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5.15 GEOLOGICAL HAZARDS AND RESOURCES

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.
- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.
- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.
- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration.
- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  - **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  - **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

Identification of geologic hazards and mineral resources is based on published literature and the Project Site geotechnical investigation (URS, 2009). Regarding geologic resources, evaluations of impact significance are based on the type and the proximity of the resource to the Project. Recommendations are provided for mitigation of geologic hazards and geotechnical issues at the Project. Figures are located at the end of this section.

The information provided in this section is based on a review of published geologic and mineral resource references.

Additional information related specifically to the OEHI Project is contained Appendix A-1 to this AFC Amendment, Section 4.6, Geology and Soils.

5.15.1 Affected Environment

5.15.1.1 Regional Stratigraphy

The Project is located in the Great Valley Geomorphic Province of California (CGS, 2002a). The Great Valley is an alluvial plain about 50 miles wide and 400 miles long in the central part of California. Its northern part is the Sacramento Valley, drained by the Sacramento River; and its southern part is the San Joaquin Valley, drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic period (about 160 million years ago).

The southern portion of the Great Valley Province is characterized as being a nearly flat-surfaced, north-trending, asymmetric trough bounded by the Coast Range to the west and Sierra Nevada Mountains to the east. Tertiary rocks, which were deposited nearly continuously from Cretaceous to Pleistocene time (1.6 to 65 million years ago), are largely of marine origin and underlie a relatively thin cover of Quaternary alluvium. The Tertiary rocks overlie Jurassic-Cretaceous marine sedimentary rocks along the western side of the valley. Northwest-trending anticlines in the Tertiary strata are reflected by the gas and oil fields and by low hills in the valleys.

5.15.1.2 Local Geology

The Project is located along the northeastern face of the Elk Hills, which are the surface manifestation of an anticlinal uplift along the western side of the San Joaquin Valley. The Elk Hills are composed of sands, conglomerates, mudstones, and shales derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the eroded materials on an apron of small coalescing fans along the northeastern flank of the hills, which abut the much larger Kern River fan to the north.

As shown on Figure 5.15-1, Regional Geologic Map of Project, and Figure 5.15-2, Project Site Geologic Map, surficial deposits at the Project and Project Site have been described as Quaternary age (less than 1.6 million years old) alluvial gravel and sand of valley areas (Q); and bedrock at the surface and underlying alluvium consisting of Pliocene- to Pleistocene-age (11,000 to 5.3 million years old) Tulare Formation (QPc) that consists of alternating beds of sandstone and mudstone (Dibblee, 2005). According to Dibblee (2005) these deposits are stream-laid, weakly indurated pebble gravels, sands, and clays; they are light gray in color. The pebbles are composed chiefly of Monterey siliceous shale and debris from bedrock in the adjacent Temblor Range to the west.

The Project is located in the Kern County subbasin (DWR Subbasin No. 5-22.14) of the San Joaquin Valley Groundwater Basin. Groundwater was not encountered within 60 to 100 feet of the ground surface, based on the geotechnical borings drilled and cone penetration tests performed at the Project Site during the subsurface investigations (URS, 2009). In the vicinity of the Project Site, spring-time groundwater elevations based on regional data from the California Department of Water Resources (DWR) have ranged from approximately elevation 180 to 250 above mean sea level in recent years, which corresponds to approximately 40 to 110 feet below grade (DWR, n.d.). For additional information regarding groundwater conditions, see Section 5.14, Water Resources.

The linear facilities (electrical transmission line, natural gas pipeline, water supply pipelines, and railroad spur) will be underlain by earth materials that are similar to those at the Project Site.

5.15.1.3 Tectonic Framework

The Project, like most of California, is in a seismically active region. A review of geologic literature did not identify the presence of any known active or potentially active faults at the Project Site, or crossing the Project linears. Except for an inactive fault crossed by the CO_2 pipeline, Figure 5.15-1, Regional Geologic Map of Project, does not show any faults mapped within the Project.

The closest known faults classified as active by the State of California Geological Survey (CGS) are the San Andreas Fault, located, using Blake (2000), approximately 21 miles to the west; the White Wolf Fault, located approximately 23 miles to the southeast; and the Pleito Thrust, located approximately 27 miles south of the Project Site. These faults are shown on Figure 5.15-3, Regional Fault Map—Major Faults of Southern California.

5.15.1.4 Historic Seismic Events—Southern California

The most significant recorded seismic events of Southern California in terms of their location and magnitude (relative to the Project Site) are summarized in Table 5.15-1, Significant Recorded Seismic Events in Southern California.

The largest-magnitude earthquake recorded in Southern California was a magnitude 7.9 along the San Andreas Fault at Fort Tejon on January 9, 1857. Figure 5.15-4, Epicentral Location of Major Earthquakes in Southern California, presents the location of the epicenters of recorded seismic events greater than magnitude 3.0 since 1735.

Naturally occurring seismic events on the order of magnitude 6 and smaller, even if located in the immediate area of the field, should not cause significant damage to the Project or wells in EHOF.

There is no history of induced seismicity at EHOF, and the chance of Project-induced seismicity is viewed as remote. In the unlikely event of Project-induced seismicity, the magnitude of the seismic event would be less than a magnitude 4, considering the geologic setting, areal extent, and depth of proposed operations, as well as anticipated pressure and stress changes (Terralog Technologies, 2008). Seismic events of magnitude 4 may be felt in the immediate area but would not cause structural damage to buildings or facilities.

Any potential induced seismicity is at least an order of magnitude smaller than natural seismicity hazards for the area.

5.15.1.5 Geologic Hazards

Geologic hazards that are known to be present in portions of California and that could potentially affect the Project Site or the linear facilities are described in the following paragraphs. The primary geologic hazards at the Project (Project Site and linear facilities) include ground motion from a seismic event and the potential for expansive soils due to high clay content in surface soils. The identified geologic hazards are considered less than significant with the proposed mitigation. A complete listing of potential geologic hazards, likelihood of occurrence, and potential impacts at the Project are discussed in further detail below.

Surface Rupture

Primary ground rupture is defined as the surface displacement that occurs along the surface trace of the causative fault during an earthquake. Ground rupture can occur along known pre-existing faults, unknown pre-existing faults, or new faults that develop as a result of a seismic event.

According to the California Department of Conservation, Division of Mines and Geology (CDMG, 1997; Hart and Bryant, 1997), the Project is not located in an Alquist–Priolo Earthquake Fault Zone. Based on a review of available geologic data, no surface traces of active faults pass through the Project. Therefore, the potential for primary ground rupture at the Project is considered to be low. Consequently, potential impacts from a primary ground rupture will be less than significant.

Seismic Ground Shaking

The Project Site as well as off-site linears are susceptible to ground shaking generated during earthquakes on nearby faults. The intensity of ground shaking, or strong ground motion, is dependent upon the distance of the fault to the Project, the magnitude of the earthquake, and the underlying soil conditions. This hazard can be mitigated by designing and constructing structures and buildings in conformance with current building codes and engineering practices. With the implementation of Geo-1, discussed in Section 5.15.4.1, Seismic Shaking, potential impacts from seismic shaking will be less than significant.

Liquefaction

Liquefaction is a process in which soil grains in a saturated sandy deposit lose contact because of earthquakes or other sources of ground shaking. The soil deposit temporarily behaves as a viscous fluid; pore pressures rise; and the strength of the deposit is greatly diminished. Liquefaction is often accompanied by sand boils, lateral spreading, and post-liquefaction settlement as the pore pressures dissipate. Liquefiable soils typically consist of cohesionless sands and silts that are loose to medium-dense, and saturated.

Based upon the findings of the URS (2009) geotechnical investigation, the potential for liquefaction to occur and impact the Project Site is low to nil. As a result, impacts will be less than significant. The Project linears may require additional evaluation during detailed design.

Seismically Induced Dry Sand Settlement

The presence of loose, unsaturated granular soil layers could result in some seismically induced settlement that will need to be taken into account during foundation design. The potential for seismically induced settlement for the Project Site was evaluated by URS (2009). In general, seismically induced settlement could occur within the susceptible native, loose to medium-dense sandy soils in the upper 50 feet. However, remedial grading and design can reduce the impact of seismically induced dry sand settlement to less than significant. The Project linears may require additional evaluation during detailed design. With the implementation of Geo-2, discussed in Section 5.15.4.3, Seismically Induced Dry Sand Settlement, impacts will be less than significant.

Subsidence

Subsidence ground failure can be aggravated by several causes, including ground shaking and withdrawal of large volumes of fluids from underground reservoirs, and also by the addition of surface water to certain types of soils (hydro-compaction). According to the Kern County General Plan Safety Element (2009), the Project Site, as well as the linears, is not in an area mapped as having measured land subsidence or hydro-compaction; therefore, it is unlikely that subsidence will occur at the Project Site or along the linears. As a result, potential impacts will be less than significant.

Flooding

According to Figure 14 of the Kern County General Plan Safety Element (Kern County, 2009), the Project Site is not in an area identified as having flood hazards or shallow groundwater. The CO_2 pipeline extending to the south of the Project Site will cross a flood hazard zone associated with the Kern River Flood Control Canal. None of the other Project linears crosses through designated flood hazard zones.

Provided with proper drainage design, the Project Site is not likely to experience flooding. As a result, impacts will be less than significant.

Tsunamis

A tsunami is a great sea wave, commonly called a tidal wave, produced by a significant undersea disturbance such as tectonic displacement of the sea floor associated with large, shallow earthquakes. The Project is situated more than 200 feet above sea level. As such, the Project Site and associated linears are not subject to tsunamis. As a result, impacts will be less than significant.

Seiches

A wave created by an earthquake shaking in an enclosed body of water is called a seiche. The potential for a seiche to occur is related to the natural frequency of vibration of the body of water, as well as to the predominant frequencies of vibration in the seismic event. Seiches at the Project are highly unlikely due to the absence of lakes or large bodies of water in the immediate area. As a result, impacts will be less than significant.

Volcanic Hazards

No centers of potential volcanic activity occur within hundreds of miles of the Project. Volcanic hazards, such as lava flows and ash falls, are therefore not anticipated to present a hazard. As a result, impacts will be less than significant.

Landslides and Lateral Spreading

Landsliding and lateral spreading are often triggered by earthquakes and usually occur in areas of moderate to high relief, weak soil or rock strength, and high groundwater. The Project Site is in an area of low relief. Therefore, the potential for localized landslides or lateral spreading to or occurring within the Project Site is generally low. However, man-made excavations and fills to construct the Project's existing drainage system consist of un-engineered soils with weak soil strength. These un-engineered fill slopes have a medium potential for landsliding and lateral spreading. The CO_2 pipeline that will extend south of the Project Site will traverse areas of moderate relief. The Project slopes and CO_2 pipeline will require slope stability evaluation, which will be provided by a design-level geotechnical investigation. With the implementation of Geo-3, discussed in Section 5.15.4.7, Landslides and Lateral-Spreading Hazards, impacts will be less than significant.

Expansive Soils

Expansive soils are fine-grained soils (generally high-plasticity clays) that can undergo a significant increase in volume with an increase in water content, and a significant decrease in volume with a decrease in water content. Changes in the water content of a highly expansive soil can result in severe distress to structures constructed upon the soil.

The subsurface investigation (URS, 2009) indicates that the surficial soils at the Project Site are fine-grained soils comprised predominantly of clays and silty clays. The Project Site clays have high plasticity and highly organic soils with remnants of vegetations from past and current agricultural use. In general, these upper soils possess relatively high moisture contents and are unsuitable for direct support of shallow foundations or new engineered fills. With the implementation of Geo-4, discussed in Section 5.15.4.8, Expansive Soils, impacts will be less than significant.

5.15.1.6 Geologic Resources

Geologic resources of recreational, commercial, or scientific value in the Project vicinity that could be affected include oil and gas reserves. The Project is not located over mines, aggregate deposits, or mineral deposits; no known scientific or recreational geologic resources were identified in the vicinity of the Project, based on published information (CDMG, 1962, Mines and Mineral Resources of Kern County California, Plate 1). Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) Map 421 identifies a plugged and abandoned dry hole (Quintana Production Co. "Union-Gamay" 56X-10) drilled at the Project Site (DOGGR, n.d.). The well drilled on the Project Site did not encounter petroleum. Therefore, the likelihood of petroleum reserves below the Project Site is unlikely.

The CO_2 pipeline passes through the Elk Hills, North Coles Levee, South Coles Levee petroleum fields; and the Bowerbank natural gas field. Construction of the pipeline through these petroleum fields is not likely to prevent recovery of the resources, and injection of CO_2 into the EHOF is designed to enhance recovery of those deposits while sequestering the CO_2.

As a result, the negative impacts on geologic resources will be less than significant.

5.15.2 Environmental Consequences

Potential impacts of the Project on the geologic or mineral resources and potential impacts of geologic hazards can be divided into those related to construction activities and those related to Project operation.

5.15.2.1 Construction-Related Impacts

Construction-related impacts on the geologic or mineral resources primarily involve grading operations and operations for foundation support. The Project Site slopes and temporary construction slopes and excavations should be properly designed to be stable. Project development is not anticipated to result in significant adverse impacts on geologic or mineral resources. Potentially significant impacts by geologic conditions on construction are not anticipated. With implementation of the mitigation measures outlined in Section 5.15.4, Mitigation Measures, impacts on Project construction by the geologic environment will be reduced to less-than-significant levels. There will be no significant impacts on the geologic environment resulting from construction of the Project linears.

5.15.2.2 Operation-Related Impacts

No significant adverse impacts on geologic resources have been identified as a result of operation. Potential impacts of geologic hazards on the Project and ancillary facility operations include seismic shaking. With implementation of the measures outlined in Section 5.15.4, Mitigation Measures, impacts on Project operations from geologic hazards will be reduced to a less-than-significant level.

There will be no significant impacts on the geologic environment resulting from operation of the Project linears.

5.15.2.3 OEHI Project Impacts

According to the analysis contained in Appendix A-1, Section 4.6, Geology and Soils, with implementation of identified mitigation measures, construction and operation of the OEHI Project would not result in significant adverse impacts on geologic resources and impacts on OEHI Project operations from geologic hazards will be reduced to a less-than-significant level.

5.15.3 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines Section 15130). A "cumulative impact" consists of an impact which is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines Section 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines Section 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065 [b][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines Section 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines Section 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines Section 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines Section 15130[b]).

A cumulative impact analysis starts with a list of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines Section 15130[b]). Factors to consider when determining whether to include a related project include the nature of the environmental resource being examined, the location of the project, and its type (CEQA Guidelines Section 15130[b]). For purposes of this AFC Amendment, Kern County was contacted to obtain a list of related projects, which is contained in Appendix I. Depending on its location and type, not every project on this list is necessarily relevant to the cumulative impact analysis for each environmental topic.

For purposes of geological hazards and resources, it was determined that none of the projects was relevant for the cumulative impact analysis.

Cumulative impacts on the geologic resources at the Project are considered to be negligible.

According to the analysis contained in Appendix A-1, Section 4.6, Geology and Soils, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts to geologic resources.

5.15.4 Mitigation Measures

5.15.4.1 Seismic Shaking

The potential exists for ground shaking from a variety of nearby sources, including the San Andreas Fault.

- **Geo-1.** Project facilities will be designed in accordance with the seismic design criteria of applicable building codes. Seismic design criteria will be provided either by codes or a design-level geotechnical investigation.

5.15.4.2 Liquefaction

No liquefaction hazard exists at the Project Site, and no mitigations are suggested. In general, mitigation of liquefaction on Project linears will be accomplished in the design of the specific structures.

5.15.4.3 Seismically Induced Dry Sand Settlement

- **Geo-2.** To reduce the potential for adverse differential settlement beneath heavily loaded, settlement-sensitive structures, removal of the susceptible soils and replacement with engineered fill have been recommended for structures that will be founded on shallow foundations. Alternatively, deep foundations (driven piles) have been recommended. Settlement design criteria can be provided by a design-level geotechnical investigation.

5.15.4.4 Subsidence

Subsidence at the Project Site is not considered to be a significant hazard, and no mitigations are needed.

5.15.4.5 Flooding

Flooding at the Project Site is not considered to be a significant hazard, and no mitigations are needed.

5.15.4.6 Tsunamis, Seiches, and Volcanic Hazards

Tsunamis, seiches, and volcanic hazards are not present in the Project area, and no mitigations are needed.

5.15.4.7 Landslides and Lateral-Spreading Hazards

- **Geo-3.** To reduce the potential for landslides and lateral spreading, Project Site slopes that may be susceptible will be designed to mitigate these potential hazards. Mitigation will include removal of the susceptible soils and replacement with engineered fill or reducing the hazard by elimination of Project Site slopes. Slope stability design criteria will be provided by a design-level geotechnical investigation.

5.15.4.8 Expansive Soils

- **Geo-4.** To reduce the potential for adverse expansion potential beneath Project Site improvements, removal of the susceptible soils and replacement with engineered fill have been recommended, as appropriate. Expansive soil design criteria can be provided by a design-level geotechnical investigation.

5.15.4.9 Geologic Resources

There are no significant adverse impacts on geologic resources; therefore, no mitigations are needed.

5.15.5 Laws, Ordinances, Regulations, and Standards

The Project will be constructed and operated in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to geologic hazards and resources discussed below and summarized in Table 5.15-2, Summary of LORS—Geological Hazards.

5.15.5.1 Federal

There are no federal LORS for geological hazards and resources or for grading and erosion control.

5.15.5.2 State

California Public Resources Code *(PRC)* 25523(a), 20 CCR § 1252 (b) and (c)

None of the Project components are located in or cross an Alquist–Priolo earthquake zone; therefore, the Project will not be subject to requirements for construction within an earthquake fault zone.

California Building Code

The 2010 edition of the California Building Code (CBC) is based on the International Building Code (IBC) 2009 edition**,** with revisions specifically tailored to geologic hazards in California.

- Chapter 16: Structural Design Requirements, Division IV Earthquake Design

  This section requires that structural designs be based on geologic information for seismic parameters, soil characteristics, and site geology.

- Chapter 18: Foundations and Retaining Walls, Division I and III

  Division I sets requirements for excavations and fills, foundations, and retaining structures with regard to expansive soils, subgrade bearing capacity, and seismic parameters. It also addresses waterproofing and damp-proofing foundations. In Seismic Zones 3 and 4, as defined by the Uniform Building Code (UBC), liquefaction potential at the site should be evaluated. Division III contains requirements for mitigating effects of expansive soils for slab-on-grade foundations.

- Chapter 33: Site Work, Demolition and Construction

  These sections establish rules and regulations for construction of cut-and-fill slopes, fill placement for structural support, and slope setbacks for foundations.

California Environmental Quality Act of 1970

The California Energy Commission (CEC) will be the lead agency for rules and regulations to implement the California Environmental Quality Act (CEQA). Appendix G, Section VI, of the CEQA guidelines contains the geologic hazards and resources related to the Project.

5.15.5.3 Local

Kern County General Plan, Chapter 4, Safety Element

The Safety Element of the Kern County General Plan provides an implementation program to reduce the threat of seismic and public safety hazards in unincorporated areas of Kern County.

The Project will comply with all Seismic/Geologic Hazard Elements of the Kern County General Plan. No active faults will be crossed by the Project linears.

The county will review the geologic information and geotechnical recommendations presented in design-level geotechnical reports.

5.15.6 Involved Agencies and Agency Contacts

Agencies with jurisdiction to enforce LORS related to geologic hazards and resources and the appropriate contact person are summarized in Table 15.5-3, Involved Agencies and Agency Contacts.

5.15.7 Permits Required and Permit Schedule

There are no applicable permits required for geologic hazards.

5.15.8 References

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Table 5.15-1
Significant Recorded Seismic Events in Southern California

Date	Location/Event	Approximate Distance to Project Site[1] (miles [km])	Earthquake Moment Magnitude[2] (M_w)	Approximate Site Acceleration at Project Site[3] (g)
Jan 09, 1857	Fort Tejon	23.5 [37.8]	7.9	0.242
Jul 21, 1952	Kern County	30.9 [49.8]	7.3	0.169
Jun 28, 1992	Landers	184.6 [297.0]	7.3	0.015
Oct 16, 1999	Hector Mine	183.4 [295.1]	7.1	0.010
May 19, 1940	Imperial County	285.7 [459.7]	7.0	0.003
Jan 17, 1994	Northridge	91.0 [146.5]	6.7	0.020
Feb 09, 1971	San Fernando	84.6 [136.1]	6.6	0.017

Sources: Blake, 2000; CGS, 2002a and 2007.
Notes:
1 Site coordinates for Blake analysis: latitude 35.3327, longitude 119.3845.
2 CGS, 2002b, Appendix A, 2002 California Fault Parameters.
3 Attenuation relation for Blake analysis: Sadigh *et al*., 1997.
Acronyms and Abbreviations:
CGS = California Geological Survey
g = unit of acceleration
km = kilometers
M_w = moment magnitude scale

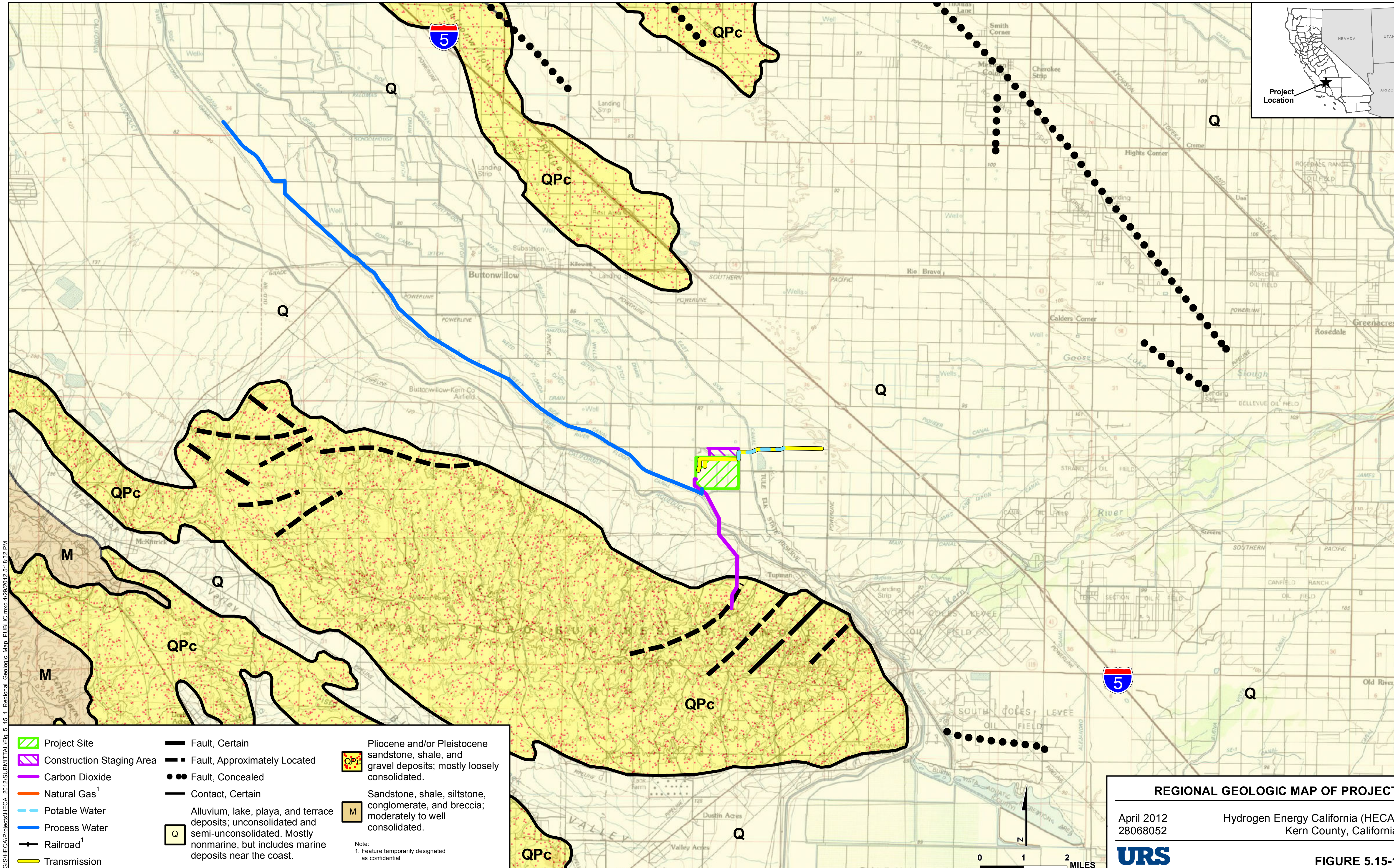
Table 5.15-2
Summary of LORS—Geological Hazards

LORS	Requirements	Conformance Section	Administering Agency
Federal Jurisdiction			
No federal LORS are applicable			
State Jurisdiction			
Cal PRC 25523(a), Alquist–Priolo Earthquake Fault Zone	N/A	5.15.5.2, State	California Energy Commission Facilities Siting Division Siting Office, California Energy Commission Facilities Siting Division Engineering Office, and Kern County Building Inspection Division
Local Jurisdiction			
Kern County General Plan/Safety Element	Minimize injuries and loss of life and reduce property damage. Reduce economic and social disruption resulting from earthquakes, fire, flooding, and other geologic hazards by assuring the continuity of vital emergency public services and functions.	5.15.5.3, Local	Kern County Planning Department
CBC, Chapters 16, 18, and 33	Codes address excavation, grading, and earthwork construction, including construction applicable to earthquake safety and seismic activity.	5.15.5.3, Local	Kern County Planning Department

Notes:
CBC = California Building Code
LORS = laws, ordinances, regulations, and standards
N/A = Not applicable
PRC = Public Resources Code

Table 5.15-3
Involved Agencies and Agency Contacts

Agency		Contact/Title	Telephone
	Kern County Planning Department 2700 “M” Street, Suite 100 Bakersfield, CA 93301	Cheryl Casdorph, Supervising Planner	(661) 862-8600
	Kern County Building Inspection Division 2700 “M” Street, Suite 100 Bakersfield, CA 93301	Charles Lackey, Director	(661) 862-8650



REGIONAL GEOLOGIC MAP OF PROJECT

April 2012
28068052

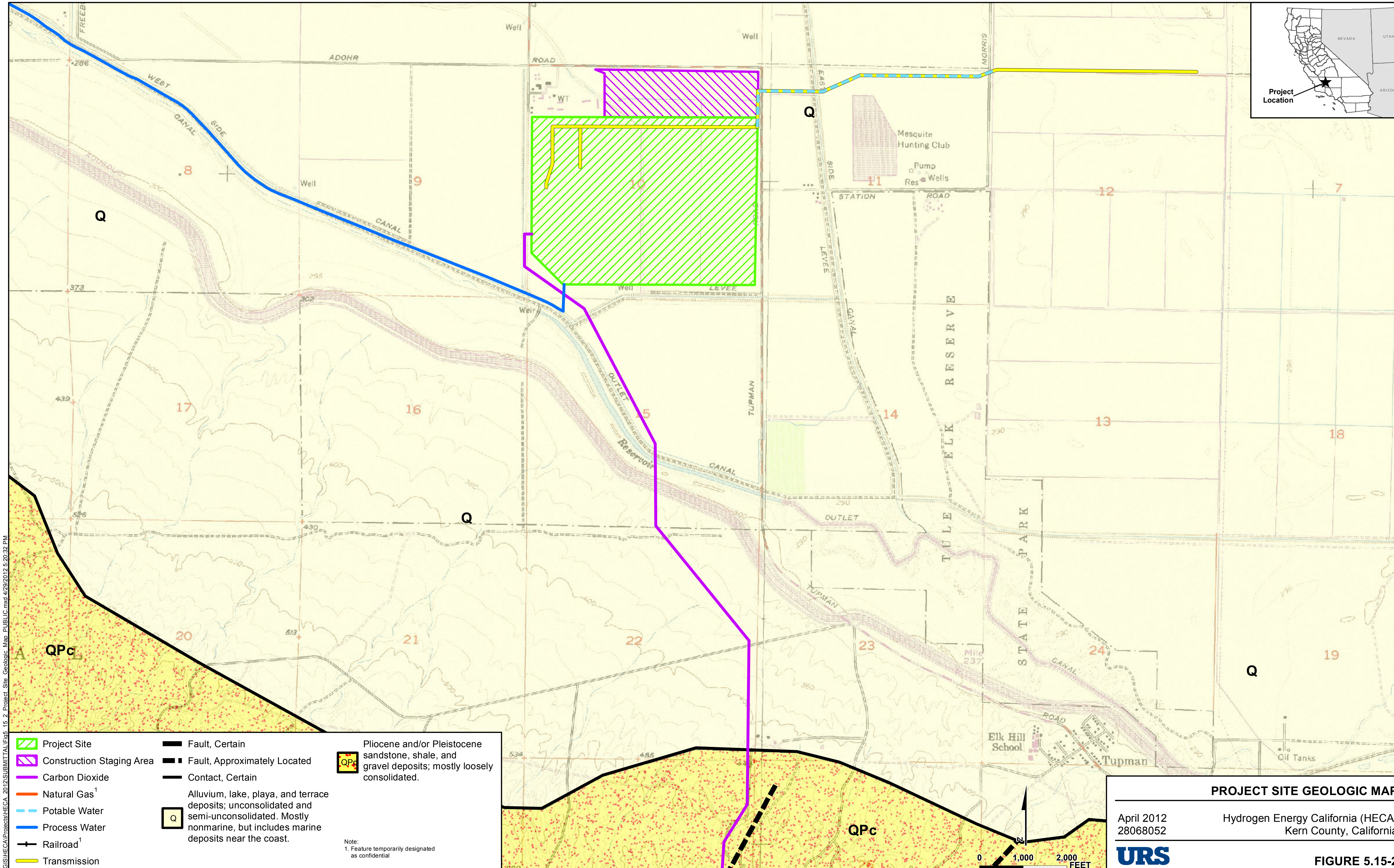
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.15-1

U:\GIS\HECA\Projects\HECA_2012\SUBMITTAL\Fig_5_15_1_Regional_Geologic_Map_PUBLIC.mxd 4/29/2012 5:18:32 PM

Sources: USGS (30'x60' quads: Taft 1982, Delano 1982). Jennings, C. W., 1977, Geologic Map of California, 1:750,000-Scale (Geology).



U:\GIS\HECA\Projects\HECA_2012\SUBMITTAL\Fig5_15_2_Project_Site_Geologic_Map_PUBLIC.mxd 4/29/2012 5:20:32 PM

Sources: USGS (7.5' quads: East Elk Hills 1977, Tupman 1977). Jennings, C. W., 1977, Geologic Map of California, 1:750,000-Scale (Geology).

REGIONAL FAULT MAP: MAJOR FAULTS OF SOUTHERN CALIFORNIA

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Kern County, California

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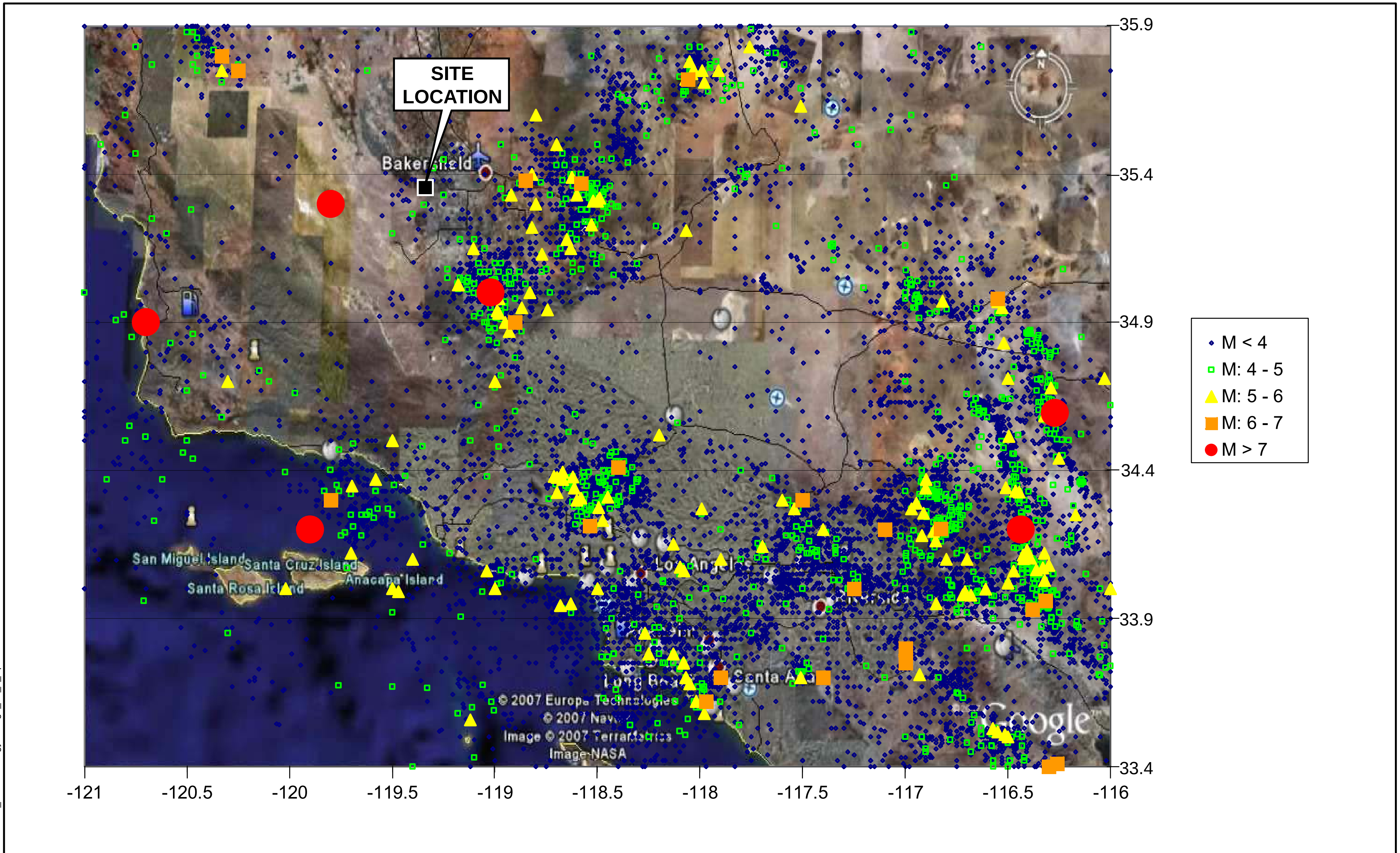
FIGURE 5.15-3

vsa_4/04/12...U:\GIS\HECA\Projects\HECA_2012\Geology\AI\Fig5_15_3_regional fault.ai

Source: United Stated Geological Survey: http://earthquake.usgs.gov



vsa_4/04/12...U:\GIS\HECA\Projects\HECA_2012\Geology\AI\Fig5_15_4_Epicentral Locs.ai

EPICENTRAL LOCATION OF MAJOR EARTHQUAKES IN SOUTHERN CALIFORNIA

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Kern County, California

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FIGURE 5.15-4