind or seismic forces. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt. Frictional resistance and passive pressure may be used in combination without reduction. The provided allowable passive pressures are based on a factor of safety of 1.5 and may be increased by one-third for short duration seismic loading conditions.

4.5 Lateral Earth Pressures for Retaining Walls

Based on our review, retaining walls up to approximately 8 feet in height are planned for the subject site. Lateral earth pressures are provided as equivalent fluid unit weights, in pounds per square foot (psf) per foot of depth or pcf. These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. A soil unit weight of 130 pcf may be assumed for calculating the actual weight of soil over the wall footing.

The following lateral pressures presented on Table 3 are for approved onsite soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a Very Low expansion potential (EI of 20 or less per ASTM D4829). The retaining wall designer should clearly indicate on the retaining wall plans that the backfill material is to be approved onsite soils.

TABLE 3

Lateral Earth Pressures – Select Onsite Backfill

Condition	Equivalent Fluid Weight (pcf)	Equivalent Fluid Weight (pcf)
	Level Backfill	2:1 Sloping Backfill
	Approved Backfill Material	Approved Backfill Material
Active	40	60
At-Rest	60	93

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

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining wall. In addition to the recommended lateral earth pressure, retaining walls adjacent to streets should be designed to resist a uniform lateral pressure of 100 pounds per square foot

(psf) due to normal street vehicle traffic, if applicable. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating surcharge loads.
If required, the retaining wall designer may use a seismic lateral earth pressure increment of 14 pcf. This increment should be applied in addition to the provided static lateral earth pressure using a triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). Per Section 1803.5.12 of the California Building Code (CBC), the seismic earth pressure is applicable to "structures assigned to Seismic Design Category D, E, or F in accordance with Section 1613." This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010). The provided seismic lateral earth pressure is for a level backfill condition. Due to the sensitivity of seismic earth pressures for sloping conditions, the retaining wall designer should provide the geotechnical engineer with cross sections based on the configuration of the planned retaining walls in order to estimate the specific seismic increment.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, saturation of near surface soils (1-foot) in front of the retaining walls, the perforated subdrain pipe should be located a minimum of 1-foot below lower adjacent (non-retained) pad grade. The outlet pipe should be sloped to drain to a suitable outlet. We do not recommend retaining wall outlet pipes be connected to area drains. If subdrains are connected to area drains, special care and information should be provided to homeowners to maintain these drains. Typical retaining wall drainage is illustrated in Figure 2. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is a white crystalline powder (discoloration) that results when water containing soluble salts migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed accordingly to reduce this potential.

4.6 __Fences and Freestanding Walls__

As their name indicates, freestanding walls are those walls not designed to retain soil and/or water. These walls are generally located at the rear or side yard of lots. To reduce the potential for unsightly cracks due to differential settlement, we recommend the inclusion of construction joints at a maximum spacing of 16 feet on-center. This spacing may be altered by the structural engineer based upon the wall reinforcement. If the soil-moisture content below the wall foundation varies significantly, some wall movement should be expected. However, movement is unlikely to cause more than cosmetic distress. Allowable soil bearing values for wall footing design are provided in Section 4.4 above.

4.7 __Subsurface Infiltration__

Recent regulatory changes have occurred that mandate that storm water be infiltrated below grade into subsurface soils rather than collected in a conventional storm drain system. Typically, a combination of methods is implemented to reduce surface water runoff and increase infiltration including; permeable pavements/pavers for roadways and walkways, directing surface water runoff to grass-lined swales, retention areas, and/or drywells, etc.

It should be noted that collecting and concentrating surface water for the purpose of intentionally infiltrating below grade, conflicts with the geotechnical engineering objective of directing surface water away from slopes, structures and other improvements. The geotechnical stability and integrity of a site is reliant upon appropriately handling surface water.

Infiltration rates were previously estimated for the site in the area of the large basin in the southeastern portion of the site (LGC Geotechnical, 2016). Estimation of infiltration rates was performed in general accordance with guidelines set forth by the County of Riverside (2011). The tested infiltration rates are considered representative of the site soils in the southeast portion of the site. These tested infiltration rates do not include any factor of safety but have been normalized to correct the 3-Dimensional flow that occurs within the field test to 1-Dimensional flow out of the bottom of the boring. The approximate infiltration test locations are shown on the Geotechnical Map (Sheet 1) and the infiltration test data is summarized in Table 2 on the following page.

TABLE 4

Summary of Infiltration Testing

Boring/Infiltration Location	Approx. Depth Below EG (ft)	Approx. Bottom of Infiltration Test Elevation (ft)	Infiltration Rate (in/hr.)	
			Tested	Design*
I-1A	9.95	907	3.0	1.0
I-2A	9.85	904	1.0	0.33
I-1B	6	908	7.4	2.5
I-2B	6	908	27.7	9.2
I-3B	4	908	13.9	4.6

*Includes a minimum factor of safety of 3 from Tested Rate per Table 1 – Infiltration Testing Requirements, County of Riverside Guidelines (2011).

It should be emphasized that infiltration test results are only representative of the location and depth where they are performed. Varying subsurface conditions may exist outside of the test locations which could alter the calculated infiltration rates indicated above. Infiltration tests are performed using relatively clean water free of particulates, silt, etc.

Based on the previous infiltration testing data and our knowledge of the site soils, it is recommended that a provisional design infiltration rate of 2.0 inches per hour may be utilized for infiltration systems associated with Bedford Marketplace. The recommended infiltration rate provided herein shall be verified prior to construction based on final locations and elevations of proposed infiltration systems.

4.7 Control of Surface Water and Drainage Control

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

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

4.8 Geotechnical Plan Review

When available, project plans (grading, foundation, etc.) should be reviewed by LGC Geotechnical from a geotechnical viewpoint and updated recommendations shall be provided as necessary. Additional field work may be necessary based on the proposed design.

4.9 Geotechnical Observation and Testing

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC Geotechnical. Geotechnical observation and testing is required per Section 1705 of the 2016 California Building Code (CBC).

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

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

5.0 LIMITATIONS

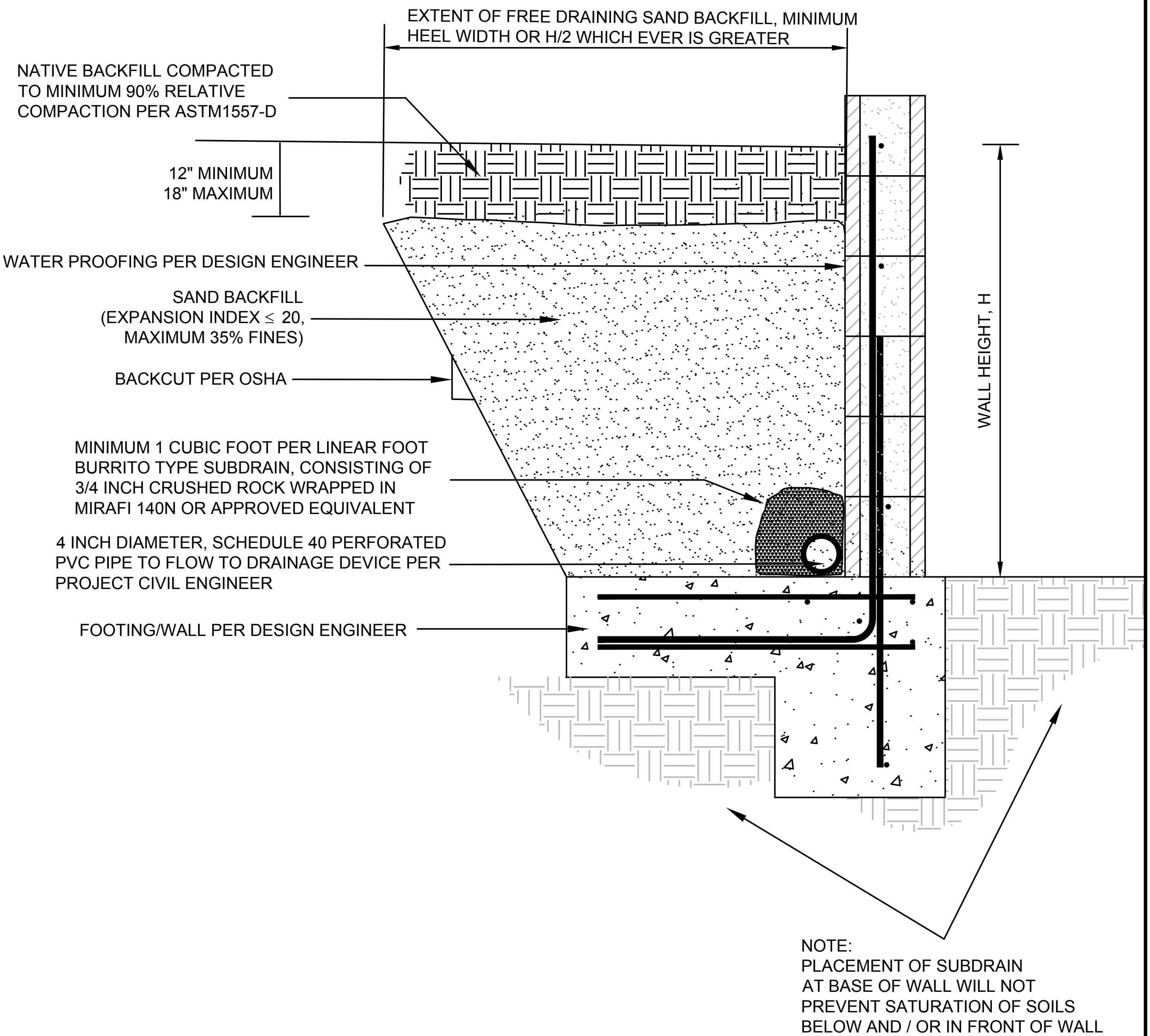
Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included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

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

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

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

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



LGC Geotechnical, Inc.

FIGURE 2

Retaining Wall Backfill Detail

(Approved On-Site or Imported Sand Backfill)

PROJECT NAME	Bedford Marketplace
PROJECT NO.	19080-01
ENG.	TJL / /KAD
SCALE	Not to Scale
DATE	July 2019

Appendix A
References

APPENDIX A

References

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Appendix B
Subsurface Data

From LOR, 2002

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

The site was investigated on January 31, February 1, 4 through 7, and 14 of 2002 and consisted of excavating a total of 31 trenches to depths between 4.5 to 15.0 feet below the existing ground surface and advancing a total of 23 borings to depths between 24.0 and 51.1 feet below the existing ground surface. The approximate locations of the trenches and borings are shown on Enclosures A-7 and A-8, within Appendix A.

The exploration was conducted using a FORD 555 E backhoe with a 24-inch bucket. The soil encountered were continuously logged by a geologist from this firm who visually observed the site, maintained detailed logs of the trenches, obtained disturbed soil samples for laboratory evaluation and testing, and classified the soils encountered by visual examination in accordance with the Unified Soil Classification System.

In-place density determinations were conducted at selected levels, within the trenches utilizing the Nuclear Gauge Method (ASTM D 2922). Disturbed soil samples were obtained at soil changes and other selected levels within the trenches. The samples were placed in sealed containers for transport to the laboratory.

The exploration was conducted using a CME-55 drill rig equipped with an 8-inch diameter hollow stem auger. The soils were continuously logged by a geologist from this firm who inspected the site, maintained detailed logs of the borings, obtained undisturbed, as well as disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System.

Relatively undisturbed samples of the subsoils were obtained at a maximum interval of 5 feet. The samples were recovered by using a California split barrel sampler of 2.50 inch inside diameter and 3.00 inch outside diameter from the ground surface to 35 feet deep. The samplers were driven by a 140 pound automatic trip hammer dropped from a height of 30 inches. The number of hammer blows required to drive the sampler into the ground the final 12 inches were recorded and further converted to an equivalent SPT N-value. Factors such as efficiency of the automatic trip hammer used during this investigation (80%), borehole diameter (8"), and rod length at the test depth were considered for further computing of equivalent SPT N-values corrected for field procedures ($\approx N_{60}$) which are included in the boring logs, Enclosures B-1 through B-23.

The undisturbed soil samples were retained in brass sample rings of 2.42 inches in diameter and 1.00 inch in height, and placed in sealed plastic containers. Disturbed soil samples were obtained at selected levels within the borings and placed in sealed containers for transport to the laboratory.

All samples obtained were taken to our laboratory for storage and testing. Detailed logs of the trenches and borings are presented on the enclosed Trench and Boring Logs, Enclosures B-1 through B-54. A Sampling Key is presented on Enclosure B.

CONSISTENCY OF SOILS

SANDS

SPT BLOWS	CONSISTENCY
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0 - 2	Very soft
2 - 4	Soft
4 - 8	Medium
8 - 15	Stiff
15 - 30	Very stiff
30 - 60	Hard
Over 60	Very Hard

SAMPLING KEY

Symbol	Description
	- INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE
	- INDICATES SAND CONE OR NUCLEAR DENSITY TEST
	- INDICATES BAG SAMPLE
	- INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" ¾" No. 4 No. 10 No. 40 200

(U.S. STANDARD SIEVE SIZE)

SAMPLE KEY

PROJECT: 580± ACRES, BEDFORD CANYON, CORONA AREA, RIVERSIDE CO., CA	PROJECT NO.: 31558.1
CLIENT: BLUESTONE COMMUNITIES	ENCLOSURE: B
LOR Geotechnical Group, Inc.	DATE: MARCH 2002
	SCALE: NO SCALE

LOG OF BORING B-1

DEPTH IN FEET	EQUIVALENT SPT BLOW COUNTS		MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0			5.2					SM	TOPSOIL/FERTILIZER 2 inches thick.
	16		3.7		102.0			SM	@ 0.2 feet TOPSOIL: SILTY SAND with gravel, approximately 15% angular gravel to 2", 10% coarse grained sand, 15% medium grained sand, 30% fine grained sand, 30% silty fines, dark brown, damp.
5			9.2		113.1				@ 1 foot ALLUVIUM: SILTY SAND with gravel, approximately 15% angular gravel to 2", 15% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 20% silty fines, grayish brown, damp.
10	27		8.1		92.7				@ 10 feet becomes finer grained, approximately 70% fine grained sand, 30% silty fines, dark brown, damp.
15	36		2.8		121.2				@ 15 feet becomes coarser grained, approximately 20% fine gravel, 10% coarse grained sand, 20% medium grained sand, 35% fine grained sand, 15% silty fines, brown, damp.
20	50-6"		1.6		115.8				
									END OF BORING DUE TO REFUSAL ON BOULDER
									No fill No caving No groundwater No bedrock
25									
30									
35									

PROJECT: 500+ Acres in Bedford Canyon, Corona, CA	PROJECT NUMBER: 31558.1
CLIENT: Bluestone Communities	ELEVATION: 904
LOR GEOTECHNICAL GROUP INC.	DATE DRILLED: January 31, 2002
	EQUIPMENT: CME 55
	HOLE DIA.: 8" ENCLOSURE: B-1

LOG OF BORING B-18

DEPTH IN FEET	EQUIVALENT SPT BLOW COUNTS		MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0			5.2					SM	FILL: SILTY SAND, approximately 5% fine gravel, 10% coarse grained sand, 15% medium grained sand, 35% fine grained sand, 35% silty fines, brown, damp, loose.
	18		5.5		92.2				
								SM	@ 3 feet ALLUVIUM: SILTY SAND, approximately 5% fine subrounded gravel, 15% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 30% silty fines, dark brown, damp.
5	23		2.8		117.3				
10	7		7.3		122.6				@ 10 feet becomes finer grained, approximately 10% coarse grained sand, 15% medium grained sand, 40% fine grained sand, 35% silty fines, brown, damp. @ 11 feet very difficult drilling on cobbles or gravel.
15	17		2.8		113.2				
20	26		5.0		121.8				@ 20 feet becomes coarser grained, approximately 10% fine gravel, 15% coarse grained sand, 30% medium grained sand, 20% fine grained sand, 25% silty fines, brown, damp. @ 22 feet very difficult drilling on gravel and/or cobbles.
									END OF BORING DUE TO SLOW PROGRESS
25									Fill 0-3' No caving No groundwater No bedrock
30									
35									

PROJECT: 500+ Acres in Bedford Canyon, Corona, CA	PROJECT NUMBER: 31558.1
CLIENT: Bluestone Communities	ELEVATION: 921
LOR GEOTECHNICAL GROUP INC.	DATE DRILLED: February 14, 2002
	EQUIPMENT: CME 55
	HOLE DIA.: 8" ENCLOSURE: B-18

LOG OF BORING B-19

DEPTH IN FEET	EQUIVALENT SPT BLOW COUNTS		MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0			5.0					SM	FILL: SILTY SAND, approximately 10% very fine gravel, 10% medium grained sand, 45% fine grained sand, 35% silty fines, brown, loose, damp.
	15		5.7		108.7				
								SM	@ 4 feet ALLUVIUM: SILTY SAND with gravel, approximately 20% gravel to 1 inch, 10% coarse grained sand, 15% medium grained sand, 30% fine grained sand, 25% silty fines, brown, damp.
5	17		3.4		112.1				
10	33		4.1		120.3				
15	25		4.8		118.9				
20	56		3.4		124.8				
25	46		3.5		127.6				
30									END OF BORING Fill 0-4' No caving No groundwater No bedrock
35									

PROJECT: **500+ Acres in Bedford Canyon, Corona, CA**	PROJECT NUMBER: **31558.1**
CLIENT: **Bluestone Communities**	ELEVATION: **892**
LOR GEOTECHNICAL GROUP INC.	DATE DRILLED: **February 14, 2002**
	EQUIPMENT: **CME 55**
	HOLE DIA.: **8"** ENCLOSURE: **B-19**

LOG OF TRENCH T-1

DEPTH IN FEET			ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0				6.0				SM	FILL: SILTY SAND, approximately 5% gravel to 1/2", 10% coarse grained sand, 30% medium grained sand, 30% fine grained sand, 25% silty fines, dark brown, moist, loose.
			81	12.6	106.6			SM	@ 1 foot ALLUVIUM: SILTY SAND, trace gravel to 1/2", approximately 5% coarse grained sand, 10% medium grained sand, 50% fine grained sand, 35% silty fines, dark brown, moist, roots.
			85	4.8	111.6				@ 3 feet approximately 20% gravel to 1", 20% coarse grained sand, 20% medium grained sand, 25% fine grained sand, 15% silty fines, dark brown, moist. @ 3.5 feet trace cobbles to 10".
5								ML	@ 5 feet SANDY SILT, trace gravel to 1", trace coarse grained sand, approximately 5% medium grained sand, 40% fine grained sand, 55% silty fines with trace clay of low plasticity, dark brown, moist.
10									
									@ 11 feet occasional cobble to 5".
								SM	@ 13 feet SILTY SAND, approximately 20% gravel to 2", 20% coarse grained sand, 30% medium grained sand, 10% fine grained sand, 20% silty fines, red brown, moist.
15									**END OF TRENCH** Fill 0-1' No caving No groundwater No bedrock

PROJECT: **500+ Acres in Bedford Canyon, Corona, CA**	PROJECT NUMBER: **31558.1**
CLIENT: **Bluestone Communities**	ELEVATION: **916**
LOR GEOTECHNICAL GROUP INC.	DATE EXCAVATED: **February 4, 2002**
	EQUIPMENT: **Ford 555E**
	BUCKET W.: **24"** ENCLOSURE: **B-24**

LOG OF TRENCH T-2

DEPTH IN FEET			ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0				4.4				SM	FILL: SILTY SAND with gravel, approximately 10% gravel to 1", 10% coarse grained sand, 15% medium grained sand, 35% fine grained sand, 30% silty fines, brown, moist, loose.
								SW	@ 1 foot ALLUVIUM: WELL GRADED SAND with gravel, approximately 15% gravel to 6", 20% coarse grained sand, 30% medium grained sand, 5% silty fines, brown, moist.
			89	3.3	116.1				
			84	5.8	109.7				@ 4 feet approximately 5% gravel to 1", 35% coarse grained sand, 35% medium grained sand, 20% fine grained sand, 55% silty fines, brown, moist.
5									@ 5 feet occasional cobble to 10".
10									
15									END OF TRENCH Fill 0-1' No caving No groundwater No bedrock

PROJECT: 500+ Acres in Bedford Canyon, Corona, CA	PROJECT NUMBER: 31558.1
CLIENT: Bluestone Communities	ELEVATION: 914
	DATE EXCAVATED: February 4, 2002
LOR GEOTECHNICAL GROUP INC.	EQUIPMENT: Ford 555E
	BUCKET W.: 24" ENCLOSURE: B-25

LOG OF TRENCH T-3

DEPTH IN FEET	TEST DATA		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S	DESCRIPTION
0				18.3				SM	<u>FILL:</u> **SILTY SAND with trace clay, approximately 5% coarse grained sand, 15% medium grained sand, 45% fine grained sand, 35% silty fines with trace clay of low plasticity, brown, moist, loose.**
			80	10.7	104.8				
								SW	**@ 1.5 feet** <u>ALLUVIUM:</u> **WELL GRADED SAND with silt, approximately 10% gravel to 1", 30% coarse grained sand, 35% medium grained sand, 20% fine grained sand, 10% silty fines, brown, moist.**
			90	4.9	118.7				
5									**@ 5 feet occasional cobble to 10".**
									@ 7 feet approximately 30% gravel to 10", 25% coarse grained sand, 25% medium grained sand, 20% fine grained sand, 5% silty fines, brown, moist.
10									
15									**END OF TRENCH** **Fill 0-1.5'** **No caving** **No groundwater** **No bedrock**

PROJECT: **500+ Acres in Bedford Canyon, Corona, CA**	PROJECT NUMBER: **31558.1**
CLIENT: **Bluestone Communities**	ELEVATION: **896**
	DATE EXCAVATED: **February 4, 2002**
LOR GEOTECHNICAL GROUP INC.	EQUIPMENT: **Ford 555E**
	BUCKET W.: **24"** ENCLOSURE: **B-26**

**Appendix C**

**Laboratory Summary from Phase 1 Grading**

APPENDIX C

Laboratory Test Results

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

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

No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
1	Red-Brown Silty, Clayey Sand w/ Gravel	137.0	7.5
2	Red-Brown Silty, Clayey Sand w/ Gravel	134.5	7.5
3	Dark Brown Silty Gravel w/ Sand	152.5	3.5
4	Brown Silty Sand w/ Gravel	133.5	8.0
5	Dark Brown Silty, Clayey Sand w/ Gravel	140.0	6.0
6	Dark Brown Clayey Sand w/ Gravel	142.0	6.0
8A	Gravelly Sand (30% Rock)	144.0	6.0
8B	Gravelly Sand (35% Rock)	146.0	5.0
8C	Gravelly Sand (40% Rock)	147.0	5.0
8D	Gravelly Sand (45% Rock)	149.0	5.0

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

Sample Location	Sample Number	Expansion Index	Expansion Potential*
Near “A” Street	EI-1	58	Medium
Central Fill	EI-2	1	Very Low
Near “C” Street	EI-3	7	Very Low
Central Fill	EI-4	0	Very Low
Central Fill	EI-5	8	Very Low

* ASTM D4829

Appendix D
General Earthwork and Grading Specifications for Rough Grading

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

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

1.2 The Geotechnical Consultant of Record

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

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

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

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

1.3 The Earthwork Contractor

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

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

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

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

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

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

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

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

2.2 Processing

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

2.3 Over-excavation

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

2.4 Benching

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

2.5 Evaluation/Acceptance of Fill Areas

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

3.0 Fill Material

3.1 General

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

3.2 Oversize

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

3.3 Import

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

4.0 Fill Placement and Compaction

4.1 Fill Layers

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

4.2 Fill Moisture Conditioning

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

4.3 Compaction of Fill

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

4.4 Compaction of Fill Slopes

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

4.5 Compaction Testing

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

4.6 Frequency of Compaction Testing

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

4.7 Compaction Test Locations

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

5.0 Subdrain Installation

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

6.0 Excavation

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

7.0 Trench Backfills

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

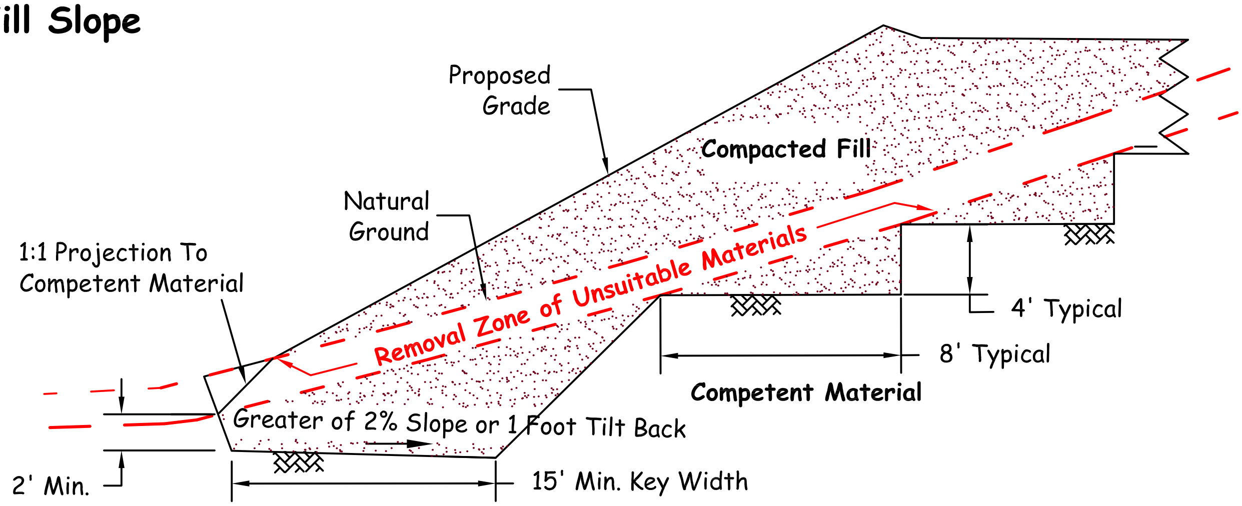
7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

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

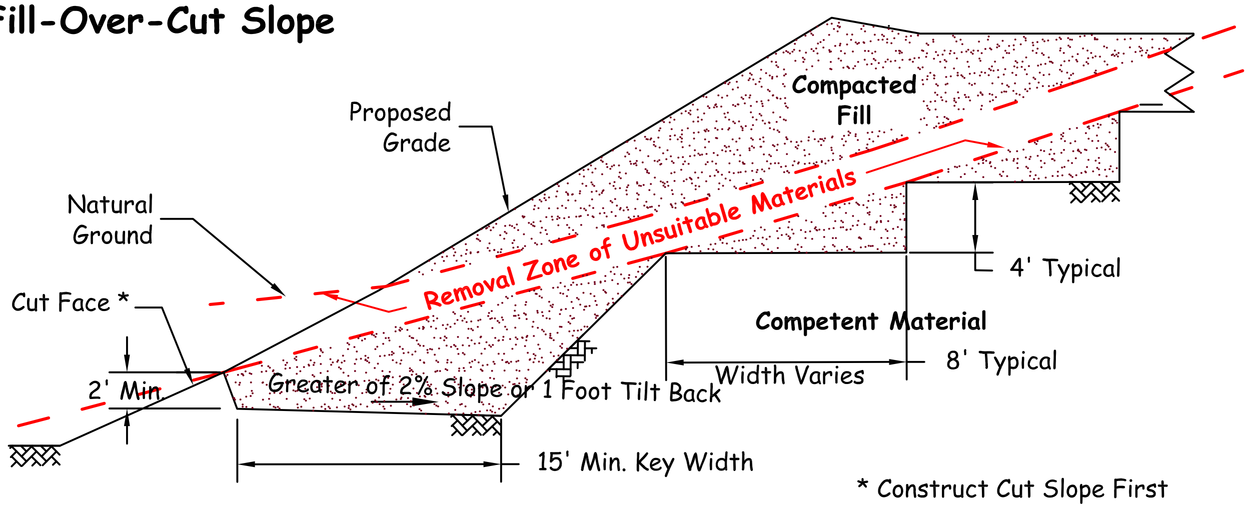
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

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

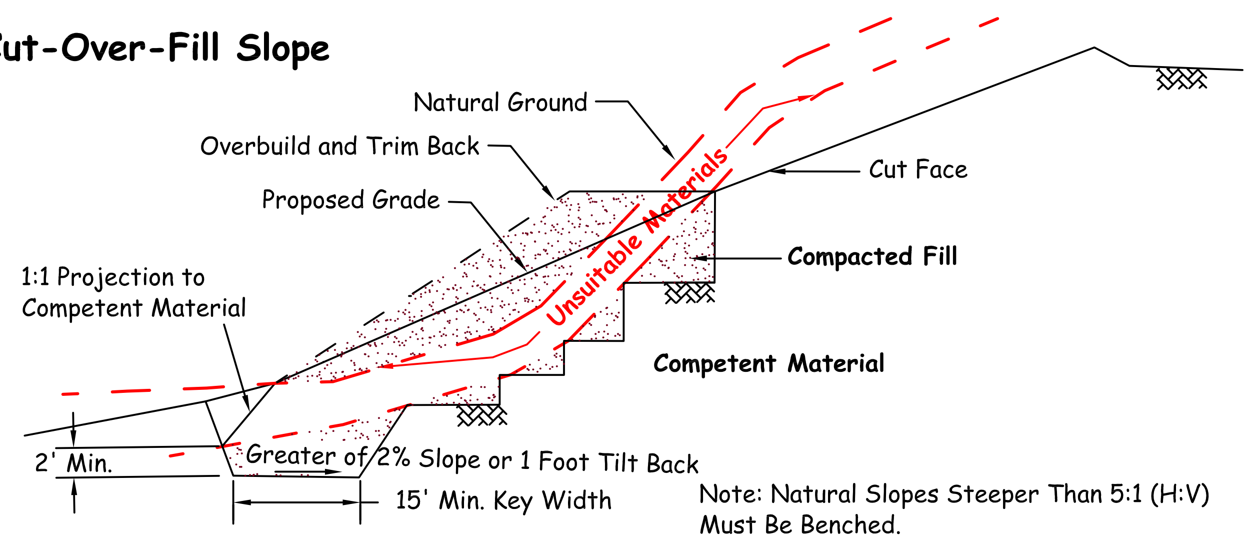
Fill Slope



Fill-Over-Cut Slope



Cut-Over-Fill Slope



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

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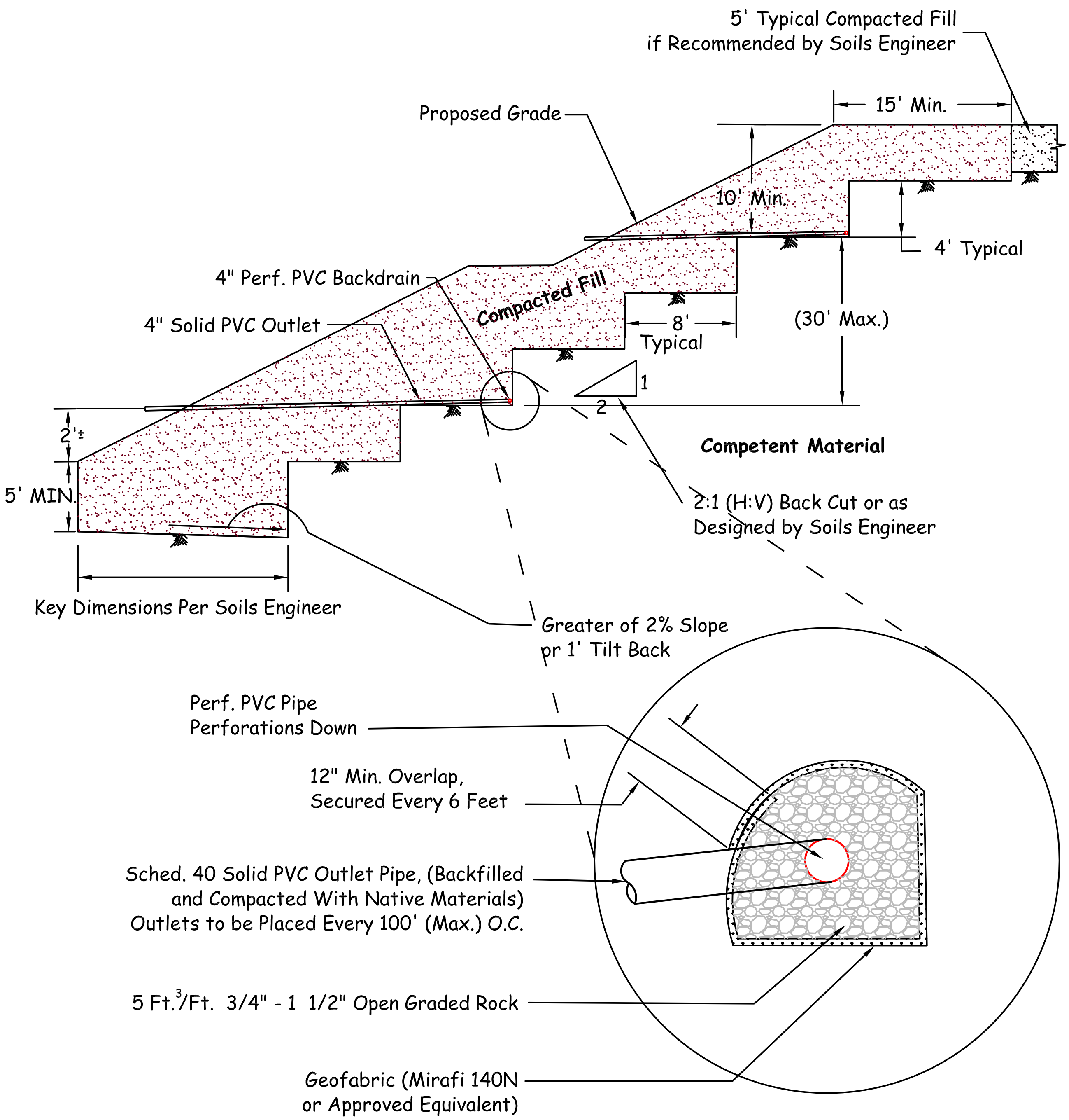
KEYING AND BENCHING



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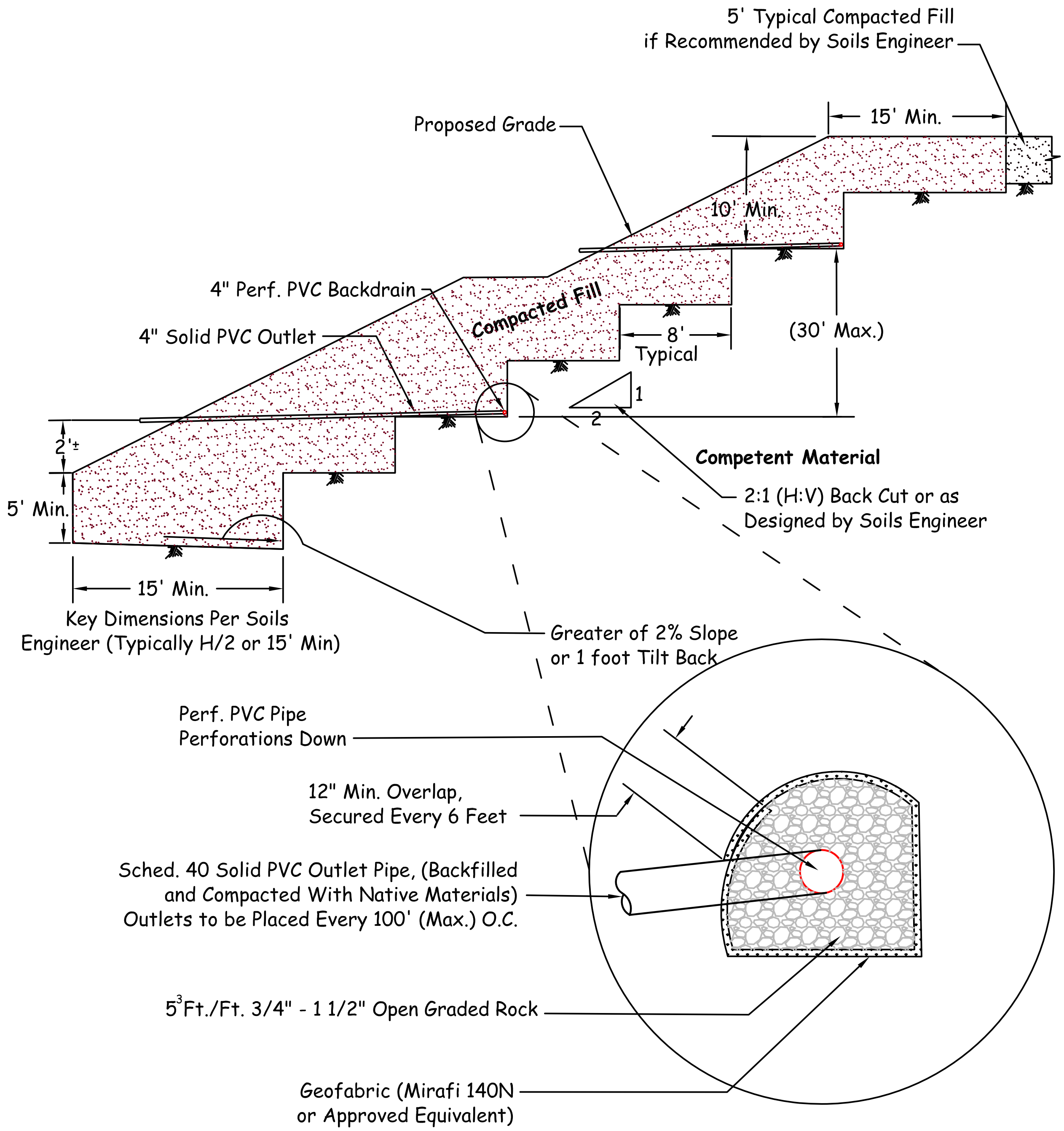
TYPICAL BUTTRESS DETAIL



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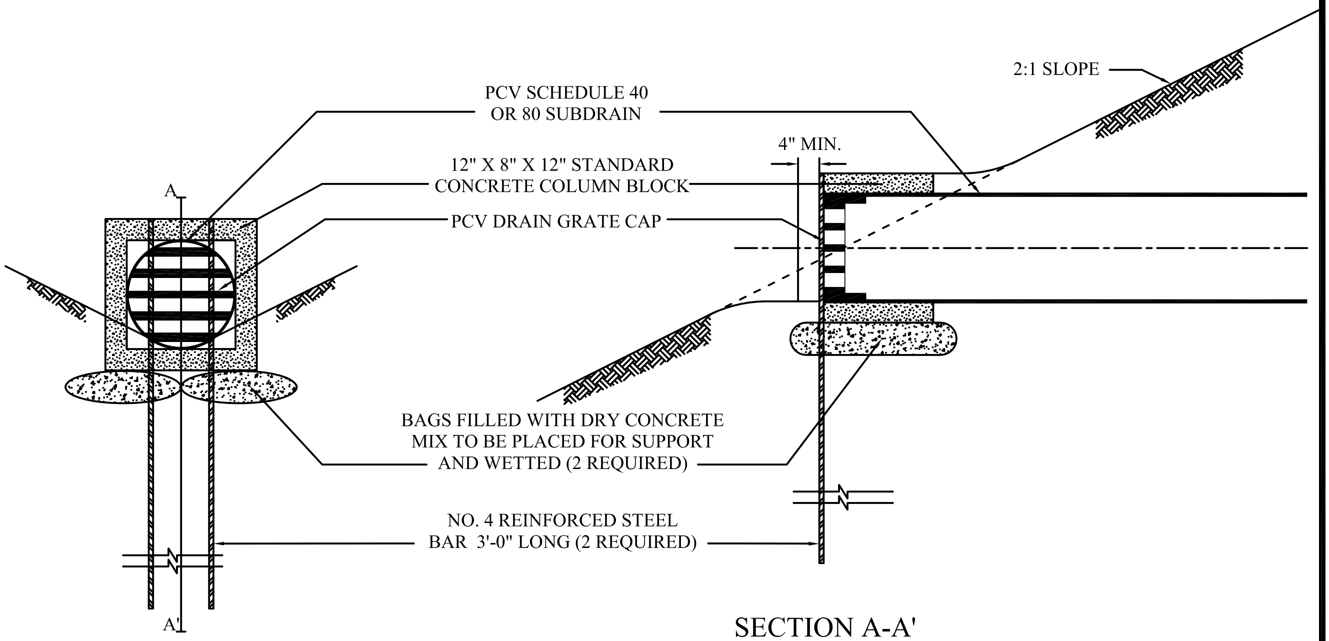
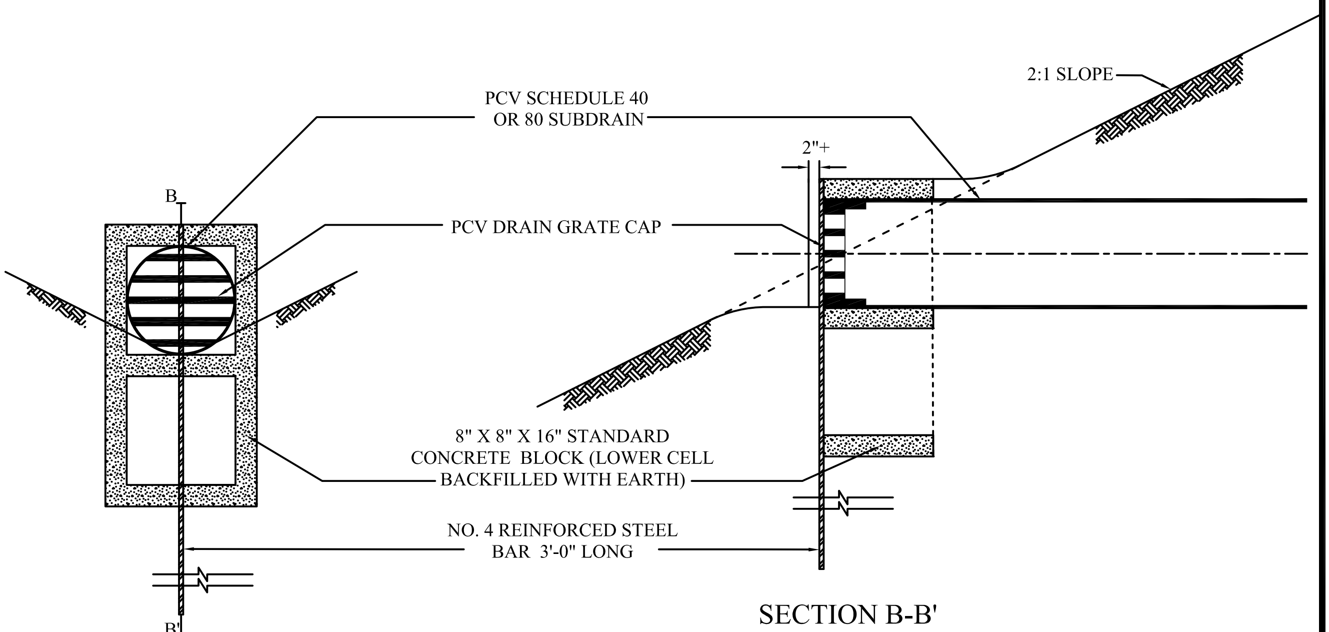
TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SUBDRAIN OUTLET MARKER -4" PIPE



NOT TO SCALE

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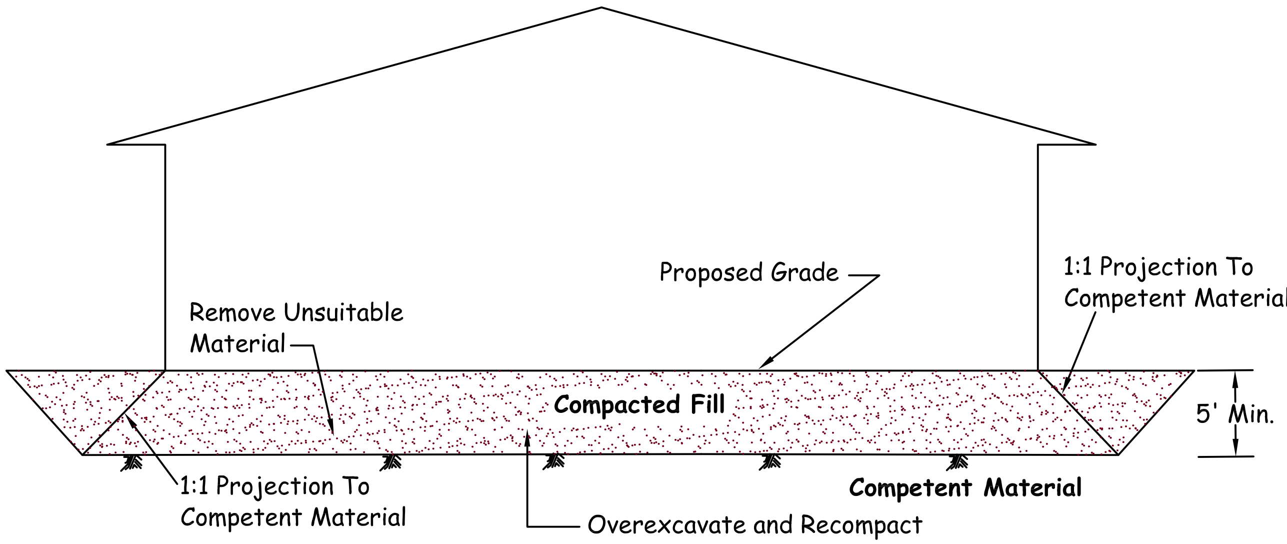
SUBDRAIN OUTLET MARKER DETAIL

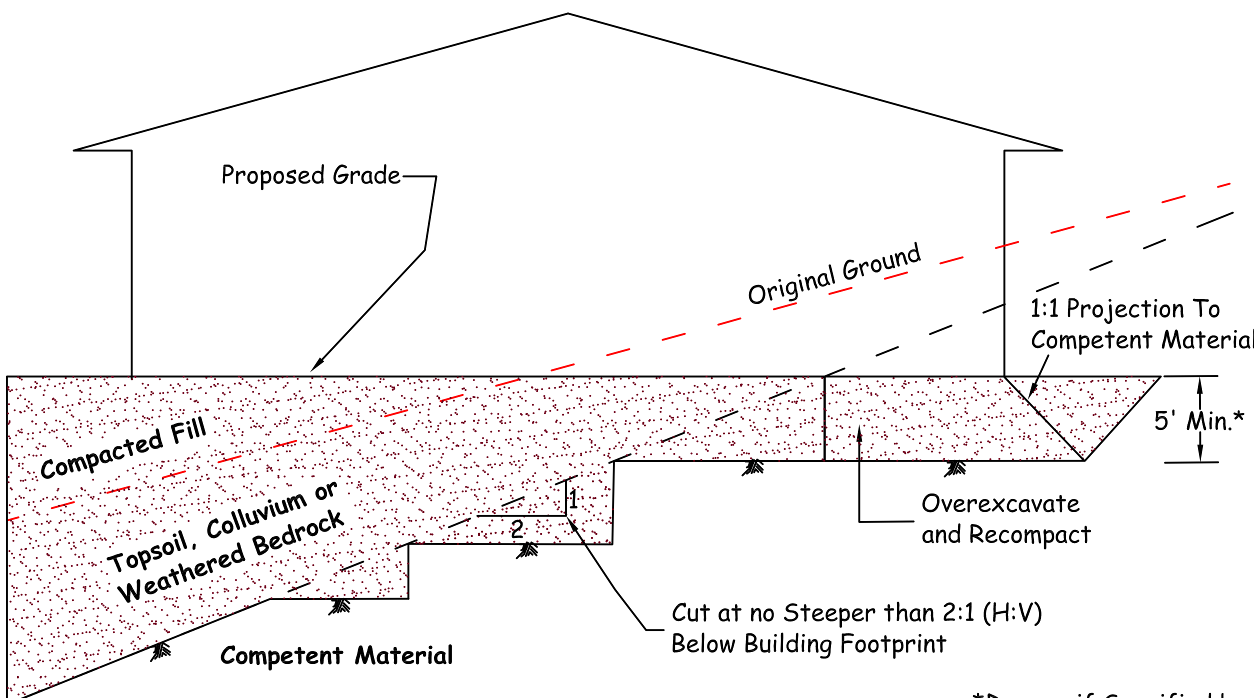
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



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

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

Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

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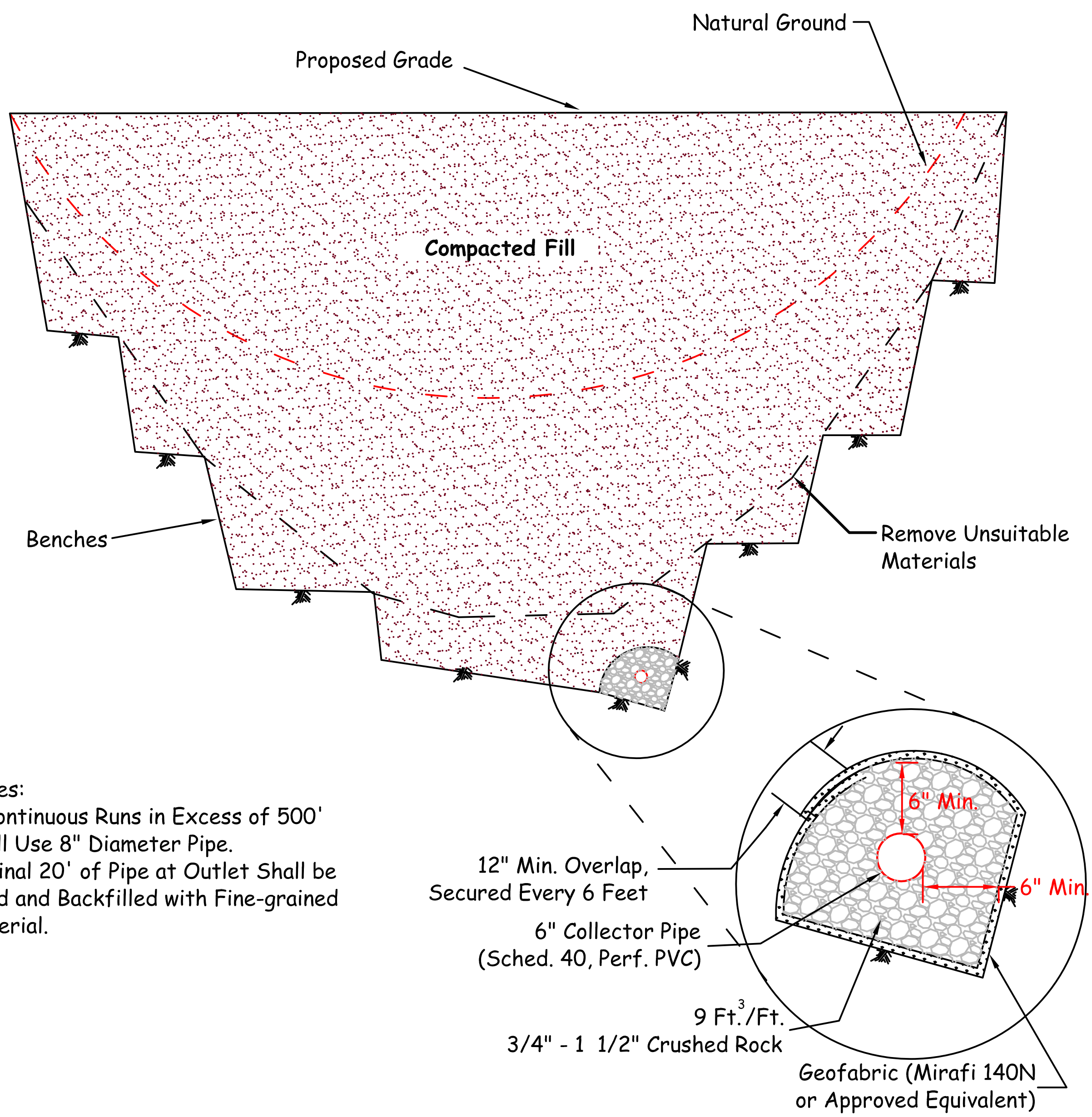
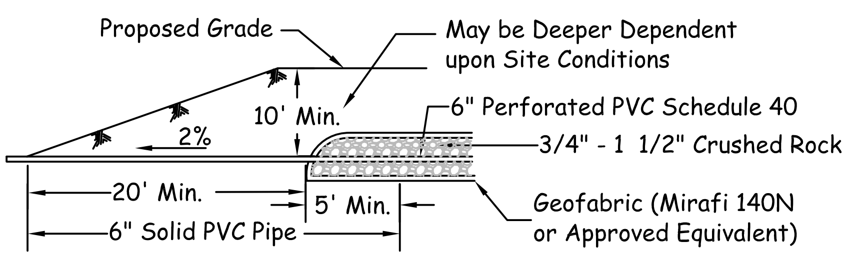
CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



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

Proposed Outlet Detail



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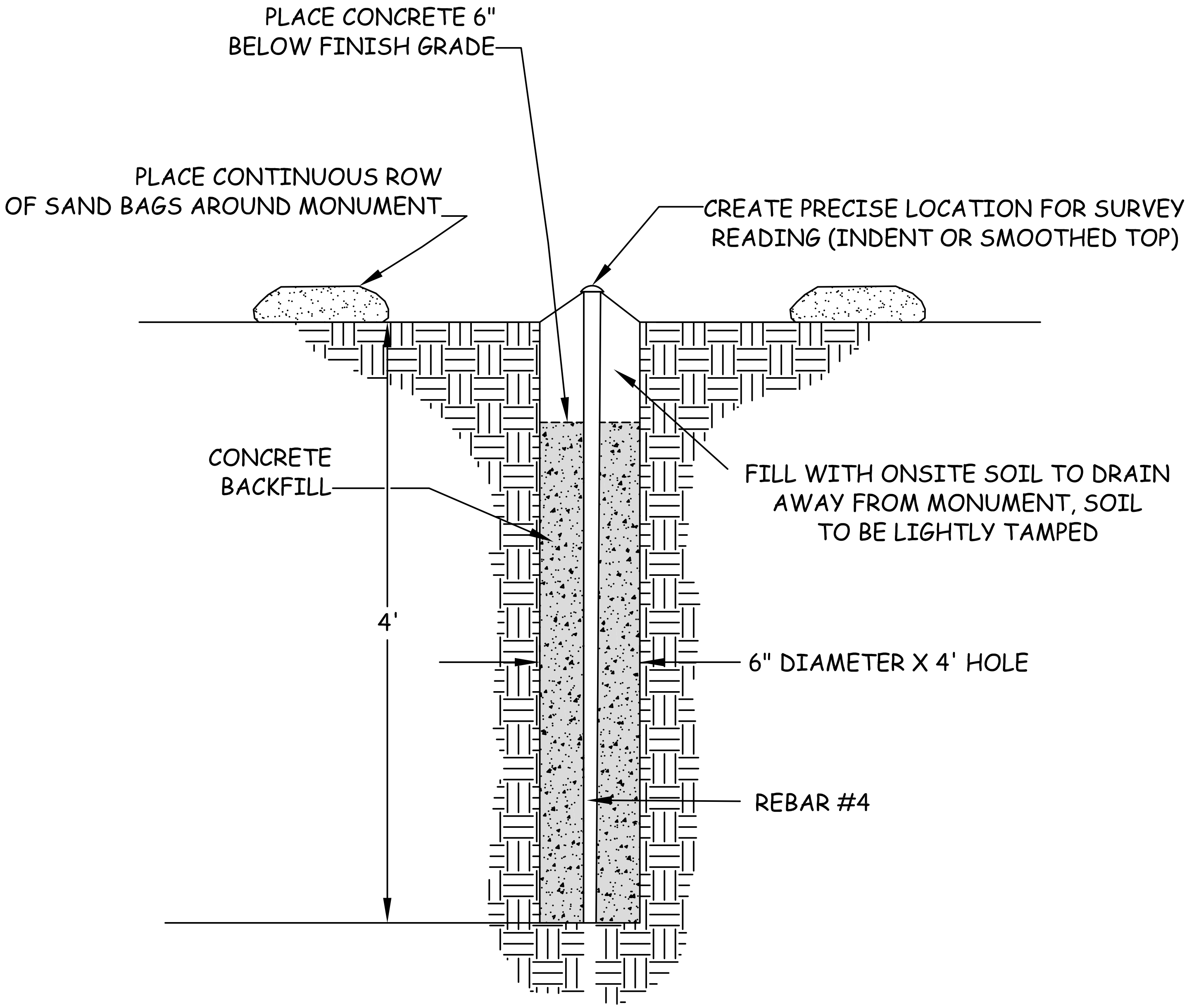
CANYON SUBDRAINS



NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

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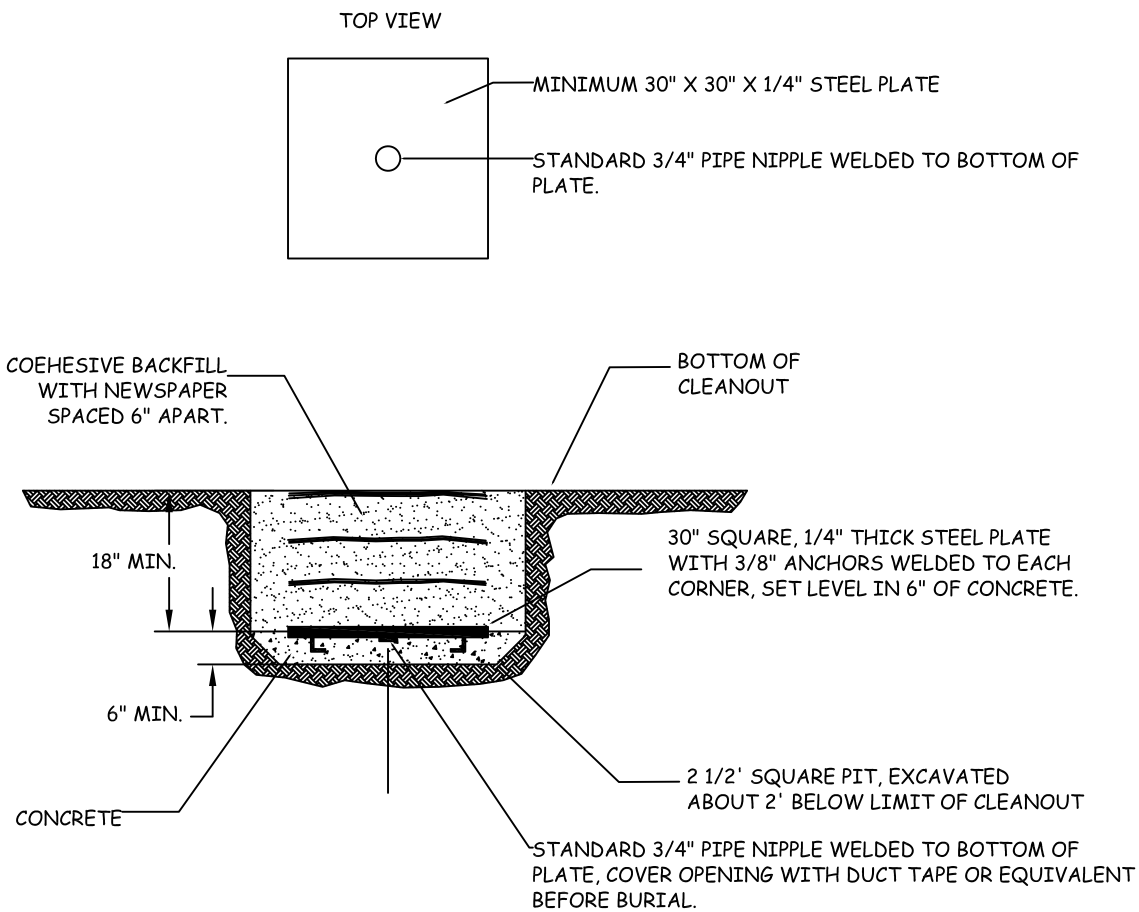
TYPICAL SURFACE SETTLEMENT MONUMENT



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

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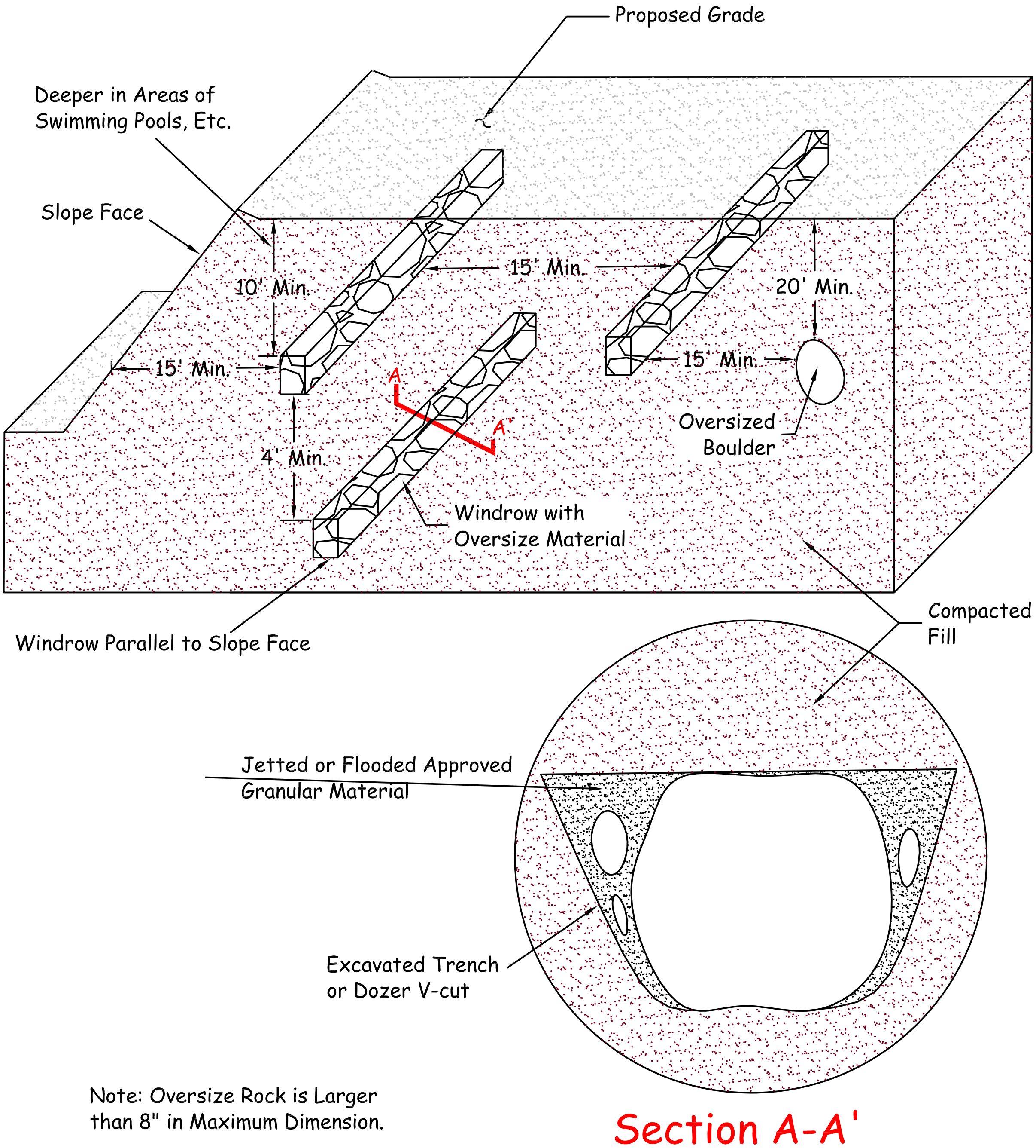
TYPICAL SETTLEMENT PLATE AND RISER



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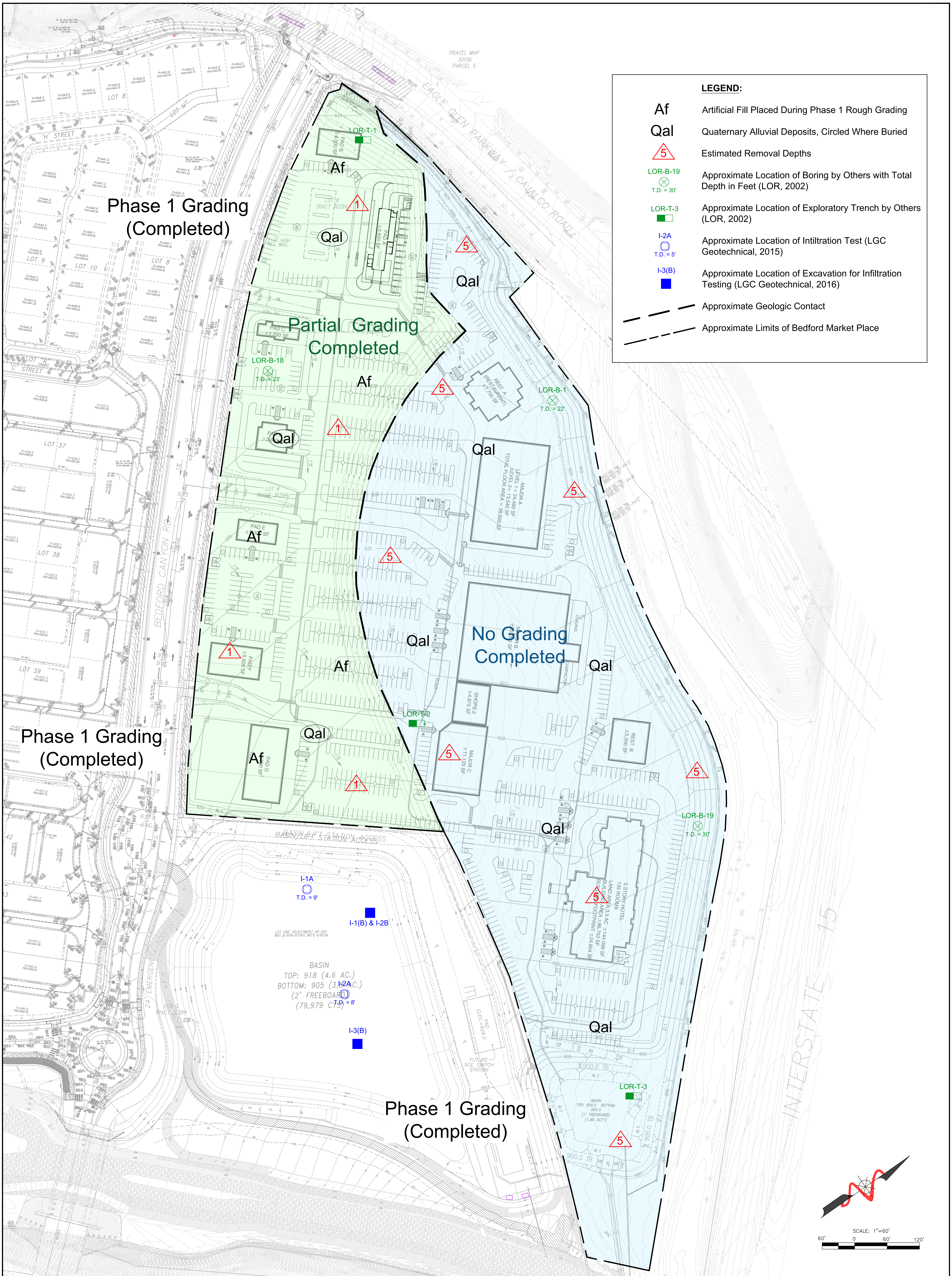
OVERSIZE ROCK DISPOSAL DETAIL



LGC Geotechnical, Inc.

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

Geotechnical Map
Bedford Market Place

PROJECT NAME	Bedford Market Place
PROJECT NO.	18002-01
ENG. / GEOL.	TJL / KAD
SCALE	1" = 60'
DATE	July 2019