CHRISTIAN WHEELER
ENGINEERING

REPORT OF UPDATED GEOTECHNICAL INVESTIGATION AND INFILTRATION FEASIBILITY STUDY

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

PREPARED FOR

GAMBLE HOMES, INC.
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ENCINITAS, CALIFORNIA 92024

PREPARED BY

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March 14, 2022

Galey Homes, Inc.
171 Saxony Road, Suite 101
Encinitas, California 92024
Attention: Mike Galey

CWE 2220070.01

Subject: Report of Updated Geotechnical Investigation and Infiltration Feasibility Study
Calle Catalina Subdivision, Calle Catalina and Gamble Lane, Escondido, California

Ladies and Gentlemen:

In accordance with your request and our proposal dated January 31, 2022, we have completed an updated geotechnical investigation and infiltration feasibility study for the subject project. We are presenting herewith a report of our findings and recommendations.

It is our professional opinion and judgment that no geotechnical conditions exist on the subject property that would preclude the construction of the proposed subdivision provided the recommendations presented herein are implemented.

If you have questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

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ENGINEERING

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AND INFILTRATION FEASIBILITY STUDY

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
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INTRODUCTION AND PROJECT DESCRIPTION

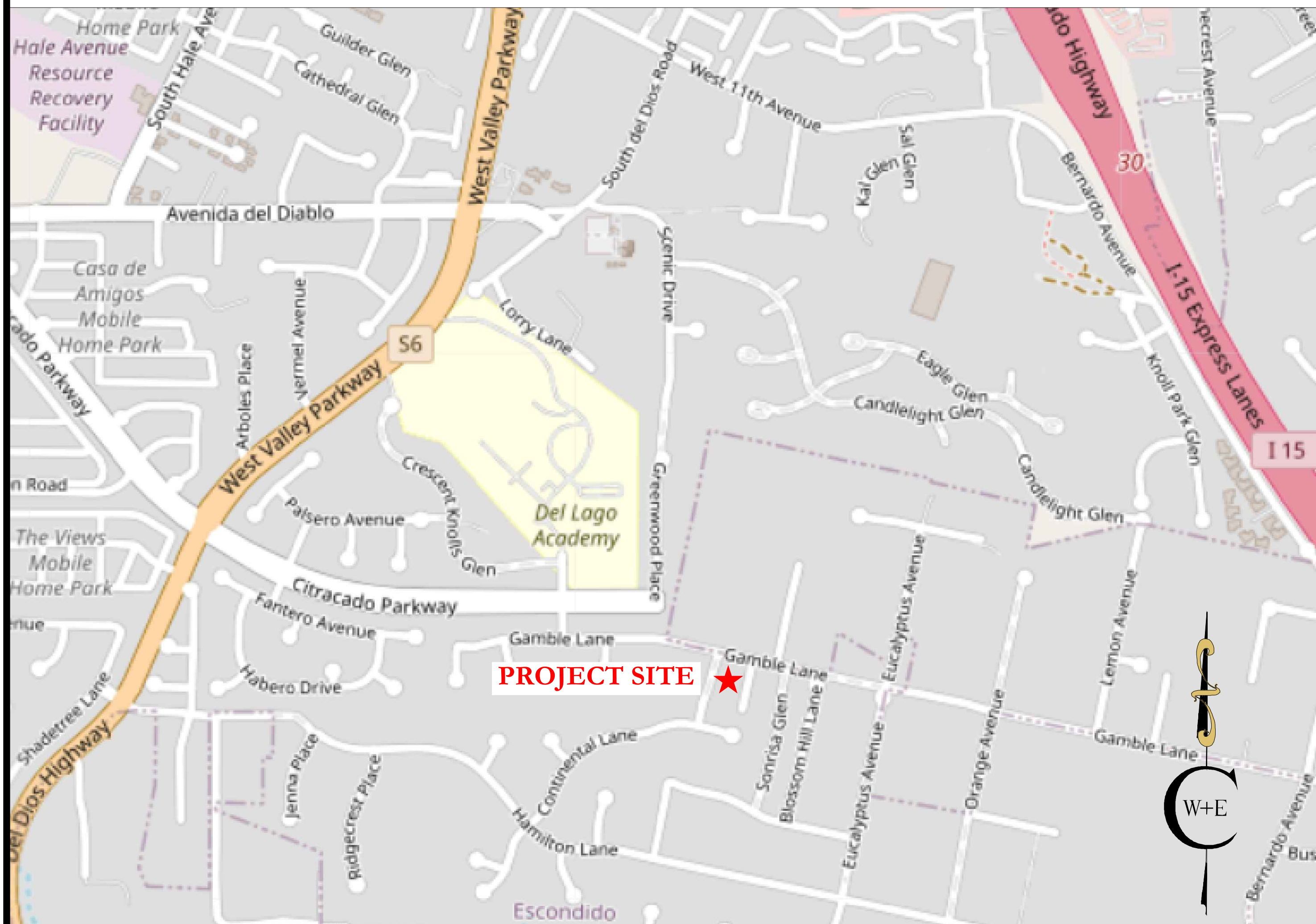
This report presents the results of an updated geotechnical investigation and infiltration feasibility study performed for a proposed residential subdivision to be located at the northern terminus of Calle Catalina, in the City of Escondido, California. The following Figure No. 1 presents a vicinity map showing the location of the property.

We understand that the subject project will consist of the construction of three residential structures and the extension of Calle Catalina which will connect with Gamble Lane. It is anticipated that the structures will be one-and-two stories, of wood-frame construction, supported by conventional shallow foundations, and will incorporate conventional slabs-on-grade floor systems. Grading to accommodate the proposed construction will consist of cuts and fills up to about 8 feet and 15 feet from existing site grades, respectively. We also understand that storm water BMPs are planned as part of the storm water management for the subject project and that it is necessary to provide information as required by the City of Escondido to complete the design.

To assist in the preparation of this report, we were provided with a tentative parcel map and a DMA Exhibit, both undated and prepared by bHA, Inc. A copy of the tentative parcel map was used as a base map for our Site Plan and Geotechnical Map, and is included herein as Plate No. 1. We have also created a geologic cross section to depict the subsurface soil conditions and proposed topography which is presented on Plate No. 2. In addition, we have reviewed our report titled "Preliminary Geotechnical Investigation, Proposed Six Residential Lots", CWE 2090482.01, dated November 30, 2009. Data from the geotechnical report is included in Appendices A and B.

This report has been prepared for the exclusive use of Galey Homes, Inc., and its design consultants, for specific application to the project described herein. Should the project be modified, the conclusions and

SITE VICINITY



CALLE CATALINA SUBDIVISION CALLE CATALINA AND GAMBLE LANE ESCONDIDO, CALIFORNIA		
DATE: MARCH 2022	JOB NO.: 2220070.01	CHRISTIAN WHEELER ENGINEERING
BY: SD	FIGURE NO.: 1	

recommendations presented in this report should be reviewed by Christian Wheeler Engineering for conformance with our recommendations and to determine whether any additional subsurface investigation, laboratory testing and/or recommendations are necessary. Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, expressed or implied.

SCOPE OF SERVICES

Our preliminary geotechnical investigation consisted of surface reconnaissance, review of the subsurface exploration logs and laboratory test data presented in the aforementioned geotechnical report, analysis of the previous field and laboratory data and review of relevant readily available geologic literature. Our scope of service did not include assessment of hazardous substance contamination, recommendations to prevent floor slab moisture intrusion or the formation of mold within the structures, evaluation or design of storm water infiltration facilities, or any other services not specifically described in the scope of services presented below.

More specifically, the intent of our proposed investigation was to:

- Review of our previous preliminary geotechnical report.
- Drill 2 small-diameter borings to explore the subsurface conditions to a depth of at least 10 feet below the bottom of the proposed BMPs.
- Drill 6 borings to a depth of approximately 3 feet below existing grade to perform borehole falling head percolation testing. Two percolation test holes are planned for each proposed BMP location.
- Backfill the boring holes using a grout or a grout/bentonite mix as required by the County of San Diego Department of Environmental Health.
- Evaluate, by data from our previous report, our past experience with similar soil types, the engineering properties of the various soil strata that may influence the proposed construction, including bearing capacities, expansive characteristics and settlement potential.
- Describe the general geology at the site, including possible geologic hazards that could have an effect on the proposed construction, and provide the seismic design parameters in accordance with the 2019 edition of the California Building Code.
- Discuss potential construction difficulties that may be encountered due to soil conditions, groundwater or geologic hazards, and provide geotechnical recommendations to mitigate identified construction difficulties.
- Provide site preparation and grading recommendations for the anticipated work.

- Provide foundation recommendations for the type of construction anticipated and develop soil engineering design criteria for the recommended foundation designs.
- Complete Worksheet C.4-1: Categorization of Infiltration Feasibility Condition, Criteria 1, 2, 5 and 6 based on our percolation testing, the hydrologic soil mapping, and our observations during the investigation.
- Provide a preliminary geotechnical report presenting the results of our investigation, including a plot plan showing the location of our subsurface explorations, excavation logs, laboratory test results, and our conclusions and recommendations for the proposed project. The report will be provided as an electronic document in portable document format (PDF).

FINDINGS

SITE DESCRIPTION

The subject site is located at the northern terminus of Calle Catalina, in the City of Escondido, California. The property comprises 3 vacant parcels which are bounded to the north by Gamble Lane and on the remaining sides by developed residential properties and associated access roads. Parcels 2 and 3 are adjacent to one another, rectangular in shape, and located northeast of the terminus of Calle Catalina. Parcel 1 is separated from the other parcels by a developed residential lot, its flag shaped, and located northwest of the terminus of Calle Catalina. An approximately 30-foot-wide portion of parcel 1 connects it to Calle Catalina and the other parcels. Topographically, the lots slope gently to the east. According to the tentative map, the average site elevation for the eastern lots is about 810 feet while the average site elevation for the western lot is about 835 feet.

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

GEOLOGIC SETTING AND SOIL DESCRIPTION: The subject site is located in the Foothills Physiographic Province of San Diego County. Based upon the findings of our subsurface explorations and review of readily available, pertinent geologic and geotechnical literature, it was determined that the project area is generally underlain by artificial fill, topsoil, and granitic rock. These materials are described below:

ARTIFICIAL FILL (Qaf): Man-placed fill soils were observed underlying the northeastern and easterly portions of parcels 2 and 3. The fill location is shown on the attached Plate Number 1. As encountered in the trenches, the fill ranges in depth from 2 feet to 6 feet below existing grade. This material consists of light brown, reddish-brown and light grayish-brown, dry to moist, loose to medium dense, silty sand (SM). The upper 3 feet of fill encountered in trench T-5 contained concrete debris with a maximum dimension of about 6 inches. The fill was judged to have a low expansive potential (EI between 21 and 50).

TOPSOILS: A relatively thin veneer of topsoil was encountered overlying the granitic rock within the portions of the site not previously graded, and underlying the fill in trenches T-4 and T-5 (parcel 2). This material ranges in thickness from one foot to three feet. The topsoil consists of light brown, dry, loose, silty sand (SM). The topsoil was judged to have a very low expansive potential (EI< 20).

GRANITIC ROCK (Kgr): Granitic rock in various degrees of weathering was encountered underlying the surficial soils throughout the site. The granitic rock encountered in the subsurface explorations was found to consist of light gray, reddish-brown, light brown and brown, moist, silty sand (SM) and well graded sand with silt (SW-SM). The upper 1 to 2 feet of the granitic rock was highly weathered and medium dense to dense. The granitic rock is very dense below said depth and practical refusal on unweather granitic rock was encountered in boring B-2 at depths ranging from 8 feet to 12 feet below existing grades. The granitic rock was judged to have a very low expansive potential (EI< 20).

GROUNDWATER: No groundwater or major seepage was encountered in the subsurface explorations. We do not expect any significant groundwater related conditions during or after the proposed construction. However, it should be recognized that minor groundwater seepage problems might occur after construction and landscaping are completed, even at a site where none were present before construction. These are usually minor phenomena and are often the result of an alteration in drainage patterns and/or an increase in irrigation water. Based on the anticipated construction and the permeability of the on-site soils, it is our opinion that any seepage problems that may occur will be minor in extent. It is further our opinion that these problems can be most effectively corrected on an individual basis if and when they occur.

TECTONIC SETTING: It should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones that consist of several individual, en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as active while others are classified as only potentially active according to the criteria of the California Division of Mines and Geology. Active fault zones are those which have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years) while potentially active fault zones have demonstrated movement during the Pleistocene Epoch (11,000 to

1.6 million years before the present) but no movement during Holocene time. Inactive faults are those faults that can be demonstrated to have no movement in the past 1.6 million years.

The active Newport Inglewood-Rose Canyon and Elsinore Fault Zones are located approximately 14 miles southwest and 18 miles northeast of the site, respectively. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough, and San Clemente Fault Zones to the west, the Palos Verdes and Newport Inglewood Fault Zones to the northwest, and the Earthquake Valley, San Jacinto, and San Andreas Fault Zones to the northeast.

GENERAL GEOLOGIC HAZARDS

GENERAL: The site is located in an area where the risks due to significant geologic hazards are relatively low. No geologic hazards of sufficient magnitude to preclude the construction of the subject project are known to exist. In our professional opinion and to the best of our knowledge, the site is suitable for the proposed improvements.

SURFACE RUPTURE: There are no known active faults that traverse the subject site; therefore, the risk for surface rupture at the subject site is considered low.

LANDSLIDE POTENTIAL AND SLOPE STABILITY: As part of this investigation, we reviewed the publication, "Landslide Hazards in the Northern Part of the San Diego Metropolitan Area" by Tan, 1995. This reference is a comprehensive study that classifies San Diego County into areas of relative landslide susceptibility. According to this publication, the site is located in Relative Landslide Susceptibility Area 3-1, which is considered to be "generally susceptible" to landsliding. Due to the competent nature of the underlying granitic rock and relatively gentle topography at the site, the potential for slope failures or deep-seated landsliding is considered to be very low. Further, it is anticipated that the proposed construction will not increase the potential for slope instability on or immediately adjacent to the subject site.

LIQUEFACTION: The earth materials underlying the site are not considered subject to liquefaction due to such factors as soil density and grain-size distribution, and the absence of a shallow groundwater table.

FLOODING: As delineated on the Flood Insurance Rate Map (FIRM), map number 06073C1076G prepared by the Federal Emergency Management Agency, the site is in Zone X which is considered to be an "area of minimal flood hazard." Areas of minimal flood hazards are located outside of the boundaries of both the 100-year and 500-year flood zones.

TSUNAMIS: Tsunamis are great sea waves produced by submarine earthquakes or volcanic eruptions. Due to the site's setback from the ocean and elevation, it will not be affected by a tsunami.

SEICHES: Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Due to the site's location, it will not be affected by seiches.

CONCLUSIONS

In general, it is our professional opinion and judgment that the subject property is suitable for the construction of the proposed residential subdivision and associated improvements provided the recommendations presented herein are implemented. The main geotechnical conditions affecting the proposed project consist of potentially compressible artificial fill and topsoil and cut/fill transitions. These conditions are discussed hereinafter.

The site is underlain by potentially compressible artificial fill and topsoil. As encountered in the subsurface explorations, these materials extend to a maximum combined depth of about 8 feet from existing grade (Trench T-5). Deeper compressible soils may exist in areas of the site not investigated. These materials are considered unsuitable, in their present condition, for the support of settlement sensitive improvements. It is recommended that these materials be removed and replaced as compacted fill.

The recommendations discussed in the previous paragraph and the proposed grading will result in transition cut/fill building pads. This configuration may result in differential settlements detrimental to the proposed structures and associated improvements due to the potential of fill soils and formational soils to settle differently. In order to mitigate this condition, it is recommended that the cut portion of pads be undercut as recommended hereinafter. In addition, this recommendation will improve drainage and landscaping, and will facilitate excavations with light trenching equipment.

The granitic rock encountered in the subsurface explorations is comprised of sands and silty sands that generally have a relatively high erosion potential. Prompt landscaping with appropriate ground cover, and appropriate drainage measures will help to mitigate this condition.

Hard rock boulders have been encountered in boring B-2 and have also been placed at the site. In addition, large boulders have been placed to limit access to the property. Oversized rock will require special handling as described hereinafter.

An existing retaining wall is located along the easterly property lines of parcels 1 and 2. A small fill slope associated with BMP C is proposed above and adjacent to the wall (see Plate No.2). The suitability of this wall to support this surcharge load should be evaluated by others.

As part of the storm water management for the site, we understand that on-site BMPs will be constructed. Design infiltration rates within the weathered granitic fall within the "Partial Infiltration" category based on the limits presented in the current City of Escondido BMP Design Manual. In addition, infiltration restrictions have been identified at the subject site. Appendix F of this report presents our Preliminary Storm Water Infiltration Feasibility Analysis for the proposed project.

The site is located in an area that is relatively free of geologic hazards that will have a significant effect on the proposed construction. The most likely geologic hazard that could affect the site is ground shaking due to seismic activity along one of the regional active faults. However, construction in accordance with the requirements of the most recent edition of the California Building Code and the local governmental agencies should provide a level of life-safety suitable for the type of development proposed.

RECOMMENDATIONS

GRADING AND EARTHWORK

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the City of Escondido, and the recommended Grading Specifications and Special Provisions attached hereto, except where specifically superseded in the text of this report.

PREGRADE MEETING: It is recommended that a pregrade meeting including the grading contractor, the client, and a representative from Christian Wheeler Engineering be performed, to discuss the recommendations of this report and address any issues that may affect grading operations.

OBSERVATION OF GRADING: Continuous observation by the Geotechnical Consultant is essential during the grading operation to confirm conditions anticipated by our investigation, to allow adjustments in design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein.

CLEARING AND GRUBBING: Site preparation should begin with the removal of any existing vegetation and other deleterious materials.

SITE PREPARATION: It is recommended that existing potentially compressible fill soils and topsoil underlying proposed structures, associated improvements and new fills be removed in their entirety. Based on the findings of the previous report, the maximum removal depth is about 8 feet below existing grade. Deeper removals may be necessary in areas of the site not investigated or due to unforeseen conditions. Lateral removal limits should extend at least 5 feet from the perimeter of the structures, any settlement sensitive improvements, and new fills or equal to removal depth, whichever is more. No removals are recommended beyond property lines. All excavated areas should be approved by the geotechnical engineer or his representative prior to replacing any of the excavated soils. The excavated materials can be replaced as properly compacted fill in accordance with the recommendations presented in the “Compaction and Method of Filling” section of this report.

TRANSITION UNDERCUT: It is recommended that granitic rock be undercut to a minimum depth of 4 feet below proposed grade. The removals and undercuts should be performed in such a way as to provide for a continuous contact between the new fill and formational soil that drains away from the proposed structures and avoids adjacent zones with different undercut depths that may impair subsurface drainage.

EXCAVATION CHARACTERISTICS: Based on our findings, it is our opinion that the bulk of the granitic rock to be encountered during grading for the proposed development will likely be rippable with heavy construction equipment. However, excavations into the very dense granitic rock utilizing light trenching equipment may be difficult. Occasional hard rock floaters maybe encountered. Furthermore, hardrock boulders will require special handling as described in hereinafter.

OVERSIZED ROCK: Oversized rock is defined as rock exceeding 6 inches in maximum dimension. Oversized rock was observed at the site. Oversized rock may be broken into smaller pieces, utilized for landscaping purposes or placed in accordance with the recommendations contained in the “Compaction and Method of Filling” section of this report, Plate No. 3, or City of Escondido specifications, whichever are more stringent. Due to the relative limited extent of most of the proposed fills, it is anticipated that oversized rock placement in proposed fills will be very limited.

FILL SLOPE KEYWAY: In areas to support the fill slopes, a key should be cut into the granitic rock. Where the proposed fill slopes are less than 10 feet high, the keyway should be at least 5 feet wide. Where the proposed fill slopes are higher than 10 feet high, the keyway should be at least 12 feet wide. The keyway should be sloped back into the hillside at least 2 percent and should extend at least 1 foot into the granitic rock. Where the existing ground has a slope of 5:1 (horizontal to vertical) or steeper, it should be benched into as the fill extends upward from the keyway. A keyway detail is provided on Plate No. 4.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 12 inches, watered thoroughly, and compacted to at least 90 percent relative compaction. In areas to support fill slopes, keys should be cut into the competent supporting materials. The keys should be at least 10 feet wide, and be sloped back into the hillside at least 2 percent. The keys should extend at least 1 foot into the competent supporting materials. Where the existing ground has a slope of 5:1 (horizontal to vertical) or steeper, it should be benched into as the fill extends upward from the keyway.

COMPACTION AND METHOD OF FILLING: In general, all structural fill placed at the site should be compacted to a relative compaction of at least 90 percent of its maximum laboratory dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts 6 to 8 inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by the Geotechnical Consultant. Fill material should be free of rocks or lumps of soil in excess of 3 inches in maximum dimension.

Utility trench backfill within 5 feet of the proposed structure and beneath all concrete flatwork or pavements should be compacted to a minimum of 90 percent of its maximum dry density.

SURFACE DRAINAGE: The drainage around the proposed improvements should be designed to collect and direct surface water away from proposed improvements and the top of slopes toward appropriate drainage facilities. Rain gutters with downspouts that discharge runoff away from the structure and the top of slopes into controlled drainage devices are recommended.

The ground around the proposed improvements should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structure slope away at a gradient of at least 5 percent for a minimum distance of 10 feet. If the minimum distance of 10 feet cannot be achieved, an alternative method of drainage runoff away from the building at the termination of the 5 percent slope will need to be used. Swales and impervious surfaces that are located within 10 feet of the building should have a minimum slope of 2 percent.

Drainage patterns provided at the time of construction should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Over watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

CUT SLOPES: Cut slopes should be constructed at a minimum 2:1 (horizontal to vertical) or flatter inclination. Cut slopes should be observed by the engineering geologist to ascertain that no unforeseen adverse conditions are encountered.

FILL SLOPES: Fill slopes should be constructed at a minimum 2:1 (horizontal to vertical) or flatter inclination. Fill slopes should be compacted by back-rolling with a sheepsfoot compactor at vertical intervals not exceeding 4 feet in vertical dimension as the fill is being placed. The face of fill slopes should also be track-walked when the slope is completed. As an alternative, fill slopes can be overfilled by at least three feet and cut back to the compacted core at the design finish contour. We should be contacted during site grading and construction to evaluate the necessity of subdrains in the keyways of proposed fill or fill over cut slopes.

EROSION CONTROL: The prevailing on-site soils consist of silty sands and slightly silty sands with relatively high erosion potential. Slopes should be planted as soon as feasible after grading. Sloughing, deep riling and slumping of surficial soils may be anticipated if slopes are left unplanted for a long period of time, especially during the rainy season. Irrigation of slopes should be carefully monitored to ensure that only the minimum amount necessary to sustain plant life is used. Over-irrigating could be extremely erosive and should be avoided.

GRADING PLAN REVIEW: The grading plans should be submitted to this office for review in order to ascertain that the recommendations contained in this report have been implemented, and that no additional recommendations are needed due to the proposed grading.

FOUNDATIONS

GENERAL: Based on our findings and engineering judgment, the proposed structures and associated improvements may be supported by conventional shallow continuous and isolated spread footings. The following recommendations are considered the minimum based on the anticipated soil conditions, and are not intended to be lieu of structural considerations. All foundations should be designed by a qualified engineer.

DIMENSIONS: Spread footings supporting proposed one and two-story structures should be embedded at least 12 inches and 18 inches below lowest adjacent finish pad grade, respectively. Spread footings supporting light exterior improvements should be embedded at least 12 inches below lowest adjacent finish pad grade. Continuous and isolated footings should have a minimum width of 12 inches and 24 inches, respectively. Retaining wall footings should be at least 18 inches deep and 24 inches wide. Footings located adjacent or within slopes should also extend to a doeth such that a minimum horizontal distance of 10 feet exists between the face of the slope and the bottom of the footing.

BEARING CAPACITY: Spread footings supporting the proposed structures and associated improvements with a minimum depth and width of 12 inches may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). This value may be increased by 600 pounds per square foot for each additional foot of embedment and 400 pounds per square foot for each additional foot of width up to a maximum of 4,000 pounds per square foot. These values may be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOOTING REINFORCING: Reinforcement requirements for foundations should be provided by the structural designer. However, based on the expected soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least 2 No. 5 bars positioned near the bottom of the footing and 2 No. 5 bars positioned near the top of the footing.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.35. The passive resistance may be considered to be equal to an equivalent fluid weight of 350 pounds per cubic foot. These values are based on the assumption that the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

FOUNDATION EXCAVATION OBSERVATION: All footing excavations should be observed by Christian Wheeler Engineering prior to placing of forms and reinforcing steel to determine whether the foundation recommendations presented herein are followed and that the foundation soils are as anticipated in the preparation of this report. All footing excavations should be excavated neat, level, and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential settlement is expected to be less than about 1 inch and 1 inch over 40 feet, respectively, provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to concrete shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

EXPANSIVE CHARACTERISTICS: Provided the site preparation recommendations described in this report are implemented, the prevailing foundation soils are assumed to have a low expansive potential (EI between 21 and 50). The recommendations within this report reflect these conditions.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

CORROSION: The water-soluble sulfate content and water-soluble chloride of a selected soil sample from the site was determined in accordance with California Test Method 417 and California Test Method 422, respectively. The pH and resistivity were determined in accordance with California Test Method 643. Test results are presented in Appendix B.

It should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our corrosion testing should only be used as a guideline to determine if additional testing and analysis is necessary.

SEISMIC DESIGN FACTORS

The seismic design factors applicable to the subject site are provided below. The seismic design factors were determined in accordance with the 2019 California Building Code. The site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters are presented in the following Table I.

TABLE I: SEISMIC DESIGN FACTORS

Site Coordinates: Latitude Longitude	33.093° -117.095°
Site Class	C
Site Coefficient F_a	1.2
Site Coefficient F_v	1.5
Spectral Response Acceleration at Short Periods S_s	0.9871g
Spectral Response Acceleration at 1 Second Period S_1	0.32 g
$S_{MS}=F_aS_s$	1.046 g
$S_{M1}=F_vS_1$	0.48 g
$S_{DS}=2/3*S_{MS}$	0.697 g
$S_{D1}=2/3*S_{M1}$	0.32 g

Probable ground shaking levels at the site could range from slight to moderate, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed improvements.

ON-GRADE SLABS

GENERAL: It is our understanding that the floor system of the structures will consist of a concrete slab. The following recommendations are considered the minimum slab requirements based on the soil conditions and are not intended in lieu of structural considerations. These recommendations assume that the site preparation recommendations contained in this report are implemented.

INTERIOR FLOOR SLABS: The minimum slab thickness should be 4 inches (actual) and the slab should be reinforced with at least No. 3 bars spaced at 18 inches on center each way. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. The slab reinforcement should extend down into the perimeter footings at least 6 inches.

UNDER-SLAB VAPOR RETARDERS: The following recommendations apply to conventional slabs-on-grade. Steps should be taken to minimize the transmission of moisture vapor from the subsoil through the interior slabs where it can potentially damage the interior floor coverings. Local industry standards typically include the placement of a vapor retarder, such as plastic, in a layer of coarse sand placed directly beneath the concrete slab. Two inches of sand are typically used above the plastic. In this case it is further recommended that the plastic be underlain by a 6-inch-thick gravel layer placed over filter fabric such as Mirafi 140N or equivalent. The vapor retarder should be at least 15-mil Stegowrap® or similar material with sealed seams and should extend at least 12 inches down the sides of the interior and perimeter footings. The sand should have a sand equivalent of at least 30, and contain less than 10% passing the Number 100 sieve and less than 5% passing the Number 200 sieve. The membrane should be placed in accordance with the recommendation and consideration of ACI 302, "Guide for Concrete Floor and Slab Construction" and ASTM E1643, "Standards Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under Concrete Slabs." It is the flooring contractor's responsibility to place floor coverings in accordance with the flooring manufacturer specifications.

EXTERIOR CONCRETE FLATWORK: Exterior concrete slabs on grade should have a minimum thickness of 4 inches and be reinforced with at least No. 3 bars placed at 18 inches on center each way (ocew). Driveway slabs should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 12 inches ocew. Driveway slabs should be provided with a thickened edge a least 12 inches deep and 6 inches wide. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

EARTH RETAINING WALLS

FOUNDATIONS: Foundations for any proposed retaining walls should be constructed in accordance with the foundation recommendations presented previously in this report.

PASSIVE PRESSURE: The passive pressure for the anticipated foundation soils may be considered to be 350 pounds per square foot per foot of depth. The upper foot of embedment should be neglected when calculating passive pressures, unless the foundation abuts a hard surface such as a concrete slab. The passive pressure may be increased by one-third for seismic loading. The coefficient of friction for concrete to soil may be assumed to be 0.35 for the resistance to lateral movement. When combining frictional and passive resistance, the friction should be reduced by one-third.

ACTIVE PRESSURE: The lateral soil pressure for the design of unrestrained earth retaining structures with level backfill may be assumed to be equivalent to the pressure of a fluid weighing 35 pounds per cubic foot (pcf). An additional 17 (pcf) should be added to the above value for a 2:1 (horizontal to vertical) sloping backfill condition. These pressures do not consider any other surcharge. If any are anticipated, this office should be contacted for the necessary increase in soil pressure. These values are based on a drained, non-detrimentally expansive backfill condition.

Seismic lateral earth pressures on restrained and unrestrained retaining walls may be assumed to equal an inverted triangle starting at the bottom of the wall with the maximum pressure equal to 7.3H pounds per square foot (where H = wall height in feet) occurring at the top of the wall.

WATERPROOFING AND WALL DRAINAGE SYSTEMS: The need for waterproofing should be evaluated by others. If required, the project architect should provide (or coordinate) waterproofing details for the retaining walls. The design values presented above are based on a drained backfill condition and do not consider hydrostatic pressures. Unless hydrostatic pressures are incorporated into the design, the retaining wall designer should provide a detail for a wall drainage system. Typical retaining wall drain system details are presented as Plate No. 5 of this report for informational purposes. Additionally, outlet points for the retaining wall drain system should be coordinated with the project civil engineer.

BACKFILL: Retaining wall backfill soils should be compacted to at least 90 percent relative compaction. Expansive or clayey soils should not be used for backfill material. The wall should not be backfilled until the masonry has reached an adequate strength.

PERMEABLE PAVERS

It is recommended that existing potentially compressible fill soils and topsoil underlying proposed pavers be removed in their entirety. Lateral removal limits should extend at least 2 feet from the perimeter of the pavers and paver installation should adhere to the manufacture's specifications. Prior to placing the crushed rock material, the subgrade soils should be scarified to a depth of 12 inches, moisture-conditioned and compacted to at least 95 percent of its maximum dry density as determined in accordance to ASTM D 1557. Geogrid material such as Tensar TX130S or equivalent is recommended under the crushed rock portion of the paver sections to support vehicular traffic and is optional under the pedestrian areas. Underdrains are also recommended in the paver design. The underdrains should be perforated below the paver area, at least 3 inches in diameter, and connected to a proper outlet. We also recommend that deepened concrete curbs be poured along the edge of the proposed pavers and that the curbs extend at least 12 inches below the bottom of the subgrade rock storage section. For pervious paver areas located adjacent to foundations, we recommend that the foundations extend at least 12 inches below the bottom of the subgrade rock storage section.

LIMITATIONS

REVIEW, OBSERVATION AND TESTING

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the geotechnical engineer and engineering geologist so that they may review and verify their compliance with this report and with the California Building Code.

It is recommended that Christian Wheeler Engineering be retained to provide continuous soil engineering services during the earthwork operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the geotechnical engineer so that he may make modifications if necessary.

CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

TIME LIMITATIONS

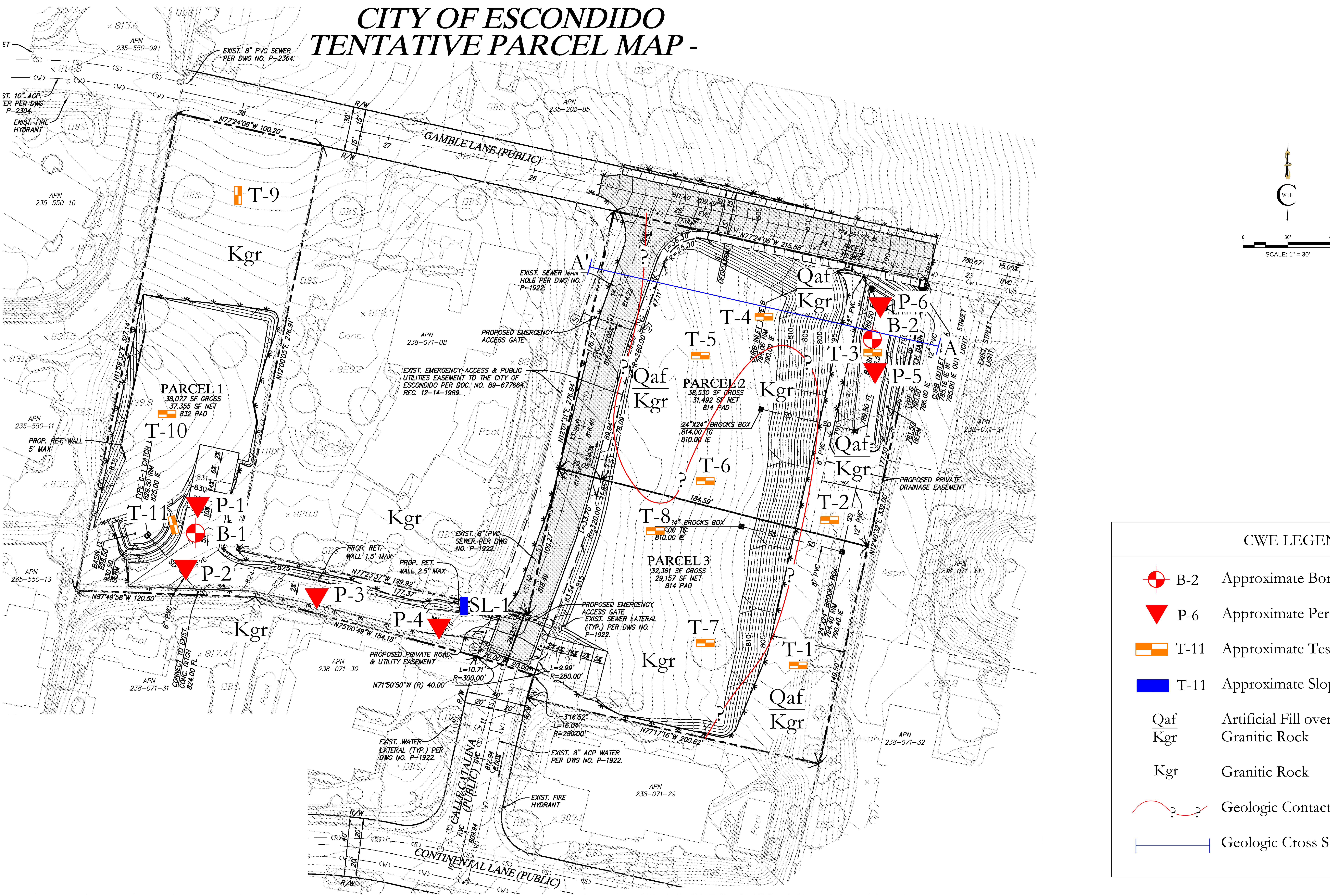
The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Government Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations be based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the Client, or its representatives, to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer and architect for the project and incorporated into the project's plans and specifications. It is further their responsibility to take the necessary measures to ensure that the contractor and his subcontractors carry out such recommendations during construction.



CWE LEGEND

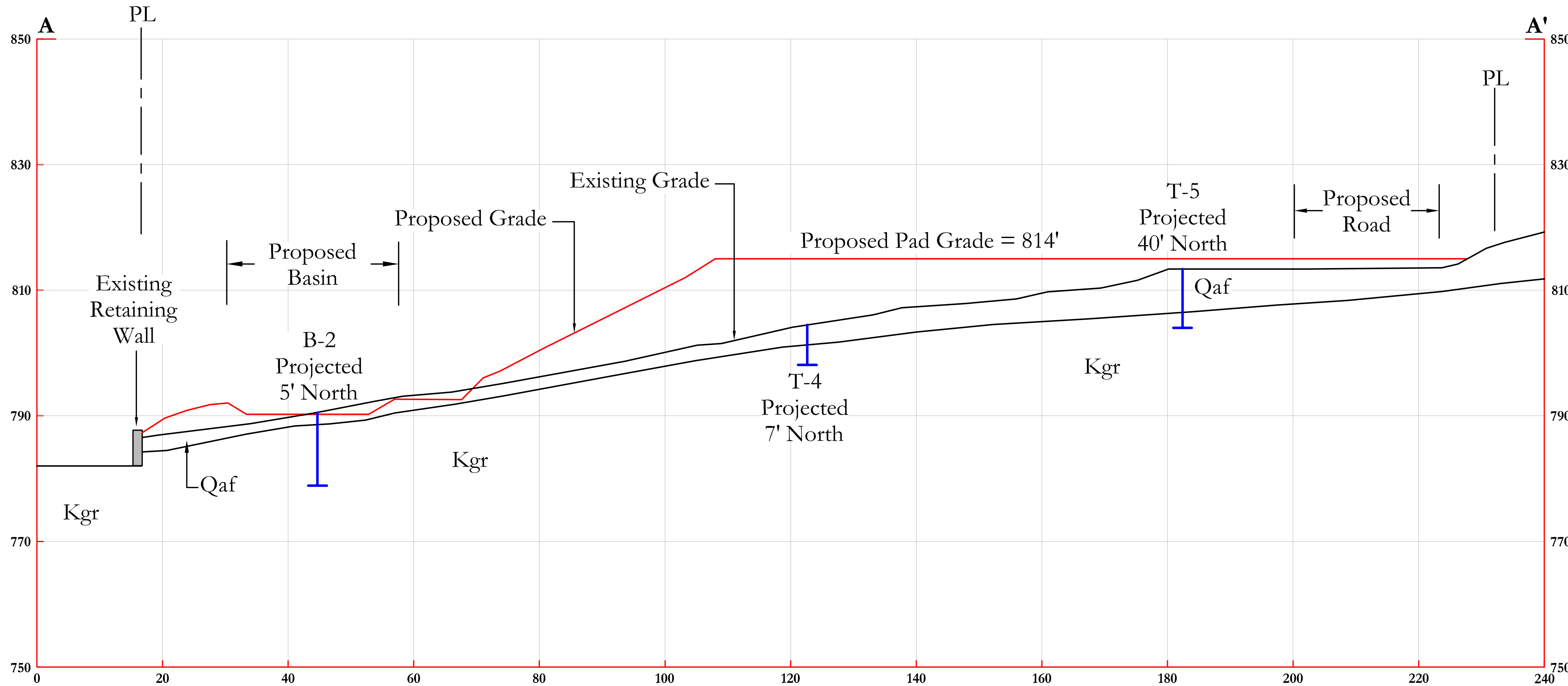
B-2	Approximate Boring Location
P-6	Approximate Percolation Test Location
T-11	Approximate Test Trenches (2009)
T-11	Approximate Slope Log (2009)
Qaf / Kgr	Artificial Fill over Granitic Rock
Kgr	Granitic Rock
	Geologic Contact (Queried where Inferred)
	Geologic Cross Section

SITE PLAN AND GEOTECHNICAL MAP

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

DATE:	MARCH 2022	JOB NO.:	2220070.01
BY:	SD	PLATE NO.:	1

CHRISTIAN WHEELER ENGINEERING



CWE LEGEND	
Qaf	Artificial Fill
Kgr	Granitics
Note: Topsoils Not Mapped	

0 20' 40'

SCALE: 1" = 20'

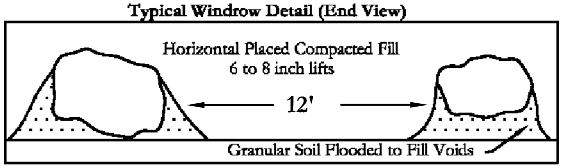
GEOLOGIC CROSS SECTION A-A'

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

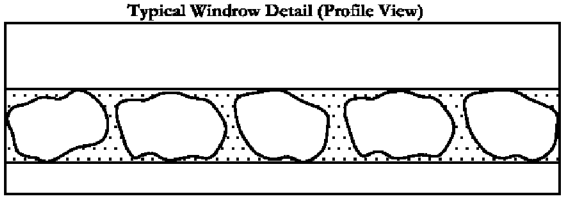
DATE:	MARCH 2022	JOB NO.:	2220070.01
BY:	SD	PLATE NO.:	2

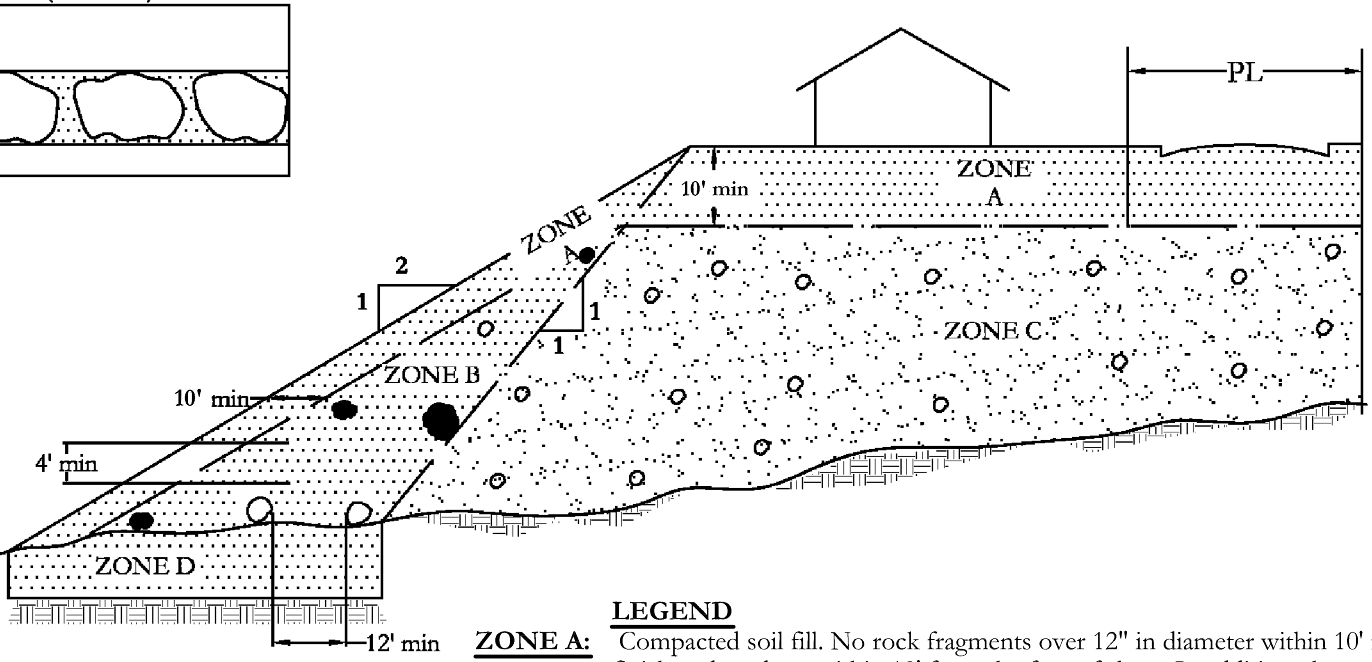
CHRISTIAN WHEELER ENGINEERING

Typical Window Detail (End View)



Typical Window Detail (Profile View)





LEGEND

ZONE A: Compacted soil fill. No rock fragments over 12" in diameter within 10' from finish pad grade or within 10' from the face of slope. In addition, the upper 3' of fill beneath the building pad should have no rock fragments over 6" in diameter.

ZONE B: Rocks 2 to 4 feet in maximum dimension placed in windows surrounded by compacted soil fill conforming to ZONE A.

ZONE C: Rocks 6 inches to 2 feet in maximum dimension uniformly distributed and well spaced in compacted soil fill conforming to ZONE A.

ZONE D: Required for all existing slopes 6:1 and steeper, 90% maximum compaction. ZONE A or C material may be used for ZONE D.

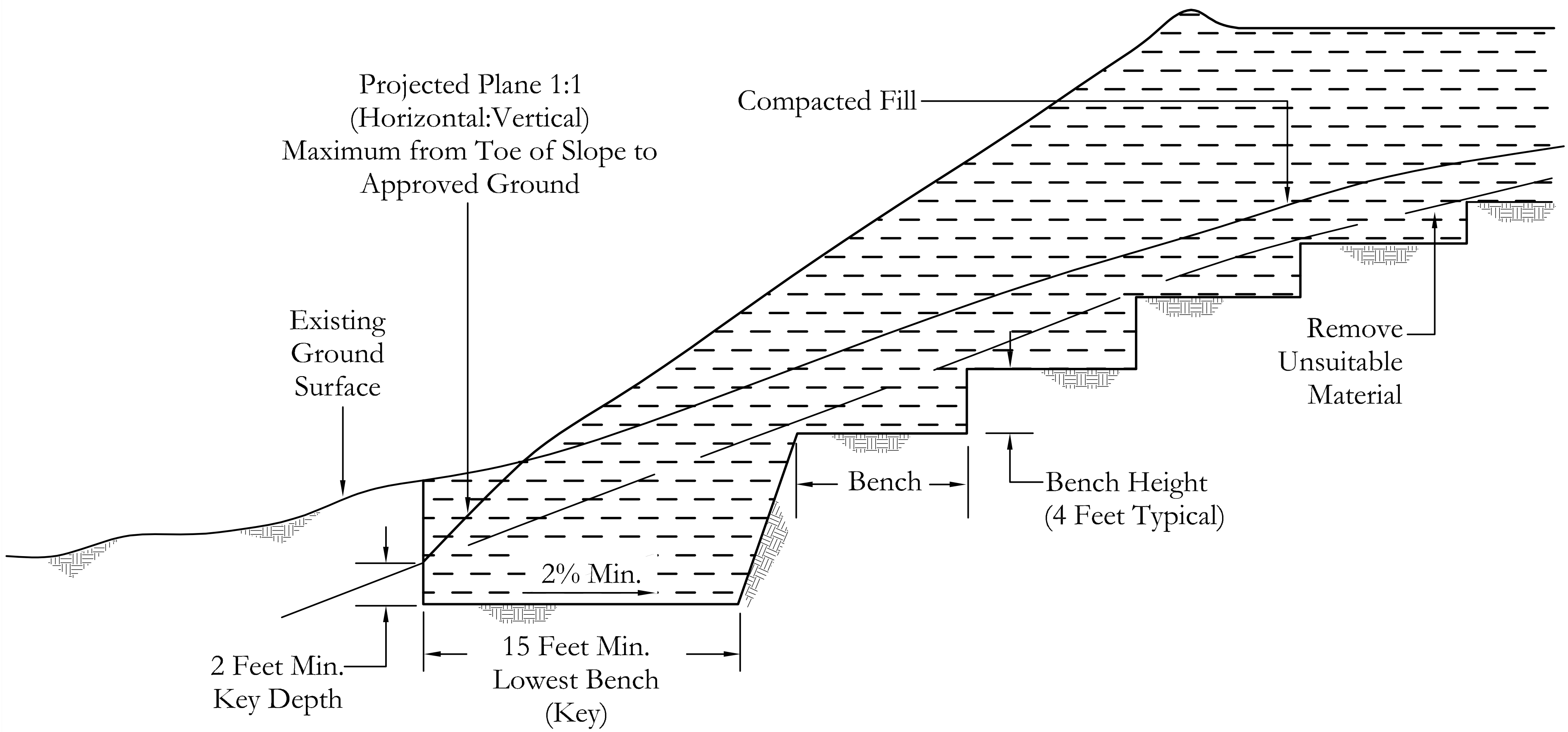
NOTES

1. Compacted soil fill shall contain at least 40 percent soil sizes passing 3/4 inch sieve, (by weight), and be compacted in accordance with specifications for structural fill.
2. Rocks over 4 feet in maximum dimension not permitted in fill.

OVERSIZED ROCK DISPOSAL

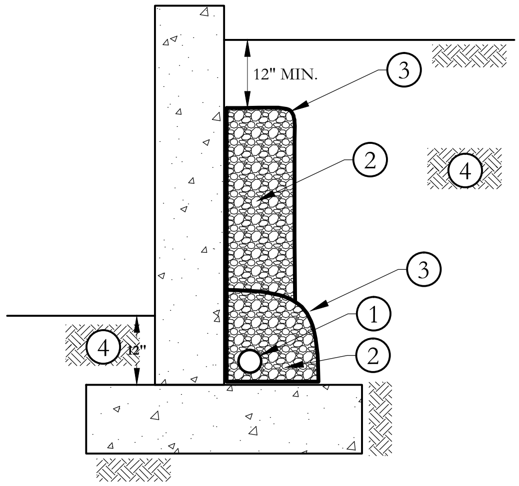
CALLE CATALINA SUBDIVISION CALLE CATALINA AND GAMBLE LANE ESCONDIDO, CALIFORNIA	
DATE: MARCH 2022	JOB NO.: 2220070.01
BY: SD	PLATE NO.: 3

CHRISTIAN WHEELER
ENGINEERING

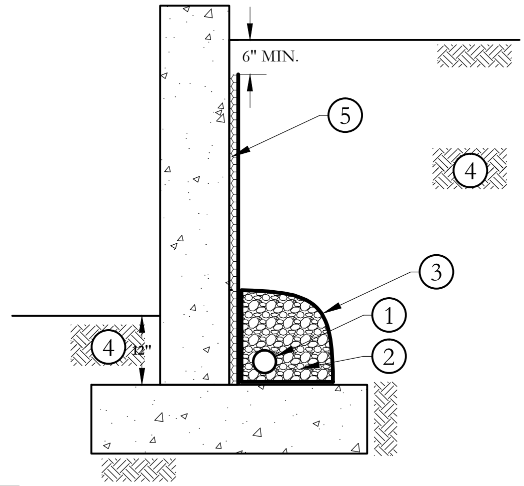


NO SCALE

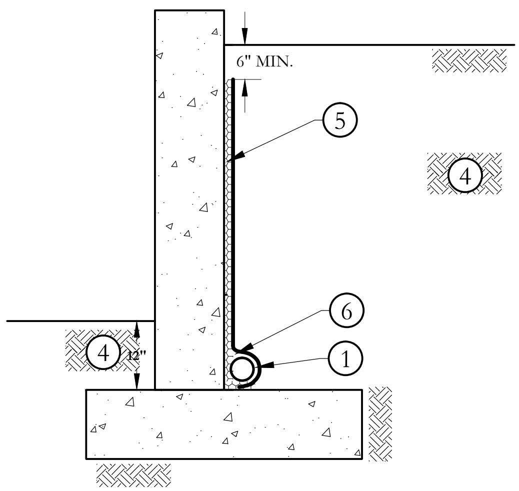
FILL SLOPE KEYWAY DETAIL	**CALLE CATALINA SUBDIVISION** **CALLE CATALINA AND GAMBLE LANE** **ESCONDIDO, CALIFORNIA**		CHRISTIAN WHEELER ENGINEERING
	DATE: MARCH 2022	JOB NO.: 2220070.01	
	BY: SD	PLATE NO.: 4	



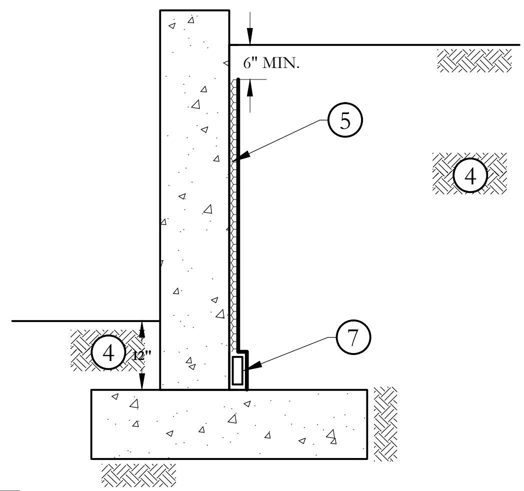
1 DETAIL



2 DETAIL



3 DETAIL



4 DETAIL

NOTES AND DETAILS

GENERAL NOTES:

1) THE NEED FOR WATERPROOFING SHOULD BE EVALUATED BY OTHERS.
2) WATERPROOFING TO BE DESIGNED BY OTHERS (CWE CAN PROVIDE A DESIGN IF REQUESTED).
3) EXTEND DRAIN TO SUITABLE DISCHARGE POINT PER CIVIL ENGINEER.
4) DO NOT CONNECT SURFACE DRAINS TO SUBDRAIN SYSTEM.

DETAILS:

1. 4-INCH PERFORATED PVC PIPE ON TOP OF FOOTING, HOLES POSITIONED DOWNWARD (SDR 35, SCHEDULE 40, OR EQUIVALENT).
2. ¾ INCH OPEN-GRADED CRUSHED AGGREGATE.
3. GEOFARBRIC WRAPPED COMPLETELY AROUND ROCK.
4. PROPERLY COMPACTED BACKFILL SOIL.
5. WALL DRAINAGE PANELS (MIRADRAIN OR EQUIVALENT) PLACED PER MANUFACTURER'S REC'S.
6. UNDERLAY SUBDRAIN WITH AND CUT FABRIC BACK FROM DRAINAGE PANELS AND WRAP FABRIC AROUND PIPE.
7. COLLECTION DRAIN (TOTAL DRAIN OR EQUIVALENT) LOCATED AT BASE OF WALL DRAINAGE PANEL PER MANUFACTURER'S RECOMMENDATIONS.

CANTILEVER RETAINING WALL DRAINAGE SYSTEMS

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

DATE:	MARCH 2022	JOB NO.:	2220070.01
BY:	SD	PLATE NO.:	5

CHRISTIAN WHEELER
ENGINEERING

Appendix A

Subsurface Explorations

LOG OF TEST BORING B-1

Date Logged:	2/17/22	Equipment:	IR A-300
Logged By:	AJC/DJF	Auger Type:	140lbs @ 30" drop
Existing Elevation:	Unknown	Drive Type:	N/A
Finish Elevation:	Unknown	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil:** Light brown to reddish-brown, damp, loose, very fine- to medium-grained, SILTY SAND, porous, with rootlets.							
1			SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, medium dense, very fine- to coarse-grained, SILTY SAND, extremely weathered up to 3 feet.							
3			SW-SM	Light gray to reddish-brown, moist, very dense, fine- to coarse-grained, well-graded SAND/SILTY SAND, porphontic, micaceous.							
4					50/6"	SPT					SO4 Chl Res
6					50/4"	SPT					
10					50/6"	SPT					
15				Boring terminated at 15 feet. No groundwater or seepage encountered.	50/3"	SPT					

Notes:

Symbol Legend

- ∇ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

DATE:	MARCH 2022	JOB NO.:	2220070.01
BY:	SD	APPENDIX:	A-1

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	2/17/22	Equipment:	IR A-300
Logged By:	AJC/DJF	Auger Type:	140lbs @ 30" drop
Existing Elevation:	Unknown	Drive Type:	N/A
Finish Elevation:	Unknown	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Light brown, moist, loose, fine- to coarse-grained, SILTY SAND, some roots.							
3			SW-SM	**Weathered Granitics (Kgr):** Light brown to light gray, moist, medium dense, fine- to coarse-grained, well-graded SAND-SILTY SAND, porphontic, micaceous.							
5				Very dense.							
8				Refusal at 8' on hard rock. Boring moved 8' west.							
12				Boring terminated at 12 feet. No groundwater or seepage encountered.							
13											
14											
15											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

DATE:	MARCH 2022	JOB NO.:	2220070.01
BY:	SD	APPENDIX:	A-2

CHRISTIAN WHEELER ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.

b) **SOLUBLE SULFATE CONTENT:** The soluble sulfate content of a representative sample was determined in accordance with California Test Methods 417.

c) **SOLUBLE CHLORIDE CONTENT:** The soluble chloride content of a representative sample was determined in accordance with California Test Methods 422.

d) **pH and RESISTIVITY:** The pH and Resistivity of a representative sample was determined in accordance with California Test Methods 643.

CORROSIVITY TESTS

Sample No.	CALTEST 643		CALTEST 417	CALTEST 422
	Resistivity (ohm-cm)	pH	Sulfate Content (% SO_4)	Chloride Content (%)
B-1 @10'-15'	7,900	7.4	0.003	0.001

CORROSIVITY STANDARDS

Building Code Requirements for Structural Concrete (ACI 318-11)
Table 4.2.1 Exposure Categories and Classes & Table 4.3.1 Requirements for Concrete by Exposure Class

Severity	Water-Soluble Sulfate in Soil Percentage by Weight	Cementitious Materials- Types (ASTM C150)	Maximum Water-cementitious Material Ratio (w/cm)	Minimum F'c, psi
Not Applicable	$SO_4 < 0.10$	No Type Restriction	N/A	2500
Moderate	$0.10 \leq SO_4 < 0.20$	II	0.50	4000
Severe	$0.20 \leq SO_4 \leq 2.00$	V	0.45	4500
Very Severe	SO4 > 2.00	V+ Pozzolan or Slag	0.45	4500

* See ACI 318-11 for exceptions and additional requirements

California Department of Transportation (DOT), Division of Engineering Services
Material Engineering and Testing, Corrosion and Structural Concrete, Field Investigation Branch
Corrosion Guidelines, Version 2.1, January 2015

Corrosive Environment	Resistivity (ohm-cm)	pH	Soluble Sulfate (%)	Chloride (%)
	<1000 *	**<5.5**	**>0.2**	**>0.05**

*Soil and water that have a minimum resistivity equal to or less than, 1,000 ohm-cm
are required to be tested by a certified lab for chlorides and sulfates per CT417 and CT422.

For structural elements, the DOT considers a site to be corrosive if one or more of the conditions (pH, sulfate concentration, or chloride concentation) exists for the soil and/or water samples taken at the site.

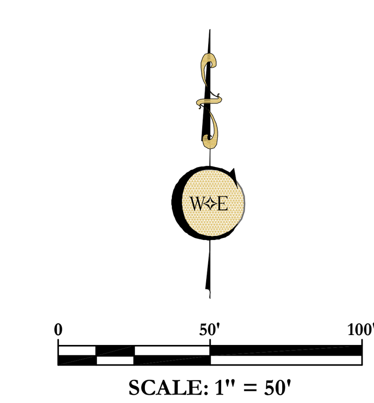
	CALLE CATALINA SUBDIVISION CALLE CATALINA AND GAMBLE LANE, ESCONDIDO,CALIFORNIA			
	BY: DBA	DATE: March 2022	REPORT NO.:2220070.01	Plate N. B-2

Appendix C

Data From Report CWE 2090482.01

CWE LEGEND

Qaf/Kgr	ARTIFICIAL FILL UNDERLAIN BY GRANITIC ROCK
Kgr	GRANITIC ROCK
T-15	APPROXIMATE TEST TRENCH LOCATION
SL-1	APPROXIMATE SLOPE LOG LOCATION
	GEOLOGIC CONTACT
	SURFACE BOULDERS



SITE PLAN AND GEOTECHNICAL MAP

PROPOSED SIX RESIDENTIAL LOTS

DATE:	November 2009	JOB NO.:	2090482.01
BY:	CHC/DBA/MAH	PLATE NO.:	1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-1 (East)

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	796 feet	Drive Weight:	N/A
Proposed Elevation:	814 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	796		SM	**Artificial Fill (Qaf):** Brown, damp, loose, SILTY SAND, fine to coarse-grained, porous.							
2	794		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 3½ feet.							
4	792		SW-SM	Light gray, damp, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, micaceous, porphoritic.							
				Test Trench terminated at 4½ feet. No water or seepage encountered.							
6	790										
8	788										
10	786										
12	784										
14	782										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	2

LOG OF TEST TRENCH T-1 (West)

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	804 feet	Drive Weight:	N/A
Proposed Elevation:	814 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	804		SM	**Artificial Fill (Qaf):** Light brown to reddish-brown, dry, loose to medium dense, SILTY SAND, fine to coarse-grained. Upper 2 feet porous with rootlets.		CK					
2	802			Moist, medium dense.		CK		4.2	120.7		
4	800			Light gray.							
6	798		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 7½ feet.		CK		5.0	119.7		
8	796		SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, micaceous, porphoritic.		CK					
10	794			Test Trench terminated at 9 feet. No water or seepage encountered.							
12	792										
14	790										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	3

LOG OF TEST TRENCH T-2

Sample Type and Laboratory Test Legend

Cal Modified California Sampler; CK Chunk Sample
SPT Standard Penetration Test; DR Density Ring
ST Shelby Tube

MD Maximum Density; DS Direct Shear
SO4 Soluble Sulfates; Con Consolidation
SA Sieve Analysis; EI Expansion Index
HA Hydrometer; R-Val Resistance Value
SE Sand Equivalent; Chl Soluble Chlorides
PI Plasticity Index; Res pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	794 feet	Drive Weight:	N/A
Proposed Elevation:	812 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	794		SM	**Artificial Fill (Qaf):** Light brown to light grayish-brown, dry, loose to medium dense, SILTY SAND, fine to coarse-grained, porous.		CK					
2	792		SM	**Weathered Granitics (Kgr):** Reddish-brown to brown, damp, dense, SILTY SAND, fine to coarse-grained. Deeply weathered, porphoritic, micaceous.		CK					
				Brown, very dense.		CK		3.7	126.8		
4	790										
				Test Trench terminated at 4½ feet. No water or seepage encountered.							
6	788										
8	786										
10	784										
12	782										
14	780										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	4

LOG OF TEST TRENCH T-3

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	790 feet	Drive Weight:	N/A
Proposed Elevation:	810 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	790		SM	**Artificial Fill (Qaf):** Light brown to brown, damp, loose to medium dense, SILTY SAND, fine to coarse-grained.		CK					
2	788		SW-SM	**Weathered Granitics (Kgr):** Light brown to light gray, moist, dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained. Deeply weathered to 5 feet, porphoritic, micaceous.		CK		5.3	127.4		
4	786										
				Very dense.		CK					
6	784			Test Trench terminated at 6 feet. No water or seepage encountered.							
8	782										
10	780										
12	778										
14	776										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	5

LOG OF TEST TRENCH T-4

Sample Type and Laboratory Test Legend

Cal Modified California Sampler — CK Chunk Sample
SPT Standard Penetration Test — DR Density Ring
ST Shelby Tube

MD Maximum Density — DS Direct Shear
SO4 Soluble Sulfates — Con Consolidation
SA Sieve Analysis — EI Expansion Index
HA Hydrometer — R-Val Resistance Value
SE Sand Equivalent — Chl Soluble Chlorides
PI Plasticity Index — Res pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	803 feet	Drive Weight:	N/A
Proposed Elevation:	810 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	803		SM	**Artificial Fill (Qaf):** Light brown, dry, loose, SILTY SAND, very fine to coarse-grained, with AC debris.							
2	801										
			SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, fine to medium-grained, porous, with rootlets.							
4	799		SM	**Weathered Granitics (Kgr):** Brown to reddish-brown, moist, dense, SILTY SAND, very fine to coarse-grained. Extremely weathered up to 5 feet.		CK		8.5	119.5		
			SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, porphoritic, micaceous.							
6	797			Test Trench terminated at 6 feet. No water or seepage encountered.							
8	795										
10	793										
12	791										
14	789										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	6

LOG OF TEST TRENCH T-5

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	812 feet	Drive Weight:	N/A
Proposed Elevation:	810 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	812		SM	**Artificial Fill (Qaf):** Light brown to light grayish-brown, dry, loose, SILTY SAND, very fine to medium-grained, with concrete debris in upper 3 feet.							SA MD DS
2	810										
				Brown.							
4	808										
6	806		SM	**Topsoil:** Reddish-brown, moist, loose, SILTY SAND, very fine to medium-grained, porous, friable.		CK					
8	804		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained, extremely weathered.		CK		9.5	114.3		
				Test Trench terminated at 9 feet. No water or seepage encountered.							
10	802										
12	800										
14	798										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	7

LOG OF TEST TRENCH T-6

Sample Type and Laboratory Test Legend

Cal Modified California Sampler; CK Chunk Sample
SPT Standard Penetration Test; DR Density Ring
ST Shelby Tube

MD Maximum Density; DS Direct Shear
SO4 Soluble Sulfates; Con Consolidation
SA Sieve Analysis; EI Expansion Index
HA Hydrometer; R-Val Resistance Value
SE Sand Equivalent; Chl Soluble Chlorides
PI Plasticity Index; Res pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	810 feet	Drive Weight:	N/A
Proposed Elevation:	812 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	810		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous, with abundant roots.							
2	808										
			SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 4½ feet.							
4	806										
			SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, porphoritic, micaceous.							
6	804			Test Trench terminated at 5½ feet. No water or seepage encountered.							
8	802										
10	800										
12	798										
14	796										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
E n g i n e e r i n g

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	8

LOG OF TEST TRENCH T-7

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	808 feet	Drive Weight:	N/A
Proposed Elevation:	814 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler
SPT Standard Penetration Test
ST Shelby Tube
CK Chunk Sample
DR Density Ring

MD Maximum Density
SO4 Soluble Sulfates
SA Sieve Analysis
HA Hydrometer
SE Sand Equivalent
PI Plasticity Index
DS Direct Shear
Con Consolidation
EI Expansion Index
R-Val Resistance Value
Chl Soluble Chlorides
Res pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	808		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous, with roots.							
2	806		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 3 feet.							
			SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, porphoritic, micaceous.							
4	804			Test Trench terminated at 4 feet. No water or seepage encountered.							
6	802										
8	800										
10	798										
12	796										
14	794										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	9

LOG OF TEST TRENCH T-8

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	814 feet	Drive Weight:	N/A
Proposed Elevation:	812 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	808		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous.							
2	806		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, very fine to coarse-grained. Extremely weathered up to 3 feet.		CK		4.0	111.1		
4	804		SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, porphoritic, micaceous.							
6	802			Test Trench terminated at 5 feet. No water or seepage encountered.							
8	800										
10	798										
12	796										
14	794										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	10

LOG OF TEST TRENCH T-9

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	822 feet	Drive Weight:	N/A
Proposed Elevation:	830 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler — CK Chunk Sample
SPT Standard Penetration Test — DR Density Ring
ST Shelby Tube

MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	822		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous, with roots.			X				
2	820		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, very fine to coarse-grained. Extremely weathered up to 4 feet.		CK		9.4	114.9		
4	818		SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, porphoritic, micaceous.							
6	816			Test Trench terminated at 5 feet. No water or seepage encountered.							
8	814										
10	812										
12	810										
14	808										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
E n g i n e e r i n g

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	11

LOG OF TEST TRENCH T-10

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	837 feet	Drive Weight:	N/A
Proposed Elevation:	830 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler
SPT Standard Penetration Test
ST Shelby Tube
CK Chunk Sample
DR Density Ring

MD Maximum Density
SO4 Soluble Sulfates
SA Sieve Analysis
HA Hydrometer
SE Sand Equivalent
PI Plasticity Index
DS Direct Shear
Con Consolidation
EI Expansion Index
R-Val Resistance Value
Chl Soluble Chlorides
Res pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	837		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous, with rootlets.							
2	835		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, medium dense to dense, SILTY SAND, very fine to coarse-grained. Extremely weathered up to 3 feet.		CK		3.9	108.7		
4	833		SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, porphoritic, micaceous.		CK					SA MD DS
6	831					CK		2.5	147.4		
8	829										
10	827			Test Trench terminated at 9 feet. No water or seepage encountered.							
12	825										
14	823										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	12

LOG OF TEST TRENCH T-11

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	830 feet	Drive Weight:	N/A
Proposed Elevation:	830 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	830		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous.							
2	828		SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 3 feet.		CK		4.5	122.4		
			SM	Very dense. At 4 feet becomes light gray.							
4	826			Test Trench terminated at 4 feet. No water or seepage encountered.							
6	824										
8	822										
10	820										
12	818										
14	816										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
E n g i n e e r i n g

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	13

LOG OF TEST TRENCH T-12

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	776 feet	Drive Weight:	N/A
Proposed Elevation:	790 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	776		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to coarse-grained, porous, with rootlets.							
2	774										
			SM	**Weathered Granitics (Kgr):** Light brown, damp, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 4½ feet.							
4	772					CK					
				Light gray, very dense.							
				Test Trench terminated at 5 feet. No water or seepage encountered.							
6	770										
8	768										
10	766										
12	764										
14	762										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	14

LOG OF TEST TRENCH T-13

Sample Type and Laboratory Test Legend

Cal Modified California Sampler · CK Chunk Sample
SPT Standard Penetration Test · DR Density Ring
ST Shelby Tube

MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	790 feet	Drive Weight:	N/A
Proposed Elevation:	790 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	790		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous, with rootlets.							
2	788		SM	**Weathered Granitics (Kgr):** Light brown to light reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 3½ feet.		CK		7.8	112.1		
4	786		SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, micaceous, porphoritic.		CK		5.0	133.0		
6	784			Test Trench terminated at 5 feet. No water or seepage encountered.							
8	782										
10	780										
12	778										
14	776										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	15

LOG OF TEST TRENCH T-14

Sample Type and Laboratory Test Legend

Cal Modified California Sampler CK Chunk Sample
SPT Standard Penetration Test DR Density Ring
ST Shelby Tube

MD Maximum Density DS Direct Shear
SO4 Soluble Sulfates Con Consolidation
SA Sieve Analysis EI Expansion Index
HA Hydrometer R-Val Resistance Value
SE Sand Equivalent Chl Soluble Chlorides
PI Plasticity Index Res pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	776 feet	Drive Weight:	N/A
Proposed Elevation:	780 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	776		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous.		CK					
2	774		SM	**Weathered Granitics (Kgr):** Brown, moist, dense to very dense, SILTY SAND WITH CLAY, very fine to medium-grained. Extremely weathered up to 5 feet.		CK		10.3	121.3		
4	772										
			SW-SM	Light gray, moist, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, micaceous, porphoritic.							
6	770										
				Test Trench terminated at 7 feet. No water or seepage encountered.							
8	768										
10	766										
12	764										
14	762										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
E n g i n e e r i n g

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	16

LOG OF TEST TRENCH T-15

Sample Type and Laboratory Test Legend

Cal Modified California Sampler | CK Chunk Sample
SPT Standard Penetration Test | DR Density Ring
ST Shelby Tube

MD Maximum Density | DS Direct Shear
SO4 Soluble Sulfates | Con Consolidation
SA Sieve Analysis | EI Expansion Index
HA Hydrometer | R-Val Resistance Value
SE Sand Equivalent | Chl Soluble Chlorides
PI Plasticity Index | Res pH & Resistivity

Date Excavated:	11/5/09	Equipment:	Komatsu PC78MR
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	786 feet	Drive Weight:	N/A
Proposed Elevation:	786 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	786		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous.							
2	784			Loose to medium dense.							
4	782		SW-SM	**Weathered Granitics (Kgr):** Light gray, damp, very dense, WELL GRADED SAND-SILTY SAND, fine to coarse-grained, porphoritic, micaceous.		CK		2.5	147.6		SA MD DS
6	780			Test Trench terminated at 5 feet. No water or seepage encountered.							
8	778										
10	776										
12	774										
14	772										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	17

LOG OF SLOPE SL-1

Date Excavated:	11/5/09	Equipment:	N/A
Logged by:	DJF	Bucket Size:	N/A
Existing Elevation:	824 feet	Drive Weight:	N/A
Proposed Elevation:	N/A	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler
SPT Standard Penetration Test
ST Shelby Tube
CK Chunk Sample
DR Density Ring

MD Maximum Density
SO4 Soluble Sulfates
SA Sieve Analysis
HA Hydrometer
SE Sand Equivalent
PI Plasticity Index
DS Direct Shear
Con Consolidation
EI Expansion Index
R-Val Resistance Value
Chl Soluble Chlorides
Res pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	824		SM	**Topsoil:** Light brown, dry, loose, SILTY SAND, very fine to medium-grained, porous.							
			SM	**Weathered Granitics (Kgr):** Reddish-brown, moist, dense, SILTY SAND, fine to coarse-grained. Extremely weathered up to 2½ feet.							
2	822										
			SW-SM	Light gray to reddish-brown, moist, very dense, WELL GRADED SAND-SILTY SAND, porphoritic, micaceous.							
4	820			Slope Log terminated at 4 feet (toe of slope). No water or seepage encountered.							
6	818										
8	816										
10	814										
12	812										
14	810										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SIX RESIDENTIAL LOTS
Continental Lane, Calle Catalina, & Gamble Lane, Escondido, California

BY:	HF	DATE:	November 30, 2009
JOB NO.:	2090482	PLATE NO.:	18

Appendix D

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REFERENCES

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Appendix E

Recommended Grading Specifications – General Provisions

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the preliminary geotechnical investigation report and/or the attached Special Provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

Christian Wheeler Engineering shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him appraised of work schedules, changes and new information and data so that he may provide these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations, the Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc., construction should be stopped until the conditions are remedied or corrected or he shall recommend rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D1557
Density of Soil In-Place - ASTM D1556 or ASTM D6938

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground which is defined as natural soil which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut to a firm competent formational soil. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two (2) percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities not to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary.

All water wells which will be abandoned should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3 feet below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report. When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction by sheepsfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cut-back to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper six inches should be compacted to at least 95 percent relative compaction.

EXPANSIVE SOILS: Detrimentally expansive soil is defined as clayey soil which has an expansion index of 50 or greater when tested in accordance with the Uniform Building Code Standard 29-2.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over 6 inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material are provided by the Geotechnical Engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.

Appendix F

Preliminary Storm Water Infiltration Feasibility Study

Percolation to Infiltration Rate Conversion (Porchet Method)

Worksheet C.4-1

NRCS Web Soil Survey Map

PRELIMINARY STORM WATER INFILTRATION FEASIBILITY STUDY

CALLE CATALINA SUBDIVISION
CALLE CATALINA AND GAMBLE LANE
ESCONDIDO, CALIFORNIA

We have prepared this feasibility study to address the potential for storm water infiltration at the subject site. In general, the purpose of our feasibility analysis is to provide design phase infiltration rates based on our borehole percolation tests and our subsurface explorations.

SITE AND PROJECT DESCRIPTION

The subject site is located at the northern terminus of Calle Catalina, in the City of Escondido, California. The property comprises 3 vacant parcels which are bounded to the north by Gamble Lane and on the remaining sides by developed residential properties and associated access roads. Parcels 2 and 3 are adjacent to one another, rectangular in shape, and located northeast of the terminus of Calle Catalina. Parcel 1 is separated from the other parcels a developed residential lot, flag shaped, and located northwest of the terminus of Calle Catalina. An approximately 30 foot wide portion of parcel 1 connects it to Calle Catalina and the other parcels. Topographically, the lots slope gently to the east. According to the tentative map, the average site elevation for the eastern lots is about 810 feet while the average site elevation for the western lot is about 835 feet.

We understand that the subject project will consist of the construction of three residential structures and the extension of Calle Catalina which will connect with Gamble Lane. It is anticipated that the structures will be one-and-two stories, of wood-frame construction, supported by conventional shallow foundations, and will incorporate conventional slabs-on-grade floor systems. Grading to accommodate the proposed construction will consist of cuts and fills up to about 8 feet and 15 feet from existing site grades, respectively. We understand that the storm water management facilities are to consist of biofiltration basins and permeable pavers.

FIELD INVESTIGATION

The subsurface explorations associated with this study consisted of 8-inch-diameter auger borings drilled by an Ingersol Rand A-300 truck mounted drill rig. Two borings were drilled to explore the subsurface soil conditions below the proposed BMPs and six borings were drilled for borehole percolation testing. The borings were drilled to supplement our previous (2009) subsurface explorations. The borings were logged in detail with emphasis on describing the soil profile. Low permeability and relatively impermeable materials were identified in the borings. No evidence of soil contamination was detected within the samples obtained. The approximate locations of these borings are shown on Plate No. 1 and logs of the explorations are presented in Appendix A.

GEOLOGIC SETTING AND SOIL DESCRIPTION: It was determined that the site is generally underlain by relatively thin veneer of artificial fill and/or topsoil which overlies granitic rock. As encountered in our borings the topsoil was approximately 1 to 3 feet thick and the artificial fill extends up to a depth of about 6 feet. These materials generally consisted of light brown, dry, loose, silty sand (SM). Below these materials granitic rock in various degrees of weathering was encountered. The granitic rock generally consisted of light gray, reddish-brown, and brown, moist, silty sand (SM) and well graded sand with silt (SW-SM). The upper 1 to 2 feet of the granitic rock was highly weathered and medium dense to dense. The granitic rock is very dense below said depth and practical refusal on unweather granitic rock was encountered in boring B-2 at depths ranging from 8 feet to 12 feet below existing grades. This unweathered granitic rock is considered impermeable and exists within 10 feet from the bottom of proposed biofiltration basin designated BMP C.

MAPPED HYDROLOGIC SOIL GROUP: According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the site is located in the map unit designated Fallbrook sandy loam (FaD2 and FaE2). Fallbrook sandy loam has a Hydrologic Soil Group rating of C which correlates to a slow infiltration rate when thoroughly wet. The findings from our subsurface explorations corroborate a Hydrologic Soil Group rating of C. The NRCS Web Soil Survey map for the subject site and corresponding map unit description are presented hereafter.

GROUNDWATER

No groundwater or seepage was encountered in our subsurface explorations. We have also reviewed available groundwater data in the vicinity of the site to determine the historic high groundwater elevation. The main resources utilized were Geotracker and California Department of Water Resources websites. A monitoring well (state well # 12S02W29H001S) located approximately 1 mile north of the site near West 11th street has recorded groundwater elevations to be between on elevation of 650 and 660 feet. The depth to seasonal high groundwater beneath the site is expected to fluctuate seasonally and is estimated to be as high as 100 feet below the existing site grades based on nearby monitoring well information. Based on this information we anticipate that seasonal high groundwater will not encroach within 10 feet of the base of the proposed BMPs.

INFILTRATION RATE DETERMINATION

FIELD MEASUREMENTS

Percolation testing was performed within 6 borings that were drilled within the proposed storm water infiltration areas at the site. The eight-inch-diameter borings, which are labelled as PT-1 through PT-6, were drilled to depths ranging from 42 inches to 60 inches below existing site grades. The approximate locations of the percolation borings are shown on Plate No. 1. Once cleaned of slough, a 3-inch diameter perforated pipe was set in the excavation and surrounded by ¾-inch gravel to prevent caving. After pipe installation, the percolation borings were presoaked.

The field percolation rates were determined the following day by using the falling head test method. It should be noted that no water remained within the borings from presoaking on the previous day. The initial water level was established by refilling the test holes and percolation rates were monitored and recorded every 30 minutes over a period of 6 hours until the infiltration rates stabilized. Measurements were taken using a water level meter (Solinst, Model 101) with an accuracy of measurement of 0.005 foot (0.06 inch). To account for the use of gravel placed around the perforated pipe, an adjustment factor of 0.51 was used in the calculations.

FACTOR OF SAFETY

The City of Escondido BMP Design Manual states that "a maximum factor of safety of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified. If the site passes the feasibility analysis at a factor of safety of 2.0, then infiltration must be investigated, but a higher factor of safety may be selected at the discretion of the design engineer." The average field infiltration rates, safety factor, and the design infiltration rates are presented in Table I.

TABLE I: INFILTRATION RATES

Test No.	Location	Soil Tested	Depth of Testing (Inches)	Tested Infiltration Rate (Inches per hour)	Average Tested Infiltration Rate	Average Infiltration Rate with a Safety Factor of 2 Applied
PT-1	BMP A1/A2	Kgr	36	0.19	0.17 inches per hour	0.08 inches per hour
PT-2	BMP A1/A2		48	0.21		
PT-3	BMP A2		42	0.04		
PT-4	BMP A2		42	0.24		
PT-5	BMP C		117	0.17	0.16 inches per hour	0.08 inches per hour
PT-6	BMP C		118	0.16		

Infiltration and percolation are two related but different processes describing the movement of moisture through soil. Lateral and downward movement of water into soil and porous or fractured rock is called percolation, and the downward entry of water into soil and porous or fractured rock is called infiltration. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases where an infiltration basin is similarly dimensioned to the borehole. As such, adjustments of the measured percolation rates were converted into infiltration rates using the Porchet Method. The spreadsheet used for the conversion is included hereafter.

POTENTIAL STORM WATER INFILTRATION HAZARDS

SETTLEMENT AND VOLUME CHANGE: Settlement and volume change can occur when water is introduced below grade. Settlement refers to a condition when soils decrease in volume (i.e. hydro collapse, calcareous soils, consolidation or liquefaction). Heave refers to expansion of soils or an increase in volume (i.e. expansive soils or frost heave). Based upon the soil conditions observed in our borings, the potential storm water infiltration areas will be underlain by granitic rock which has a very low potential for heave and hydro collapse.

SLOPE STABILITY: Infiltration of water has the potential to increase the risk of failure to nearby slopes. The BMP Design Manual recommends that infiltration BMPs be set back at least 50 feet from natural slopes (<25%) and at least a distance of 1.5H from the fill slopes where H is the height of the fill slope. The setbacks should be measured from the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.

Proposed biofiltration basin designated BMP A1 is located approximately 20 feet from a descending steep slope along the southerly property line. In our opinion, infiltrating storm water into BMP A1 will result in the migration of water towards the nearby slope. This could lead to possible slope instability and daylight water seepage. Due to these geotechnical concerns we recommend that BMP A1 be restricted from infiltration and have an impermeable liner as discussed in the conclusions and recommendations section below.

UTILITY CONSIDERATIONS: Utilities are either public or private infrastructure components that include underground pipelines, vaults, and wires/conduit, and above ground wiring and associated structures. Infiltration of water can pose a risk to subsurface utilities, or geotechnical hazards can occur within the utility trenches when water is introduced. We anticipate that the proposed BMP devices will be located at least 10 feet away from the existing and proposed utilities to prevent water migration into the utility trenches. If the utility trenches are not located at a sufficient distance away from the proposed BMP devices, vertical cut-off liners should be used to prevent groundwater infiltration into the utility trenches. Therefore, the risk of introducing water into a utility trench may be considered low.

GROUNDWATER MOUNDING: Groundwater mounding occurs when infiltrated water creates a rise in the groundwater table beneath the facility. Groundwater mounding can affect nearby subterranean structures and utilities. Based on the anticipated soil conditions below the proposed BMP devices, the risk of groundwater mounding below the BMP devices is anticipated to be negligible.

RETAINING WALLS AND FOUNDATIONS: Infiltration of water can result in potential increases in lateral pressures and potential reduction in soil strength. Retaining walls and foundations can be negatively impacted by these changes in soil conditions. The BMP manual recommends BMPs be setback at least 10 feet from foundations or settlement-sensitive improvements. The setback must be measured from the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.

The proposed biofiltration basin designated BMP C will be located above an existing retaining wall associated with a neighboring asphaltic concrete (AC) driveway to the northeast of parcel 2, see Plate No. 2. In our opinion, infiltrating storm water into BMP C will result in the migration of water behind and below the nearby retaining wall as well as into the pavement section for the driveway. Distress to the retaining wall and AC pavement from storm water infiltration could occur. Due to these geotechnical concerns, we recommend that BMP C be restricted from infiltration and have an impermeable liner as discussed conclusions and recommendations section below.

SOIL AND GROUNDWATER CONTAMINATION: Infiltration should be avoided in areas where infiltration could contribute to the movement or dispersion of soil or groundwater contamination or adversely affect ongoing clean-up efforts, either on site or down-gradient of the project. Based on the information found on http://geotracker.waterboards.ca.gov/, there are no sites with ongoing cleanup efforts located within 100 feet of the proposed BMPs.

SEPARATION TO SEASONAL HIGH GROUNDWATER: The depth to seasonal high groundwater beneath the site is expected to fluctuate seasonally and is estimated to be 100 feet below the existing site grades. Based on this information we anticipate that seasonal high groundwater will not encroach within 10 feet of the base of the proposed BMPs.

WELLHEAD PROTECTION: Wellheads, natural and man-made, are water resources that may potentially be adversely impacted by storm water infiltration through the introduction of contaminants or alterations in water supply and levels. Infiltration BMP devices must be located at a minimum of 100 feet horizontally from any water supply well. We have no knowledge of any water supply wells within 100 feet of the proposed BMP devices.

CONCLUSIONS AND RECOMMENDATIONS

Design infiltration rates within the weathered granitic rock fall into the "Partial Infiltration" category based on the limits presented in the current City of Escondido BMP Design Manual. However, infiltration restrictions have been identified for BMP A1 and BMP C. The design infiltration rate and infiltration restrictions are discussed below.

- Practical refusal on unweather granitic rock was encountered in boring B-2 at depths ranging from 8 feet to 12 feet below existing grades. This unweathered granitic rock is considered impermeable and exists within 10 feet from the bottom of proposed biofiltration basin designated BMP C. In addition, BMP C will be located above an existing retaining wall associated with a neighboring asphaltic concrete (AC) driveway (see Plate No. 2). In our opinion, infiltrating storm water into BMP C will result in the migration of water behind and below the nearby retaining wall as well as into the pavement section for the driveway. Distress to the retaining wall and AC pavement from storm water infiltration could occur. Due to these geotechnical concerns, we recommend that BMP C be restricted from infiltration and have an impermeable liner.

- The BMP Design Manual recommends that infiltration BMPs be set back at least 50 feet from natural slopes (<25%) and at least a distance of 1.5H from the fill slopes where H is the height of the fill slope. The setbacks should be measured from the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. The proposed biofiltration basin designated BMP A1 is located approximately 20 feet from a descending steep slope along the southerly property line. In our opinion, infiltrating storm water into BMP A1 will result in the migration of water towards the nearby slope. This could lead to possible slope instability and daylight water seepage. Due to these geotechnical concerns we recommend that BMP A1 be restricted from infiltration and have an impermeable liner.
- In order to mitigate the risk to acceptable levels, liners and underdrains are recommended in the design and construction of biofiltration basins designated BMP A1 and BMP C. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC). The underdrains should be perforated within the liner area, installed at the base and above the liner, be at least 3 inches in diameter and consist of Schedule 40 PVC pipe. The underdrains outside of the liner should consist of solid pipe. The penetration of the liners at the underdrains should be properly waterproofed. The underdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.
- Based on our findings, it is our opinion that passive infiltration within BMP A2 (pervious pavers) can be considered to possess a "Partial Infiltration" condition in accordance with Appendix C of the BMP Design Manual. The field infiltration rates in the area of BMP A2 were averaged and a default safety factor of 2.0 was applied in order to determine a design infiltration rate of 0.08 inches per hour. We have completed the Worksheet C.4-1: Categorization of Infiltration Feasibility Condition which is presented hereafter.
- Site preparations for the proposed pervious pavers should be performed in accordance with the attached Report of Preliminary Geotechnical Investigation and paver installation should adhere to the manufacturer's specifications. Prior to placing the crushed rock material, the subgrade soils should be scarified to a depth of 12 inches, moisture-conditioned and compacted to at least 95 percent of its maximum dry density as determined in accordance to ASTM D 1557. Geogrid material such as Tensar TX130S or equivalent is recommended under the crushed rock portion of the paver sections to support vehicular traffic and is optional under the pedestrian areas. Underdrains are also recommended in the paver design. The underdrains should be perforated below the paver area, at least 3 inches in diameter, and connected to a proper outlet. We also recommend that deepened concrete curbs be poured along the edge of the proposed pavers and that the curbs extend at least 12 inches below the bottom of the subgrade rock storage section. For pervious paver areas located adjacent to foundations, we recommend that the foundations extend at least 12 inches below the bottom of the subgrade rock storage section.

LIMITATIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on our limited percolation testing, an evaluation of the subsurface soil conditions encountered at our subsurface exploration locations and the assumption that the infiltration rates and soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the BMPs may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the soils engineer so that he may make modifications if necessary. In addition, this office should be advised of any changes in the project scope, proposed site grading or storm water BMP design so that it may be determined if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

It should be recognized that routine inspection and maintenance of infiltration basins are necessary to prevent clogging and failure. A maintenance plan should be specified for each basin by the designer and followed by the owner during the entire lifetime of the BMP device. It is not our intent to review the civil engineering plans, notes, details, or calculations, when prepared, to verify that the engineer has complied with any particular storm water design standards. It is the responsibility of the designer to properly prepare the storm water plan based on the municipal requirements considering the planned site development and infiltration rates.

Percolation to Infiltration Rate Conversion (Porchet Method)

CALLE CATALINA SUBDIVISION, ESCONDIDO, CALIFORNIA

CWE 2220070.01

Test #	Gravel Adjustment Factor	Effective Radius (inches) r	Depth of Hole Below Existing Grade (inches)	Time Interval (min.) Δt	Height of pipe above surface (feet)	Initial Water Depth without correction (feet)	Final Water Depth without correction (feet)	Initial Water Height with correction (inches) H_o	Final Water Height with correction (inches) H_f	Change in head (inches) ΔH	Average Head Height (inches) H_{avg}	Gravel Adjusted Percolation Rate (inch/hour)	Tested Infiltration Rate (inch/hour) I_t
PT-1	0.51	4	36	30	2.00	4.50	4.56	6.00	5.28	0.72	5.64	0.73	0.19
PT-2	0.51	4	48	30	1.00	3.65	3.80	16.20	14.40	1.80	15.30	1.84	0.21
PT-3	0.51	4	42	30	1.75	2.95	3.00	27.60	27.00	0.60	27.30	0.61	0.04
PT-4	0.51	4	42	30	2.33	3.69	3.95	25.72	22.60	3.12	24.16	3.18	0.24
PT-5	0.51	4	117	30	0.25	8.25	8.40	21.00	19.20	1.80	20.10	1.84	0.17
PT-6	0.51	4	118	30	0.16	7.30	7.52	32.32	29.68	2.64	31.00	2.69	0.16

"Initial and final water depth without correction" are measurements taken from top of pipe if pipe is sticking out of ground (most cases)

"Initial and final water height with correction" factors in the height of pipe above surface, and provides measurement of water above bottom of pipe

If measurements are taken from grade "Height of pipe above surface" = 0

Gravel Adjustment Factor:

4-inch Diameter Pipe:
- 1.00 - No Gravel Used (No Caving)
- 0.51 - 3/4 inch gravel with 8 inch diameter hole
- 0.56 - 3/4 inch gravel with 7 inch diameter hole
- 0.64 - 3/4 inch gravel with 6 inch diameter hole

3-inch Diameter Pipe:
- 1.00 - No Gravel Used (No Caving)
- 0.44 - 3/4 inch gravel with 8 inch diameter hole
- 0.47 - 3/4 inch gravel with 7 inch diameter hole
- 0.51 - 3/4 inch gravel with 6 inch diameter hole

Porchet Method - Tested Percolation Rate Conversion to Tested Infiltration Rate

$$I_t = \frac{\Delta H \, 60 \, r}{\Delta t \, (r + 2H_{avg})}$$

I_t = tested infiltration rate, inches per hour

ΔH = change in head over the time interval, inches

Δt = time interval, minutes

r = effective radius of test hole

H_{avg} = average head over the time interval, inches

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: An infiltration rate assessment has been performed for the soils beneath the subject site as presented in the Preliminary Geotechnical Investigation and Infiltration Feasibility Study (CWE 2220070.01). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of Escondido BMP Design Manual states that "a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified." Field infiltration rates within the weathered granitic rock were relatively low and fall into the partial infiltration criterion. The average field infiltration rate was calculated to be 0.16 inches per hour. A default safety factor of 2.0 was applied in order to determine a design infiltration rate of 0.08 inches per hour.			
2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis:			
4	Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis:			
Part 1 Result*	If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

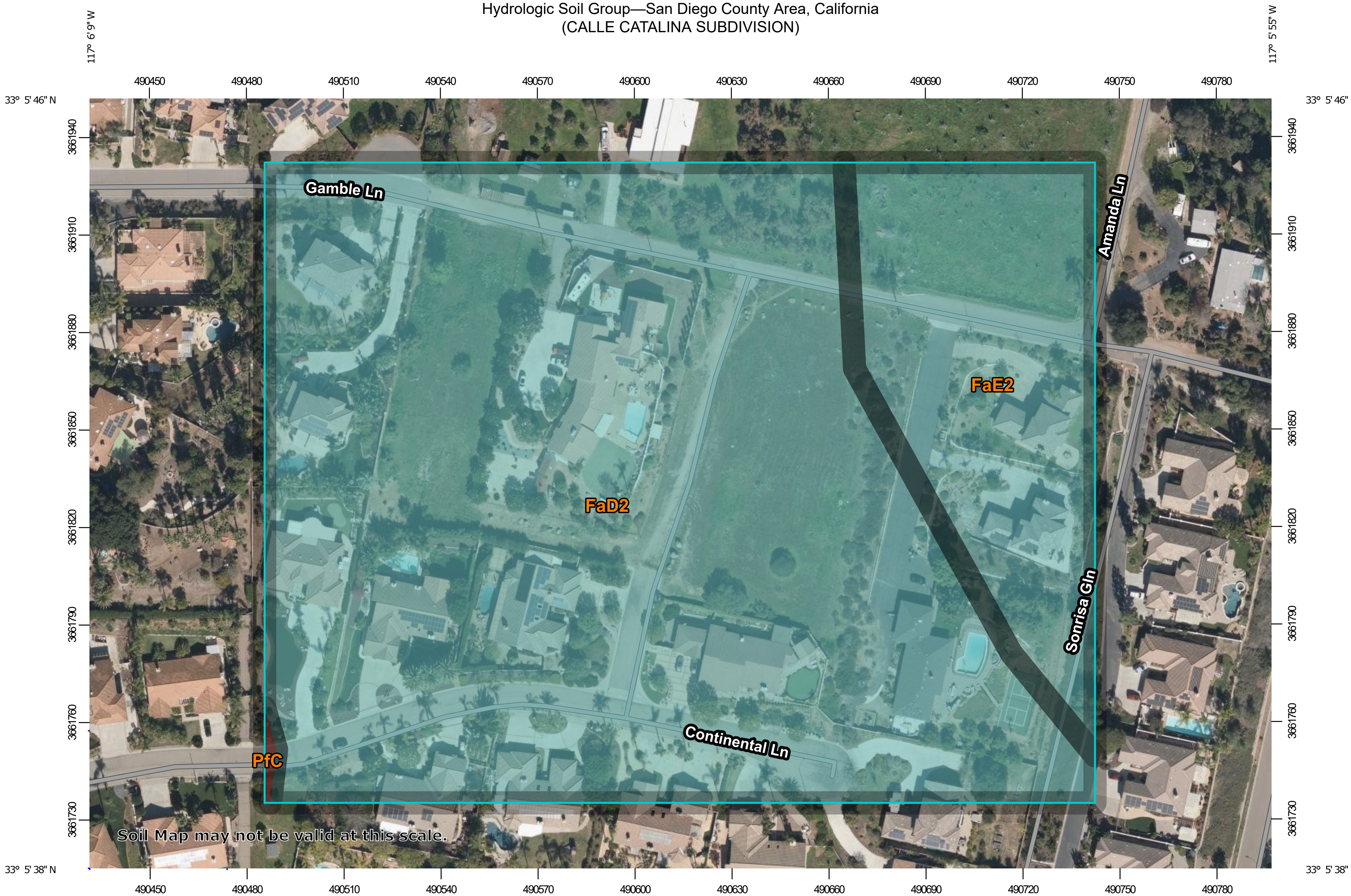
Worksheet C.4-1 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
Provide basis: An infiltration rate assessment has been performed for the soils beneath the subject site as presented in the Preliminary Geotechnical Investigation and Infiltration Feasibility Study (CWE 2220070.01). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of Escondido BMP Design Manual states that "a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified." Field infiltration rates within the weathered granitic rock were relatively low and fall into the partial infiltration criterion. The average field infiltration rate was calculated to be 0.16 inches per hour. A default safety factor of 2.0 was applied in order to determine a design infiltration rate of 0.08 inches per hour.			
6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
Provide basis: An infiltration rate assessment has been performed for the subject site. Based on the underlying soil conditions and our recommendations presented in our report, we anticipate that infiltration greater than 0.5 inches per hour can be allowed without increasing risk of geologic hazards that cannot be mitigated to an acceptable level. C.2.1 A site specific geotechnical investigation was performed. C.2.2 The underlying weathered granitics were found to have a low and very low potential for hydro collapse and consolidation, respectively. C.2.3 BMP A1 is located within 20 feet of a descending slope. We recommend that BMP A1 have an impermeable liner be designed for no infiltration condition. C.2.6 BMP C will be located above an existing retaining wall associated with a neighboring asphaltic concrete (AC) driveway. In our opinion, infiltrating storm water into BMP C will result in the migration of water behind and below the nearby retaining wall as well as into the pavement section for the driveway. Distress to the retaining wall and AC pavement from storm water infiltration could occur. Due to these geotechnical concerns we recommend that BMP C have an impermeable liner be designed for a no infiltration condition.			

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Based on our review of items presented in Appendix C.3, we anticipate that infiltration greater than 0.5 inches per hour can be allowed without increasing risk of groundwater contamination that cannot be mitigated to an acceptable level. C.3.1 The subgrade soil appears to be suitable for onsite infiltration. We have no knowledge of groundwater or soil contamination onsite or down-gradient from the site. C.3.2 The depth to seasonal high groundwater beneath the site is expected to fluctuate seasonally and is estimated to be 100 feet below the existing site grades. Based on this information we anticipate that seasonal high groundwater will not encroach within 10 feet of the base of the proposed BMPs. C.3.3 No existing wellheads are known within the vicinity of the subject site. C.3.4 We have no knowledge of the site being previously used for industrial use. C.3.5 We recommend that infiltration activities be coordinated with the applicable groundwater management agency. C.3.6 There does not appear to be a high risk of causing potential water balance issues. C.3.7 We do not know of any water rights downstream of the project and have not evaluated this impact as part of our study.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Downstream water rights have not been evaluated at this time; however, we are not aware of any water rights in the area of the project or downstream of the project.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		Partial Infiltration

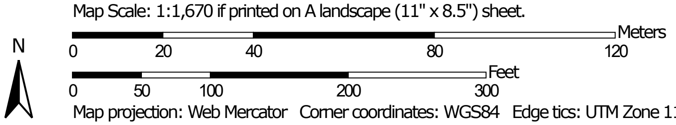
*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings

Daniel J. Flowers, CEG #2686

Hydrologic Soil Group—San Diego County Area, California
(CALLE CATALINA SUBDIVISION)



Map Scale: 1:1,670 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 23, 2020—Feb 13, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	C	10.2	80.9%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	C	2.4	19.0%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	0.0	0.1%
Totals for Area of Interest			**12.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher