4.7 Geology and Soils

This section of the PEA describes the geology and soils in the area of the Ivanpah-Control Project (IC Project). This analysis describes the existing geology and soils in the vicinity of the IC Project and assesses the potential impacts that have the potential to occur as a result of construction and operations of the IC Project and its Alternatives.

4.7.1 Environmental Setting

4.7.1.1 Regional Geologic Setting

The IC Project Alignment is located within the Basin and Range and the Mojave Desert Geologic Provinces of California. Both of these provinces are characterized by narrow mountain ranges, generally trending north-south or northwest-southeast, which are separated by roughly parallel basins. In the Basin and Range Province, which includes the northern part of the IC Project Alignment, the mountain ranges are generally higher and longer, and the valleys are narrower. In the Basin and Range Province, which includes the northern part of the IC Project Alignment, the mountain ranges are generally higher and longer, and the basins are narrower. In the Mojave Desert Province, which includes the southern part of the IC Project Alignment, the mountain ranges are generally lower and shorter, and the basins are broader.

The northern part of the IC Project Alignment is also located close to the eastern edge of the Sierra Nevada Geomorphic Province. The Sierra Nevada is a major north-south trending mountain range that rises steeply on the west side of the Owens Valley, and which forms the western boundary of the Basin and Range Province.

4.7.1.2 Physiography

The principal mountain and valley areas crossed by the five Segments of the IC Project Alignment are shown in Figureset 4.7-1 and described below. The boundaries between these areas are not sharply defined, and so the descriptions are general.

4.7.1.2.1 Segment 1

Segment 1 runs for approximately 126 miles in a generally north-south direction, between the Control and Inyokern substations; it also includes the intermediate Coso and Haiwee substations. Segment 1 runs roughly parallel to US Route 395 through the Owens Valley, over the Coso Range, and through Rose Valley and Indian Wells Valley.

4.7.1.2.1.1 Owens Valley

The northern terminus of Segment 1 is at the Control Substation, approximately 5 miles southwest of Bishop, California. The Control Substation is located near the western edge of the Owens Valley, at an elevation of approximately 4,800 feet above mean sea level (ft msl). The Control Substation is located near the base of the Sierra Nevada, which rises to the southwest. The Segment 1 alignment runs generally southward from the Control Substation through the Owens Valley for approximately 90 miles. The Owens Valley is a roughly linear valley, drained by the Owens River, bordered by the Sierra Nevada to the west and by the White Mountains and Inyo Mountains to the east. The IC Project Alignment passes west of the community of Big Pine, and east of the communities of Independence, Lone Pine, Cartago, and Olancha.

In some parts of the valley, the IC Project Alignment runs near the base of the adjacent Sierra Nevada or Inyo Mountains. It also passes east of Crater Mountain, the Poverty Hills, and the Alabama Hills, which are smaller topographical features located within the valley.

The alignment passes west of Owens Lake, which is the principal surface water body in the Owens Valley. Owens Lake is a largely dry lake bed that occupies much of the southern part of the valley. The IC Project Alignment also passes west of the Tinemaha Reservoir in the northern part of the valley, and west of the North and South Haiwee Reservoirs at the southern end of the valley.

South of Owens Lake, the Owens Valley is bound by the Sierra Nevada to the west and by the Coso Range to the east. The IC Project Alignment rises in elevation as it approaches the North and South Haiwee Reservoirs, which are located at the base of the Coso Range.

The surface elevations along Segment 1 in the Owens Valley generally decrease from north to the south. The lowest elevations are about 3,600 ft msl, between Owens Lake and Cartago.

4.7.1.2.1.2 Coso Range and Rose Valley

At the southern end of the Owens Valley, Segment 1 reaches the western edge of the Coso Range. It runs across the bedrock of the Coso Range for approximately 6 miles, reaching an elevation of approximately 3,900 ft msl, and then descends to the floor of Rose Valley, a small valley bound by the Sierra Nevada to the west and by the Coso Range to the east. The Haiwee Substation is located along the IC Project Alignment at the northern end of Rose Valley.

The IC Project Alignment runs southward across Rose Valley for approximately 13 miles, generally decreasing in elevation. The Coso Substation is located in the northern part of the valley, approximately 2 miles south of the Haiwee Substation. Further south, the IC Project Alignment runs along the western side of Red Hill, a late Pleistocene cinder cone that is part of the Coso Volcanic Field.

At the southern end of Rose Valley, the IC Project Alignment crosses the southwestern end of Little Lake, a small natural lake. The alignment spans the surface waters of the lake for a distance of approximately 1,000 feet.

The IC Project Alignment descends to an elevation of approximately 3,100 ft msl south of Little Lake. It then rises over a small ridge on the western side of the Coso Range at an elevation of approximately 3,150 ft msl. After about 1 mile, it descends into Indian Wells Valley. The total length of the IC Project Alignment in the Coso Range and Rose Valley is approximately 20 miles.

4.7.1.2.1.3 Indian Wells Valley

Segment 1 of the IC Project Alignment runs for approximately 20 miles across the floor of Indian Wells Valley, generally decreasing in elevation and crossing the Inyo-Kern county line. It runs adjacent to the southwestern boundary of the Naval Air Weapons Station China Lake in most of the valley.

The alignment descends to an elevation of approximately 2,250 ft msl approximately 5 miles north of the Inyokern Substation. It then rises slightly in elevation to the southern terminus of Segment 1 at the Inyokern Substation at an elevation of approximately 2,430 ft msl. The Inyokern Substation is located near the intersection of U.S. Route 395 (US 395) and California State Route (SR-) 178, approximately 1 mile northeast of the community of Inyokern and about 6 miles west of Ridgecrest.

4.7.1.2.2 Segment 2

Segment 2 of the IC Project Alignment runs for approximately 48 miles in a generally north-south direction, between the Inyokern and Kramer substations; it also includes the intermediate Randsburg Substation. Segment 2 runs roughly parallel to US 395 through the Indian Wells Valley and Mojave Desert.

4.7.1.2.2.1 Indian Wells Valley

The northern terminus of Segment 2 is at the Inyokern Substation, at an elevation of about 2,430 feet above mean sea level (ft msl). The Inyokern Substation is in the southern part of Indian Wells Valley between the Sierra Nevada to the west and the Coso Range to the east. The IC Project Alignment runs to the southern end of the valley and into the adjacent El Paso Mountains.

Indian Wells Valley and the El Paso Mountains are within the Basin and Range Geologic Province. The alignment descends from the El Paso Mountains and crosses the Garlock Fault Zone, which represents the boundary with the Mojave Desert Geologic Province.

4.7.1.2.3 Mojave Desert

The IC Project Alignment then crosses Fremont Valley and the Rand Mountains. The Randsburg Substation is located along Segment 2 in the Rand Mountains about 0.5 mile southeast of the community of Randsburg at an elevation of approximately 3,670 ft msl.

The alignment descends from the Rand Mountains, crosses from Kern County into San Bernardino County, and enters a broad plain associated with the Cuddeback and Harper Valley groundwater basins. Segment 2 terminates at the Kramer Substation in the southern part of this plain. The Kramer Substation is located near the intersection of US 395 and SR-58 approximately six miles east of the community of Boron at an elevation of about 2,500 ft msl.

The lowest elevation along Segment 2 is approximately 2,430 feet msl at the Inyokern Substation. The highest elevation, approximately 3,950 ft msl, is attained in the El Paso and Rand mountains.

4.7.1.2.4 Segment 3N

Segment 3N of the IC Project Alignment is approximately 44 miles long. From the Kramer Substation, Segment 3N runs east across the plain associated with the Harper Valley groundwater basin. It runs directly south of the Harper Dry Lake Bed and the Mojave Solar Project facility. Segment 3N passes between the Waterman Hills and the Mitchel Range approximately six miles north of Barstow, and then enters the valley of the Mojave River, specifically the Lower Mojave River Valley as recognized by the California Department of Water Resources. (CDWR 2016)

It then turns to the southeast, crosses Interstate 15 (I-15) and the Mojave River, and terminates at the Coolwater Substation. The Coolwater Substation is on the south side of the Mojave River, approximately 2 miles east of the community of Daggett and 1 mile north of I-40 at an elevation of approximately 1,970 ft msl.

The lowest elevation along Segment 3N is approximately 1,960 feet msl at the Mojave River. The highest elevation is approximately 3,100 ft msl between the Waterman Hills and the Mitchel Range.

4.7.1.2.5 Segment 3S

Segment 3S of the IC Project Alignment is approximately 44 miles long. From the Kramer Substation, Segment 3S runs southeast across the plain associated with the Harper Valley groundwater basin. It then turns east and crosses a ridge associated with Iron Mountain about three miles southwest of the community of Hinkley. Segment 3S continues eastward to the Lower Mojave River Valley; it crosses the Mojave River about one mile northwest of the community of Lenwood.

On the south side of the Mojave River, Segment 3S turns southeast. It then reaches the Tortilla Substation, located approximately two miles south of Barstow at an elevation of approximately 2,700 ft msl. It runs generally eastward from the Tortilla Substation to its terminus at the Coolwater Substation.

The lowest elevation along Segment 3S is approximately 2,180 feet msl near the Mojave River. The highest elevation is approximately 2,740 ft msl near the Tortilla Substation.

4.7.1.2.6 Segment 4

Segment 4 of the IC Project Alignment is approximately 96 miles in length, running generally northeast from the Coolwater Substation to the Ivanpah Substation; it also includes the intermediate Dunn Siding, Baker, and Mountain Pass substations. Segment 4 runs roughly parallel to I-15. It crosses a series of valleys separated by relatively narrow mountainous areas.

Segment 4 initially runs north from the Coolwater Substation to the north side of the Mojave River. It then turns to the northeast and runs across a plain associated with the Lower Mojave River Valley and Caves Canyon Valley groundwater basins. The Dunn Siding Substation is near the northeastern end of this plain at an elevation of approximately 1,670 ft msl.

The alignment then runs between the Cronese Mountains (to the north) and Cave Mountain (to the south) and enters the Cronese Valley. It continues northeast, passing south of the East Cronese Dry Lake, crosses an arm of the Soda Mountains, and enters Soda Lake Valley. The Baker Substation is in this area, about one mile north of the community of Baker, at an elevation of approximately 5,300 ft msl.

Segment 4 continues to the northeast, crosses an unnamed range of hills near Yucca Grove, and enters the Upper Kingston Valley. It then ascends between the Clark and Ivanpah mountains. The Mountain Pass Substation is in this area, approximately two miles north of the community of Mountain Pass, at an elevation of approximately 5,300 ft msl.

Segment 4 then descends to the Ivanpah Valley. The eastern terminus of the IC Project Alignment is at the Ivanpah Substation, located approximately six miles southwest of the community of Primm, Nevada, at an elevation of approximately 3,000 ft msl.

The lowest elevation along Segment 4 is approximately 920 feet msl west of the Baker Substation. The highest elevation is approximately 5,400 feet msl west of the Mountain Pass Substation. These represent the highest and lowest elevations along the IC Project Alignment.

4.7.1.3 Geology

Geologic units along the IC Project Alignment are summarized in Table 4.7-1, based on U.S. Geological Survey (USGS 2018) generalized maps for California (Figureset 4.7-2).

Table 4.7-1: Geologic Units Along the IC Project Alignment

Project Segment	Unit	Rock Type	Rock Type
1	Tertiary (4-22 Ma)	rhyolite	basalt
1	Quaternary (0-4 Ma)	basalt	rhyolite
1	Quaternary	basalt	andesite
1	Pliocene to Holocene	alluvium	terrace
1	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
1	Miocene to Pleistocene	sandstone	conglomerate
2	Pliocene to Holocene	alluvium	terrace
2	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
2	Miocene to Pleistocene	sandstone	conglomerate
2	Late Cretaceous to Eocene	mica schist	mica schist
2	Early Proterozoic to Miocene	gneiss	granitoid
2	Cambrian to Jurassic	argillite	chert
3N	Tertiary	rhyolite	basalt
3N	Pliocene to Holocene	alluvium	terrace
3N	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
3N	Miocene to Pleistocene	sandstone	conglomerate
3S	Pliocene to Holocene	alluvium	terrace
3S	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
3S	Miocene to Pleistocene	sandstone	conglomerate
3S	Late Proterozoic to Pennsylvanian	marble	limestone
4	Triassic to Cretaceous	felsic volcanic rock	intermediate volcanic rock
4	Tertiary (4-22 Ma)	rhyolite	basalt
4	Pliocene to Holocene	alluvium	terrace
4	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
4	Pennsylvanian to Triassic	limestone	sandstone
4	Paleocene to Pliocene	conglomerate	sandstone
4	Oligocene to Pleistocene	sandstone	conglomerate
4	Miocene to Pleistocene	sandstone	conglomerate
4	Middle to Late Devonian	limestone	dolostone (dolomite)
4	Late Proterozoic to Middle Devonian	sandstone	dolostone (dolomite)
4	Early to Middle Triassic	mudstone	limestone
4	Early Proterozoic to Miocene	gneiss	granitoid

4.7.1.3.1 Segment 1

The geology along Segment 1 is described below.

4.7.1.3.1.1 Owens Valley

The surficial deposits on the floor of the Owens Valley are mapped as Pliocene to Holocene alluvium and terrace deposits. The Proposed Project alignment in the Owens Valley is primarily associated with these unconsolidated alluvial deposits.

The Proposed Project alignment also passes through or near areas of bedrock associated with the Sierra Nevada on the west side of the valley; the Inyo Mountains on the east side of the valley; and Crater Mountain, the Alabama Hills, and the Poverty Hills within the valley. The principal bedrock type in these areas is granodiorite and quartz monzonite, primarily of Mesozoic age, associated with the Sierra Nevada. Other types of bedrock along or near the Proposed Project alignment in the Owens Valley include Quaternary basalt and andesite, Miocene to Pleistocene sandstone and conglomerate; Mesozoic felsic and intermediate volcanic rock, and Early Proterozoic to Cretaceous phaneritic plutonic rock and gneiss.

4.7.1.3.1.2 Coso Range and Rose Valley

The Coso Range bedrock between the Owens and Rose valleys is mapped as Tertiary rhyolite and basalt. The surficial deposits on the floor of Rose Valley are mapped as Pliocene to Holocene alluvium and terrace deposits. The Coso Range bedrock between the Rose and Indian Wells valleys is mapped as primarily Mesozoic granodiorite and quartz monzonite with Quaternary rhyolite and basalt.

4.7.1.3.1.3 Indian Wells Valley

The surficial deposits on the floor of Indian Wells Valley are mapped as Pliocene to Holocene alluvium and terrace deposits.

4.7.1.3.2 Segment 2

The geology along Segment 2 is described below.

4.7.1.3.2.1 Indian Wells Valley

The surficial deposits on the floor of Indian Wells Valley are mapped as Pliocene to Holocene alluvium and terrace deposits.

4.7.1.3.2.2 El Paso Mountains

Segment 2 passes through areas mapped as Cambrian to Jurassic argillite and chert.

4.7.1.3.2.3 Rand Mountains

The portions of the Rand Mountains crossed by Segment 2 are mapped primarily as Mesozoic granodiorite and quartz monzonite with some areas of Miocene to Pleistocene sandstone and conglomerate, Late Cretaceous to Eocene mica schist, and Early Proterozoic to Miocene gneiss and granitoids. The Rand Mountains are known as an historical gold and silver mining district. The southern part of Segment 2 is mostly in a valley but includes a few areas primarily of Mesozoic granodiorite and quartz monzonite.

4.7.1.3.3 Segment 3N

Segment 3N runs predominantly in valley areas. It passes south of unconsolidated Quaternary dune sand and lake deposits associated with Harper Dry lake bed. Near the Waterman Hills and Mitchel Range, it passes through areas that are primarily Mesozoic granodiorite and quartz monzonite with some areas of Miocene to Pleistocene sandstone and conglomerate, Tertiary rhyolite and basalt, and Early Proterozoic to Miocene gneiss and granitoids. The eastern end of Segment 3N is in the Lower Mojave River Valley.

4.7.1.3.4 Segment 3S

Segment 3S runs predominantly in valley areas. It passes through areas that are primarily Mesozoic granodiorite and quartz monzonite, which is accompanied by Late Proterozoic to Pennsylvanian marble and limestone in the Iron Mountain area. Segment 3S passes through areas of Miocene to Pleistocene sandstone and conglomerate after crossing to the south side of the Mojave River.

4.7.1.3.5 Segment 4

The geology along Segment 4 is described below.

4.7.1.3.5.1 Lower Mojave River Valley

The western part of Segment 4 is in the Lower Mojave River Valley. It passes through Miocene to Pleistocene sandstone and conglomerate on the west end of Cronise Valley, then through Tertiary rhyolite and basalt at the east end of Cronise Valley. West of Baker, near the Soda Mountains, it crosses areas that are primarily Mesozoic granodiorite and quartz monzonite with some areas of Paleocene to Pliocene conglomerate and sandstone, Triassic mudstone and limestone, Mesozoic felsic and intermediate volcanic rock, and Pennsylvanian to Triassic limestone. East of Baker, Segment 4 passes through areas that are primarily Mesozoic granodiorite and quartz monzonite near Yucca Grove, and some areas of Paleocene to Pliocene conglomerate and sandstone.

4.7.1.3.5.2 Clark and Ivanpah Mountains

In the Clark and Ivanpah mountains, Segment 4 crosses areas of Late Proterozoic to Devonian sandstone, limestone and dolostone, and Early Proterozoic to Miocene gneiss and granitoids. The Mountain Pass rare-earth mining district is in this area.

4.7.1.3.5.3 Ivanpah Valley

The eastern end of Segment 4 is in the Ivanpah Valley, which has unconsolidated Pliocene to Holocene alluvium and terrace deposits.

4.7.1.4 Soils

The availability of soil data varies across the IC Project Alignment. Where available, soils data from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database are used to inform the descriptions below; SSURGO data is not available for approximately 44 percent of the IC Project Alignment (158.2 miles, including Segment 2). (NRCS 2019a) Supplemental coverage for areas not included in the SSURGO database is provided by the more generalized NRCS State Soil Geographic (STATSGO2) soil database. (NRCS 2019b) Selected SSURGO soil properties including hydrologic group, erodibility, and linear extensibility are summarized in Tables 4.7-2a through -2d; STATSGO2 data are presented in Tables 4.7-2e through -2i. Figureset 4.7-3 illustrates mapped soil unit distribution along the IC Project Alignment.

The hydrologic group classification is a measure of infiltration rate and runoff potential that can provide general information about soil depth and texture. (NRCS 2018) Group A soils have the highest infiltration rates and lowest runoff potentials; they are typically coarse-grained and deep. Conversely, Group D soils have the lowest infiltration rates and highest runoff potential; they are typically fine-grained and shallow, or in areas with high water tables. Groups B and C soils are intermediate. Soils from all four hydrologic groups can be found locally in both mountain and valley areas along the IC Project Alignment.

4.7.1.4.1 Segment 1

4.7.1.4.1.1 Owens Valley

The soils found in the Owens Valley area in the northern portion of Segment 1 are commonly deep to very deep and are associated with alluvial deposits derived from granitic or mixed rock sources, including alluvial fans, floodplains, and river terraces.

4.7.1.4.1.2 Rose and Indian Wells Valleys

SSURGO soil data are not available for the portions of the Rose and Indian Wells valleys crossed by the IC Project Alignment. Soil associations from the STATSGO2 soils database in the Rose and Indian Wells valleys in Segment 1 are as follows:

- White Hills, China Lake. Rosamond variant – Rosamond-Playas-Gila-Cajon variant-Cajon soil association (soil map unit s768; soil map unit key 660871).
- Majority of the Indian Wells Valley. Wasco-Rosamond-Cajon soil association (soil map unit s1024; soil map unit key 660471).

- Volcano Peak. Rock outcrop-Mexispring soil association (soil map unit s1077; soil map unit key 660524).
- Rose Valley, along valley floor. Yermo-Ulymeyer-Tinemaha-Goodale-Cartago general soil association (soil map unit s1086; soil map unit key 660533).
- Owens Valley, along valley floor. Hesperia family-Cajon soil association (soil map unit s1090; soil map unit key 660537).
- Little Lake area, surrounding Volcano Peak. Upspring-Sparkhule-Rock outcrop soil association (soil map unit S1127; soil map unit key 660574).

4.7.1.4.2 Segment 2

SSURGO soil data for Segment 2 are limited to areas just west of the IC Project Alignment south of the Rand Mountains and a small area near the community of Kramer Junction. Soil associations from the STATSGO2 soils database in Segment 2 are as follows:

- Rand Mountains. Tecopa-Rock outcrop-Lithic Torriorthents (soil map unit s1126; soil map unit key 660573).
- Rand Mountains. Randsburg-Muroc (soil map unit s770; soil map unit key 660873).
- El Paso Mountains. Trigger-Sparkhule-Rock outcrop (soil map unit s813; soil map unit key 660916).
- Plains associated with the Cuddeback and Harper Valley. Neuralia-Garlock-Cajon-Alko (soil map unit s769; soil map unit key 660872).
- Indian Wells Valley, El Paso Mountains, Fremont Valley, Cuddeback and Harper Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).

4.7.1.4.3 Segment 3N

SSURGO soils data are available for portions of Segment 3N in Harper Valley and the Lower Mojave River Valley. Most soils within these areas are deep, well drained sandy soils associated with alluvial deposits derived from granitic sources. Soils with higher clay content and lower infiltration rates are found between ephemeral drainages in the Harper Valley. Soil associations from the STATSGO2 soils database in Segment 3N are as follows:

- Harper Valley, Lower Mojave River Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).
- Hinkley Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Plains associated with the Cuddeback and Harper Valley. Neuralia-Garlock-Cajon-Alko (soil map unit s769; soil map unit key 660872).

Table 4.7-2a: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**	**Off-Road Erosion Hazard[1]**	**Linear Extensibility Percent[2]**
110	488003	Aquents-Aquic torripsamments association, 0 to 2% slopes	4.3	1.7	C	3	Slight	1.5
115	488008	Arizo gravelly loamy sand, 5 to 9% slopes	2.4	1.0	A	2	Slight	1.5
116	488009	Arizo gravelly loamy sand, 9 to 15% slopes	2.0	0.8	A	2	Slight	1.5
118	488011	Arizo-Yellowrock complex, 5 to 9% slopes	9.3	3.7	A	2	Slight	1.5
145	488038	Cajon loamy sand, stratified substratum, 0 to 5% slopes	2.2	0.9	A	2	Slight	1.5
146	488039	Cajon gravelly loamy sand, 0 to 5% slopes	9.2	3.6	A	2	Slight	1.5
148	488041	Cajon-Mazourka-Eclipse complex, 0 to 2% slopes	1.5	0.6	A	1	Slight	1.6
149	488042	Cajon-Typic Torriorthents complex, 0 to 5% slopes	1.5	0.6	A	1	Slight	1.5
152	488045	Cartago gravelly loamy coarse sand, 5 to 30% slopes	4.0	1.6	A	2	Moderate	1.5
154	488047	Cartago gravelly loamy sand, 0 to 2% slopes	4.6	1.8	A	2	Slight	1.5
155	488048	Cartago gravelly loamy sand, 2 to 5% slopes	1.4	0.5	A	2	Slight	1.5
184	488077	Dehy loam, 0 to 2 percent slopes	0.1	0.0	C	5	Slight	1.5
187	488080	Dehy sandy loam, loamy substratum, 0 to 2% slopes	1.1	0.4	C	3	Slight	1.5
191	488084	Division-Numu complex, 0 to 2% slopes	3.85	1.4	D	3	Slight	3
196	488089	Goodale loamy coarse sand, 5 to 15% slopes	0.3	0.1	A	3	Slight	1.5
200	488094	Goodale-Cartago complex, 5 to 15% slopes	4.8	1.9	A	3	Slight	1.5
201	488096	Goodale-Cartago complex, moist, 2 to 5% slopes	0.9	0.4	A	3	Slight	1.5
202	488100	Goodale-Cartago complex, moist, 5 to 15% slopes	3.9	1.6	A	3	Slight	1.5
207	488112	Helendale-Cajon complex, 0 to 5% slopes	5.3	2.1	A	2	Slight	1.5
208	488113	Helendale-Cajon complex, dry, 0 to 5% slopes	2.5	1.0	A	2	Slight	1.5
210	488116	Hesperia-Cartago complex, 0 to 5% slopes	0.8	0.3	A	3	Slight	1.5
221	488136	Inyo sand, 0 to 9% slopes	1.1	0.4	A	1	Slight	1.5
230	488157	Lithic Torriorthents-Badland complex, 15 to 75% slopes	1.8	0.7	D	2	Severe	1.5

Table 4.7-2a: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
231	488158	Lithic Torriorthents-Lithic Haplargids-Rock outcrop complex, 30 to 75% slopes	1.8	0.7	D	2	Very Severe	2.1
245	488177	Lubkin-Tinemaha complex, moist, 5 to 15% slopes	1.2	0.5	A	2	Slight	1.5
247	488179	Lucerne gravelly loamy sand, 2 to 5% slopes	2.7	1.1	A	2	Slight	1.5
249	488181	Manzanar silt loam, 0 to 2% slopes	10.8	4.3	B	4L	Slight	3.4
251	488186	Manzanar-Westguard association, 0 to 2% slopes	1.9	0.8	C	4L	Slight	3.3
252	488188	Manzanar-Winnedumah association, 0 to 2% slopes	3.4	1.3	B	4L	Slight	3.7
257	488197	Mazourka-Eclipse complex, 0 to 2% slopes	2.3	0.9	C	1	Slight	1.8
259	488199	Mazourka-Slickspots-Cajon complex, 0 to 2% slopes	1.5	0.6	C	1	Slight	1.9
261	488203	Mazourka hard substratum-Mazourka-Eclipse complex, 0 to 2% slopes	9.5	3.8	C	1	Slight	2
273	488219	Neuralia-Timosea-Typic Argidurids complex, 2 to 15% slopes	11.5	4.6	C	2	Slight	2.4
283	488233	Playa	0.8	0.3	—	—	—	7.5
290	488244	Pokonahbe-Rindge family association, 0 to 5% slopes	2.5	1.0	C	2	Slight	2.7
293	488248	Poleta-Mazourka-Eclipse complex, 0 to 2% slopes	3.8	1.5	B	1	Slight	1.7
294	488249	Poleta-Mazourka-Slickspots complex, 0 to 2% slopes	2.4	0.9	B	1	Slight	1.7
296	488252	Rienhakel sand, 0 to 2% slopes	5.9	2.4	C	1	Slight	2.5
297	488253	Riverwash	0.1	0.0	—	—	—	—
308	488265	Seaman-Yellowrock complex, 2 to 5% slopes	2.2	0.9	A	2	Slight	1.5
311	488270	Shabbell sandy loam, 0 to 2% slopes	0.6	0.2	A	5	Slight	1.5
318	488279	Shondow-Hessica association, 0 to 2% slopes	0.7	0.03	C	5	Slight	3.1
321	488283	Taboose-Lava flows complex, 5 to 30% slopes	9.8	3.9	A	3	Moderate	1.5
324	488286	Timosea-Neuralia complex, warm, 2 to 9% slopes	5.3	2.1	C	5	Slight	1.8

Table 4.7-2a: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**	**Off-Road Erosion Hazard[1]**	**Linear Extensibility Percent[2]**
327	488289	Torrifluvents, 0 to 2% slopes	4.2	1.7	C	6	Slight	3.1
328	488290	Torrifluvents-Fluvaquentic Endoaquolls complex, 0 to 2% slopes	1.9	0.7	C	6	Slight	3
332	488294	Typic Psammaquents, 0 to 2% slopes	4.3.	1.7	A/D	1	Slight	1.5
358	488320	Westguard-Rienhakel association, 0 to 2% slopes	3.7	1.5	C	1	Slight	1.8
359	488321	Whitewolf-Toquerville families association, 15 to 50% slopes	1.7	0.7	A	1	Moderate	1.5
360	488322	Whitewolf-Toquerville families association, warm, 15 to 50% slopes	0.6	0.3	A	1	Moderate	1.5
362	488324	Winerton-Hessica complex, 0 to 2% slopes	5.4	2.1	D	3	Slight	3.5
363	488325	Winnedumah silt loam, 0 to 2% slopes	10.6	4.2	C	5	Slight	3.3
364	488326	Winnedumah fine sandy loam, 0 to 2% slopes	2.9	1.1	—	—	Slight	2
366	488328	Xeric Argidurids, 2 to 9% slopes	2.8	1.1	D	2	Slight	4.8
369	488331	Xeric Haplodurids, 2 to 9% slopes	3.3	1.3	A	2	Slight	1.5
370	488332	Xerofluvents, 0 to 5 percent slopes	0.1	0.0				
372	488334	Yellowrock sand, 0 to 5% slopes	1.2	0.5	A	1	Slight	1.5
374	488336	Yellowrock-Seaman complex, 2 to 5% slopes	0.8	0.3	A	2	Slight	1.5
378	488340	Yermo stony-Yermo complex, 5 to 15% slopes	2.4	0.9	A	5	Slight	1.5
379	488341	Yermo stony-Yermo complex, cool, 5 to 15% slopes	1.2	0.5	A	5	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
1. The NRCE “Erosion Hazard (Off-Road, Off-Trail)” ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available
Sources: NRCS 2019a

Table 4.7-2b: Mapped Soil Units and Soil Properties, SSURGO2, Segment 3N

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
112	463931	Cajon Sand, 0 To 2 Percent Slopes (112)	5.3	11.9	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9 Percent Slopes (113)	3.3	7.4	—	—	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15 Percent Slopes (115)	4.6	10.4	A	1	Slight	1.5
117	463936	Cajon Loamy Sand, Loamy Substratum, 0 To 2 Percent Slopes (117)	1.5	3.4	A	2	Slight	1.5
131	463950	Helendale Loamy Sand, 0 To 2% Slopes	0.5	1.1	A	2	Slight	1.5
137	463956	Kimberlina Loamy Fine Sand, Cool, 0 To 2 Percent Slopes (137)	0.1	0.2	A	2	Slight	1.9
151	463970	Nebona-Cuddeback Complex, 2 To 9 Percent Slopes* (151)	0.7	1.7	D	3	Slight	1.7
152	463971	Norob-Halloran Complex, 0 To 5 Percent Slopes* (152)	4.7	10.7	C	2	Slight	2.6
156	463975	Playas	0.2	0.4	—	—	—	—
157	463976	Riverwash (157)	0.4	0.9	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50 Percent Slopes* (158)	0.2	0.4	—	—	—	—
159	463978	Rosamond Loam, Saline-Alkali (159)	0.7	1.5	C	5	Slight	3.5
170	463989	Victorville Variant Sand	0.3	0.8	B	1	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
1. The NRCE “Erosion Hazard (Off-Road, Off-Trail)” ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available
Sources: NRCS 2019a

Table 4.7-2c: Mapped Soil Units and Soil Properties, SSURGO2, Segment 3S

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
100	463919	Arizo Gravelly Loamy Sand, 2 To 9% Slopes	0.8	1.8	A	2	Slight	1.5
105	463924	Bryman Loamy Fine Sand, 0 To 2% Slopes	0.2	0.5	C	2	Slight	2.1
112	463931	Cajon Sand, 0 To 2 Percent Slopes	0.2	0.4	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9 Percent Slopes	3.8	8.6	—	—	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15 Percent Slopes	7.5	16.9	A	1	Slight	1.5
117	463936	Cajon Sand, 0 To 2 Percent Slopes	0.4	1.0	A	2	Slight	1.5
120	463939	Cave Loam, Dry, 0 To 2% Slopes	0.8	1.8	D	6	Slight	1.5
123	463942	Dune Land	0.1	0.3	—	—	—	—
124	461703	Lavic-Norob Complex, 2 To 9% Slopes	0.5	1.1	B	2	Slight	—
135	463954	Joshua Loam, 2 To 5% Slopes	0.1	0.2	B	5	Slight	2.4
136	461722	Norob Sandy Loam, 2 To 5% Slopes	0.3	0.7	C	3	Slight	3.4
140	463959	Lavic Loamy Fine Sand	0.2	0.3	B	2	Slight	1.5
141	463960	Lovelace Loamy Sand, 5 To 9% Slopes	0.5	1.1	A	1	Slight	1.5
151	463970	Nebona-Cuddeback Complex, 2 To 9 Percent Slopes*	1.9	4.4	D	3	Slight	1.7
152	463971	Norob-Halloran Complex, 0 To 5% Slopes*	2.2	5.0	C	2	Slight	2.6
157	463976	Riverwash	0.4	1.0	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50 Percent Slopes*	0.4	1.0	—	—	—	—
159	463978	Rosamond Loam, Saline-Alkali	1.2	2.7	C	5	Slight	3.5
168	463987	Typic Haplargids-Yermo Complex, 8 To 30% Slopes*	1.1	2.6	—	—	—	1.5
169	463988	Victorville Sandy Loam	0.6	1.3	A	3	Slight	2.1
171	463990	Villa Loamy Sand	1.6	3.6	A	2	Slight	1.5
172	463991	Villa Loamy Sand, Hummocky	0.2	0.5	A	2	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number

1. The NRCE "Erosion Hazard (Off-Road, Off-Trail)" ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available

Sources: NRCS 2019a

Table 4.7-2d: Mapped Soil Units and Soil Properties, SSURGO2, Segment 4

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**	**Off-Road Erosion Hazard[1]**	**Linear Extensibility Percent[2]**
103	463922	Badland	1.1	1.7	—	—	—	—
112	463931	Cajon Sand, 0 To 2% Slopes	4.6	7.1	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9% Slopes	6.8	10.4	—	-	Slight	1.5
114	463933	Cajon Sand, 9 To 15% Slopes	0.4	0.6	A	1	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15% Slopes	1.3	1.9	A	1	Slight	1.5
116	463935	Cajon Loamy Sand, 5 To 9% Slopes	0.2	0.3	—	—	Slight	1.5
117	463936	Cajon Loamy Sand, Loamy Substratum, 0 To 2% Slopes	2.7	4.2	A	2	Slight	1.5
127	463946	Halloran Sandy Loam	1.1	1.7	C	1	Slight	1.5
137	463956	Kimberlina Loamy Fine Sand, Cool, 0 To 2% Slopes	0.7	1.0	A	2	Slight	1.9
148	463967	Mirage Sandy Loam, 5 To 9% Slopes	0.1	0.2	C	3	Slight	
150	463969	Mohave Variant Loamy Sand, 0 To 2% Slopes	0.4	0.7	C	2	Slight	2.4
151	463970	Nebona-Cuddeback Complex, 2 To 9% Slopes*	0.1	0.2	D	3	Slight	1.7
157	463976	Riverwash	0.6	0.9	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50% Slopes*	0.1	0.2	—	—	—	—
3000	1860742	Copperworld Association, 30 To 60% Slopes	1.3	1.9	—	—	Moderate	1.5
3520	1860747	Arizo Loamy Sand, 2 To 8% Slopes	1.9	2.9	—	—	Slight	0.1
4122	1860752	Popups Sandy Loam, 4 To 30% Slopes	1.9	2.9	—	—	Slight	1.5
5000	1860763	Copperworld-Lithic Ustic Haplargids Association, 30 To 60% Slopes	0.3	0.4	D	5	Moderate	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
1. The NRCE "Erosion Hazard (Off-Road, Off-Trail)" ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available
Source: NRCS 2019a

Table 4.7-2e: Mapped Soil Units and Soil Properties, STATSGO, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**
s1077	660524	Entic Haploxerolls, Loamy, Mixed, Mesic, Shallow	0.37	0.3	D	5
s1127	660574	Typic Durorthids, Loamy-Skeletal, Mixed, Thermic	4.3	3.4	C	7
s1086	660533	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	10.4	8.3	A	5
s768	660871	Typic Torripsamments, Mixed, Thermic	1.3	1.0	A	1
s1024	660471	Typic Torripsamments, Mixed, Thermic	18.0	14.2	A	2

Notes:
Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2f: Mapped Soil Units and Soil Properties, STATSGO, Segment 2

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**
s1142	660589	Haplic Durargids, Fine-Loamy, Mixed, Thermic	1.0	2.0	C	7
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	3.1	6.3	D	3
s813	660916	Typic Durorthids, Loamy, Mixed, Thermic, Shallow	2.9	5.9	D	3
s769	660872	Typic Haplargids, Fine-Loamy, Mixed, Thermic	6.4	13.3	B	1
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	1.0	21	A	4
s1024	660471	Typic Torripsamments, Mixed, Thermic	3.1	6.5	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	16.4	33.9	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	5.1	10.6	A	2

Notes:
Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2g: Mapped Soil Units and Soil Properties, STATSGO, Segment 3N

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1142	660589	Haplic Durargids, Fine-Loamy, Mixed, Thermic	3.8	8.5	C	7
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	1.4	3.1	D	3
s769	660872	Typic Haplargids, Fine-Loamy, Mixed, Thermic	7.9	17.9	B	1
s1024	660471	Typic Torripsamments, Mixed, Thermic	11.8	26.5	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	0.6	1.3	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	2.7	6.0	A	2

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Sources: NRCS 2019b

Table 4.7-2h: Mapped Soil Units and Soil Properties, STATSGO, Segment 3S

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1039	660486	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	6.9	16.0	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	11.4	26.2	A	2

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2i: Mapped Soil Units and Soil Properties, STATSGO, Segment 4

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.1	0.1	D	3
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	0.3	0.3	D	3
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	2.3	2.4	D	3
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.6	0.6	D	3
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.6	0.6	D	3
s1124	660571	Typic Calciorthids, Loamy-Skeletal, Mixed, Thermic	0.4	0.4	B	5
s1124	660571	Typic Calciorthids, Loamy-Skeletal, Mixed, Thermic	5.4	5.7	B	5
s1140	660587	Typic Camborthids, Coarse-Loamy, Mixed, Hyperthermic	9.5	9.9	B	3
s1127	660574	Typic Durorthids, Loamy-Skeletal, Mixed, Thermic	1.1	1.2	C	7
s1138	660585	Typic Torrifluvents, Coarse-Loamy Over Clayey, Mixed (Calcareous), Hyperthermic	0.3	0.3	C	4L
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	5.4	5.6	B	3
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	7.7	8.1	B	3
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	0.5	0.5	B	3
s1131	660578	Typic Torriorthents, Sandy-Skeletal, Mixed, Hyperthermic	2.4	2.5	A	5
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	5.4	5.6	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	10.4	10.9	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	2.1	2.2	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	3.4	3.5	A	4
s1123	660570	Typic Torripsamments, Mixed, Thermic	3.2	3.4	A	5
s1024	660471	Typic Torripsamments, Mixed, Thermic	6.0	6.3	A	2
s1128	660575	Typic Torripsamments, Mixed, Thermic	1.5	1.6	A	1
s1128	660575	Typic Torripsamments, Mixed, Thermic	1.2	1.2	A	1

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

4.7.1.4.4 Segment 3S

SSURGO soils data are available for the majority of Segment 3S, except areas within the Harper Valley east of Kramer. As with Segment 3N to the north, soils within the IC Project Alignment in Segment 3S are generally associated with alluvial soils derived from granitic or mixed sources. Most of these soils are deep, well drained sandy soils. Locally, some soils have higher clay content and lower infiltration rates. Soil associations from the STATSGO2 soils database in Segment 3S are as follows:

- Lower Mojave River Valley. Nebona-Mirage-Joshua-Cajon (soil map unit s1007; soil map unit key 660454).
- Along the Mojave River. Villa-Victorville-Riverwash-Cajon (soil map unit s1008; soil map unit key 660455).
- Hinkley Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Harper Valley, Lower Mojave River Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).

4.7.1.4.5 Segment 4

SSURGO soils data are available for portions of Segment 4 within the Lower Mojave River Valley from the Coolwater Substation to approximately 20 miles to the northeast and from approximately Mountain Pass to the eastern terminus of the IC Project Alignment in Ivanpah Valley. Within the Lower Mojave River Valley, mapped soil types are deep, well drained sandy soils associated with alluvium derived from granitic and mixed sources. Mountain soils near Mountain Pass are shallow, well drained soils formed on metamorphic residuum. Within Ivanpah Valley, soils are deep, extremely well drained sandy soils formed on alluvium derived from metamorphic and sedimentary sources. Soil associations from the STATSGO2 soils database in Segment 4 are as follows:

- Soda Mountains. Rillito-Gunsight (soil map unit s1140; soil map unit key 660587).
- Mojave Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Mojave Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).
- Along the Mojave River. Villa-Victorville-Riverwash-Cajon (soil map unit s1008; soil map unit key 660455).
- Soda Mountains, Clark and Ivanpah Mountains. Tecopa-Rock outcrop-Lithic Torriorthents (soil map unit s1126; soil map unit key 660573).
- Shadow Valley. Bluepoint-Arizo (soil map unit s1123; soil map unit key 660570).
- Lower Mojave River Valley and Caves Canyon Valley, unnamed range of hills near Yucca Grove, and Upper Kingston Valley. Cajon-Arizo (soil map unit s1143; soil map unit key 660590).
- Cronese Mountains and Cave Mountain. Cajon-Bitterwater-Bitter-Badland (soil map unit s1128; soil map unit key 660575).
- Dry lake beds in the Soda Valley. Playas (soil map unit s1138; soil map unit key 660585).
- Cronese Mountains and Cave Mountain and Cronese Valley, Baker Valley. Rositas-Carrizo (soil map unit s1137; soil map unit key 660584).
- Cronese Velley. Rock outcrop (soil map unit s1131; soil map unit key 660578).
- Between the Clark and Ivanpah Mountains. Nickel-Blackmount-Arizo (soil map unit s1124; soil map unit key 660571).
- Ivanpah Valley. Skyhaven-Rillito-Mead-McCullough-Ireteba-Bluepoint (soil map unit s1144; soil map unit key 660591).

4.7.1.5 Geologic Hazards

4.7.1.5.1 Faults and Seismicity

The IC Project Alignment is located in a seismically-active area with numerous active and potentially active faults, as identified by the California Geological Survey (CGS; 2017b) and the U.S. Geological Survey (USGS; 2019a, 2019b). An "active fault" is one which has had surface displacement within approximately the past 11,000 to 15,000 years; a "historically active fault" has had surface displacement with approximately the past 150 years. A "potentially active fault" is considered to be any fault that shows evidence of surface displacement during approximately the past 1.6 million years. Active faults are commonly known as "Holocene faults" or "latest Quaternary faults", and potentially active faults are commonly known as "Quaternary faults", although the ages of the Holocene Epoch and Quaternary Period, as currently defined, do not correspond exactly to the ages used to define fault activity.

Active ("Holocene") and potentially active ("Quaternary") faults are shown on Figureset 4.7-4. Table 4.7 3 lists the active and potentially active faults near the IC Project Alignment, including available data for fault type, fault activity, fault and section length, slip rate, and maximum estimated moment magnitude. There are also numerous older pre-Quaternary faults in the IC Project Alignment area, but these are not regarded as potential seismic sources by CGS or USGS.

4.7.1.5.1.1 Segment 1

Active and potentially active fault zones in the vicinity of Segment 1 of the IC Project Alignment are discussed in the sections below

Unnamed Faults in Volcanic Tablelands. A cluster of active faults is located in the volcanic tablelands to the northwest of Bishop. The closest mapped fault segments are located approximately 3 miles north-northeast of the Control Substation.

Owens Valley Fault Zone. This fault zone is generally located in the central part of the Owens Valley in Segment 1. The IC Project Alignment runs close to this fault zone in most parts of the valley.

Many of the fault segments near the IC Project Alignment are classified as historically active. A major historical earthquake, the 1872 Lone Pine earthquake, was associated with the Owens Valley Fault Zone in the vicinity of the IC Project Alignment. This earthquake had an estimated moment magnitude of 7.4, and caused widespread destruction in Lone Pine and other communities in the Owens Valley. (ICCB 2016). The 1872 rupture area is extensive, and is close to the IC Project Alignment throughout much of the Owens Valley.

Southern Sierra Nevada Fault Zone. This fault zone occurs at the base of the Sierra Nevada, generally west of the IC Project Alignment. The IC Project Alignment crosses an active segment of this fault zone to the west of Owens Lake, where it approaches the base of the Sierra Nevada.

White Mountains Fault Zone. This fault zone occurs at the base of the Inyo Mountains in the Owens Valley, east of the IC Project Alignment in the northern Owens Valley.

An historical earthquake, the July 21, 1986 Chalfant Valley earthquake, occurred along the White Mountains Fault Zone near the IC Project Alignment. This earthquake had an estimated moment magnitude of 6.5 and a maximum Mercalli intensity of VI. (Brewer 1989)

The greatest damage associated with the 1986 Chalfant Valley earthquake was in the community of Chalfant, where many mobile homes were shaken off their foundations. Only non-structural damage was reported in Bishop.

Little Lake Fault Zone and Airport Lake Fault Zone. These fault zones occur near Segment 1 in the Indian Wells Valley. The IC Project Alignment crosses an active segment of the Little Lake Fault Zone approximately 1.5 miles south of Little Lake. Some of the other fault segments associated with these zones are considered historically active, based on surface rupture associated with the 5.2 magnitude Indian Wells Valley earthquake in 1982 and the 5.4 to 5.8 magnitude Ridgecrest earthquake sequence in 1995. (CGS 2010)

4.7.1.5.1.2 Segment 2

The active and potentially active fault zones in the vicinity of Segment 2 of the IC Project Alignment are discussed in the sections below.

Little Lake Fault Zone. This active fault zone occurs near Segment 2 in the Indian Wells Valley. Some of the fault segments associated with these zones are considered historically active, based on surface rupture associated with the 5.2 magnitude Indian Wells Valley earthquake in 1982. (CGS 2010)

Inferred Unknown Faults near Inyokern. The IC Project Alignment crosses the approximate location of two inferred "unknown faults" to the east and southeast of Inyokern. These inferred faults are thought to be of late Quaternary age, and therefore potentially active.

Sierra Nevada Fault Zone. This fault zone occurs at the base of the Sierra Nevada, to the west of the IC Project Alignment, near the northern part of Segment 2. Some of the nearby segments are classified as active.

Garlock Fault Zone. This fault zone occurs on the southern side of the El Paso Mountains in the northern part of Segment 2. The IC Project Alignment crosses an active segment of this fault zone. Some of the other fault segments in this fault zone are considered historically active.

Lenwood-Lockhart and Helendale-South Lockhart Fault Zones. Segment 2 crosses both of these fault zones to the north of Kramer Junction. The fault segments at the crossings are considered potentially active. In other nearby areas (including Segments 3N and 3S), these fault zones are considered active.

4.7.1.5.1.3 Segment 3N

The active and potentially active fault zones in the vicinity of Segment 3N of the IC Project Alignment are discussed in the sections below.

Helendale-South Lockhart Fault Zone. Segment 3N crosses an active segment of this fault zone to the east of Kramer.

Lenwood-Lockhart Fault Zone. Segment 3N crosses this fault zone to the east of Kramer. The fault segment at the crossing is considered potentially active, but other segments nearby are considered active or historically active.

Mt. General Fault Zone. Segment 3N passes north of this fault zone to the north of Hinckley. The closest fault segments are considered potentially active, but other segments nearby are considered active.

Harper Fault Zone. Segment 3N crosses two segments of this fault zone to the north of Barstow. The fault segments at the crossings are considered potentially active, but other segments nearby are considered active.

4.7.1.5.1.4 Segment 3S

The active and potentially active fault zones in the vicinity of Segment 3S of the IC Project Alignment are discussed in the sections below.

Helendale-South Lockhart Fault Zone. Segment 3S crosses an active segment of this fault zone to the southeast of Kramer.

Lenwood-Lockhart Fault Zone. Segment 3S crosses this fault zone near Lenwood. The fault segment at the crossing is considered potentially active, but other segments nearby are considered active or historically active.

Mt. General Fault Zone. Segment 3S passes south of this fault zone near the Tortilla Substation. The closest fault segment is considered potentially active, but other segments nearby are considered active.

Harper Fault Zone. Segment 3S passes south of this fault zone to the east of Barstow. The closest fault segment is considered potentially active, but other segments nearby are considered active.

4.7.1.5.1.5 Segment 4

The active and potentially active fault zones in the vicinity of Segment 4 of the IC Project Alignment are discussed in the sections below.

Calico-Hidalgo Fault Zone. The western part of Segment 4 crosses this fault zone to the east of the Coolwater Substation. The fault segment at the crossing is considered active. Other fault segments nearby are considered active or historically active, based on surface rupture associated with the magnitude 7.3 Landers earthquake in 1992. (CGS 2010)

Manix Fault. The western part of Segment 4 crosses this fault zone between the Coolwater and Dunn Siding Substations. The fault segment at the crossing is considered potentially active, but other fault segments nearby are considered active or historically active, based on surface rupture associated with the magnitude 6.2 Manix earthquake in 1947. (CGS 2010)

Inferred Unknown Fault near East Cronese Lake. Segment 4 crosses the approximate location of an inferred “unknown fault” to the southwest of East Cronise Dry Lake. This inferred fault is thought to be of Quaternary age, and therefore potentially active.

Red Pass Fault. Segment 4 runs to the south of the inferred of this fault to the east of East Cronise Dry Lake. Relatively little is known about this fault, but it is thought to be active.

Baker Fault. Segment 4 crosses the inferred location of this fault to the southwest of Baker. Relatively little is known about this fault, but it is thought to be potentially active.

Table 4.7-3: Holocene Fault Properties

Project Segment	Fault Name	Fault Activity	Fault Type	Fault/Section Length (miles)	Slip Rate (mm/yr)	Maximum Moment Magnitude	Distance to IC Project Alignment (miles)
1	Unnamed faults in Volcanic Tablelands	active	normal	25	0.2 to 1.0	unspecified	3.0
1	Owens Valley fault zone (Keough Hot Springs section)	active	normal	84 / 13	1.0 to 5.0	7.3	0
1	Owens Valley fault zone (1872 Rupture section)	historically active	right lateral	84 / 73	1.0 to 5.0	7.3	0
1	Southern Sierra Nevada fault zone (Independence section)	active	normal	126 / 44	0.2 to 1.0	7.5	3.5
1, 2	Southern Sierra Nevada fault zone (Haiwee section)	active	normal	126 / 81	0.2 to 1.0	7.5	0
1	White Mountains fault zone (central section)	historically active	right lateral	68 / 24	0.2 to 1.0	7.4	4.5
1	White Mountains fault zone (Inyo-Waucoba section)	active	right lateral	68 / 18	0.2 to 1.0	7.4	0.1
1, 2	Little Lake fault zone	historically active	right lateral, normal	33	1.0 to 5.0	6.9	0
1	Airport Lake fault zone	historically active	normal, right-lateral	25	0.2 to 1.0	unspecified	5.2
1, 2	Inferred unknown faults near Inyokern	potentially active	unspecified	unspecified	unspecified	unspecified	0
2	Garlock fault zone (Central Garlock section)	historically active	left lateral	159 / 66	> 5.0	7.3	0
2, 3N	Lenwood-Lockhart fault zone (Lockhart section)	active	right lateral	88 / 43	0.2 to 1.0	7.5	0.5
3S	Lenwood-Lockhart fault zone (Lenwood section)	historically active	right lateral	88 / 46	0.2 to 1.0	7.5	0.2
2, 3N, 3S	Helendale-South Lockhart fault zone (South Lockhart section)	active	right lateral	84 / 31	0.2 to 1.0	7.4	0.8
3N, 3S	Harper fault zone	active	right lateral	49	unspecified	7.1	0.8
3N, 3S	Mt. General fault	active	right lateral	14	unspecified	unspecified	1.3
4	Calico-Hidalgo fault zone (Calico section)	historically active	right lateral	73 / 39	0.2 to 1.0	7.4	0
4	Manix	historically active	left lateral	unspecified	unspecified	unspecified	0.6
4	Inferred unknown fault near East Cronise Lake	potentially active	unspecified	unspecified	unspecified	unspecified	unspecified
4	Red Pass fault (or Red Pass Lake fault)	active	right lateral	12	unspecified	unspecified	0.7
4	Baker fault	potentially active	unspecified	unspecified	unspecified	unspecified	0

Notes:
Data from USGS (2019a); maximum moment magnitudes from USGS (2019b)

The greatest damage associated with the 1986 Chalfant Valley earthquake was in the community of Chalfant, where many mobile homes were shaken off their foundations. Only non-structural damage was reported in Bishop.

Little Lake Fault Zone and Airport Lake Fault Zone. These fault zones occur in Segment 1 in the Indian Wells Valley. Some of the fault segments are considered historically active, based on surface rupture associated with the 5.2 magnitude Indian Wells Valley earthquake in 1982 and the 5.4 to 5.8 magnitude Ridgecrest earthquake sequence in 1995. (CGS 2010)

4.7.1.5.1.6 Segment 2

The Holocene fault zones in the vicinity of Segment 2 of the IC Project Alignment are discussed in the sections below.

Southern Sierra Nevada Fault Zone. This fault zone occurs at the base of the Sierra Nevada near the northern part of Segment 2. The youngest portions are classified as Holocene age.

Garlock Fault Zone. This fault zone occurs on the southern side of the El Paso Mountains in the northern part of Segment 2. In the vicinity of the IC Project Alignment, the youngest faults within this zone are classified as Holocene age. Some of the fault segments are considered historically active; the closest are about 8 miles southwest of Segment 2.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near the southern part of Segment 2. The youngest faults within these zones are classified as Holocene in age.

4.7.1.5.1.7 Segment 3N

The Holocene fault zones in the vicinity of Segment 3N of the IC Project Alignment are discussed in the sections below.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near Segment 3N. The youngest faults within these zones are classified as Holocene in age.

4.7.1.5.1.8 Segment 3S

The Holocene fault zones in the vicinity of Segment 3S of the IC Project Alignment are discussed in the sections below.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near Segment 3S. The youngest faults within these zones are classified as Holocene in age. Fault creep has been historically documented along a short segment of the Lenwood Fault Zone near Segment 3S.

4.7.1.5.1.9 Segment 4

The Holocene fault zones in the vicinity of Segment 4 of the IC Project Alignment are discussed in the sections below.

Calico Fault Zone. The western part of Segment 4 crosses this fault zone. In the vicinity of the IC Project Alignment, the youngest faults within this zone are classified as Holocene. Some fault segments near the IC Project Alignment are considered historically active, based on surface rupture associated with the magnitude 7.3 Landers earthquake in 1992. (CGS 2010)

Manix Fault. The western part of Segment 4 crosses this fault. In the vicinity of the IC Project Alignment, the youngest fault segments are classified as Holocene age. Some fault segments near the IC Project Alignment are considered historically active, based on surface rupture associated with the magnitude 6.2 Manix earthquake in 1947. (CGS 2010)

Red Pass Lake Fault. The central part of Segment 4 runs near this fault. It is considered remote and little-studied, but is thought to be of Holocene age.

4.7.1.6 Surface Fault Rupture

There is a risk of surface fault rupture associated with Holocene faults such as those found along the IC Project Alignment. The State of California has established “Alquist-Priolo (AP) Special Studies Zones” in areas where Holocene faults are known to pose a risk of surface displacement. (CGS 2017a) There may be a risk of surface fault rupture in other area, outside of Alquist-Priolo Zones, where Holocene faults have not been identified or are incompletely studied.

There are 20 crossings of AP Special Studies Zones (Figureset 4.7-5) associated with the local Holocene faults along the IC Project Alignment. In some areas, such as the Alabama Hills along Segment 1, the IC Project Alignment trends in roughly the same direction as a Special Studies Zone and may run within the Zone for a distance of 1 to 2 miles. The IC Project Alignment makes multiple crossings of Alquist-Priolo Zones associated with the Owens Valley Fault Zone in Segment 1; it also crosses the Garlock Fault Zone in Segment 3N, the South Lockhart Fault Zone in Segment 3N, and the Calico Fault Zone in Segment 4. The IC Project Alignment runs near mapped Alquist-Priolo Special Studies Zones at several other locations along Segments 2, 3N, and 3S.

Most of the Special Studies Zones that affect the IC Project Alignment are associated with the Owens Valley Fault Zone in the central parts of the Owens Valley. The IC Project Alignment also crosses Special Studies Zones associated with the Southern Sierra Nevada Fault Zone on the western side of the Owens Valley, and Special Studies Zones associated with the Little Lake Fault Zone in Indian Wells Valley.

4.7.1.7 Seismic Ground Shaking

The expected long period (1.0 second) ground motions associated with a 2-percent exceedance probability in 50 years, based on Branum et al. (2016) and CGS (2017c), are shown in Figureset 4.7-6. This represents a recurrence interval of approximately 2,500 years. These estimates were calculated considering historical earthquakes, slip rates on major faults, and deformation throughout the region, and the potential for amplification of seismic waves by near-surface geologic materials.

In general, the estimated ground motions are highest where unconsolidated Quaternary alluvium coincides with Holocene faults. Ground motions greater than 0.65g (g = standard acceleration due to gravity, or 9.8 m/s^2) are often associated with heavy damage and violent perceived shaking. (Wald et al. 1999) Predicted ground motion values along the IC Project Alignment are commonly above 0.60g, except along Segment 4, east of the Soda Mountains (Figureset 4.7-6). The highest estimated ground motion values along the IC Project Alignment, up to 1.05g, occur in the Owens Valley in Segment 1. Other areas of very high predicted ground motions (greater than 0.95g) include the northern part of Segment 2 near the Garlock Fault Zone, and the western part of Segment 4 near the Mojave River.

4.7.1.8 Liquefaction

Liquefaction occurs where strong ground motions produce a rise in pore-water pressures that in turn causes granular material to briefly lose strength and liquefy. This can lead to settlement, lateral spreading, and damage to structures, even in areas of flat topography. Ground motions in excess of 0.1g can potentially trigger liquefaction in areas of unconsolidated granular sediment and shallow groundwater. (Southern California Earthquake Center [SCEC] 1999) The risk of liquefaction is highest in areas with high predicted ground motions, unconsolidated sediments, and shallow groundwater.

There is a potential risk of ground motions above this level throughout the IC Project Alignment, and the valley areas may contain unconsolidated granular sediment. However, with the exception of Segment 1, the IC Project Alignment is not generally characterized by shallow groundwater. The absence of shallow groundwater reduces the local liquefaction risk: The valley areas along Segments 2, 3N, 3S, and 4 are considered to have low to moderate susceptibility, which is typical for valley areas throughout Kern and San Bernardino counties. (USGS 2008, San Bernardino County 2011) No areas of "high" or "very high" liquefaction susceptibility were mapped along the IC Project Alignment.

The California Geological Survey's Seismic Hazard Zonation Program includes mapping of earthquake-induced liquefaction zones. However, this program focuses on the major metropolitan areas of California; it has not addressed the area along the IC Project Alignment.

4.7.1.8.1 Segment 1

Historical records of liquefaction in the Owens Lake area are extant as described below. Many parts of Segment 1 are characterized by both unconsolidated sediments and shallow groundwater, and potential liquefaction risks appear to exist in these areas.

The IC Project Alignment in Segment 1 crosses three valley areas filled with unconsolidated sediments. The potential occurrence of shallow groundwater in these valley areas is summarized below.

- Owens Valley. Shallow groundwater is likely to occur along the IC Project Alignment in many parts of the Owens Valley, particularly in the central parts near the Owens River, and in the southern part near Owens Lake. The California Department of Water Resources noted that "in extensive portions of the [Owens Valley] basin ground water levels are near or at the surface." (DWR 1964) The Safety Element of the City of Bishop General Plan notes that "the ground water under the [Owens] valley floor is shallow enough to suggest potential liquefaction problems." (City of Bishop 1993) However, no further evaluation or mapping are available.

  Historical records indicate that liquefaction occurred around the edges of Owens Lake in association with the 1876 Lone Pine earthquake. (ICCB 2016) More recently, liquefaction was observed in the Owens Lake area following the 2009 Olancha earthquake, which had a magnitude of 5.2. (Holzer et al. 2010) This study noted "extensive liquefaction as well as permanent horizontal ground deformation within [a] 1.2 km^2 area."
- Rose Valley. Current groundwater conditions in Rose Valley are not well documented. However, the CDWR (2004) reported shallow groundwater "about 20 feet below the surface" near Little Lake. The IC Project Alignment passes directly across the southwestern part of Little Lake, and the IC Project includes proposed structures on the north and south shores of Little Lake.
- Indian Wells Valley. There are no permanent surface water bodies near the IC Project Alignment in Indian Wells Valley. Current groundwater conditions in this area are not well documented. In 1985, the groundwater elevations in the southern Kern County portion of Indian Wells Valley were estimated at approximately less than 2,200 ft msl (Berenbrock and Martin 1991), while the local surface elevations are consistently above 2,250 ft msl. Based on these findings, groundwater does not appear to occur at shallow depths in this area.

  The Kern County portion of Indian Wells Valley has been addressed as part of a liquefaction susceptibility map for southern California. (USGS 2008) Most of the valley areas of Kern County, including Indian Wells Valley, are considered to have "moderate" liquefaction susceptibility. No areas of "high" or "very high" liquefaction susceptibility are mapped near the IC Project Alignment in Kern County.

4.7.1.8.2 Segments 2, 3N, 3S, and 4

Liquefaction susceptibility zones in Segments 2, 3N, 3S, and 4 have been mapped by USGS. (USGS 2008; San Bernardino County 2011) In general, the mountainous areas along the IC Project Alignment are considered to have no susceptibility to liquefaction. The valley areas along the IC Project Alignment are considered to have low to moderate susceptibility, which is typical for valley areas throughout Kern and San Bernardino counties. No areas of "high" or "very high" liquefaction susceptibility are mapped along the IC Project Alignment.

4.7.1.9 Slope Instability

No records of major historical landslides were found along the IC Project Alignment. Much of the IC Project Alignment is in valley areas. The hazards of landslides, rockfalls, slope creep, or other slope-related concerns are low to absent in these areas as they are, in general, characterized by relatively flat topography.

The susceptibility to deep-seated landslides, based on Wills et al. (2011) and CGS (2017d), is shown in Figureset 4.7-7. The estimated values indicate the relative likelihood of deep landsliding based on regional estimates of rock strength and steepness of slopes. Localized areas of relatively steep slopes and increased landslide hazards occur where the IC Project Alignment runs within or along the edges of hills and mountains, such as the Coso, El Paso, Cronese, Soda, and Clark-Ivanpah mountains. Figureset 4.7-7 shows the location of the IC Project Alignment within these areas.

Ground motions associated with earthquakes could potentially trigger landslides or rockfalls in the IC Project Alignment. Seismically-induced landslides are most commonly associated with earthquakes of magnitude 4.0 or more. (Keefer 1984)

The California Geological Survey's Seismic Hazard Zonation Program includes mapping of earthquake-induced landslide zones. However, this program focuses on the major metropolitan areas of California; it has not addressed the area along the IC Project Alignment.

4.7.1.10 Soil Erosion

Susceptibility of soils to erosion by water along the IC Project Alignment are summarized in Tables 4.7-1 and 4.7-2. Water erosion hazard ratings developed by the United States Department of Agriculture (USDA) utilize SSURGO data and assume that vegetative cover has been removed, but soil horizons remain intact. The erosion hazard rating is influenced by slope and soil erosion factor K. (SSS 2016) Erosion by water is a slight hazard for the majority of mapped soils crossed by the IC Project Alignment. Approximately 3 percent of the mapped soil units within the IC Project Alignment have a moderate erosion hazard; approximately 0.5 percent have a severe or very severe hazard. Soils with higher erosion hazards are generally associated with steeper terrain along the IC Project Alignment.

Wind erosion is similarly most prevalent in silty and fine sandy soils with disturbed vegetation. Dust storms associated with wind erosion are identified as hazards in Inyo, Kern, and San Bernardino counties. (Kern 2012; ICCB 2016; SBC 2011) Wind erodibility groups (WEGs) are made up of soils that have similar properties affecting their susceptibility to wind erosion. The soils assigned to Wind Erodibility Group 1 are the most susceptible to wind erosion, and those assigned to Group 8 are the least susceptible. Table 4.7-4 presents the relative Wind Erodibility Group presence of soils along the IC Project Alignment. Soils with relatively high levels of wind erodibility (Wind Erodibility Groups 1 and 2) occur at various locations and make up the majority of soil units that have been assigned a WEG.

Table 4.7-4: Relative Wind Erodibility Group Presence of Soils along the IC Project Alignment

Wind Erodibility Group	Description	Percent of IC Project Alignment[1]
1	Coarse sands, sands, fine sands, and very fine sands.	13.0
2	Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.	13.8
3	Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.	5.8
4L	Calcareous loams, silt loams, clay loams, and silty clay loams.	2.2
4	Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.	0
5	Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.	3.3
6	Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.	1.1
7	Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.	0
8	Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.	0
Undefined	N/A	60.0

Notes:
1 Percentages rounded; total may not equal 100 percent.

4.7.1.11 Collapsible Soils

Soil collapse occurs when water enters the void space between soil particles and weakens the bonds between particles. The weight of overlying soils or structures causes the soil particles to shift, filling the voids and resulting in a reduced overall soil volume. Collapse of the soil at depth is translated to downward motion of the surface, causing differential settlement. Soils susceptible to collapse typically contain a large amount of void space (porosity), low bulk density, low clay content (less than 30 percent and most commonly 10 to 15 percent), and have formed rapidly in arid or semiarid climates, especially on alluvial fans. (Scheffe and Lacy 2004) Soil collapse has not been identified as a significant issue within Inyo, Kern, or San Bernardino counties. (Kern 2012; ICCB 2016; SBC 2011) However, soils with low clay content, formed on alluvial fans, are mapped in multiple locations along the IC Project Alignment. Potential for soil collapse may be locally present in those areas.

4.7.1.12 Expansive Soils

An expansive soil is any soil that is prone to large volume changes (shrinking and swelling) directly related to changing moisture conditions. The swelling capacity can cause heaving or lifting of structures whilst shrinkage can cause differential settlement. Linear extensibility percent (LEP) is the linear expression of the volume difference of natural soil; LEP is used to identify shrink-swell classes as follows: Low (<3), Moderate (3-6), High (6-9), and Very High (>9).

Expansive soil issues are not prevalent along the IC Project Alignment. (Kern 2012; ICCB 2016; SBC 2011) Most of the soils along Segment 1 have low to moderate shrink-swell potential (with LEP values of less than 6.0). Soils with high shrink-swell potential (LEP values of 6.0 to 9.0) are found locally along the IC Project Alignment near the edges of the Owens Lake bed. No soils with a very high (LEP above 9.0) shrink-swell potential have been mapped along the northern portion of Segment 1. All mapped soils within Segments 2, 3N, 3S, and 4 have LEP values of less than 6.0 and therefore have low to moderate shrink-swell potential.

4.7.1.13 Subsidence

No records of land subsidence were found along Segment 1; there are no historical or expected occurrences of subsidence in Inyo County, which includes most of Segment 1. (ICCB 2016)

Land subsidence associated with groundwater overdraft is a concern in several of the valley areas crossed by Segments 2, 3N, 3S, and 4. The IC Project Alignment crosses parts of ten groundwater basins recognized by the California Department of Water Resources (CDWR). The overall estimated potential for future subsidence in each of these basins, as rated by CDWR (2014), is summarized in Table 4.7-5.

Table 4.7-5: Subsidence Potential

Groundwater Basin	CDWR Basin No.	Project Segment(s)	Subsidence Potential
Indian Wells Valley	6-54	2	Low
Fremont Valley	6-46	2	Medium to High
Cuddeback Valley	6-50	2	Insufficient Data
Harper Valley	6-47	2, 3N, 3S	High
Lower Mojave River Valley	6-40	3N, 3S, 4	High
Caves Canyon Valley	6-38	4	Medium to Low
Cronese Valley	6-35	4	Insufficient Data
Soda Lake Valley	6-33	4	Insufficient Data
Upper Kingston Valley	6-22	4	Insufficient Data
Ivanpah Valley	6-30	4	Insufficient Data

The areas with the greatest documented subsidence potential are generally associated with the southern part of Segment 2; most parts of Segments 3N and 3S; and the western part of Segment 4. Segment 2 crosses a portion of the Fremont Valley where earth fissures attributed to land subsidence caused by groundwater pumping have been documented. (CDWR 2014) Segment 3N runs directly south of the Harper Dry Lake bed; between 1992 and 2009, more than 6 inches of subsidence was documented at the Harper Dry Lake, at a steady rate of about 0.4 inches per year. The subsidence was associated with a decline in groundwater elevations (Brandt and Sneed 2017).

4.7.2 Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.7.2.1 Federal

4.7.2.1.1 National Earthquake Hazards Reduction Act of 1977

The National Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) created the National Earthquake Hazards Reduction Program (NEHRP), establishing a long-term earthquake risk reduction program to better understand, predict, and mitigate risks associated with seismic events. Four federal agencies are responsible for coordinating activities under NEHRP: U.S. Geological Survey (USGS); National Science Foundation (NSF); Federal Emergency Management Agency (FEMA); and National Institute of Standards and Technology (NIST). Since its inception, NEHRP has shifted its focus from earthquake prediction to hazard reduction. The current program objectives (NEHRP 2009) are as follows:

1. Developing effective measures to reduce earthquake hazards;

2. Promoting the adoption of earthquake hazard reduction activities by federal, state, and local governments, national building standards and model building code organizations, engineers, architects, building owners, and others who play a role in planning and constructing buildings, bridges, structures, and critical infrastructure or "lifelines";

3. Improving the basic understanding of earthquakes and their effects on people and infrastructure through interdisciplinary research involving engineering, natural sciences, and social, economic, and decision sciences; and

4. Developing and maintaining the USGS seismic monitoring system (Advanced National Seismic System); the NSF-funded project aimed at improving materials, designs, and construction techniques (George E. Brown Jr. Network for Earthquake Engineering Simulation); and the global earthquake monitoring network (Global Seismic Network).

Implementation of NEHRP objectives is accomplished primarily through original research, publications, and recommendations and guidelines for state, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

4.7.2.1.2 Clean Water Act

Enacted in 1972, the Federal Clean Water Act (CWA; 33 U.S.C. § 1251 et seq.) and subsequent amendments outline the basic protocol for regulating discharges of pollutants to waters of the U.S. It is the primary federal law applicable to water quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. Enforced by the USEPA, it was enacted "… to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA authorizes States to adopt water quality standards and includes programs addressing both point and non-point pollution sources. The CWA also established the NPDES, and provides the USEPA the authority to implement pollution control programs, such as setting wastewater standards for industry and water quality standards for surface waters (see below for a discussion of the NPDES program).

In California, programs and regulatory authority under the CWA have been delegated by USEPA to the SWRCB and its nine RWQCBs. Under Section 402 of the CWA as delegated to the State of California, a discharge of pollutants to navigable waters is prohibited unless the discharge complies with an NPDES permit. The SWRCB and RWQCBs have developed numeric and narrative water quality criteria to protect beneficial uses of state waters and waterways. Beneficial uses along the IC Project Alignment include water supply, groundwater recharge, aquatic habitat, wildlife habitat, and recreation.

4.7.2.2 State

4.7.2.2.1 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo (AP) Earthquake Fault Zoning Act was enacted by the State of California in 1972 to mitigate the hazard of surface faulting to structures planned for human occupancy and other critical structures. The State has established regulatory zones, known as Earthquake Fault Zones and often referred to as AP zones, around the surface traces of active faults and has issued Earthquake Fault Zone Maps to be used by government agencies in planning and reviewing new construction. In addition to residential projects, structures planned for human occupancy that are associated with industrial and commercial projects are of concern.

4.7.2.2.2 California Public Utilities Commission General Order 95

California Public Utilities Commission (CPUC) General Order (GO) 95 Rules for Overhead Line Construction provides general standards for the design and construction of overhead electric transmission lines.

4.7.2.2.3 California Public Utilities Commission General Order 128

CPUC GO 128 (Rules for Construction of Underground Electric Supply and Communication Systems) provides general standards for the construction of underground electric systems.

4.7.2.2.4 Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (California Public Resources Code, Chapter 7.8, Segment 2690-2699.6) directs the California Department of Conservation (DOC) to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of this program is to minimize loss of life and property through the identification, evaluation, and mitigation of seismic hazards. Seismic Hazard Zone Maps that identify Zones of Required Investigation have been generated as a result of the program. Cities and counties are then required to use the Seismic Hazard Zone Maps in their land use planning and building permit processes. As discussed previously, the IC Project Alignment is in an area that has not yet been mapped as part of the Seismic Hazards Mapping Act.

4.7.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

4.7.2.3.1 Kern County General Plan

The Kern County General Plan has provisions that state that areas within the AP Special Study Zone and other recently active faults shall be designated with Map Code 2.1 – Seismic Hazard and areas of down-slope ground movement shall be designated with Map Code 2.2 – Landslide. (Kern County 2009) The Kern County General Plan outlines policies that aim to reduce to potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion.

4.7.2.3.2 Kern County General Plan, Land Use, Open Space, and Conservation Element

Section 1.3, Physical and Environmental Constraints, of the Land Use, Open Space, and Conservation Element notes that natural hazards are a long-term constraint that may affect developed uses of land. The Section contains Goals, Policies, and Implementation Measures to mitigate the risks presented by physical and environmental constraints. These Goals, Policies, and Implementation measures are generally applicable to new developments and are designed to reduce to potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion. The Element establishes Land Use Designations for areas with natural hazards, including seismic hazards, landslides, shallow groundwater, steep slopes, and flood hazards.

4.7.2.3.3 Kern County General Plan, Safety Element

Per Section 65302(g) of the California Government Code, the Safety Element includes Policies and Implementation Measures designed to protect the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence, liquefaction and other seismic hazards; flooding; and wildland and urban fires.

4.7.2.3.4 Inyo County General Plan, Safety Element

The Safety Element of the Inyo County General Plan contains a number of goals, policies, and implementation measures designed to maintain a safe environment and to protect public safety and property. The Safety Element addresses avalanches and geologic and seismic hazards among other topics. The goals, policies, and implementation measures contained in the General Plan are directed toward traditional residential, commercial, and institutional projects, and are not applicable to the IC Project.

4.7.2.3.5 Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan

The Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan (ICCB 2016) establishes a strategy for Inyo County and the City of Bishop, California, to reduce hazard impacts. The Plan focuses on hazard mitigation in reducing the impacts of disasters by identifying effective and feasible actions to reduce the risks posed by potential hazards. The Plan develops mitigation actions to strengthen community resilience, which helps ensure coordinated and consistent hazard mitigation activities across Inyo County and Bishop. The County and the City have developed this Plan to be consistent with current standards and regulations, ensuring that the understanding of hazards facing the communities reflects best available science and current conditions. The Plan is also consistent with Federal Emergency Management Agency (FEMA) requirements.

4.7.2.3.6 San Bernardino General Plan, Safety Element

The Safety Element of the County of San Bernardino 2007 General Plan contains the following goals to address geologic and seismic hazards:

> Goal S 1: The County will minimize the potential risks resulting from exposure of County residents to natural and man-made hazards in the following priority: loss of life or injury, damage to property, litigation, excessive maintenance and other social and economic costs
>
> Goal S 6: The County will protect residents from natural and manmade hazards
>
> Goal S 7: The County will minimize exposure to hazards and structural damage from geologic and seismic conditions

4.7.2.3.7 City of Barstow General Plan, Safety Element

The Safety Element of the City of Barstow General Plan (City of Barstow 2015) sets forth goals, policies, and strategies geared toward ensuring the safety of City residents and visitors to the community. The City of Barstow General Plan's Safety Element contains the following:

> Goal 3 (Policies 3.1 and Strategies 3.1.A and 3.1.B). Ensure that all development occurring under the General Plan is designed and built in accordance with current standards for seismic safety, fire protection and defensible space.

4.7.3 Significance Criteria

The significance criteria for assessing the impacts to geology and soils come from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project causes a potentially significant impact if it would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, or injury, or death involving: 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 a known fault (Refer to Division of Mines and Geology Special Publication 42.); strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides
- Result in substantial soil erosion or the loss of topsoil
- Be located on a geologic unit or soil 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
- 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
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water

4.7.4 Impact Analysis

4.7.4.1 Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: 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 a known fault strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides?

4.7.4.1.1 Construction

Less than Significant Impact. The replacement components included in the IC Project would have the potential to be directly impacted by surface rupture in the Alquist-Priolo Special Studies Zones crossed by the alignment. Portions of the IC Project would be constructed within these zones, and as a result could experience strong seismic ground shaking. Even though the IC Project Alignment is located in an area susceptible to earthquake forces, the subtransmission infrastructure involved would not be used for human occupancy and would be designed consistent with CPUC GO 95, Rules for Overhead Line Construction, to withstand wind, temperature, and wire tension loads. Accounting for these factors would result in a design that would be adequate to withstand expected seismic loading, and therefore impacts due to strong seismic ground shaking would be less than significant.

The IC Project Alignment may pass through areas of liquefaction hazard in parts of Owens Valley and Rose Valley, particularly near surface water features such as the Owens River, Owens Lake, or Little Lake. Settlements induced by dynamic (earthquake) forces are anticipated to be uniform for the proposed TSPs and LWS poles given their small footprint, and thus use of these poles reduces the potential for differential settlements and other adverse effects including loss of functionality, or risk of injury or loss of life. Therefore, impacts associated with liquefaction would be less than significant in areas potentially subject to liquefaction.

Most of the IC Project Alignment passes through valley areas with relatively low to absent potential of landslides or other slope-related hazards. In localized areas with higher potential of landslides or other slope-related hazards, structures would be exposed to the risk of loss from a landslide or rockfall. These areas are uninhabited and non-SCE structures are generally not present proximate to the location of existing or replacement subtransmission poles. Therefore, reconstruction of the existing subtransmission lines in these areas would not expose people or non-SCE structures to potential substantial adverse effects, including the risk of loss, injury, or death, and thus impacts due to landslides would be less than significant.

4.7.4.1.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt or reconductored under the IC Project. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the IC Project, and therefore no impacts would be realized under this criterion during operations and maintenance.

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

4.7.4.2.1 Construction

Less than Significant Impact. Loss of topsoil and erosion could result from construction activities, including the operation of heavy machinery on unimproved roadways, grading activities, excavation, drilling, or wind or water erosion of stockpiled fill/excavated materials. Preparation of the staging areas may result in the loss of topsoil; however, the application of road base or crushed rock would serve to reduce erosivity. Use of existing access roads would also result in the loss of topsoil; however, compaction associated with that use would serve to minimize erosion on roadways.

Erosion due to water runoff and wind would be minimized by the implementation of best management practices (BMPs) that would be described in the Storm Water Pollution Prevention Plan (SWPPP) prepared for the IC Project. During construction, water trucks and other measures would be used to minimize the quantity of fugitive dust created by construction. Implementation of the SWPPP and site-specific BMPs would ensure that no substantial soil erosion or loss of topsoil results from construction of the IC Project, and thus impacts would be less than significant.

4.7.4.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt and reconductored under the IC Project. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the IC Project, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.3 Would the project be located on a geologic unit or soil 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?

4.7.4.3.1 Construction

Less than Significant Impact. The IC Project is located on geologic units and soils that are unstable; no geologic units or soils would become unstable as a result of construction of the IC Project.

The potential for risk from on- or off-site landslides is considered to be low because components of the IC Project are generally located in valley areas with relatively low threats of landslide or other slope-related hazards. Localized areas of steeper slopes and higher landslide hazard occur where IC Project components are located along the edges of hills and mountains; these few areas are unpopulated and third-party structures are generally not present, and thus potential effects from on- or off-site landslide are less than significant.

Ground subsidence related to decreasing groundwater levels has been documented along the southern part of Segment 2; most parts of Segments 3N and 3S; and the western part of Segment 4. The construction of the IC Project would not result in subsidence.

The IC Project Alignment may pass through areas of liquefaction hazard in parts of Owens Valley and Rose Valley, particularly near surface water features such as the Owens River, Owens Lake, or Little Lake. These valleys are characterized by unconsolidated sediment, surface water or possible shallow groundwater. Liquefaction-induced lateral spreading may also be a hazard in these areas. Construction of the IC Project would not in and of itself result in liquefaction of soils or lateral spreading, and therefore impacts would be less than significant.

Soils subject to collapse due to water infiltration may be locally present on alluvial fans. Construction of the IC Project would not in and of itself result in the collapse of soils, and therefore impacts would be less than significant.

As presented above, impacts associated with the risk of landslides, lateral spreading, subsidence, liquefaction, and collapse would be less than significant.

4.7.4.3.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt and reconductored under the IC Project. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the IC Project, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.4 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?

4.7.4.4.1 Construction

Less than Significant Impact. Soils along the IC Project Alignment have a low to moderate shrink-swell potential, with the exception of a limited area of high potential near Owens Lake. Inyo, Kern, and San Bernardino counties have determined that expansive soils are generally not a hazard along the IC Project Alignment. Components of the IC Project are not located immediately proximate to residences or third-party improvements near Owens Lake. Therefore, less than significant impacts would be realized.

4.7.4.4.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt and reconductored under the IC Project. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the IC Project, and therefore no impacts would be realized under this criterion during operations and maintenance.

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

4.7.4.5.1 Construction

No Impact. No septic tanks or alternative waste water disposal systems are included in the IC Project. Therefore, no impacts would be realized.

4.7.4.5.2 Operations

No Impact. No septic tanks or alternative waste water disposal systems are included in the IC Project. Therefore, no impacts would be realized.

4.7.5 Applicant Proposed Measures

Because no significant impacts would occur as a result of the IC Project, no avoidance or minimization measures are proposed.

4.7.6 Alternatives

Alternatives to the IC Project are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

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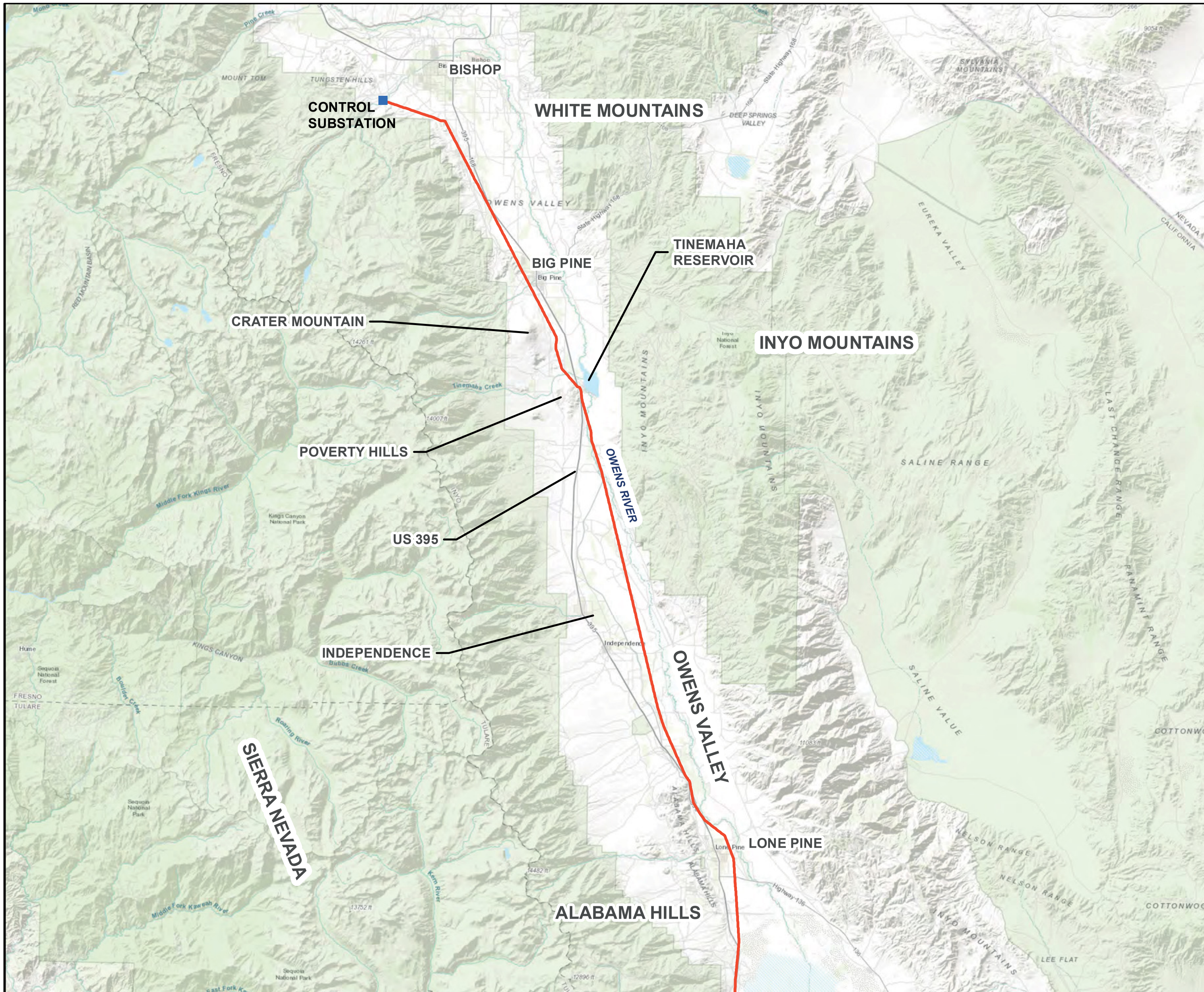

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SITE LOCATION MAP

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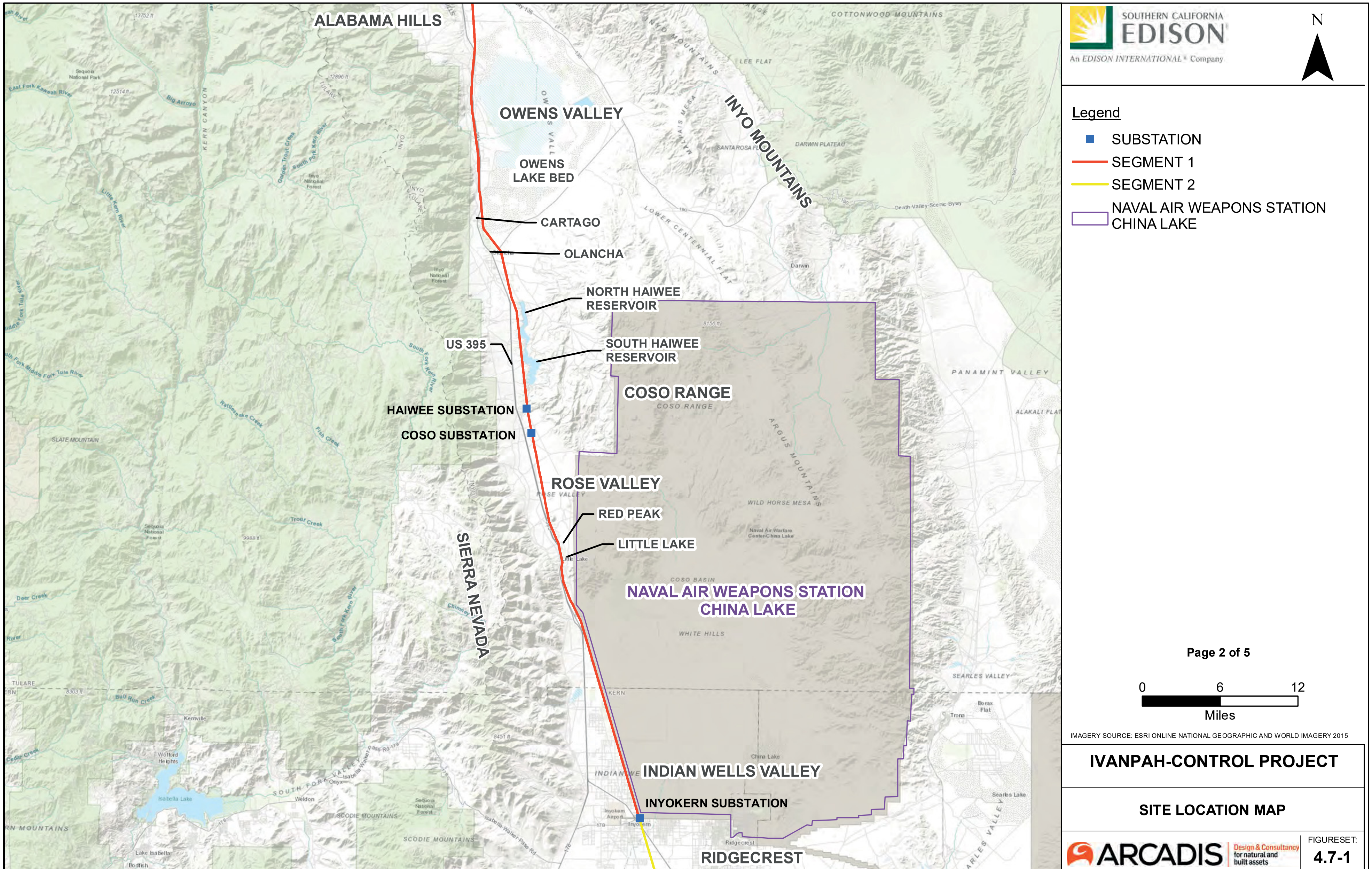

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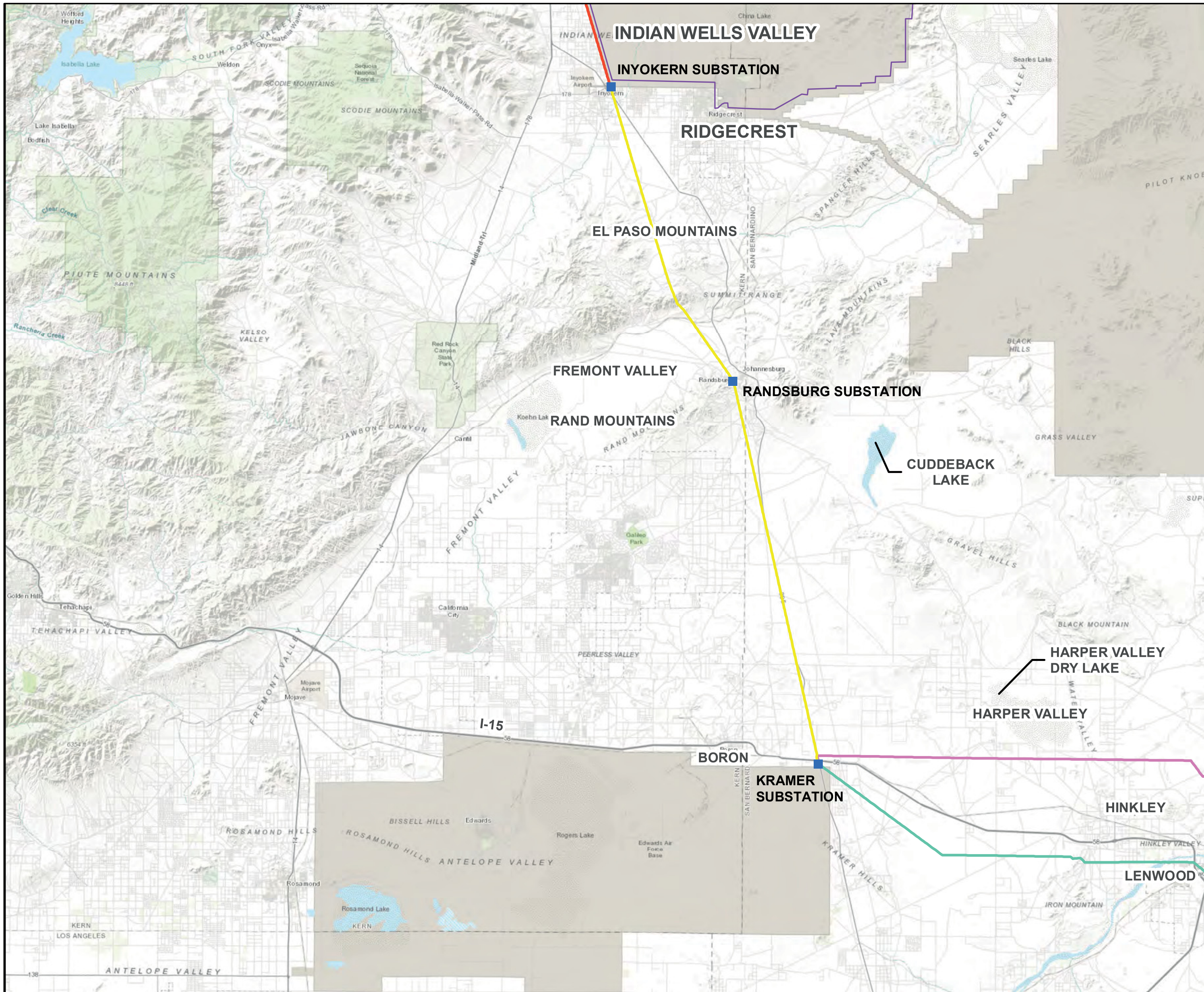

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SITE LOCATION MAP

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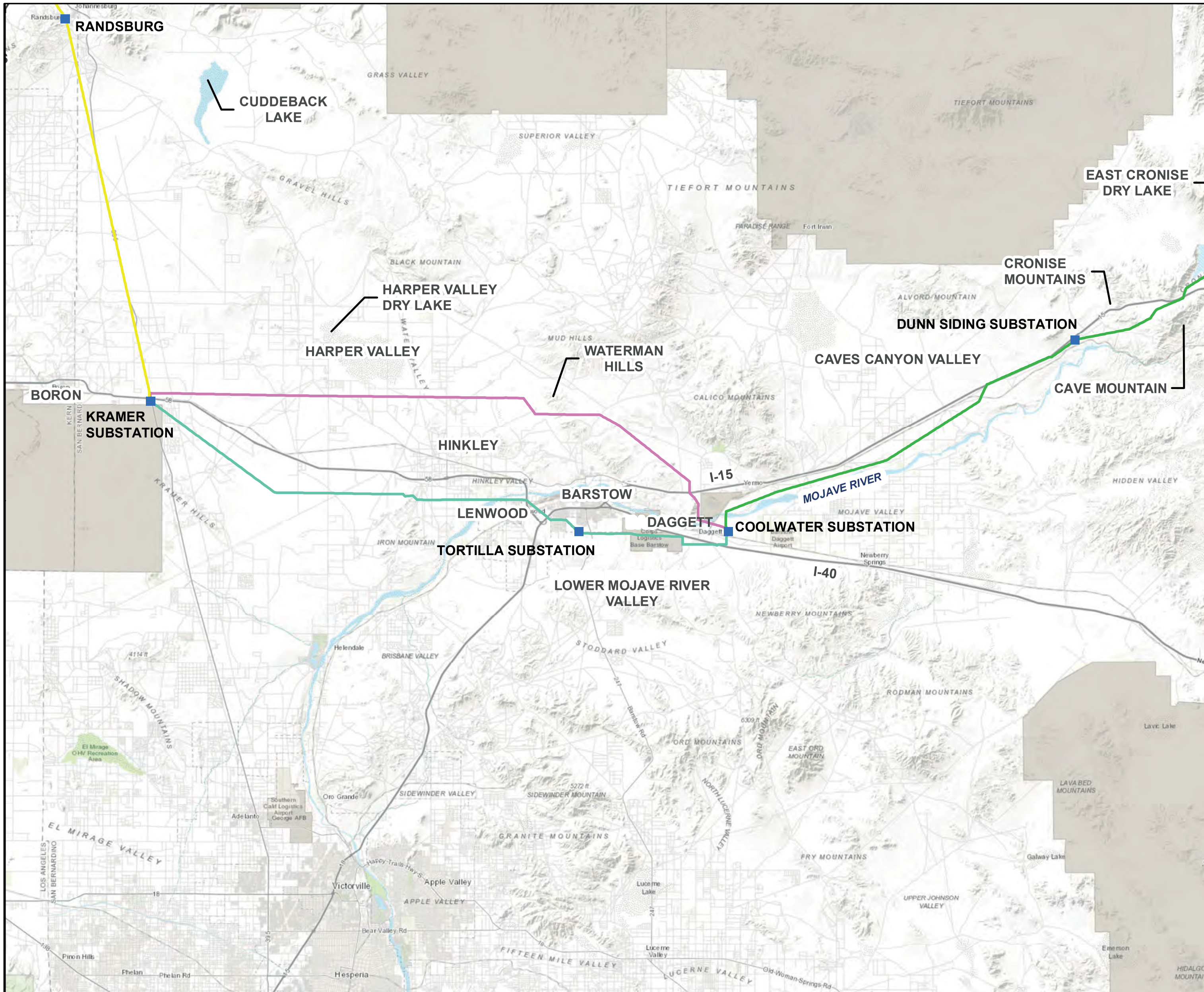

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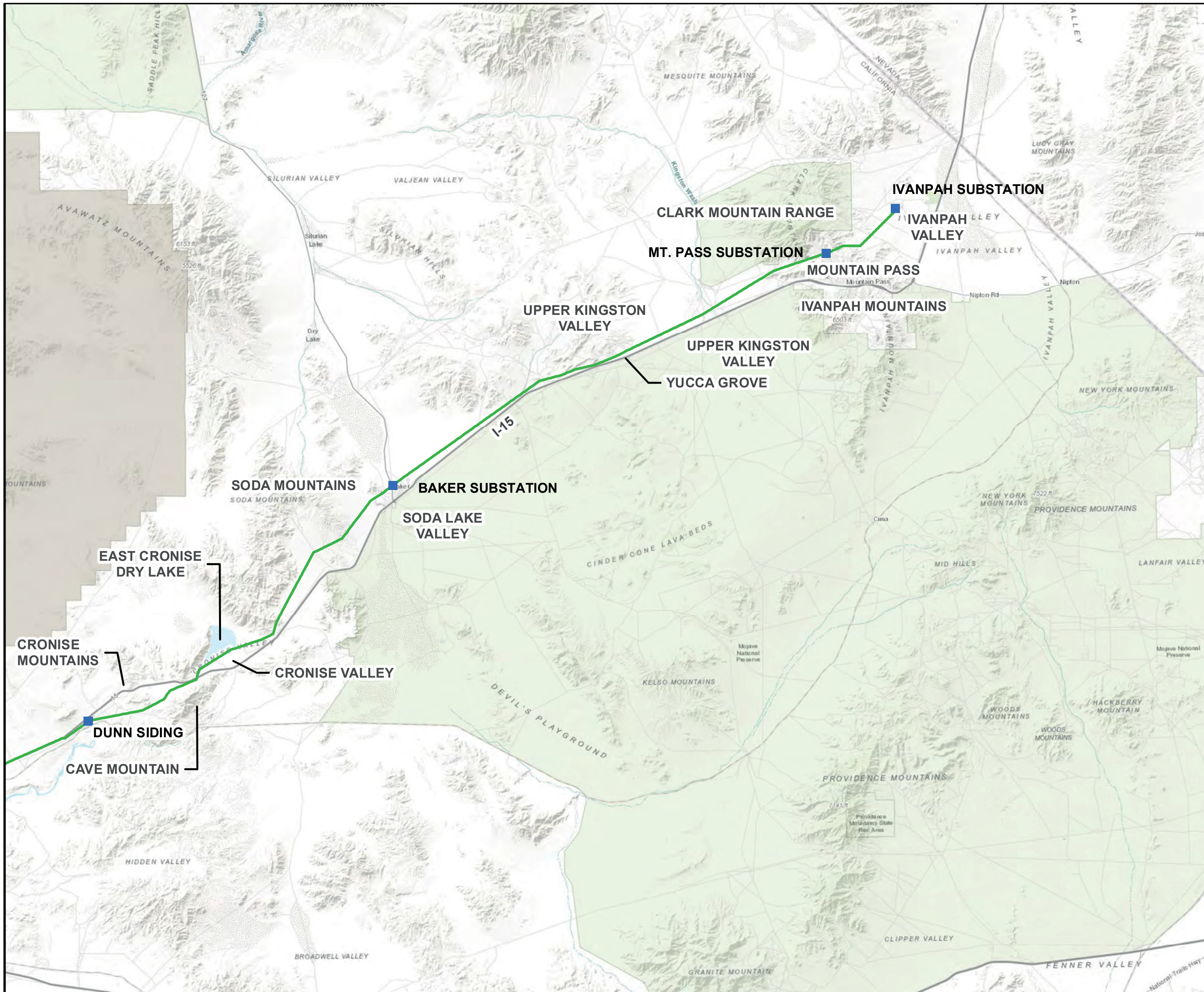

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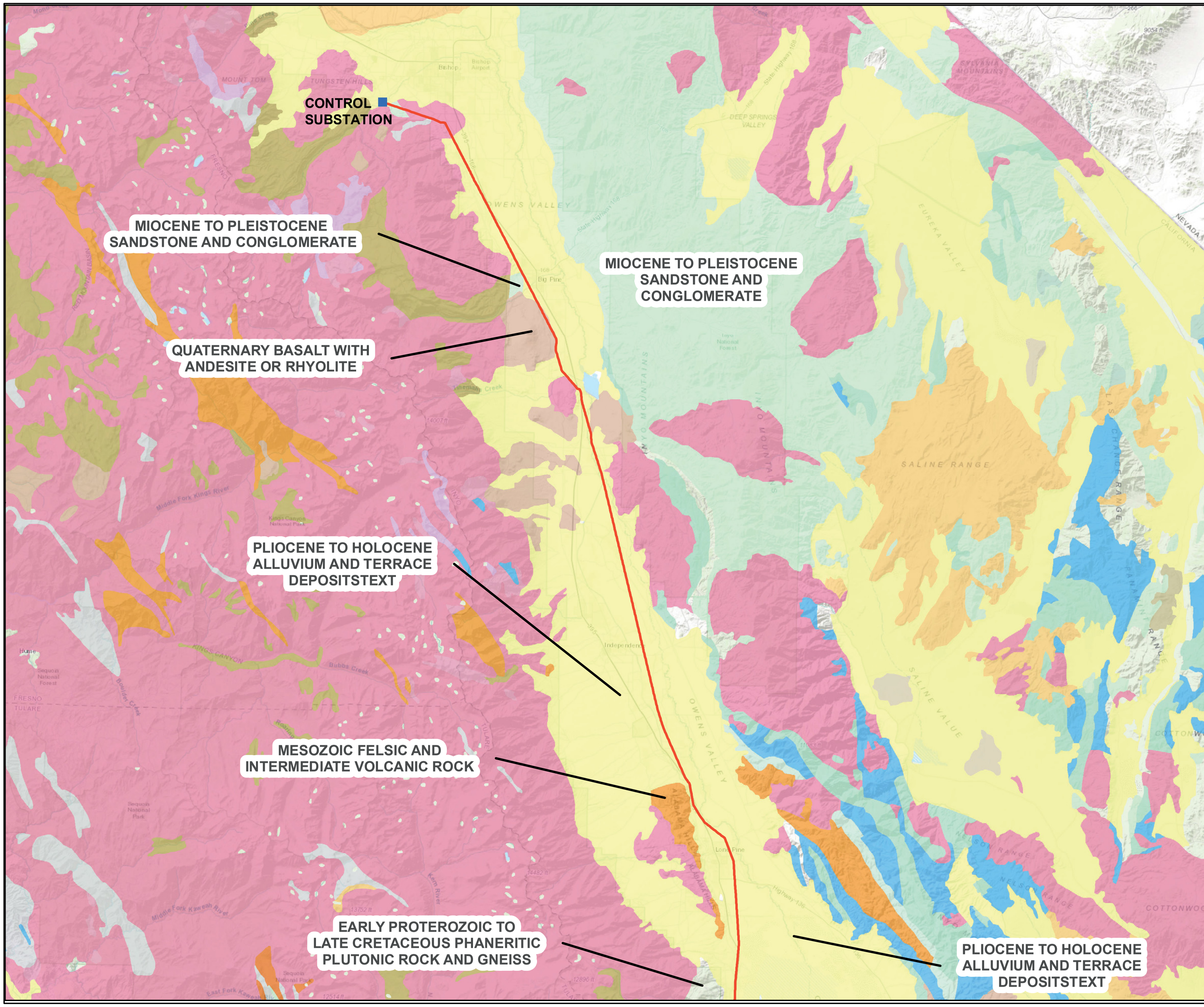

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- MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
- QUATERNARY BASALT WITH ANDESITE OR RHYOLITE
- TERTIARY RHYOLITE AND
- MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
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Source: USGS 2017

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GENERALIZED GEOLOGIC MAP

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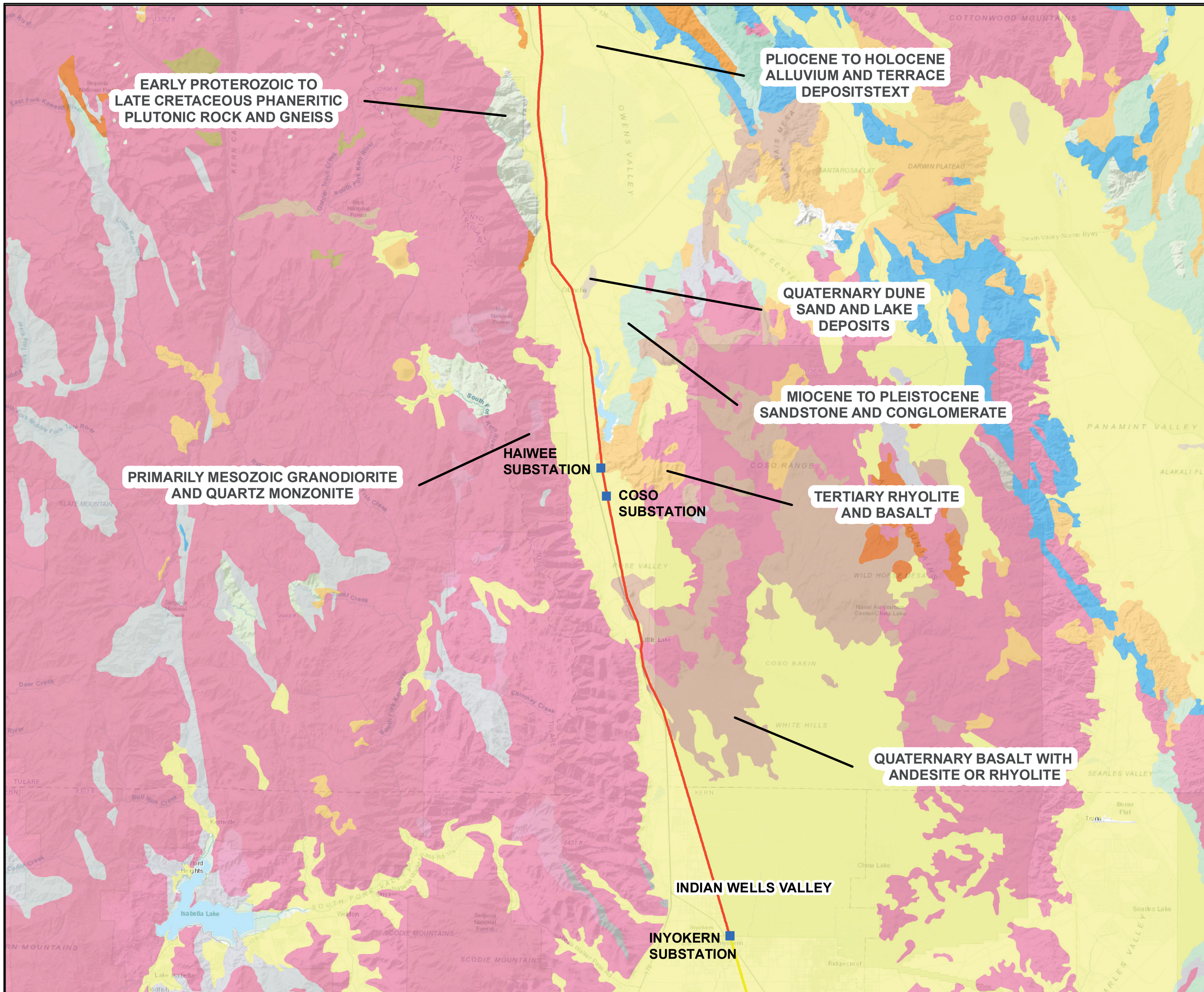

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- TERTIARY RHYOLITE AND
- MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
- PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
- EARLY PROTEROZOIC TO LATE CRETACEOUS PHANERITIC PLUTONIC ROCK AND GNEISS

Source: USGS 2017

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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

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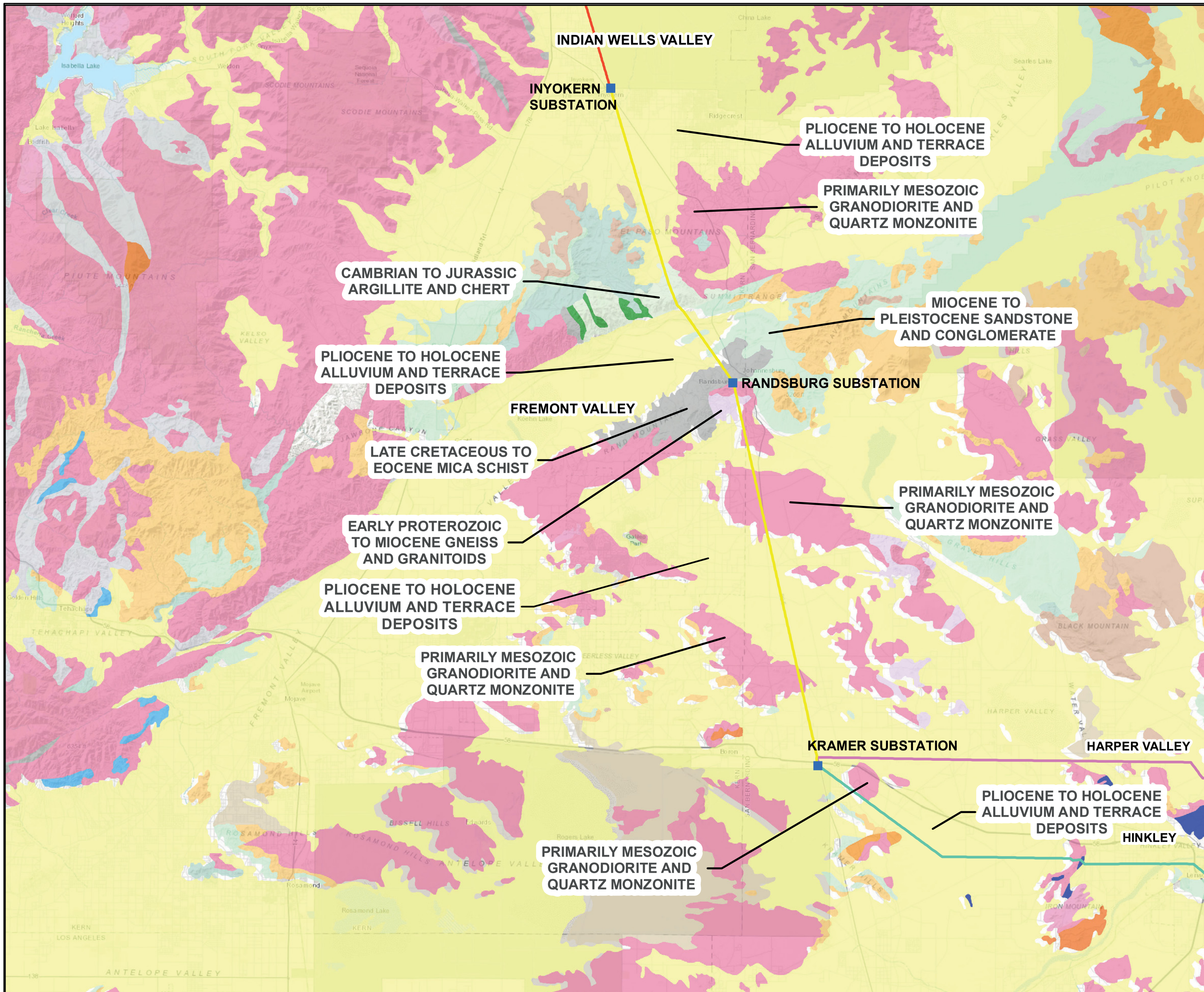

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- QUATERNARY BASALT AND TEPHRITE
- MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
- TERTIARY RHYOLITE AND BASALT
- PALEOCENE TO PLIOCENE CONGLOMERATE AND SANDSTONE
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- PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
- MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
- EARLY PROTEROZOIC TO MIOCENE GNEISS AND GRANITOIDS
- TRIASSIC MUDSTONE AND LIMESTONE
- PENNSYLVANIAN TO TRIASSIC LIMESTONE AND SANDSTONE
- DEVONIAN LIMESTONE AND DOLOSTONE
- CAMBRIAN TO JURASSIC ARGILLITE AND CHERT
- LATE PROTEROZOIC TO PENNSYLVANIAN MARBLE AND LIMESTONE
- LATE PROTEROZOIC TO DEVONIAN SANDSTONE AND DOLOSTONE

Source: USGS 2017

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IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: **4.7-2**

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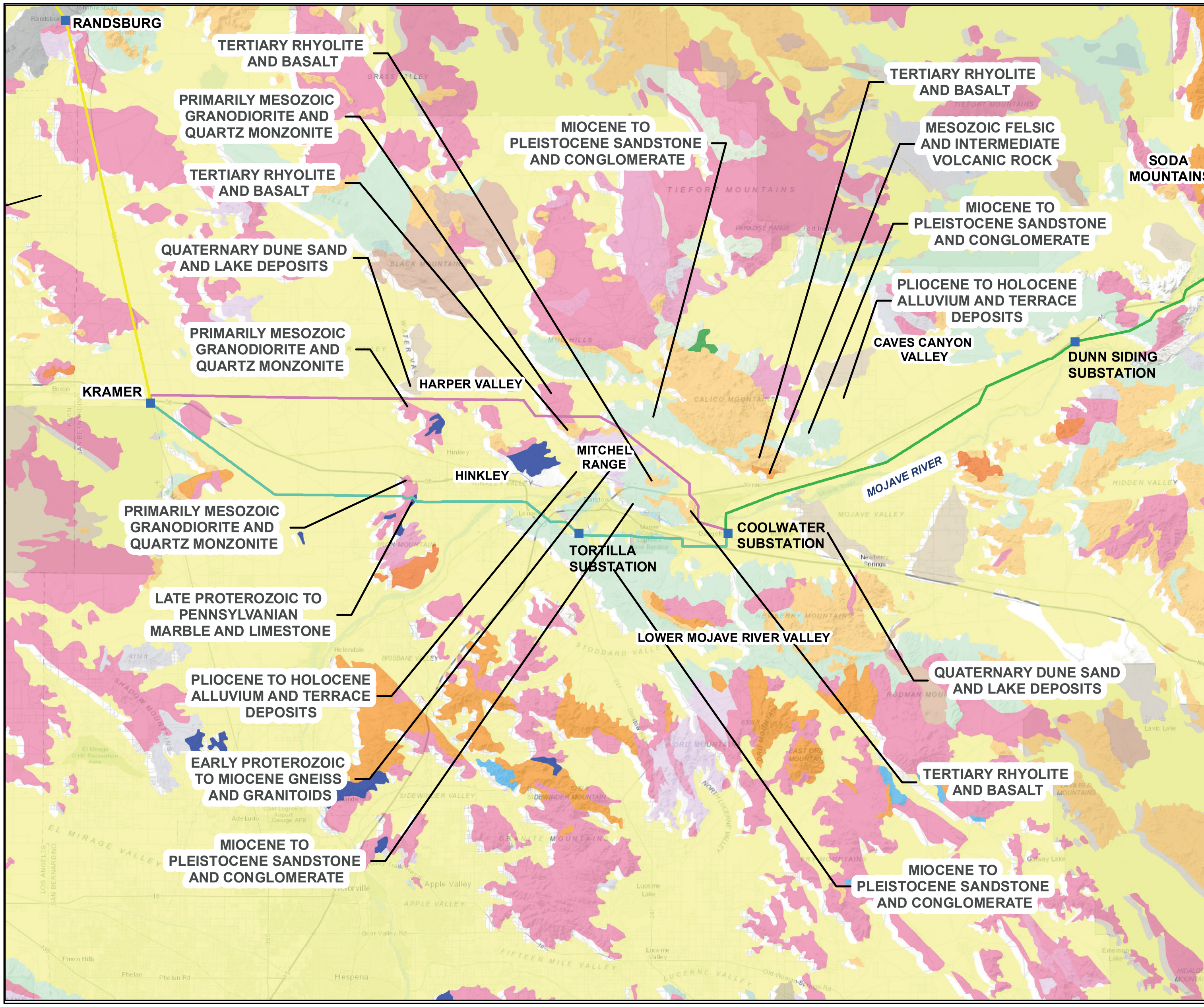

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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

LITHOGRAPHY

- PLIOCENE TO HOLOCENE ALLUVIUM AND TERRACE DEPOSITS
- QUATERNARY DUNE SAND AND LAKE DEPOSITS
- QUATERNARY BASALT AND TEPHRITE
- MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
- TERTIARY RHYOLITE AND BASALT
- PALEOCENE TO PLIOCENE CONGLOMERATE AND SANDSTONE
- LATE CRETACEOUS TO EOCENE MICA SCHIST
- PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
- MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
- EARLY PROTEROZOIC TO MIOCENE GNEISS AND GRANITOIDS
- TRIASSIC MUDSTONE AND LIMESTONE
- PENNSYLVANIAN TO TRIASSIC LIMESTONE AND SANDSTONE
- DEVONIAN LIMESTONE AND DOLOSTONE
- CAMBRIAN TO JURASSIC ARGILLITE AND CHERT
- LATE PROTEROZOIC TO PENNSYLVANIAN MARBLE AND LIMESTONE
- LATE PROTEROZOIC TO DEVONIAN SANDSTONE AND DOLOSTONE

Source: USGS 2017

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-2

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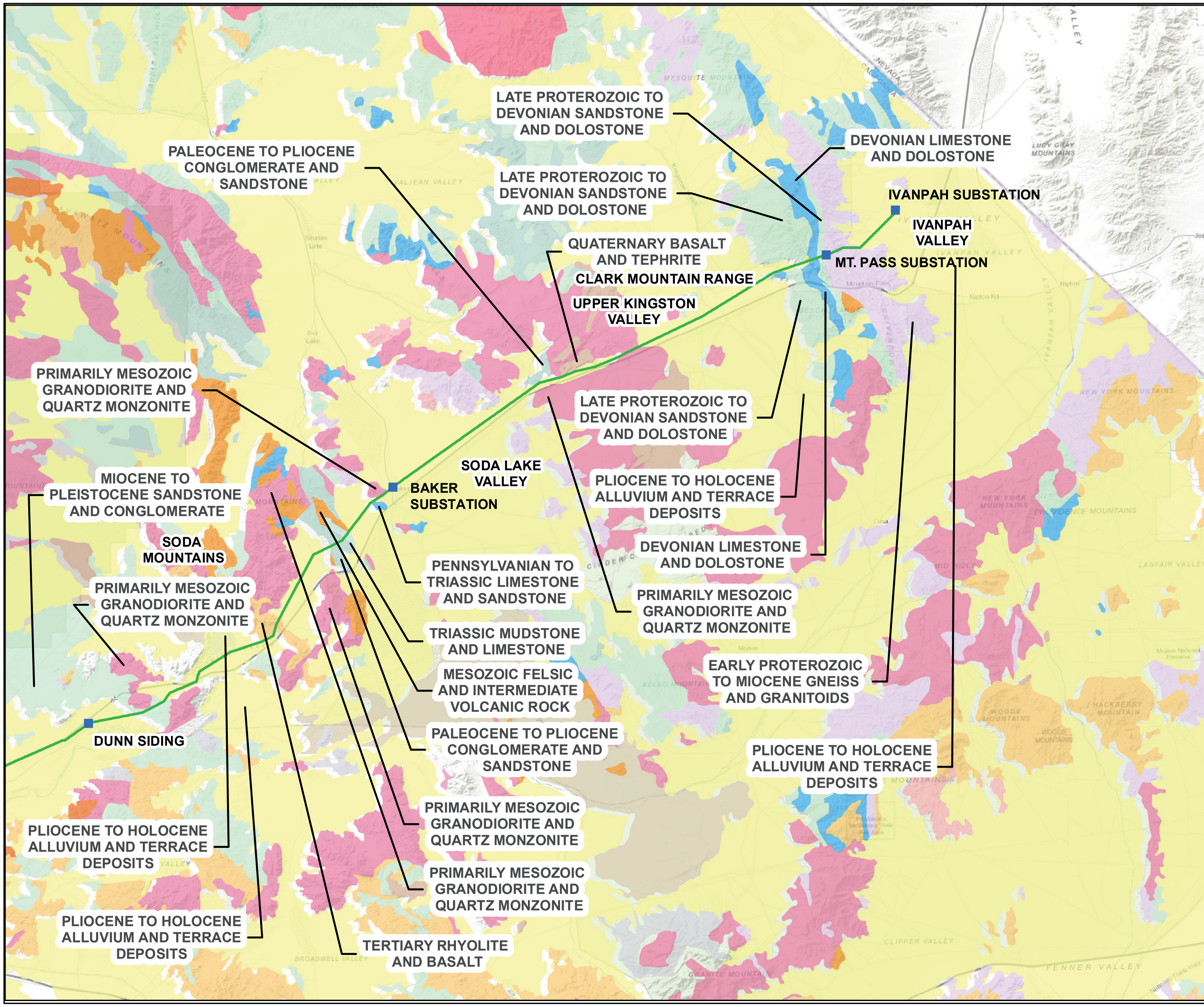

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Legend

- SUBSTATION
- SEGMENT 4

LITHOGRAPHY

- PLIOCENE TO HOLOCENE ALLUVIUM AND TERRACE DEPOSITS
- QUATERNARY DUNE SAND AND LAKE DEPOSITS
- QUATERNARY BASALT AND TEPHRITE
- MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
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- EARLY PROTEROZOIC TO MIOCENE GNEISS AND GRANITOIDS
- TRIASSIC MUDSTONE AND LIMESTONE
- PENNSYLVANIAN TO TRIASSIC LIMESTONE AND SANDSTONE
- DEVONIAN LIMESTONE AND DOLOSTONE
- CAMBRIAN TO JURASSIC ARGILLITE AND CHERT
- LATE PROTEROZOIC TO PENNSYLVANIAN MARBLE AND LIMESTONE
- LATE PROTEROZOIC TO DEVONIAN SANDSTONE AND DOLOSTONE

Source: USGS 2017

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-2

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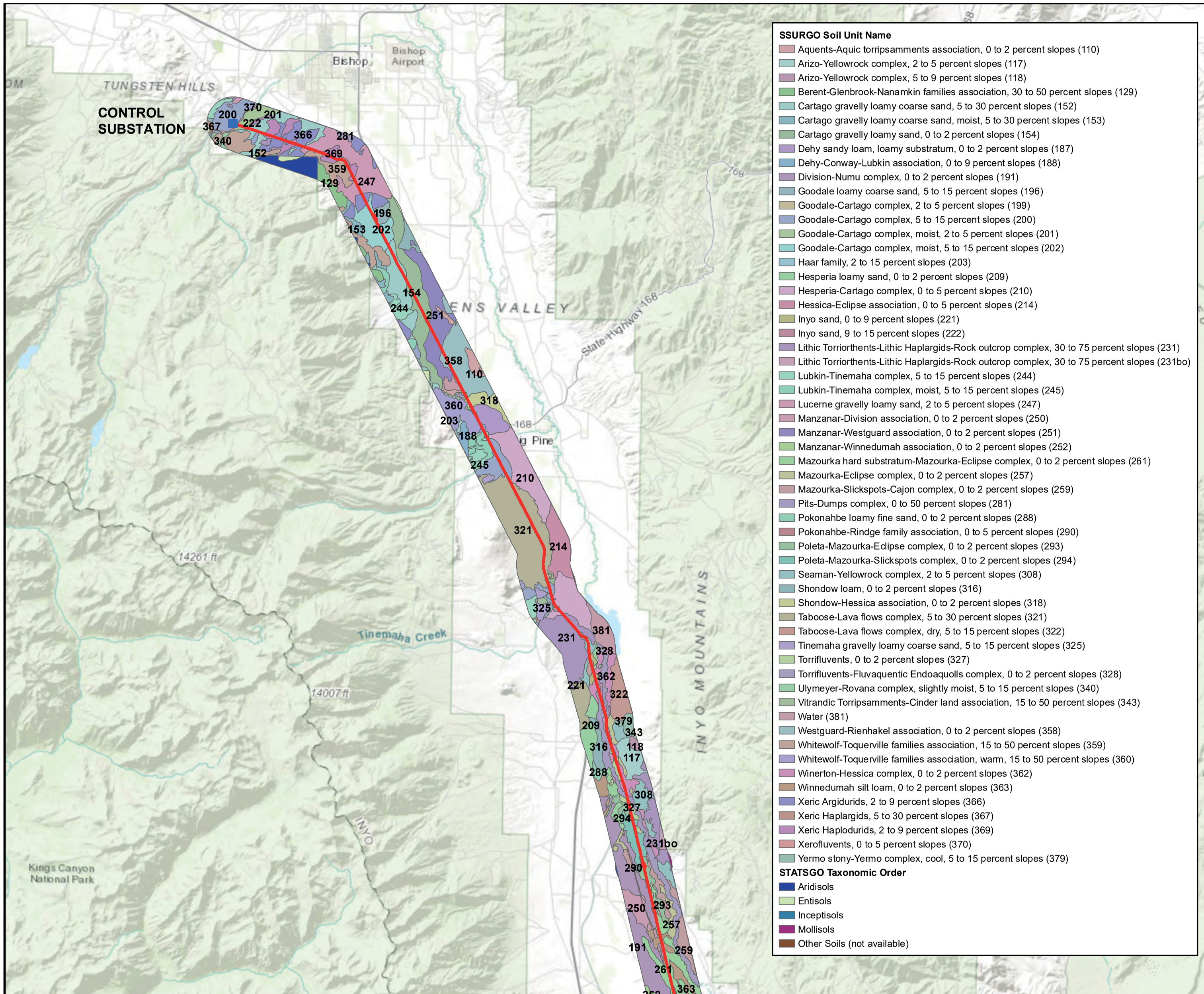

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Legend

- SUBSTATION
- SEGMENT 1

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. U.S. GENERAL SOIL MAP (STATSGO2). AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.

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0 4 8
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

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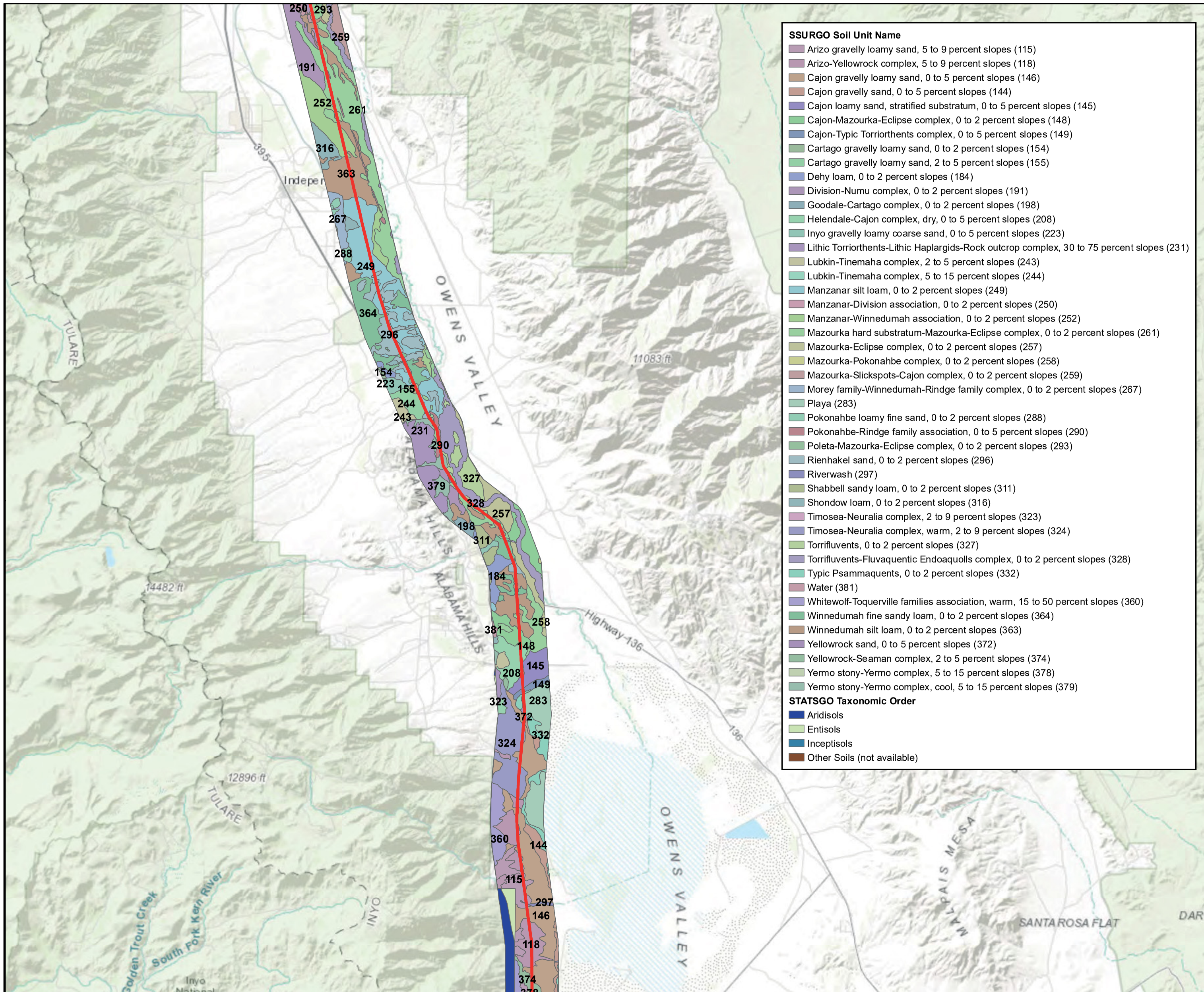

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Legend

SEGMENT 1

SOURCE:
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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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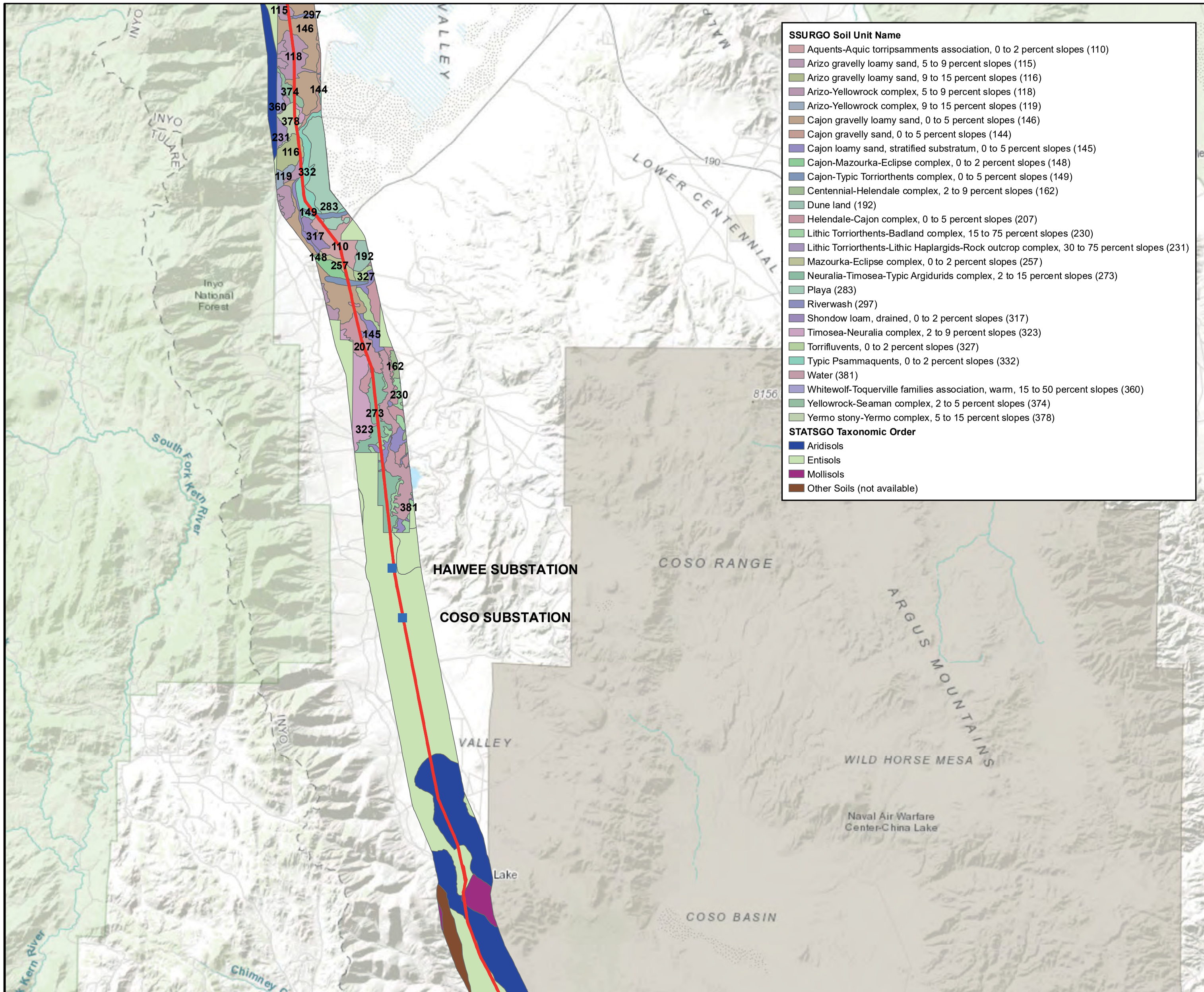

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Legend

SUBSTATION

SEGMENT 1

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
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0 4 8
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

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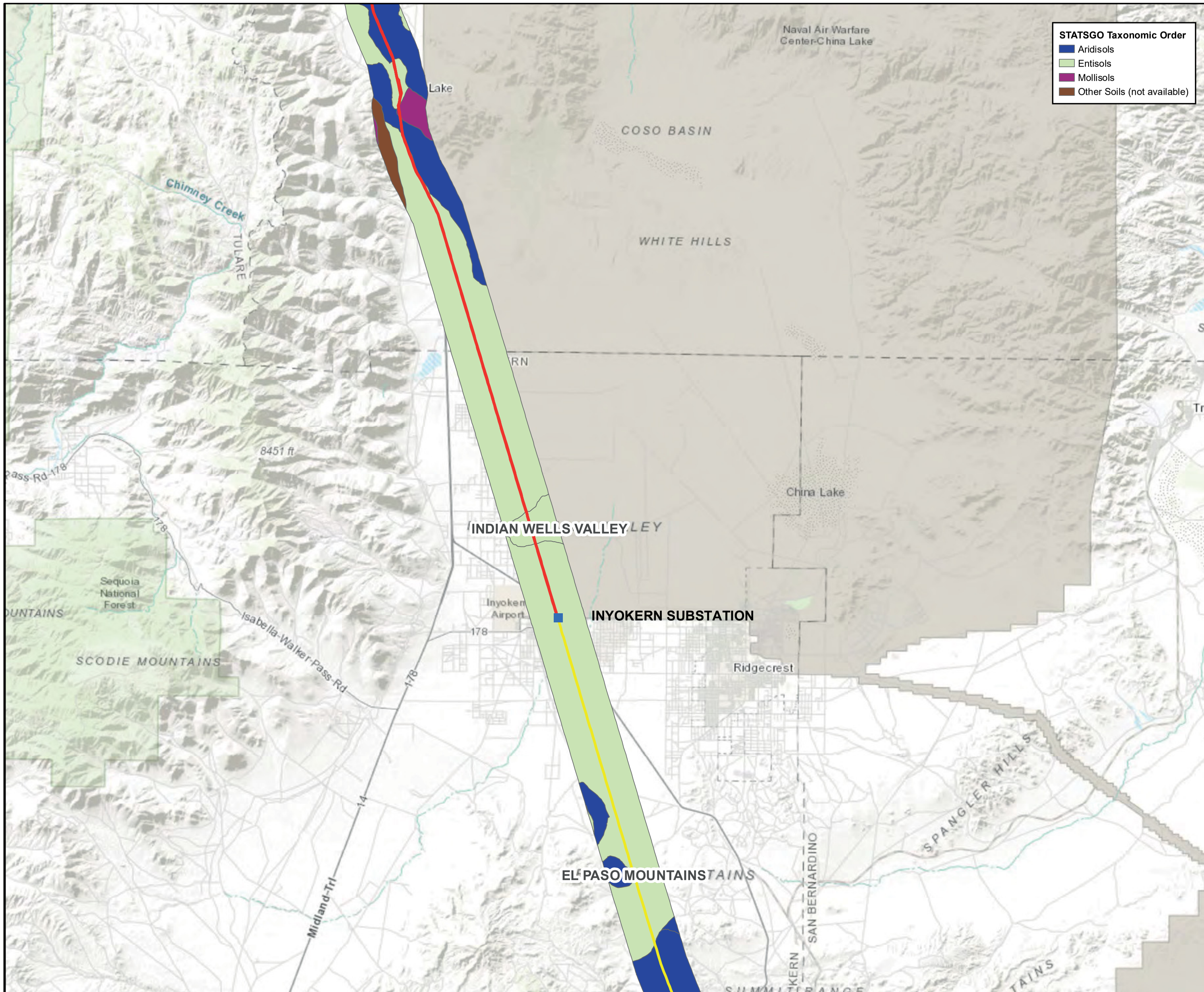

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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

SOURCE:
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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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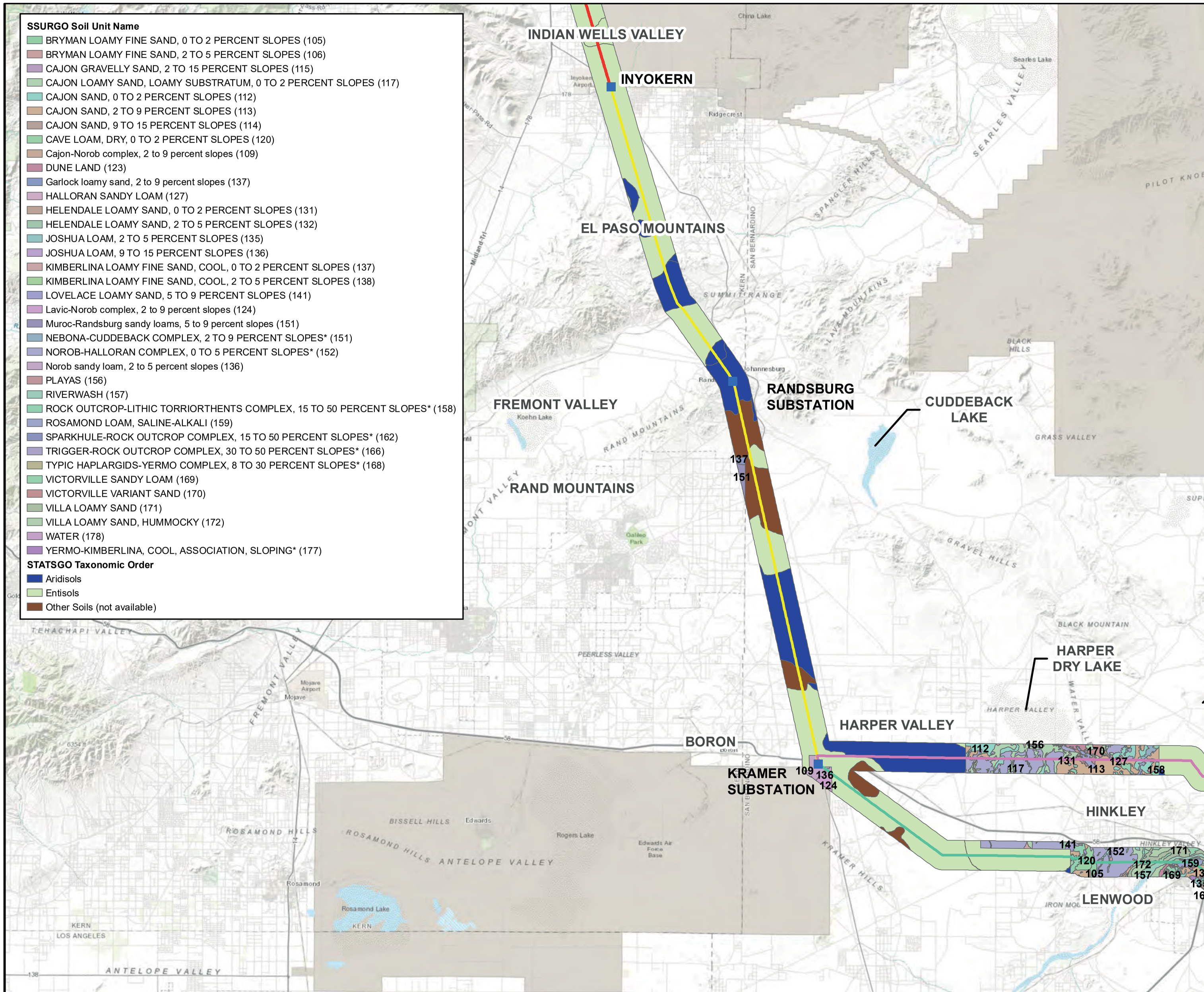

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Legend
SUBSTATION
SEGMENT 1
SEGMENT 2
SEGMENT 3N
SEGMENT 3S

SOURCE:
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0 7.5 15
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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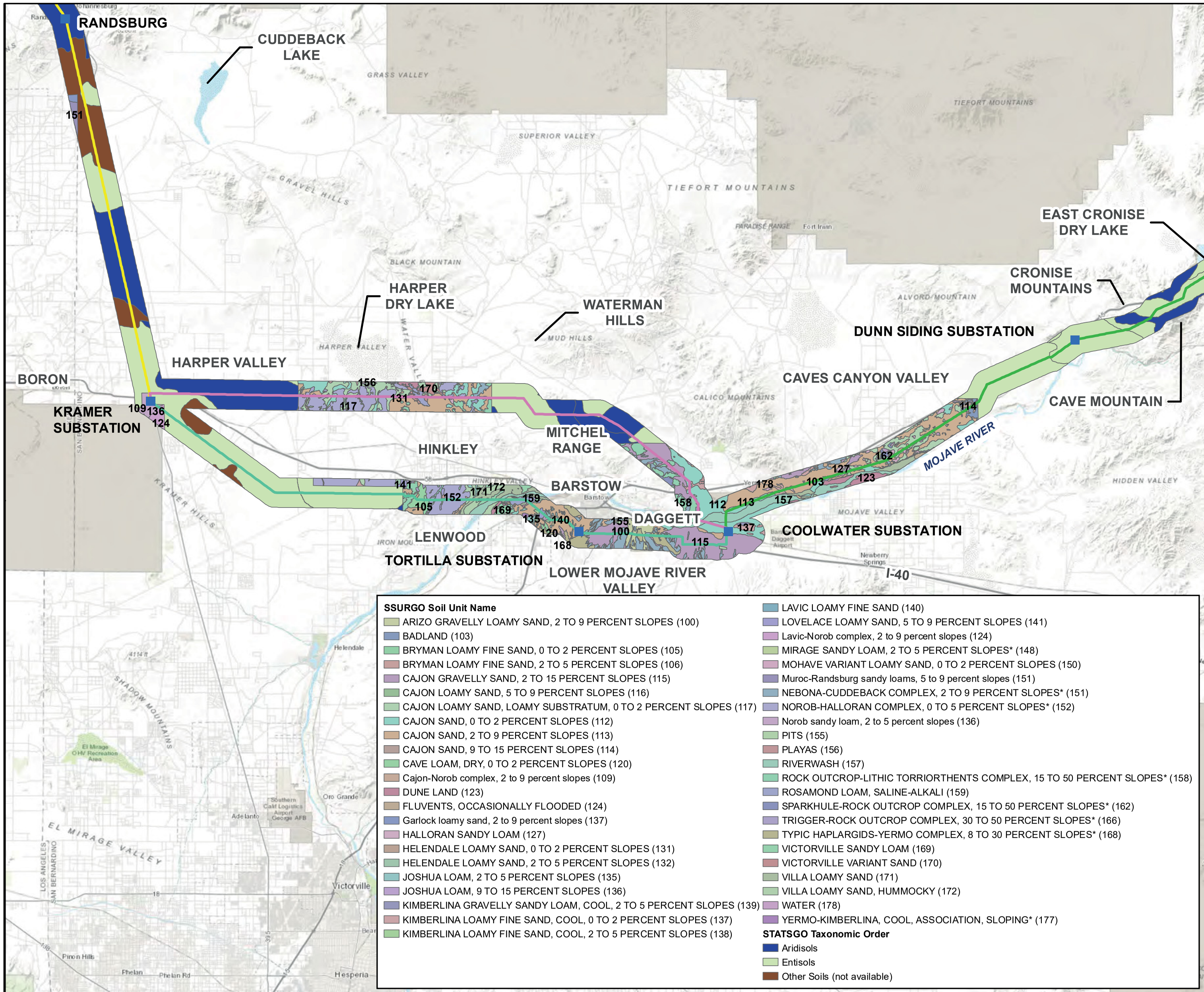

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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

SOURCE:
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0 7.5 15
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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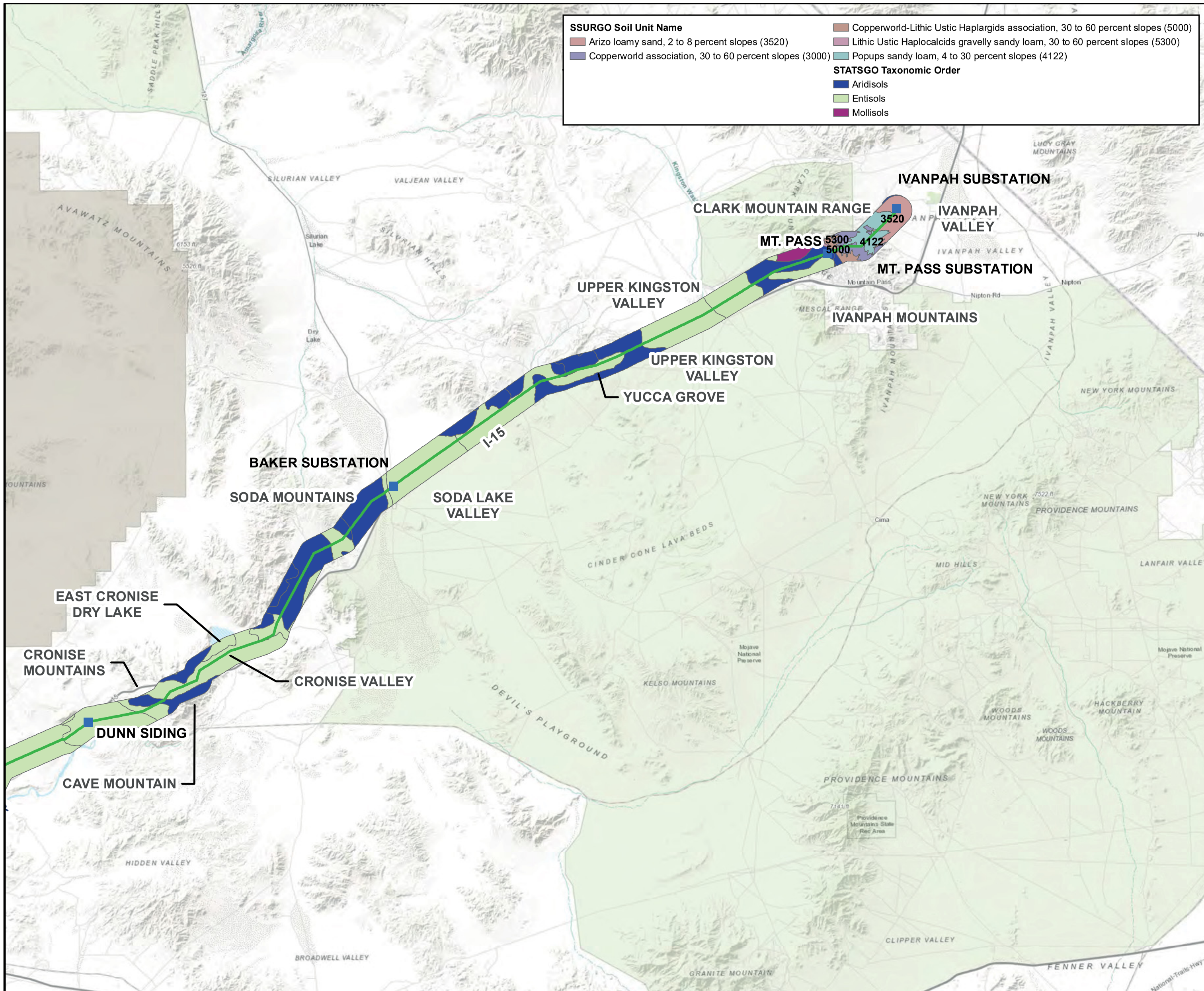

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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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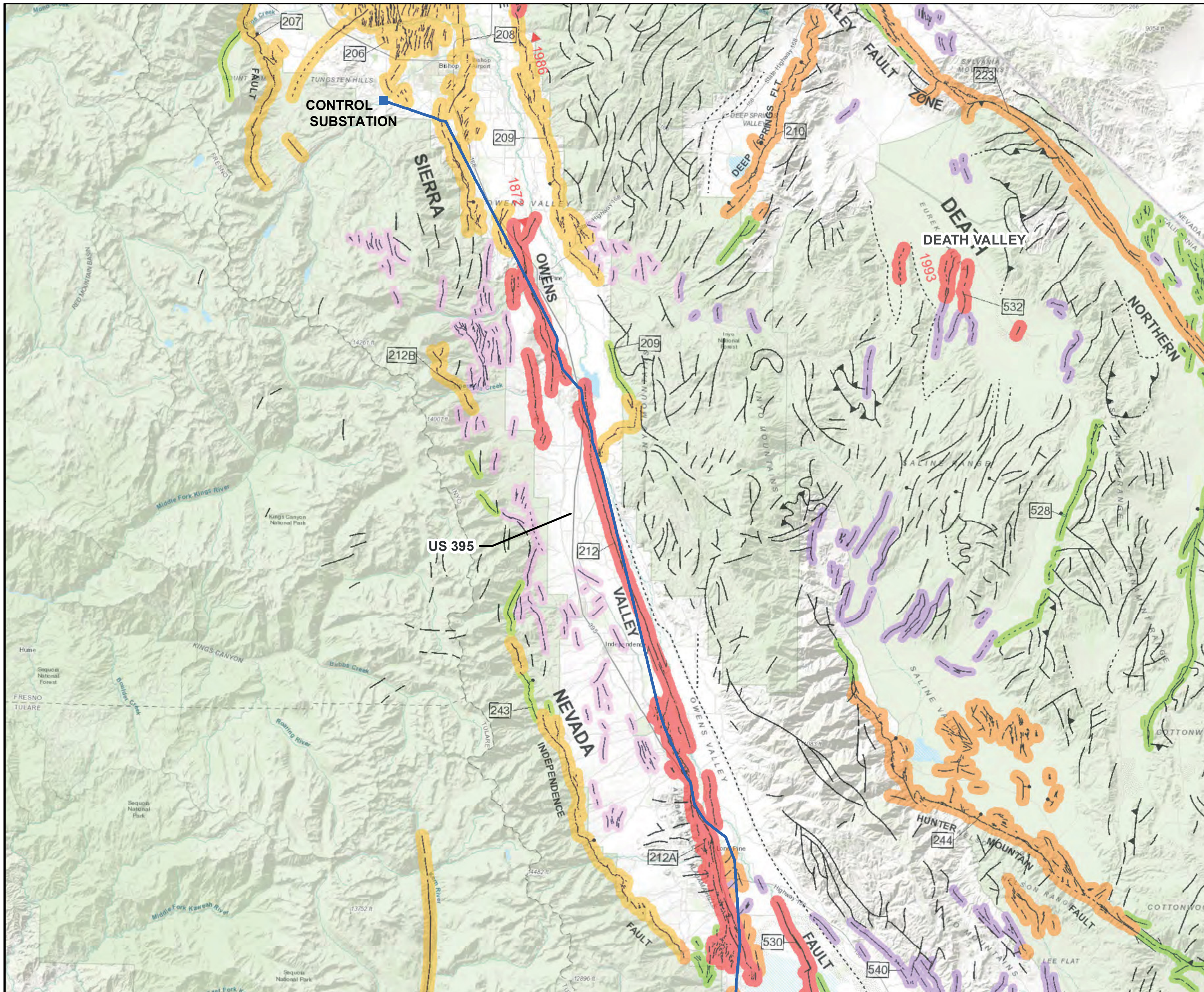

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Legend

- SUBSTATION
- SEGMENT 1

FAULT
- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

Page 1 of 5

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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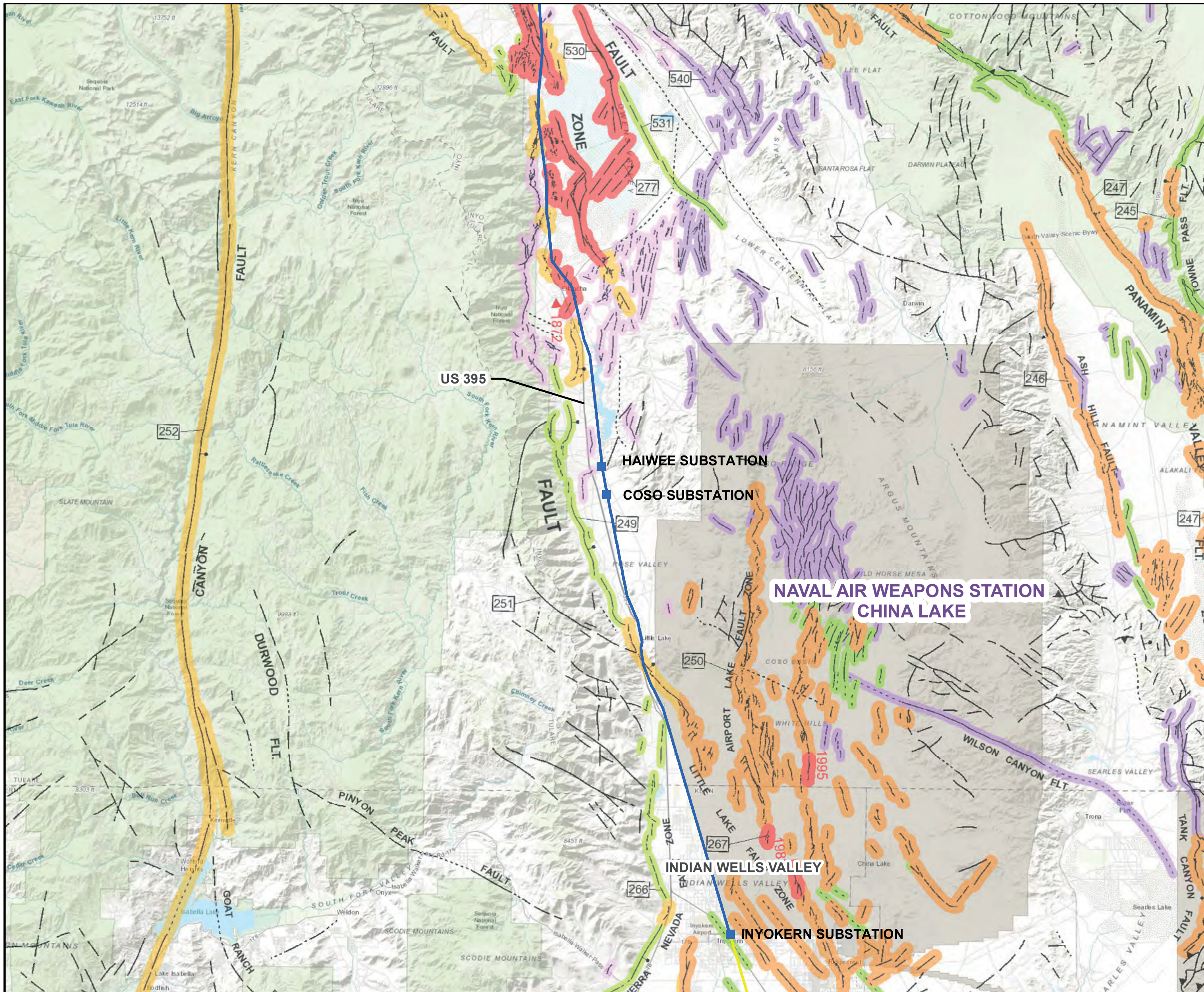

SOUTHERN CALIFORNIA EDISON

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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-4_Faults_IC.mxd 2/11/2019 adavis
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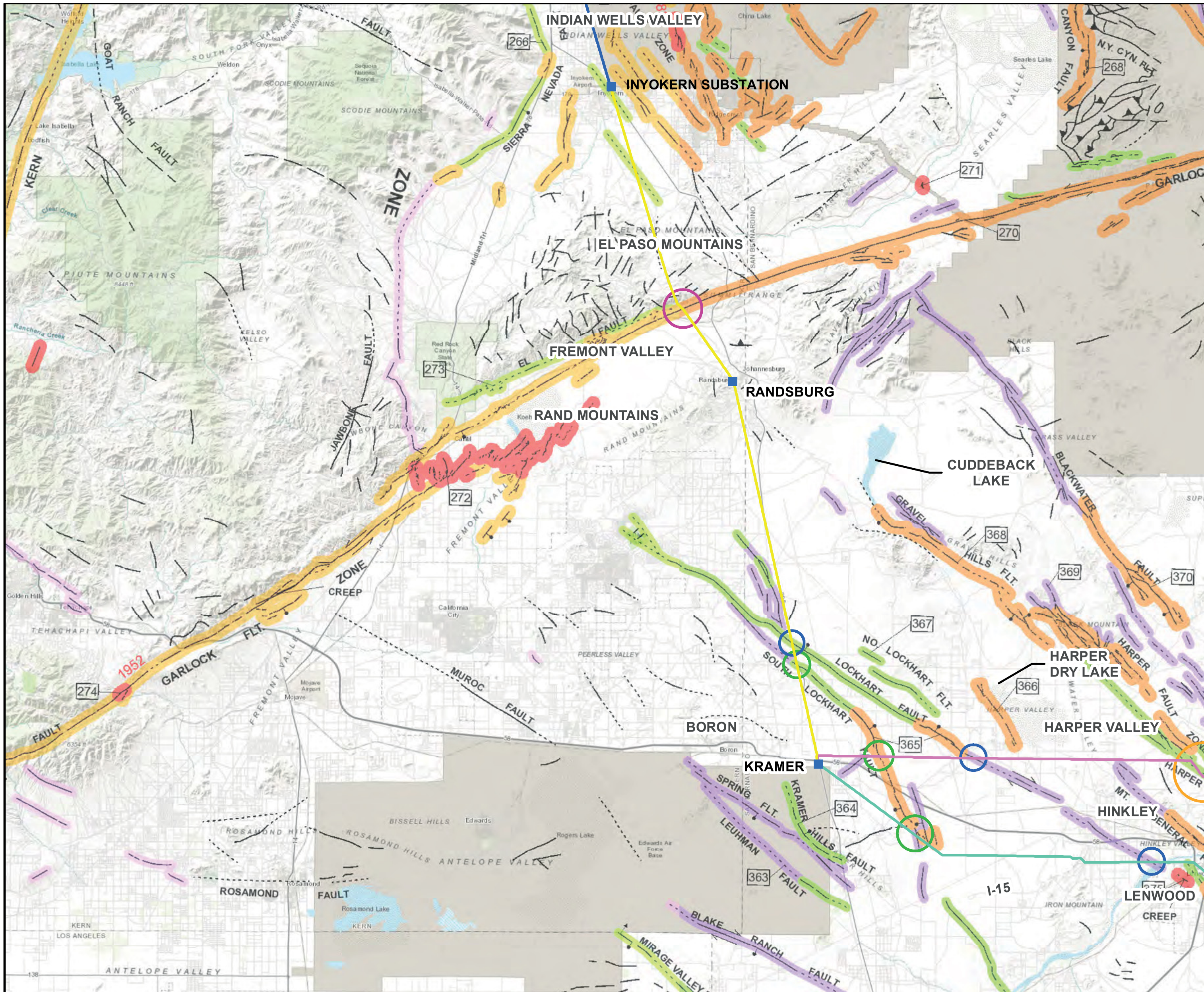

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

HOLOCENE FAULT ZONES

- HARPER LAKE FAULT
- SOUTH LOCKHART FAULT
- LOCKHART FAULT
- CARLOCK FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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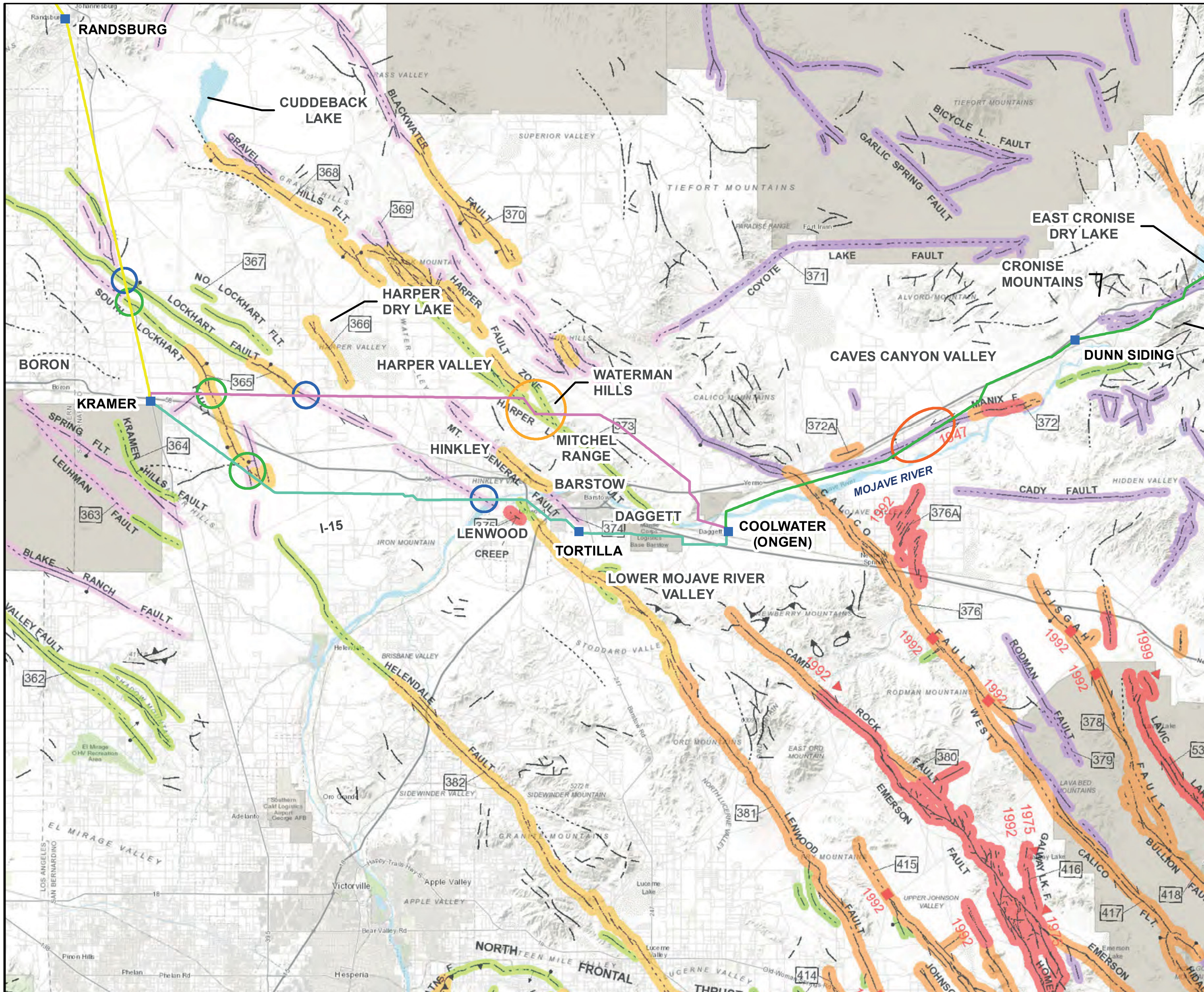

Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

HOLOCENE FAULT ZONES

- HARPER LAKE FAULT
- MANIX FAULT
- SOUTH LOCKHART FAULT
- LOCKHART FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12 Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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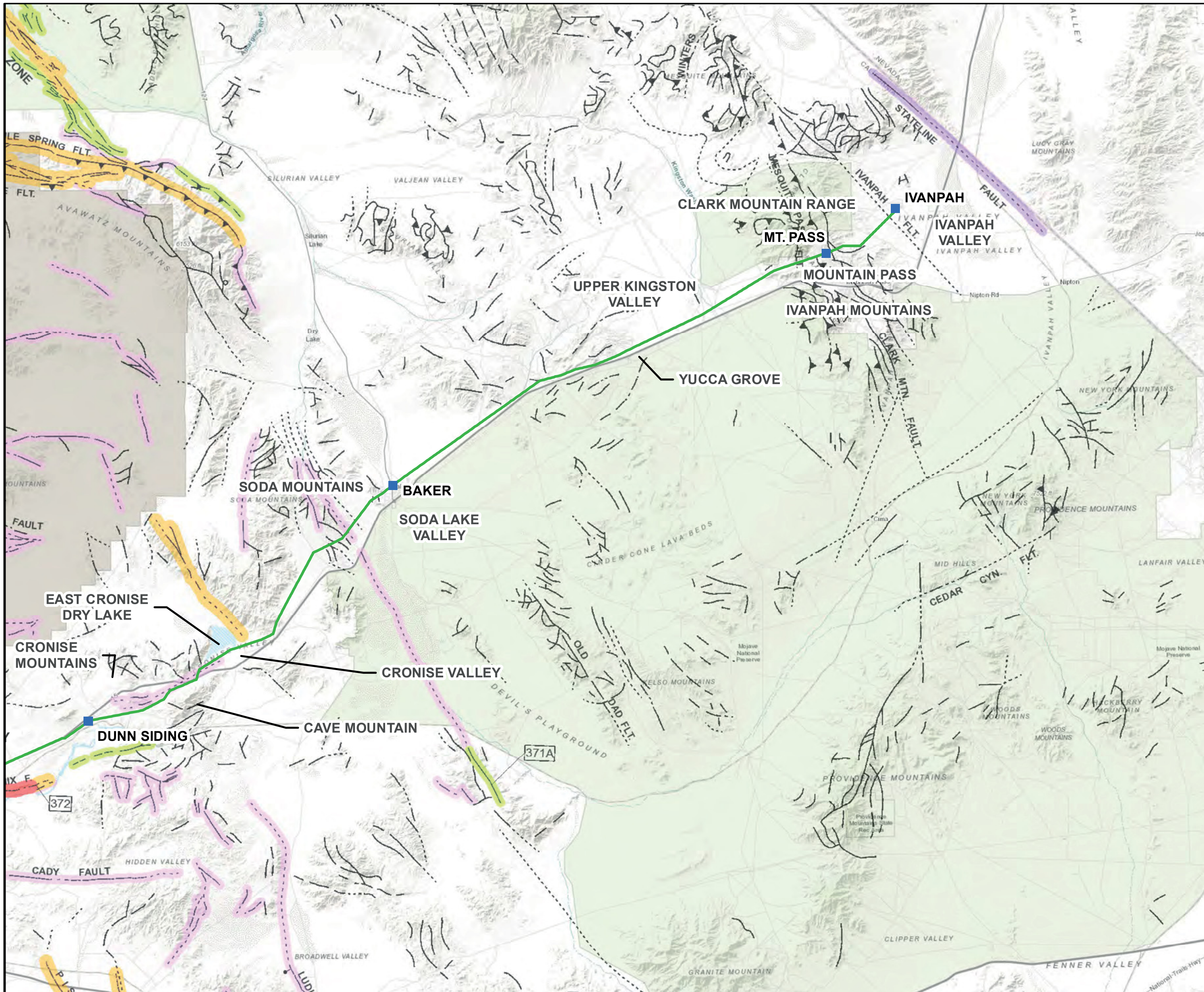

SOUTHERN CALIFORNIA EDISON
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Legend

- SUBSTATION
- SEGMENT 4

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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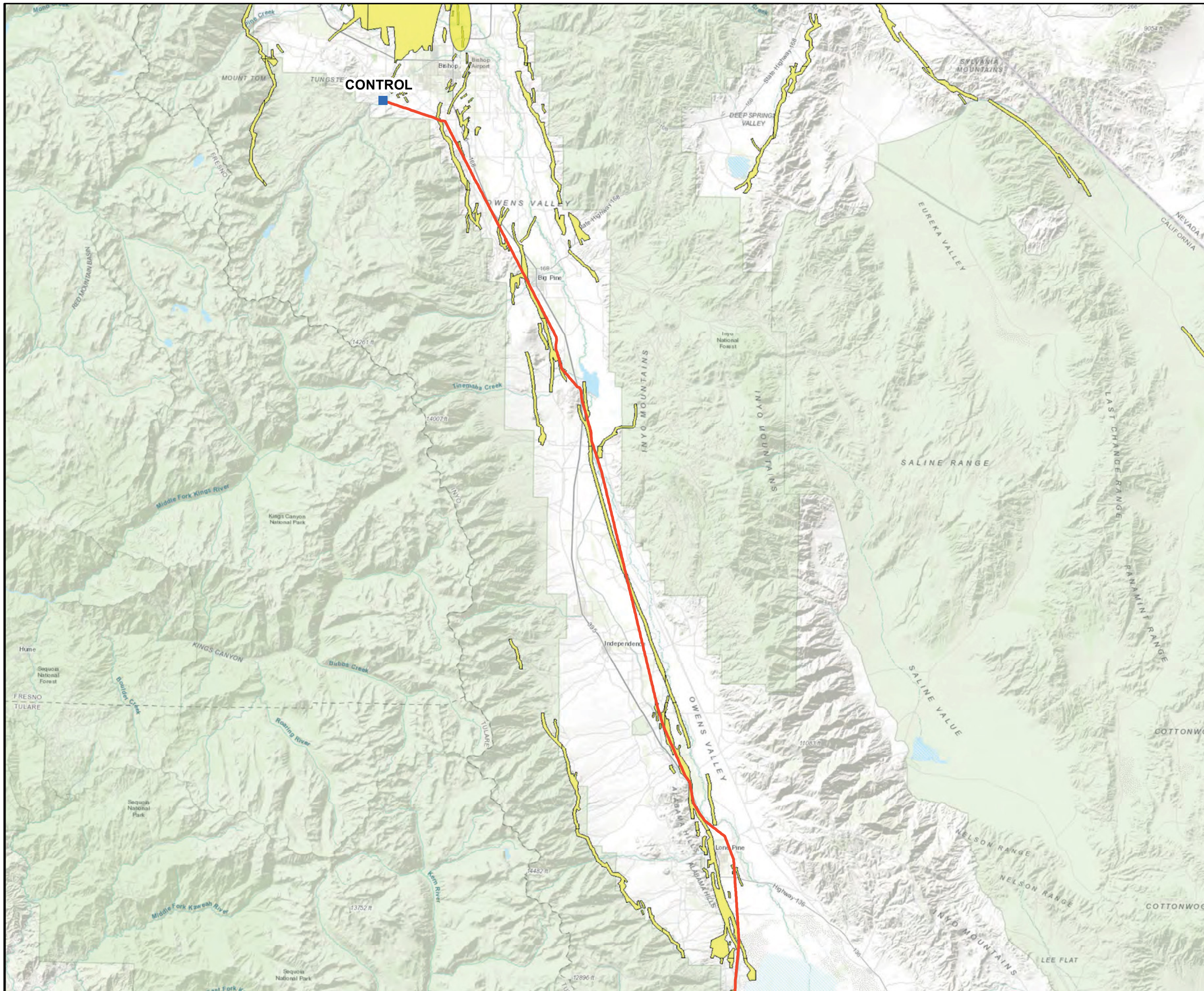

Legend

- SUBSTATION
- SEGMENT 1
- HOLOCENE FAULT TRACES
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

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ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

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FIGURESET: 4.7-5

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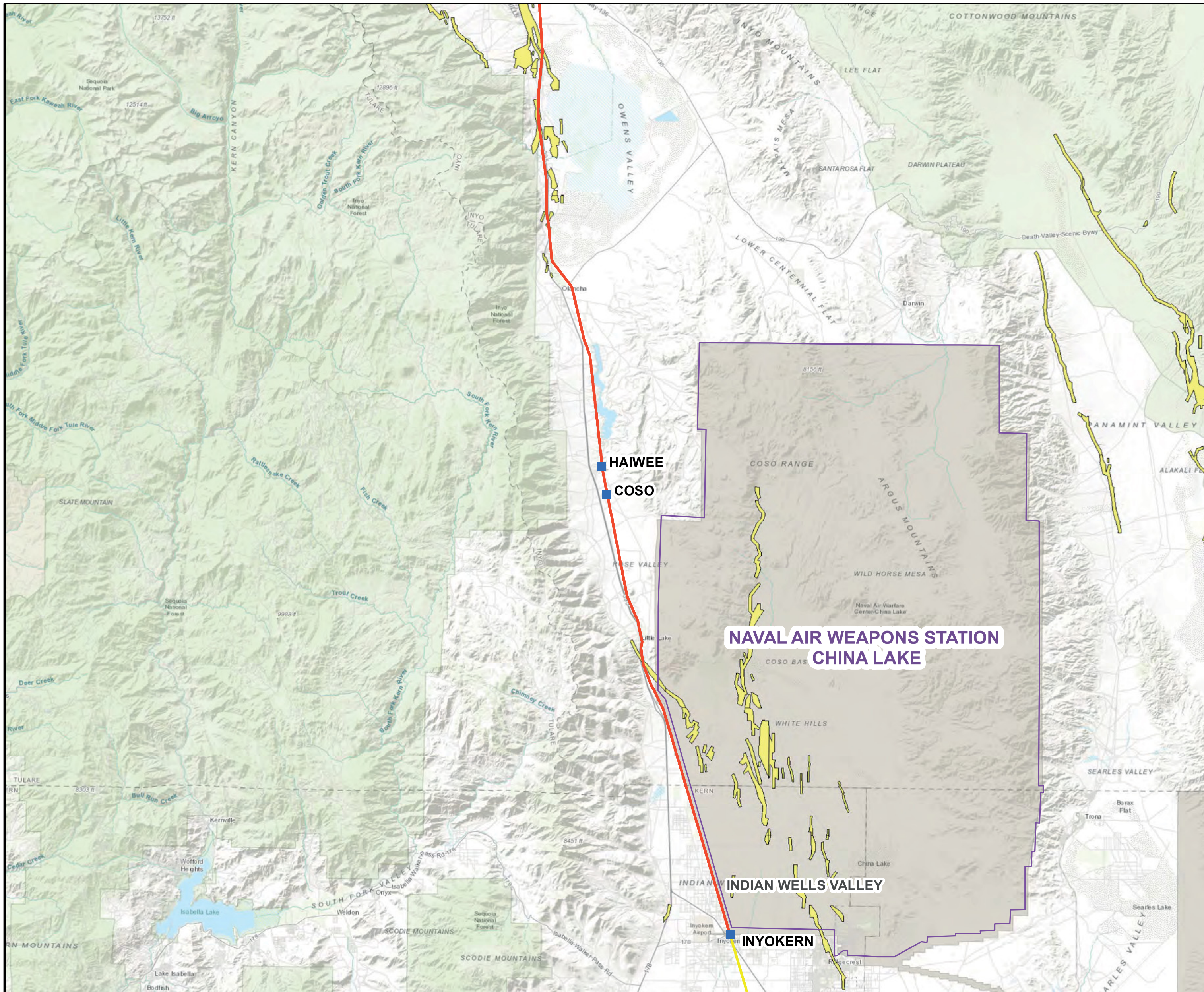

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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- HOLOCENE FAULT TRACES
- NAVAL AIR WEAPONS STATION CHINA LAKE
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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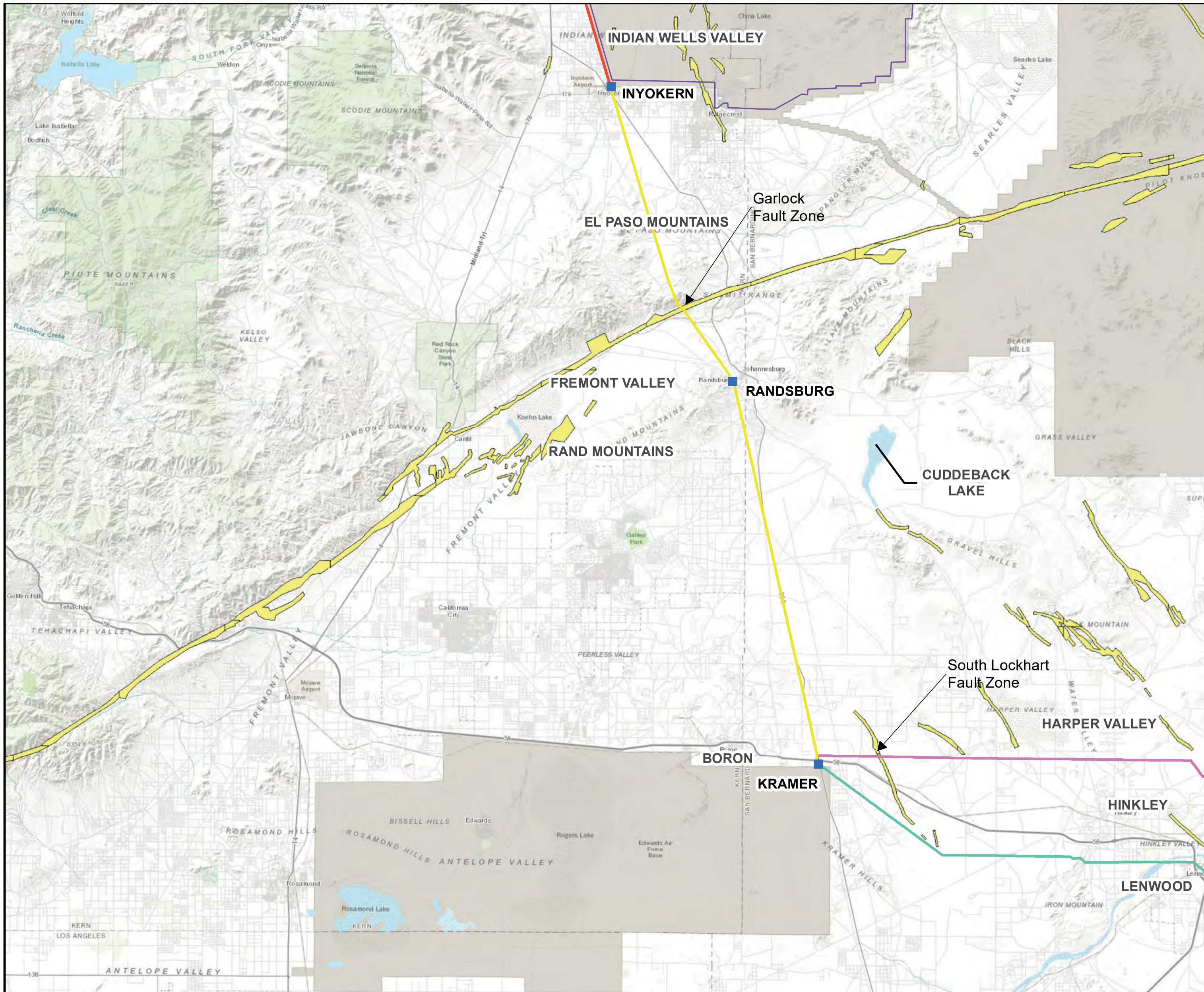

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- HOLOCENE FAULT TRACES
- NAVAL AIR WEAPONS STATION CHINA LAKE
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

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IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

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FIGURESET: 4.7-5

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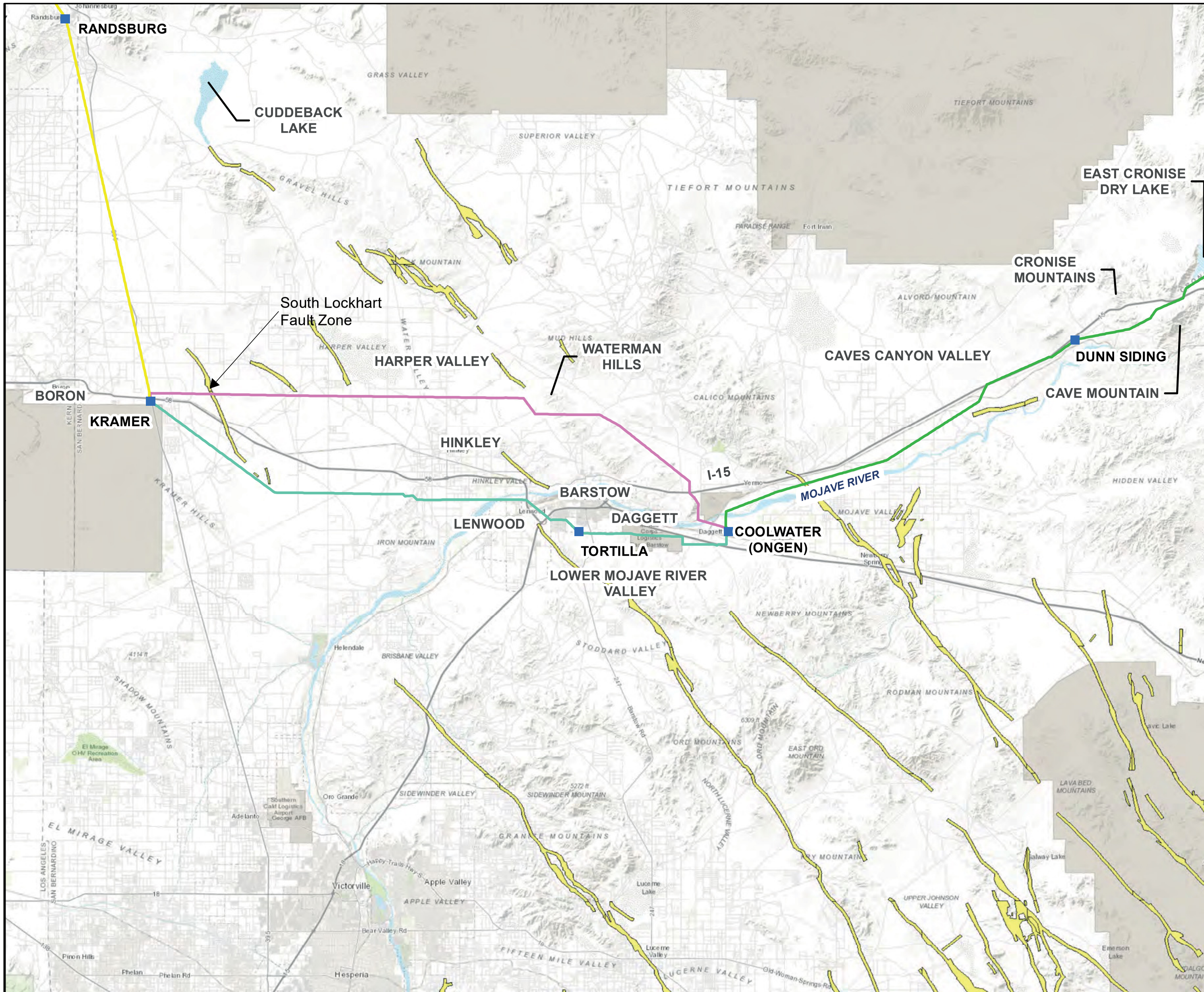
Coordinate System: NAD 1983 UTM Zone 11N



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N

Legend
- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4
- HOLOCENE FAULT TRACES
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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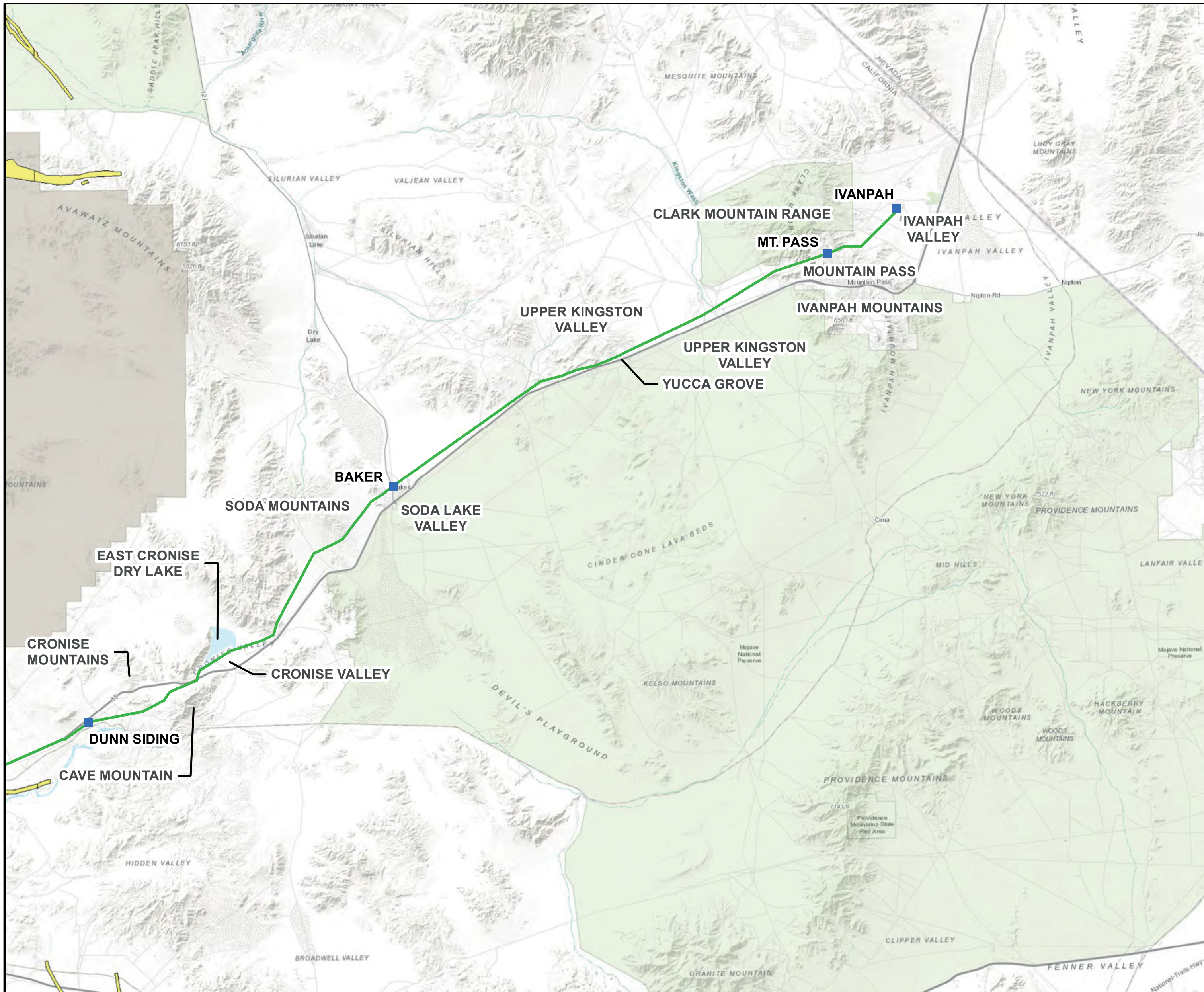

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N

Legend

- SUBSTATION
- SEGMENT 4
- HOLOCENE FAULT TRACES
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-5_Alquist_Priolo_Special_Studies_Zones_IC.mxd 2/11/2019 adavis
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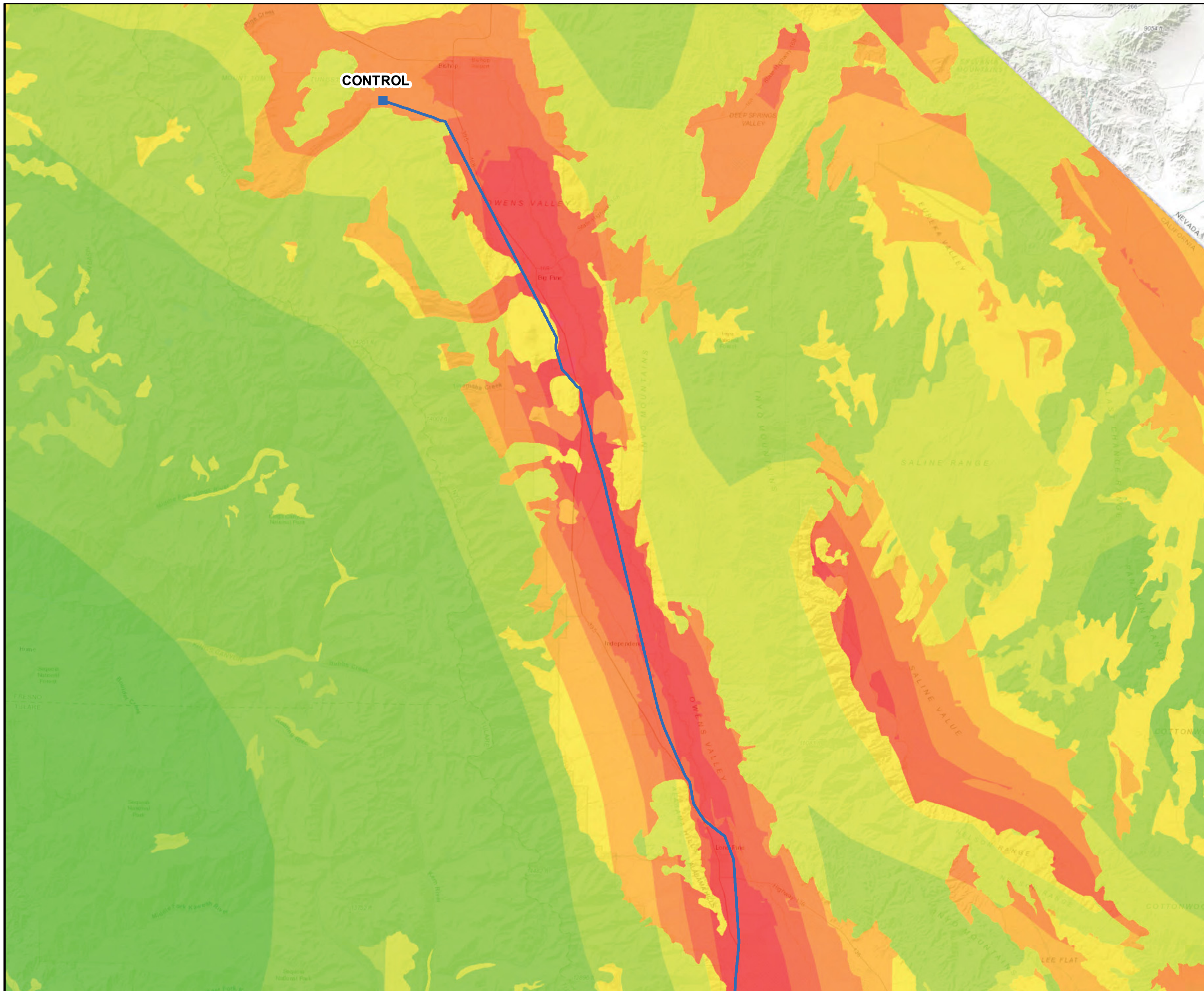

SOUTHERN CALIFORNIA EDISON
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N

Legend

- SUBSTATION
- SEGMENT 1

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

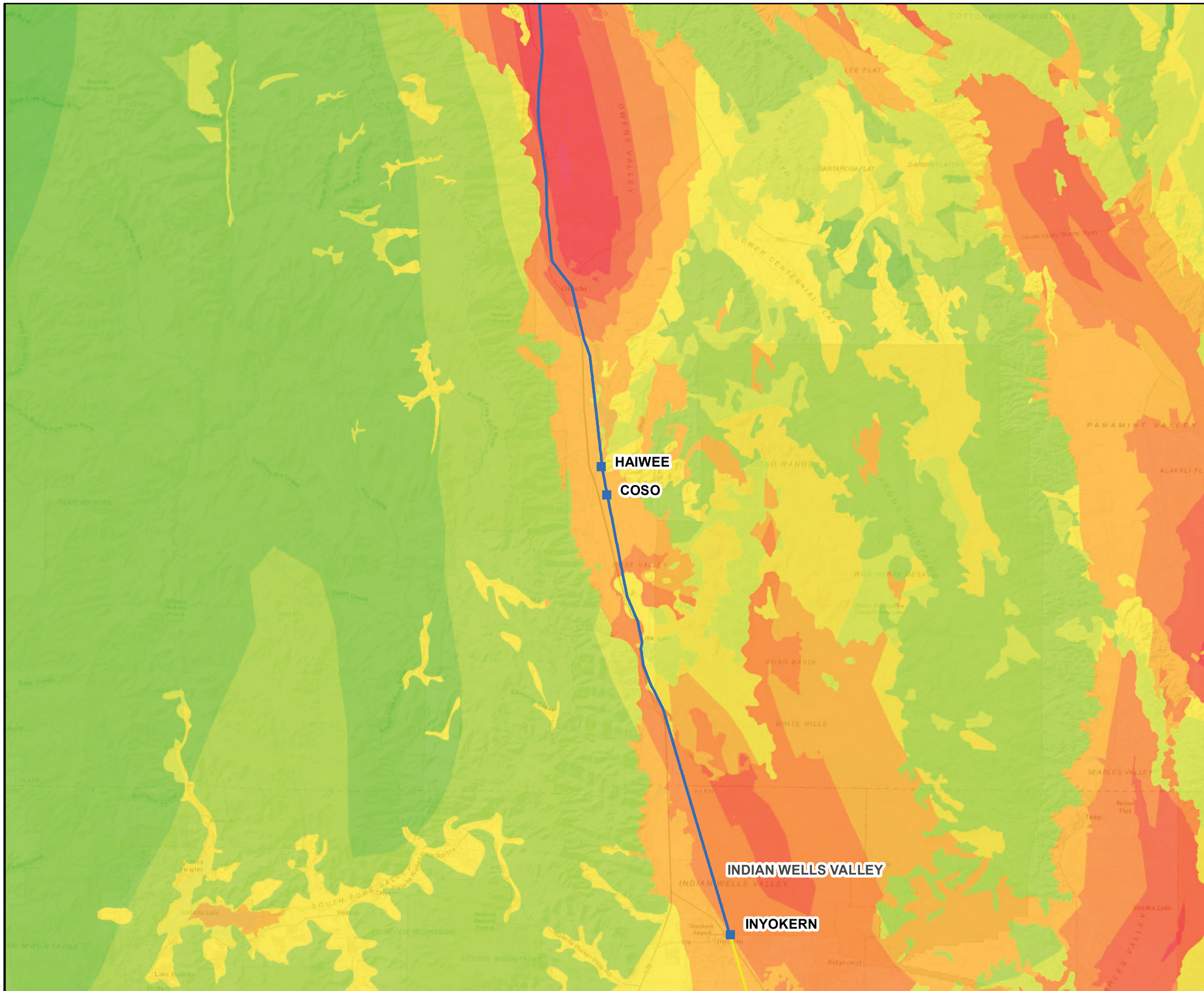
IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-6

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-6_Earthquake_Shaking_Potential_IC.mxd 2/11/2019 adavis
Coordinate System: NAD 1983 UTM Zone 11N



SOUTHERN CALIFORNIA EDISON
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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

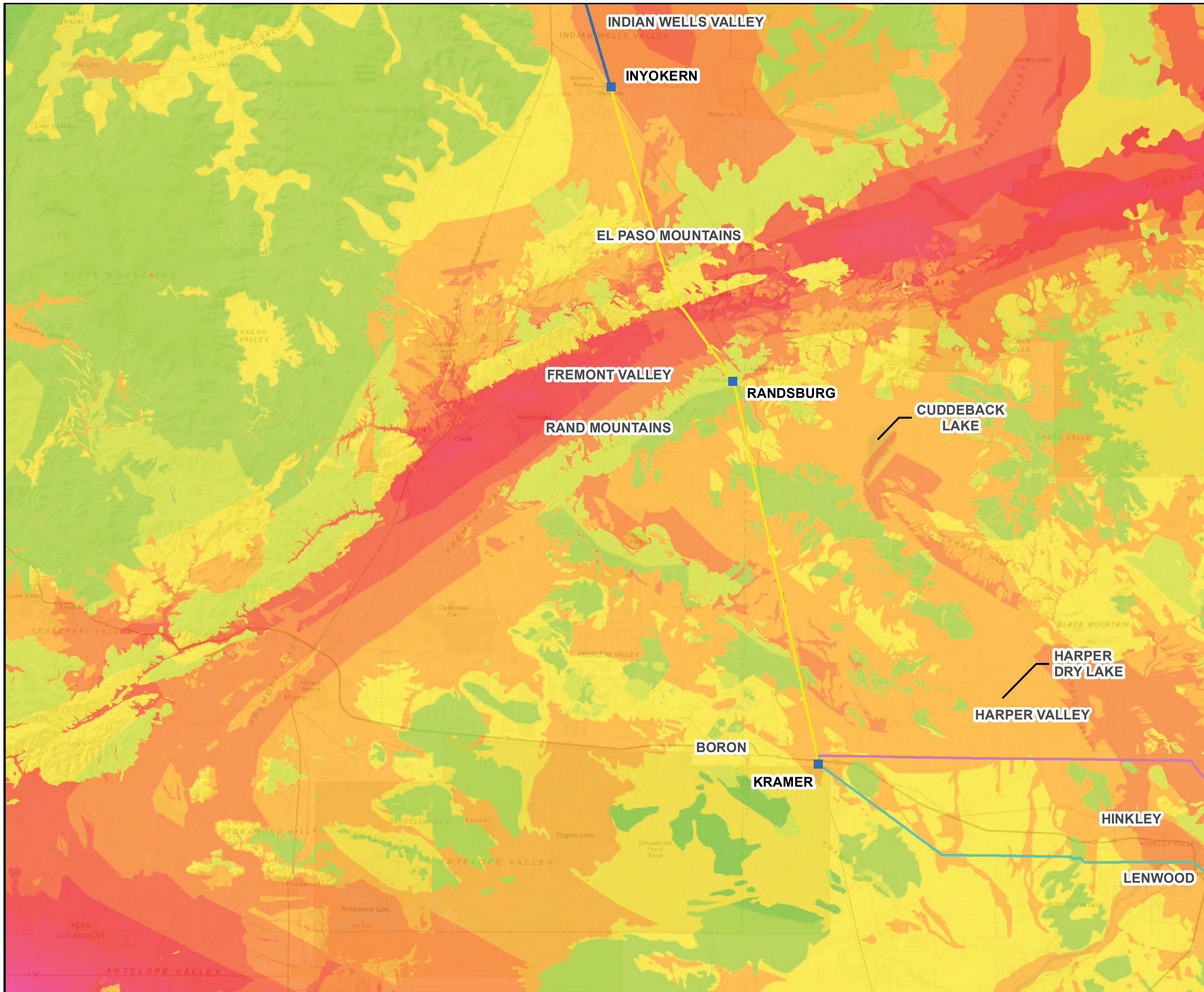
IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-6

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-6_Earthquake_Shaking_Potential_IC.mxd 2/11/2019 adavis
Coordinate System: NAD 1983 UTM Zone 11N



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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
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3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-6

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-6_Earthquake_Shaking_Potential_IC.mxd 2/11/2019 adavis
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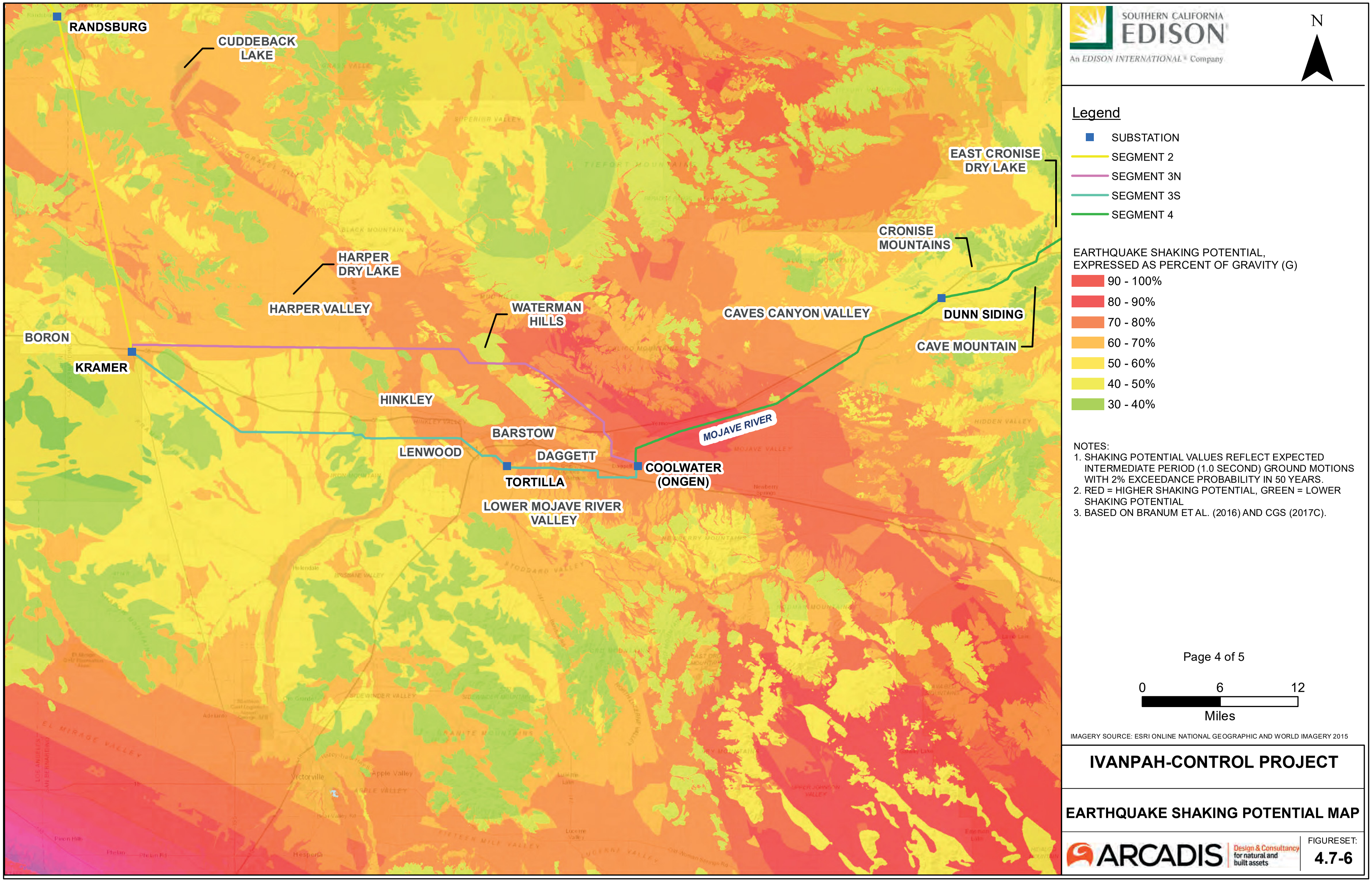

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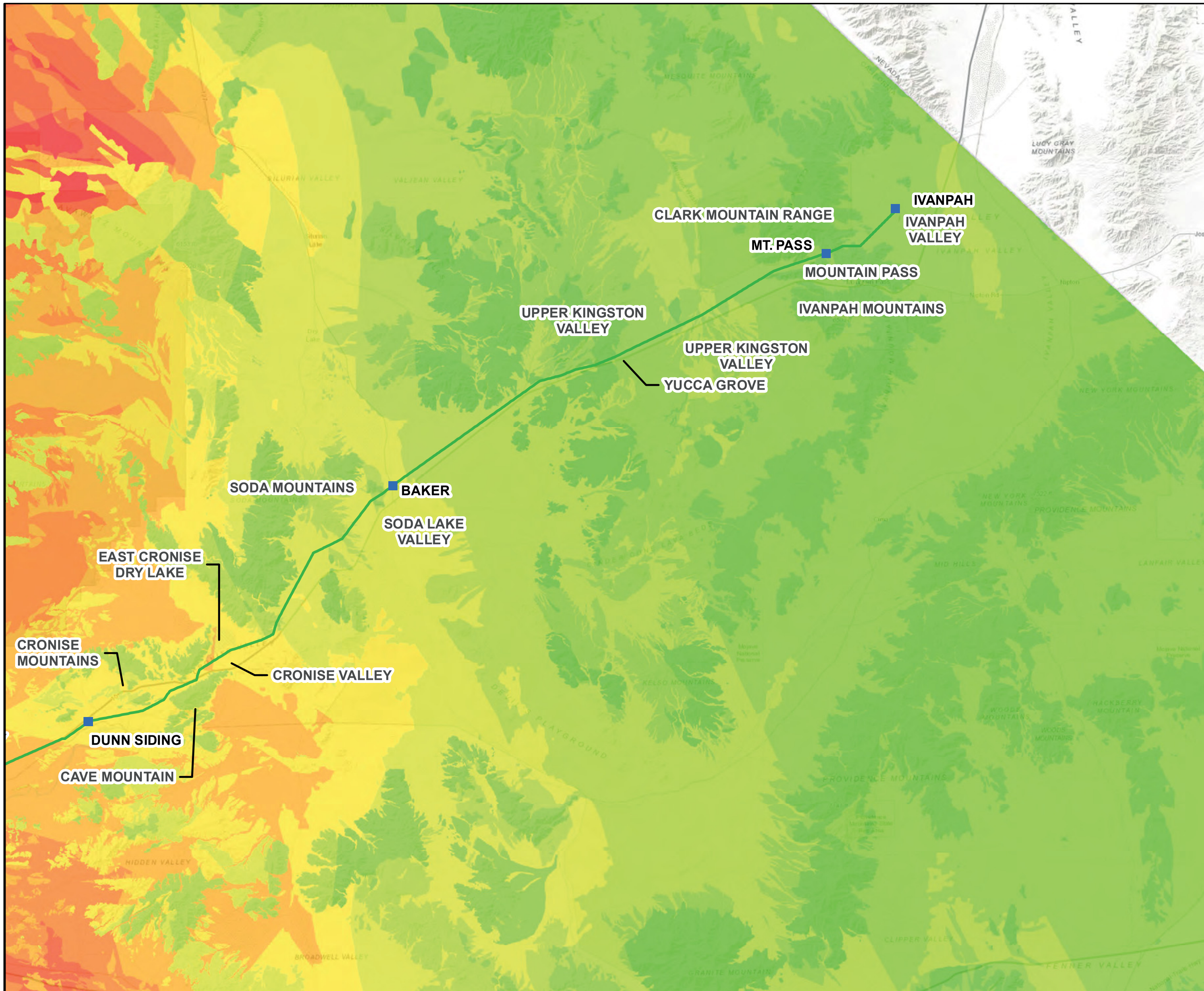
Coordinate System: NAD 1983 UTM Zone 11N



Legend

- SUBSTATION
- SEGMENT 4

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

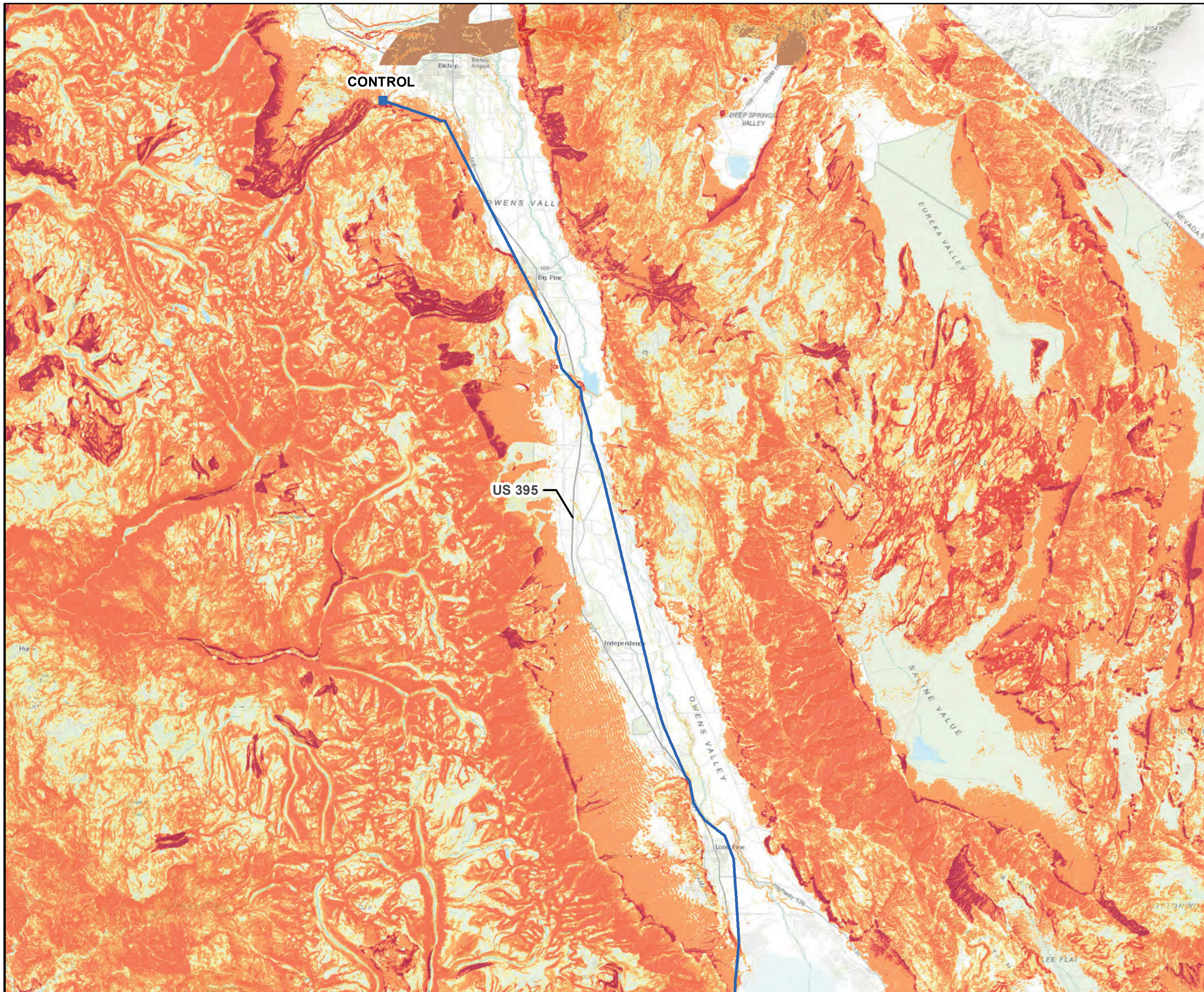
IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

FIGURESET: 4.7-6

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-6_Earthquake_Shaking_Potential_IC.mxd 2/11/2019 adavis
Coordinate System: NAD 1983 UTM Zone 11N



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N

Legend

- SUBSTATION
- SEGMENT 1
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: **4.7-7**

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-7_Landslide_Suseceptibility_IC.mxd 2/11/2019 adavis
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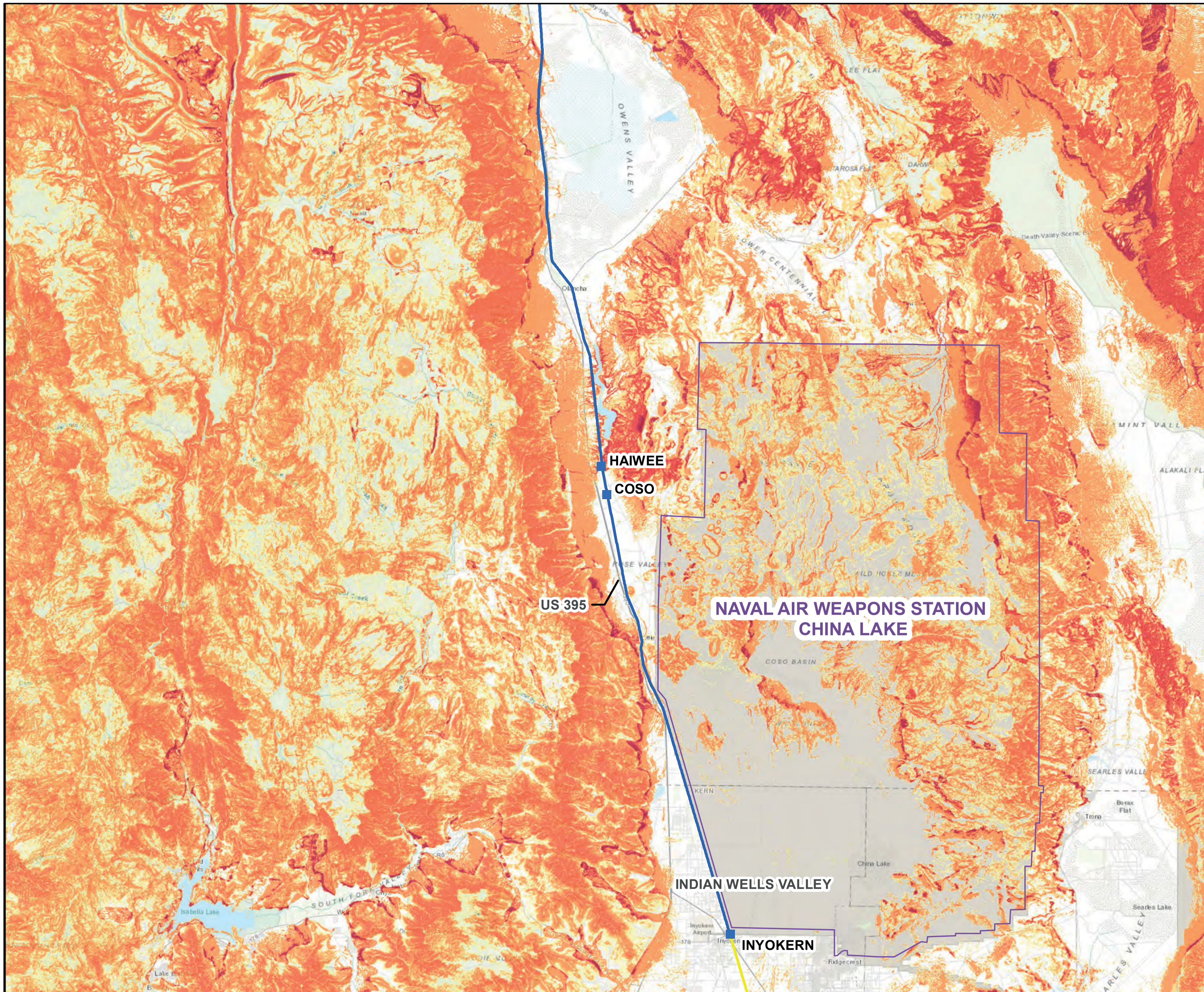

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N

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-7_Landslide_Suseceptibility_IC.mxd 2/11/2019 adavis
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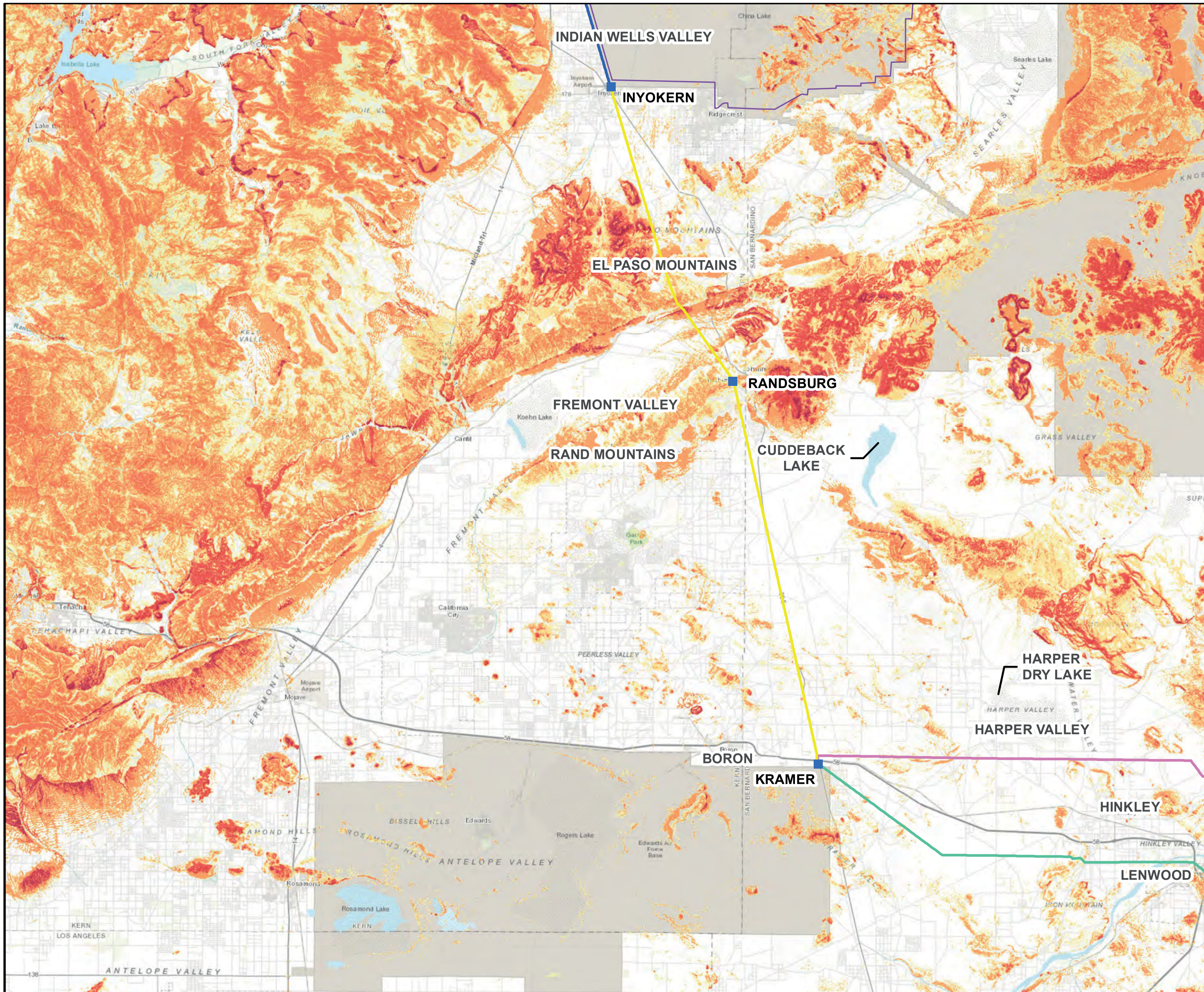

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

SOUTHERN CALIFORNIA EDISON
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IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-7_Landslide_Susceptibility_IC.mxd 2/11/2019 adavis
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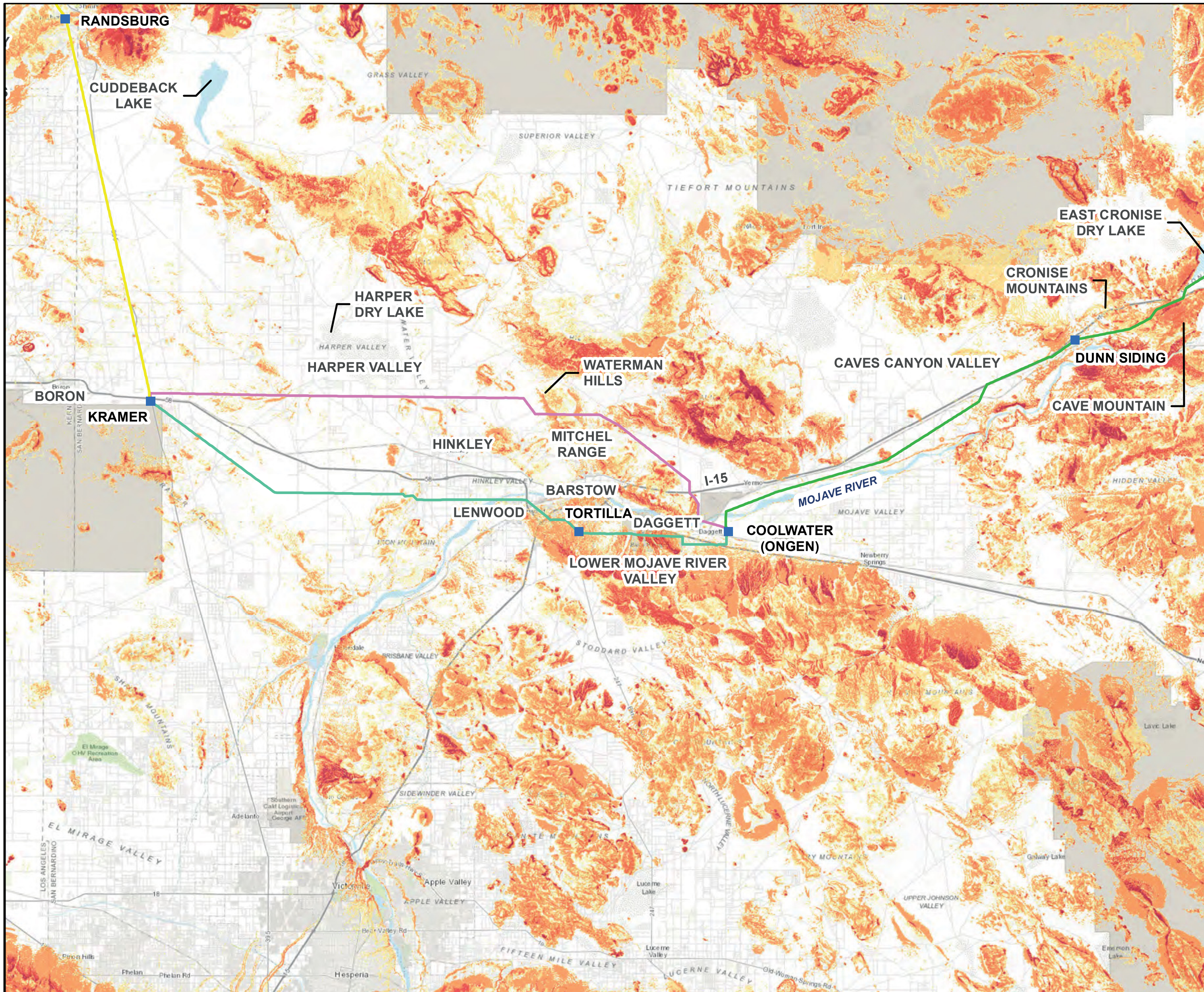

SOUTHERN CALIFORNIA EDISON
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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-7_Landslide_Susceptibility_IC.mxd 2/11/2019 adavis
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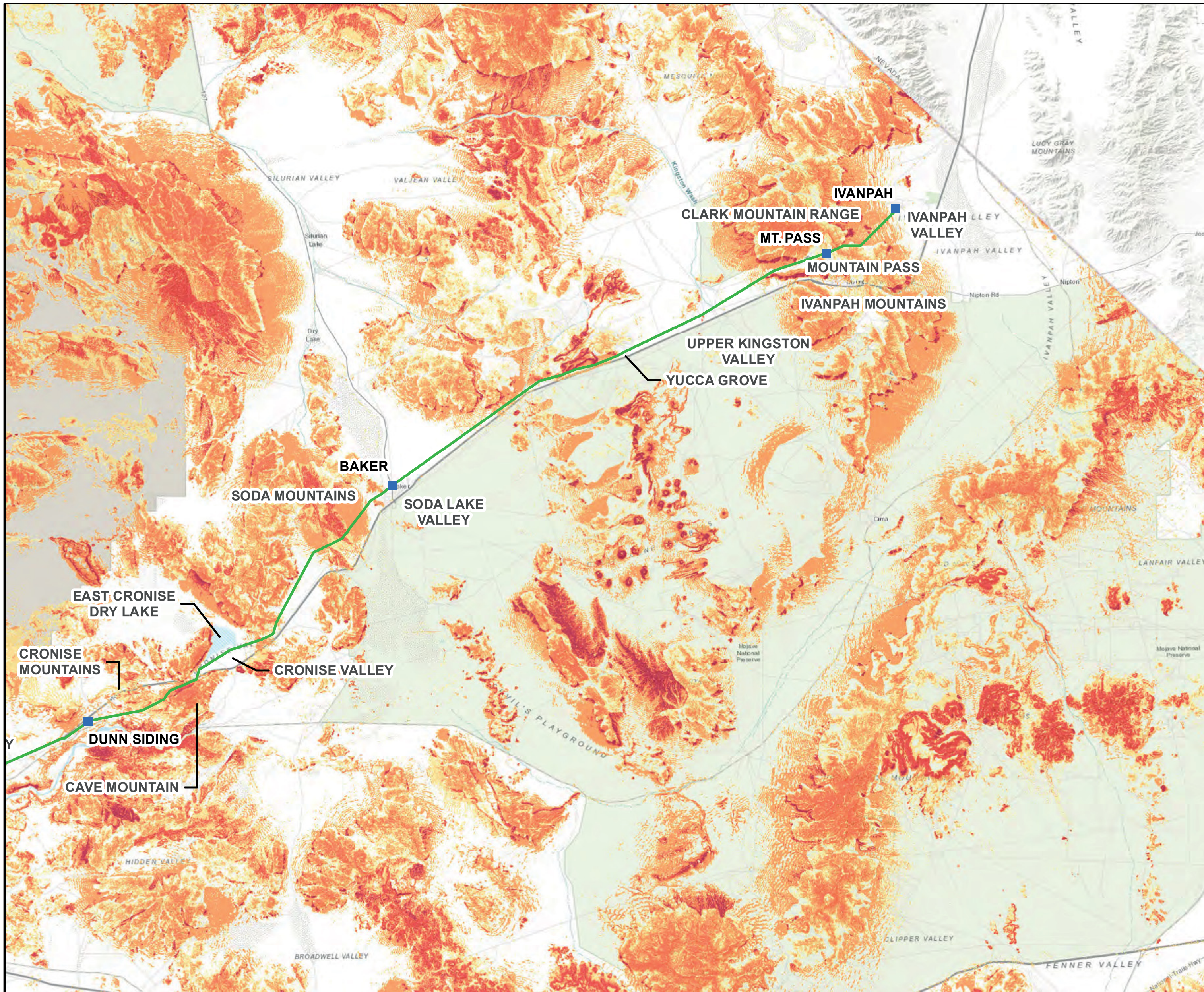

SOUTHERN CALIFORNIA EDISON
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Legend

- SUBSTATION
- SEGMENT 4
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

\\corparcgis\Data\ArcGisData\GISPROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-7_Landslide_Suseceptibility_IC.mxd 2/11/2019 adavis
Coordinate System: NAD 1983 UTM Zone 11N