3.~~3~~2 Geology and Soils

Geocon, Incorporated conducted field investigations of the Project Site on July 1, 2, and 8 of 2002. These investigations consisted of a Project Site reconnaissance and the excavation of exploratory borings, trenches, and seismic refraction traverses. The purpose of this investigation was to evaluate the surface and subsurface soil and geologic conditions and to provide recommendations as to the feasibility of Project Site development. The ~~geotechnical~~ Geotechnical ~~feasibility study~~Investigation (updated November 20, 2006) prepared for the Project Site is summarized below and can be found in its entirety in this EIR as Appendix G~~H~~ 1. ~~Two a~~Additional documents including an ~~addendum~~ Addendum to the Geotechnical Investigation (September 19, 2007), Response to County Review Comments ~~and memorandum~~ (September 16, 2008), and Response to County Review Comments for Rockfall Potential (March 31, 2011) ~~that include additional information, boring logs, recommendations, and responses to County Comments,~~ are attached to this EIR as Appendix G~~H~~ 2.

3.~~3~~2.1 Existing Conditions

Faults

According to a review of published geologic maps and reports (Alquist-Priolo Earthquake Fault Zoning Act, Special Publication 42, Revised 1997, Fault Rupture Hazard Zones in California), the Project Site does not lie within any special hazard area identified by the Alquist-Priolo Earthquake Fault Zoning Map. One unnamed inactive fault (California Geological Survey County Report 3, 1963, as cited in Geocon 2002) was mapped approximately three miles northeast of the Project Site, but was not evaluated since it is situated off-site and its strike does not extend into the Project Site.

There are 29 known active faults located within a search radius of 62 miles (100 kilometers) from the Project Site, and the nearest known active faults are the Temecula and Julian segments of the Elsinore Fault located approximately seven and eight miles northeast of the Project Site, respectively. Major earthquakes occurring on the Elsinore Fault or other regionally active faults located in the southern California area could subject the Project Site to moderate-to-severe ground shaking within the life span of the proposed structures.

Geology/Soils

Three surficial soil types and three geologic formations were encountered during the field investigation. Surficial soil deposits include undocumented fill, topsoil, and alluvium. Formational units include Quaternary-aged Terrace Deposits, Cretaceous-aged Bonsall Tonalite, and San Marcos Gabbro (Larsen 1948). The on-site soils consist predominantly of fine- to coarse-grained, silty sands, clayey sands, and sandy silts. These materials generally have a very low to medium expansion potential and should provide good capping material for the streets and lots.

Oversize concrete rubble and other undocumented fill are present within two westward-draining arroyos in the central portion of the Project Site. The rubble fill is estimated to be in excess of 20 feet thick in the deeper arroyos and canyons. The fills are potentially compressible and subject to collapse with an increase in moisture content.

Expansive Soils

The Project Site is located on expansive soils as defined within Table 18-I-B of the Uniform Building Code (UBC; 1994). This was confirmed by Geocon staff review of the Soil Survey for the San Diego Area, prepared by the U.S. Department of Agriculture, Soil Conservation and Forest Service dated December 1973.

Liquefaction

Liquefaction is a phenomenon where loose, saturated, and relatively cohesionless soil deposits lose strength during strong ground motions. Liquefaction analyses were conducted on the Project Site, which indicated that alluvium deposits are located below the water table. Because of the high groundwater table, the alluvium deposits, and the proximity to active and potentially active seismic areas of the County (namely the Elsinore Fault Zone), there is the potential for the Proposed Project to be susceptible to liquefaction. The areas susceptible to seismic related ground failure and/or liquefaction under current groundwater conditions include the alluvial formations that are identified on the geology map as Qal (Figure 3.~~3~~2-1).

Saturated alluvium (alluvium below the water table) is generally located along the western property margin and in the southwestern portion of the Project Site. Based on Geocon's analysis, a zone of approximately 17 feet of potentially liquefiable material exists in the main drainage area at the southwestern corner of the Project Site.

Rockfall

The Project Site is on and near steep slopes with boulders/rocks that could become unstable in the event of seismic activity or heavy precipitation. The natural hillside has slope inclinations ranging between 1.3:1 to 3:1. A potential exists for rockfall off-site from the west-facing slope of Rosemary's Mountain located immediately south of Monserate Mountain. Large boulders on the order of 20 feet or greater in diameter are present on the natural slopes above the road. Figures 3.~~3~~2-2 and 3.~~3~~2-3 show the approximate locations of specific boulders that have been identified with potential for rockfall.

Erodibility

The entire Project Site is comprised of soils that are categorized by the Soil Survey of San Diego County as "Severely or Moderately Erodible." Some of the geologic effects created by poorly protected severely erodible soils can range from altering natural drainage features to creating environments suitable for landsliding and rockfall.

3.2~~3~~.2 Guidelines for the Determination of Significance

For the purpose of this EIR, the basis for the determination of significance is the CEQA Appendix G Guidelines (Guidelines 1 through 4) and Table 18-1 of the UBC (1994).

A significant geologic/soils impact would occur as a result of proposed project implementation if it:

1. Exposes people or structures to geologic hazards such as rupture of a known earthquake fault, strong seismic shaking, landslides, mudslides, and ground failure including liquefaction;

2. Is located on a geologic unit or soils that is unstable, or that would become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse;

3. Results in substantial soil erosion or the loss of top soil; and

4. Is located on expansive soils, as defined in Table 18-1 of the UBC (1994) and does not conform with the UBC.

3.~~3~~2.3 Analysis of Project Effects and Determination as to Significance

Faults and Liquefaction (Guideline 1)

A significant impact would occur if the project exposes people or structures to geologic hazards such as rupture of a known earthquake fault, strong seismic shaking, and ground failure including liquefaction.

Although the Project Site is not located within a hazard zone of the Alquist-Priolo Earthquake Fault Zone Map, it is situated relatively close to active and potentially active seismic areas of the County. Since there are no known active faults on the Project Site, the potential impact of rupture of a known earthquake fault is **less than significant**. Major earthquakes occurring on the Elsinore Fault that could subject the Project Site to moderate-to-severe ground shaking within the life span of the structures associated with the Proposed Project. The Project Site is considered to be comparable to the surrounding developed area with respect to seismic shaking. The Proposed Project design would address strong seismic shaking by ensuring that the Proposed Project design is in conformance with the UBC/CBC and the County Zoning Ordinance (see Table 1-5), as well as all recommendations found in Section 7 of the geotechnical study, thereby reducing the potential impact of strong seismic shaking to a level that is **less than significant**.

Much of the Project Site would require only a 13-foot-thick non-liquefiable layer to resist liquefaction, which currently already exists over most of the Proposed Project area. The main area of concern is the main drainage in the southwestern area of the site (near the proposed school site, and north of SR-76) which does not have enough non-liquefiable material to resist liquefaction. There are also smaller areas along the western edge of the property with similar liquefaction potential. The geotechnical report estimates that (in some areas) an 18- to 22-foot-thick non-liquefiable layer would be required in order to resist the upward pressure of the liquefying stratum for the level of ground-shaking that was assumed possible for the Project Site. Since standard design measures would not completely eliminate the risks associated with liquefaction in the southwestern and western areas of the Project Site, impacts would be **significant** (**GE-1**).

Rockfall (Guideline 2)

A significant impact would occur if the project is located on a geologic unit or soils 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 potential exists on the Project Site for rockfall from the west-facing slope of Rosemary's Mountain due to seismic or erosional events. The identified area of having rockfall potential is not located on the Project Site and will not be impacted by grading and construction of the Proposed Project. Lots located down gradient from the potential area of rockfall include the proposed school site and residential lots 356, 383 through 396, 403, 404, and 406 through 409. These lots are located on the west side of Horse Ranch Creek Road, as shown on Figures 3.2~~3~~-2 and 3.2~~3~~-3. Future seismic activity or heavy precipitation/erosional events could potentially dislodge boulders.

The Proposed Project design will incorporate features, such as open space buffers and tree plantings, to reduce impacts from rockfall and soil instability. However, pursuant to Guideline 2, standard design measures would not completely eliminate risks associated with rockfall, and as such, impacts would be **significant** (**GE-2**).

Erodibility (Guideline 3)

A significant impact would occur if the project would result in substantial soil erosion or the loss of top soil.

Due to the erodible soils that exist on the Project Site, there is the potential for significant erosion impacts to occur. However, the Proposed Project design includes erosion control measures and a landscaping plan that comply with current San Diego County and Fallbrook community rules and regulations to prevent soil erosion on- and off-site (see Table 1-5). Therefore, the Proposed Project impacts would be **less than significant**.

Expansive Soils (Guideline 4)

A significant impact would occur if the project is located on expansive soils, as defined in Table 18-1 of the UBC (1994) and does not conform with the UBC.

The Project Site is located on expansive soils as defined within Table 18-I-B of the UBC. The Proposed Project will comply with the improvement requirements identified in the 1997 UBC. The geotechnical study performed by Geocon Incorporated found that complete removal and recompaction of the compressible deposits, which are found in several locations across the Project Site, will be required in order to support structural improvements. Because of the presence of groundwater in the main drainages, complete removal of the alluvium will likely not be possible. Compressible deposits and expansive soils would be addressed by remedial grading and other Proposed Project design considerations listed in Table 1-5. These specific design measures are required to reduce the potential for hazards associated with both cut and fill slopes and seepage and perched water. Implementation of these design features assure that impacts relating to expansive soils would be **less than significant.**

3.23.4 Cumulative Impact Analysis

As discussed above the Proposed Project could result in potentially significant geological hazards due to soil liquefaction and rockfall. This significant impact is reduced to a level of less than significance through the implementation of mitigation measures, discussed below. Additionally, Project Site conditions relating to erosion and expansive soils are less than significant due to erosion control measures, landscaping plans, and conformance with current San Diego County and Fallbrook community rules and regulations, as well as the CBC/UBC. Based on the strict requirements identified in the listed National Pollutant Discharge Elimination System (NPDES) permits and the fact that other planned and proposed developments in the Proposed Project vicinity would be required to implement similar controls, no significant cumulative erosion and sedimentation impacts are anticipated. As with the Proposed Project, cumulative area projects with similar potential would be required to implement similar site-specific measures to address potential impacts to geology and soil. Because of the site-specific nature of these potential hazards and the measures to address them, there would be no connection to similar potential issues or cumulative effects to or from other properties. Based on these requirements, cumulative impacts to geology would result from development of the Proposed Project would be **less than significant**.

3.23.5 Mitigation Measures Proposed to Minimize the Significant Effects

M-GE-1 The applicant shall raise the existing grade while also removing and re-compacting the alluvium above the groundwater table to increase the overburden pressure over the liquefiable deposits as recommended by the geotechnical engineer.

M-GE-2 Mitigation of rockfall potential shall consist of: the following:

- The boulders identified as having a high potential of rockfall in the Response to County of San Diego Review Comments for Rockfall prepared by Geocon Incorporated dated March 31, 2011 shall be broken and removed from the slope or alternatively rock bolted to the slope as part of the grading of the site.

- Boulders identified as having a less than significant rockfall potential shall be tested by applying pressure with an excavator. If the boulders move, they shall be mitigated using the same techniques as described for boulders with high potential for rockfall. Boulders identified as having a less than significant rockfall potential shall be monitored during grading after any heavy rains if they should occur. If any undermining on the downhill side of any of the boulders has occurred, removal and/or breaking of the boulder(s) as recommended shall be performed to mitigate the rockfall hazard.

- A letter of certification shall be provided by a California Registered Professional Engineer or Certified Engineering Geologist to the *[DPLU, PCC]*, which states that the identified rockfall hazards at the site have been mitigated to a level of less than significant and any proposed buildings are safe for human occupancy.

- The above certification letter shall be provided prior to approval of any building plans and issuance of any building permit. The *[DPLU, PCC]* shall review the rockfall hazard certification report for compliance with this condition.

~~(1) identifying boulders that have a high potential for rockfall and breaking and/or removing these rocks from the hillside; (2) identifying boulders that have a less significant rockfall potential, testing these rocks with excavation equipment, and removing rocks that move or appear to be unstable; and (3) monitoring rocks during development of the Proposed Project identified that have a less than significant rockfall potential.~~

~~1) Boulders identified as having a high potential (eroded at the base or entirely free from the soil) shall be broken and removed from the slope, or alternatively rock bolted to the slope. This will require use of an excavator with a rock breaking device or drilling the rock and using chemicals that break rock, or the use of anchors to pin the rock to the slope. Large rocks that are impractical to completely remove or anchor to the slope shall be broken down such that they are relatively flat or on contour with the slope face to create a rock with a shape that will not roll.~~

~~2) Boulders identified as having a less significant rockfall potential shall be tested by applying pressure with the excavator. If the boulders move they shall be mitigated as recommended under No. 1. Boulders that are small enough such that they can easily be moved shall be pushed or rolled down the slope.~~

~~3) During the monitoring period after a period of heavy rain, the boulders shall be observed to assess if runoff has caused undermining of the downhill side of the boulder. Removal and/or breaking of the boulders as recommended shall be performed if undermining occurs.~~

3.23.6 Conclusion

Implementation of the Proposed Project could result in risks associated with liquefaction, especially along the main drainage in the southwestern area of the Project Site, as well as other smaller areas along the properties western edge (GE-1). M-GE-1 requires the inclusion of site-specific geotechnical design criteria beyond standard design measures including the requirement to raise the grade of the Proposed Project and the re-compacting of soils over liquefiable deposits. Implementation of these additional measures, as detailed in Section 7 of the geotechnical report, would reduce potentially significant impacts to below a level of significance.

Implementation of the Proposed Project could result in risks associated with rockfall due to seismic activity or heavy precipitation/erosional events (GE-2). M-GE-2 provides specific mitigation that would reduce the hazard of rockfall by assuring that boulders identified as potentially dangerous are removed or broken down, testing of smaller boulders and monitoring after heavy rainfall. Implementation of these mitigation measures would reduce potentially significant impacts to below a level of significance.

No other soil or geologic conditions were encountered that would prevent the development of the Proposed Project for residential uses provided the Project Site is graded in accordance with the UBC/CBC, the County Grading Ordinance, and the geotechnical report's recommendations (Section 7). These recommendations are listed as project design considerations in Table 1-5 and would preclude impacts associated with geologic hazards resulting from implementation of the Proposed Project.

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FIGURE 3.2-1
Geology

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Map Source: Geocon Inc., September, 2008

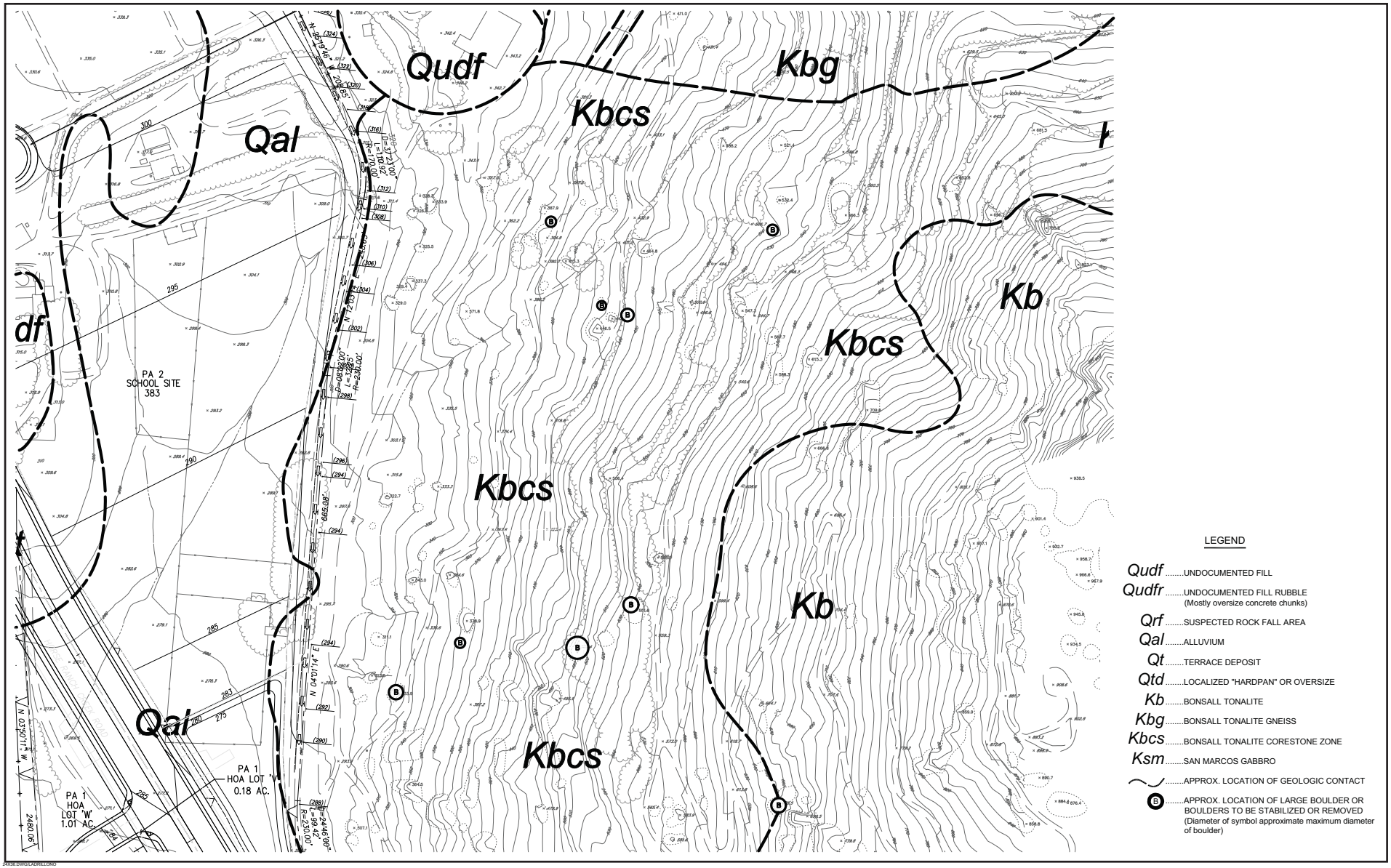

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FIGURE 3.2-2

Boulders with Rockfall Potential (North)

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Map Source: Geocon Inc., September, 2008

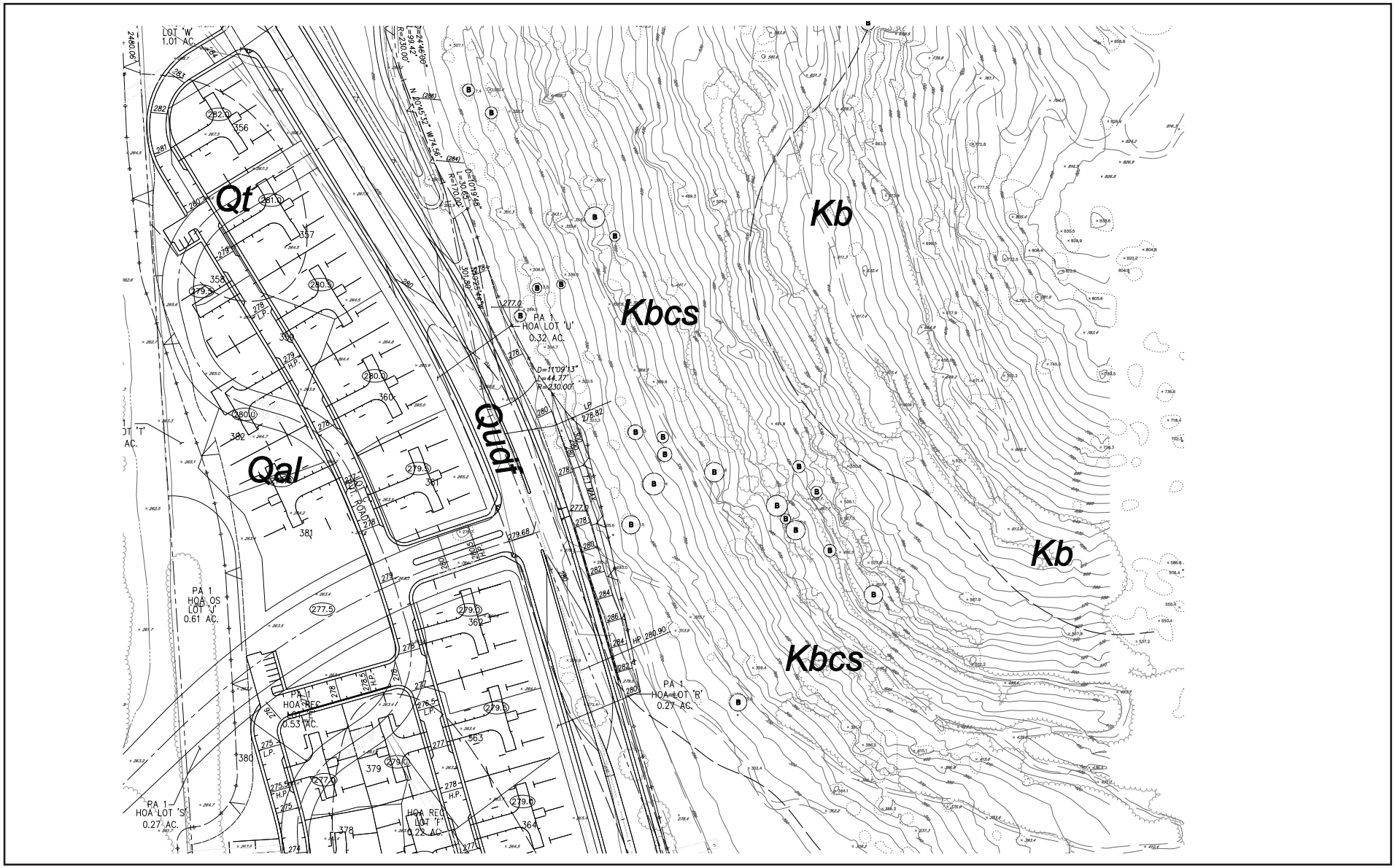

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FIGURE 3.2-3

Boulders with Rockfall Potential (South)

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