Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

December 10, 2015
(Revised May 2, 2016)

Project No. 10618.002

Newland Sierra, LLC
9820 Town Centre Drive, Suite 100
San Diego, California 92121

**Attention:** Ms. Rita Brandin

**Subject:** **Geotechnical Evaluation of Rockfall Potential, Newland Sierra, San Diego County, California**

**References:** Leighton and Associates, 2015, Preliminary Geotechnical Investigation, Newland Sierra, San Diego County, California, Project No. 10618.002, dated November 6, 2015.

## Introduction

In accordance with your request, we have prepared this letter report to further address potential rockfall issues at the Newland Sierra project located in northern San Diego County, California (Figure 1). The purpose of this letter report is to evaluate the potential rockfall hazards and to provide a preferred method of rock fall mitigation for the subject site. Additional observations and recommendations by our geology staff will also be required during the site grading and construction operations. This will ensure boulders that are judged to be a rockfall hazard are properly mitigated prior to downslope development of residential/commercial structures.

## Site Description

The property is generally located west of Interstate 15, east of North Twin Oaks Valley Road, Deer Springs Road to the south and Lawrence Welk Lane to the north, in an area of San Diego County named the Merriam Mountains (Figure 1). Topographically, the site generally consists of moderate to steeply sloping hillside terrain with localized valleys and gently sloping terraces. Elevations range from a high of approximately 1,765 ± feet mean sea level (msl) in the west-central portion of the site to a low of 800 ± feet (msl) along the southerly site boundary.

Generally, natural drainage is presently accomplished through a network of narrow steep-sided canyons in all directions away from the approximately central, northwesterly trending ridgeline. The largest canyon on the site is located along the southerly site boundary and drains in a southward direction. Vegetation on the site ranges from native grasses and weeds in the relatively flat areas and in canyon bottoms to moderate to thick chaparral on the upper elevations.

Man-made features on the site include: 1) two above-ground water storage tanks and associated buried water lines; 2) short sections of deteriorating asphalt pavement access roads adjacent to the water tanks: 3) numerous dirt roads which cross the property; 4) minor amounts of undocumented fills associated with the dirt roads and water tank pads; 5) an abandoned crude runway within an elevated valley in the west portion of the site; 6) fences around most of the site perimeter and scattered fences within; and 7) an abandoned rock quarry at the west margin of the property and outside of the areas proposed for development. Existing cut slopes within this abandoned quarry are as high as 225 feet with gradients steeper than ½:1 (horizontal to vertical). It is also possible that several water wells are present on site.

## Proposed Development

The current plan proposes to develop a master-planned community integrating residential, commercial, recreational and open space land uses. The proposed project will consist of 2,135 single-family, multi-family, and variable residential dwelling units with an overall density of 1.08 dwelling units per acre within the 1,985 acre area. Proposed residential products range from attached units to 7,000 square foot single family lots. In addition, the project would also include neighborhood commercial uses, parks, trails, open space areas and associated community facilities and infrastructure.

It is anticipated the localized development areas will be primarily located in the flatter site areas with cuts in the higher elevations and fill areas anticipated in lower site areas. Cut and fill slopes were originally planned at 2:1 (horizontal to vertical) gradients. In order to minimize intrusion into open space areas, reduced slope heights and overall grading, both cut and fill slopes are planned to be at inclinations of 1-1/2:1 (horizontal to vertical) and with 1:1 cut slopes along proposed roadways. The maximum height of proposed fill slopes is on the order of 186 feet while the maximum height of proposed cut slopes is on the order of 85 feet. Although not recommended at this time, steeper slopes may be locally feasible in rock slopes as demonstrated by the existing slopes in the area of the abandoned quarry. However, a site specific evaluation of the area and proposed slope will be required prior to design.

## Site-Specific Geology

Based on our site visit and review of our referenced preliminary geotechnical report, the primary bedrock unit onsite is Cretaceous-aged Granite although Jurassic-aged Metavolcanic rock is present along the western margin. These units are in turn overlain by surficial units consisting of colluvium, alluvium, slopewash and minor undocumented fill soils. Surficial soil deposits generally consist of relatively fine-grained material useful during grading of a site where abundant oversize material is expected. The approximate aerial extent is provided on the attached Rockfall Hazard Map (Plate 1).

## Potential Rock Fall Issues

The Newland Sierra project is a rugged and heavily vegetated site of approximately 2,000 acres. In order to evaluate the potential for rock-fall issues on future building pads, we plotted the site grading plan on an aerial photo base. Using the proposed site grading plan and large scale aerial photographs, two certified engineering geologists from Leighton visited the site to observe the hillsides located above future building pads and to map the limits of potential rock fall hazard zones.

As observed in the field, a majority of the boulder outcrops appear to be large intact rock masses or boulders that are located on flatter slope areas where rock movement will not be an issue. In other cases, there are places where loose boulders are located in areas of nested rock that limit the potential for rock falls. Based on our evaluation, most of the areas that contain abundant boulders with a potential to pose a rockfall hazard are located within the limits of the proposed grading and the boulders will be removed by planned grading operations.

There are however, approximately thirteen localized areas that will not be graded and are located above proposed building pads where rocks appear to have a potential to become dislodged. These areas have been mapped and are shown on the attached Rockfall Hazard Map (Plate 1) and summarized on Table 1 below. As shown on the Rockfall Hazard Map (Plate 1), rockfall hazards located outside the proposed limits of grading that may potentially affect building areas include thirteen areas designated as rockfall hazard areas, RF-1 through RF-13. It should be noted that no potential rockfall hazard areas were identified north of RF-13 at the subject site.

## Proposed Mitigation

Rockfall mitigation was addressed in the referenced Leighton and Associates, Inc., 2015, Preliminary Geotechnical Investigation. The report identified mitigation measures for rock fall issues that could be utilized during construction. The following discussion has been provided to further clarify specific measures that may be used for each location that may represent a potential for rockfall.

All of the areas that were observed to have potential rockfall hazards are located either within the proposed residential development areas, neighborhood commercial uses and associated community facilities and infrastructure. We recommended that the boulders in these potential rockfall hazard areas be removed in conjunction with grading for the pad sites and roadways. If removal of the rock is not possible, the hazard may be mitigated by breaking up the rock in place to reduce the potential for the rock to be dislodged and/or implementing catchment mitigation techniques (see Table 1, Rockfall Mitigation Table). This work should be done prior to construction of structures in downslope areas.

As part of the site clearing, the grading contractor should work with the Leighton field geologist to remove loose boulders that have a potential to become dislodged. In approximately thirteen isolated locations (See Rockfall Hazard Map, Plate 1), implementing catchment mitigation techniques, breaking the boulders in place and/or removal would mitigate potential rockfall hazard at each location. Specific recommendations can be made during the grading operations if breaking or anchoring is warranted (see discussion under “Alternative Methods” below).

In nine of the thirteen locations, removal of the boulders appears to be the most feasible option. These areas can be easily accessed by a large dozer or excavator tracking through the brush. It is anticipated, that the areas can be accessed with the dozer blade in the air to minimize disturbance and construction of an access road will not be required. Some

localized disturbance is anticipated as the boulders are pushed/rolled into the proposed grading areas where they can be broken down and removed from the site. Large boulders that cannot be easily dislodged by the strong forces applied by the grading equipment may be determined not to be a rockfall hazard and may be left in place. In some instances boulders with a large flat side may be flipped onto the flat surface where they are no longer have a rolling potential and can then be left in place per the recommendations of a State Certified Engineering Geologist.

In three of the thirteen locations, breaking the boulders in place appears to be the most feasible option. This may be accomplished by hand drilling and breaking of the rock until it is reduced in size such that it is no longer a hazard or split to large flat surfaces that eliminate the potential for rolling. The disturbance in these areas would likely consist of trampled brush and creation of rubble piles.

Rockfall hazard location RF-7(See Rockfall Hazard Map, Plate 1) is located outside the site limits which is not included in the development of the subject project. Due to potential limited access to this property, we recommended that catchment mitigation techniques be implemented at the toe of the rockfall slope located directly below rockfall hazard location RF-7 and proposed Sarver Lane. The catchment area should use sections of flat or negatively sloped ground to dissipate rockfall energy and to collect rocks, boulders and other debris that have detached from rockfall hazard location RF-7. In addition, a ditch in combination with a barrier (typically a wall or berm) should be constructed in this catchment mitigation area.

Table 1 summarizes the area identified as potential Rockfall Hazard areas along with the recommended mitigation for each rockfall hazard area.

**Table 1 - Rockfall Mitigation Table**

| Rockfall Hazard Area | Acreage (approx) with potentially hazardous boulders | Proposed Lots or Affected Roadways | Recommended Mitigation Measure | Feasibility of Mitigation | Impacts Due to Implementation of Mitigation |
|---|---|---|---|---|---|
| RF-1 | 0.3ac | Mesa Rock Road | Removal of Boulders | Boulders can be moved into grading area by heavy equipment, then broken down and disposed of. Site can be readily accessed from the adjacent graded slope. | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed graded cut slope. It is anticipated that no more than 0.15 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |
| RF-2 | 1.0ac | Street T-2, and Lots 23 and 29 | Removal of Boulders | (see RF-1) | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed graded cut slope. It is anticipated that no more than 0.5 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |
| RF-3 | 0.2ac | Mesa Rock Road | Break Boulders in Place | Areas located on steep slope, boulders can be reduced utilizing hand drills and rock breaking methods | Areas can be accessed on foot and boulders to be reduced in size by use of hand held power tools. Disturbance limited to the hazardous boulders location and the immediately surrounding area. It is anticipated that less than 0.10 acres would be disturbed. |

**Table 1 - Rockfall Mitigation Table (continued)**

| Rockfall Hazard Area | Acreage (approx) with potentially hazardous boulders | Proposed Lots or Affected Roadways | Recommended Mitigation Measure | Feasibility of Mitigation | Impacts Due to Implementation of Mitigation |
|---|---|---|---|---|---|
| RF-4 | 1.2ac | Mesa Rock Road and Lots 117-124 | Removal of Boulders | Site can be reached with heavy equipment from an existing access road that is located approximately 150 feet away. | A dozer will be utilized to access the location of boulders to be removed. A dozer will need to track across about 600 feet of distance during boulder removal. It is anticipated that 0.3 acres would be disturbed from boulder removal. |
| RF-5 | 0.4ac | Lots 1126-1129 | Removal of Boulders | (see RF-1) | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed graded cut slope. It is anticipated that no more than 0.2 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |
| RF-6 | 0.1ac | Sarver Lane and Lots 1098-1103 | Break Boulders in Place | (see RF-3) | Areas can be accessed on foot and boulders to be reduced in size by use of hand held power tools. Disturbance limited to the hazardous boulders location and the immediately surrounding area. It is anticipated that less than 0.10 acres would be disturbed. |
| RF-6a | 0.3ac | Lots 1098-1103 | Removal of Boulders | (see RF-1) | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed graded cut slope. It is anticipated that no more than 0.15 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |

**Table 1 - Rockfall Mitigation Table (continued)**

| Rockfall Hazard Area | Acreage (approx) with potentially hazardous boulders | Proposed Lots or Affected Roadways | Recommended Mitigation Measure | Feasibility of Mitigation | Impacts Due to Implementation of Mitigation |
|---|---|---|---|---|---|
| RF-7 | 0.2ac | Sarver Lane | Catchment Area | Sections of flat or negatively sloped ground located directly adjacent to the toe of the potential rockfall slope and proposed Sarver Lane can be utilized. | A trench with a barrier (typically a wall or berm) may need to be installed in the area located directly adjacent to the toe of the potential rockfall slope and proposed Sarver Lane. A excavator or backhoe will be utilized to dig the rockfall ditch to be located directly adjacent to the toe of the potential rockfall slope. It is anticipated that no more than 0.15 acres would be disturbed for the installation of the catchment area. |
| RF-8 | 0.9ac | Sarver Lane and Lots 1022-1026 | Break Boulders in Place | (see RF-3) | Areas can be accessed on foot and boulders to be reduced in size by use of hand held power tools. Disturbance limited to the hazardous boulders location and the immediately surrounding area. It is anticipated that less than 0.3 acres would be disturbed. |

**Table 1 - Rockfall Mitigation Table (continued)**

| Rockfall Hazard Area | Acreage (approx) with potentially hazardous boulders | Proposed Lots or Affected Roadways | Recommended Mitigation Measure | Feasibility of Mitigation | Impacts Due to Implementation of Mitigation |
|---|---|---|---|---|---|
| RF-9 | 1.1ac | Lots 847-856 | Break Boulders in Place | (see RF-3) | Areas can be accessed on foot and boulders to be reduced in size by use of hand held power tools. Disturbance limited to the hazardous boulders location and the immediately surrounding area. It is anticipated that less than 0.3 acres would be disturbed. |
| RF-10 | 0.4ac | Mesa Rock Road and Lots 566-568 | Removal of Boulders | Site can be reached with heavy equipment from an existing access road that is located approximately 100 feet away. | A dozer will be utilized to access the location of boulders to be removed. A dozer will need to track across about 100 feet during boulder removal. It is anticipated that 0.2 acres would be disturbed from boulder removal. |
| RF-11 | 0.3ac | Lots 610-612 | Removal of Boulders | (see RF-1) | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed graded cut slope. It is anticipated that no more than 0.3 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |

**Table 1 - Rockfall Mitigation Table (continued)**

| Rockfall Hazard Area | Acreage (approx) with potentially hazardous boulders | Proposed Lots or Affected Roadways | Recommended Mitigation Measure | Feasibility of Mitigation | Impacts Due to Implementation of Mitigation |
|---|---|---|---|---|---|
| RF-12 | 0.3ac | Lots 571-577 | Removal of Boulders | Boulders to be removed are located along an existing access road within 40 feet of a graded slope. | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed cut slope. It is anticipated that fifty percent of the 0.3 acre area could be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |
| RF-13 | 0.3ac | Street S-1 and Lots 578-580 | Removal of Boulders | Boulders to be removed are located along an existing access road within 30 feet of a graded slope. | A dozer will be utilized to access the location of boulders to be removed. Site is immediately adjacent to a proposed cut slope. It is anticipated that no more than 0.15 acres would be disturbed for boulder removal. Based on the location of boulders to be removed, no access road would be required. |

## Alternative Methods

In addition to the methods of mitigation proposed above, possible alternative methods may also be found feasible through future studies. These can include the use of cables to drag isolated boulders up or down existing slopes. The excavation of isolated areas next to a boulder and then embedding the boulder in the excavation, the use of deflection berms or catchment areas and various anchoring systems. These alternative methods are not proposed at this time but are potential options that may be utilized in the future per the recommendations of a State of California Engineering Geologist upon review and approval by the County of San Diego. Any impacts associated with alternative methods will be evaluated at the time they are proposed.

**Limitations**

The recommendations contained in this report are based on available project information. Changes made during design development and construction, should be reviewed by Leighton to determine if recommendations are still applicable.

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

Respectfully submitted,

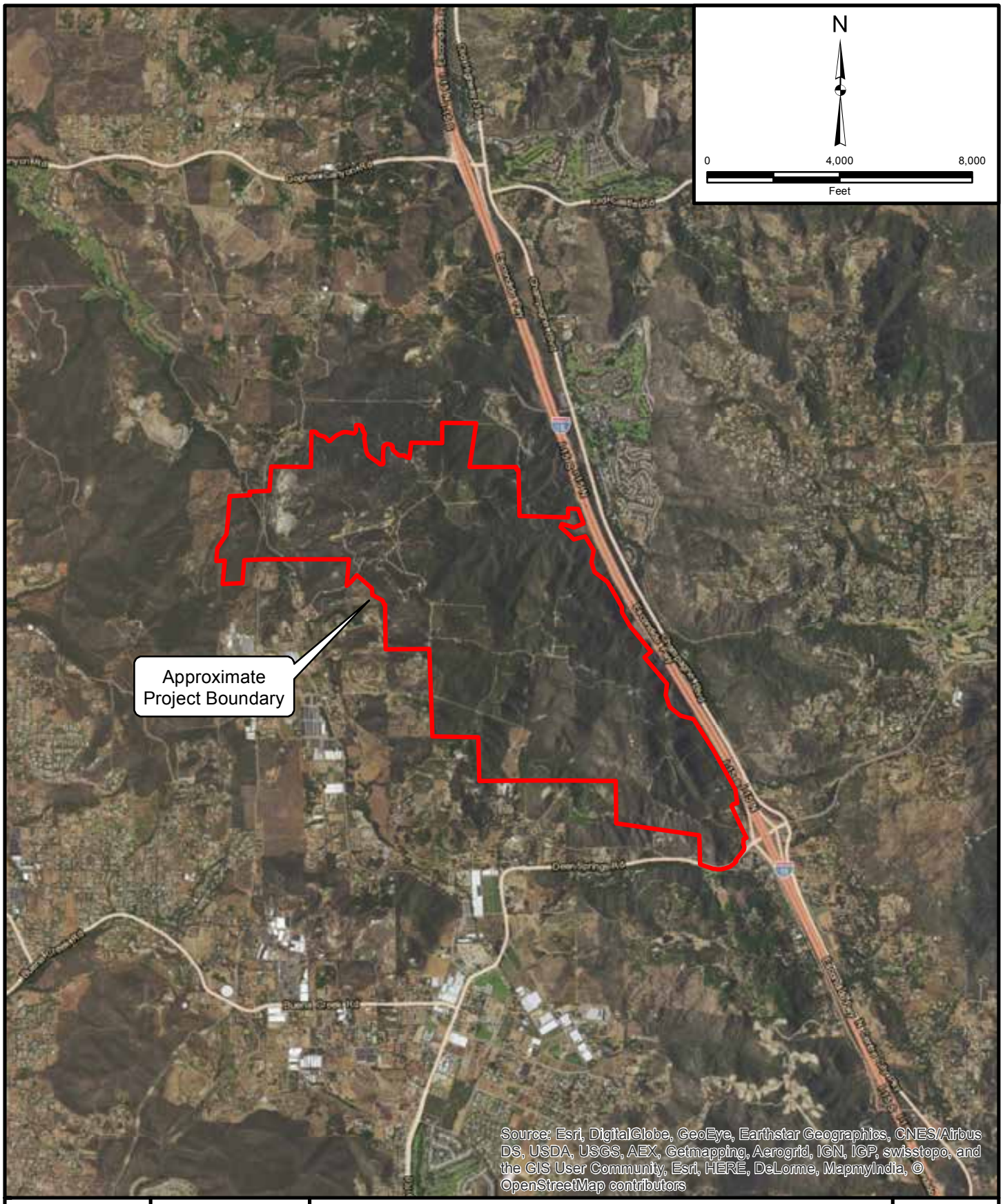
LEIGHTON AND ASSOCIATES, INC

Robert Stroh, CEG 2099
Associate Engineering Geologist

William D. Olson, RCE 45283
Associate Engineer

Attachments: Site Location Map
Plate 1 – Rockfall Hazard Map

Distribution: (3) Addressee
(1) Fuscoe Engineering; Attention: Mr. Eric Armstrong




| | |
|---|---|
| Project: 10618.002 | Eng/Geol: WDO/RCS |
| Scale: 1 " = 4,000 ' | Date: April 2016 |
| Base Map: ESRI ArcGIS Online 2015<br>Author: mmurphy (mmurphy) | |

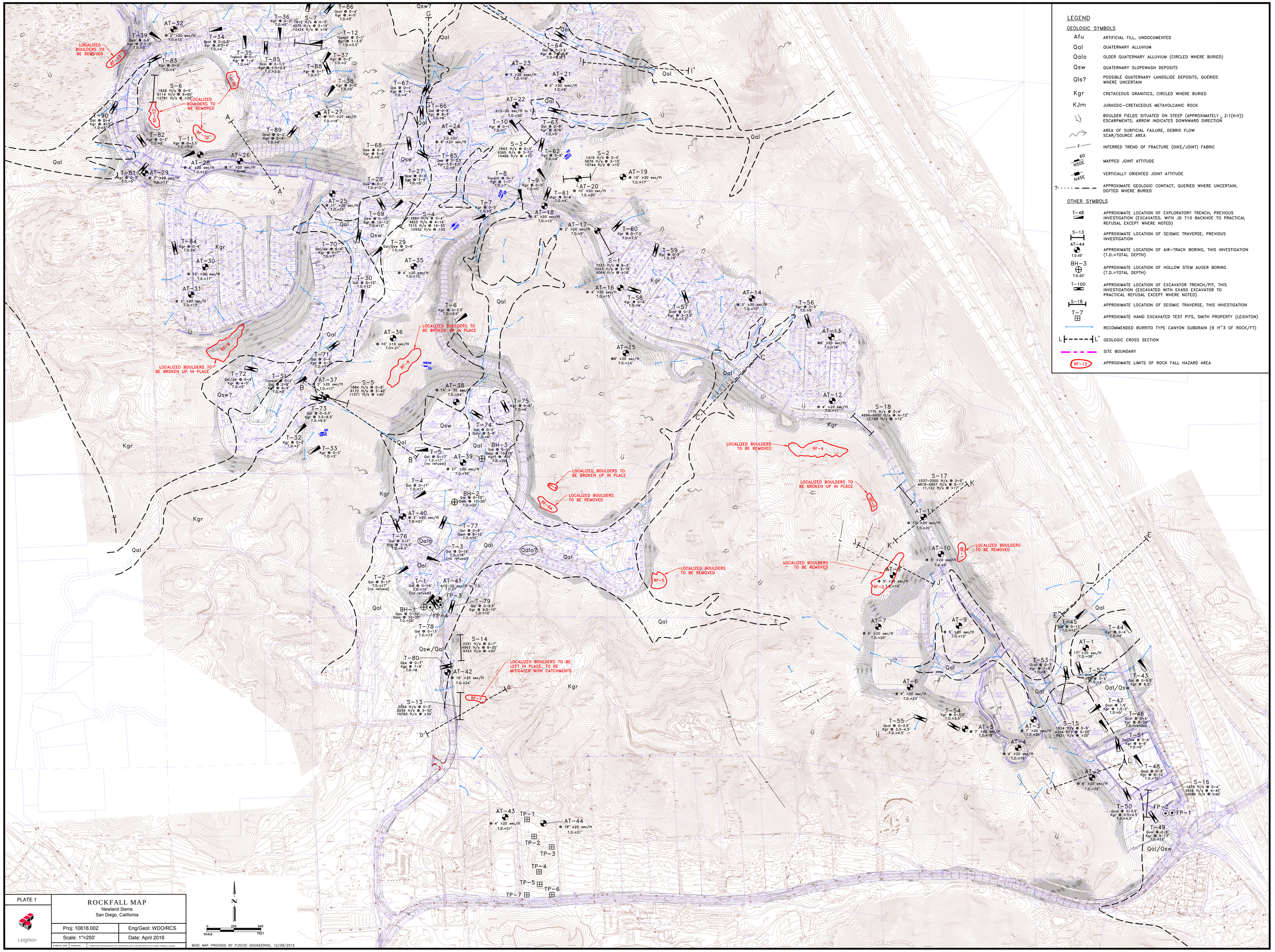
# SITE LOCATION MAP

Newland Sierra
San Diego, California

Figure 1

Leighton

Map Saved as V:\Drafting\10618\002\Maps\10618-002_F01_SLM_2015-06-26.mxd on 12/10/2015 9:31:58 AM




## LEGEND

### GEOLOGIC SYMBOLS

| | |
|---|---|
| Afu | ARTIFICIAL FILL, UNDOCUMENTED |
| Qal | QUATERNARY ALLUVIUM |
| Qalo | OLDER QUATERNARY ALLUVIUM (CIRCLED WHERE BURIED) |
| Qsw | QUATERNARY SLOPEWASH DEPOSITS |
| Qls? | POSSIBLE QUATERNARY LANDSLIDE DEPOSITS, QUERIED WHERE UNCERTAIN |
| Kgr | CRETACEOUS GRANITICS, CIRCLED WHERE BURIED |
| KJm | JURASSIC–CRETACEOUS METAVOLCANIC ROCK |
| | BOULDER FIELDS SITUATED ON STEEP (APPROXIMATELY 2:1(H:V)) ESCARPMENTS, ARROW INDICATES DOWNWARD DIRECTION |
| | AREA OF SURFICIAL FAILURE, DEBRIS FLOW SCAR/SOURCE AREA |
| F | INFERRED TREND OF FRACTURE (DIKE/JOINT) FABRIC |
| 60 N50E | MAPPED JOINT ATTITUDE |
| N45E | VERTICALLY ORIENTED JOINT ATTITUDE |
| ?. . . . . | APPROXIMATE GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN, DOTTED WHERE BURIED |

### OTHER SYMBOLS

| | |
|---|---|
| T-48 | APPROXIMATE LOCATION OF EXPLORATORY TRENCH, PREVIOUS INVESTIGATION (EXCAVATED, WITH JD 710 BACKHOE TO PRACTICAL REFUSAL EXCEPT WHERE NOTED) |
| S-13 | APPROXIMATE LOCATION OF SEISMIC TRAVERSE, PREVIOUS INVESTIGATION |
| AT-44 T.D.45' | APPROXIMATE LOCATION OF AIR–TRACK BORING, THIS INVESTIGATION (T.D.=TOTAL DEPTH) |
| BH-3 T.D.20' | APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (T.D.=TOTAL DEPTH) |
| T-100 | APPROXIMATE LOCATION OF EXCAVATOR TRENCH/PIT, THIS INVESTIGATION (EXCAVATED WITH EX450 EXCAVATOR TO PRACTICAL REFUSAL EXCEPT WHERE NOTED) |
| S-18 | APPROXIMATE LOCATION OF SEISMIC TRAVERSE, THIS INVESTIGATION |
| T-7 | APPROXIMATE HAND EXCAVATED TEST PITS, SMITH PROPERTY (LEIGHTON) |
| | RECOMMENDED BURRITO TYPE CANYON SUBDRAIN (9 ft^3 OF ROCK/FT) |
| L L' | GEOLOGIC CROSS SECTION |
| | SITE BOUNDARY |
| RF-13 | APPROXIMATE LIMITS OF ROCK FALL HAZARD AREA |

PLATE 1

Leighton

# ROCKFALL MAP

Newland Sierra
San Diego, California

| | |
|---|---|
| Proj: 10618.002 | Eng/Geol: WDO/RCS |
| Scale: 1"=250' | Date: April 2016 |

Drafted By: MAM | Checked By:

BASE MAP PROVIDED BY FUSCOE ENGINEERING, 12/08/2015