Assessment of the Mineral Potential of Public Lands Located within Proposed Solar Energy Zones in Nevada

July 2012

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The following is a list of acronyms, abbreviations, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
CBO	Congressional Budget Office
CFR	Code of Federal Regulations
DOE	Department of Energy
DOI	U.S. Department of the Interior
EERE	Energy Efficiency and Renewable Energy
FHWA	Federal Highway Administration
FLPMA	Federal Land Policy and Management Act of 1976
FR	*Federal Register*
GIS	geographic information system
IBLA	Interior Board of Land Appeals
LR2000	Land and Mineral Legacy Rehost 2000 System
MRDS	Mineral Resource Data System
NBMG	Nevada Bureau of Mines and Geology
NCMR	State of Nevada Commission on Mineral Resources
NDWR	State of Nevada Division of Water Resources
PEIS	programmatic environmental impact statement
P.L.	Public Law
PM	Principal Meridian
RMP	resource management plan
ROW	right-of-way
SEZ	solar energy zone

U.S.	United States
USC	*United States Code*
USGS	U.S. Geological Survey

UNITS OF MEASURE

ft	foot (feet)
kg	kilogram(s)
km	kilometer(s)
km2	square kilometer(s)
m	meter(s)
mi	mile(s)
oz	ounce(s)

ASSESSMENT OF THE MINERAL POTENTIAL OF PUBLIC LANDS LOCATED WITHIN PROPOSED SOLAR ENERGY ZONES IN NEVADA

LANDS INVOLVED

Amargosa Valley Solar Energy Zone
Covering 9,737 acres of public land in Nye County, Nevada
T13S, R47E, sections 35 and 36
T14S, R47E, sections 8 to 11, 13 to 16, 21 to 27, and 34 to 36
T15S, R47E, sections 1, 2, and 12
Mount Diablo P.M.

Dry Lake Solar Energy Zone
Covering 6,186 acres of public land in Clark County, Nevada
T17S, R63E, sections 33 to 36
T18S, R63E, sections 1 to 4, and 11 to 14
T17S, R64E, sections 31 and 32
T18S, R64E, sections 6 and 7
Mount Diablo P.M.

Dry Lake Valley North Solar Energy Zone
Covering 28,726 acres of public land in Lincoln County, Nevada
T1N, R64E, sections 35 and 36
T1N, R65E, sections 31 and 32
T1S, R64E, sections 1, 12, 13, 21 to 28, and 33 to 36
T2S, R64E, sections 1 to 4, 10, 11 to 15, and 23 to 25
T1S, R65E, sections 6 to 8, 17 to 20, and 29 to 32
T2S, R65E, sections 5 to 8, 17 to 20, 29, and 30
Mount Diablo P.M.

Gold Point Solar Energy Zone
Covering 4,810 acres of public land in Esmeralda County, Nevada
T6S, R41E, sections 13, 14, and 23 to 26
T6S, R41½, sections 13 to 16, 21 to 23, and 26 to 28
Mount Diablo P.M.

ASSESSMENT OF THE MINERAL POTENTIAL OF PUBLIC LANDS LOCATED WITHIN PROPOSED SOLAR ENERGY ZONES IN NEVADA

LANDS INVOLVED (CONT.)

Millers Solar Energy Zone
Covering 16,787 acres of public land in Esmeralda County, Nevada
T3N, R39E, sections 1, 2, 11, and 12
T4N, R39E, section 36
T3N, R40E, sections 4 to 6
T4N, R40E, sections 10 to 35

Prepared by:

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ASSESSMENT OF THE MINERAL POTENTIAL OF PUBLIC LANDS LOCATED WITHIN PROPOSED SOLAR ENERGY ZONES IN NEVADA

SUMMARY

The report that follows presents an assessment of mineral resource potential of public lands located within five proposed solar energy zones (SEZs) in southern Nevada on behalf of the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM). The assessment was conducted in consultation with several BLM mineral specialists: Mr. Matt Shumaker, Chief Mineral Examiner (Division of Solid Minerals); Mr. Scott Murrellwright, Senior Geologist (Nevada State Office); Mr. Alan Buehler, Supervisory Geologist (Battle Mountain District Office); Mr. David Fanning, Geologist (Pahrump Field Office); Mr. Alan Kunze, Geologist (Caliente Field Office); and Mr. George Varhalmi, Geologist (Las Vegas Field Office). Mr. Jeff Holdren, Senior Realty Specialist (Division of Lands, Realty and Cadastral Survey) prepared the legal descriptions for the SEZs.

The subject lands are located within the five SEZs in southern Nevada: Amargosa Valley (Nye County), Dry Lake (Clark County), Dry Lake Valley North (Lincoln County), Gold Point (Esmeralda County), and Millers (Esmeralda County). The mineral resource potential for each of these sites is summarized below.

S.1 AMARGOSA VALLEY SEZ

There are no documented occurrences of locatable mineral deposits within the Amargosa Valley SEZ. Most of the metallic locatable minerals in the region are concentrated in the gold-base metal-quartz vein deposits hosted by Precambrian (metamorphic) and Cambrian (sedimentary) rocks and in the gold-mercury-fluorite deposits found in Cambrian and Tertiary (volcanic) rocks. These geologic units typically occur in the mountains to the north and south of the SEZ. The nearest occurrences of locatable minerals (diatomite) are along the northeastern border of the site; altered ash has been reported in the Amargosa Community Pit about 7 mi (11 km) south of the SEZ. Gold prospects are located in Black Marble Mountain less than a mile to the northeast (all in Bare Mountain District) and to the south in Lee District. Alluvial sediments below the SEZ are estimated to be about 550 ft (170 m) deep (based on well logs) and dolomite occurs between depths of 2,000 ft (610 m) to 5,000 ft (1,520 m); however, the stratigraphic units below the site have not been well-characterized. Based on the proximity of nonmetallic mineral occurrences, the potential for diatomite and specialty clays to occur within the SEZ is moderate (level of certainty A). The potential for metallic minerals (such as gold) is low (level of certainty A).[1]

The Amargosa Valley SEZ is an area with moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The site is underlain by alluvial and basin-fill sediments (river channel, alluvial fan, and playa deposits), which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are no active oil and gas leases within the Amargosa Valley SEZ. A good portion of the land within the site was leased in the past, but these leases were closed in 1987 and 1988. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as the Amargosa Valley, to be conceptually prospective for hydrocarbons. An exploration well was drilled to the southeast of the SEZ (in section 25 of T15S, R49E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons, but there has been no commercial oil or gas production in that area.

The SEZ is located in a region that is only marginally favorable for geothermal development, and the BLM (1998) reports that the low temperatures of waters in the Southern Nevada District preclude direct application uses. Although there are no active or historical geothermal leases within the site, public lands immediately to the northeast of the site have been nominated for geothermal sale. The potential for geothermal development within the site is low (level of certainty B).

S.2 DRY LAKE SEZ

There are no documented occurrences of locatable mineral deposits within the Dry Lake SEZ. The nearest occurrences of locatable minerals in the region are in the Apex District to the immediate south, where high-grade carbonate rocks are mined. Carbonates below the central part of the SEZ occur at a depth of about 1,000 ft (305 m), becoming more shallow toward the site's eastern, western, and southern corners (based on well logs and current surface mining to the south). Four placer claims in the northeast quadrant of section 14 in T18S, R63 (at the southernmost end of the SEZ) are held by Chemical Lime, the company that operates the

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[1] Definitions of mineral potential are from the mineral potential classification system outlined in *BLM Manual 3031* (BLM 1985). Mineral potential ratings of low, moderate, or high are assigned where the geologic environment and inferred geologic processes indicate low, moderate, or high potential for accumulation of mineral resources. Levels of certainty are defined as follows: A = available data are *insufficient* to support or refute the occurrence of mineral resources; B = available data provide *indirect* evidence to support or refute the occurrence of mineral resources; C = available data provide *direct but quantitatively minimal* evidence to support or refute the occurrence of mineral resources; and D = available data provide *abundant direct and indirect* evidence to support or refute the occurrence of mineral resources.

limestone quarry to the south. The potential for high-grade limestone to occur within the SEZ is high, especially in the southernmost and westernmost parts of the site where overlying sediments are relatively shallow (level of certainty C). The potential for locatable metallic minerals to occur with the SEZ is undetermined (level of certainty A).

The Dry Lake SEZ is an area with a high potential for the occurrence of sand and gravel (level of certainty D) and a moderate potential for the occurrence of clay (level of certainty A). The site is underlain by alluvial and lacustrine sediments, which are potential sources of clay, sand, and gravel materials. The current mining of saleable mineral deposits (sand and gravel) at 16 authorized Federal Highway Administration (FHWA) sites within and immediately adjacent to the SEZ indicate that future extraction of such resources within the SEZ is viable. However, there are no other mineral material sites within the SEZ (suggesting a low demand for these resources in the area), and such resources are available on other BLM lands in the region.

There are no active oil and gas leases within the Dry Lake SEZ. The southern and western portions of the site were leased in the past, but these leases were closed in the late 1980s and 1990s. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), more than 160 mi (257 km) to the north of the site. The SEZ is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons, because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley, but there has been no commercial oil or gas production within or near the SEZ. Exploration wells were drilled to the northeast of the site (in sections 11 and 14 of T17S, R64E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons.

The SEZ is located in a region that is only marginally favorable for geothermal development, and the BLM (1998) reports that the low temperatures of waters in the Southern Nevada District preclude direct application uses. There are no active or historical geothermal leases within the site, and the nearest nominated lands for geothermal sale are located about 80 mi (129 km) to the west–northwest. The potential for geothermal development within the site is low (level of certainty B).

S.3 DRY LAKE VALLEY NORTH SEZ

There are no documented occurrences of locatable mineral deposits within the Dry Lake Valley North SEZ. Most of the locatable minerals in the region occur in the surrounding mountains. The nearest occurrences of locatable minerals (manganese, silver, and arsenic) are in the carbonate rocks of the Ely Springs Range less than a mile to the east. Alluvial and basin-fill sediments below the SEZ are estimated to be at least 3-mi (5-km) thick. The occurrence of mineralized zones below the site is unconfirmed but, based on geologic studies to date, is likely to be very deep if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Dry Lake Valley North SEZ is an area with a moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The SEZ is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are six authorized (and numerous closed) oil and gas leases within the Dry Lake Valley North SEZ. These occur mainly in the southwestern portion of the site and overlap the area designated as non-development for solar projects. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), about 70 mi (110 km) to the northwest of the site. The SEZ is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley, but there has been no commercial oil or gas production within or near the SEZ.

The Dry Lake Valley North SEZ is located in a region that is only marginally favorable for geothermal development, and the BLM (2007) reports that there are no known areas of established geothermal production in the Ely District. The nearest geothermal project (Caliente) occurs about 12 mi (19 km) to the southeast of the SEZ. There are no active or historical geothermal leases within the SEZ. The potential for geothermal development within the site is low (level of certainty B).

S.4 GOLD POINT SEZ

There are no documented occurrences of locatable mineral deposits within the Gold Point SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals (silver and gold) are in the Gold Point District (along Slate Ridge), a few miles to the south of the site. Mineral deposits in this area are associated with intrusive bodies within the Precambrian Wyman Formation. Alluvial sediments below the SEZ are estimated to be about 500 ft deep (152 m) (based on a gravity survey); however, the underlying geologic units have not been characterized. Therefore, the potential for locatable minerals to occur within the SEZ is not determined (level of certainty A).

The Gold Point SEZ is an area with moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The site is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are no active or historical oil and gas leases within the Gold Point SEZ. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province, where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as Lida Valley, to be conceptually prospective for hydrocarbons. There has been no oil and gas exploration activity within the site.

The SEZ is located in the Battle Mountain District, an area of high geothermal potential. The BLM forecasts that geothermal resource exploration and development in the district will increase in the coming years. While there are no active geothermal leases within the site, current geothermal exploration projects in the region are numerous. The potential for geothermal development within the site is high (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high. There are no playas/marshes located within the Gold Point SEZ; however, the presence of playa-related deposits at depth is unknown. The potential for salt production within the site is low (level of certainty A). There are no active or historical leases for this commodity within the site.

S.5 MILLERS SEZ

There are no documented occurrences of locatable mineral deposits within the Millers SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals in the region (copper, lead, silver, and uranium) are in quartz veins cutting granitic intrusive rock, in the Crow Springs District, a few miles to the northwest. Alluvial and basin-fill sediments below the SEZ are estimated to be about 2,300 ft (700 m) deep (based on logs of a deep boring about 7 mi [11 km] southwest of the site). Carbonates and granites (and associated mineralization) occur at approximate depths of 2,300 ft (700 m) and 4,700 ft (1,430 m) below the site, respectively. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Millers SEZ is an area with high potential for the occurrence of sand and gravel (level of certainty B) and a moderate potential for the occurrence of clay (level of certainty A). The site is underlain by alluvial and lacustrine deposits, which are potential sources of clay, sand, and gravel materials. The current mining of saleable mineral deposits (sand and gravel) at one authorized FHWA site that overlaps a small portion of the southern site boundary (and several others in close proximity) indicates that future extraction of such resources within the SEZ is viable.

There are no active oil and gas leases within the Millers SEZ; a good portion of the land within the site was leased in the past, but these leases were closed in 2000 and 2001. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province, where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential; however, there has been no exploration within the site. The hypothetical plays in this province consider deep sediment-filled basins, such as the Big Smoky Valley, to be conceptually prospective for hydrocarbons. An exploratory well drilled to the southwest of the SEZ in 1997 encountered older (Ordovician) sedimentary rocks between depths of 2,288 and 4,704 ft (697 to 1,434 m) with no oil shows.

The SEZ is located in the Battle Mountain District, an area of high geothermal potential. The BLM forecasts that geothermal resource exploration and development in the district will increase in the coming years. While there are no active geothermal leases within the site, current geothermal exploration projects in the region are numerous and public lands nominated for geothermal sale occur immediately south of the site (overlapping a portion of it). The potential for geothermal development within the site is high (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high. Playa-related sediments occur within the Millers SEZ; however, the quality of these deposits has not been characterized. The potential for salt production within the site is moderate (level of certainty A). There are no active or historical leases for this commodity within the site.

1 INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this report is to assess the mineral resource potential (for locatable, saleable, and leasable minerals) of 66,246 acres (268 km^2) of public lands within five SEZs in southern Nevada, which the Secretary of the Interior may decide to withdraw from potentially conflicting uses through the issuance of a Public Land Order. If approved, the public lands within the SEZs would be withdrawn, subject to valid existing rights, from settlement, sale, location, or entry under the general land laws, including the mining laws, as follows:

- New mining claims could not be filed on the withdrawn lands; however, valid mining claims filed prior to the date the lands were segregated (i.e., withdrawal application notice was published in the *Federal Register*) would take precedence over future solar energy development right-of-way (ROW) application filings.

- Lands could not be sold, exchanged, or otherwise disposed of during the term of the withdrawal.

- Withdrawn lands would remain open to mineral leasing, geothermal leasing, and mineral material laws; the BLM could elect to lease the oil, gas, coal, or geothermal steam resources or to sell common-variety mineral materials such as sand and gravel, if the authorized officer determined there would be no unacceptable impacts on future solar energy development.

- Withdrawn lands would remain open to ROW authorizations and land leases or permits authorized under Section 302 of the Federal Land Policy and Management Act of 1976 (FLPMA).

The public lands are currently segregated under BLM's Interim Temporary Final Rule, which was published on April 26, 2011, and is in effect until June 30, 2013 (Vol. 76, pp. 23198–23205 of the *Federal Register* [76 FR 23198–23205]).

1.2 LEGAL DESCRIPTION OF THE SUBJECT LANDS

There are five SEZs in Nevada: Amargosa Valley (Nye County) and Dry Lake (Clark County), both of which are located in the Southern Nevada District; Dry Lake Valley North (Lincoln County), which is located in the Ely District; and Gold Point and Millers (Esmeralda County), both of which are located in the Battle Mountain District. Two other proposed SEZs, Delamar Valley and East Mormon Mountain (both in Lincoln County), were dropped from further consideration on the basis of public comments received on the Draft Solar Programmatic Environmental Impact Statement (PEIS) (BLM and DOE 2011). The locations of the SEZs are shown in Figure 1. Their full legal descriptions are provided in Appendix A.

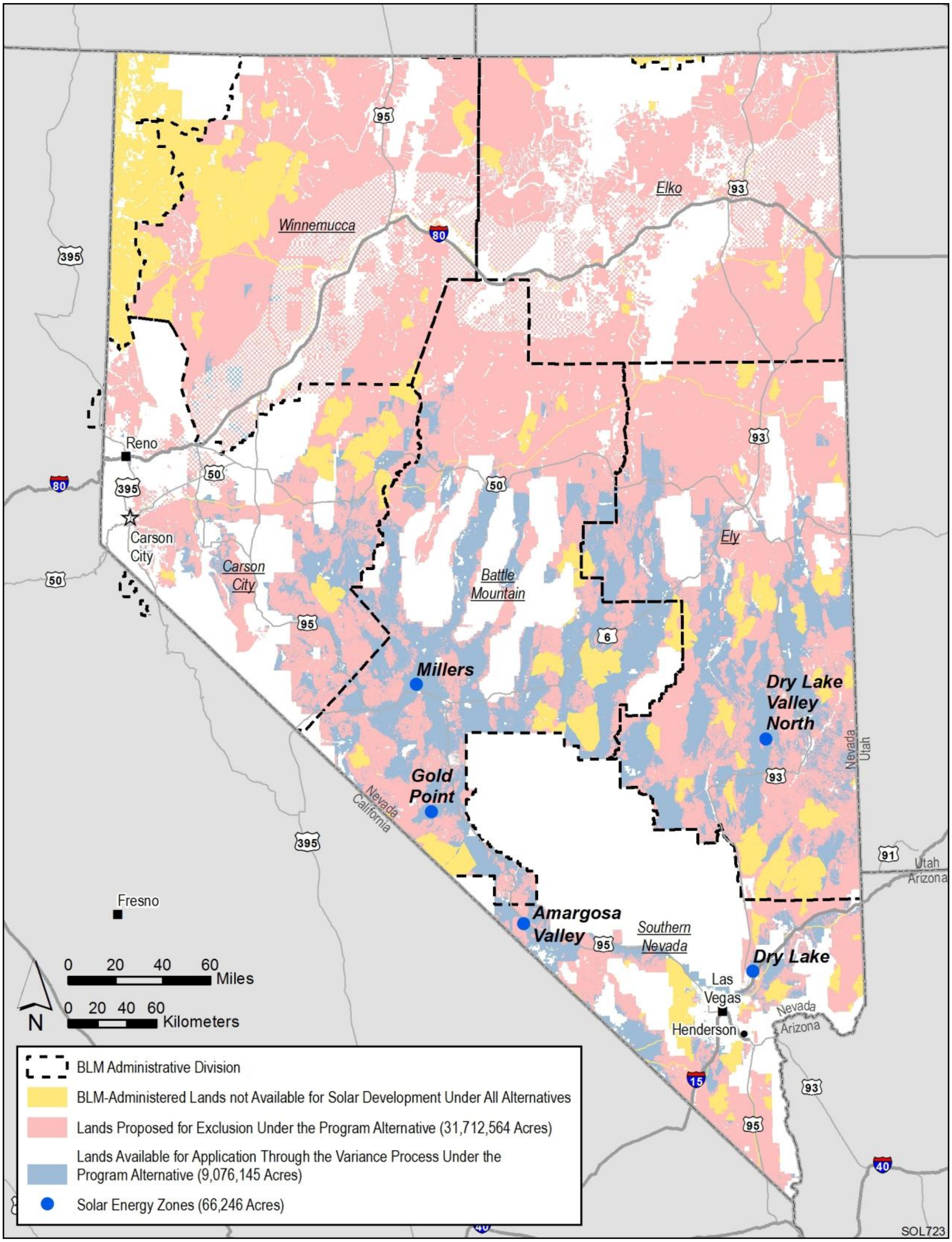

FIGURE 1 BLM-Administered Lands in Nevada Available for Application for Solar Energy Right-of-Way Authorization (SEZs are represented by the blue dots)

1.3 METHODOLOGY AND RESOURCES

The assessment presented in this report focuses on locatable (including those classified as strategic and critical), saleable, and leasable mineral resources within five SEZs in Nevada. The conclusions concerning mineral occurrence and development potential (and levels of certainty) follow the methodology outlined in BLM Manual 3031 (BLM 1985) and are based on a review of topographic maps, geologic maps, mineral resource maps and reports, the scientific literature on the geology and mineral resources of Nevada, and consultation with BLM mineral specialists. No mapping or field sampling was conducted as part of this assessment.

Digital data for the geologic maps in Figures 2, 4, 6, 8, and 10 were obtained from the Nevada Bureau of Mines and Geology (NBMG) (Crafford 2007); maps by Stewart and Carlson (1978) and Albers and Stewart (1972) were also consulted. The large-scale, folded maps (Maps 1 through 5) provided in the back of this report show the public land survey system grid (township and range) and should be consulted to locate mines and other features discussed in the text. In addition, the Solar PEIS Web site (http://solareis.anl.gov/sez/index.cfm) features mapped photographs of the SEZs.

The BLM's Legacy Rehost System (LR2000; BLM 2012a) was queried on June 26 and 27, 2012, for information on active and historical (unpatented) mining claims and various leases and permits, including oil and gas leases, geothermal leases and land nominations, and free use permits or mineral materials contracts, issued on public lands within and around the five SEZs. Another key BLM resource consulted was the recent Mineral Assessment Report prepared as part of the Battle Mountain District's Resource Management Plan (RMP) revision (BLM 2012b); this report covers the regions in which the Gold Point and Millers SEZs are located. RMPs for the Las Vegas Field Office (BLM 1998) and the Ely District (BLM 2007) were also consulted.

Mines and mineral prospects and occurrences and their descriptions are those reported in the U.S. Geological Survey's (USGS's) Mineral Resource Data System (MRDS; USGS 2011; Lipin 2000) and supplemented with information provided by BLM mineral specialists from the districts and field offices in which the proposed SEZs are located. The MRDS is a large database containing historical records of the USGS and the U.S. Bureau of Mines (which is now part of the USGS). These records are of variable quality and currency, so it is possible that some information will be found to be out of date (the revision and refinement of these records and database is an ongoing effort at the USGS). The mining activity maps in Figures 3, 5, 7, 9, and 11 were generated from the MRDS and are intended to provide a general picture of the location and nature of mining activity in the vicinity of each of the five Nevada SEZs. Refinements with regard to the status of particular mines are included in the text as warranted based on conversations with BLM mineral specialists.

The NBMG map of active mines and energy producers in Nevada (Davis and Hess 2010) was consulted; the NBMG Web site also has key information on the state's oil and gas and geothermal development. Geographic information system (GIS) data for Nevada's mining districts, based on Tingley (1998), were also obtained from the NBMG for the mining activity maps. Well logs for wells drilled near the SEZs were obtained from the NBMG Nevada Oil and

Gas Well Information Web site (2011 Update) (http://www.nbmg.unr.edu/Oil&Gas/NVWellInfo.html) and the State of Nevada Division of Water Resources well log database (http://water.nv.gov/data/welllog/index.cfm).

1.4 LOCATABLE MINERALS

Under U.S. mining laws, minerals fall into three categories: locatable, leasable, and saleable. Because these categories were created by acts of Congress, they do not fall into simple economic or mineralogical divisions. Creating an exact and thorough list of locatable minerals (e.g., those subject to appropriation by locating mining claims) is therefore difficult. Metallic minerals (e.g., gold, silver, copper, mercury, aluminum, antimony, lithium, molybdenum, tungsten, uranium, vanadium, and rare earths) are considered to be locatable. Numerous uncommon varieties of nonmetallic minerals may also be locatable, depending on their chemical content, quality, uses, and characteristics, as well as certain associated economic and legal matters. These nonmetallic minerals could include barite, calcite, specialty clays, bentonite, diatomite, feldspar, some gemstones (e.g., opals and diamonds), gypsum, chemical-grade limestone, perlite, chemical-grade silica sand, specific types of stone, talc, zeolites, and specific and uncommon types of dolomite. The determination of the actual locatability of uncommon varieties of nonmetallic minerals and the validity of mining claims for them is complex and relies on Public Law (P.L.) 84-167 (*United States Code*, Title 30, Section 601 et seq. [30 USC 601 et seq.]) and applicable case law (e.g., *United States vs. Kenneth McClarty*, 17 Interior Board of Land Appeals [IBLA] 20, 1974 [81 Interior Department (I.D.) 472]) (Shumaker 2011).

The intensity of exploration for and development of mineral commodities in Nevada is based mainly on their price and demand (e.g., the historically high price of gold has stimulated focused exploration). Exploration activity and the number of active claims on public lands in Nevada were down in 2009 relative to 2008, because financing was difficult to obtain as a result of the economic recession (as well as a significant one-time fee on mining claims instituted by the Nevada legislature [Dobra 2011]). Most of the exploration in Nevada has focused on gold, with some continued exploration for copper, molybdenum, silver, lithium, limestone (for cement), diatomite, and uranium (Price 2010). There have been increases in exploration for rare earth minerals and for lithium, as a result of the demand for lithium batteries and the demand for neodymium for compact magnets used in hybrid automobiles, as examples (Shumaker 2011). Dobra (2011) and Muntean (2011) report that exploration activity in 2010 increased significantly relative to that in 2009. The increase is attributed to the recent increase in gold prices.

1.5 STRATEGIC AND CRITICAL MINERALS

Table 1 lists the nonfuel strategic and critical nonfuel minerals that are imported by the United States for its National Defense Stockpile, as authorized by the Strategic and Critical Materials Stock Piling Act (50 USC 98 et seq.). Several of the minerals produced in Nevada are classified as strategic and critical minerals. These include antimony, beryllium, bismuth, cadmium, copper, fluorspar, manganese, mercury, tungsten, vanadium, and zinc.

TABLE 1 Strategic and Critical Nonfuel Minerals

Antimony	Copper	Platinum group
Asbestos	Diamonds (industrial)	Quartz crystals
Bauxite and alumina	Fluorspar	Rutile (titanium)
Beryllium	Graphite	Silicon
Bismuth	Iodine	Tantalum
Cadmium	Manganese	Thorium
Chromium	Mercury	Tin
Cobalt	Mica sheet	Tungsten
Columbian	Nickel	Vanadium
		Zinc

Source: CBO (1983).

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2 AMARGOSA VALLEY SEZ

2.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 9,737 acres (39.4 km^2) of public lands within an area known as the Amargosa Valley SEZ, located in Nye County in southern Nevada. The SEZ is about 11 mi (18 km) south of and 12 mi (20 km) northwest of the towns of Beatty and Amargosa Valley, respectively.

There are no documented occurrences of locatable mineral deposits within the Amargosa Valley SEZ. Most of the metallic locatable minerals in the region are concentrated in the gold-base metal-quartz vein deposits hosted by Precambrian (metamorphic) and Cambrian (sedimentary) rocks and in the gold-mercury-fluorite deposits found in Cambrian and Tertiary (volcanic) rocks. These geologic units typically occur in the mountains to the north and south of the SEZ. The nearest occurrences of locatable minerals (diatomite) are along the northeastern border of the site; altered ash has been reported in the Amargosa Community Pit about 7 mi (11 km) south of the SEZ. Gold prospects are located in Black Marble Mountain less than a mile to the northeast (all in Bare Mountain District) and to the south in Lee District. Alluvial sediments are estimated to be about 550 ft (170 m) deep (based on well logs) and dolomite occurs between depths of 2,000 ft (610 m) to 5,000 ft (1,520 m); however, the stratigraphic units below the site have not been well-characterized. Based on the proximity of nonmetallic mineral occurrences, the potential for diatomite and specialty clays to occur within the SEZ is moderate (level of certainty A). The potential for metallic minerals (such as gold) is low (level of certainty A),

The Amargosa Valley SEZ is an area with moderate potential for the occurrence of sand and gravel, and clay (level of certainty A). The site is underlain by alluvial and basin-fill sediments (river channel, alluvial fan, and playa deposits), which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are no active oil and gas leases within the Amargosa Valley SEZ. A good portion of the land within the site was leased in the past, but these leases were closed in 1987 and 1988. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as the Amargosa Valley, to be conceptually prospective for hydrocarbons. An exploration well was drilled to the southeast of the SEZ (in section 25 of T15S, R49E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons, but there has been no commercial oil or gas production in that area.

The SEZ is located in a region that is only marginally favorable for geothermal development, and the BLM (1998) reports that the low temperatures of waters in the Southern

Nevada District preclude direct application uses. Although there are no active or historical geothermal leases within the site, public lands immediately to the northeast of the site have been nominated for geothermal sale. The potential for geothermal development within the site is low (level of certainty B).

2.2 LANDS INVOLVED

The Amargosa Valley SEZ is located on BLM lands within the Southern Nevada District (Pahrump Field Office), in Nye County. The site lies within Township 13 South, Range 47 East (T13S, R47E), sections 35 and 36; T14S, R47E, sections 8 to 16, 21 to 27, and 34 to 36; and T15S, R47E, sections 1, 2, and 12 (Mount Diablo Principal Meridian). Within this area, 1,258 acres (5.1 km^2) have been identified as non-development areas. These areas consist of lands within the Amargosa River floodplain that were included in the SEZ only to facilitate the definition of the boundaries using the public land survey system (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 1). The full legal description of the SEZ is provided in Appendix A.

2.3 LAND STATUS

According to the LR2000, accessed on June 26, 2012, there are no active locatable mining claims within the Amargosa Valley SEZ; however, there are numerous closed lode and placer claims (including gold and borate) within and immediately adjacent to the site (BLM 2012a). There is one active mill site claim in the northeast quadrant of section 25 in T14S, R47E (NMC 5511066; Bullfrog Mine) and two closed mill site claims within the site boundaries. The land within the SEZ was first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). It is currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198-23205).

There are currently no free use permits or mineral materials contracts within the SEZ (BLM 2012a). The site remains open for the disposal of saleable mineral materials.

There are no active oil and gas leases within the SEZ; however, a good portion of the site was leased for oil and gas in the past (three oil and gas leases covered most of the site but were closed in 1987 and 1988). There are no active or historical geothermal leases within the SEZ. The site remains open for discretionary leasing for oil and gas and other leasable minerals.

2.4 GEOLOGIC SETTING

The Amargosa Valley SEZ is located in the Amargosa Desert region of the Basin and Range physiographic province in southern Nevada. The area lies between Bare Mountain range to the northeast and the Funeral Mountains to the southwest. The Bullfrog Hills border the northwest end of the valley (Hunt 1974; Crafford 2007).

The Amargosa Desert is one of the largest intermontane basins in Nevada. Basin fill consists of Quaternary and Tertiary river channel, alluvial fan, and playa deposits of variable thickness and induration. Sediments are thickest in the southeastern end of the basin near Amargosa Flat and Ash Meadows, ranging from 3,500 to 5,000 ft (1,070 to 1,520 m). In the north area, sediments are up to 3,500-ft (1,070-m) thick, thinning to about 1,400 ft (430 m) near Lathrop Wells. Tertiary conglomerates of alluvial fan sediments are moderately indurated. Tertiary rhyolite flows and tuffs interbedded with basin-fill sediments occur at depth and in outcrops along the edge of the basin. Several thousand feet of rhyolite tuffs are exposed in the Bullfrog Hills. Paleozoic carbonate rocks are known to occur beneath Amargosa Flat but may be limited in extent. The surrounding mountains are composed primarily of thick sequences of Paleozoic carbonates (limestone and dolomite) and Paleozoic and Precambrian metamorphic rocks (quartzite and phyllitic siltstone) (NBMG 1972; Winograd and Thordarson 1975; Kilroy 1991; Burbey 1997).

The basin is drained by the Amargosa River, an ephemeral river that is essentially dry except along short segments fed by springs that flow seasonally (Stonestrom et al. 2007; USGS 2001). The river originates in the mountains to the north and flows to the southeast, draining into the southern part of Death Valley (Crafford 2007; Stewart and Carlson 1978).

The geology of the Amargosa Desert region near the Amargosa Valley SEZ is shown in Figure 2.

2.5 PHYSICAL FEATURES AND ACCESS

The Amargosa Valley SEZ is located in the northwest part of Amargosa Valley, immediately south of Bare Mountain and southwest of Crater Flat. Its terrain is relatively flat. Elevations range from about 2,580 ft (850 m) along the northern border to about 2,540 ft (774 m) at its southernmost end. The Amargosa River forms a braided pattern of poorly defined ephemeral stream channels that pass through the site. A large sand dune known as the Big Dune lies to the southeast of the site on the east side of the Amargosa River. The dune is protected as a BLM Area of Critical Environmental Concern (ACEC) because it provides habitat for sensitive beetle species (BLM 2009).

The land around the SEZ is rural and undeveloped. There is an 80-acre (0.3-km^2) parcel of private land along the northern border of the site; this parcel is a low-level radioactive waste disposal facility, located close to U.S. 95. The SEZ is bordered on the northeast by U.S. 95, and access to the SEZ from U.S. 95 is very good, with several dirt roads that penetrate the area. The dry washes are used for vehicle travel, although they would be unacceptable for permanent travel.

2.6 SITE GEOLOGY

Surface sediments at the Amargosa SEZ consist of Quaternary alluvium (map unit Qal; Figure 2) (Crafford 2007; Stewart and Carlson 1978; Cornwall 1972). There are no perennial

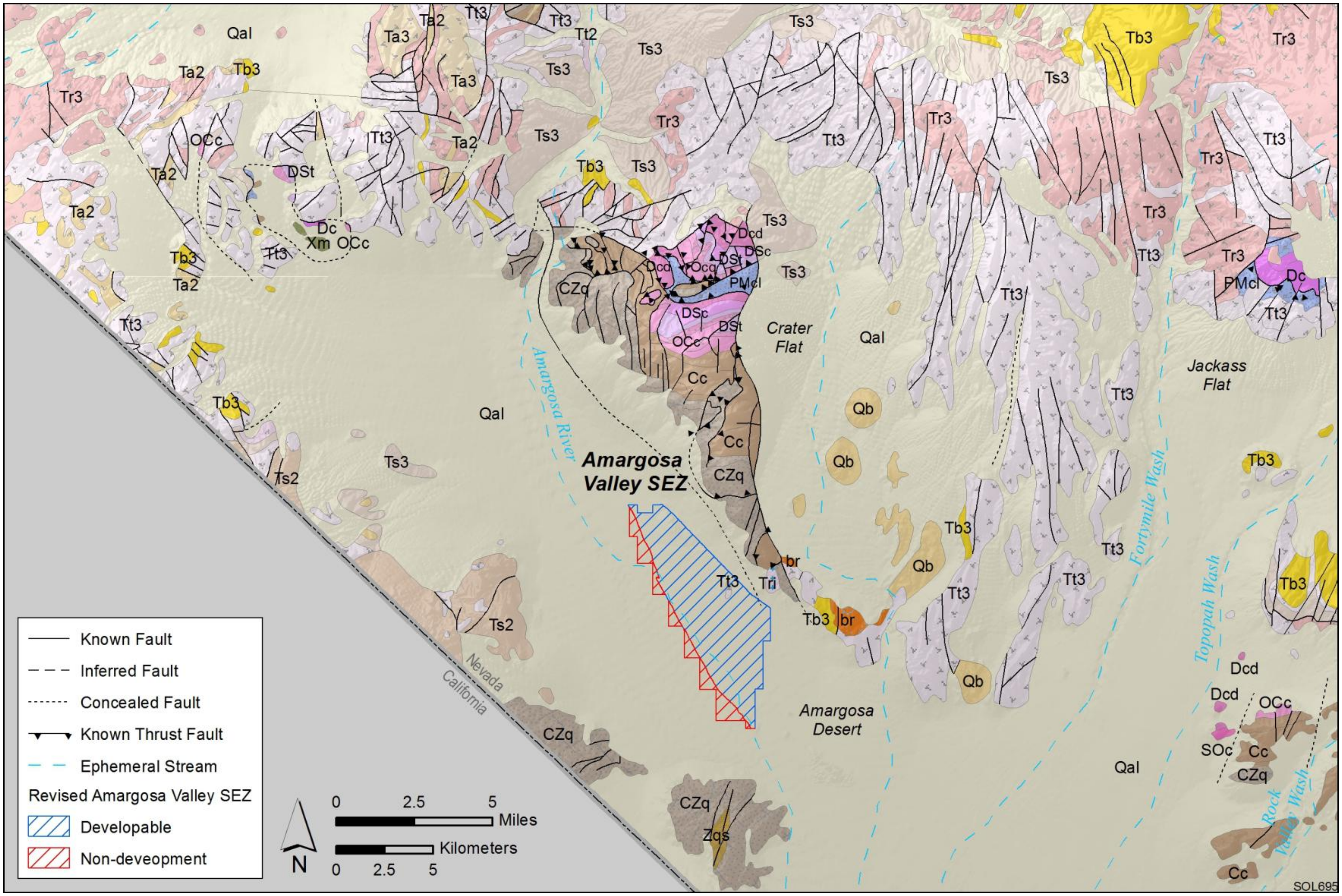

FIGURE 2 Geologic Map of the Amargosa Valley SEZ in the Amargosa Desert Region (Sources: Crafford 2007; Stewart and Carlson 1978)

Quaternary Sediments and Rocks

- Qal Alluvium, undifferentiated
- Qb Basalt flows

Tertiary and Upper Cretaceous(?) Rocks

- Ts3 Younger tuffaceous sedimentary rocks (Pliocene and Miocene)
- Tb3 Basalt (Miocene)
- Ta3 Younger andesite and intermediate flows and breccias (Miocene)
- Tt3 Younger silicic ash flow tuffs (Miocene)
- Tr3 Younger rhyolitic flows and shallow intrusive rocks (Miocene)
- Ts2 Older tuffaceous sedimentary rocks (lower Miocene and Oligocene)
- Ta2 Intermediate andesite and intermediate flows and breccias (lower Miocene and Oligocene)
- Tt2 Intermediate silicic ash flow tuff (lower Miocene and Oligocene)
- Tri Rhyolite intrusive rocks with aphanitic groundmass (Miocene to middle Eocene)

Paleozoic Rocks

- Dc Limestone and minor dolomite (Upper and Middle Devonian)
- Dcd Dolomite, sandstone, and limestone (Middle and Lower Devonian)
- DSc Dolomite (Lower Devonian and Silurian)
- SOc Dolomite, limestone, and shale (Lower Silurian to Middle Ordovician)
- Ocq Quartzite (Middle Ordovician)
- OCc Limestone, dolomite, and quartzite (Middle Ordovician to Upper Cambrian)
- Cc Dolomite, limestone, and shale (Cambrian)
- PMcl Shale, siltstone, sandstone, and conglomerate (Middle Pennsylvanian to Lower Mississippian)
- DSt Platey limestone, dolomite, and chert (Lower Devonian to Silurian)

Precambrian and Other Rocks

- CZq Crossbedded quartzite, siltstone, and phyllite (Lower Cambrian and latest Proterozoic)
- Zqs Quartzite, siltstone, conglomerate, limestone, and dolomite (Late Proterozoic)
- Xm Gneiss and schist (Early Proterozoic)
- br Mixed breccias including volcanic, thrust, jasperoid, and landslide megabreccia (Tertiary to Jurassic)

SOL695

FIGURE 2 (Cont.)

surface water features within the SEZ; the Amargosa River enters the valley out of the Bare Mountains to the northwest and flows south and southeast across the valley and through the site. Within the SEZ, the river forms a braided pattern of poorly defined ephemeral stream channels. It is typically dry, except during late spring and summer months.

The site stratigraphy was inferred from lithologic logs for water wells drilled to the southeast of the SEZ (section 32 of T14S, R48E) and along its southwestern boundary (section 21 of T14S, R47E), and a deep oil and gas exploratory well in section 25 of T15S, R49E, about 13 mi (21 km) east-southeast of the site (NDWR 2012a; Hess et al. 2011). Unconsolidated alluvial sediments (predominantly gravel) extend to about 550 ft (170 m) below the SEZ. Below this depth is a thick sequence of brown silt (from 550 to 690 ft [170 to 210 m]) and red tuff (from 690 to 1,220 ft [210 to 370 m]), which are lacustrine and volcanic (ash fall) in origin, respectively. These deposits do not extend much beyond the southeastern site boundary where well logs show finer-grained alluvium atop a basalt flow that ranges in depth from about 320 ft (100 m) to 520 ft (160 m); basin-fill below the basalt unit extends to 2,000 ft (610 m). A dolomite unit (likely of Cambrian age) is encountered at 2,000 ft (610 m) and reaches a depth of at least 5,000 ft (1,520 m), the total depth of the well. The deep well log did not provide detailed descriptions of the sediments or rock units encountered.

2.7 MINERAL HISTORY

There has been no documented mining within the Amargosa Valley SEZ. Most of the mining activity in the region has been limited to small-scale mining of metals and nonmetals in the Bare Mountain District to the north and the Lee District to the south (and in California beyond the Nevada–California state line). The nearest active mine is the IMV Nevada Pits (specialty clays) about 18 mi (29 km) to the southeast in southern Nye County (Davis and Hess 2010; Driesner and Coyner 2011).

No mineral exploration or development work is currently being conducted within the SEZ. Muntean (2010, 2011) report the activity of two gold mines in Nye County (Reward and Sterling Mines), both in the Bare Mountain District near Beatty. Atna Resources Ltd. concluded its permitting process and is positioned to initiate development activities at its Reward Mine. The mine would produce gold from the Cambrian-Proterozoic Wood Canyon Formation. This unit consists of quartzite, silty sandstone, siltstone, and some limestone/dolomite beds (Atna Resources Ltd. 2011) and corresponds to map unit CZq (Figure 2). Imperial Metals Corp. has begun work at its Sterling Mine to extend the 144 zone, a zone of gold mineralization on the periphery of the company's developed ore body about 750 ft (229 m) below the surface and hosted in lower Cambrian (sedimentary) rocks and a cross-cutting latite dike (Imperial Metals Corp. 2010).

Exploration for sedimentary rock-hosted Carlin-type gold deposits (mid-Tertiary) in northern Nye County is ongoing (Ludington et al. 2009).

2.7.1 Locatable Minerals

There are no documented occurrences of locatable mineral deposits or prospects within the Amargosa Valley SEZ. Most of the metallic locatable minerals in the region are concentrated in the gold-base metal-quartz vein deposits hosted by Precambrian (metamorphic) and Cambrian (sedimentary) rocks and in the gold-mercury-fluorite deposits found in Cambrian and Tertiary (volcanic) rocks (Tingley 1984). These geologic units typically occur in the mountains to the north and south of the SEZ. Nonmetallic locatable minerals are known to occur in the Amargosa Desert, most notably in Ash Meadows, about 19 mi (31 km) to the southeast of the SEZ. These resources are associated with playa lake deposits and include specialty clays (bentonite, saponite, sepiolite, hectorite, Fuller's earth), zeolites, and diatomite (diatomaceous earth) (Castor et al. 2006). The nearest occurrences of locatable minerals (diatomite) are along the northeastern border of the site (in section 13 of T14S, R47E). Castor (2003) reports that montmorillonite was mined at several sites in the Bullfrog District southwest of Beatty (New Discovery Mine and Mill, Vanderbilt Minerals Company) as late as 2002 (the mine was not listed as active in Driesner and Coyner [2011]). Fanning (2012) also reports the occurrence of altered ash in the Amargosa Community Pit (section 12 of T16S, R47E) about 7 mi (11 km) south of the SEZ. Gold prospects are located in Black Marble Mountain less than a mile to the northeast (all in Bare Mountain District) and to the south in Lee District.

Mines and mineral prospects in the vicinity of the SEZ are shown on the detailed map of the SEZ and surrounding region provided in the back of this report (Map 1).

There are five mining districts in the vicinity of the Amargosa Valley SEZ. Some of the minerals produced in these districts (perlite and cinder) are not classified as locatable minerals. The mining districts and their mineral occurrences, based on Tingley (1998), are shown in Figure 3 and are as follows:

- Bullfrog: gold, silver, copper, lead, montmorillonite, uranium; about 14 mi (22 km) to the north–northwest;
- Bare Mountain (fluorine): gold, fluorspar, mercury, tungsten, silver, marble, kaolin, montmorillonite, silica, uranium, perlite, and cinder; about 8.1 mi (13 km) to the north;
- Pocopah: copper, gold, silver, and magnesite; about 17 mi (27 km) to the northeast;
- Lee: gold, titanium; immediately to the south; and
- Ash Meadows (bentonite): Fuller's earth, bentonite, sepiolite, and clinoptilolite (a devitrification product of volcanic glass); about 19 mi (31 km) to the southeast (not shown in Figure 3; see Map 1).

The Bullfrog District is centered on the Bullfrog Hills, west of Beatty. Gold was discovered in 1904, and since then, the district has been a top producer of gold and silver in the

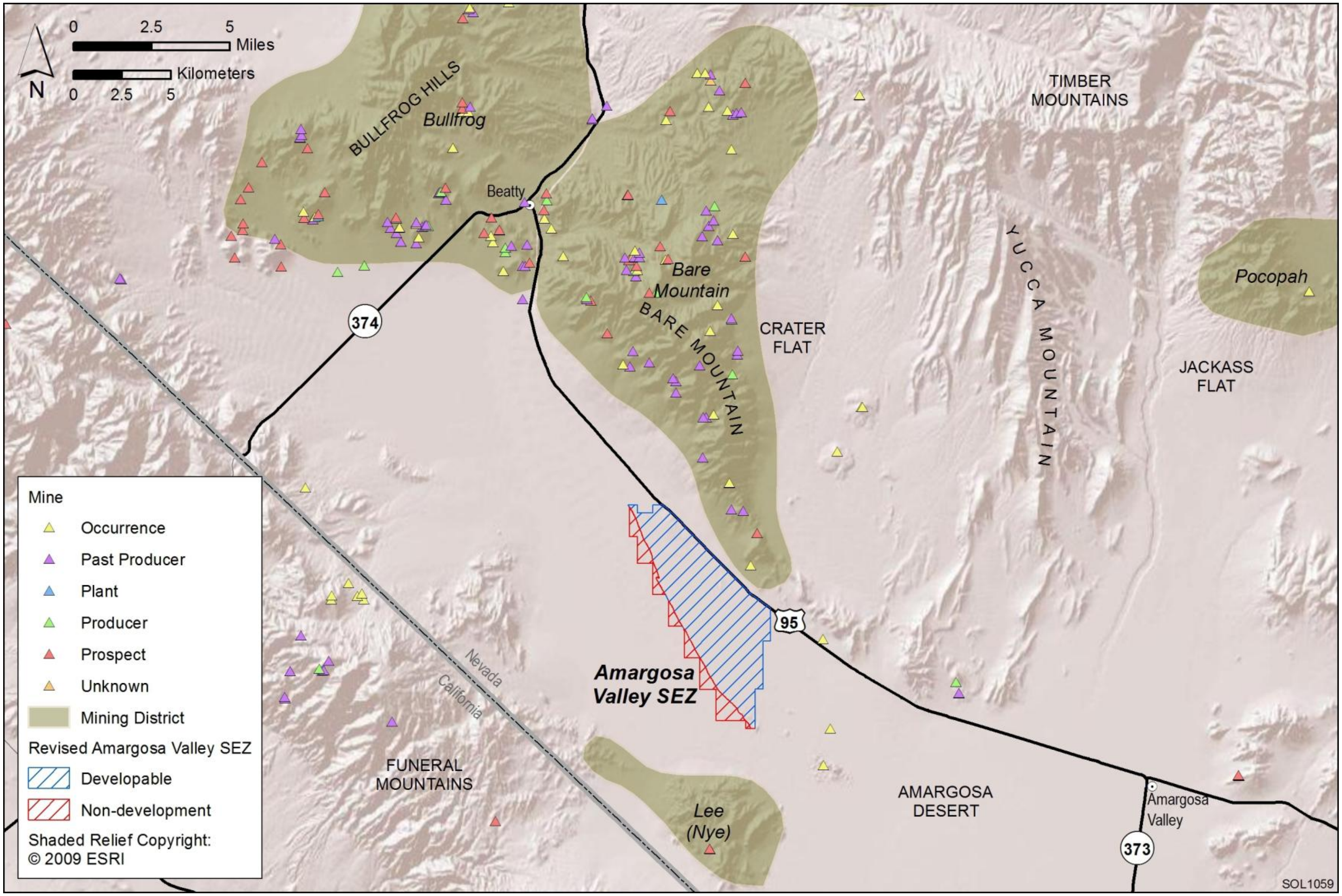

FIGURE 3 Map Showing Mining Districts, Mines, and Mineral Prospects near the Amargosa Valley SEZ (Sources: USGS 2011; Tingley 1998)

southern Nye County. Gold mineralization occurs in fissures and veins in rhyolitic welded tuffs associated with steep normal faults that are thought to define the east rim of a caldera. The district also produced small amounts of bentonite, formed by intense hydrothermal alteration of welded and nonwelded rhyolitic tuff (Cornwall 1972). Although the USGS MRDS identifies active mines in the district (e.g., New Discovery Mine and Mill and Vandenberg Mine, which produced bentonite at one time), none of these mines are listed as active in Dreisner and Coyner (2011).

Gold was first discovered in the Bare Mountain District in 1905k, and fluorspar has been mined there since 1918. Other minerals produced in the district include mercury, ceramic, silica, volcanic cinders, and pumicite (in small amounts). Most of the mineral production occurs on the north side of Bare Mountain. Minerals were likely deposited by ascending hydrothermal solutions; fluorspar deposits also occur along shear zones in dolomite of the Nopah Formation and the Lone Mountain Dolomite. Past mines include the Daisy Mine (fluorite, uranium, mercury, and clay), the Daisy Gold Mine (gold and silver), and the Mother Lode Mine (gold and silver) (USGS 2011; Cornwall 1972).

There is little reported in the literature about the Pocopah District, located in the Calico Range (Hills) on the Nevada Test Site north of Jackass Flats. The USGS MRDS reports occurrences of copper, iron, and magnesite based on several small prospect trenches and a deep hole drilled on the west side of the range. Mineralization is associated with quartzite veins (Eleana Formation) and thrust fault contacts in the dolomite of the Nevada Formation. The district is inactive (Tingley 1998; USGS 2011).

The Lee District is located in the low hills to the south of the SEZ, along the California–Nevada state line. Mineralization in the district occurs in late Precambrian rocks of the Johnnie Formation and Stirling Quartzite as free gold (in quartz veins) and in dolomite; however, there has been no mineral production in the district (USGS 2011; Cornwall 1972).

The Ash Meadows District covers a large marsh area in the lower Amargosa Desert, about 15 mi (24 km) south of Amargosa Valley. Clay deposits (bentonite and others) occur in this region as a result of alteration of shallow, flat-lying tuffaceous lakebeds of Pliocene to Pleistocene age. The district includes most of Ash Meadows (west side) and Amargosa Flat (east side) and extends into California (Tingley 1998; Cornwall 1972; Castor 2003).

The Amargosa Valley SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the metallic locatable minerals in the region are concentrated in the gold-base metal-quartz vein deposits hosted by Precambrian (metamorphic) and Cambrian (sedimentary) rocks and in the gold-mercury-fluorite deposits found in Cambrian and Tertiary (volcanic) rocks. These geologic units typically occur in the mountains to the north and south of the SEZ. The nearest occurrences of locatable minerals (diatomite) are along the northeastern border of the site; altered ash has been reported in the Amargosa Community Pit about 7 mi (11 km) south of the SEZ. Gold prospects are located in Black Marble Mountain less than a mile to the northeast (all in Bare Mountain District) and to the south in Lee District. Alluvial sediments below the SEZ are estimated to be about 550 ft (170 m) deep (based on well logs) and dolomite occurs between depths of 2,000 ft (610 m) to 5,000 ft (1,520 m); however, the stratigraphic units below the site have not been well-characterized. Based on the proximity of nonmetallic mineral occurrences, the potential for these minerals (diatomite and specialty clays) to occur within the SEZ is moderate (level of certainty A). The potential for metallic minerals (such as gold) is low (level of certainty A).

2.7.2 Saleable Mineral Materials

Saleable mineral materials in the Amargosa Valley are mainly cinder, pumice, crushed stone, clay, limestone, and marble. Volcanic materials (e.g., cinder and pumice) are associated with the Quaternary–Tertiary basalt cones in Crater Flat to the northeast. Past producing mines in the region include the Cinder Cone Pit (pumice), Cinder Cone Mine (cinder), and a sand and gravel pit, all located about 6 mi (10 km) to the east of the Amargosa Valley SEZ. The Amargosa Valley SEZ is an area with moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The SEZ is underlain by alluvial and basin-fill sediments (river channel, alluvial fan, and playa deposits), which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. According to the LR2000, accessed on June 27, 2012, there are no free use permits or mineral materials contracts within the site boundaries (BLM 2012a).

2.7.3 Leasable Minerals

There are no active oil and gas leases within the Amargosa Valley SEZ (BLM 2012a). A good portion of the land within the site was leased in the past, but these leases were closed in 1987 and 1988. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), more than 150 mi (241 km) to the north–northeast of the SEZ (BLM 2012b). The southern part of Nye County lies within the Western Great Basin Oil and Gas Province where carbonate rocks of Triassic age in west–central Nevada (northwest of the Amargosa Valley SEZ) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as the Amargosa Valley, to be conceptually prospective for hydrocarbons (Barker et al. 1995). An exploration well was drilled to the southeast of the SEZ (in section 25 of T15S, R49E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons (Hess et al. 2011), but there has been no commercial oil or gas production in that area.

The Amargosa Valley SEZ is located in a region that is only marginally favorable for geothermal development (Coolbaugh 2005), and the BLM (1998) reports that the low temperatures of waters in the Southern Nevada District preclude direct application uses. The nearest geothermal projects occur about 75 mi (121 km) to the northwest of the SEZ (e.g., in Clayton Valley); see the NBMG project list for a full roster of geothermal projects in Nevada (NBMG 2012). There are no active or historical geothermal leases within the Amargosa SEZ

(BLM 2012a); however, there are nominated lands for geothermal sale immediately to the northeast of the site in sections 1 and 12 of T14S, R47E; sections 5 to 8, 17, and 18 of T14S, R48E; sections 13, 24, 25, and 36 of T13S, R47½E; and sections 7 to 10, 15, 18, 19, 22, 27, 30, and 31 of T13S, R48E (BLM 2012a). The Amargosa Valley SEZ is an area with low potential for geothermal development (level of certainty B).

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3 DRY LAKE SEZ

3.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 6,186 acres (25.0 km^2) of public lands within an area known as the Dry Lake SEZ, located in Clark County in southern Nevada. The SEZ is about 23 mi (37 km) west–southwest of Overton.

There are no documented occurrences of locatable mineral deposits within the Dry Lake SEZ. The nearest occurrences of locatable minerals in the region are in the Apex District to the immediate south where high-grade carbonate rocks are mined. Carbonates below the central part of the SEZ occur at a depth of about 1,000 ft (305 m) below the SEZ, becoming more shallow toward the site's eastern, western, and southern corners (based on well logs and current surface mining to the south). Four placer claims in the northeast quadrant of section 14 in T18S, R63 (at the southernmost end of the SEZ) are held by Chemical Lime, the company that operates the limestone quarry to the south. The potential for high-grade limestone to occur within the SEZ is high, especially in the southernmost and westernmost parts of the site where overlying sediments are relatively shallow (level of certainty C). The potential for locatable metallic minerals to occur with the SEZ is undetermined (level of certainty A).

The Dry Lake SEZ is an area with a high potential for the occurrence of sand and gravel (level of certainty D), and a moderate potential for the occurrence of clay (level of certainty A). The site is underlain by alluvial and lacustrine sediments; potential sources of clay, sand, and gravel materials. The current mining of saleable mineral deposits (sand and gravel) at 16 authorized FHWA sites within and immediately adjacent to the SEZ indicate that future extraction of such resources within the SEZ is viable. However, there are no other mineral material sites within the SEZ (suggesting a low demand for these resources in the area), and such resources are available on other BLM lands in the region.

There are no active oil and gas leases within the Dry Lake SEZ. The southern and western portions of the site were leased in the past, but these leases were closed in the late 1980s and 1990s. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), more than 160 mi (257 km) to the north of the site. The SEZ is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons, because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley, but there has been no commercial oil or gas production within or near the SEZ. Exploration wells were drilled to the northeast of the site (in sections 11 and 14 of T17S, R64E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons.

The SEZ is located in a region that is only marginally favorable for geothermal development and the BLM (1998) reports that the low temperatures of waters in the Southern Nevada District preclude direct application uses. There are no active or historical geothermal leases within the site and the nearest nominated lands for geothermal sale are located about 80 mi (129 km) to the west-northwest. The potential for geothermal development within the site is low (level of certainty B).

3.2 LANDS INVOLVED

The Dry Lake SEZ is located on BLM lands within the Southern Nevada District (Las Vegas Field Office), in Clark County. The site lies within T17S, R63E, sections 33 to 36; T18S, R63E, sections 1 to 4 and 10 to 14; T17S, R64E, sections 31 and 32; and T18S, R64E, sections 6 and 7 (Mount Diablo Principal Meridian). Within this area, 469 acres (1.9 km2) of floodplain and wetlands have been identified as non-development areas (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 2). The full legal description of the SEZ is provided in Appendix A.

3.3 LAND STATUS

According to the LR2000, accessed on June 27, 2012, there are seven active placer claims in section 14 of T18S, R63E (held by Chemical Lime); four of these overlap the Dry Lake SEZ (in the northeast quadrant of the section 14). There also are 25 active mill site claims within the site: two in section 14 of T18S, R63E (held by Chemical Lime) and 23 in section 13 of T18S, R63E (held by Western Mining and Mineral). Numerous closed mining (lode and placer) and mill site claims occur within and immediately adjacent to the site (BLM 2012a). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198–23205).

There are 16 authorized FHWA material sites located within and immediately adjacent to the SEZ (BLM 2012a). Most of these are located along the eastern site boundary (there are nine in section 9 of T18S, R64E). The site remains open for the disposal of saleable mineral materials.

There are no active oil and gas leases within the SEZ; however, a good portion of the site was leased for oil and gas in the past (nine oil and gas leases covered most of the site but were closed in the late 1980s and 1990s). There are no active or historical geothermal leases within the SEZ. The site remains open for discretionary leasing for oil and gas and other leasable minerals.

3.4 GEOLOGIC SETTING

The Dry Lake SEZ is located in Dry Lake Valley, a northeast-trending alluvial basin within the Basin and Range physiographic province in southern Nevada. The valley is bounded on the west by the Arrow Canyon Range and on the southeast by the Dry Lake Range. Dry Lake Valley is one of many structural basins (grabens) typical of the Basin and Range province (Hunt 1974; Crafford 2007).

Exposed sediments in Dry Lake Valley consist mainly of modern alluvial and eolian deposits. Playa lake sediments at Dry Lake occur in the valley's center just to the north of the SEZ. The surrounding mountains are composed predominantly of Paleozoic carbonates (limestone and dolomite) and Tertiary volcaniclastic sedimentary rocks. The oldest rocks in the region are the Late Proterozoic to Cambrian metamorphic rocks exposed along ridges within the Las Vegas Range to the west (Longwell et al. 1965).

The geology of the Dry Lake Valley region near the Dry Lake SEZ is shown in Figure 4.

3.5 PHYSICAL FEATURES AND ACCESS

The Dry Lake SEZ is lies in the southern part of Dry Lake Valley, between the Arrow Canyon Range to the west and the Dry Lake Range to the east. Its terrain slopes gently to the east. Elevations range from about 2,580 ft (786 m) at the western corner to 1,980 ft (603 m) at the eastern corner.

The SEZ is bordered on the southwest by U.S. 93 and on the southeast by I-15. A railroad closely follows the southeastern border of the site. Western Mining and Mineral operates a mineral processing plant at the southern end of the site (in section 13 of T18S, R63E). Several dirt roads provide access into the area. A large mining operation (Chemical Lime's Apex Quarry and Plant) produces dolomite and limestone just south of the site.

3.6 SITE GEOLOGY

The Dry Lake SEZ is located in a closed basin, just south of Dry Lake, a wetland remnant of a late Pleistocene pluvial lake (map unit Qpl; Figure 4). Surface sediments at the site consist mainly of Quaternary alluvium (map unit Qal; Figure 4). There are two unnamed washes within the SEZ that flow northward to Dry Lake (Crafford 2007; Stewart and Carlson 1978).

The site stratigraphy was inferred from lithologic logs for water wells drilled to the northwest, west (in sections 21 and 32 of T17S, R63E), and northeast (in sections 11 and 21 of T17S, R64E) of the site (NDWR 2012b), and notations on an exploratory oil well drilled along the site's eastern boundary in section 6 of T18S R64E (no well log was available for this wells) (Hess et al. 2011). Unconsolidated sediments consisting mainly of interbedded gravel, sand, and clay are about 1,000 ft (305 m) thick below the central portion of the SEZ, becoming shallower in the direction of the adjacent mountain ranges (toward the site's eastern, western, and southern corners) and more clay-rich to the north. Well logs show sediments to be about 260 ft (80 m) thick along the western base of the Arrow Canyon Range to the northwest and 500 ft (150 m) thick along the base of the Dry Lake Range to the northeast. There were no well logs found for the southern part of the site, but sediments are presumably shallow given the surface mining of limestone in the area. The underlying limestone (likely of Devonian age; Longman et al. 1965) is typically interbedded with shale and extends to depths of at least 2,400 ft (730 m).

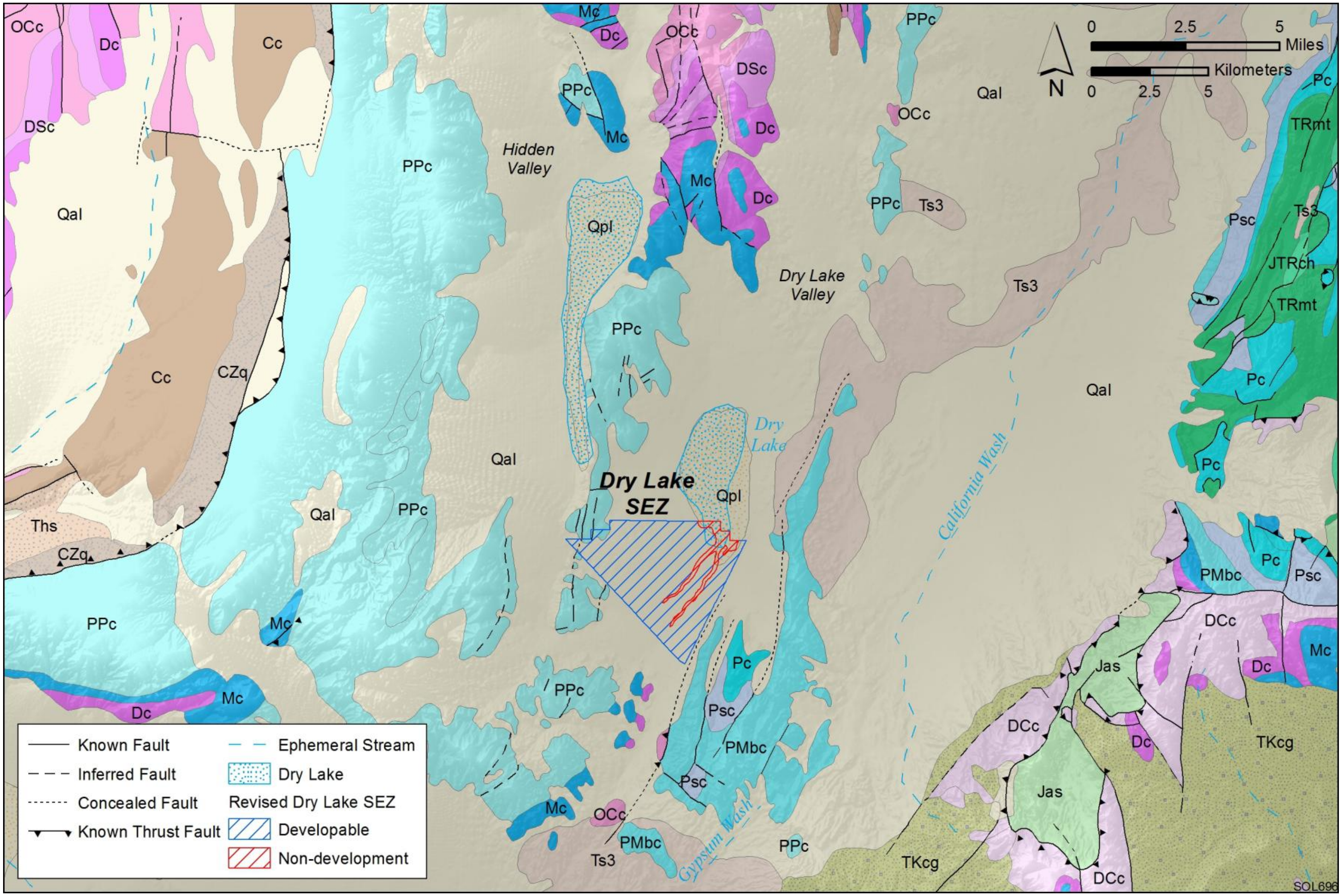

FIGURE 4 Geologic Map of the Dry Lake Valley Region (Sources: Crafford 2007; Stewart and Carlson 1978)

Quaternary Sediments and Rocks

- Qal Alluvium, undifferentiated
- Qpl Playa, lake beds, and flood plain deposits

Tertiary and Upper Cretaceous(?) Rocks

- Ths Tuffaceous sedimentary rocks (middle Miocene to upper Oligocene)
- Ts3 Younger tuffaceous sedimentary rocks (Pliocene and Miocene)
- TKcg Conglomerate and clastic rocks (Tertiary? and Cretaceous?)

Mesozoic Terranes, Sedimentary Rocks, and Assemblages

- Jas Eolian crossbedded sandstone (Jurassic)
- JTRch Continentally derived siltstone and clay (Lower Jurassic and Upper Triassic)
- TRmt Marine siltstone, limestone, and conglomerate (Middle? and Lower Triassic)

Paleozoic Rocks

- Pc Cherty limestone, dolomite, shale, and sandstone (Middle to Lower Permian)
- Psc Siltstone, sandstone, limestone, and dolomite (Lower Permian, Leonardian and Wolfcampian)
- PPc Limestone, dolomite, siltstone, sandstone, and shale (Lower Permian and Pennsylvanian)
- PMbc Bioclastic limestone (Pennsylvanian and Upper Mississippian)
- Mc Limestone (Mississippian)
- Dc Limestone and minor dolomite (Upper and Middle Devonian)
- DSc Dolomite (Lower Devonian and Silurian)
- OCc Limestone, dolomite, and quartzite (Middle Ordovician to Upper Cambrian)
- Cc Dolomite, limestone, and shale (Cambrian)
- DCc Dolomite and limestone (Middle Devonian to Upper Cambrian)

Precambrian and Other Rocks

- CZq Crossbedded quartzite, siltstone, and phyllite (Lower Cambrian and latest Proterozoic)

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FIGURE 4 (Cont.)

3.7 MINERAL HISTORY

There has been no documented mining within the Dry Lake SEZ other than mineral materials mining at FHWA sites along the eastern site boundary. Chemical Lime operates a high-grade dolomite and limestone quarry immediately south of the site (Apex Quarry and Plant) and Western Mining and Mineral operates a processing plant at the southern tip of the site. Historic activity in the region includes the mining of silica, dimension stone, limestone, and gypsum in the Arrow Canyon Range District to the north and the Apex District to the south (USGS 2011).

Other active mines in central Clark County include the PABCO Gypsum, Pioneer Gypsum Mine, and Simplot Silica Products (silica sand) (Davis and Hess 2010; Driesner and Coyner 2011).

3.7.1 Locatable Minerals

Most of the metallic locatable mineral deposits produced in Clark County are associated with upper Cretaceous and lower Tertiary intrusive rocks and occur in brecciated zones along major faults in Paleozoic carbonate rocks. Important resources include zinc, lead, gold, silver, copper, and manganese (with minor amounts of vanadium, cobalt, nickel, platinum, palladium, and tungsten). Nonmetallic locatable mineral deposits in the region are predominantly the carbonates mined in the Apex District (Longwell et al. 1965). The nearest occurrences of locatable minerals (dolomite and limestone) are immediately south of the SEZ (Apex Quarry and Plant).

There are four active placer claims (Chemical Lime) and 25 active mill site claims (Chemical Lime and Western Mining and Mineral) within the Dry Lake SEZ (BLM 2012a). The placer claims are located at the site’s southern tip in the northeast quadrant of section 14 of T18S, R63E. Several closed placer claims (69) and lode claims (nine) occur throughout the site, concentrated mainly in sections 33 and 34 of T17S, R63E; sections 3, 4, and 11 to 14 of T18S, R63E; and section 7 of T18S, R64E. Active mill site claims are located in section 14 of T18S, R63E. There are also numerous closed mill site claims, concentrated mainly in sections 1 to 3 and 11 to 14 of T18S, R63E and section 7 of T18S, R64E.

Mines and mineral prospects in the vicinity are shown on the detailed map of the SEZ and surrounding region provided in the back of this report (Map 2). There are seven mining districts in the vicinity of the Dry Lake SEZ, four of which have produced locatable minerals. The mining districts and their mineral occurrences, based on Tingley (1998), are shown in Figure 5 and are as follows:

- Apex (nonmetallic): high-grade dolomite and limestone; immediately to the south;
- Dike: lead (galena); about 8.8 mi (14 km) to the southwest;

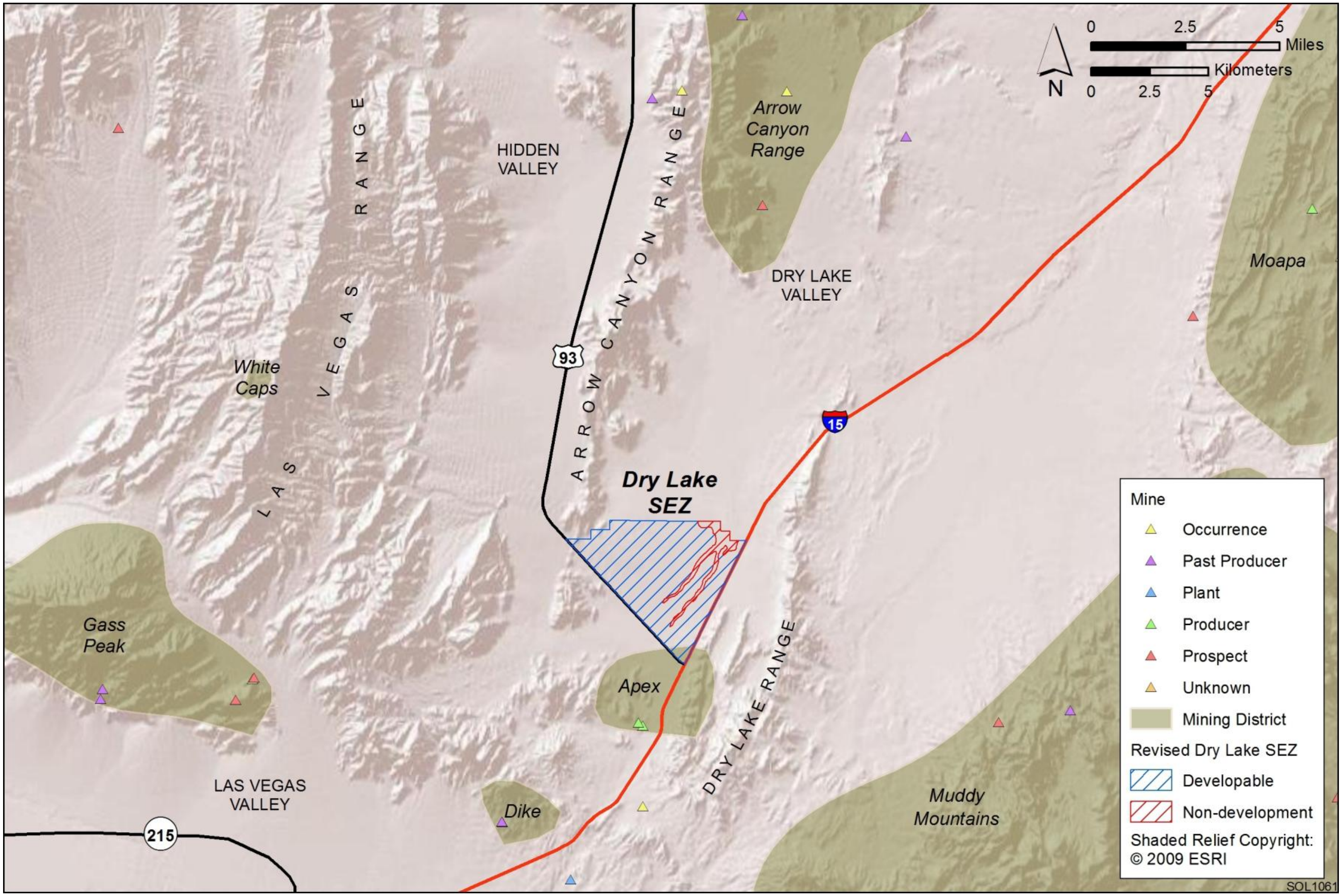

FIGURE 5 Map Showing Mining Districts, Mines, and Mineral Prospects near the Dry Lake SEZ (Sources: USGS 2011; Tingley 1998)

- Gass Peak: zinc, silver, lead, gold, and uranium; about 13 mi (21 km) to the west-southwest; and
- White Caps: lead, zinc, and silver; about 11 mi (18 km) to the west–northwest.

The Apex District is the closest producing district to the SEZ. It produces high-grade limestone and dolomite from Devonian to Mississippian Age units that lie between the southern part of the Arrow Canyon Range (to the west) and the Dry Lake Range (to the east) (Longman et al. 1965). The Apex Quarry and Plant operations are located immediately to the south of the SEZ.

Mining claims (Lead King Mine) in the Dike District were located in 1916, and mine workings were examined and described by the USGS in 1953. Mine workings (galena with cerussite) within the district are located in shear zones within Pennsylvanian limestone (Longwell et al. 1965). There are reportedly no active mines in the district (USGS 2011).

Production in the Gass Peak District has been small and limited to the gold, silver, lead, and zinc deposits mined at the June Bug property in 1916 and 1917. These deposits occur in altered (dolomitized) Mississippian Monte Cristo Limestone that has been replaced by oxidized zinc minerals along shear zones (Longwell et al. 1965; USGS 2011).

The White Caps District is located in the carbonate rocks of the Las Vegas Range to the west; there are reportedly no active mines in the district (USGS 2011).

The Dry Lake SEZ crosses none of the mineralized areas or historical mining districts listed above. Western Mining and Mineral operates a mineral processing plant at the southern tip of the site. There has been no other hard rock or locatable mining activity within the site. The nearest occurrences of locatable minerals in the region are in the Apex District to the immediate south where high-grade carbonate rocks are mined. Carbonates below the central part of the SEZ occur at a depth of about 1,000 ft (305 m) below the SEZ, becoming more shallow toward the site’s eastern, western, and southern corners (based on well logs). Four placer claims in the northeast quadrant of section 14 in T18S, R63 (at the southernmost end of the SEZ) are held by Chemical Lime, the company that operates the limestone quarry to the south. The potential for high-grade limestone to occur within the SEZ is high, especially in the southernmost and westernmost parts of the site where overlying sediments are relatively shallow (level of certainty C). The potential for locatable metallic minerals to occur with the SEZ is undetermined (level of certainty A).

3.7.2 Saleable Mineral Materials

Saleable mineral materials in the Dry Lake region are limited mainly to sand and gravel. The Dry Lake SEZ is an area with a high potential for the occurrence of sand and gravel (level of certainty D), and a moderate potential for the occurrence of clay (level of certainty A).The SEZ is underlain by alluvial and lacustrine sediments; potential sources of clay, sand, and gravel materials. According to the LR2000, there are 16 authorized FHWA material sites located within and immediately adjacent to the SEZ (BLM 2012a). Most of these are located along the eastern site boundary (there are nine in section 9 of T18S, R64E). Four occur within the site boundaries—three located along I-15 near the northeastern corner of the site (one in section 31 of T7S, R64E and two in section 6 of T18S, R64E) and one located near U.S. 93 near the northwestern corner of the site (in section 33 of T17S, R63E). There are no other mineral materials sites within the SEZ (suggesting a low demand for these resources in the area), and such resources are available on other BLM lands in the region.

3.7.3 Leasable Minerals

There are no active oil and gas leases within the Dry Lake SEZ (BLM 2012a). The southern and western portions of the site were leased in the past, but these leases were closed in the late 1980s and 1990s. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), over 160 mi (257 km) to the north of the SEZ (BLM 2012b). Clark County is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons, because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley (BLM 2012b), but there has been no commercial oil or gas production within or near the SEZ. Exploration wells were drilled to the northeast of the SEZ (in sections 11 and 14 of T17S, R64E) in 1991. Well records did not reflect the presence or absence of oil shows for proprietary reasons (Hess et al. 2011).

The Dry Lake SEZ is located in a region that is only marginally favorable for geothermal development (Coolbaugh 2005) and the BLM (1998) reports that the low temperatures of waters in the Southern Nevada District preclude direct application uses. The nearest geothermal project (Caliente) occurs about 80 mi (129 km) to the north of the SEZ; see the NBMG project list (2012) for a full roster of geothermal projects in Nevada. There are no active or historical geothermal leases within the Dry Lake SEZ (BLM 2012a), and the nearest nominated lands for geothermal sale are located about 80 mi (129 km) to the west–northwest in T15S, R49E (BLM 2012a). The Dry Lake SEZ is an area with low potential for geothermal development (level of certainty B).

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4 DRY LAKE VALLEY NORTH SEZ

4.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 28,726 acres (116 km^2) of public lands within an area known as the Dry Lake Valley North SEZ, located in Lincoln County in southeastern Nevada. The SEZ is about 15 mi (24 km) southwest of, and 15 mi (24 km) northwest of, the towns of Pioche and Caliente, respectively.

There are no documented occurrences of locatable mineral deposits within the Dry Lake Valley North SEZ. Most of the locatable minerals in the region occur in the surrounding mountains. The nearest occurrences of locatable minerals (manganese, silver, and arsenic) are in the carbonate rocks of the Ely Springs Range less than a mile to the east. Alluvial and basin-fill sediments below the SEZ are estimated to be at least 3-mi (5-km) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on geologic studies to date, is likely to be very deep if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Dry Lake Valley North SEZ is an area with a moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The SEZ is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are six authorized (and numerous closed) oil and gas leases within the Dry Lake Valley North SEZ. These leases occur mainly in the southwestern portion of the site and overlap the area designated as non-development for solar projects. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), about 70 mi (110 km) to the northwest of the site. The SEZ is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley, but there has been no commercial oil or gas production within or near the SEZ.

The Dry Lake Valley North SEZ is located in a region that is only marginally favorable for geothermal development, and the BLM (2007) reports that there are no known areas of established geothermal production in the Ely District. The nearest geothermal project (Caliente) occurs about 12 mi (19 km) to the southeast of the SEZ. There are no active or historical geothermal leases within the SEZ. The potential for geothermal development within the site is low (level of certainty B).

4.2 LANDS INVOLVED

The Dry Lake Valley North SEZ is located on BLM lands within the Ely District (Caliente Field Office), in Lincoln County. The site lies within T1N, R64E, sections 35 and 36; T1N, R65E, sections 31 and 32; T1N, R64S, sections 1, 12, 13, 21 to 28, and 33 to 36; T2S, R64E, sections 1 to 4, 10 to 15, and 23 to 25; T1S, R65E, sections 6 to 8, 17 to 20, and 29 to 32; and T2S, R65E, sections 5 to 8, 17 to 20, 29, and 30 (Mount Diablo Principal Meridian). Within this area, 3,657 acres (15 km2) of wetland and dry land have been identified as non-development areas (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 3). The full legal description of the SEZ is provided in Appendix A.

4.3 LAND STATUS

According to the LR2000, accessed on June 27, 2012, there are no active locatable mining claims within the Dry Lake Valley North SEZ and only one closed lode claim (in sections 7 and 8 in T2S, R65E) (BLM 2012a). The lands within the SEZ were segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198-23205).

There are currently no free use permits or mineral materials contracts within the SEZ (BLM 2012a). The site remains open for the disposal of saleable mineral materials.

There are six authorized (and numerous closed) oil and gas leases within the Dry Lake Valley North SEZ; these mainly cover the southwestern portion of the site and overlap the area designated as non-development for solar projects (see Section 4.2 and Map 3). There are no active or historical geothermal leases within the SEZ. The site remains open for discretionary leasing for oil and gas and other leasable minerals.

4.4 GEOLOGIC SETTING

The Dry Lake Valley North SEZ is located in Dry Lake Valley, a north-trending alluvial basin within the Basin and Range physiographic province in southern Nevada. The valley lies to the south of Muleshoe Valley, at the southern ends of the Schell Creek and Fairview Ranges. It extends southward about 40 mi (64 km), bounded by the North Pahroc Range to the west and the Bristol, Highland, and Burnt Springs Ranges to the east, and it ends at a series of low bedrock hills that also mark the southern end of the North Pahroc Range. Dry Lake Valley is one of many structural basins (grabens) typical of the Basin and Range province (Crafford 2007; Hunt 1974).

Exposed sediments in Dry Lake Valley consist mainly of modern alluvial and eolian deposits. Fan deposits along the valley margins are made up of poorly sorted gravel, gravelly sand, and sand. Playa lake sediments occur in the valley center to the north and south and cover about 10% of the SEZ. The surrounding mountains are composed mainly of Late Proterozoic and

Cambrian metamorphic rocks overlain by Paleozoic carbonate and shale and capped by late-Tertiary ash-flow tuffs from the Caliente caldera complex, one of a series of Tertiary caldera complexes in the region. The oldest rocks in the region are the Precambrian metamorphic rocks exposed in the Highland Range to the east and the Delamar Mountains to the southeast (Crafford 2007)

Semiconsolidated to unconsolidated basin-fill deposits are estimated to be about 3-mi (5-km) thick across most of Dry Lake Valley (Mankinen et al. 2008). Recent gravity studies describe the basin as a “slot-like” graben with the greatest depths (on the order of 3 to 4 mi [5 to 7 km]) occurring beneath the dry lake where valley elevations are lowest (Scheirer 2005).

The geology of the region near the Dry Lake Valley North SEZ is shown in Figure 6.

4.5 PHYSICAL FEATURES AND ACCESS

The Dry Lake Valley North SEZ is located in the northern part of Dry Lake Valley, between the North Pahroc Range to the west and the Bristol and Highland Ranges to the east. Its terrain slopes gently to the west. Elevations range from about 1,460 ft (445 m) along the site’s eastern boundary to less than 1,400 ft (427 m) along the eastern edge of Dry Lake.

The land around the SEZ is rural and undeveloped. There is a 600-acre (2-km^2) parcel of private land on its east side. State Route 318 provides access to the northern end of the SEZ via a 10-mi (16-km) connecting dirt road. U.S. 93 provides good access to the southern portion of the SEZ via a connecting dirt road. Numerous dirt roads cross the area to access livestock facilities; some of these roads cross the site.

4.6 SITE GEOLOGY

The Dry Lake Valley North SEZ is located in a closed basin; it partially overlaps a wetland remnant of a late Pleistocene pluvial lake to the southwest. Surface sediments within the SEZ consist mainly of Quaternary alluvium (map unit Qal; Figure 6), consisting of unconsolidated and slightly consolidated sand and gravelly sand (distal alluvial fan deposits). Finer-grained playa sediments (fine sand, silt, and clay) occur in the southwestern portion of the site at the location of the dry lake (map unit Qpl). There are no perennial surface water features within the site; however, ephemeral washes (Coyote Wash and Cherry Creek) flow from north to south through the SEZ to the dry lake (Crafford 2007; Stewart and Carlson 1978; Swadley 1995).

The site stratigraphy was inferred from lithologic logs for water wells within 7 mi (11 km) to the south of the site (in sections 12 and 27 of T3S, R64E) (NDWR 2012c). Unconsolidated sediments consist mainly of interbedded sands and gravel that extend to depths of at least 1,300 ft (400 m) (the total depth of the deepest well). Gravity studies indicate that basin-fill sediments are very deep in the valley (3 to 4 mi [5 to 7 km]); however, there are no deep wells in the region to confirm this estimate (Scheirer 2005).

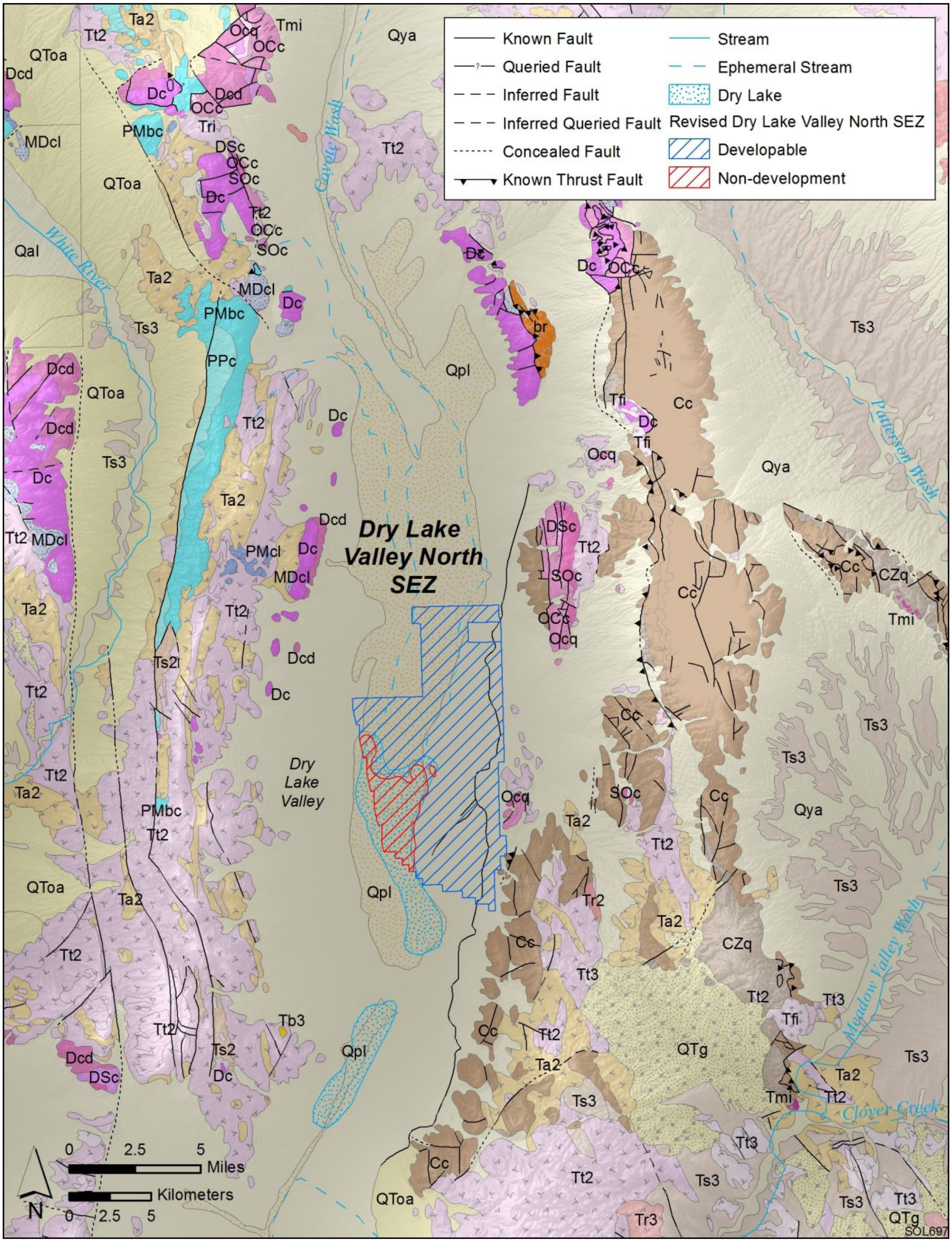

FIGURE 6 Geologic Map of the Dry Lake Valley North Region (Sources: Crafford 2007; Stewart and Carlson 1978)

Quaternary Sediments and Rocks

- Qal Alluvium, undifferentiated
- Qya Younger alluvium
- Qpl Playa, lake beds, and flood plain deposits

Quaternary and Pliocene Sediments and Rocks

- QTg Older gravels (Pleistocene and Pliocene)
- QToa Older alluvium and alluvial fan deposits (Pleistocene and Pliocene)

Tertiary and Upper Cretaceous(?) Rocks

- Ts3 Younger tuffaceous sedimentary rocks (Pliocene and Miocene)
- Tb3 Basalt (Miocene)
- Tt3 Younger silicic ash flow tuffs (Miocene)
- Tr3 Younger rhyolitic flows and shallow intrusive rocks (Miocene)
- Ts2 Older tuffaceous sedimentary rocks (lower Miocene and Oligocene)
- Ta2 Intermediate andesite and intermediate flows and breccias (lower Miocene and Oligocene)
- Tt2 Intermediate silicic ash flow tuff (lower Miocene and Oligocene)
- Tr2 Intermediate rhyolitic flows and shallow intrusive rocks (lower Miocene and Oligocene)
- Tmi Mafic phaneritic intrusive rocks (Miocene to middle Eocene)
- Tfi Felsic phaneritic intrusive rocks (Miocene to Eocene)
- Tri Rhyolite intrusive rocks with aphanitic groundmass (Miocene to middle Eocene)

Paleozoic Rocks

- PPc Limestone, dolomite, siltstone, sandstone, and shale (Lower Permian and Pennsylvanian)
- PMbc Bioclastic limestone (Pennsylvanian and Upper Mississippian)
- Dc Limestone and minor dolomite (Upper and Middle Devonian)
- Dcd Dolomite, sandstone, and limestone (Middle and Lower Devonian)
- DSc Dolomite (Lower Devonian and Silurian)
- SOc Dolomite, limestone, and shale (Lower Silurian to Middle Ordovician)
- Ocq Quartzite (Middle Ordovician)
- OCc Limestone, dolomite, and quartzite (Middle Ordovician to Upper Cambrian)
- Cc Dolomite, limestone, and shale (Cambrian)
- PMcl Shale, siltstone, sandstone, and conglomerate (Middle Pennsylvanian to Lower Mississippian)
- MDcl Siltstone, limestone, shale, and sandstone (Lower Mississippian and Upper Devonian)

Precambrian and Other Rocks

- CZq Crossbedded quartzite, siltstone, and phyllite (Lower Cambrian and latest Proterozoic)
- br Mixed breccias including volcanic, thrust, jasperoid, and landslide megabreccia (Tertiary to Jurassic)

SOL697

FIGURE 6 (Cont.)

4.7 MINERAL HISTORY

There has been no documented mining within the Dry Lake Valley North SEZ. Most of the mining activity in the region has been limited to small-scale mining of metallic and nonmetallic minerals in the Silverhorn, Bristol, Highland, Ely Springs, Comet, Pioche, and Chief Districts to the northeast, east, and southeast. The nearest active mine is the Tenacity Perlite Mine and Mill (Wilkin Mining and Trucking, Inc.), located south of Route 93 between Hiko and Caliente in Lincoln County (Davis and Hess 2010; Driesner and Coyner 2011).

No mineral exploration or development work is currently being conducted within the Dry Lake Valley North SEZ. Meadow Bay Capital Corp. is exploring the feasibility of expanding mining pits on a 1,200-acre (4.9-km^2) site known as the Atlanta Project, located about 50 mi (80 km) northeast of Pioche in Lincoln County (Meadow Bay Capital Corp. 2011). The property is an area of gold mineralization localized along brecciated fault zones (primarily the north–south trending Atlanta Fault). The mineral deposit is characterized as a low-sulfidation, epithermal fill and replacement of carbonate fault breccias. The project technical report estimates a total of 460,670 oz (13,060 kg) of gold and 2,040,120 oz (57,836 kg) of silver resources at the site (Meadow Bay Capital Corp. 2011).

Excalibur Resources Ltd. is exploring a group of 53 gold claims (called the Stinger Claims) in the Delamar District to the southeast of the SEZ. The claims are located on a brecciated quartz vein system in the Caliente Caldera Complex and overlie a north–northwest trending fault line that intersects another well-known gold mining operation. Alluvium covers the property to a depth of about 50 ft (15 m) (Excalibur Resources Ltd. 2011).

4.7.1 Locatable Minerals

Most of the locatable minerals produced in Lincoln County are hydrothermal, belonging to six major types (in decreasing order of production): (1) bedded replacement deposits in limestone, producing most of the zinc, lead, silver, and manganese in the county; (2) fissure veins and related silicified breccia deposits, producing most of the gold and much of the silver in the county; (3) irregular replacement deposits in limestone and dolomite, producing most of the copper and much of the silver, lead, zinc, and manganese in the county; (4) pyrometasomatic deposits (contact metamorphic rocks); (5) replacement veins, which are important sources of silver, lead, zinc, and copper; and (6) deposits in jasperoid, an important source of fluorspar and uranium (Tschanz and Pampeyan 1970).

There are no documented occurrences of locatable mineral deposits or prospects within the Dry Lake Valley North SEZ. Most of the locatable minerals in the region occur in the surrounding mountains. The nearest occurrences of locatable minerals (manganese, silver, and arsenic) are in the limestone and dolomite rocks (map unit Cc; Figure 6) of the Ely Springs Range less than a mile to the east. Occurrences of gold, silver, copper, iron, manganese, lead, and zinc are also abundant in the quartzite (map unit Czq) and limestone and dolomite (map unit Cc) rocks of the Highland Range farther to the east.

Mines and prospects in the vicinity are shown on the detailed map of the SEZ and surrounding region provided in the back of this report (Map 3). There are six mining districts in the vicinity of the Dry Lake Valley North SEZ. The mining districts and their mineral occurrences, based on Tingley (1998), are shown in Figure 7 and are as follows:

- Bristol (Bristol Range): silver, copper, lead, zinc, gold, manganese, and montmorillonite; about 10 mi (16 km) to the northeast;

- Highland (Highland Range): lead, silver, gold, copper, tungsten, manganese, and iron; about 8.2 mi (13 km) to the east;

- Ely Springs (Ely Springs Range): silver, zinc, lead, and gold; about 3.9 mi (6.3 km) to the east;

- Comet (Black Canyon Range): lead, silver, zinc, gold, copper, and tungsten; about 11 mi (18 km) to the east;

- Pioche (Pioche Hills): silver, lead, gold, copper, zinc, manganese, iron, arsenic, and vanadium; about 11 mi (18 km) to the east; and

- Chief (Chief Range): gold, silver, lead, copper, and vanadium; about 21 mi (34 km) to the southeast.

The Bristol District, located on the west side of the north end of the Bristol Range, was first prospected in the 1860s. Mineral deposits occur mainly as replacement deposits along fissure systems in Cambrian rocks (including the Pioche Shale and limestone of the Highland Peak Formation) (Tschanz and Pampeyan 1970). Past mines in the district (Lucky Star, Iron, Fortuna, Ida May, Hillside, Black Metal, OSL, Home Run, and Monarch) have produced copper, iron, lead, manganese, phosphorus-phosphates, silver, zinc, and bismuth. The Black Metal Mine also produced coal (a leasable mineral) (USGS 2011).

Mining in the Highland District (Highland Range) is linked to that in the Pioche District because of its close proximity. The district is underlain by Cambrian rocks that have been intruded by small stocks and dikes. Mineral deposits (lead, silver, and gold) occur as siliceous replacement veins and small bedded replacement deposits (Tschanz and Pampeyan 1970).

Mineral deposits in the Ely Springs District, located on the west side of the Ely Springs Range, occur in silicified brecciated fault zone in Upper Cambrian limestone. The principal mine in the district (Hedman) was established in 1943 and produced silver, gold, manganese, lead, tungsten, and zinc (Tschanz and Pampeyan 1970; USGS 2011).

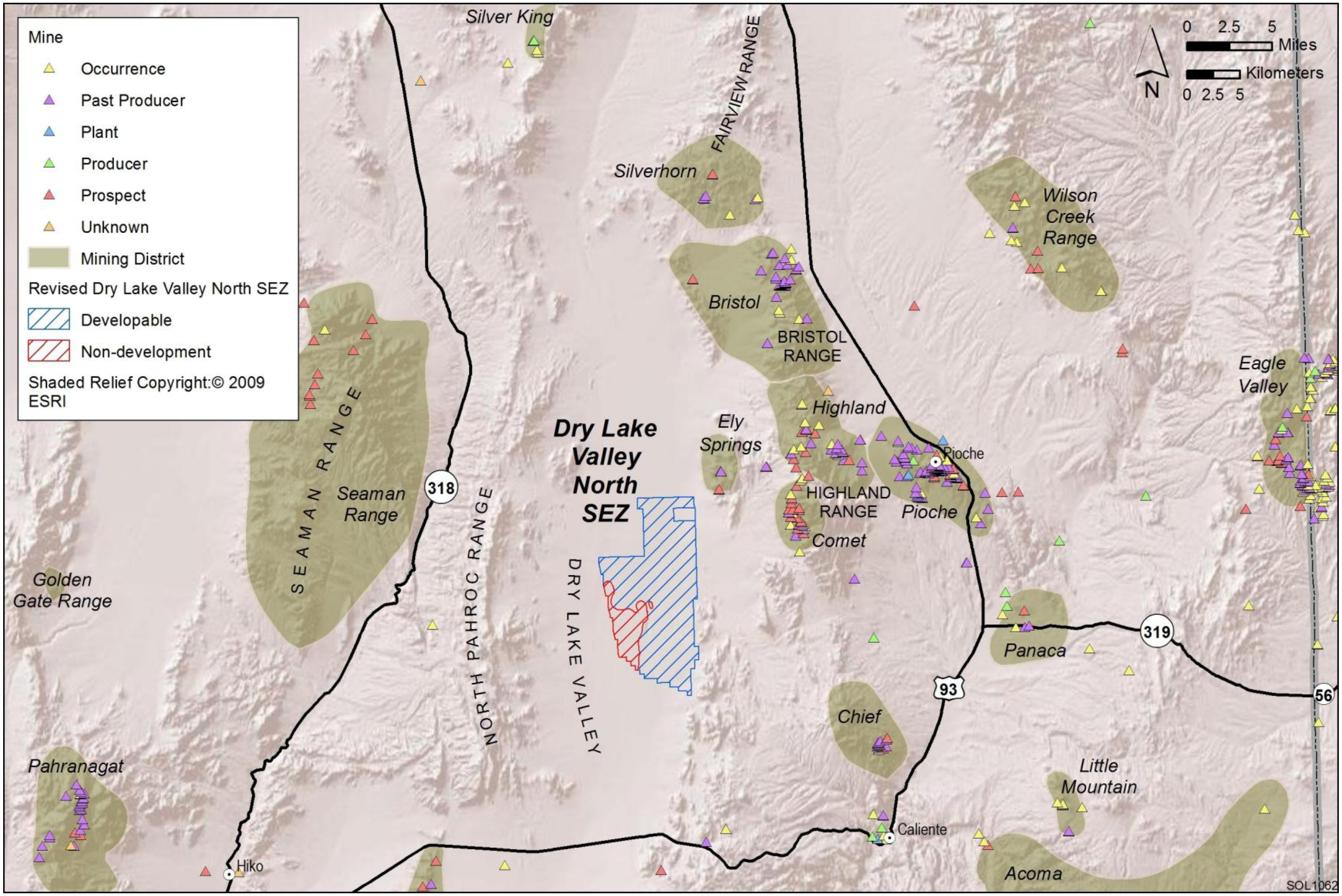

FIGURE 7 Map Showing Mining Districts, Mines, and Mineral Prospects near the Dry Lake Valley North SEZ (Sources: USGS 2011; Tingley 1998)

The Pioche District, located in the Pioche Hills, is considered to be the most important district in the county. Earliest production in the district dates back to 1869; it focused first on silver and silver-lead workings in quartzite, then on the large, low-grade manganese fluxing ores (Prince and Virginia Louise Mines), and finally on the bedded replacement zinc–lead–silver deposits in the Pioche Shale (with production in the latest period approaching $100 million). Mineral deposits in the district occur mainly in fissure veins (Prospect Mountain Quartzite) and in replacement deposits in limestone within and above the Pioche Shale (Tschanz and Pampeyan 1970). The only active mine in the district (Half Moon) produces lead, silver, gold, zinc, copper, arsenic, and tungsten (USGS 2011).

The Chief District, located on the eastern slope of the Chief Range, has been mined since the late 1860s. The Chief Range is composed largely of Prospect Mountain Quartzite, a productive unit, especially for gold. Mineral deposits (mainly gold, silver, and lead) occur in fissure veins in the quartzite or in breccia zones between quartzite and carbonate rocks (Tschanz and Pampeyan 1970). Past mines in the district (Gold Chief, Lucky Chief, Lucky Hobo, Old Democrat, Advance, Republic, and Contact) produced gold, silver, lead, iron, arsenic, antimony, manganese, barium-barite, copper, cadmium, zirconium, tin, and uranium (USGS 2011).

The Dry Lake Valley North SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mineral activity within the site. Most of the locatable minerals in the region occur in the surrounding mountains. The nearest occurrences of locatable minerals (manganese, silver, and arsenic) are in the carbonate rocks of the Ely Springs Range less than a mile to the east. Alluvial and basin-fill sediments below the SEZ are estimated to be at least 3-mi (5-km) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on geologic studies to date, is likely to be very deep if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

4.7.2 Saleable Mineral Materials

Saleable mineral materials in the Dry Lake Valley North region are mainly limited to sand and gravel, which is mined intermittently from several borrow pits along the base of the Ely Springs Range and the Burnt Springs Range to the east of the site. The Dry Lake Valley North SEZ is an area with a moderate potential for the occurrence of sand, gravel, and clay (level of certainty A).The SEZ is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. According to the LR2000, accessed on June 27, 2012, there currently are no free use permits or mineral materials contracts within the site boundaries (BLM 2012a).

4.7.3 Leasable Minerals

There are six authorized (and numerous closed) oil and gas leases within the Dry Lake Valley North SEZ (BLM 2012a). These leases occur mainly in the southwestern portion of the site and overlap the area designated as non-development for solar projects. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), about 70 mi (km) to the northwest of the SEZ (BLM 2012b). Lincoln County is also located in the Eastern Great Basin Oil and Gas Province. The province is considered prospective for hydrocarbons because source rocks and traps are known to occur, as demonstrated by the oil fields in the Railroad Valley (BLM 2012b), but there has been no commercial oil or gas production within or near the SEZ (BLM 2012a; BLM 2007).

The Dry Lake Valley North SEZ is located in a region that is only marginally favorable for geothermal development (Coolbaugh et al. 2005), and the BLM (2007) reports that there are no known areas of established geothermal production in the Ely District. The nearest geothermal project (Caliente) occurs about 12 mi (19 km) to the southeast of the SEZ; see the NBMG project list for a full roster of geothermal projects in Nevada (NBMG 2012). There are no active or historical geothermal leases within the Dry Lake SEZ (BLM 2012a). The Dry Lake SEZ is an area with low potential for geothermal development (level of certainty B).

There are no known economic deposits of solid leasable minerals—coal, oil shale, phosphate, or sodium—and there are no active leases for these resources in the Ely District (BLM 2007).

5 GOLD POINT SEZ

5.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 4,810 acres (19.5 km^2) of public lands within an area known as the Gold Point SEZ, located in Esmeralda County in southwestern Nevada. The nearest residences are in Gold Point, a well-preserved ghost town and point of interest for tourists about 2 mi (3.2 km) south of the SEZ.

There are no documented occurrences of locatable mineral deposits within the Gold Point SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals (silver and gold) are in the Gold Point District (along Slate Ridge), a few miles to the south of the site. Mineral deposits in this area are associated with intrusive bodies within the Precambrian Wyman Formation. Alluvial sediments below the SEZ are estimated to be about 500 ft (152 m) deep (based on a gravity survey); however, the underlying geologic units have not been characterized. Therefore, the potential for locatable minerals to occur within the SEZ is not determined (level of certainty A).

The Gold Point SEZ is an area with moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The site is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. There currently are no free use permits or mineral materials contracts within the site boundaries.

There are no active or historical oil and gas leases within the Gold Point SEZ. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province, where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as Lida Valley, to be conceptually prospective for hydrocarbons. There has been no oil and gas exploration activity within the site.

The Gold Point SEZ is located in the Battle Mountain District, an area of high geothermal potential. The BLM forecasts that geothermal resource exploration and development in the district will increase in the coming years. While there are no active geothermal leases within the SEZ, current geothermal exploration projects in the region are numerous. The potential for geothermal development within the site is high (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high. There are no playas/marshes located within the Gold Point SEZ; however, the presence of playa-related deposits at depth is unknown. The potential for salt production within the site is low (level of certainty A). There are no active or historical leases for this commodity within the SEZ.

5.2 LANDS INVOLVED

The Gold Point SEZ is located on BLM lands within the Battle Mountain District (Tonopah Field Office), in Esmeralda County. The site lies within T6S, R41E, sections 13, 14, and 23 to 26, and T6S, R41½E, sections 13 to 16, 21 to 23, and 26 to 28 (Mount Diablo Principal Meridian). Within this area, 214 acres (0.87 km^2) of a significant unnamed intermittent stream passing east–west through the center of the SEZ have been identified as non-development areas (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 4). The full legal description of the SEZ is provided in Appendix A.

5.3 LAND STATUS

According to the LR2000, accessed on June 26, 2012, there are no active locatable mining claims within the Gold Point SEZ; however, there are numerous closed lode and placer claims within and immediately adjacent to the site (BLM 2012a). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198–23205).

There are currently no free use permits or mineral materials contracts within the SEZ (BLM 2012a). The site remains open for the disposal of saleable mineral materials.

There are no active or historical oil and gas or geothermal leases within the SEZ. The site remains open for discretionary leasing for oil and gas and other leasable minerals.

5.4 GEOLOGIC SETTING

The Gold Point SEZ is located in the southern part of Lida Valley, a closed alluvial basin within the Basin and Range physiographic province in southern Nevada. The southern part of the valley lies between the Mount Jackson Ridge and Cuprite Hills to the north and Slate Ridge to the south. It is bounded on the west by the Palmetto Mountains and on the east by Stonewall Mountain (Hunt 1974).

Exposed sediments within and adjacent to the SEZ consist mainly of modern alluvial, eolian, and playa deposits. Exposures in the surrounding mountains are predominantly Jurassic age felsic intrusive rocks (diorite and granite), especially along Slate Ridge south and southwest of the SEZ. Paleozoic and Precambrian metamorphic rocks are exposed in the Palmetto Mountains and along Slate Ridge (Crafford 2007; Stewart and Carlson 1978).

Basin fill consists of Quaternary and Tertiary alluvial fan and playa deposits of variable thickness and induration. Recent gravity surveys in southern Lida Valley indicate that basin-fill sediments are about 500 ft (150 m) near the SEZ, increasing to more than 1,900 ft (600 m) near the alkali flat, about 8.5 mi (14 km) to the northeast of the site (Hasbrouck 2010a,b).

The geology of the Lida Valley region near the Gold Point SEZ is shown in Figure 8.

5.5 PHYSICAL FEATURES AND ACCESS

The Gold Point SEZ is located in the southern part of Lida Valley. Its terrain gently slopes to the northeast. Elevations range from about 5,040 ft (1,535 m) along the southwestern boundary to about 4,840 ft (1,475 m) at its northeastern corner. Jackson Wash flows to the northeast through the center of the site.

The SEZ is remote but accessible via U.S. 95. State Route 774 is within 0.25 mi (0.4 km) of the site's eastern boundary. Its overall character is rural and undeveloped, with only a few dirt roads present.

5.6 SITE GEOLOGY

Surface sediments at the Gold Point SEZ consist predominantly of Quaternary alluvium (map unit Qal; Figure 8) (Crafford 2007; Stewart and Carlson 1978; Albers and Stewart 1972). The depth of these sediments below the site is estimated to be about 500 ft (150 m), based a gravity survey conducted to the west and northwest of the SEZ (Hasbrouck 2010a). The underlying geologic units, however, have not been characterized. (There were no wells/well logs for the region in the NBMG oil and gas well database or the Nevada Division of Water Resources well log database, and few wells have been drilled in Esmeralda County [Hess et al. 2011]). There are no perennial surface water features within the SEZ; an unnamed ephemeral stream crosses the site in northeasterly direction, converging with Jackson Wash about 1.5 mi (2.4 km) east of the site (Figure 8). Jackson Wash originates in the Montezuma Range in the northern part of Lida Valley and enters southern Lida Valley through the pass between Mount Jackson and Mount Jackson Ridge.

5.7 MINERAL HISTORY

There has been no documented mining within the Gold Point. Most of the mining activity in the region has been limited to small-scale mining of metals and nonmetals in the Lida and Cuprite Districts to the north, the Tule Canyon District to the west, and the Gold Point District to the south. Cook Mill, a gold mine and processing plant (active in the 1980s), is located a few miles to the south (USGS 2011). The mill was a small experimental operation that did not produce any gold (Buehler 2011).

No mineral exploration or development work is currently being conducted within the SEZ. First Liberty Power Corp. (2011) reports that it completed its exploration program for a lithium brine prospect on a 12,800-acre (52-km2) site in Lida Valley, about 7.0 mi (11 km) to the northeast of the site; however, this activity could not be confirmed based on Notice to Drill records (Buehler 2011). Montezuma Peak is thought to be the source of the region's lithium.

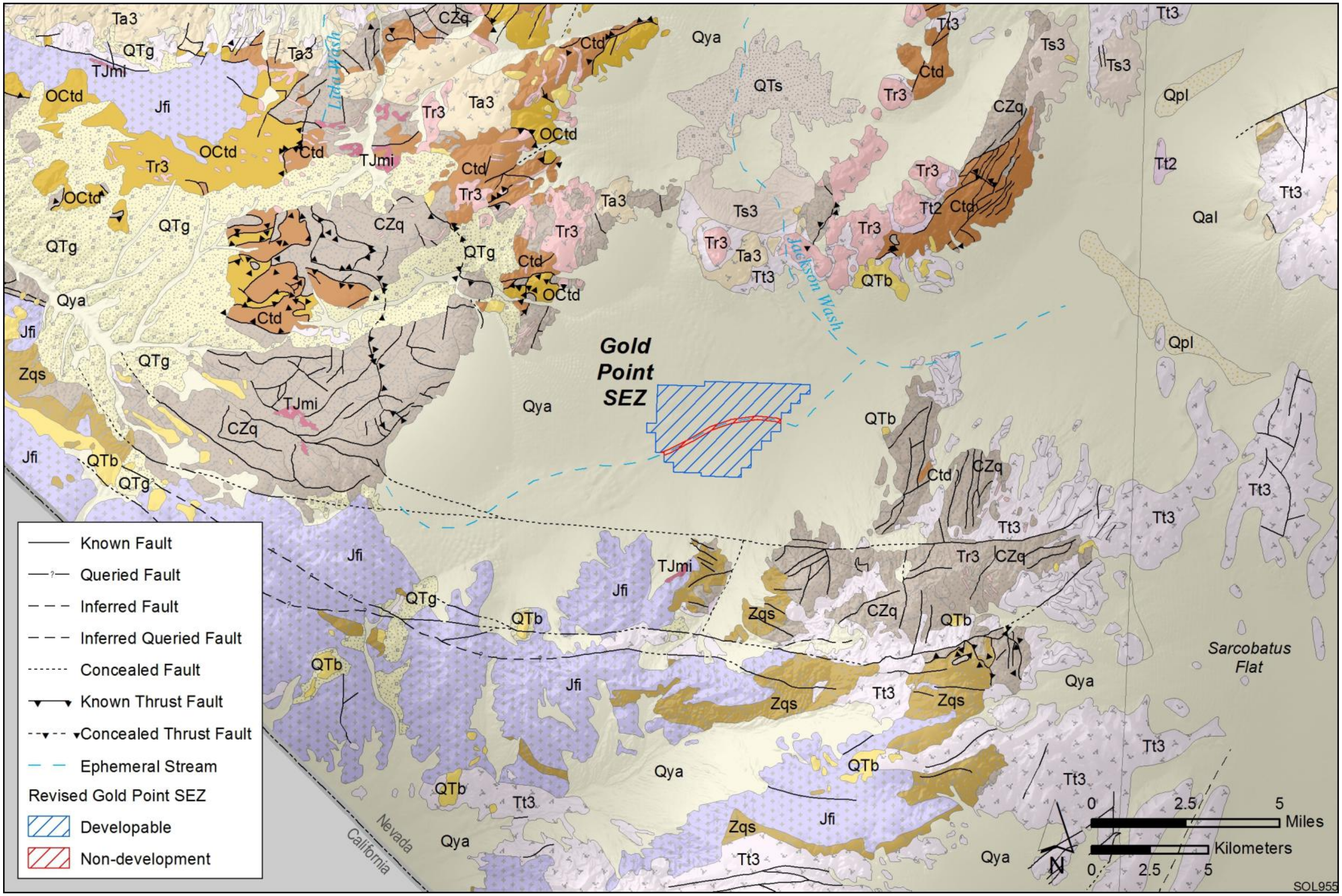

FIGURE 8 Geologic Map of the Gold Point SEZ in Southern Lida Valley (Sources: Crafford 2007; Stewart and Carlson 1978)

Quaternary Sediments and Rocks

- Qal Alluvium, undifferentiated
- Qya Younger alluvium
- Qpl Playa, lake beds, and flood plain deposits

Quaternary and Pliocene Sediments and Rocks

- QTg Older gravels (Pleistocene and Pliocene)
- QTs Tuffaceous limestone, siltstone, sandstone, and conglomerate (Holocene to Pliocene)
- QTb Basalt flows (Holocene to Pliocene)

Tertiary Rocks

- Ts3 Younger tuffaceous sedimentary rocks (Pliocene and Miocene)
- Ta3 Younger andesite and intermediate flows and breccias (Miocene)
- Tt3 Younger silicic ash flow tuffs (Miocene)
- Tr3 Younger rhyolitic flows and shallow intrusive rocks (Miocene)
- Tt2 Intermediate silicic ash flow tuff (lower Miocene and Oligocene)

Miocene(?) to Jurassic(?) Intrusive Rocks

- TJmi Mafic phaneritic intrusive rocks (Miocene(?) to Jurassic(?))

Mesozoic Intrusive and Volcanic Rocks

- Jfi Felsic phaneritic intrusive rocks (Jurassic)

Paleozoic Rocks

- OCtd Shale, chert, phyllite, quartzite, and limestone (Ordovician to Cambrian)
- Ctd Phyliite, schist, shale, thin-bedded limestone, chert, and siltstone (Cambrian)

Precambrian and Other Rocks

- CZq Crossbedded quartzite, siltstone, and phyllite (Lower Cambrian and latest Proterozoic)
- Zqs Quartzite, siltstone, conglomerate, limestone, and dolomite (Late Proterozoic)

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FIGURE 8 (Cont.)

Muntean (2011) reports increased exploration activities for gold in several mining districts in Esmeralda County: Hasbrouck Mountain project, Allied Nevada Gold Corp. (Divide District); Tonopah Divide project, Centerra Gold Corp. (Divide District); Castle Peak project, Kinross Gold Corp. (Gilbert District); Gold Summit project, Gold Summit Corp. (Gilbert District); Goldfield project, International Minerals Corp. (Goldfield District); Goldfield West project, TAC Gold Corp. (Goldfield District); Oasis project, Centerra Inc. (Palmetto District); and Mineral Ridge, Scorpio Gold Corp. (Silver Peak District). All these activities are some distance from the SEZ. Several small companies (e.g., Infrastructure Materials Corp. [2011]) are also conducting exploration work in the county (Buehler 2011).

Active mines in Esmeralda County include the Basalt Mine and Mill (diatomite), the Silver Peak Operations (lithium compounds), the Lone Mountain Mine (turquoise), and the Royal Blue Turquoise Mine (Davis and Hess 2010; Driesner and Coyner 2011). Another (historical) mine, Mineral Ridge (located partially on BLM-administered land in the Silver Peak Range about 30 mi [48 km] to the north–northeast), is temporarily inactive, but exploration for gold is planned in the near term (Buehler 2011; BLM 2011).

5.7.1 Locatable Minerals

Most of the locatable minerals produced in the Battle Mountain District (including Esmeralda County) are associated with intrusive centers. Important resources include copper, gold, silver, and lead. These resources are found in pluton-related deposits (skarns and porphyrys), polymetallic vein and replacement deposits, sediment-hosted disseminated (Carlin-type) deposits, and some types of epithermal gold-silver deposits (BLM 2012b; Ludington et al. 2009).

There are no documented occurrences of locatable mineral deposits or prospects within the Gold Point SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals (silver and gold) are associated with Slate Ridge, just south of the town of Gold Point and less than 2 mi (3.2 km) south of the SEZ (Buehler 2011). The Washington–Nevada Claims (copper, silver, and gold) are located about 5.7 mi (9.2 km) to the west (USGS 2011).

Mines and prospects in the vicinity are shown on the detailed map of the SEZ and surrounding region provided in the back of this report (Map 4). There are four mining districts in the vicinity of the Gold Point SEZ. Some of the minerals produced in these districts (turquoise and sulfur) are not classified as locatable minerals. The mining districts and their mineral occurrences, based on Tingley (1998), are shown in Figure 9 and are as follows:

- Lida: silver, lead, gold, copper, and turquoise; about 6.0 mi (9.7 km) to the northwest;

- Cuprite: copper, gold, silver, lead, mercury, silica, and sulfur; about 4.5 mi (7.2 km) to the north;

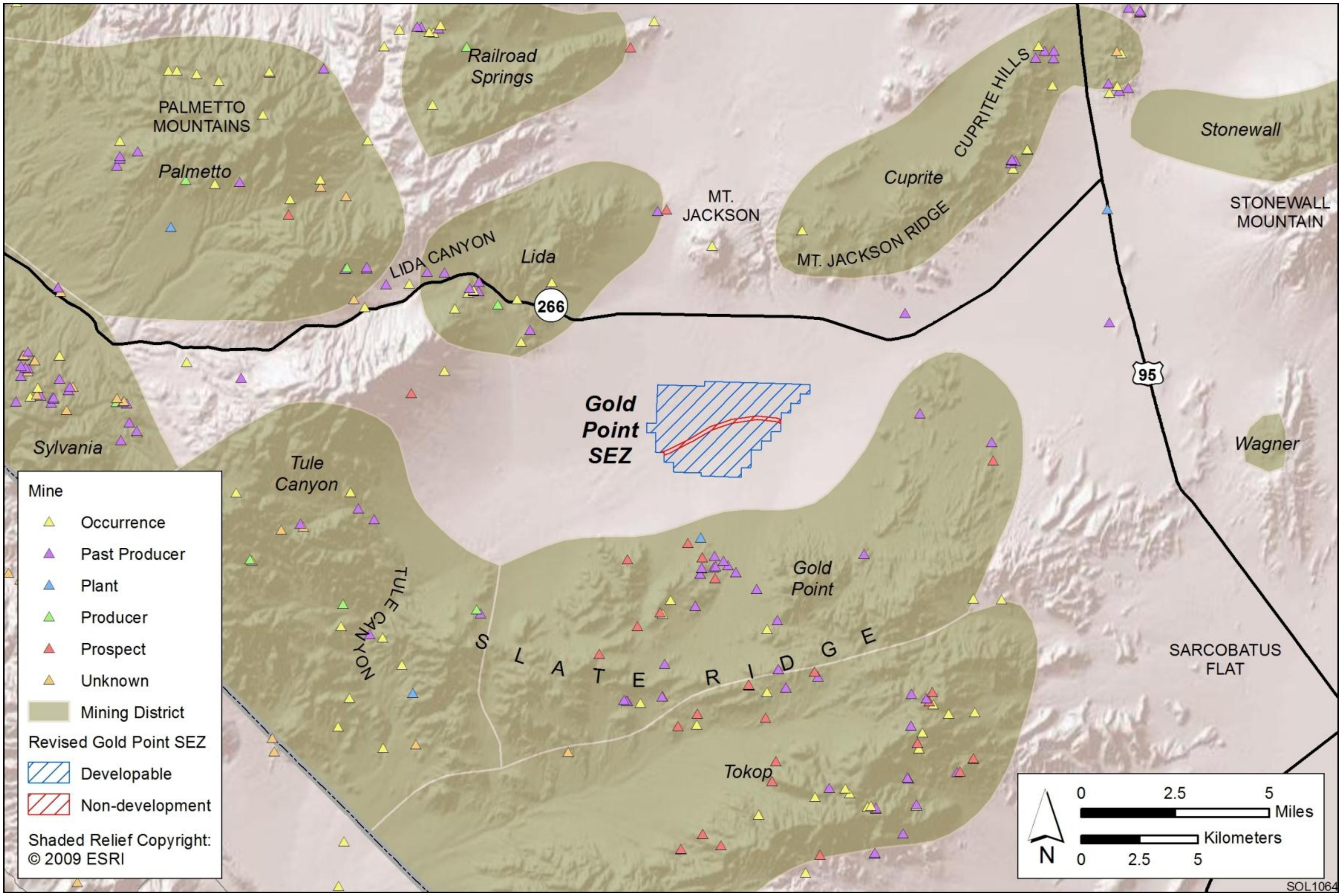

FIGURE 9 Map Showing Mining Districts, Mines, and Mineral Prospects near the Gold Point SEZ (Sources: USGS 2011; Tingley 1998)

- Tule Canyon: gold, silver, molybdenum, and uranium; about 10 mi (16 km) to the southwest; and

- Gold Point: gold, silver, lead, zinc, copper, tungsten, and uranium; about 4.0 mi (6.4 km) to the south.

Early mines in the Lida District were located mainly at the base of the Palmetto Mountains, to the north and south of Lida Canyon, with more recent activity centered around Mount Jackson. Mineral occurrences in the district are concentrated in quartz and calcite veins in limestone units of the Cambrian age Deep Spring, Poleta, and Harkless Formations. Exploratory drilling in the 1970s failed to verify the presence of porphyry-type copper mineralization (Smith and Tingley 1983). Past mines in the district (Gold and Silver Bell Mine, Wisconsin Mine, Wisconsin Claims, Death Valley Mine, Lida and Nancy Ann Claims, and Brown Hope Group) have produced gold, silver, copper, lead, and zinc. The Florida Mine produced gold and silver (USGS 2011) but is not currently active (Buehler 2011).

Production in the Cuprite District, located near Route 95 and encompassing the eastern part of Mount Jackson Ridge and the southern part of Goldfield Hills, has been historically very small. Mineralization occurs as a result of acid-sulfate alteration that has changed Cambrian siltstones and Tertiary volcanic and volcaniclastic sedimentary rocks to silicified, opalized, and argillized rocks. Minerals related to this type of alteration include minor amounts of silica, sulfur, and clay; there is a high potential for discoveries of silica and a low to moderate potential for discoveries of gold and mercury. Older mineralization (likely Mesozoic age) consists of base-metal veins (copper, lead) with minor silver content in unaltered to locally hornfelsic Cambrian siltstones. The mining district has been inactive since the 1960s; however, a 2,965-acre (12-km^2) area of hydrothermally altered Tertiary rocks (tuffs, conglomerates, and basalt flows) was evaluated in the late 1970s for its potential for precious metals (Abrams et al. 1977; Ashley and Abrams 1980; Smith and Tingley 1983).

Placer gold was discovered in Tule Canyon in 1876, and minor lode operations have occurred along the east and west sides of the canyon. The Tule Canyon District cuts through the Jurassic Sylvania pluton—a quartz monzonite intrusive body cut with massive quartz veins and alaskite dikes. Pyrite, chalcopyrite, galena, and tetrahedrite occur locally in veins and stringers (Smith and Tingley 1983). Past mines in the district (Los Angeles Rock and Gravel Corp., Ray White Placer Claims, and Tule Canyon Placers) have produced gold, tungsten, fluorite, and uranium. Although the USGS (2011) reports that the Tule Canyon Placers and Nevada Talc Mine produced fluorite, gold, tungsten, and talc at one time, the only commodity confirmed was gold from the placer mine (Buehler 2011).

The Gold Point District, located along Slate Ridge to the south of the SEZ, produced gold, silver, copper, lead, and zinc intermittently at least up through the early 1980s. The host rock is the Precambrian Wyman Formation, consisting of interbedded silt, claystone, and limestone metamorphosed to shale, phyllite, calc-silicate, and marble. The Jurassic Sylvania pluton intrudes the Wyman Formation; both units are faulted, sheared, and cut by fine-grained diorite dikes and ore-bearing quartz veins. The Gold Point deposits consist of silver (cerargyrite) with minor amounts of native gold, galena, and cerussite (Smith and Tingley 1983). The Slate Range Mine, located about 4 mi (6.4 km) to the east of the SEZ, produced mercury.

The Gold Point SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals (silver and gold) are in the Gold Point District (along Slate Ridge), a few miles to the south of the site. Mineral deposits in this area are associated with intrusive bodies within the Precambrian Wyman Formation. Alluvial sediments below the SEZ are estimated to be about 500 ft (152 m) deep (based on a gravity survey); however, the underlying geologic units have not been characterized. Therefore, the potential for locatable minerals to occur within the SEZ is not determined (level of certainty A).

5.7.2 Saleable Mineral Materials

There is little if any current mining of saleable mineral materials in the part of Lida Valley near the Gold Point SEZ; however, the BLM (2012b) forecasts that the demand for aggregate, sand, and gravel will increase in the Battle Mountain District, especially along the I-80 corridor (about 2 hours north of Tonopah). The SEZ is an area with moderate potential for the occurrence of sand, gravel, and clay (level of certainty A). The site is underlain by alluvial, eolian, and playa deposits, which are potential sources of clay, sand, and gravel materials; however, the quality of these sediments has not been characterized. According to the LR2000, accessed on June 26, 2012, there currently are no free use permits or mineral materials contracts within the site boundaries (BLM 2012a).

5.7.3 Leasable Minerals

There are no active or historical oil and gas leases within the Gold Point SEZ (BLM 2012a). Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), about 130 mi (209 km) to the northeast of the SEZ; there are no producing fields in Esmeralda County (BLM 2012b). Esmeralda County lies within the Western Great Basin Oil and Gas Province, where carbonate rocks of Triassic age in west–central Nevada (northwest of the Gold Point SEZ) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as Lida Valley, to be conceptually prospective for hydrocarbons (Barker et al. 1995). A search of the NBMG’s Oil and Gas Web site (Hess et al. 2011) could find no evidence of test wells drilled near the SEZ.

The Battle Mountain District is an area of high geothermal potential, and BLM forecasts that geothermal resource exploration and development will increase in the coming years (BLM and EERE 2003; BLM 2012b). Although known geothermal areas, hot springs, and existing geothermal lease (and lease application) areas have the highest potential for future use, there are extensive areas of high potential in the planning area that have yet to be explored. According to the LR2000, accessed on June 26, 2012, there are no active geothermal leases within the Gold Point SEZ (BLM 2012a). Current geothermal exploration projects in the region are numerous, especially in the areas to the north and northwest of the SEZ (e.g., in Clayton Valley); see the NBMG project list for a full roster of geothermal projects in Nevada (NBMG 2012). The nearest nominated lands for are located in T3S, 39E about 20 mi (32 km) to the northwest (BLM 2012a). The Gold Point SEZ is an area with high potential for geothermal development (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high (BLM 2012b). There are no playas/marshes located within the Gold Point SEZ; however, the presence of playa-related deposits at depth is unknown. The potential for salt production within the site is low (level of certainty A). There are no active or historical leases for this commodity within the SEZ (BLM 2012a).

6 MILLERS SEZ

6.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 16,787 acres (67.9 km^2) of public lands within an area known as the Millers SEZ, located in Esmeralda County in southwestern Nevada. The SEZ is about 15 mi (24 km) northwest of Tonopah.

There are no documented occurrences of locatable mineral deposits within the Millers SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals in the region (copper, lead, silver, and uranium) are in quartz veins cutting granitic intrusive rock, in the Crow Springs District, a few miles to the northwest. Alluvial and basin-fill sediments below the SEZ are estimated to be about 2,300 ft (700 m) deep (based on logs of a deep boring about 7 mi [11 km] southwest of the site). Carbonates and granites (and associated mineralization) occur at approximate depths of 2,300 ft (700 m) and 4,700 ft (1,430 m) below the site, respectively. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Millers SEZ is an area with high potential for the occurrence of sand and gravel (level of certainty B) and a moderate potential for the occurrence of clay (level of certainty A). The site is underlain by alluvial and lacustrine deposits, which are potential sources of clay, sand, and gravel materials. The current mining of saleable mineral deposits (sand and gravel) at one authorized FHWA site that overlaps a small portion of the southern site boundary (and several others in close proximity) indicates that future extraction of such resources within the SEZ is viable.

There are no active oil and gas leases within the Millers SEZ; a good portion of the land within the site was leased in the past, but these leases were closed in 2000 and 2001. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in Nye, Eureka, and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). The SEZ is located within the Western Great Basin Oil and Gas Province, where carbonate rocks of Triassic age in west–central Nevada (northwest of the site) have demonstrated hydrocarbon potential; however, there has been no exploration within the site. The hypothetical plays in this province consider deep sediment-filled basins, such as the Big Smoky Valley, to be conceptually prospective for hydrocarbons. An exploratory well drilled to the southwest of the SEZ in 1997 encountered older (Ordovician) sedimentary rocks between depths of 2,288 and 4,704 ft (697 to 1,434 m) with no oil shows.

The Millers SEZ is located in the Battle Mountain District, an area of high geothermal potential. The BLM forecasts that geothermal resource exploration and development in the district will increase in the coming years. Although there are no active geothermal leases within the SEZ, current geothermal exploration projects in the region are numerous and public lands nominated for geothermal sale occur immediately south of the site (overlapping a portion of it). The potential for geothermal development within the site is high (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high. Playa-related sediments occur within the SEZ; however, the quality of these deposits has not been characterized. The potential for salt production within the site is moderate (level of certainty A). There are no active or historical leases for this commodity within the SEZ.

6.2 LANDS INVOLVED

The Millers SEZ is located on BLM lands within the Battle Mountain District (Tonopah Field Office), in Esmeralda County. The site lies within T3N, R39E, sections 1, 2, 11 and 12; T4N, R39E, section 36; T3N, R40E, sections 4 to 6; and T4N, R40E, sections 10 to 35 (Mount Diablo Principal Meridian). Within this area, the Ione Wash and a small wetland area in the southern portion of the SEZ, totaling 253 acres (1.0 km^2), have been identified as non-development areas (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 5). The full legal description of the SEZ is provided in Appendix A.

6.3 LAND STATUS

According to the LR2000, accessed on June 27, 2012, there are no active locatable mining claims within the Millers SEZ; however, there are numerous closed lode and placer claims within and immediately adjacent to the site (BLM 2012a). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198-23205).

There is one authorized FWHA material site that overlaps a small portion of the SEZ along its southern boundary (in section 5 of T30N, R40E) (BLM 2012a). The site remains open for the disposal of saleable mineral materials.

There are no active oil and gas leases within the SEZ; however, a good portion of the site was leased for oil and gas in the past (nine oil and gas leases covered most of the site but were closed in 2000 and 2001). There are no active or historical geothermal leases within the SEZ. The site remains open for discretionary leasing for oil and gas and other leasable minerals.

6.4 GEOLOGIC SETTING

The Millers SEZ is located in the Big Smoky Valley, a north-trending alluvial basin within the Basin and Range physiographic province in south–-central Nevada. In the Millers SEZ region, the valley is bounded on the northwest by the Monte Cristo Range and the Royston Hills and on the east by the San Antonio Mountains; Lone Mountain lies to the south. The Big Smoky

Valley is one of many structural basins (grabens) typical of the Basin and Range province (Meinzer 1917; Hunt 1974).

Exposed sediments in the Big Smoky Valley consist mainly of modern alluvial and playa sediments. Alluvial sediments at the Millers SEZ cover or partially cover lacustrine deposits associated with Lake Tonopah, an ancient lake that covered the valley during the Pleistocene. These fine-grained sediments—sandy silts, silts, sandy clays, and clays—are found in the valley center and are abundant within the SEZ. Sand dunes and dune complexes also occur throughout the valley; the Crescent Dunes are located about 6 mi (10 km) to the northwest of the SEZ. In the surrounding mountains, exposures are predominantly Tertiary volcanics. The oldest rocks in the region are the Late Proterozoic to Cambrian metamorphic rocks that occur in Lone Mountain to the south. These rocks have been intruded by Mesozoic granites and granodiorites (Crafford 2007; Stewart and Carlson 1978).

Semiconsolidated to unconsolidated basin-fill deposits are estimated to be about 5,000-ft (1,530-m) thick in the northern part of the Big Smoky Valley (Handman and Kilroy 1997); a well log from an exploratory oil well drilled about 7 mi (11 km) to the southwest of the SEZ shows basin-fill deposits to be about 2,300-ft (700-m) thick (Hess et al. 2011).

The geology of the Big Smoky Valley region near the Millers SEZ is shown in Figure 10.

6.5 PHYSICAL FEATURES AND ACCESS

The Millers SEZ lies in the southern part of the Big Smoky Valley, between the Monte Cristo Range and Royston Hills to the northwest, the Lone Mountain to the south, and the San Antonio Mountains to the east. Its terrain is relatively flat, with elevations ranging from about 4,850 ft (1,480 m) along the northern border to 4,780 ft (1,460 m) near the southwest end. Several drainages enter the SEZ from the north and drain to a large playa southwest of the site. A series of unnamed sand dunes occupy the northeast corner of the site.

The land around the SEZ is rural and undeveloped. Numerous dirt roads cross the SEZ. The old town site of Millers is located just south of the SEZ, and there is land disturbance all around the SEZ associated with road and power line construction, mining, and development of the town site. U.S. 6/U.S. 95 runs parallel to the southern boundary of the SEZ and provides good access to the site. There is a highway rest stop just south of the site's southeastern corner.

6.6 SITE GEOLOGY

Surface sediments within the Millers SEZ consist predominantly of Quaternary alluvium (map unit Qal; Figure 10) (Crafford 2007; Stewart and Carlson 1978; Albers and Stewart 1972). Playa lake/alluvial flats deposits (map unit Qpl) associated with Pleistocene Lake Tonopah occur to the southwest of the site. There are no perennial surface water features within the SEZ; three ephemeral streams form braided stream channels and flow from north to south across the site (Figure 10).

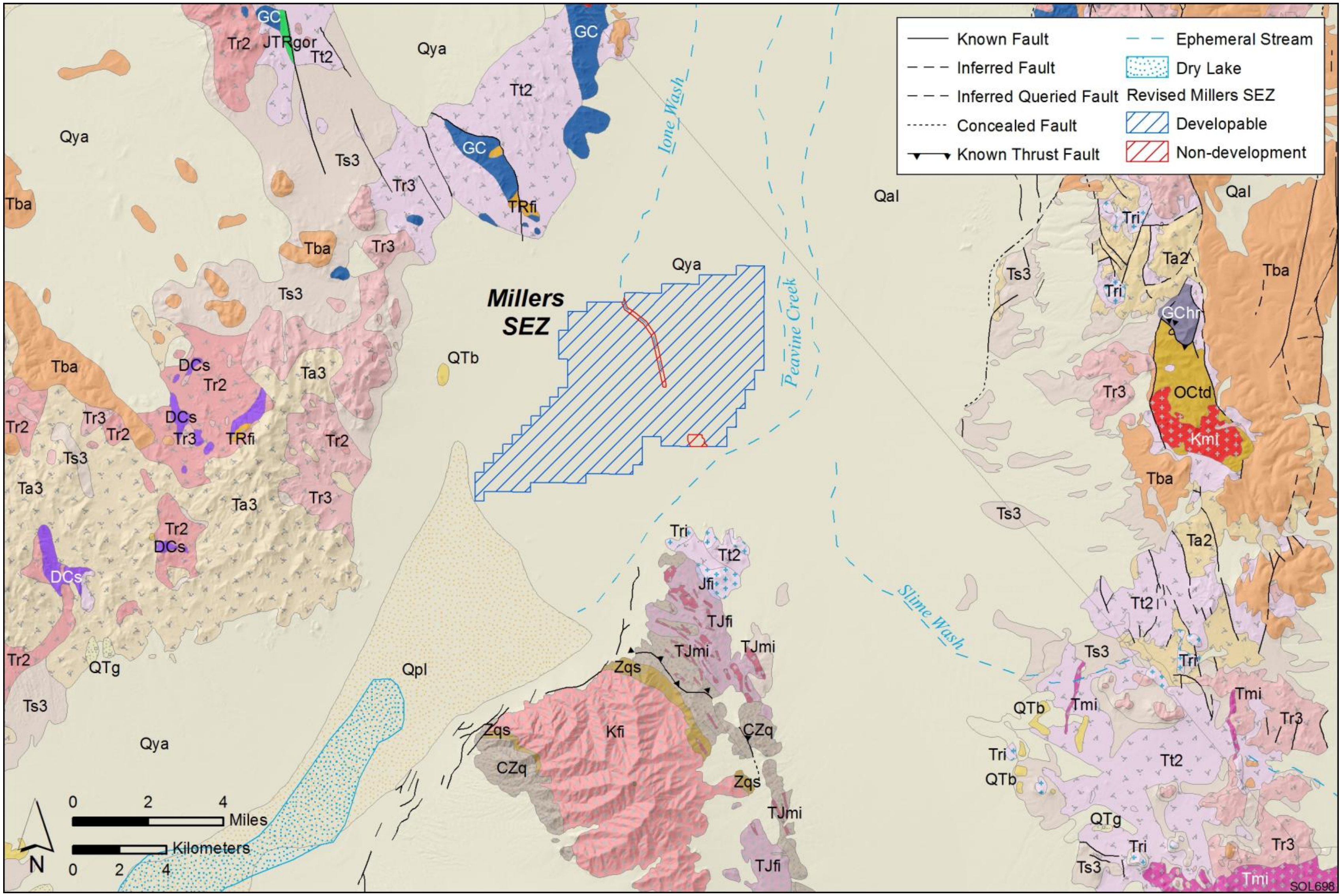

FIGURE 10 Geologic Map of the Millers SEZ in the Big Smoky Valley (Sources: Crafford 2007; Stewart and Carlson 1978; Soller et al. 2009)

Quaternary Sediments and Rocks

- Qal Alluvium, undifferentiated
- Qya Younger alluvium
- Qpl Playa, lake beds, and flood plain deposits

Quaternary and Pliocene Sediments and Rocks

- QTg Older gravels (Pleistocene and Pliocene)
- QTb Basalt flows (Holocene to Pliocene)

Tertiary Rocks

- Tba Andesite and basalt flows (Miocene and Oligocene)
- Ts3 Younger tuffaceous sedimentary rocks (Pliocene and Miocene)
- Ta3 Younger andesite and intermediate flows and breccias (Miocene)
- Tr3 Younger rhyolitic flows and shallow intrusive rocks (Miocene)
- Ta2 Intermediate andesite and intermediate flows and breccias (lower Miocene and Oligocene)
- Tt2 Intermediate silicic ash flow tuff (lower Miocene and Oligocene)
- Tr2 Intermediate rhyolitic flows and shallow intrusive rocks (lower Miocene and Oligocene)
- Tmi Mafic phaneritic intrusive rocks (Miocene to middle Eocene)
- Tri Rhyolite intrusive rocks with aphanitic groundmass (Miocene to middle Eocene)

Miocene(?) to Jurassic(?) Intrusive Rocks

- TJmi Mafic phaneritic intrusive rocks (Miocene(?) to Jurassic(?))
- TJfi Felsic phaneritic intrusive rocks (Miocene(?) to Jurassic (?))

Mesozoic Intrusive and Volcanic Rocks

- Kmi Mafic phaneritic intrusive rocks (Cretaceous)
- Kfi Felsic phaneritic intrusive rocks (Cretaceous)
- Jfi Felsic phaneritic intrusive rocks (Jurassic)
- TRfi Felsic phaneritic intrusive rocks (Triassic)

Mesozoic Terranes, Sedimentary Rocks, and Assemblages

- JTRgor Terrigenous clastic and volcanogenic rocks (Lower Jurassic and Upper Triassic)

Paleozoic Rocks

- GC Golconda terrane - Basinal, volcanogenic, terrigenous clastic, and minor carbonate rocks (Permian to Upper Devonian)
- GChr Golconda terrane, Home Ranch subterrane - Limestone, basalt, chert, and volcaniclastic rocks (Mississippian)
- DCs Shale, chert, quartzite, greenstone, and limestone (Devonian to Upper Cambrian)
- OCtd Shale, chert, phyllite, quartzite, and limestone (Ordovician to Cambrian)

Precambrian and Other Rocks

- CZq Crossbedded quartzite, siltstone, and phyllite (Lower Cambrian and latest Proterozoic)
- Zqs Quartzite, siltstone, conglomerate, limestone, and dolomite (Late Proterozoic)

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FIGURE 10 (Cont.)

The site stratigraphy was inferred from a lithologic log of a deep boring (Jake #1) drilled in section 7 of T2N, R39E, about 7 mi (11 km) to the southwest of the site (Hess et al. 2011). The SEZ is underlain by unconsolidated alluvial and basin-fill sediments of Quaternary and Tertiary age, consisting of sands and gravels interbedded with poorly indurated pyroclastic clay. These sediments extend to a depth of about 2,300 ft (900 m) below the site (several logs for water wells drilled immediately south of the SEZ corroborate these findings to depths of up to 350 ft [110 m]). Basin rocks of Devonian to Cambrian age (e.g., Palmetto and Emigrant Formations) are encountered at 2,300 ft (700 m). They consist of dark gray, very well indurated, very fine-grained shale interbedded locally with dark gray siltstone and grading to siliceous siltstone with depth. The contact between the Palmetto and Emigrant Formations (based on palynological age dating) is estimated to occur between 3,200 and 4,500 ft (975 and 1,370 m). Granitic rocks with abundant white quartz occur at depths of about 4,700 ft (1,430 m). Meta-sedimentary rocks (marble, phyllitic mica schist) intruded by metamorphosed diorite dikes occur below 8,000 ft (2,440 m). These rocks are interpreted to be Lower Cambrian to Precambrian in age at depths between 8,560 and 8,590 ft (2,610 and 2,620 m).

6.7 MINERAL HISTORY

There has been no documented mining within the Millers SEZ. Most of the activity in the region has been limited to small-scale mining of metals and nonmetals in the Gilbert, Crow Springs, and Royston Districts to the west and north–northwest, the Tonopah and San Antone Districts to the east and northeast, and the Lone Mountain District to the south (USGS 2011).

Currently, no mineral exploration or development work is being conducted within the SEZ. Gold Summit Corporation reports that it is exploring lode claims (gold and silver) on about 3,900 acres (16 km^2) located about 24 mi (40 km) west–northwest of the town of Tonopah in the eastern part of the Monte Cristo Range (Gilbert District), due west of the SEZ (Gold Summit Corporation 2010). Gold-silver mineralization occurs in two faults that cross the property and in the McLean Lode, a brecciated fault zone hosting ore-bearing quartz veins. Near-surface portions of the lode were open-pit mined in the late 1980s. The depth of the lode is unknown.

Muntean (2011) reports increased exploration activities for gold in several mining districts in Esmeralda County: Hasbrouck Mountain project, Allied Nevada Gold Corp. (Divide District); Tonopah Divide project, Centerra Gold Corp. (Divide District); Castle Peak project, Kinross Gold Corp. (Gilbert District); Gold Summit project, Gold Summit Corp. (Gilbert District); Goldfield project, International Minerals Corp. (Goldfield District); Goldfield West project, TAC Gold Corp. (Goldfield District); Oasis project, Centerra Inc. (Palmetto District); and Mineral Ridge, Scorpio Gold Corp. (Silver Peak District). All these activities are some distance from the SEZ. Several small companies (e.g., Infrastructure Materials Corp. [2011]) are also conducting exploration work in the county (Buehler 2011).

Active mines in Esmeralda County include the Basalt Mine and Mill (diatomite), the Silver Peak Operations (lithium compounds), the Lone Mountain Mine (turquoise), and the Royal Blue Turquoise Mine (Davis and Hess 2010; Driesner and Coyner 2011). Another (historical) mine, Mineral Ridge (located partially on BLM-administered land in the Silver Peak

Range about 30 mi [48 km] to the north-northeast of the SEZ), is temporarily inactive, but exploration for gold is planned in the near term (Buehler 2011; BLM 2011).

6.7.1 Locatable Minerals

Most of the locatable minerals produced in the Battle Mountain District (including Esmeralda County) are associated with intrusive centers. Mineral deposits (including copper, molybdenum, tungsten, gold, silver, lead, and zinc) are found in pluton-related deposits (skarns and porphyrys), polymetallic vein and replacement deposits, sediment-hosted disseminated (Carlin-type) deposits, and some types of epithermal gold-silver deposits (BLM 2012b; Ludington et al. 2009).

There are no documented occurrences of locatable mineral deposits or prospects within the Millers SEZ. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals (copper, lead, silver, and uranium) are in quartz veins cutting granitic intrusive rock, in the Crow Springs District (section 1 of T4N, R39E), a few miles to the northwest (USGS 2011; Garside 1973).

Mines and prospects in the vicinity are shown on the detailed map of the SEZ and surrounding region provided in the back of this report (Map 5). There are five mining districts in the vicinity of the Millers SEZ. Some of the minerals produced in these districts (turquoise and perlite) are not classified as locatable minerals. The mining districts and their mineral occurrences, based on Tingley (1998), are shown in Figure 11 and are as follows:

- Royston: turquoise, silver, gold, copper, and lead; about 9.9 mi (16 km) to the north–northwest;
- Crow Springs: turquoise, silver, lead, copper, gold, antimony, uranium, and perlite; about 14.7 mi (24 km) to the northwest;
- Gilbert: gold, silver, mercury, turquoise, copper, lead, and antimony; about 7.5 mi (12 km) to the west;
- Lone Mountain: silver, lead, copper, gold, zinc, turquoise, fluorspar; about 5.1 mi (8.2 km) to the south; and
- Tonopah: silver, gold, lead, copper, tungsten, zinc, mercury, uranium, and arsenic; about 13 mi (21 km) to the east and northeast.

Mining in the Royston and Crow Springs Districts is concentrated in the southern Cedar Mountains, the northeastern Monte Cristo Range, and Royston Hills along the Nye-Esmeralda county line. The district has produced gem-quality turquoise, variscite (hydrated aluminum phosphate), and minor amounts of diatomaceous earth, silver, lead, copper, and gold. Turquoise occurs as minor lenses and nodules in veinlets and seams in fracture zones within altered trachyte, rhyolite, and quartz porphyry and along the contact between volcanic sediments and

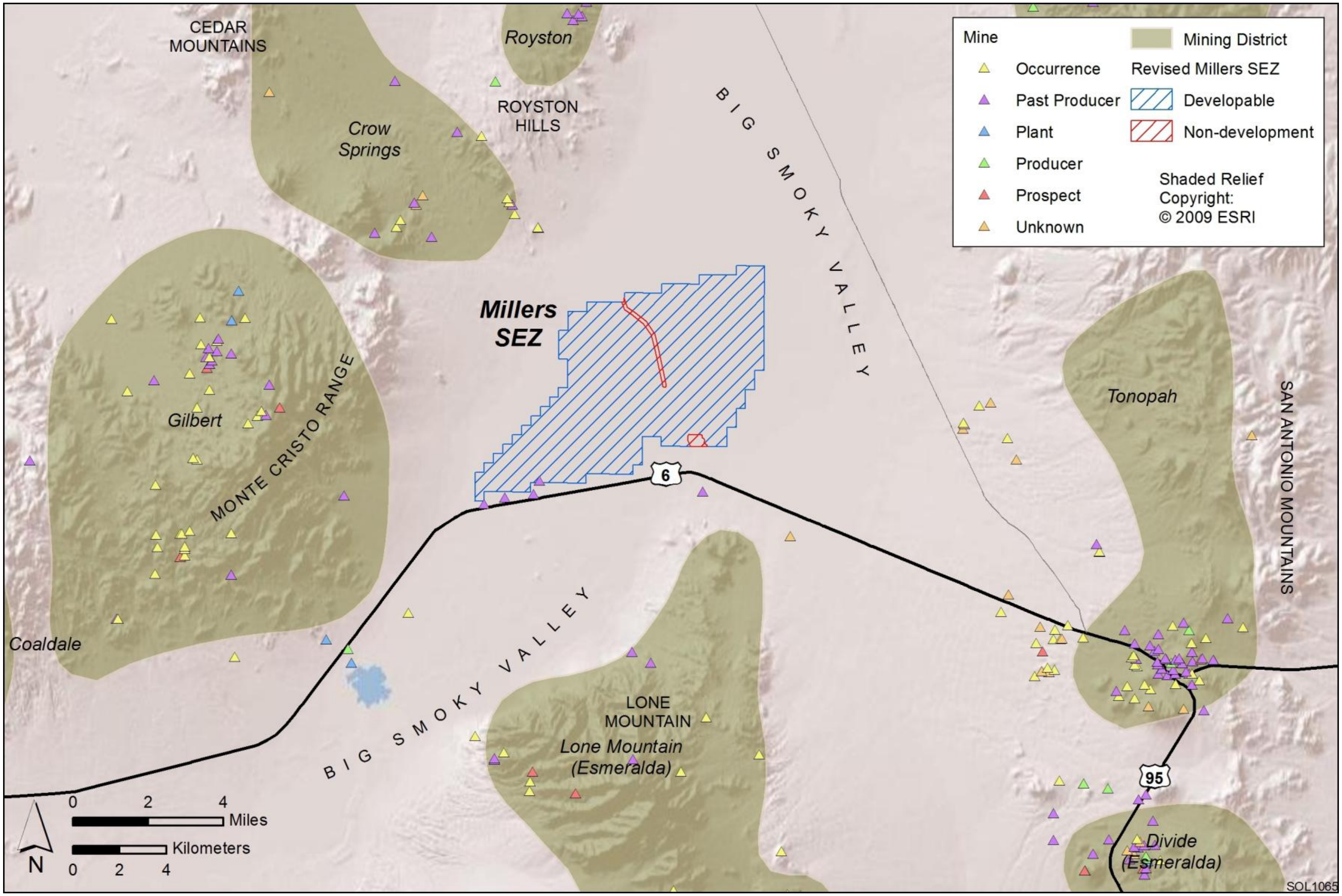

FIGURE 11 Map Showing Mining Districts, Mines, and Mineral Prospects near the Millers SEZ (Sources: USGS 2011; Tingley 1998)

intrusive bodies (Smith and Tingley 1983). Ludington et al. (2009) report that the Royston District is a copper porphyry system, as indicated by the presence of sulfide-bearing quartz veins and hydrothermal alteration minerals typical of such systems. Mineralized rock in the district is thought to be of Late Triassic or Early Jurassic age. The Blue Bell Claims Mine currently produces turquoise in the Royston District; there are no active mines in the Crow Springs District (USGS 2011).

The Gilbert District is located in the eastern part of the Monte Cristo Range, just west of the Big Smoky Valley. Mineralization in the district occurs in deep skarns (at the contact between the sediments of the Ordovician Palmetto Formation and Mesozoic granitic intrusives) and quartz veins. Mineral deposits in these units include pyrite, chalcopyrite, argentiferous galena, sphalerite, molybdenite, and tetrahedrite. A more shallow system of massive quartz and calcite veins occurs in Tertiary volcanic rocks and the Palmetto Formation. The principal mineral in these units is free gold, with minor amounts of silver chlorides and sulfides. Cinnibar and stibnite are known to occur along brecciated fault zones in the Gilbert Andesite (Smith and Tingley 1983). Past mines in the district (Last Hope Prospect, Red Cloud Claims, Carrie Mines, Miller's Mill, and Gilbert Mine) have produced copper, gold, silver, lead, antimony, molybdenum, tungsten, and zinc (USGS 2011).

The Lone Mountain District has intermittently produced gold and base metals (and minor barite and turquoise) since the 1860s. The mining district is centered around the Lone Mountain and Weepah plutons, which are composed predominantly of medium- to coarse-grained quartz monzonite that grades into granodiorite and granite with irregular masses of biotite granite. The plutons intrude the Precambrian Wyman Formation and Reed Dolomite and Late Cambrian Deep Springs, Capito, Poleta, and Harkless Formations. Intrusion of the Lone Mountain pluton created a dome structure (anticline) over which the Precambrian and Cambrian metasediments are draped, with remnant limbs dipping away from the mountain. Most of the mining activity has taken place along these limbs—either along the pluton-sediment contact (where sediments are metamorphosed to hornfels, phyllite, schist, marble, and tactite) or within the related system of faults, veins, and dikes. Mineralization also occurs as replacement deposits in carbonate rocks (Smith and Tingley 1983).

Since the Tonopah District was discovered in 1900, it has produced gold and silver. Mineral deposits occur in fault zones and quartz veins cutting Tertiary volcanic rocks composed of dacite to rhyolite (Smith and Tingley 1983). There are currently no active mines in the district (Buehler 2011).

The Millers SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the locatable minerals in the region occur in the surrounding mountain ranges. The nearest occurrences of locatable minerals in the region (copper, lead, silver, and uranium) are in quartz veins cutting granitic intrusive rock, in the Crow Springs District, a few miles to the northwest. The SEZ is in a region where alluvial and basin-fill sediments are estimated to be about 2,300 ft (700 m) deep (based on logs of a deep boring about 7 mi [11 km]) southwest of the site). Carbonates and granites (and associated mineralization) occur at approximate depths of 2,300 ft

(700 m) and 4,700 ft (1,430 m) below the site, respectively. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

6.7.2 Saleable Mineral Materials

There is little if any current mining of saleable mineral materials in the part of Big Smoky Valley near the Millers SEZ; however, the BLM (2012b) forecasts that the demand for aggregate, sand, and gravel will increase in the Battle Mountain District, especially along the I-80 corridor (about 2 hours north of Tonopah). The SEZ is an area with high potential for sand and gravel (level of certainty C) and moderate potential for clay (level of certainty A). The site is underlain by alluvial and lacustrine deposits, which are potential sources of clay, sand, and gravel materials. According to the LR2000, accessed on June 27, 2012, there is one authorized FHWA material site (sand and gravel) overlapping the southern boundary of the SEZ along U.S. 6 (in section 5 of T30N, R40E); several others are located in close proximity (BLM 2012a).

6.7.3 Leasable Minerals

There are no active oil and gas leases within the Millers SEZ (BLM 2012a). A good portion of the land within the site was leased in the past, but these leases were closed in 2000 and 2001. Relative to more favorable areas for oil and gas accumulative in the state (concentrated in Nye, Eureka and Elko Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Most of the oil in Nevada is produced from oil fields in the Railroad Valley in the Eastern Great Basin Oil and Gas Province (Nye County), more than 100 mi (160 km) to the east–northeast of the SEZ; there are no producing fields in Esmeralda County (BLM 2012b). Esmeralda County lies within the Western Great Basin Oil and Gas Province where carbonate rocks of Triassic age in west–central Nevada (northwest of the Millers SEZ) have demonstrated hydrocarbon potential. The hypothetical plays in this province consider deep sediment-filled basins, such as the Big Smoky Valley, to be conceptually prospective for hydrocarbons (Barker et al. 1995). An exploratory well (Jake #1) drilled to the southwest of the SEZ (in section 7 of T2N, R39E) in 1997 encountered older (Ordovician) sedimentary rocks between depths of 2,288 and 4,704 ft (697 and 1,434 m) with no oil shows (Hess et al. 2011).

The Battle Mountain District is an area of high geothermal potential, and the BLM forecasts that geothermal resource exploration and development will increase in the coming years (BLM and EERE 2003; BLM 2012b). Although known geothermal areas, hot springs, and existing geothermal lease (and lease application) areas have the highest potential for future use, there are extensive areas of high potential in the planning area that have yet to be explored. According to the LR2000, accessed on June 27, 2012, there are no active geothermal leases within the Millers SEZ (BLM 2012a). Current geothermal exploration projects in the region are numerous, especially in the areas to the south, west, and northwest of the SEZ; see the NBMG project list for a full roster of geothermal projects in Nevada (NBMG 2012). The nearest permitted facility is the Rock Hill Geothermal Area about 20 mi (32 km) to the west of the SEZ in T3-4N, R36E (BLM 2012b; NCMR 2008). The nearest nominated public lands for geothermal sale are located immediately south of the SEZ in T3N, 40E, overlapping a portion of the site in section 4 of T3N, R40E (BLM 2012a). The Millers SEZ is an area with high potential for geothermal development (level of certainty C).

There is currently no production of (sodium) salt in the Battle Mountain District; however, the potential for salt deposits, especially in the playas that occupy the many basins in the region, is considered high (BLM 2012b). Playa-related sediments occur within the SEZ; however, the quality of these deposits has not been characterized. The potential for salt production within the site is moderate (level of certainty A). There are no active or historical leases for this commodity within the SEZ (BLM 2012a).

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8 LIST OF PREPARERS

Table 2 lists the BLM management team members and mineral specialists consulted during the preparation of this assessment. Table 3 lists the names, education, and expertise of the report preparers.

TABLE 2 BLM Management Team and Mineral Specialists Consulted

Name	Office/Title
Linda Resseguie	Minerals and Realty Management Directorate, Realty Specialist
Shannon Stewart	Renewable Resources and Planning Directorate, Senior Planning and Environmental Analyst
Matt Shumaker	Division of Solid Minerals, Chief Mineral Examiner
Jeff Holdren	Division of Lands, Realty and Cadastral Survey, Senior Realty Specialist (legal descriptions)
Jason Powell	Division of Solid Minerals, Geologist
Scott Murrellwright	Nevada State Office, Mineral Specialist
David Fanning	Southern Nevada District Office, Geologist
Alan Kunze	Ely District Office, Geologist
George Varhalmi	Las Vegas Field Office, Geologist
Alan Buehler	Battle Mountain District Office, Supervisory Geologist
Tom Seley	Tonopah Field Office, Field Manager

TABLE 3 Report Preparers

Name	Education/Expertise	Contribution
Linda Graf	Desktop publishing specialist; 41 years of experience in creating, revising, formatting, and printing documents.	Document assembly and production
Heidi Hartmann	M.S., Environmental Toxicology and Epidemiology; 25 years of experience in environmental assessment, exposure and risk analysis, and environmental impact assessment.	Solar PEIS Project Manager
Irene Hogstrom	M.A. Geography and Environmental Studies; B.L.A., Landscape Architecture; 23 years of experience in landscape architecture, including design, regional planning, and ecological restoration.	LR2000 queries
Patricia Hollopeter	B.A., Religion; M.A., Philosophy; 27 years of experience in technical editing and environmental assessment document production.	Editor
James E. May	M.S., Water Resources Management, B.A., Zoology; 34 years of experience in natural resources management; 8 years of consulting experience in resource management, land use planning, and NEPA compliance.	Lands and realty; and mineral review
Greg McGovern	M.S., B.S., Geology (Hydrogeology); 23 years of experience in environmental site assessment and contaminant fate and transport studies.	Site-specific geology
Mary R. Moniger	B.A., English; 35 years of experience in editing and writing.	Lead editor
Michele Nelson	Graphic designer; 35 years of experience in graphical design and technical illustration	Report cover design and foldout map layout
Terri L. Patton	M.S., B.S., Geology (Igneous Petrology and Mineral Chemistry); 24 years of experience in environmental research and assessment.	Lead author; geology and mineral assessment
Kurt Picel	Ph.D., Environmental Health Sciences; 33 years of experience in environmental health analysis and 18 years in environmental assessment.	Environmental analysis and review
Lorenza Salinas	Desktop publishing specialist; 30 years of experience in creating, revising, formatting, and printing documents.	Document assembly and production

TABLE 3 (Cont.)

Name	Education/Expertise	Contribution
Barbara Simmons	B.A., Technical Writing; E.L.S. certification by the Board of Editors in the Life Sciences; Fellow, Society for Technical Communication; 45 years of experience in technical editing and publications management	Editor
Karen P. Smith	M.S., B.A., Geology; B.S., Anthropology; more than 23 years of experience in energy and environmental regulatory and policy analysis.	Solar PEIS Program Manager
Emily A. Zvolanek	B.A., Environmental Science; 4 years of experience in GIS mapping	GIS mapping

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APPENDIX A:

LEGAL DESCRIPTIONS OF NEVADA SOLAR ENERGY ZONES

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LEGAL DESCRIPTIONS OF NEVADA SOLAR ENERGY ZONES

This appendix presents the legal descriptions for the five SEZs in Nevada.

Mount Diablo Meridian

Amargosa Valley SEZ

T. 13 S., R. 47 E.,
sec. 35, E½NE¼, SW¼NE¼, NW¼NW¼, S½NW¼, and S½;
sec. 36, that portion south and west of the centerline of I-95.

T. 14 S., R. 47 E.,
sec. 8, E½, unsurveyed;
sec. 9, unsurveyed;
secs. 10, 11, 13, and 14, those portions south and west of the centerline of I-95, unsurveyed.
secs. 15 and 16, unsurveyed;
sec. 21, E½, unsurveyed;
secs. 22 and 23, unsurveyed;
sec. 24, W½E½ and W½, and those portions of the W½NE¼ and W½SE¼ south and west of the centerline of I-95, unsurveyed;
sec. 25, W½NE¼ and W½, unsurveyed;
secs. 26 and 27, unsurveyed;
sec. 34, E½, unsurveyed;
sec. 35, unsurveyed;
sec. 36, W½, unsurveyed.

T. 15 S., R. 47 E.,
sec. 1, W½W½, unsurveyed;
sec. 2, unsurveyed;
sec. 12, NW¼NW¼, unsurveyed.

The areas described aggregate approximately 9,737 acres (39.4 km^2).

Dry Lake SEZ

T. 17 S., R. 63 E.,
sec. 33, that portion of the S½ north and east of the centerline of Nev 060522;
sec. 34, lots 1 to 4, inclusive, NE¼, S½NW¼, and N½S½;
sec. 35, lots 1 to 4, inclusive, N½, and N½S½;
sec. 36, lots 1 to 4, inclusive, N½, and N½S½.

T. 18 S., R. 63 E.,
secs. 1 to 4, inclusive, and 10;
sec. 11, those portions north and east of the centerline of Nev 060522;
sec. 12;
sec. 13, lots 15 and 16, and that portion of the N½ lying north and west of the westerly right-of-way line of Highway 93;
sec. 14, lot 1.

T. 17 S., R. 64 E.,
sec. 31, lots 5 to 8, inclusive, SW¼NE¼, E½W½, and SE¼;
sec. 32, that portion of the SW¼, lying north and west of the centerline of I-15.

T. 18 S., R. 64 E.,
secs. 6, and 7, those portions lying north and west of the centerline of I-15;

The areas described aggregate approximately 6,186 acres (25.0 km^2).

Dry Lake Valley North SEZ

T. 1 N., R. 64 E.,
secs. 35 and 36.

T. 1 N., R. 65 E.,
sec. 31;
sec. 32, W½SW¼.

T. 1 S., R. 64 E.,
secs. 1, 12, and 13;
sec. 21, E½ and E½W½;
secs. 22 to 27, inclusive;
sec. 28, E½;
sec. 33, E½E½ and NW¼NE¼;
secs. 34, 35, and 36.

T. 2 S., R. 64 E.,
secs. 1, 2, and 3;
sec. 4, lot 1 and SE¼NE¼;
sec. 10, N½, N½SW¼, SE¼SW¼, and SE¼;
secs. 11 to 14, inclusive;
sec. 15, NE¼, E½NW¼, NE¼SW¼, N½SE¼, and SE¼SE¼;
sec. 23, NE¼, E½NW¼, NW¼NW¼, N½SE¼, and SE¼SE¼;
sec. 24;
sec. 25, N½NE¼.

T. 1 S., R. 65 E.,
sec. 6, lots 3 and 4, and lots 7 to 13, inclusive;
secs. 7, 8, 17 to 20 inclusive, and secs. 29, 30, and 31;
sec. 32, N½, SW¼, and W½SE¼.

T. 2 S., R. 65 E.,
sec. 5, lots 2, 3, and 4, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
secs. 6 and 7;
sec. 8, W½E½ and W½;
sec. 17, SE¼NE¼, W½NE¼, W½, and SE¼;
secs. 18 and 19;
sec. 20, W½NE¼ and W½;
sec. 29, NW¼, N½SW¼, and SE¼SW¼;
sec. 30, lot 1, NE¼, E½NW¼, and NE¼SE¼.

The areas described aggregate approximately 28,726 acres (116 km^2).

Gold Point SEZ

T. 6 S., R. 41 E.,
sec. 13, S½;
sec. 14, E½SE¼;
sec. 23, E½E½ and NW¼SE¼;
sec. 24;
sec. 25, N½, NE¼SW¼, and N½SE¼;
sec. 26, NE¼NE¼.

T. 6 S., R. 41½ E.,
sec. 13, N½SW¼ and SW¼SW¼, unsurveyed;
sec. 14, S½, unsurveyed;
sec. 15, S½, unsurveyed;
sec. 16, S½, unsurveyed;
secs. 21 and 22, unsurveyed;
sec. 23, N½NE¼, SW¼NE¼, W½, and NW¼SE¼, unsurveyed;
sec. 26, NW¼NW¼, unsurveyed;
sec. 27 N½, SW¼, N½SE¼, and SW¼SE¼, unsurveyed;
sec. 28, unsurveyed.

The areas described aggregate approximately 4,810 acres (19.5 km^2).

Millers SEZ

T. 3 N., R. 39 E.,
sec. 1;
sec. 2, lot 1, S½NE¼, NE¼SW¼, S½SW¼, and SE¼;
sec. 11, N½N½ and SW¼NW¼;
sec. 12, N½NW¼.

T. 4 N., R. 39 E.,
sec. 36, E½NE¼, SW¼NE¼, NE¼SW¼, S½SW¼, and SE¼.

T. 3 N., R. 40 E.,
sec. 4, lots 3 and 4, S½NW¼, and NW¼SW¼;
sec. 5, lots 1 to 4, inclusive, S½N½, and N½S½;
sec. 6.

T. 4 N., R. 40 E.,
sec. 10, S½S½;
sec. 11, S½;
sec. 12, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
sec. 13, W½E½ and W½;
secs. 14, 15, and 16;
sec. 17, S½N½ and S½;
sec. 18, SE¼;
sec. 19, E½, E½NW¼, and NE¼SW¼;
secs. 20 to 23, inclusive;
sec. 24, W½E½ and W½;
sec. 25, NW¼ and W½SW¼;
secs. 26 to 29, inclusive;
sec. 30, lot 4, E½, and E½SW¼;
secs. 31 and 32;
sec. 33, N½, N½S½, and S½SW¼;
sec. 34;
sec. 35, N½, SW¼, and W½SE¼.

The areas described aggregate approximately 16,787 acres (67.9 km^2).