APPENDIX F

Geology and Soils/Hydrology and Water Quality Evaluation

GEOLOGY AND SOILS/HYDROLOGY AND WATER QUALITY EVALUATIONS
MITSUBISHI CEMENT SOUTH QUARRY EIR/EIS
CUSHENBURY MINE
SAN BERNARDINO COUNTY, CALIFORNIA

PREPARED FOR:
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September 11, 2013
Project No. 107331001

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Project No. 107331001

Ms. Anne Surdzial
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Subject: Geology and Soils/Hydrology and Water Quality Evaluations
Mitsubishi Cement South Quarry EIR/EIS
Cushenbury Mine
San Bernardino County, California

Dear Ms. Surdzial:

In accordance with your request and authorization, we have performed a geology and soils evaluation and a hydrology and water quality evaluation for the Mitsubishi Cement South Quarry project at the Cushenbury Mine. The project proposes to construct a new quarry on undeveloped land south of the existing East Pit and permitted West Pit. The attached report presents our methodology, findings, opinions, and recommendations regarding the geology and soils conditions at the site.

We appreciate the opportunity to be of service on this project.

Respectfully submitted,
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1. INTRODUCTION

In accordance with your request, Ninyo & Moore has completed an evaluation of geologic and soil conditions as well as hydrology and water quality for the proposed South Quarry project (the project) located south of the existing East Pit at Mitsubishi Cement's Cushenbury Mine in San Bernardino County (Figure 1).

Our evaluation is based on geologic reconnaissance, reviews of published and unpublished geologic, geotechnical, and hydrologic reports, aerial photographs, in-house data, and our assessment of the potential geologic hazards the project. The purpose of this survey was to estimate the potential for impacts to the project from geologic, soil, hydrologic, and water quality conditions on or in close proximity to the site, and to discuss measures that might be considered during project design to reduce or mitigate the potential impacts with respect to the development of the proposed project.

2. SCOPE OF SERVICES

Ninyo & Moore's scope of services for this geologic and soils evaluation included the activities listed below:

- Review of readily available regional and site-specific geologic and geotechnical reports.
- Review of readily available background information including topographic, soils, mineral resources, geologic, and seismic and geologic hazard maps, and stereoscopic aerial photographs.
- Performance of a geologic reconnaissance of the site and vicinity.
- Compilation and analysis of the data obtained from our background review and site reconnaissance.
- Review of the Assessment of Slope Stability and Hydrologic Conditions prepared by Golder Associates (2010) and plans for the proposed South Quarry prepared for the Mitsubishi Cement Corporation with respect to geotechnical and hydrologic conditions.
- Preparation of this report documenting findings and providing opinions and recommendations regarding possible geologic and soil impacts at the site. The findings were evaluated with respect to questions listed in Section 6 (Geology and Soils) and Section 8 (Hydrology and Water Quality) within Appendix G, "Environmental Checklist Form" of the "Guidelines for Implementation of the California Environmental Quality Act (CEQA)."

3. REGULATORY FRAMEWORK

Geologic resources and geotechnical hazards within the proposed project area are governed by the United States Forest Service (Forest Service), County of San Bernardino, and the State of California. The Forest Service administers mining regulation on Forest Service land. The County Building Division plans contain conservation and safety elements for the evaluation of geologic hazards. The procedures for construction related earthwork and excavation are established by local grading ordinances developed by the County of San Bernardino Department of Public Works, Land Development Division. The site is also governed by the regulations of the California Code of Regulations (CCR) and the 2010 California Building Code (CBC).

The CBC is promulgated under CCR, Title 24, Parts 1 through 12, also known as the California Building Standards Code, and is administered by the California Building Standards Commission (CBSC). The CBSC is responsible for administering California's building codes.

The Surface Mining and Reclamation Act of 1975 (SMARA) was enacted to promote conservation of the State's mineral resources and to ensure adequate reclamation of lands once they have been mined. Among other provisions, SMARA requires the State Geologist to classify land in California for mineral resource potential. The four categories include: Mineral Resource Zone MRZ-1, areas of no mineral resource significance; MRZ-2, areas of identified mineral resource significance; MRZ-3, areas of undetermined mineral resource significance; and MRZ-4, areas of unknown mineral resource significance. The distinction between these categories is important for land use considerations.

4. SITE LOCATION AND DESCRIPTION

The Mitsubishi Cement Corporation Cushenbury Mine is located at 5808 State Highway 18 in an unincorporated area of southwestern San Bernardino County, California near Lucerne Valley (Figure 1). The proposed South Quarry consists of approximately 150 acres of land within the mine site, located south of the West Pit, which is under development, and the existing East Pit (Figure 2). The majority of the South Quarry site is on unpatented claims owned by the Mitsubishi Cement Corporation (MCC) within the jurisdiction of the San Bernardino National Forest, and the remainder is on MCC owned land.

The proposed quarry is situated along a NW-trending ridgeline and covers an area with elevations ranging from approximately 5,550 feet above mean sea level (MSL) and 6,675 feet MSL. The site is currently undeveloped and covered with sparse to moderate growth of trees, chaparral, and other native vegetation. Except for a mining operation to the west (Marble Canyon Quarry), the Cushenbury mine is surrounded by mostly vacant land.

5. PROJECT DESCRIPTION

The Mitsubishi Cement Corporation is proposing development of the South Quarry to mine approximately 156 million tons of high- and medium-grade limestone. The project involves development of an approximately 128-acre quarry, associated landscape berm, stockpiles, and haul road. Mining of the quarry will involve four phases of conventional open-pit and benching methods. The anticipated depth of the quarry is up to approximately 1,200 feet.

Project improvements will include implementation of an Industrial Storm Water Pollution Protection Plan (SWPPP) to divert and collect runoff from storm water and snow melt. SWPPP's include construction of vegetated earthen safety berms, containment catch basins, collection ditches, berms, and check dams; placement of erosion control materials, sediment fences, or straw bales; and other appropriate measures to reduce the flow and velocity of surface runoff.

6. GEOLOGY AND SOILS

The following sections present our findings relative to regional and site geology, geologic hazards (e.g., faulting, seismicity, landslides, or expansive soils), groundwater, and agricultural soils.

6.1. Regional Geologic Setting

The project site is situated in the San Bernardino Mountains, an eastern extension of the Transverse Ranges Geomorphic Province (Norris and Webb, 1990). The Transverse Ranges are a unique unit of several east- to west-trending mountain ranges with intervening valleys in Santa Barbara, Ventura, Los Angeles, and San Bernardino Counties. The San Bernardino Mountains are located in the eastern portion of the province and are bounded by Cajon Pass

on the west, Twentynine Palms Valley on the east, Mojave Desert on the north, and Morongo Valley on the south. The mountains are generally a complex of metamorphic rocks, including Proterozoic gneisses and schists and Late Paleozoic limestones and quartzites that have been intruded by Triassic to possibly Tertiary igneous rocks. Cenozoic deposits within the range include minor volcanics on the east end of the range and alluvial fans, lake bed deposits, and stream deposits within the intervening valleys.

The Transverse Ranges province has been tectonically active during the late Tertiary and Quaternary Periods. Rapid rates of uplift along bounding faults have produced the current regional landscape of rugged highlands with eroded material accumulating in alluvial fans along the base of the mountains. The San Andreas and San Jacinto faults are major active fault systems located southwest of the study area, and the North Frontal Thrust, Helendale, and Lenwood-Lockhart are active fault zones located north and northeast of the project (Figure 3). Major tectonic activity associated with these and other faults within this regional tectonic framework consists of south-dipping thrust faulting and right-lateral, strike-slip movement.

6.2. Site Geology

Based on our background review and site reconnaissance, surficial soils at the project site consist of topsoils and minor fills. In addition, young landslide deposits have been mapped within the southern margin of the site (USGS, 2004 and Golder Associates, 2010). Golder Associates (2010) has also identified two other landslides within the proposed quarry. These surficial materials are underlain by Paleozoic meta-carbonate rocks (Figure 4) which are the source of ore for the planned quarry. The meta-carbonate rocks include various members of the Bird Spring, Monte Cristo, and Sultan Formations and range in age from Devonian to early Permian. A brief description of the geologic units, as described in the cited literature or as observed on the site, is presented below.

6.2.1. Fill

Thin fill soils were observed during our site reconnaissance along the ridge top in the southeasterly portion of the proposed quarry. As observed at the surface, the fill soils are generally composed of locally derived, reworked rock and are on the order of 1-foot thick.

6.2.2. Topsoil

In undisturbed areas of the site, a mantle of topsoil was observed overlying the native bedrock. Where observed, topsoils generally consisted of light colored, silty fine to medium sand with organic debris (plant matter).

6.2.3. Young Landslide Deposits

Quaternary-age landslide deposits have been mapped within the southernmost portion of the proposed quarry (USGS, 2004). In addition, Golder Associates (2010) has identified two other landslides within the proposed quarry. Although not observed during our site reconnaissance, these landslide deposits are expected to be derived from erosion of local bedrock and may consist of silty sands with gravels, cobbles, and boulders.

6.2.4. Bird Spring Formation

Two members of the Pennsylvanian-age Bird Spring Formation (the Lower and Middle Carbonate Members) have been mapped within the proposed quarry. These meta-carbonate rocks are characterized as medium- to thick-bedded calcite, dolomite and siliceous marble (USGS, 2004).

6.2.5. Monte Cristo Formation

Three members of the Mississippian-age Monte Cristo Formation (the Yellowpine, Bullion, and Lower Members) have been mapped across the majority of the site. These meta-carbonate rocks are characterized as medium- to very thick-bedded calcite and dolomite marble (USGS, 2004).

6.2.6. Sultan Formation

The Crystal Pass Member of the Sultan Formation has been mapped within the southern and southwestern portions of the proposed quarry. This Devonian-age meta-carbonate is composed of mostly thin-to thick bedded calcite marble with thin intervals of dolomite marble (USGS, 2004).

6.3. Faulting and Seismicity

Our review of geologic literature did not indicate the presence of any known active or potentially active faults on the site. The site is not located within a currently designated Earthquake Fault Zone (Alquist-Priolo Special Studies Zone). The subject site is considered to be in a seismically active area, as is the majority of southern California. The closest active fault (i.e., a fault that exhibits evidence of ground displacement within the Holocene Age or the last 11,000 years) is the western section of the North Frontal Fault Zone. Segments of the North Frontal Fault Zone (West) lie within the northern portion of the Cushenbury Mine. The closest mapped segment of this fault is located approximately 1 mile north of the proposed South Quarry. Furthermore, as the fault segments of the North Frontal Fault Zone trend east-west, they are not projected to underlie the site. The western section of the North Frontal Fault Zone is capable of generating a maximum moment magnitude earthquake of 7.2 (Cao et al., 2003). Figures 3 and 5 show the approximate location of the site with respect to the regional active faults.

Several reverse faults have been mapped trending across the proposed South Quarry area (USGS, 2004). Based on descriptions of these faults by Golder Associates (2010) and our review of background data, these faults appear to be inactive and are not considered zones of significant structural weakness.

In general, hazards associated with seismic activity include strong ground motion, ground surface rupture, liquefaction, lateral spread, and tsunamis. These hazards are discussed in the following sections.

6.3.1. Strong Ground Motion

The 2010 CBC (CBSC, 2010) recommends that the design of structures be based on the peak horizontal ground acceleration (PGA) having a 2 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. The Design Earthquake (PGA_{DE}) corresponds to two-thirds of the PGA_{MCE}. The site modified PGA_{MCE} was estimated to be 0.81g using the United States Geological Survey (USGS, 2011) ground motion calculator (web-based) and the corresponding PGA_{DE} for the site is 0.54g.

As noted above, the nearest known active fault is the North Frontal Fault Zone (West), which is mapped trending east-west approximately 1 mile north of the proposed South Quarry. Table 1 below lists principal known active faults that may affect the subject site, the maximum moment magnitude (M_{max}) and the fault types as published for the CGS by Cao et al. (2003). The approximate fault to site distance was calculated by the computer program FRISKSP (Blake, 2001).

Table 1 – Principal Active Faults

Fault	Approximate Distance miles (km)[1]	Maximum Moment Magnitude (M_{max})[1]	Fault Type[2]
North Frontal Fault Zone (West)	1 (1.5)	7.2	B
Helendale - S. Lockhart	2 (4)	7.3	B
North Frontal Fault Zone (East)	3 (5)	6.7	B
Lenwood - Lockhart - Old Woman Springs	12 (19)	7.5	B
Johnson Valley (Northern)	16 (25)	6.7	B
Cleghorn	20 (32)	6.5	B
San Andreas - San Bernardino	20 (32)	7.5	A
Pinto Mountain	21 (34)	7.2	B
Landers	22 (36)	7.3	B
Emerson S. - Copper Mountain	23 (36)	7.0	B
Calico - Hidalgo	29(46)	7.3	B
Burnt Mountain	30 (48)	6.5	B
Eureka Peak	30 (49)	6.4	B
San Jacinto - San Jacinto Valley	31 (50)	6.9	A
San Jacinto - San Bernardino	31 (50)	6.7	A
Pisgah - Bullion Mountain - Mesquite Lake	34 (54)	7.3	B
Cucamonga	35 (56)	6.9	B
San Andreas - Coachella	36 (58)	7.2	A
Gravel Hills - Harper Lake	37 (60)	7.1	B

Table 1 – Principal Active Faults

Fault	Approximate Distance miles (km)[1]	Maximum Moment Magnitude (M_{max})[1]	Fault Type[2]
San Jacinto - Anza	41 (66)	7.2	A
Blackwater	48 (77)	7.1	B
San Jose	50 (80)	6.4	B
Sierra Madre	53 (84)	7.2	B
Chino - Central Avenue (Elsinore)	53 (86)	6.7	B
Elsinore (Glen Ivy)	54 (88)	6.8	A
Elsinore (Temecula)	55 (89)	6.8	A
Whittier	56 (90)	6.8	A
Clamshell - Sawpit	57 (91)	6.5	B

Notes:
[1] Cao, et al., 2003.
[2] California Building Code (CBC), 2010; Cao, et al., 2003.

6.3.2. Ground Surface Rupture

Based on our review of the referenced literature, no active faults are known to cross or trend towards the project site. Therefore, the potential for ground surface rupture due to faulting at the site is considered low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

6.3.3. Liquefaction and Seismically Induced Settlement

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by a relatively shallow groundwater table are susceptible to liquefaction. Based on the dense nature of the underlying materials and anticipated depth to groundwater, the site is not subject to liquefaction or seismically induced settlement.

6.4. Landsliding

Based on our review of published geologic literature, up to three areas within the proposed quarry are underlain by young landslide deposits (USGS, 2004 and Golder Associates, 2010). One of these landslides is also mapped over a large area south of the site. During our review of topographic maps, aerial photographs, and our site reconnaissance in the

mapped areas, we identified geomorphic features typical of landslides, such as topographic breaks and hummocky hills. Based on our review of the slope stability analyses for the proposed quarry (Golder Associates, 2010), these landslide deposits are not anticipated to affect the global stability of the proposed quarry.

6.5. Expansive Soils

Expansive soils generally result from specific clay minerals that have the capacity to shrink or swell in response to changes in moisture content. Based on review of regional geologic maps, geologic reconnaissance, and review of other documents, the site is underlain by meta-carbonate rock. Soils developed from such materials are considered to have very low to low potential for expansion. As we anticipate onsite fills will be derived from the surrounding materials, the potential for near-surface expansive soils at the project is considered low.

6.6. Compressible Soils

Compressible soils, like expansive soils, result from specific clay minerals or loose granular materials that have the capacity to shrink or compress in response to changes in moisture content or new loads. Based on review of regional geologic maps, geologic reconnaissance, and knowledge of the vicinity, the thin soils underlying the project are considered negligibly compressible under new loading.

6.7. Corrosive Soils

Caltrans corrosion (2003) criteria define corrosive soils as soils with more than 500 parts per million chlorides, more than 0.2 percent sulfates, a pH less than 5.5, or an electrical resistivity of 1,000 ohm-centimeters or less. Due to the alkaline nature of the on-site soils and rock, site soils should not be considered corrosive. However, laboratory testing for corrosivity should be performed as part of a comprehensive geotechnical evaluation to be performed before final design or construction.

6.8. Agricultural Soils

Review of the referenced soil survey report (United States Department of Agriculture [USDA], 2012) delineates one soil series at the project site. This soil, Lithic Xerorthents, is developed on a calcareous-rock outcrop complex with 50 to 100 percent slopes (Figure 6). The potential for loss of agricultural soils due to further development of the study area is considered low. Soils encountered on site that may contain organic material will be salvaged by MCC and stored on site.

6.9. Mineral Resources

According to the USGS Mineral Resources Data System and the California Division of Mines and Geology (1999), the project is located in Mineral Resource Zone 3a (MRZ-3a) for limestone. MRZ-3a is defined as an area that contains identified mineral resources of statewide or regional significance. We understand that as part of the development of the proposed quarry, compensation lands will be provided by MCC.

7. HYDROLOGY AND WATER QUALITY

This section presents our findings with respect to post-construction impacts to the hydrology and quality of water in the vicinity of the South Quarry project.

7.1. Water Regulatory Setting

The South Quarry project site is located almost entirely on public lands within the San Bernardino National Forest (SBNF). SBNF lands are administered by the United States Department of Agriculture. The project will be required to comply with Forest Service Mineral Regulation. Mining activities are also subject to the State of California's Surface Mining and Reclamation Act (SMARA). Water used for the project will be supplied by wells owned by MCC, which owns and operates the Cushenbury cement plant and mine. Public water will not be used to develop the site or during mining operations, although, the site is located within the boundaries of the Mojave Water Agency (MWA). The MWA serves as the Watermaster for the adjudicated Mojave Basin (Liburn Corporation, 2010). Because the site is located within an unincorporated area of San Bernardino County, the County of San Bernardino will act as the lead agency and will enforce SMARA, federal and local regulations.

7.2. Environmental Setting

The Cushenbury Mine is located near the base of the north-northeast facing side of the San Bernardino Mountains. These mountains were created by faulting activity. The bedrock material forming the mountains consists of layers of limestone deposited during Mississippian to Devonian period. Drainage in the vicinity of the project site is toward the north-northeast. Runoff occurs as sheet flow until concentrated in topographic lows. Concentrated runoff has created slightly- to deeply-incised drainage features or canyons that cut into the limestone bedrock. Natural slopes in the vicinity of the site have inclinations that range from approximately 50 to 100 percent. Existing elevations across the South Quarry location vary from approximately 6,600 feet MSL near the southern end of the pit to approximately 5,400 feet MSL near the northern end of the pit (Figure 7). Elevations across the alignment of the haul road vary from approximately 6080 feet MSL near the entrance to the South Quarry to a low elevation of approximately 5020 feet MSL.

Surficial soils covering the project site and adjacent areas are on the order of 1 foot thick. The soil layer is derived from weathered limestone materials including Lithic Xerorthents, Calcareous (Figure 6). The soil layer overlies unweathered bedrock. Rock outcrops are also present on the slopes (Glenn Lukos Associates, 2010). The substrates within the drainage features generally consist of boulder to gravel materials. Soils at the site are not considered to be hydric. The site does not include wetland areas (Glenn Lukos Associates, 2010). The hillsides are covered with sparse vegetation including brush, trees, cactus and low lying plants.

7.3. Watershed Hydrology

The project is located within the San Jacinto River sub-basin of the Colorado River Hydrologic Region (Figure 8). There are six drainage features in the vicinity of the site (Figure 7). Each drainage feature consists of ephemeral or non-relatively permanent waters (non-RPW's) (Glen Lukos Associates, 2010). Drainage flow is toward the north-northeast and west. The drainages are isolated and do not flow into navigable water. The largest drainage feature within the site vicinity is Marble Canyon Creek. Marble Canyon Creek is located below and to the west and southwest of the South Quarry excavation and haul road (Figure 7). The ordinary

high water mark varies from approximately 1 to 20 feet wide. The ordinary high water marks for north-northeast drainages vary from approximately 1 to 5 feet wide. These drainages are interrupted by the existing east pit. However, the proposed project is at a topographic high and construction of the quarry creates a hole (low area) for surface drainage.

7.4. Floodplains

The project site and adjacent areas are not located within a Federal Emergency Management Agency Potential 100-year floodplains area (Figure 9).

7.5. Dam Inundation, Seiche and Tsunami

There are no levees or dams located down-gradient of the site. Based on the Safety Element of the County of San Bernardino General Plan (2007), the project site and adjacent areas are not subject to dam inundation or inundation from a lake or river.

7.6. Climate Setting

The climate of the study area is generally characterized by mild, dry summers and moist, cold winters. The rainfall and snowfall season generally occurs in the winter and spring; summer monsoonal storms can occur, typically in August and September. Western Regional Climate Center (WRCC) data from three stations in the in the vicinity of the study area have been included in our evaluation: the Big Bear Lake Station (No. 040741) located approximately 7½ miles southwest of the site at an elevation of approximately 6,760 feet MSL; the Lucerne Valley Station (No. 045182) located approximately 8½ miles northwest of the site at an elevation of approximately 2,963 feet MSL; and the Big Bear Lake Dam Station (No. 040742) located approximately 10⅛ miles southwest of the site at an elevation of approximately 6,815 feet MSL (WRCC, 2012).

The climatic record for the Big Bear Lake Station includes the period from July 1, 1960 to May 31, 2012. The annual monthly average temperature is approximately 47.1 degrees Fahrenheit. The lowest monthly average temperature occurs in January and is approximately 20.3 degrees Fahrenheit. The high monthly average temperature occurs in July and is approximately 80.8 degrees Fahrenheit. Average annual precipitation at this station is approximately 21.8 inches. The low average annual precipitation is approximately 0.14 inches and occurs in June. The high average annual precipitation is approximately 4.49 inches and occurs in January. Average annual snowfall is approximately 62.6 inches. The average high snowfall occurs in January and is approximately 14.5 inches (WRCC, 2012).

The climatic record for the Lucerne Valley Station includes the period from September 29, 1919 to December 31, 2000. The annual monthly average temperature is approximately 60.2 degrees Fahrenheit. The lowest monthly average temperature occurs in January and is approximately 26.0 degrees Fahrenheit. The high monthly average temperature occurs in July and is approximately 99.8 degrees Fahrenheit. Average annual precipitation at this station is approximately 4.1 inches. The low average annual precipitation is approximately 0.01 inches and occurs in June and September. The high average annual precipitation is approximately 0.91 inches and occurs in August. Average annual snowfall is approximately 2.3 inches. The average high snowfall occurs in December and is approximately 1.1 inches (WRCC, 2012).

The climatic record for the Big Bear Dam Station includes the period from December 1, 1914 to September 30, 1971. The annual monthly average temperature is approximately 44.5 degrees Fahrenheit. The lowest monthly average temperature occurs in January and is approximately 15.9 degrees Fahrenheit. The high monthly average temperature occurs in July and is approximately 77.8 degrees Fahrenheit. Average annual precipitation at this station is approximately 35.6 inches. The low average annual precipitation is approximately 0.06 inches and occurs in June and the high average annual precipitation is approximately 6.13 inches and occurs in February. Average annual snowfall is approximately 128.3 inches. The average high snowfall occurs in March and is approximately 30.9 inches (WRCC, 2012).

7.7. Groundwater and Wells

There are four groundwater wells (Well-1 through Well-4) within the plant area of the Cushenbury Mine. The wells include two active wells (Well-1 and Well-4) and two non-active wells (Well-2 and Well-3). There are also four monitoring wells (MW-1 through MW-4) within the plant area. The approximate locations of the wells are presented on Figure 7. The water wells are used to supply the mine with operational water. Water quality monitoring at the four monitoring wells within the mine has been performed on a semi-annual basis since 1999. Until 2004, monitoring of the groundwater wells was performed on an irregular basis. In 2004, semi-annual monitoring of the wells began. Groundwater elevation data from monitoring wells MW-1, MW-2, MW-3 and MW-4 indicates that the groundwater elevation varies from approximately 4,107 feet MSL to 4,141 feet MSL (Ron Barto, 2012). The lowest elevation for the South Quarry excavation is anticipated to be approximately 5,365 feet MSL (Lilburn, 2010).

Groundwater level data indicates that over the past several years there has been a relative balance between replenishment and discharge. It is anticipated that the proposed project would increase the total demand from the mine by approximately 105.3 acre-feet/year. This amounts to approximately 7 percent of the project groundwater deficient, which is approximately 1,500 acre-feet in a single dry year event (Lilburn, 2010). Based on a technical memorandum prepared by Golder Associates (Golder Associates, 2013), the increase in groundwater withdrawal will not affect Cushenberry Springs which is north of the site.

7.8. Groundwater Quality

Based upon Drinking Water Standards (DWS) set by the United Stated Environmental Protection Agency, some of constituent concentrations exceed the secondary standards for the DWS. Secondary drinking water standards pertain to constituents that can affect the water color, odor, taste and can cause discoloration of teeth and skin. Except in Well-3, water samples obtained from the wells have total dissolved solids (TDS) that vary from approximately 290 to 550 milligrams per liter (mg/l). The secondary standard for TDS is approximately 500 mg/l. In Well-3, TDS concentrations varied from approximately 930 to 970 mg/l. Excessive concentrations of iron, concentrations that exceed approximately 0.3 mg/l, have

been obtained in water samples taken from MW-1, MW-2, MW-3, MW-4, Well-1 and Well-2. Manganese concentrations that exceed the secondary drinking water standard of approximately 0.05 mg/l have been recorded in water samples taken from MW-2 and MW-3. Aluminum concentrations in excess of the secondary drinking water standard of 0.2 mg/l have been recorded in water samples taken from MW-2, MW-3 and MW-4.

8. CONCLUSIONS

Based on our review of the referenced background data and our geologic field reconnaissance it is our opinion that geologic and geotechnical considerations at the project include the following:

- Surficial soils at the project site consist of fill, topsoil, and landslide deposits, which are underlain by Paleozoic meta-carbonate rocks. The fill includes relatively thin material placed during light grading operations. Landslide deposits are mapped at three locations within the proposed quarry (Golder Associates, 2010). Geotechnical constraints related to soils at the project are discussed below:
    - *Expansive Soils* – Soils derived from existing site soils and bedrock are anticipated to have a very low to low potential for expansion.
    - *Compressible Soils* – The thin soils underlying the project typically consist of silty sand and gravel, which are not considered compressible under new loading.
    - *Fill Soils* – Fill soils placed without engineering supervision may be loosely or inadequately compacted, may contain oversize materials unsuitable for reuse in engineered fills, and may contain unsuitable organic materials and debris that may preclude their re-use in engineered fills.
    - *Landslide Deposits* – Landslide deposits within the proposed quarry will be removed during excavation.
- The project site is located within 1 mile of the active North Frontal Fault Zone (western section) and is also in proximity to several other active faults. Geotechnical constraints related to faulting and seismic events at the project are:
    - *Ground Shaking* – The project has a high potential for strong ground motions due to earthquakes on adjacent and nearby active faults.
    - *Ground Surface Rupture* – Ground surface rupture at the project site due to active faulting is not anticipated. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

- *Liquefaction* – The soils underlying the project are not subject to dynamic settlement or liquefaction during a nearby seismic event provided proper drainage of the site is maintained.
- *Lateral Spread* – The soils underlying the project are not considered to be susceptible to seismically-induced lateral spread during a nearby seismic event.

- Groundwater is expected at an elevation approximately 1,000 feet below the lowest proposed grade of the quarry.
- Although the proposed quarry will increase groundwater withdrawal demand, the increase in groundwater withdrawal as a result of the new quarry will not affect Cushenberry Springs (Golder Associates, 2013).
- Based on our review of published geologic literature, aerial photographs, and our site reconnaissance, three areas of the proposed quarry may be underlain by young landslide deposits. The mapped landslides are not anticipated to adversely affect the global stability of the proposed quarry (Golder Associates, 2010).
- Based on review of dam inundation maps, flooding due to dam inundation is not expected to occur at the project.
- Due to the alkaline nature of the on-site soils, the soils at the project site should not be considered corrosive.

9. RECOMMENDATIONS

Based on the geologic and geotechnical considerations at the project presented in the previous section, our general recommendations for the project development are presented below. These recommendations assume that a geotechnical evaluation will be conducted and specific recommendations provided at that time for the actual proposed development.

- Landsliding – Areas mapped as underlain by landslides should be further evaluated. Should landslides be found present within the quarry, appropriate mitigating engineering measures should be employed to stabilize cuts into quarry walls. Such measures may include removal of landslide debris, construction of buttresses, or other stabilization measures. Monitoring of cut slopes by an Engineering Geologist should also be performed during excavation of the quarry so that further recommendations for slope stabilization can be provided as appropriate.
- Expansive Soils – Expansive soils are not anticipated at the project site. However, if expansive soils exist on site, the following recommendations may be implemented during construction to address this condition: the soils could remain in deeper fill areas or the soils could be excavated and removed from the site.

- Compressible Soils – Compressible soils may lead to settlement of the proposed project and potential instability for overlying slopes. The following recommendations may be implemented during construction to address this condition: the soils could be excavated and removed from the site; they could be treated to mitigate their potential for compression, or the materials could be surcharged through the benefit of proposed fills.

- Ground Shaking – Although there is a high potential for ground shaking at the project during a nearby seismic event, this would not preclude the proposed construction. Engineering measures to mitigate the effects of ground shaking are anticipated to be included in future development.

- Liquefaction – Soils underlying the project are not subject to liquefaction or static settlement. However, the following recommendations may be implemented during construction to mitigate this condition: removal and replacement of soils susceptible to liquefaction, densification of these soils through geotechnical engineering methods (e.g., stone columns, compaction grouting, or deep, dynamic compaction), or selecting an engineering foundation design to accommodate the expected effects of liquefaction.

- Flooding – The project is located outside of flood hazard areas and flooding is not anticipated to preclude the proposed construction.

- Corrosive Soils – Due to the alkaline nature of soils developed from meta-carbonate rock, on-site soils are not anticipated to be corrosive. However, laboratory testing for corrosivity should be performed as part of a comprehensive geotechnical evaluation to be performed before design or construction.

10. IMPACT ANALYSIS

Based upon the results of our Geology, Soils, Hydrology, and Water Quality Evaluations, our opinions, and recommendations are provided in the following sections.

10.1. Significance Thresholds

The South Quarry project should be designed and constructed using Best Management Practices (BMP) to avoid exceeding the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) thresholds of significance, as well, as meeting local agency requirements. In evaluating the significance of potential environmental concerns in a particular study area, the criteria to consider are presented in the CEQA Guidelines. In accordance with the scope of work, the findings of this study were evaluated

with respect to questions in Section 6 "Geology and Soils" and Section 8 "Hydrology and Water Quality" within Appendix G of the CEQA Guidelines (2009).

10.2. Project Impacts and Significance: Geology and Soils

Based on the above criteria and the results of the evaluation, the potential impact by geologic and soil conditions at the project site have been identified, and are discussed below.

A. Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of known fault?

No active faults are known to cross or trend toward the project site. Therefore, ground surface rupture due to active faulting is not anticipated at the project site. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible. This risk should be evaluated by a geotechnical evaluation performed for the specific development of the project once development details are known.

ii. Strong seismic ground shaking?

The project has a high potential for strong ground motions due to earthquakes on nearby active faults. Pseudostatic slope stability analysis has been incorporated into the design of the project. This impact is considered less than significant with mitigation incorporated.

iii. Seismic-related ground failure, including liquefaction?

Soils underlying the project are not considered subject to liquefaction or static settlement during a nearby seismic event.

iv. Landslides?

Based on our review of published geologic literature, aerial photographs, and our site reconnaissance, the presence and extend of landslide deposits mapped onsite (USGS, 2004 and Golder Associates 2010) should be further evaluated. Should landslides be found present within the quarry, appropriate mitigating engineering measures should be employed to stabilize cuts into quarry walls. Monitoring of cut slopes by an Engineering Geologist should also be performed during excavation of the quarry so that further recommendations for slope stabilization can be provided as appropriate.

B. Would the project result in substantial soil erosion or the loss of topsoil?

While topsoils will be removed as part of the quarry excavation activities, these soils are relatively thin and have minimal agricultural value. Soils encountered on site that may contain organic material will be salvaged and stored on site. Based on proposed implementation of BMPs in the SWPPP during the life of the project, soil erosion would be less than substantial.

C. Would the project be located on geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

The project involves excavation and slope construction that may result in on- or off-site landslides. Excavation of the quarry will be conducted according the recommendations provided by Golder Associates (2010) based on appropriate stability analyses of the proposed quarry slopes. Furthermore, specific excavation methods will be implemented to prevent off-site material erosion and landsliding. An annual report discussing the findings of on-going geotechnical study will be prepared. The impacts of lateral spreading, subsidence, liquefaction and collapse are not considered significant.

D. Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Soils with a moderate to high potential for expansion are not anticipated at the site. However, should these materials be encountered, mitigation techniques can be implemented. Such techniques include overexcavation and replacement with non-expansive soil, moisture control, and/or development of specific structural design for expansive soil condition.

E. Would the project have soils incapable of inadequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of wastewater?

No septic tanks or alternative wastewater disposal systems are proposed.

10.3. Project Impacts and Significance: Hydrology and Water Quality

Based on thresholds of significance and the results of the evaluation, the potential impact to hydrologic conditions and water quality at the project site have been identified, and are discussed below.

A. Would the project violate water quality standards or waste discharge requirements?

Water runoff due to rainfall events and snow melt will occur at the site. An Industrial SWPPP has been developed to manage storm water runoff and snow melt runoff from the haul road. Offsite runoff from the pit excavation will not be significant because runoff will be retained within the excavation. Runoff water collected in BMPs and excavations will leave by evaporation or infiltration. In addition, the project will meet all waste discharge required by the MWA and State Water Resources Control Board. This impact is considered less than significant.

B. Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level?

Groundwater level data indicates that in the vicinity of the mining plant that the groundwater levels generally follow the pumping trends. Over the past several years there has been a relative equilibrium with withdrawal and replenishment. The project will continue to monitor groundwater levels and groundwater pumping levels to insure that the groundwater level is not significantly reduced.

C. Would the project substantially alter the existing drainage pattern of the site or area that would result in substantial on- or off-site erosion or siltation?

SWPPPs using best management practices will be used for the project. BMPs include a vegetated earthen berm along the south side of the South Pit. The vegetated berm will allow up-slope runoff occurring southeast of the project site to continue the natural flow. Runoff occurring on the southwest side of the project site will flow naturally into the Marble Canyon Creek. Rainfall or snow occurring within the largest area of disturbance, the South Quarry excavation, will be contained within the excavation and will leave either by evaporation or infiltrated as groundwater. A vegetated earthen berm will be constructed along the northern edge of the haul road to control concentrated runoff from the road onto the adjacent descending natural slope. Storm water catch basins will be constructed on the south side of the road. The catch basins will collect the concentrated flow occurring on the roadway and intercept naturally occurring drainage flow. The water will pond in the catch basins and will leave the basin either by evaporation or will percolate into the groundwater. In addition, collection ditches, berms, check dams; placement of erosion control materials, sediment fences, or straw bales; and other appropriate measures will be used to reduce the flow and velocity of runoff. Although the soil thickness in the vicinity of the site is relatively thin, gradual siltation will occur in the catch basins. Periodic maintenance should be performed to avoid a reduction in the size of the basins and the absorption rates due to siltation. Siltation disturbance to the natural areas outside of the project is considered less than significant. During mining operations water trucks will apply water to the haul road and with the pit excavation to mitigate dust and wind related erosion.

D. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff which would result in flooding on- or off-site?

The project will not substantially alter the off-site drainage patterns. The drainage within the South Quarry will remain in the pit. The project does not include construction of large non-vegetated areas with uncontrolled runoff. The haul road will include SWPPPs including earthen berms to convey runoff to catch basins. Water will leave the pit through evaporation or as groundwater. Therefore, the amount of runoff that could result in flooding will not be significantly increased. This impact is considered less than significant.

E. Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

The project will not substantially alter the off-site drainage patterns. The drainage within the South Quarry will remain in the pit. The project does not include construction of large non-vegetated areas with uncontrolled runoff. The haul road will include SWPPPs including earthen berms to convey runoff to catch basins. Water will leave the pit through evaporation or infiltrated as groundwater. Therefore, the project would not create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff. This impact is considered less than significant.

F. Would the project otherwise substantially degrade water quality?

The project will meet waste discharge requirements as required by DWR, CalEPA, NPDRS and San Bernardino County. This includes meeting requirements for surface runoff that can enter into the groundwater by infiltration. The project will include design and construction of SWPPs that will control surface runoff. In addition, the on-going water quality monitoring program that includes testing of groundwater wells and monitoring wells located within and outside of the operations area of the mine will continue. The purpose of the on-going monitoring is to ensure proper treatment of runoff. This impact is less than significant.

G. Would the project place housing within a 100-year flood hazard boundary area or other flood hazard delineation map?

Marble Canyon Creek is the largest and closest water course to the site. Marble Canyon Creek is an ephemeral stream located from approximately 95 feet to 1265 feet west of the site. The creek, project site or adjacent areas are not located within a Federal Emergency Management Agency's Flood Insurance Rate Map. No housing is proposed as part of the project, therefore no impact would occur.

H. Would the project place within a 100-year flood hazard boundary area structures that would redirect or impede flood flows?

The project site and adjacent areas are not located within a Federal Emergency Management Agency's Flood Insurance Rate Map. No impact would occur.

I. Would the project expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam?

There are no levees or dams located along Marble Canyon Creek or down-gradient of the site. No impact would occur.

J. Would the project expose people or structures to inundation by seiche, tsunami or mudflow?

Based on the Safety Element of the County of San Bernardino 2007 General Plan, the site does not cross areas subject to dam inundation. The site is not located near a natural or manmade lake or reservoir, and is not subject to inundation from seiche. Due to the distance from the Pacific Ocean, the project is not subject to tsunami run-up hazards.

11. LIMITATIONS

The field evaluation and geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No warranty, implied or expressed, is made regarding the conclusions, recommendations, and professional opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered. Our preliminary conclusions and recommendations area based on an analysis of the observed conditions and the referenced background information.

The purpose of this study was to evaluate geologic and geotechnical conditions within the project and to provide a geotechnical reconnaissance report to assist in the preparation of environmental impact documents for the project. A comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing, should be performed prior to design and construction of structural improvements.

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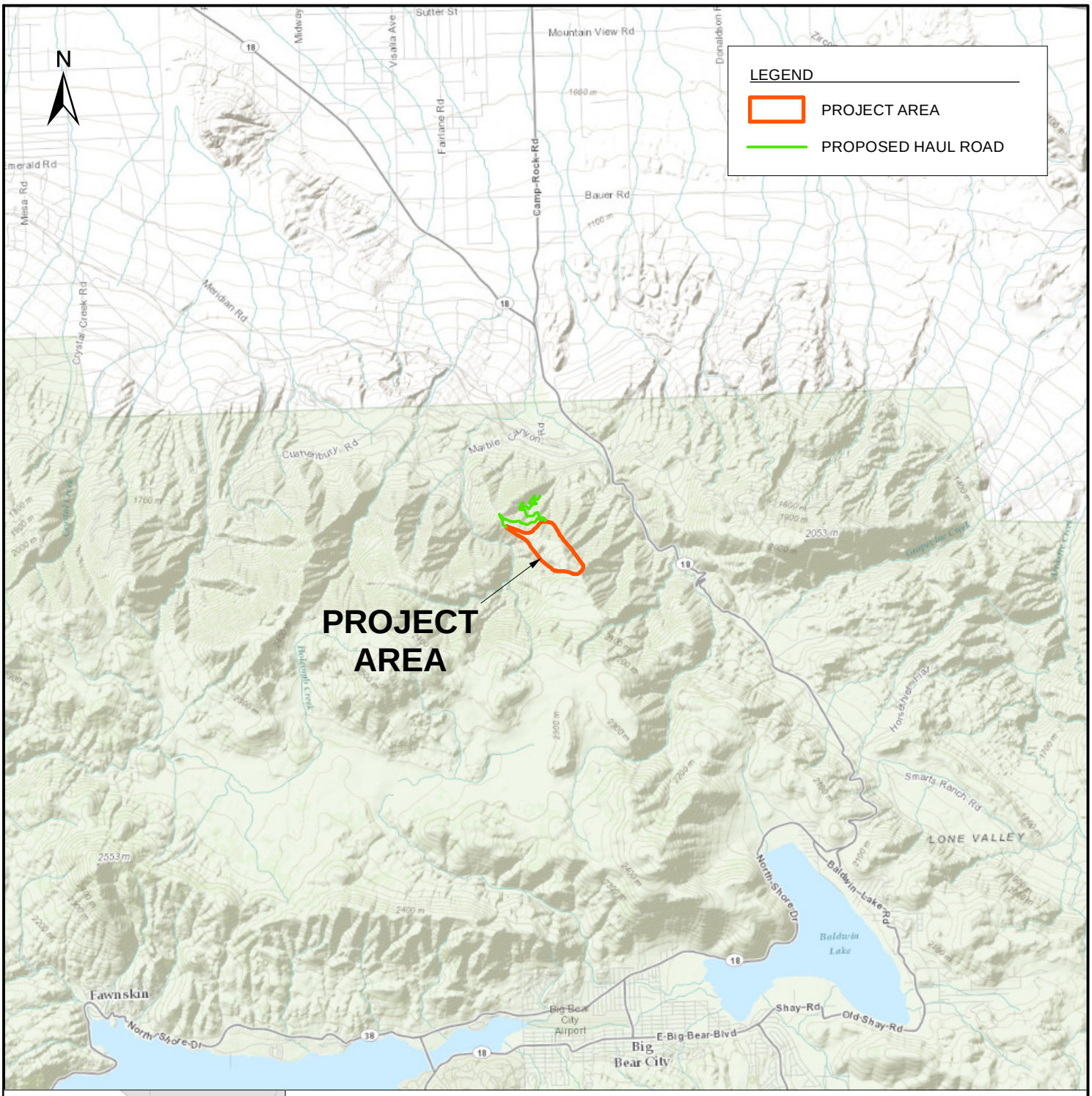
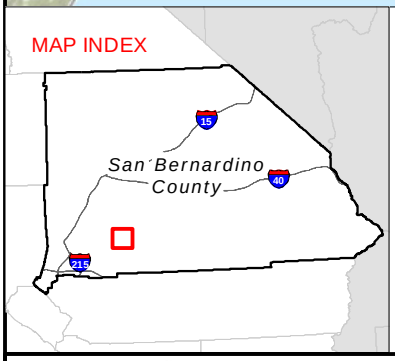




SOURCES: ESRI, DELORME, NAVTEQ, TOMTOM, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, AND THE GIS USER COMMUNITY

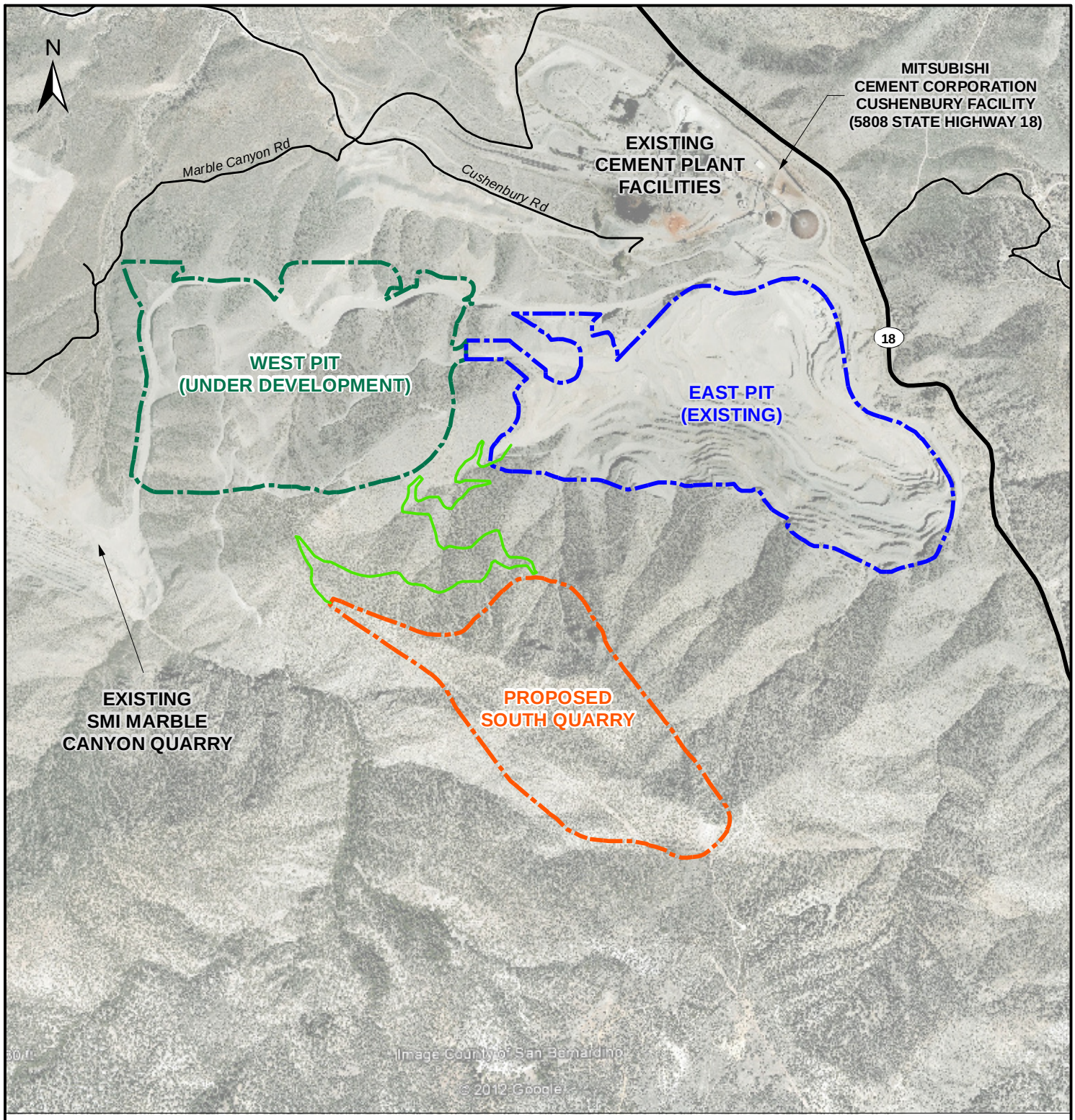
SCALE IN FEET

0 4,000 8,000 16,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore	PROJECT AREA LOCATION	FIGURE
PROJECT NO. / DATE	MITSUBISHI CEMENT CORPORATION SOUTH QUARRY SAN BERNARDINO COUNTY, CALIFORNIA	1
107331001 / 9/13		

1_107331001_SL.mxd 9/11/2013 1:37:40 PM JDL



SOURCE: FIG 3 - EXISTING AND PLANNED OPERATIONS, MITSUBISHI CEMENT COPORATION - SOUTH QUARRY, LILBURN CORPORATION, UNDATED; AERIAL IMAGERY - PHOTO DATE: FEBRUARY, 2009; (C) GOOGLE EARTH, 2012

LEGEND

PROJECT AREA

PROPOSED HAUL ROAD

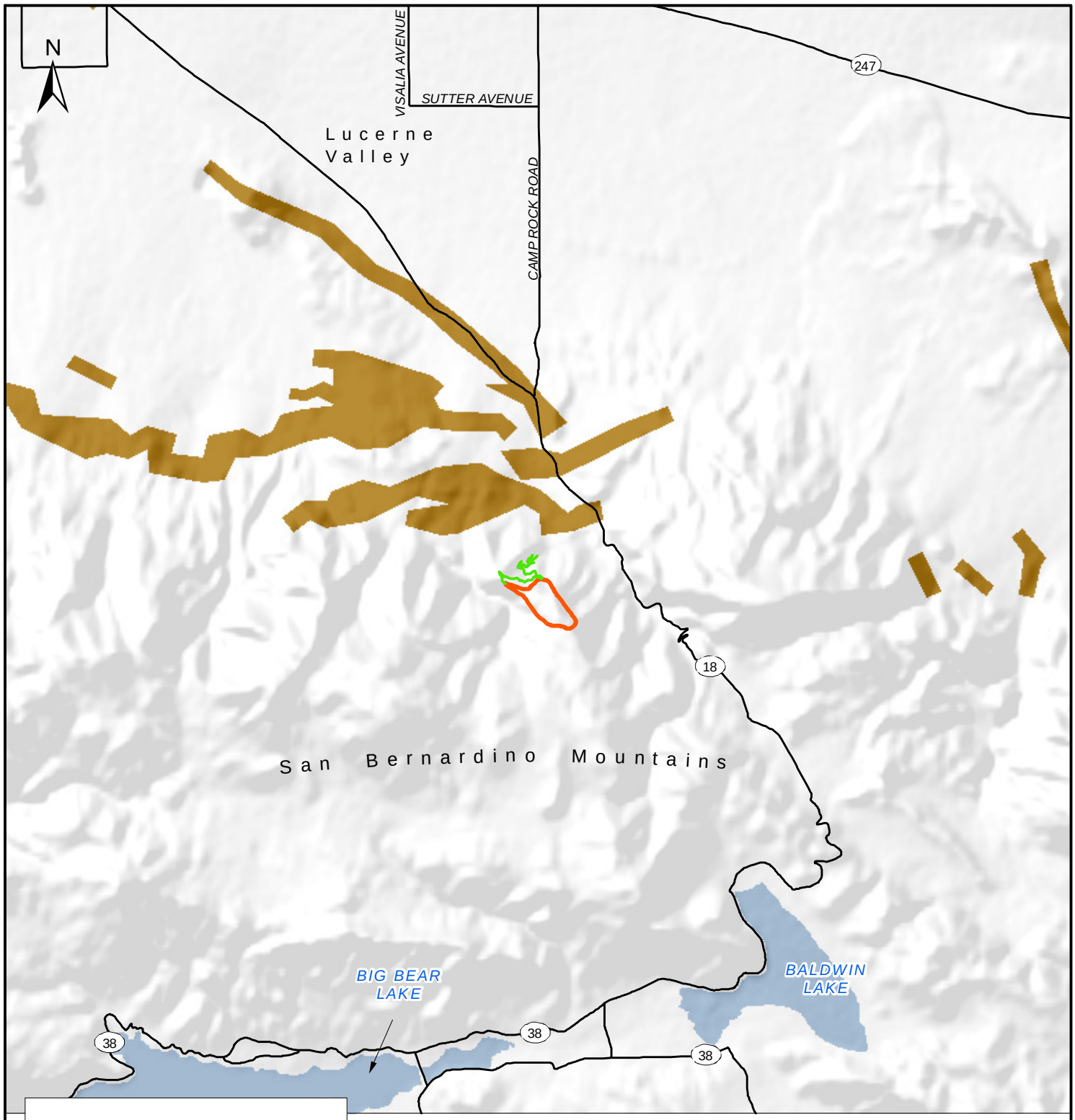
SCALE IN FEET

0 750 1,500 3,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore		SITE PLAN	FIGURE
PROJECT NO.	DATE	MITSUBISHI CEMENT CORPORATION SOUTH QUARRY SAN BERNARDINO COUNTY, CALIFORNIA	2
107331001	9/13		

2_107331001_SP.mxd 9/11/2013 1:37:41 PM JDL



SOURCE: EARTHQUAKE FAULT ZONES - CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY, 2002

LEGEND

- PROJECT AREA
- PROPOSED HAUL ROAD
- EARTHQUAKE FAULT ZONE

SCALE IN FEET

0 4,250 8,500 17,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	EARTHQUAKE FAULT ZONES	FIGURE
PROJECT NO. / DATE	MITSUBISHI CEMENT CORPORATION PROPOSED SOUTH QUARRY LUCERNE VALLEY, CALIFORNIA	3
107331001 / 9/13		

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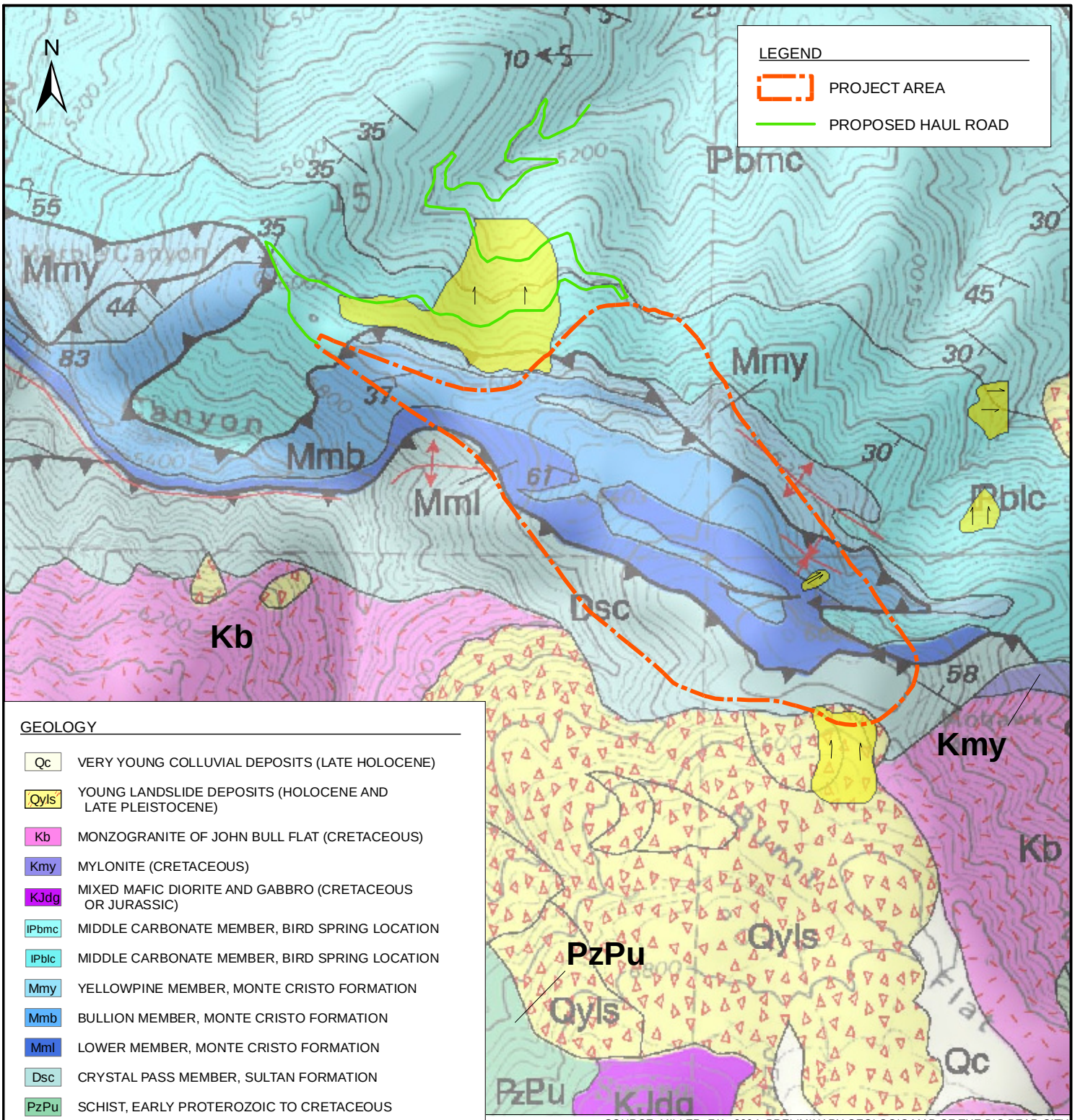

GEOLOGY

Qc	VERY YOUNG COLLUVIAL DEPOSITS (LATE HOLOCENE)
Qyls	YOUNG LANDSLIDE DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)
Kb	MONZOGRANITE OF JOHN BULL FLAT (CRETACEOUS)
Kmy	MYLONITE (CRETACEOUS)
KJdg	MIXED MAFIC DIORITE AND GABBRO (CRETACEOUS OR JURASSIC)
IPbmc	MIDDLE CARBONATE MEMBER, BIRD SPRING LOCATION
IPblc	MIDDLE CARBONATE MEMBER, BIRD SPRING LOCATION
Mmy	YELLOWPINE MEMBER, MONTE CRISTO FORMATION
Mmb	BULLION MEMBER, MONTE CRISTO FORMATION
Mml	LOWER MEMBER, MONTE CRISTO FORMATION
Dsc	CRYSTAL PASS MEMBER, SULTAN FORMATION
PzPu	SCHIST, EARLY PROTEROZOIC TO CRETACEOUS

THRUST FAULT—OLDER OVER YOUNGER. SOLID WHERE LOCATED WITHIN ±15 METERS; DASHED WHERE LOCATED WITHIN ±30 METERS; DOTTED WHERE CONCEALED.

ANTICLINE

SYNCLINE

STRIKE AND DIP OF BEDS, INCLINED

QLS - MAPPED LANDSLIDE (GOLDER ASSOCIATES, 2010)

65

10

BEARING AND PLUNGE OF LINEAR FEATURES, MINOR FOLD AXES

SOURCE: MILLER, F.K., 2004, PRELIMINARY GEOLOGIC MAP OF THE BIG BEAR CITY 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA

SCALE IN FEET

0 500 1,000 2,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	GEOLOGY	FIGURE
PROJECT NO. / DATE	MITSUBISHI CEMENT CORPORATION PROPOSED SOUTH QUARRY LUCERNE VALLEY, CALIFORNIA	4
107331001 / 9/13		

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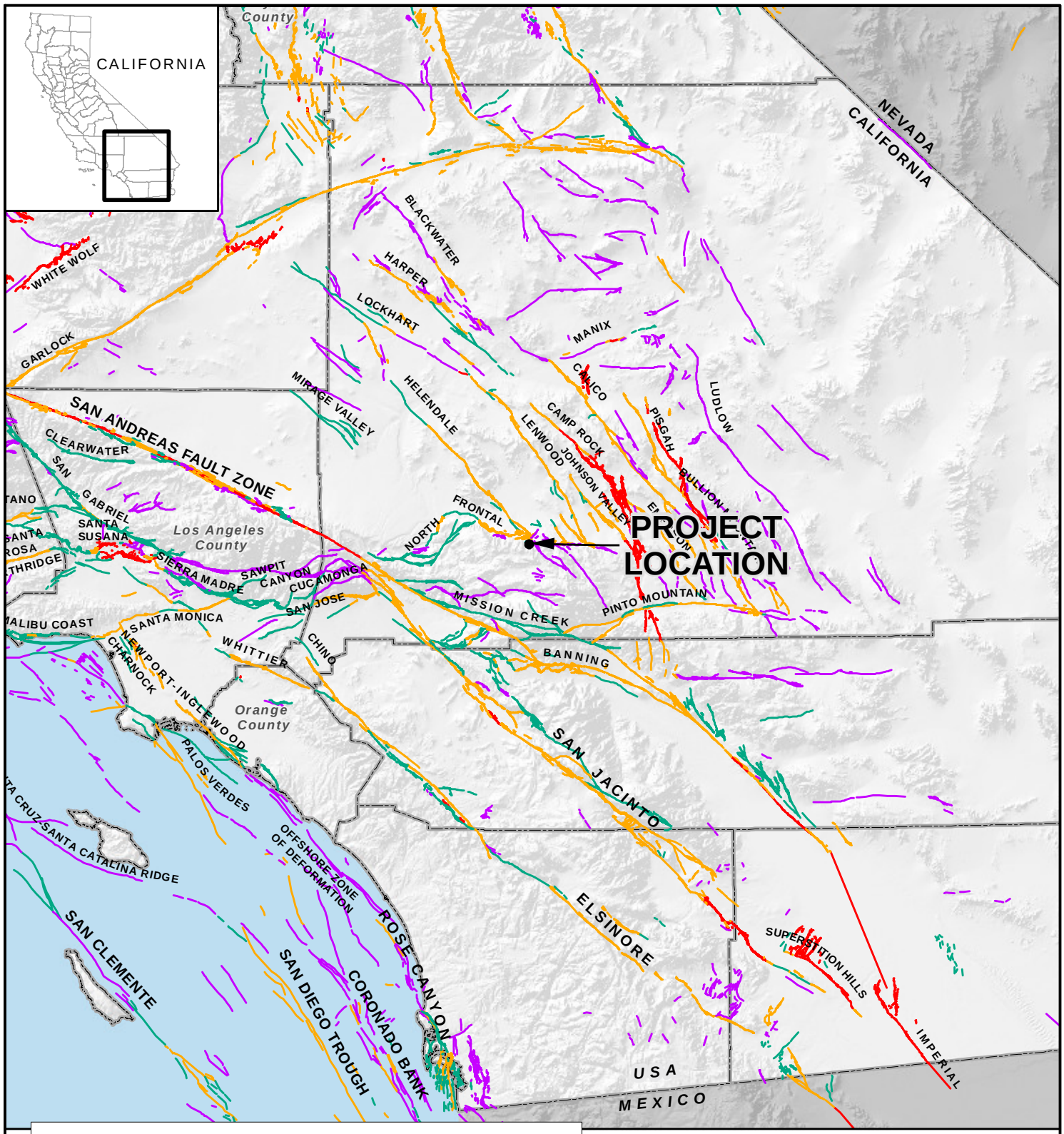


LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

SOURCE: U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, 2006, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES, ACCESSED 2011.

SCALE IN MILES

0 30 60

N

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

PROJECT NO.	DATE
107331001	9/13

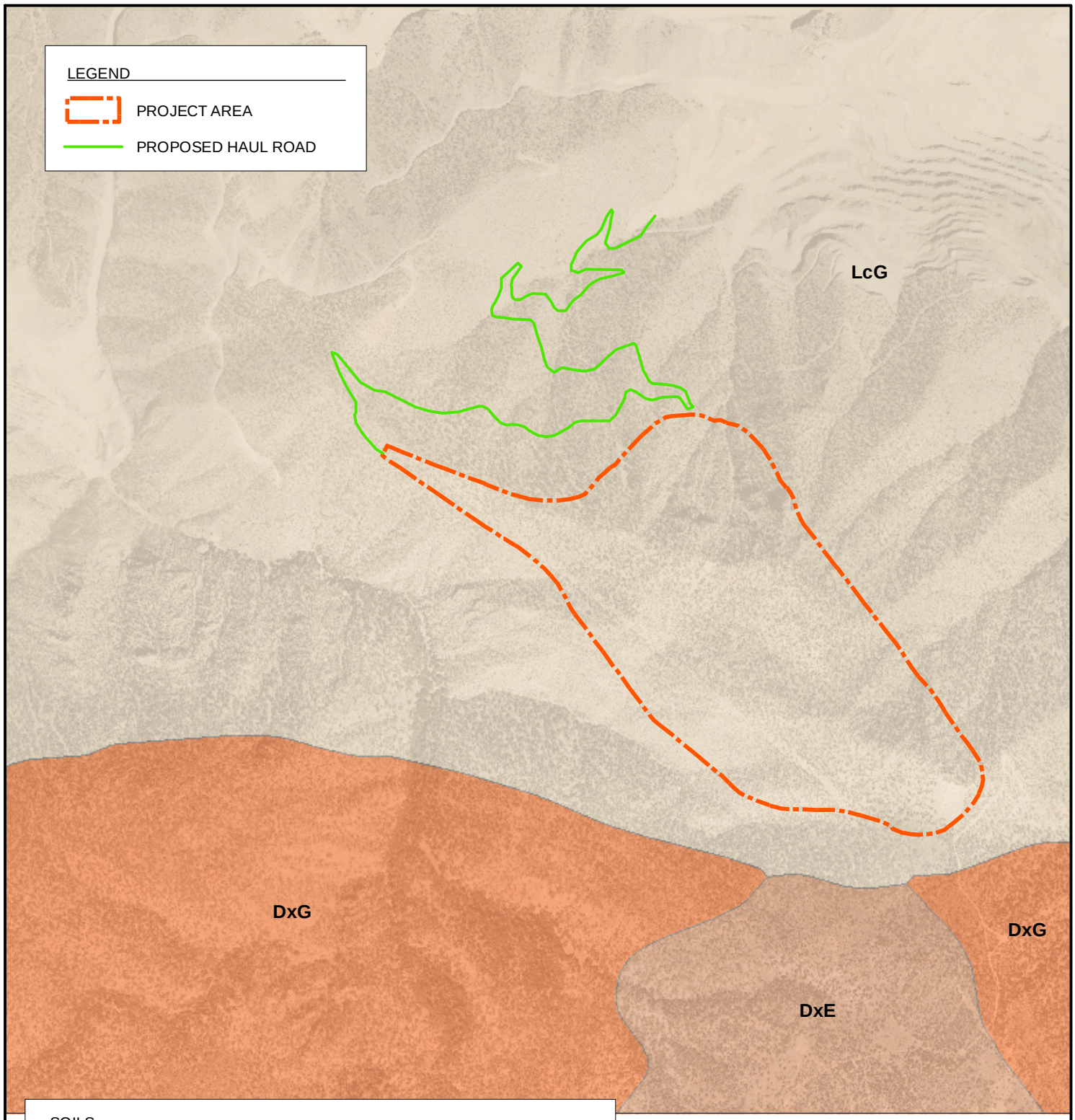
FAULT LOCATIONS

MITSUBISHI CEMENT CORPORATION
PROPOSED SOUTH QUARRY
LUCERNE VALLEY, CALIFORNIA

FIGURE

5

5_107331001_FI2.mxd 2/18/2013 4:09:30 PM JDL



SOILS

DxE	WAPI-PACIFICO FAMILIES, DRY-ROCK OUTCROP COMPLEX, 15 TO 30 PERCENT SLOPES
DxG	WAPI-PACIFICO FAMILIES, DRY-ROCK OUTCROP COMPLEX, 50 TO 75 PERCENT SLOPES
LcG	LITHIC XERORTHENTS, CALCAREOUS-ROCK OUTCROP COMPLEX, 50 TO 100 PERCENT SLOPES

SOURCE: SOILS - NATIONAL COORDINATED COMMON RESOURCE AREA (CRA) - U.S. DEPARTMENT OF AGRICULTURE (USDA) / NATURAL RESOURCES CONSERVATION SERVICE (NRCS), 2012

SCALE IN FEET

0 500 1,000 2,000

N

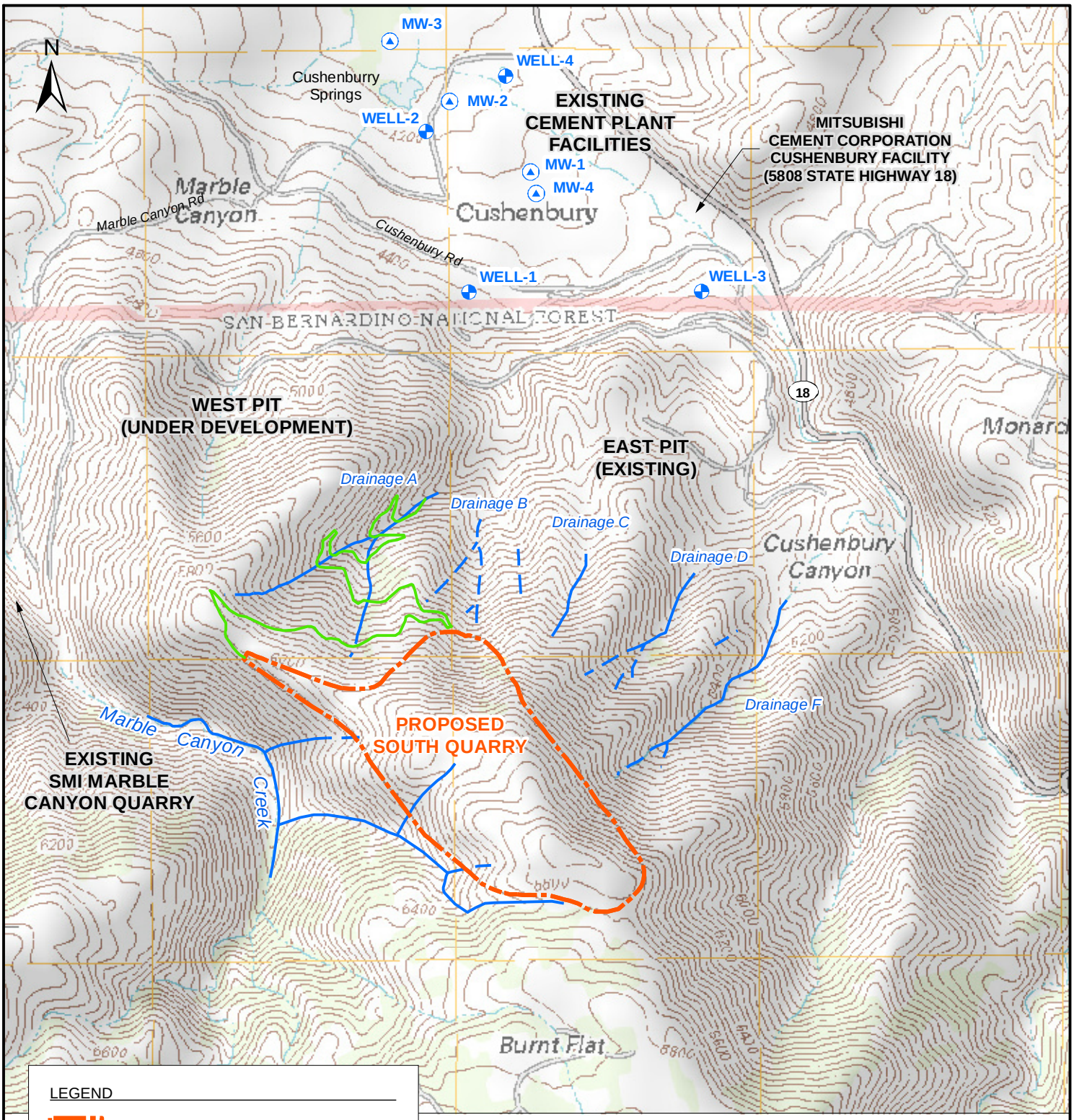
NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

USDA SOILS

PROJECT NO.	DATE	MITSUBISHI CEMENT CORPORATION SOUTH QUARRY SAN BERNARDINO COUNTY, CALIFORNIA	FIGURE
107331001	9/13		6

6_107331001_S.mxd 9/11/2013 1:51:42 PM JDL



LEGEND

- PROJECT AREA
- PROPOSED HAUL ROAD
- MW-4 GROUNDWATER MONITORING WELL
- GROUNDWATER WELL

SOURCE: BASE - USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - BIG BEAR CITY, CA - 2012.

SCALE IN FEET

0 750 1,500 3,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

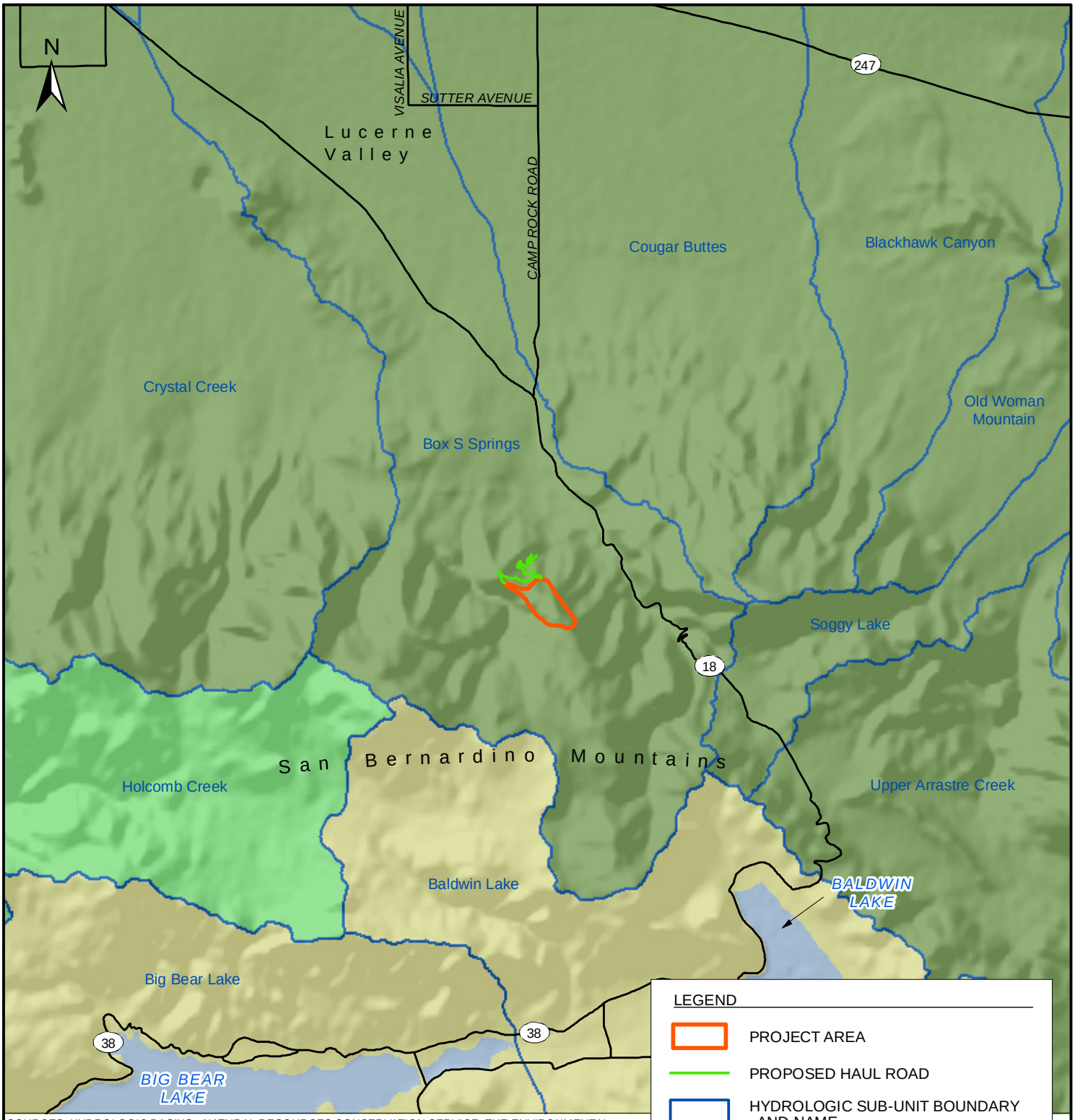
TOPOGRAPHY AND HYDROLOGY

PROJECT NO.	DATE
107331001	9/13

MITSUBISHI CEMENT CORPORATION
SOUTH QUARRY
SAN BERNARDINO COUNTY, CALIFORNIA

FIGURE 7

7_107331001_TOP_HYD.mxd 9/11/2013 2:02:42 PM JDL



SOURCES: HYDROLOGIC BASINS - NATURAL RESOURCES CONSERVATION SERVICE, THE ENVIRONMENTAL PROTECTION AGENCY, AND THE UNITED STATES GEOLOGICAL SURVEY, CALIFORNIA DIGITAL CONSERVATIOJN ATLAS (CAL-ATLAS), 2012

LEGEND

- PROJECT AREA
- PROPOSED HAUL ROAD
- HYDROLOGIC SUB-UNIT BOUNDARY AND NAME

HYDROLOGIC SUB-BASINS WITHIN ALIGNMENT

- SAN JACINTO RIVER
- SANTA ANA RIVER
- WHITEWATER RIVER

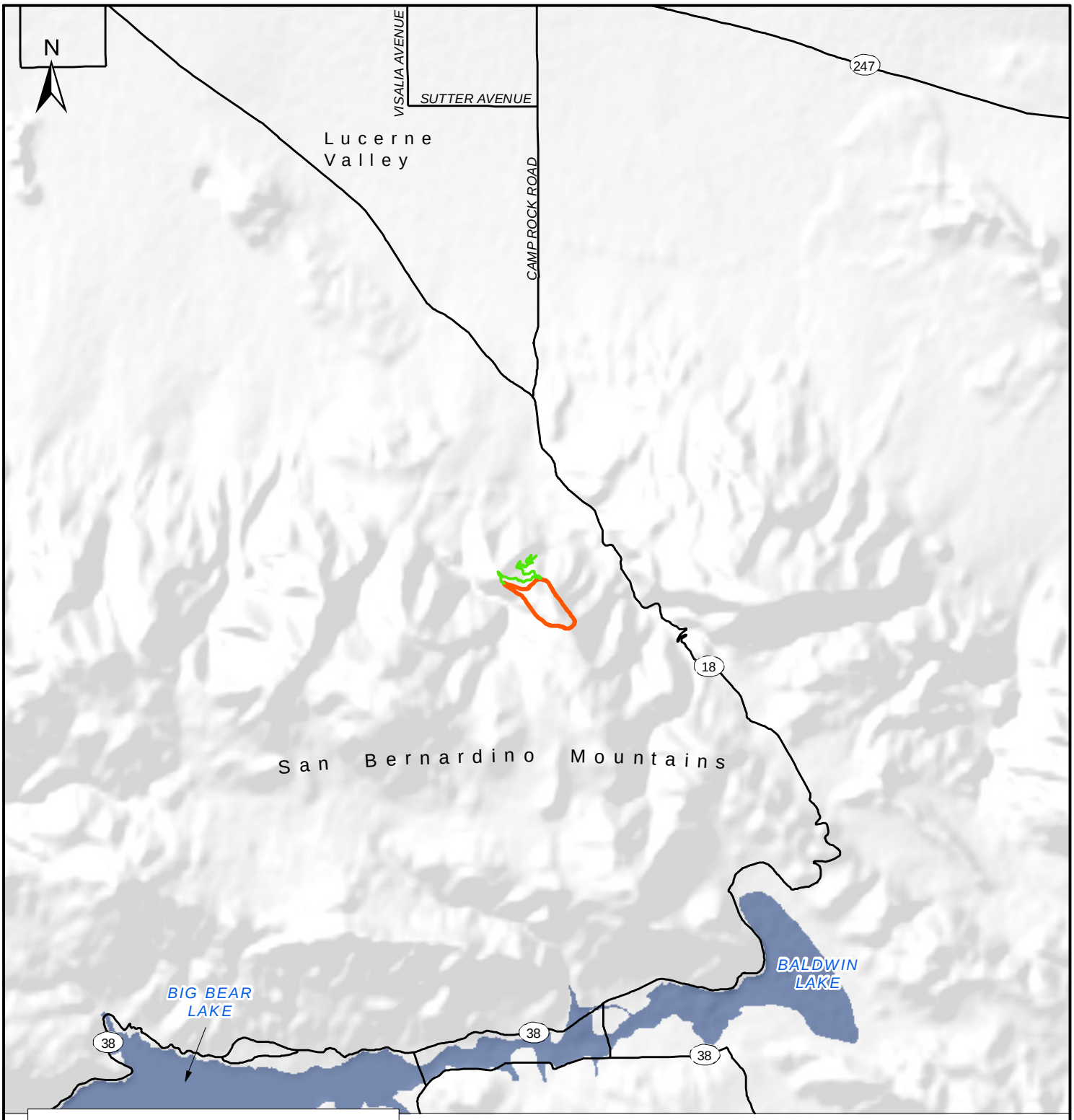
SCALE IN FEET

0 4,250 8,500 17,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	HYDROLOGIC BASINS	FIGURE
PROJECT NO. / DATE	MITSUBISHI CEMENT CORPORATION PROPOSED SOUTH QUARRY LUCERNE VALLEY, CALIFORNIA	8
107331001 / 9/13		

8_107331001_HB.mxd 9/11/2013 1:56:09 PM JDL



SOURCE: FEMA Q3 FLOOD DATA - CALIFORNIA DIGITAL CONSERVATIOJN ATLAS (CAL-ATLAS), 2012

LEGEND

- PROJECT AREA
- PROPOSED HAUL ROAD
- FEMA 100-YEAR FLOOD ZONE

SCALE IN FEET

0 4,250 8,500 17,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

FEMA 100-YEAR FLOOD ZONES

PROJECT NO.	DATE
107331001	9/13

MITSUBISHI CEMENT CORPORATION
PROPOSED SOUTH QUARRY
LUCERNE VALLEY, CALIFORNIA

FIGURE

9

9_107331001_FEMA.mxd 9/11/2013 1:58:34 PM JDL