

5.7 GEOLOGY, SOILS, AND MINERAL RESOURCES

5.7.1 INTRODUCTION

This section describes the existing regulatory and environmental settings, and analyzes the Project's potential to directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides; substantial soil erosion or topsoil loss, be on an unstable geologic unit or soils resulting in on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse; be on expansive soils, have soils incapable of supporting the use of septic tanks or alternative wastewater disposal systems; directly or indirectly destroy a unique paleontological or geological resource. This section also analyzes the Project's potential to result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State; and potential to result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. Where significant impacts remain despite compliance with the existing regulatory framework, feasible mitigation measures are recommended to avoid or reduce the Project's potentially significant environmental impacts.

Proposed General Plan

Proposed General Plan-related information in this section is based on methodology and information discussed in **Section 5.7.3** and **5.7.4**, respectively.

Barstow International Gateway (BIG)

BIG-related information in this section is based in part on the following studies:

- *Barstow International Gateway Geology, Soils, and Seismicity Technical Report*; see **Appendix 5.7 BIG-1: Geology, Soils, and Seismicity Technical Report**
- *Barstow International Gateway Mineral Resources Technical Report*; see **Appendix 5.7 BIG-2: Mineral Resources Technical Report**
- *Barstow International Gateway Paleontological Resources Assessment*; see **Appendix 5.7 BIG-3: Paleontological Resources Assessment**

Summary of Findings – Proposed General Plan

Future development in the City and its Sphere of Influence (SOI) could be subject to geologic hazards, such as strong ground shaking, liquefaction, landslides, and lateral spreading. Compliance with regulations and standards, such as the California Building Code (CBC) would reduce damage as a result of geologic hazards. In a dry desert climate like Barstow, managing soil hazards are important. Wind and rain can cause soil erosion that can be hazardous by reducing visibility and increasing the potential for damage during flooding. Additionally, different soil types can impact the design of buildings where everyday stability and the potential for earthquakes must be considered. Compliance with regulations, such as the CBC and

Chapter 15.12 – Grading, of the Barstow Code of Ordinances (Barstow Code) would ensure adequate building design and reduce soil erosion.

Geologic and paleontological resources have the potential to be discovered during construction activities that go beneath the ground surface, such as grading or trenching. Most of the City and SOI have a low-to-high paleontological sensitivity, with portions of the City and SOI also designated as having high levels of sensitivity, or no sensitivity. If paleontological resources are discovered, project-specific determinations shall be made.

The City is in a region with rich aggregate deposits that could be covered by new development. In most instances, the aggregate could not be extracted either because of the new development or because of surrounding homes. As the aggregate is throughout the proposed General Plan area, there is no effective mitigation that could reduce this impact. Therefore, this EIR acknowledges that the loss of mineral resource extraction is both significant and unavoidable.

Summary of Findings – Barstow International Gateway

BIG could affect soils, mineral resources, and paleontological resources. It would comply with state and local regulations to minimize potential geologic hazards during construction and operations. Compliance with standard engineering practices would ensure stability against potential risks such as earthquakes, landslides, and soil erosion, and a site-specific geology report was prepared to provide geotechnical recommendations to minimize these risks. There is potential to encounter paleontological resources; thus, mitigation measures, including monitoring and halting work if needed, would be implemented to protect these resources. The site overlaps with areas identified for aggregate and mineral resources within the Mojave River; however, due to environmental challenges and economic impracticalities of mining these resources, these mineral resources are not considered significant. Overall, the BIG project's impacts to soils, mineral resources, and paleontological resources would be reduced to less than significant levels through compliance with existing regulatory requirements and implementation of mitigation measures.

5.7.2 REGULATORY SETTING

5.7.2.1 Federal

Earthquake Hazards Reduction Act

The Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) established the National Earthquake Hazards Reduction Program, which is coordinated through the Federal Emergency Management Agency (FEMA), the U.S. Geologic Survey (USGS), the National Science Foundation, and the National Institute of Standards and Technology. This program was substantially amended in November 1990 by the National Earthquake Hazards Reduction Program Act (NEHRPA), which refined the description of agency responsibilities, program goals, and objectives.

NEHRPA's mission includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improved building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improved mitigation capacity; and accelerated application of research results. The NEHRPA designates

FEMA as the program's lead agency and assigns several planning, coordinating, and reporting responsibilities. Other NEHRPA agencies include the National Institute of Standards and Technology, National Science Foundation, and USGS.

Paleontological Resources Preservation, Omnibus Public Lands Act

This legislation directs the Secretaries of the U.S. Department of the Interior and U.S. Department of Agriculture (USDA) to manage and protect paleontological resources on federal land using "scientific principles and expertise." To formulate a consistent paleontological resources management framework, the Paleontological Resources Preservation Act of 2009 (PRPA), incorporates most of the recommendations from the report of the Secretary of the Interior titled "Assessment of Fossil Management on Federal and Indian Lands." In passing the PRPA, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The PRPA codifies existing policies of the Bureau of Land Management, National Park Service (NPS), U.S. Forest Service, Bureau of Reclamation, and U.S. Fish and Wildlife Service, and provides the following:

- Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossil from federal lands.
- Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants).
- Uniform definitions for "paleontological resources" and "casual collecting."
- Uniform requirements for curation of federal fossils in approved repositories.

Antiquities Act of 1906

The Antiquities Act of 1906 (16 U.S. Code 431-433) was the first U.S. law to provide general legal protection of cultural and natural resources of historic or scientific interest on federal lands, including paleontological resources (NPS, 2023a). The Antiquities Act was used to proclaim several national monuments based upon significant paleontological resources (NPS, 2023b). It states, in part:

"That any person who shall appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court. "

Occupational Safety and Health Administration Regulations

The Occupational Safety and Health Administration's (OSHA) Excavation and Trenching standard, Title 29 of the Code of Federal Regulations, part 1926, Subpart P, contains requirements for the excavation and trenching operations. The standards apply to all open excavations made in the Earth's surface. Following the OSHA requirements of the standards will prevent or greatly reduce the risk of cave-ins and other excavation-related incidents (OSHA, 2015).

Soil and Water Resources Conservation Act

The Soil and Water Resources Conservation Act gives the USDA assessment and planning authority to conserve, protect, restore, and enhance soil, water, and related natural resources. Protection and restoration activities include prevention of harmful soil changes, rehabilitation of contaminated soil and water, and precautions against negative soil impacts. Disruptions of natural soil functions, including the function as an archive of natural and cultural history, should be avoided as far as practicable. In addition, the federal Water Pollution Control Act (also referred to as the Clean Water Act) requirements, through the National Pollution Discharge Elimination System permitting process, provide guidance for protection of geologic and soil resources.

5.7.2.2 State

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code)(PRC) 2621-2624, Division 2 Chapter 7.5) was passed in 1972 to mitigate the hazard of surface faulting to structures intended for human occupancy. The Alquist-Priolo Act's main purpose is to prohibit siting buildings used for human occupancy across traces of active faults that constitute a potential hazard to structures from surface faulting or fault creep. The Alquist-Priolo Act requires the State Geologist to establish regulatory zones, known as "Earthquake Fault Zones," delineating appropriately wide earthquake fault zones to encompass potentially active and recently active traces of faults. Local agencies must regulate most development projects within these zones. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed human occupancy structures would not be constructed across active faults. A licensed geologist must prepare an evaluation and written report of a specific site. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (typically at least 50-foot setbacks are required).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (PRC, Chapter 7.8, § 2690-2699.6) directs the California Department of Conservation, California Geological Survey (CGS) Division to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the Seismic Hazards Mapping Act is to minimize loss of life and property through the identification, evaluation, and mitigation of seismic hazards.

The Seismic Hazards Mapping Act provides a statewide seismic hazard mapping and technical advisory program to assist cities, counties, and State agencies are directed to use the seismic hazard zone maps in their land use planning and permitting processes. This Act requires that site-specific hazards investigations be conducted by licensed professionals within the zones of required investigation to identify and evaluate seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy. Evaluation and mitigation of seismic hazards are to be conducted under guidelines established by the California State Mining and Geology Board (SMGB).

The CGS plans to map California's principal urban and major growth areas (CGS, 2023). CGS has not evaluated the land within BIG for seismic hazard zones and therefore the regulations under the Seismic Hazards Mapping Act do not apply to BIG.

California Seismic Hazards Program

The Seismic Hazards Program delineates areas prone to ground failure and other earthquake-related hazards including surface fault rupture, liquefaction, earthquake-induced landslides, and tsunami inundation. Cities and counties are required to use these maps in their land use planning and building permit processes to identify and mitigate these hazards for development projects.

Seismic Hazards and Zones of Required Investigation. The Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act direct the State Geologist to delineate regulatory "Zones of Required Investigation" to reduce the threat to public health and safety and to minimize the loss of life and property posed by earthquake-related ground failures and other hazards. Cities and counties affected by these zones are required to regulate certain development projects within them. These acts also require sellers of real property (and their agents) within a mapped hazard zone to disclose at the time of sale that the property lies within such a zone.

The zones of required investigation listed below for potential earthquake faulting, liquefaction, landslides, and tsunamis are delineated and distributed to cities, counties, and State construction agencies to help identify where higher building standards may be necessary for safe development. Statutes require that cities and counties use all four of these zones as part of their construction permitting process.

- Alquist-Priolo Earthquake Fault Zones: These zones are intended to prevent buildings for human occupancy from being constructed upon active faults.
- Seismic Hazard Zones
 - Liquefaction Zones: These zones identify where the stability of foundation soils must be investigated, and countermeasures undertaken in the design and construction of buildings for human occupancy.
 - Earthquake-Induced Landslide Zones: These zones identify where the stability of hillslopes must be evaluated, and countermeasures undertaken in the design and construction of buildings for human occupancy.
 - Tsunami Regulatory Zones: These zones identify where impacts from tsunami inundation and related hazards must be evaluated and countermeasures (e.g., evacuation and engineering design) be developed to protect the human occupants.

California Building Standards Code (California Code of Regulations, Title 24)

The California Building Standards Code (CBSC), Title 24 of the California Code of Regulation (referred herein as Title 24) governs the design and construction of buildings, associated facilities, and equipment and applies to buildings in California. Title 24 Part 2 is the California Building Code (CBC), which contains general building design and construction requirements relating to fire and life safety, structural safety, and access compliance. The CBC is updated every three years. The current CBC version was published on July 1, 2025, and is effective on January 1, 2026. The CBC contains seismic safety standards outlining design and construction requirements. Development projects must show compliance with the CBC through the development review process. Building permits are submitted and reviewed for compliance prior to obtaining building permits. The CBC includes estimates for maximum earthquake

magnitudes and peak ground acceleration, soil classifications and expansion potential, seismic design categories and lateral pressure, and grading and surface drainage.

Given the regional susceptibility to seismic events, CBC's seismic standards are heavily regarded by local agencies. CBC Chapter 16 addresses structural design requirements governing seismically resistant construction (CBC § 1604), including but not limited to factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design (CBC §§ 1613.5 through 1613.7).

CBC Chapter 18 includes but is not limited to the requirements for foundation and soil investigations (CBC § 1802 and § 1803); excavation, grading, and fill (CBC § 1804); allowable load-bearing values of soils (CBC § 1806); and the design of footings, foundations, and slope clearances (CBC §§ 1808 and 1809), retaining walls (CBC § 1807), and pier, pile, driven, and cast in-place foundation support systems (CBC § 1810).

CBC Chapter 33 includes requirements for safeguards at worksites to ensure stable excavations and cut or fill slopes (CBC § 3304). BIG construction and operations are subject to occupational safety standards as specified in California OSHA (CAL/OSHA) regulations (Title 8 of CCR) and Chapter 33 of the CBC.

California Geologic Survey (CGS)

The CGS (PRC Division 2 Chapter 2) provides geologic information about California's diverse nonfuel mineral resources and their related hazards through maps, reports, and other data. The CGS assists governmental agencies, mining companies, consultants, and the public in recognizing, developing, and protecting important mineral resources. The CGS produces Mineral Land Classification studies that identify areas with potentially important mineral resources that should be considered in local and regional planning.

The proposed General Plan area and BIG footprint are addressed in CGS' 2006 Geological Survey, "Aggregate Availability in California," under the "Barstow Victorville P-C Region," which contains 133 million tons of permitted aggregate resources as of January 1, 2006 (CGS, 2006, p. 4).

California Geological Survey (CGS) Special Publication 42

The CGS Special Publication 42 provides guidelines for affected permitting agencies and their reviewers, as well as for geoscience consulting practitioners representing property owners and developers. The purpose of these guidelines under the Alquist-Priolo Earthquake Fault Zoning Act is to regulate development near active faults so as to mitigate the hazard of surface fault rupture.

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act (SMARA) (PRC §§ 2710 through 2796) is the primary regulatory framework governing mining in the State. The Act requires the State Geologist to use the CGS to identify important mineral deposits in the State threatened by land uses that would be incompatible with future extraction and classify them into Mineral Resource Zones (MRZ). SMARA delegates specific regulatory authority to local jurisdictions that are required to enact specific procedures to guide mineral conservation

and extraction at identified sites and to incorporate mineral resource management policies in their general plans.

SMARA requires the California SMGB to classify California mineral resources with the MRZ system. These zones have been established based on the presence or absence of significant sand and gravel deposits and crushed rock and stone sources (e.g., products used in the production of cement). The SMGB defines “Area of regional significance” as “an area designated by the board pursuant to § 2790 which is known to contain a deposit of minerals, the extraction of which is judged to be of prime importance in meeting future needs for minerals in a particular region of the State within which the minerals are located and which, if prematurely developed for alternate incompatible land uses, could result in the permanent loss of minerals that are more than local significance.” The State Geologist uses the following MRZ categories to classify the State’s lands (CGS, ND, pp. 4-6):

- **MRZ-1:** Areas where adequate geologic information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence. This zone is applied where well developed lines of reasoning, based on economic-geologic principles and adequate data, indicate that the likelihood for occurrence of significant mineral deposits is nil or slight.
- **MRZ-2a:** Areas underlain by mineral deposits where geologic data show that significant measured or indicated resources are present. MRZ-2 is divided on the basis of knowledge and economic factors. Areas classified MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine information. Land included in MRZ-2a is of prime importance because it contains known economic mineral deposits. A typical MRZ-2a area would include an operating mine, or an area where extensive sampling indicates the presence of a significant mineral deposit.
- **MRZ-2b:** Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. Areas classified MRZ-2b contain discovered deposits that are either inferred reserves or deposits that are presently sub-economic as determined by limited sample analysis, exposure, and past mining history. Further exploration work and/or changes in technology or economics could result in upgrading areas classified MRZ-2b to MRZ-2a. A typical MRZ-2b area would include sites where there are good geologic reasons to believe that an extension of an operating mine exists or where there is an exposure of mineralization of economic importance.
- **MRZ-3a:** Areas containing known mineral deposits that may qualify as mineral resources. Further exploration work within these areas could result in the reclassification of specific localities into MRZ-2a or MRZ-2b. MRZ-3 is divided on the basis of knowledge of economic characteristics of the resources. MRZ-3a areas are considered to have a moderate potential for the discovery of economic mineral deposits. An example of an MRZ-3a area would be where there is direct evidence of a surface exposure of a geologic unit, such as a limestone body, known to be or to contain a mineral resource elsewhere but has not been sampled or tested at the current location.
- **MRZ-3b:** Areas containing inferred mineral deposits that may qualify as mineral resources. Land classified as MRZ-3b represents areas in geologic settings that appear to be favorable environments for the occurrence of specific mineral deposits. Further exploration work could

result in the reclassification of all or part of these areas into MRZ-3a or specific localities into MRZ-2a or MRZ-2b. MRZ-3b is applied to land where geologic evidence leads to the conclusion that it is plausible that economic mineral deposits are present. An example of an MRZ-3b area would be where there is indirect evidence such as a geophysical or geochemical anomaly along a permissible structure that indicates the possible presence of a mineral deposit or that an ore-forming process was operative.

- **MRZ-4:** Areas where geologic information does not rule out either the presence or absence of mineral resources. The distinction between MRZ-1 and MRZ-4 is important for land use considerations. It must be emphasized that MRZ-4 classification does not imply that there is little likelihood for the presence of mineral resources, but rather there is a lack of knowledge regarding mineral occurrence. Further exploration work could well result in the reclassification of land in MRZ-4 areas to MRZ-3 or MRZ-2 categories.

MRZs within the BIG footprint are shown in **Figure 5.7-1: County Mineral Resource Zones Map – BIG** later in this section. It is noted that any County zoning for mining, and County policies related to mining and mineral resources, would not apply to BIG’s proposed annexation areas which would be annexed to the City. BIG’s proposed annexation areas would be subject to the proposed General Plan, Barstow Code, and/or proposed BIG Specific Plan regulations.

As part of the SMARA, the SMGB is also responsible for distributing information about Aggregate Resource Areas (ARAs) to lead agencies but does not infringe on the authority of local governments to make land use decisions. ARAs are areas classified as MRZ-2a or MRZ-2b for construction aggregate areas that have current land uses similar to areas which have been mined in the past. The purpose of determining ARAs is to “provide a semi-quantified estimate of construction aggregate resources which are likely to be available to satisfy society’s needs during the 50-year period following the classification of an area” (CGS, ND). The estimation of future mineral resource availability in ARAs is not a precise analysis, but rather the best general estimate which can be made with the data available.

Once ARAs have been identified, they are divided into three relative categories of significance as follows:

- Immediately Significant – All permitted lands within ARAs
- Highly Significant – ARAs that contain 10 or more times the threshold value of material, or that are adjacent to property currently permitted for mining
- Significant – All remaining ARAs

California Geologic Energy Management Division (CALGEM)

The California Geologic Energy Management Division (CALGEM) (PRC §§ 3000 through 3473) of the CGS oversees the drilling, operation, maintenance, plugging or abandonment of oil, natural gas, and geothermal wells. CALGEM’s regulatory program emphasizes the wise development of oil, natural gas, and geothermal resources in the State through sound engineering practices that protect the environment, prevent pollution, and ensure public safety.

State Mining and Geology Board (SMGB)

The State Mining and Geology Board (SMGB) provides professional expertise and serves as a regulatory, policy, and hearing body representing the State's interest in the development, utilization, and conservation of mineral resources, the reclamation of mined lands, and the development and dissemination of geologic and seismic hazard information.

California Division of Mine Reclamation

The CGS Division of Mine Reclamation provides a measure of oversight for local governments as they administer SMARA within their respective jurisdictions. The Division of Mine Reclamation may provide comments to lead agencies on a mining operation's reclamation plan and financial assurance and, jointly with SMGB, is charged with administering actions that encourage SMARA compliance. The primary focus is on existing mining operations and reclaiming mined lands to a usable and safe condition that is readily adaptable for alternative land uses. The Division of Mine Reclamation maintains an online database (Mines Online), which identifies active mines in San Bernardino County. Mines Online lists mines subject to SMARA requirements that disturb more than one acre or remove more than 1,000 cubic yards of material. As reported on Mines Online, there are no active mines identified within the BIG footprint. The active mine nearest the BIG footprint is Best Rock Quarry, approximately 5.1 miles to the north (CGS, 2016).

California Surface Mining and Reclamation Policies and Procedures

The purpose of these guidelines is to help implement SMARA by providing the State Geologist with direction in carrying out mineral resource classification of lands in California that are threatened by uses that would be incompatible with, or would preclude, mining. In addition, these guidelines describe how the SMGB may elect to designate mineral-bearing areas of statewide or regional significance.

Oil and Gas Conservation

The CALGEM Division (PRC §§ 3000-3473) of CGS oversees the drilling, operation, maintenance, and plugging and abandonment of oil, natural gas, and geothermal wells. CalGEM's regulatory program emphasizes the wise development of oil, natural gas, and geothermal resources in the State through sound engineering practices that protect the environment, prevent pollution, and ensure public safety.

California Public Resources Code Section 5097.5

The PRC protects paleontological resources in specific contexts. In particular, PRC § 5097.5 prohibits knowing and willful excavation, removal, destruction, injury, and defacement of any vertebrate paleontological feature on public lands without express authorization from the agency with jurisdiction. Violation of this prohibition is a misdemeanor and is subject to fine or imprisonment (PRC § 5097.5(c)), and persons convicted of such a violation may also be required to provide restitution (PRC § 5097.5(d)(1)). Additionally, PRC § 30244 requires "reasonable mitigation measures" to address impacts on paleontological resources identified by the State Historic Preservation Officer.

5.7.2.3 Local

County of San Bernardino Countywide Plan

The County adopted the Countywide Plan (CWP) in October 2020. The CWP Policy Plan addresses the physical, social, and economic issues facing the County’s unincorporated portions. **Table 5.7-1: Countywide Plan Policy Plan – Relevant Geology, Soils, and Mineral Resources Goals and Policies** includes the geology, soils, and mineral resources-related goals and policies relevant to the Project. For applicability of the CWP goals and policies to the Project, see **Section 5.0: Environmental Analysis**.

Table 5.7-1: Countywide Plan Policy Plan – Relevant Geology, Soils, and Mineral Resources Goals and Policies	
Goal or Policy	
HAZARDS ELEMENT	
Goal HZ-1	Natural Environmental Hazards. Minimized risk of injury, loss of life, property damage, and economic and social disruption caused by natural environmental hazards and adaptation to potential changes in climate.
Policy HZ-1.1	New subdivisions in environmental hazard areas. We require all lots and parcels created through new subdivisions to have sufficient buildable area outside of the following environmental hazard areas: ▪ Flood: 100-year flood zone, dam/basin inundation area. ▪ Geologic: Alquist-Priolo earthquake fault zone; County-identified fault zone; rockfall/ debris-flow hazard area, existing and County-identified landslide area.
Policy HZ-1.2	New development in environmental hazard areas. We require all new development to be located outside of the environmental hazard areas listed below. For any lot or parcel that does not have sufficient buildable area outside of such hazard areas, we require adequate mitigation, including designs that allow occupants to shelter in place and to have sufficient time to evacuate during times of extreme weather and natural disasters. Flood: 100-year flood zone, dam/basin inundation area. Geologic: Alquist-Priolo earthquake fault zone; County-identified fault zone; rockfall/ debris-flow hazard area, medium or high liquefaction area (low to high and localized), existing and County-identified landslide area, moderate to high landslide susceptibility area). Fire: high or very high fire hazard severity zone.
Policy HZ-1.7	Underground utilities. We require that underground utilities be designed to withstand seismic forces, accommodate ground settlement, and hardened to fire risk.
Policy HZ-1.8	Wind erosion hazards. We require new development in medium-high or high wind erosion hazard areas to minimize the effects of wind-blown soil through building and site design features such as fencing, surface treatment or pavement, attenuation or wind barriers, architectural features, building materials, and drought resistant landscaping.
Policy HZ-1.9	Hazard areas maintained as open space. We minimize risk associated with flood, geologic, and fire hazard zones or areas by encouraging such areas to be preserved and maintained as open space.
NATURAL RESOURCES ELEMENT	
Policy NR-2.5	Stormwater discharge. We ensure compliance with the County’s Municipal Stormwater NPDES (National Pollutant Discharge Elimination System) Permit by requiring new development and significant redevelopment to protect the quality of water and drainage systems through site design, source controls, stormwater treatment, runoff reduction measures, best management practices, low impact development strategies, and technological advances. For existing development, we monitor businesses and coordinate with municipalities.

Table 5.7-1: Countywide Plan Policy Plan – Relevant Geology, Soils, and Mineral Resources Goals and Policies	
Goal or Policy	
Goal NR-6	Mineral Resources. Mineral resource zones that allow extraction industries to continue supporting the regional and national economy while minimizing negative impacts on the public and natural environment.
Policy NR-6.1	Mineral resource areas. We prioritize the conservation of land area with mineral resources by prohibiting or discouraging development of land that would substantially preclude the future development of mining facilities in areas classified as Mineral Resource Zone (MRZ) 2a, 2b, or 3a.
CULTURAL RESOURCES ELEMENT	
Goal CR-2	Historic and Paleontological Prehistoric Resources. Historic resources (buildings, structures, or archaeological resources) and paleontological resources that are protected and preserved for their cultural importance to local communities as well as their research and educational potential.
Policy CR-2.3	Paleontological and archaeological resources. We strive to protect paleontological and archaeological resources from loss or destruction by requiring that new development include appropriate mitigation to preserve the quality and integrity of these resources. We require new development to avoid paleontological and archeological resources whenever possible. If avoidance is not possible, we require the salvage and preservation of paleontological and archeological resources.
Policy CR-2.5	Public awareness and education. We increase public awareness and conduct education efforts about the unique historic, natural, tribal, and cultural resources in San Bernardino County through the County Museum and in collaboration with other entities.
ECONOMIC DEVELOPMENT ELEMENT	
Goal ED-1	Increased business investment in land and facilities and job growth in key unincorporated areas.
Policy ED-1.5	Mineral resources. We support the extraction of mineral resources in unincorporated areas and the establishment and operation of supporting businesses throughout the county.
Source: County of San Bernardino. 2020. <i>Countywide Plan</i> . https://countywideplan.com/policy-plan .	

The CWP Policy Plan includes the following Policy Maps that address geology, soils, and mineral resources:

- Policy Map HZ-1 Earthquake Fault Zones: This map depicts Alquist-Priolo and County designated fault zones;
- Policy Map HZ-2 Liquefaction & Landslides: This map depicts County areas with:
 - Suspected, low, medium, or high liquefaction susceptibility,
 - Low to moderate and moderate to high landslide susceptibility, as well as existing landslides,
 - Rockfall/debris-flow hazard.
- Policy Map LU-4 Mineral Resource Zones: Depicts County areas with either MRZ Class 2 (Known or Highly Likely Location) or MRZ Class 3 (Moderate Potential or Possible Location) for the mineral deposits listed below. The County’s MRZ Open-File Report Area Plate¹ boundaries and numbers are also depicted. Policy Map LU-4; see **Figure 5.7-1**.
 - Magmatic Concentration (Rare Earth Element)

¹ The plates pertain to a digital geologic map database.

- Contact Metasomatic (Skarns),
 - Industrial Minerals,
 - Hydrothermal Deposits, and
 - Aggregate Resource Zones.
- Policy Map HZ-11 Wind Erosion Hazards: This map depicts County areas with low, low-medium, medium, medium-high, and high wind erodibility potential.

Figure 5.7-1: County Mineral Resource Zones Map – BIG depicts the County's mineral resources and MRZ mineral deposits and indicates approximately 4,995 acres of the BIG footprint is within a County delineated MRZ (i.e., per Policy Map LU-4).

See the **Section 5.7.4: Environmental Setting** for further discussion concerning the above conditions and their potential presence within the BIG footprint.

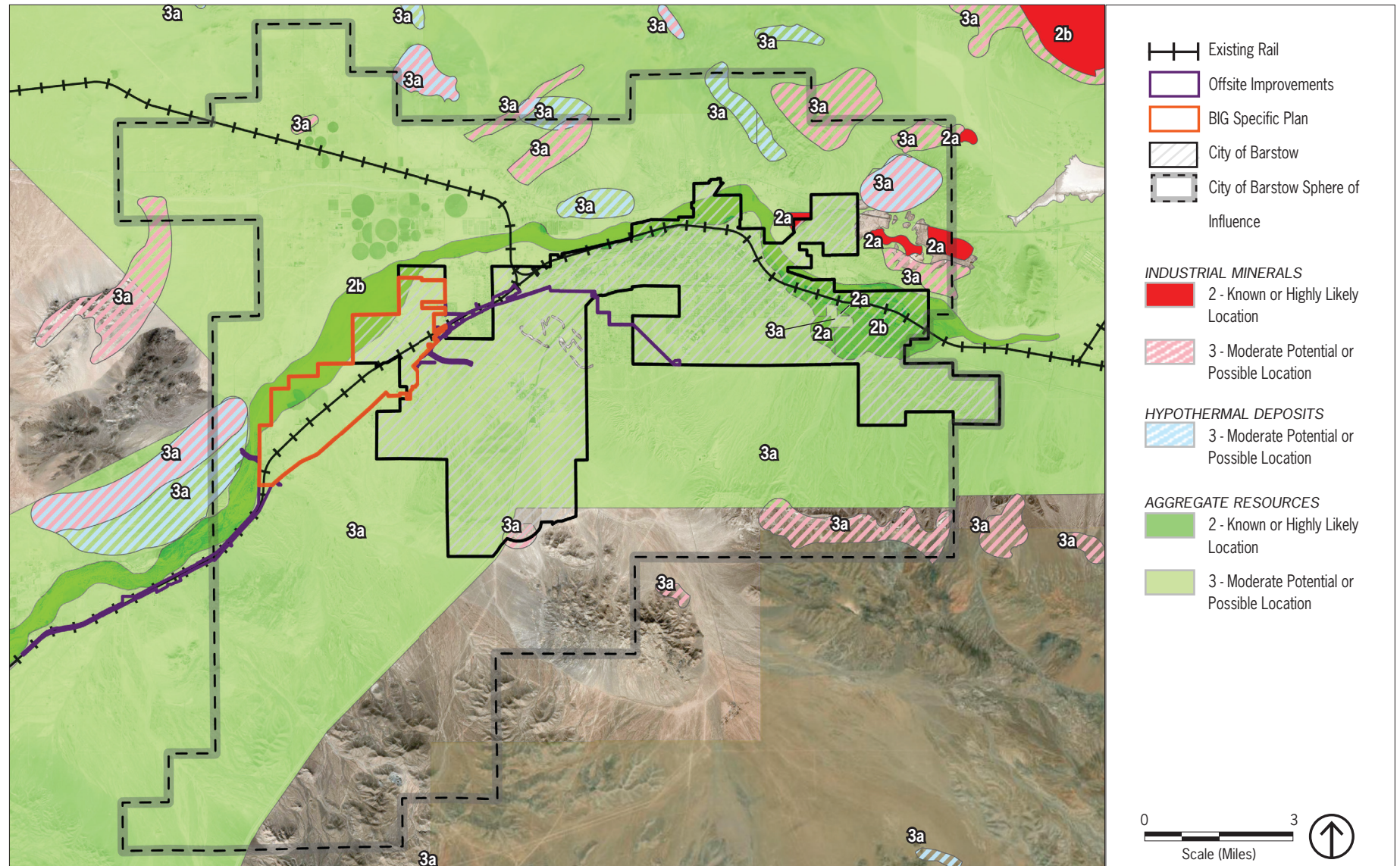
Codified Ordinances of the County of San Bernardino

The Codified Ordinances of the County of San Bernardino (County Code) regulations addressing geology, soils, and mineral resources are provided below (San Bernardino, 2025). For applicability of the County Code regulations to the Project, see **Section 5.0**.

County Code Chapter 82.15: Geologic Hazard (GH) Overlay. This chapter was created to provide greater public safety by establishing investigative requirements for areas that are subject to potential geologic problems, including active faulting and sliding, debris flow/mud flow, rockfall, liquefaction, seiche, and adverse soil conditions. County Code Title 8, Chapter 82.15.040(a), seeks to prevent construction or major rehabilitation of structures used for human occupancy within 50 feet of an active fault. County Code Chapter 82.15.040(b) requires that structures used for critical facilities be at least 150 feet from any active fault trace.

County Code Chapter 82.17: Mineral Resources (MR) Overlay. The intent of the Mineral Resources (MR) Overlay is as follows:

- Prevent or minimize all adverse environmental effects.
- Reclaim mined lands to a usable condition that is readily adaptable for alternative land uses.
- Encourage the production and conservation of minerals while preserving areas relating to environmental and recreational amenities if such amenities are located within the mining locale.
- Eliminate residual hazards to the public health and safety.



Sources:
County of San Bernardino, Y2023_PUA_Cache [aerial imagery], 2023.; County of San Bernardino, *Cities and Towns* [Data set], 2022.; County of San Bernardino, *City Spheres of Influence* [Data set], 2022.; County of San Bernardino, *Countywide Plan Policy Map NR-4 Mineral Resource Zones* [Data set], 2020.

Figure 5.7-1
County Mineral Resource Zones Map – BIG

County Code Chapter 82.20: Paleontological Resources (PR) Overlay. This chapter was created to identify and preserve significant palaeontologic (fossil) resources. It recognizes these resources as unique and non-renewable and their preservation “provides a greater knowledge of County natural history, thus promoting County identity and conserving scientific amenities for the benefit of future generations.” Where new development is proposed within a PR Overlay, field studies prior to construction, monitoring during grading, and recovery, identification, and report of specimens are required.

County Code Chapter 83.04: Conditional Grading Compliance. The purpose of this chapter is to ensure compliance with conditions of approval on projects involving earthwork grading. The provisions in this chapter regulate on-site continuous inspections that are required by the Building Official of grading projects or developments for which adopted conditions of approval:

- Require any specific or general features to be incorporated into the earthwork; or
- Restrict or limit the earthwork in any way that is more restrictive than the grading provisions prescribed in the California Building Code.

County Code Title 6 Chapter 1: California Building Code. The County’s building regulations are found in this Chapter. The County adopted the 2022 CBC. State law permits jurisdictions to amend State building codes to address local geographic, topographic, or climatic conditions. The CBSC publishes all code amendments adopted by local agencies. The County amended the 2022 CBC for administrative provisions and included excavation and grading requirements that were not in the original 2022 CBC. No other local amendments were made (Barstow, 2025).

City of Barstow 2015-2020 General Plan

The City adopted the City of Barstow 2015-2020 General Plan (2015 General Plan) in February 2015. The 2015 General Plan is the overarching guide for implementation of the Development Code, which defines development regulations and establishes zoning districts throughout the City. **Table 5.7-2: 2015 General Plan Relevant Goals and Policies – Geology, Soils, and Mineral Resources** includes the geology, soil, and mineral-related goals and policies relevant to the Project. For applicability of the 2015 General Plan goals and policies to the Project, see **Section 5.0**.

Code of the City of Barstow

The Code of the City of Barstow (Barstow Code) regulations addressing geology, soils, and mineral resources are provided below. For applicability of the Barstow Code standards to the Project, see **Section 5.0: Environmental Analysis**.

Barstow Code Title 15: Buildings and Construction. This title includes various regulations concerning erection, construction, maintenance, etc. of all buildings and/or structures in the City.

Barstow Code § 15.08.010: Building Codes. The City has adopted, including the CBC 2019 Edition, the California Existing Building Code 2019 Edition, and the California Referenced Standards Code 2019 Edition.

Table 5.7-2: 2015 General Plan Relevant Goals and Policies – Geology, Soils, and Mineral Resources	
Goal or Policy ¹	
SAFETY ELEMENT	
Goal 1	Public Safety Goals, Policies and Strategies. Maintain a comprehensive Emergency Operations Plan for the City, ensuring a high level of responsiveness to natural and human-caused disasters and other emergency situations.
Policy 1A	Periodically update the Emergency Operations Plan and implement the plan's provisions on an ongoing basis.
Goal 2	Emergency Preparation Goals, Policies and Strategies. Continue to actively participate in regional and statewide emergency preparation efforts.
Policy 2A	Cooperate and coordinate with San Bernardino County Emergency Services, Golden State Water Company, Southern California Edison, and Southwest Gas Company and other agencies and utilities in the development and dissemination of information and instructions on appropriate actions in the event of a local disaster or emergency.
Goal 3	Emergency Preparation Goals, Policies and Strategies. Ensure that all development occurring under the General Plan is designed and built in accordance with current standards for seismic safety, fire protection and defensible space.
Policy 3.1	Consider and assess vulnerability to natural and manmade disasters or emergencies when reviewing proposals for the siting and development of public/quasi-public facilities such as schools, water towers, and power and communication transmitters.
RESOURCE CONSERVATION AND OPEN SPACE ELEMENT	
Goal 4	Strive to preserve and protect important features and sites (historic, archaeological, and paleontological), as defined under this Element's Cultural Resources Management Plan, from degradation or destruction.
Policy 4A	The City shall encourage efforts to collect and preserve available local historical resources.
Source: City of Barstow. 2015. <i>2015-2020 General Plan</i> . https://www.barstowca.org/home/showpublisheddocument/5359/636607004808630000 .	

Barstow Code Chapter 15.12: Grading. Grading provides provisions for grading, excavation, and earthwork construction, including fills and embankments and the control of grading site runoff, including erosion sediments and construction related pollutants. This purpose of this chapter is to safeguard life, limb, property, and public welfare by regulating grading on private property. Barstow Code § 15.12.040: Permit Application Submittals specifies the following requirements for engineered grading:

- **Soil Engineering Report.** The soils engineering report shall include data regarding the nature, distribution and strength of existing soils, conclusions and recommendations for grading procedures and design criteria for corrective measures, including buttress fills, when necessary, and opinion on adequacy for the intended use of sites to be developed by the proposed grading as affected by soils engineering factors, including the stability of slopes. Supplemental reports and data may be required as the building official may deem necessary. Recommendations included in the reports and approved by the building official shall be incorporated in the grading plan or specifications.
- **Engineering Geology Report.** The engineering geology report shall include an adequate description of the geology of the site, conclusions, and recommendations regarding the effect of geologic conditions on the proposed development, and opinion on the adequacy for the

intended use of sites to be developed by the proposed grading, as affected by geologic factors. The engineering geology report shall include a geologic map and cross sections utilizing the most recent grading plan as a base. Supplemental reports and data may be required as the building official may deem necessary. Recommendations included in the reports and approved by the building official shall be incorporated in the grading plan or specifications.

Barstow Code Chapter 15.28: Surface Mining. Chapter 15.28 regulates the City’s surface mining operations in accordance with the SMARA requirements, the regulations adopted thereunder, and the CGS. This chapter is also intended to secure the continued availability of important mineral resources while also ensuring that adverse environmental effects are prevented or mitigated, and mined lands are reclaimed to a usable condition readily adaptable for alternative land uses.

City of Barstow Emergency Operations Plan

The Barstow Emergency Operations Plan, updated in April 2022, provides guidance for the City’s response to extraordinary emergency situations associated with natural, human-made, and technological disasters. This plan is not intended to be used for normal day-to-day emergencies, or the established routine procedures used to cope with such incidents. Rather, this plan concentrates on operational concepts and response procedures relative to large-scale emergencies and disasters. The City’s Emergency Operations Plan has been developed in accordance with the Standardized Emergency Management System and the National Incident Management System. City departments are responsible to assure the preparation and maintenance of the City’s Standard Operating Procedures, resource lists and checklists that detail how assigned responsibilities are performed to support the implementation of the City’s Emergency Operations Plan. The Standard Operating Procedures include the specific emergency authorities that designated officials, and their successors can assume during emergency situations.

5.7.3 METHODOLOGY FOR EVALUATING IMPACTS

This section defines the study area (i.e., affected environment) and summarizes the methodology used to analyze potential impacts concerning geology, soils, and mineral resources.

5.7.3.1 Definition of Study Area

The study area is the geographic boundary in which the environmental investigations were conducted specific to each resource topic.

Proposed General Plan

The study area for the proposed General Plan is the City and its SOI as shown in **Figure 3-2: Local Vicinity Map - BIG** in **Section 3.0: Project Description**.

Barstow International Gateway

The BIG study area for direct impacts concerning geology, soils, paleontological resources, and mineral resources is the BIG footprint. The BIG study area for indirect impacts concerning potential seismic-related

hazards (i.e., earthquake fault rupture, strong seismic ground shaking, seismic-related ground-failure (i.e., liquefaction), and seismic-related landslides) is the fault nearest the BIG footprint.

5.7.3.2 Terminology and Concepts

Primary Seismic Hazards

Primary seismic hazards are hazards directly associated with earthquakes and include fault rupture and ground shaking.

- **Fault Rupture.** Fault rupture is the result of tectonic movement that breaks to the surface of the earth suddenly during earthquakes, or slowly due to fault creep. Energy released during an earthquake is the result of fault rupture at depth, and when the rupture extends to the surface, it manifests as fractures, fissures, offsets, and related tectonic deformation.

The State of California Alquist-Priolo Act specifically regulates Holocene active faults, which are faults that have had surface displacement within the last 11,700 years. The CGS defines active faults as one that has had surface displacement within Holocene time (about the last 11,700 years) and a sufficiently active fault as one that has evidence of Holocene surface displacement along one of more of its segments or branches (CGS, 2018). Special Publication 42 and associated maps and published reports that delineate Earthquake Fault Zones were reviewed for the impact analysis below.

- **Strong Seismic Ground Shaking.** Ground shaking is the level of ground movement caused by a seismic event. Ground shaking occurs when energy released during a fault rupture then travels through subsurface rock, sediment, and soil materials, resulting in motion experienced at the ground surface. Ground shaking intensity varies with the earthquake magnitude, the distance from the earthquake epicenter, and the type(s) of geologic substrate the seismic waves move through. Depending on the level of ground motion and the soil stiffness, the ground shaking can amplify or de-amplify.

Secondary Seismic Hazards

Secondary seismic hazards include liquefaction, seismically-induced settlements, lateral spreading or slumps, and seismic-related landslides.

- **Liquefaction.** Liquefaction is a form of earthquake-induced ground failure that occurs primarily in relatively shallow, loose, granular, water-saturated soils. Liquefaction is defined as the transportation of a granular material from a solid state into a liquefied state due to increased pore pressure, which results in the loss of grain-to-grain contact. Almost any saturated granular soil can induce an increase in pore water pressures when shaken, and subsequently, these excess pore water pressures can lead to liquefaction if the intensity and duration of earthquake shaking are great enough. The primary factors that influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking.
- **Lateral Spreading.** Lateral spreading is a liquefaction-induced ground failure that occurs on gentle slopes adjacent to a free face.

- **Seismic Compression.** Seismic compression occurs when loose, granular soils rearrange into a denser configuration during ground shaking.
- **Seismically-Induced Landslides.** Seismically induced landslides occur when shaking from an earthquake causes pre-existing landslides to reactivate or trigger new landslides.
- **Seismically-Induced Flood Hazards.** Seismically-induced flooding is caused by failures of dams or other water-retaining structures due to seismic shaking, resulting in damage to structures and properties located downstream and possible injuries or loss to life.

Geologic Hazards

A geologic hazard area is defined as an area that poses a potential threat to the health and safety of citizens because of its susceptibility to erosion, sliding, or other geologic events and thus, these areas may not be suitable for certain developments. Specific geologic hazards include unstable geologic units (i.e., landslides, and ground subsidence. Unstable and expansive soils are discussed further below.

- **Landslides.** A landslide refers to the downslope movement of materials such as rock, soil, or fill under the direct flow of gravity. Landslides could occur in areas of moderate to steep topography where a combination of geologic factors including strength of soil, strength of rock materials, structure, and groundwater conditions result in the ground movement. Landslides can be initiated by soil saturation, earthquakes, volcanic activity, changes in groundwater elevations, or slope changes due to construction activities.
- **Ground Subsidence.** Ground subsidence is the vertical displacement of the ground surface, which can be localized or over a broad region. Subsidence can be affected by different processes and can be naturally or human induced. Land subsidence can result from a change in fluid content within soil or rock that occurs due to localized dewatering of peat, organic soils, silt, or clay.

Land subsidence can also occur from regional withdraw of groundwater, petroleum, or geothermal resources from sediments or sedimentary rocks. If a volume of water or petroleum is removed from subsurface sediment it can result in the collapse of the pore space that was previously occupied by the removed fluid. The loss of fluid-pressure support when fluids are withdrawn increases the stress on basin sediments and can result in the deformation of soil structure in the aquifer. If the volume of water or petroleum removed is sufficient, the resulting subsidence can cause damage to nearby engineered structures. Finally, subsidence can also be caused by mineral dissolution, earth extraction activities, and geological faulting.

Soil Characteristics

The Natural Resource Conservation Service (NRCS) operates and maintains a database known as the Web Soil Survey (USDA, 2023), which provides soil data and information. Soil characteristics include erodibility, collapsibility, and expansiveness.

- **Erodible Soils.** Erodible soils refer to the detachment and transportation of soil materials by wind or water. Soil erodibility depends on many factors including grain size, organic matter content, structure, permeability, and percentage of rock fragments. Potentially erosive conditions include areas that have a combination of erosive soils and uncovered slopes.

- **Collapsible Soils.** Collapsible soils are soils that are characterized by low density and low moisture content and undergo settlement upon wetting even without the application of additional load. When wet, these soils cause a net volume loss of the soil deposit that manifests at the ground surface as subsidence or settlement.
- **Expansive Soils.** Expansive soils are characterized by clay particles in soil that interact with water and their ability to undergo substantial volume changes (shrink or swell) due to variations in moisture content from precipitation, utility leakage, perched groundwater, drought, or other factors. Volume changes in soil may damage lightly loaded shallow foundations, pavement, and other shallow improvements. Expansive soils are defined as having low, moderate, or high expansive potential where the type and percentage of clay particles present in the spoil are indicative of the soil expansion type.

Paleontological Resources

Paleontological resources are the preserved remains or traces of animals and plants. They include body fossils (the remains of the organism itself) and trace fossils (which record the presence and movement of past organisms in their environment). The potential for fossil occurrence depends on the rock type exposed at the surface in a given area. Holocene Alluvium and Pleistocene older alluvium have the potential for high sensitivity geologic units. The study area for direct impacts to paleontological resources is the BIG footprint plus a one-mile radius.

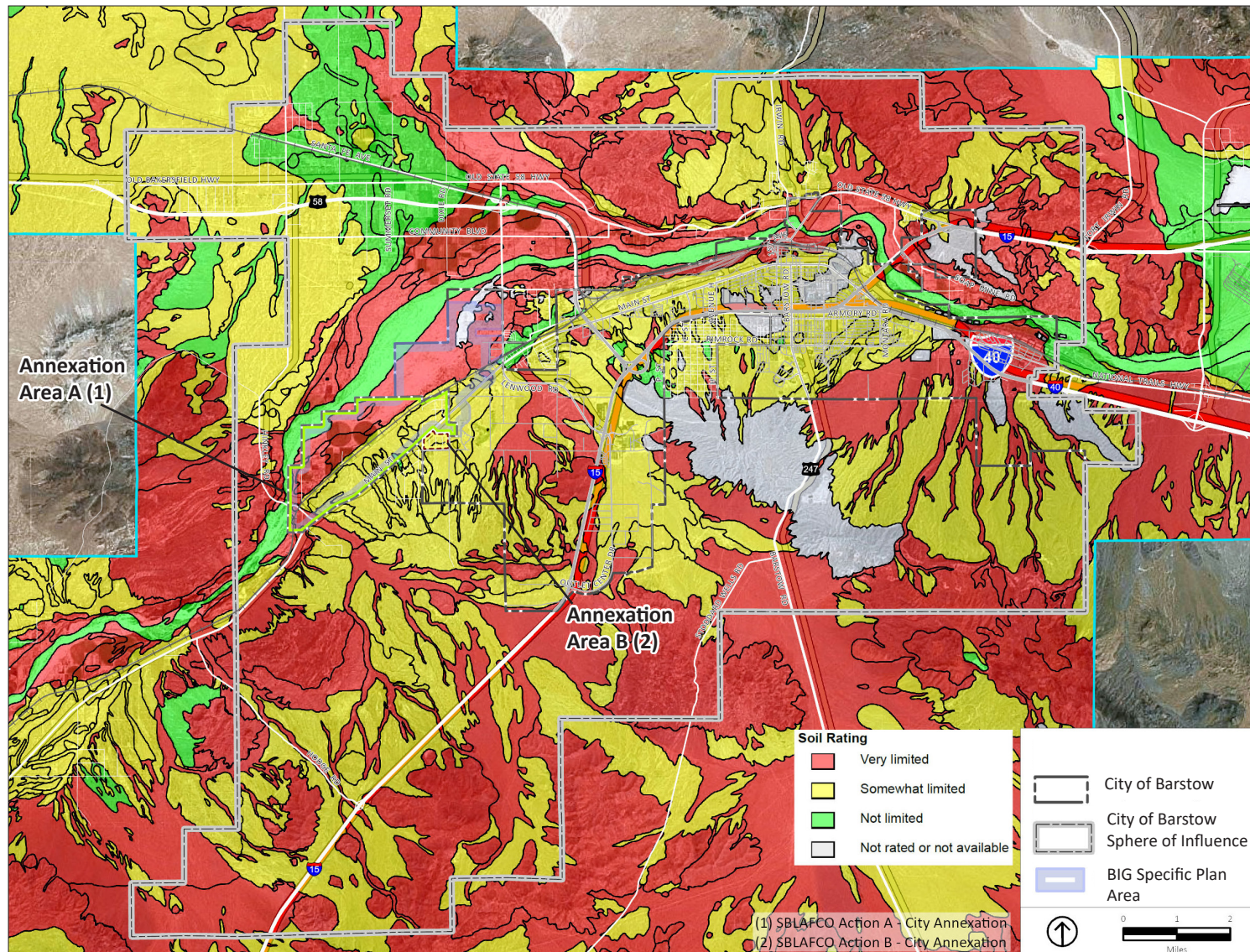
Mineral Resources

Mineral resources are broadly defined for the purposes of this analysis as naturally occurring substances that aid in urban construction (CGS, 2025a, 2025b). These substances include sand, gravel, and crushed stone that can be used as Portland-cement-concrete aggregate, asphaltic-concrete aggregate, road base, railroad ballast, riprap, and fill. The study area for direct impacts to mineral resources is the BIG grading footprint. The BIG grading footprint includes all areas within the BIG footprint that require grading activities: approximately 4,300 acres of the approximately 5,000-acre footprint.

5.7.3.3 Methodology

Proposed General Plan

Geographic Information System (GIS) and State and federal mapping systems were used to identify the geological, soil, and mineral resources within the proposed General Plan area. For purposes of this EIR, the soils information from the California Department of Water Resources (DWR), CGS, USGS, and USDA was evaluated for the potential to affect construction techniques and/or building design, or for the potential of significant mineral resources to exist within the proposed General Plan area. Because the proposed General Plan area is so large, and as shown in **Figure 5.7-2: Construction Compatibility of Soils – Proposed General Plan**, various portions of the proposed General Plan area have soils that are naturally compatible for construction, the evaluation of potential physical impacts from the Project is qualitative and focuses on procedures in place for more specific project-level information that would be provided as a part of the project review process. A review of the paleontological technical analyses for the Countywide Plan was used to identify paleontological resources in the proposed General Plan area.



Source:
Natural Resources Conservation Service, 2024.

Figure 5.7-2
Construction Compatibility of Soils – Proposed General Plan

Barstow International Gateway

Geology and Soils

Analysis included review and assessment of published maps, professional publications, and reports pertaining to the area's geology and soils to describe the affected environment. The following sources were reviewed to determine areas with potential for seismic-, geologic-, and soils-related hazards/conditions:

- USGS topographic maps
- USGS and CGS [Previously California Division of Mines and Geology (CDMG)] maps, reports, and other publications
- NRCS soils maps and data
- DWR groundwater data
- DWR, Division of Safety of Dams dam failure inundation maps
- Previous Shannon and Wilson reports prepared for other projects in BIG's vicinity (2019, 2021, 2024 a, b, c, d, e)

Where geologic hazards were present, the regulatory framework identified in **Section 5.7.2** was reviewed to determine the regulations' potential to avoid or lessen impacts.

Paleontological Resources

A review of available geologic maps was conducted for the BIG footprint. In addition to this review, a paleontological records search request was submitted for the BIG footprint plus a 1-mile buffer, to the Natural History Museums of Los Angeles County (NHMLAC) and the Western Science Center (WSC) on August 11, 2023. Results from NHMLAC were received on August 13, 2023, and results from WSC were received on September 20, 2023. NHMLAC provided a list of specimens recorded in similar contexts in the nearby Los Angeles County and San Bernardino County deserts.

Mineral Resources

The baseline conditions and impact analyses for mineral resources are based on review of BIG maps and drawings, analysis of aerial and ground-level photographs, review of CGS maps, and review of relevant local planning documents, such as the CWP and Barstow General Plan. The impact analyses consider the potential for changes in environmental conditions related to mineral resources, and BIG's potential to result in the loss of availability of a known mineral resource that would be of economic value to the region and the residents of the State; or result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. If significant deposits of mineral resources are discovered, an economic analysis on the viability of the mineral resources is conducted per CWP Mitigation Measure MIN-1, using costs per aggregate ton and the California Division of Mines and Geology threshold of \$12.5 million; see **Appendix 5.7 BIG-2** for more information.

An estimated cost for mining activities in MRZ-2b within ARA-14 and ARA-15, respectively was prepared for BIG. The memorandum also summarized the anticipated cost per acre of impacts to the Mojave River

from mining land n MRZ-2b if compensatory mitigation credits were purchased from the Mojave River Watershed Mitigation Bank. This memorandum was prepared based on Kimley-Horn’s professional experience as well as a review of permits recently issued for other projects in the high desert region.

5.7.4 ENVIRONMENTAL SETTING

Proposed General Plan

5.7.4.1 Geology and Soils

Regional Faulting, Seismicity, and Earthquakes

The proposed General Plan area lies within southern California, an active tectonic region where the interaction between the North American Plate and the Pacific Plate take place across a wide area: between the Eastern California Shear Zone in the Mojave Desert, the San Andreas Fault Zone, and active faults in the Pacific Ocean, tens of miles offshore. The Mojave Desert is bound by major active tectonic structures in California with the left-lateral Garlock Fault at its northern boundary and the right-lateral San Andreas Fault at its northern boundary. The Mojave Desert topography within this portion of California is influenced by an over 60-mile-wide network of northwest-trending, right lateral, strike-slip faults, and secondary east-west-trending faults. These faults are accommodating ongoing tectonic deformation in the region known as the Eastern California Shear Zone’s Mojave section. This deformation creates the Mojave Desert’s hill and valley topographic conditions. As with most of southern California, the proposed General Plan area is subject to strong seismically-induced ground shaking. The Mount General Fault, Harper Lake Fault, Lenwood Fault, and Lockhart Fault traverse the City and SOI. The Mount General Fault and Lenwood Fault include Alquist-Priolo Zones (CGS, 2023a). **Figure 5.7-3: Regional Faults – Proposed General Plan** shows the locations of the earthquake fault zones, including Alquist-Priolo Zones, which are within the City of Barstow and SOI. The Lenwood Fault is mapped as a historically active fault with reported anecdotal evidence of creep that was not confirmed by the CGS; the City does not have records that evaluate fault creep on the Lenwood Fault.

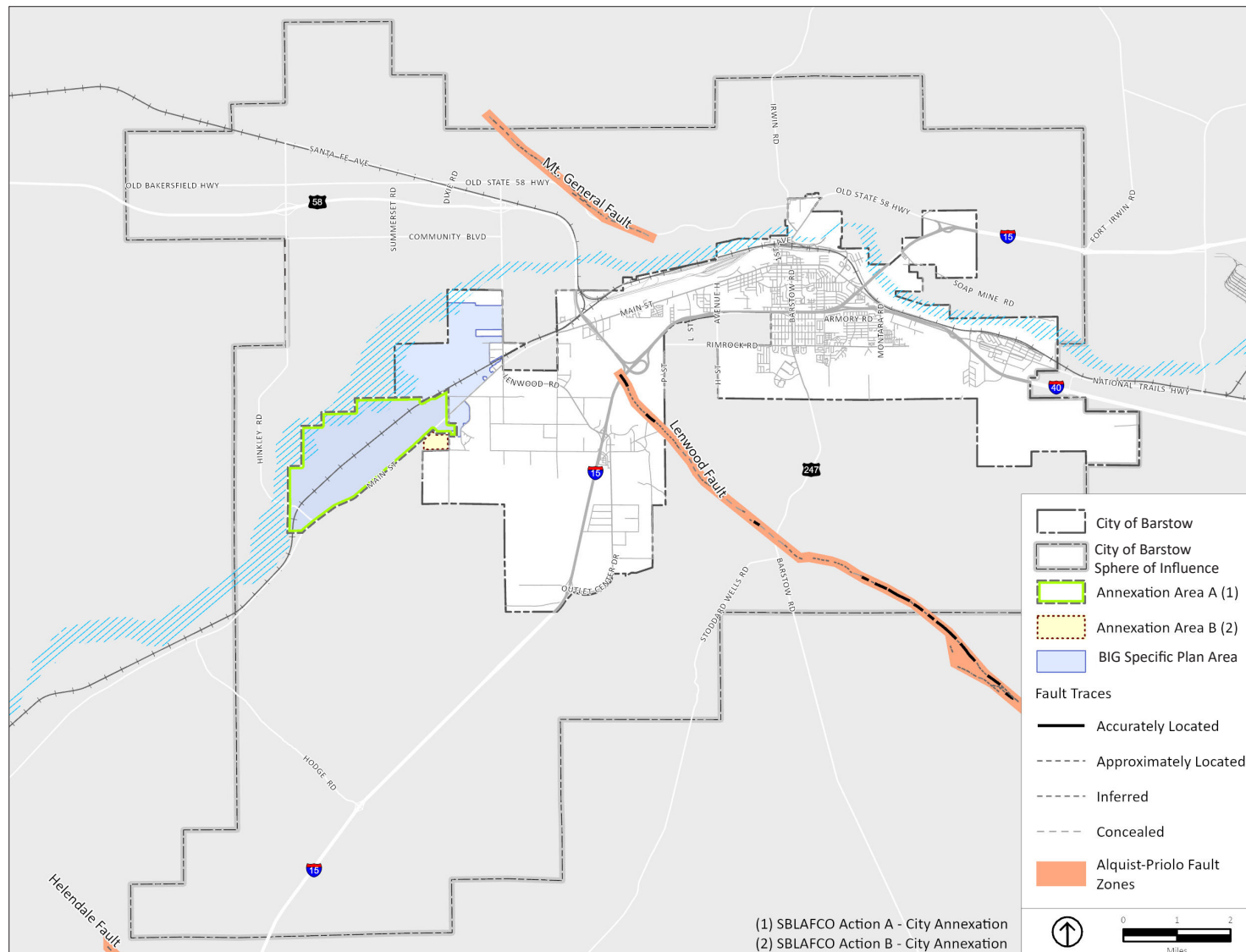
Secondary Seismic Hazards

Liquefaction. Liquefaction zones identify where the stability of foundation soils must be investigated, and countermeasures undertaken in the design and construction of buildings for human occupancy. Statutes require that cities and counties use these zones as part of their construction permitting process (CGS, 2024). Liquefaction susceptibility (low, medium or high) is the measure of a soil’s ability to liquefy during earthquakes. The area does not contain areas of low, medium, or high liquefaction zones (CGS, 2023a).

Lateral Spreading. Because there are no areas of liquefaction in the City and SOI, lateral spreading is unlikely to occur.

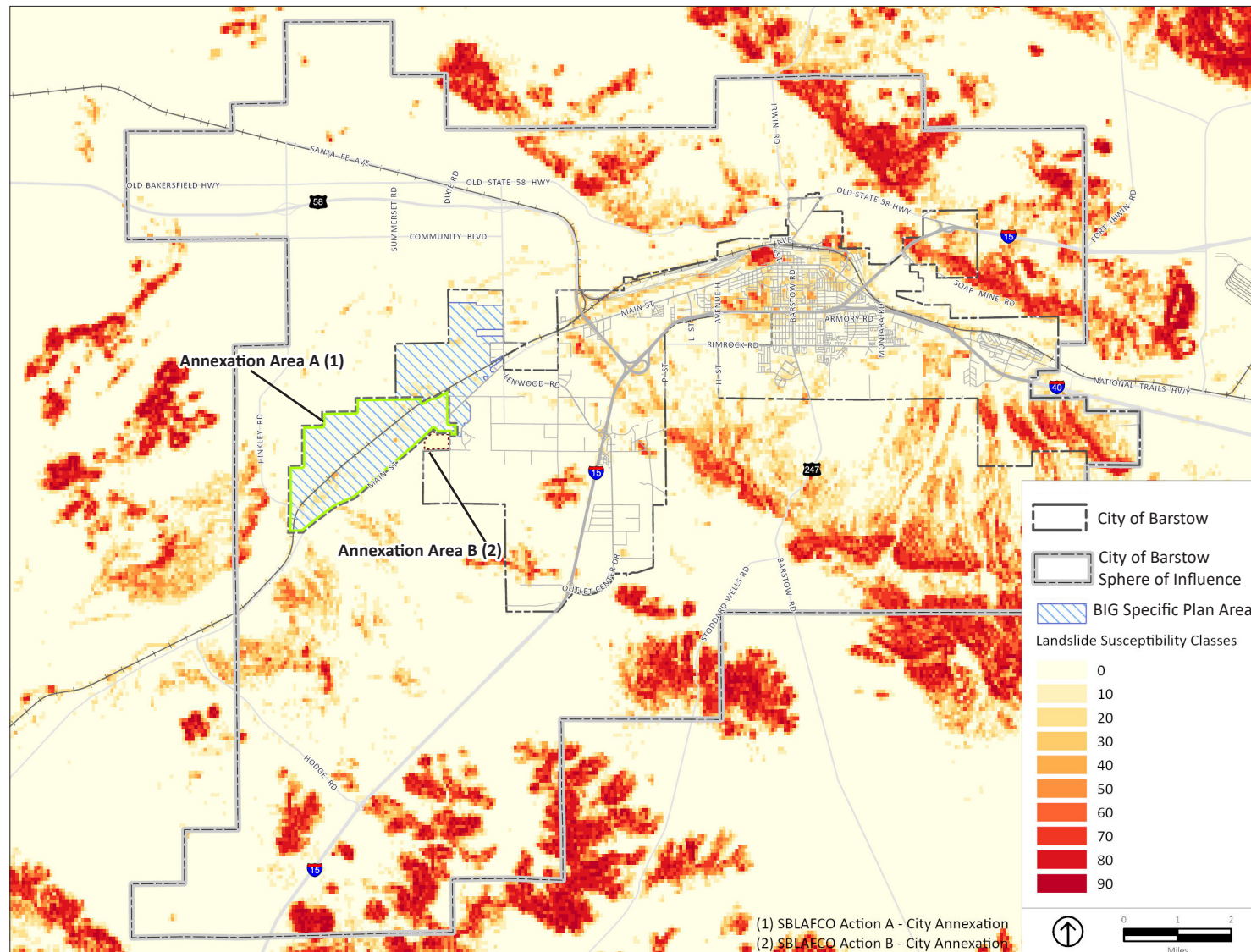
Landslides and Slope Instability. As shown in **Figure 5.7-4: Landslide Susceptibility – Proposed General Plan**, the various portions of the proposed General Plan area, particularly the eastern portion, are susceptible to landslides.

Subsidence. The City and SOI are not within a subsidence zone (USGS, 2023).



Source:
California Geological Survey, 2023; City of Barstow, 2025.

Figure 5.7-3
Regional Faults – Proposed General Plan



Sources:
City of Barstow, 2025; US Geological Survey, 2025.

Figure 5.7-4
Landslide Susceptibility – Proposed General Plan

Regional Geologic Setting

The proposed General Plan area is within the County’s Desert Region, which comprises most of the Mojave Desert and part of California’s Basin and Range geomorphic provinces. The Desert Region generally lies between 2,000 and 5,000 feet above mean sea level (msl) and is characterized by mountain ranges and hills that are partially buried and separated by broad alluvial basins. Mountain ranges and hills primarily consist of Mesozoic granitic and Mesozoic to Precambrian metamorphic rocks. Cenozoic sedimentary and volcanic rocks and landforms are also common.

Soils

Shrink-Swell Potential. Shrink-swell potential is the volume change that occurs as a result of changes in the moisture content of soils. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can damage buildings, roads, and other structures. Most of the City and SOI have a low shrink-swell potential; portions of the City and SOI have a moderate shrink-swell potential (USDA, 2023).

Construction Compatibility of Soils. There are locations in the proposed General Plan area that have soil types that are naturally compatible for the construction of small commercial buildings that are less than three stories high and do not have basements; see **Figure 5.7-2: Construction Compatibility of Soils – Proposed General Plan. Table 5.7-3: Soil Types and Construction Compatibility – Proposed General Plan**, shows the construction compatibility ratings of each soil type. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments (USDA, 2023).

Table 5.7-3: Soil Types and Construction Compatibility – Proposed General Plan	
Soil Type/Map Unit	Construction Compatibility ¹
Arizo Gravelly Loamy Sand	Very Limited
Badland	Very Limited
Bryman Loamy Fine Sand	Somewhat Limited
Cajon Sand	Not Limited to Very Limited Depending on Slope
Cajon Gravelly Sand	Very Limited
Cajon Loamy Sand, Loamy Substratum	Not Limited
Cajon-Arizo Complex	Very Limited
Cajon-Wasco Cool Complex	Somewhat Limited
Cave Loam (Dry)	Not Limited
Dune Land	Not Rated
Helendale Loamy Sand	Not Limited to Somewhat Limited Depending on Slope
Joshua Loam	Somewhat Limited to Very Limited Depending on Slope
Kimberlina Loamy Fine Sand	Not Limited to Somewhat Limited Depending on Slope
Kimberlina Gravelly Sandy Loam	Somewhat Limited
Lavic Loamy Fine Sand	Not Limited

Table 5.7-3: Soil Types and Construction Compatibility – Proposed General Plan	
Soil Type/Map Unit	Construction Compatibility ¹
Lovelace Loamy Sand	Somewhat Limited
Mirage Sandy Loam	Somewhat Limited
Mirage-Joshua Complex	Somewhat Limited
Mohave Variant Loamy Sand	Somewhat Limited
Nebona-Cuddeback Complex	Somewhat Limited
Norob-Halloran Complex	Somewhat Limited
Pits	Not Rated
Playas	Not Rated
Riverwash	Not Limited
Rock Outcrop-Lithic Torriorthents Complex	Very Limited
Rosamond Loam Saline-Alkali	Very Limited
Sparkhule-Rock Outcrop	Very Limited
Trigger-Rock Outcrop Complex	Very Limited
Typic Haplargids-Yermo Complex	Not Rated
Victorville Sandy Loam	Very Limited
Victorville Variant Sand	Very Limited
Villa Loamy Sand	Very Limited
Villa Loamy Sand, Hummocky	Very Limited
Yermo Gravelly Sandy Loam	Very Limited
Yermo-Kimberlina Cool	Very Limited
Water	Not Rated
¹ Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. “Not Limited” indicates that the soil has features that are very favorable for construction, “Somewhat Limited” indicates that the soil has features that are moderately favorable for construction, and “Very Limited” indicates that the soil has one or more features that are unfavorable for construction.	
Source: USDA, 2023b.	

Paleontological Resources

The proposed General Plan area is located within the Mojave Desert within an area that is characterized by mountain ranges and hills that are partially buried and separated by broad alluvial basins. The portion of this landscape within San Bernardino County, noted as the North Desert, encompasses 77 percent of the County’s land base. The region’s mountain ranges and hills primarily consist of Mesozoic granitic and Mesozoic to Precambrian metamorphic rocks, though Cenozoic sedimentary and volcanic rocks and landforms are also common. The Mojave Desert topography within this portion of California is influenced by a vast network of faults that accommodate ongoing tectonic deformation that creates the Mojave Desert’s hill and valley topographic conditions. Most of the City and SOI have a low-to-high paleontological sensitivity, with portions of the City and SOI also designated as having high levels of sensitivity, or no sensitivity.

5.7.4.2 Mineral Resources

There are 13 mines within the proposed General Plan area. Most of the proposed General Plan area is designated as MRZ-3a, which are areas containing known mineral deposits that may qualify as mineral

resources; however, there are also areas designated MRZ-1, which are areas where adequate geologic information indicates that no significant mineral deposits are present, and MRZ-2b, which are areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present, for aggregate resources. Additionally, portions of the proposed General Plan area are designated MRZ-2 and MRZ-3 for hydrothermal deposits and industrial minerals. **Figure 5.7-5: Mineral Resources – Proposed General Plan** shows the mineral designations and locations of mines within the City and SOI.

Barstow International Gateway

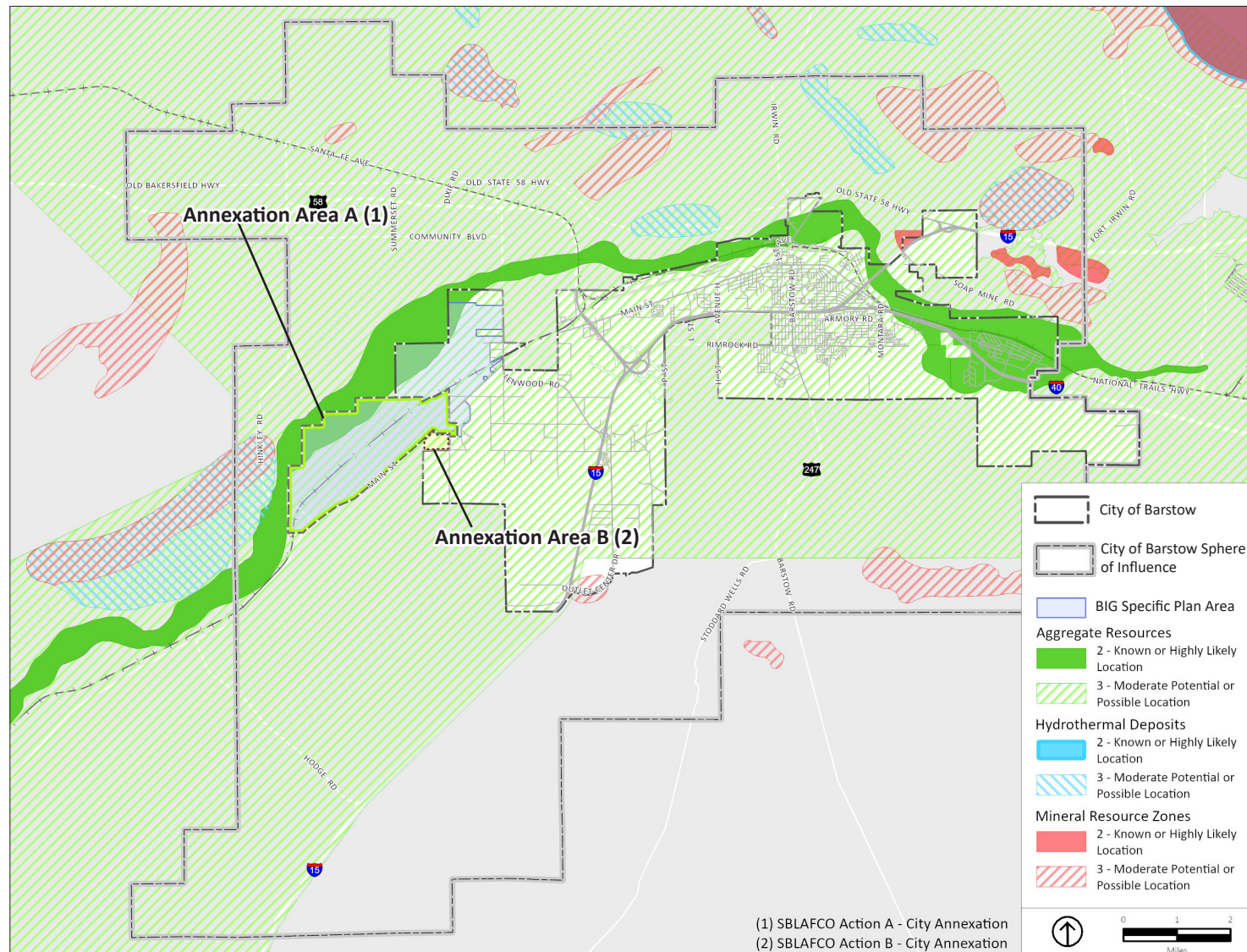
Physiography

The BIG footprint is within the Mojave Desert physiographic province and parallels the northeast trending Mojave River drainage basin. The southwesterly end of the BIG footprint (i.e., west lead track) extends into the north end of Brisbane Valley.

The BIG footprint is at the junction of the Mojave River floodplain and adjacent ascending elevated alluvial plains. At the BIG footprint's northern portion, in the vicinity of the proposed rail yard and transload warehouse center, the topography is relatively level within the Mojave River plain with localized hummocky sand dunes. The east lead track extensions, which are aligned within and adjacent to the existing BNSF corridor. The west lead track extensions are aligned on relatively level terrain at the southern edge of the Mojave River plain. From the river plain, the topography ascends an elevated alluvial plain to the southeast with the highest elevations adjacent to Main Street.

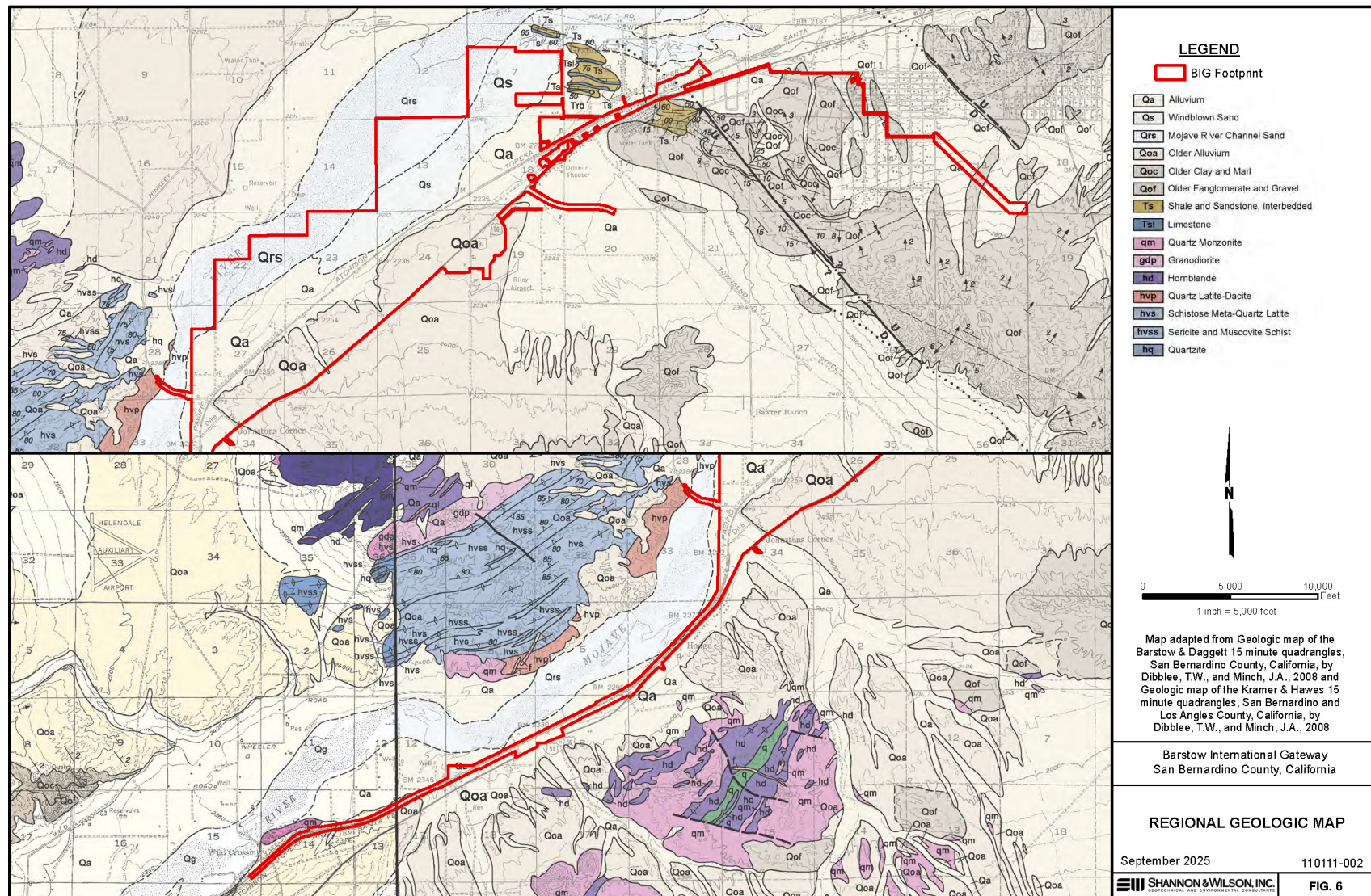
Local Geologic Setting

Figure 5.7-6: Geologic Map – BIG depicts the soils that underlie the BIG footprint and shows that the footprint south of the existing BNSF railroad corridor is largely underlain by very late Pleistocene and recent young alluvium (Qa), Pleistocene-aged older alluvium (Qoa), Older fanglomerate gravels (Qof), and Older clay (Qoc) deposits. North of the existing BNSF railroad corridor, the footprint is underlain by wind-blown dune sand (Qs), and Mojave-River channel sand (Qrs). In the central portion of the BIG footprint, west of the Hinkley road crossing, the project is underlain by a volcanic rock mapped as quartz latite-dacite (hvp). Additionally, Quartz monzonite (qm) bedrock is located at the west end of the western lead track extensions.



Source:
City of Barstow, 2025; US Geological Survey, 2025.

Figure 5.7-5
Mineral Resources – Proposed General Plan



Source:
Shannon & Wilson. (2025). Appendix 5.7 BIG-1.

Figure 5.7-6
Geologic Map – BIG

Seismic and Geologic Hazards

The three broad categories of hazards that could affect the BIG footprint (i.e., primary seismic, secondary seismic, and non-seismic geologic) are discussed below.

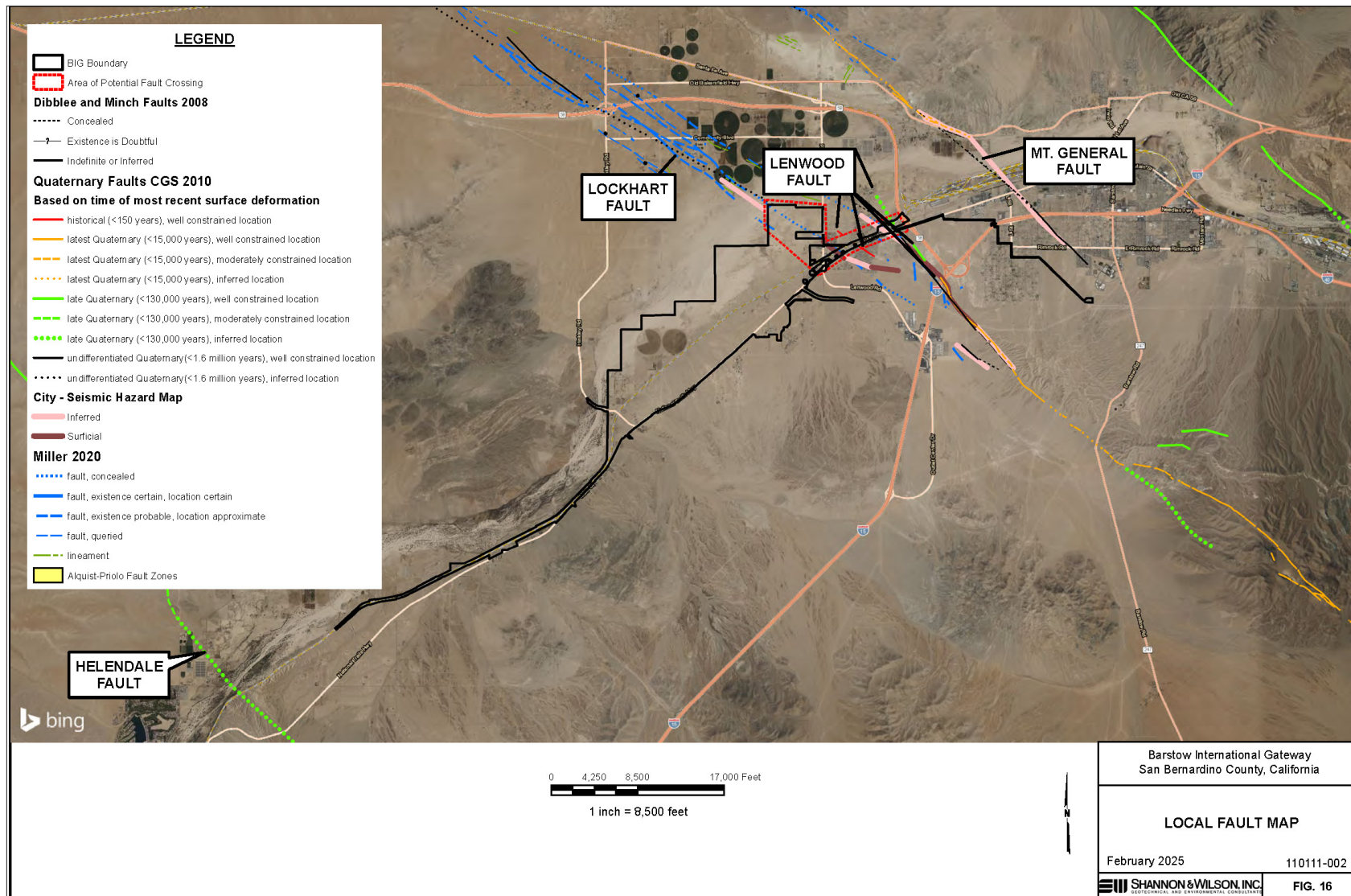
Primary Seismic Hazards. Primary seismic hazards within and near the BIG footprint are discussed below.

- **Fault Rupture.** No state-delineated Alquist-Priolo Earthquake Fault Zone/Zone of Required Investigation traverses the BIG footprint (CGS, 2023). CWP Policy Map HZ-1: Earthquake Fault Zones, **Figure 5.7-7: Local Fault Map – BIG** depicts County-delineated Alquist Priolo and County Fault Hazard Zones. There are no Alquist-Priolo Earthquake Fault Zones within the BIG footprint, but there is a reported creeping section of the Lenwood Fault that crosses the eastern portion of the BIG footprint.

Holocene active and Pre-Holocene active fault zones that are near the BIG footprint include the Lenwood-Lockhart fault zone, Gravel Hills, Harper Fault Zone, and the Helendale-South Lockhart fault zone. The Holocene active faults nearest to the BIG footprint are the Lenwood, Lockhart, and Mt. General faults and a reported creeping section of the Lenwood fault. Additionally, **Appendix 5.7 BIG-1**, Table 6: Summary of Active Faults within the Region, lists the regional faults that are considered to be active along with the fault distance and direction from the BIG footprint.

The Lenwood Fault is not an Alquist-Priolo Earthquake Fault Zone, but it is a regional fault that is considered to be active and could potentially cause a damaging earthquake in the region (**Appendix 5.7 BIG-1**). The fault trace is not mapped within an Alquist-Priolo earthquake fault zone because there is insufficient evidence to place it within a zone. One trace is mapped as a historically active fault with reported anecdotal evidence of creep that was not confirmed by the CGS (Manson 1986; Bryant 1987). The mapped features were field-checked and confirmed that evidence of fault creep is absent in the BIG footprint (**Appendix 5.7 BIG-1**). Additionally, the City does not have records that evaluate fault creep on the Lenwood fault (Domingo Gonzales, 2021).

- **Strong Seismic Ground Shaking.** As noted above, Table 6 in **Appendix 5.7 BIG-1** lists the regional faults that are considered to be active along with the fault distance and direction from the BIG footprint. The listed faults are those considered to cause potentially damaging earthquakes to the region. Several earthquakes of moderate to large magnitude have occurred in the southern California region. Table 7: Summary of Substantial Historical Earthquakes in the Region in **Appendix 5.7 BIG-1** lists the historic earthquakes of 6.0 or greater within the study area. The BIG footprint is subject to regional seismicity and therefore would be subject to strong seismic ground shaking.



Source:
Shannon & Wilson. (2025). Appendix 5.7 BIG-1.

Figure 5.7-7
Local Fault Map – BIG

Secondary Seismic Hazards. Secondary seismic hazards within and near the BIG footprint are discussed below.

- **Seismic-Related Liquefaction.** No state-delineated Liquefaction Zone/Zone of Required Investigation traverses the BIG footprint (CGS, 2023).

CWP Policy Map HZ-2: Liquefaction & Landslides, does not contain any data for the BIG footprint. As discussed in **Appendix 5.7 BIG-1**, the BIG footprint has no areas with suspected, low, medium, or high liquefaction susceptibility. Further, there are no Geologic Hazard (GH) Overlay zones present within the BIG footprint; see **Appendix 5.7 BIG-1**.

The Mojave River and Morongo groundwater basins in San Bernardino County are known for historical ground subsidence due to withdrawal of subsurface groundwater. The BIG footprint is within the Centro Subarea of the Mojave River groundwater basin (**Appendix 5.7 BIG-1**). The Mojave River and Morongo groundwater basins have undergone continuous withdrawal of subsurface groundwater causing groundwater levels to decline more than 100 feet between the 1950s and 1990s. Lowering groundwater levels have resulted in localized subsidence near dry lakebeds.

Groundwater is approximately 61 to 110 feet below ground surface[bgs] along the BIG footprint's eastern portion and areas where historic groundwater levels are greater than 50 feet are not considered liquefiable. BIG's Geotechnical Report reviewed groundwater maps from 2024 of specific areas within the BIG footprint and encountered the potential for liquefaction as localized locations within the BIG footprint where the median groundwater levels are shallower than 50 feet (**Appendix 5.7 BIG-1**). Groundwater is relatively shallow adjacent to the Mojave River at the BIG footprint's western portion (approximately 7 to 40 bgs) (Figure 3: Groundwater Map of **Appendix 5.7 BIG-1**).

- **Lateral Spreading.** Groundwater at the BIG footprint's western end has historically been within 15 feet of the ground surface. Although the ground is relatively level in this portion of the site, there is a slight slope down towards the Mojave River, thus, the potential for lateral spreading must be considered in a liquefaction analysis for the BIG footprint. Where localized liquefaction was encountered near the Mojave River, there is the potential for lateral spreading to occur during strong seismic shaking.
- **Seismic Compression.** Portions of the BIG footprint are underlain by recent alluvium that may be loose to very loose granular sands above the water table. Due to the likely potential for strong seismic ground shaking in the region, there is the potential for seismic compression in the granular soils above the groundwater table within the BIG footprint.
- **Seismically-Induced Landslides.** The BIG footprint is relatively level with elevations ranging from 2,240 feet above msl in the northwest portion to 2,370 feet above msl in the southeast portion. BIG is in relatively level terrain and existing landslides are not present. The potential for seismically-induced landslides within the BIG footprint is considered very low (**Appendix 5.7 BIG-1**).

No state-delineated Earthquake-Induced Landslide Zone/Zone of Required Investigation traverses the BIG footprint (CGS, 2023).

Non-Seismic Geologic Hazards. Non-seismic geologic hazards within and near the BIG footprint are discussed below.

- **Landslide Hazards (Non-Seismic).** Due to the BIG footprint's relatively level to gently sloping terrain and geology, existing landslides are not present. Unstable slope conditions can be created during grading without appropriate design and best management practices (BMPs) employed during grading.
- **Ground Subsidence.** Subsidence is the vertical displacement of the ground surface, which can be localized or over a broad region. Ground subsidence hazards involve either the sudden collapse of the ground or gradual compaction of sediments and lead to permanent deformation of the ground surface that can damage infrastructure such as water conveyance systems, roads, bridges, building foundations, etc. Land subsidence is a form of ground settlement that usually results from change in fluid content within soil or rock. The volume change can result from localized dewatering of peat, organic soils, or soft silts and clay. There are no known peat deposits within the BIG footprint and organic soils, soft silts, and clays are also unlikely. The peat deposit nearest the BIG footprint is Harper Lake, which is approximately six miles to the northwest. Therefore, there is low potential for ground subsidence in the BIG footprint due to localized dewatering of peat, organic soils, or soft silts or clays.

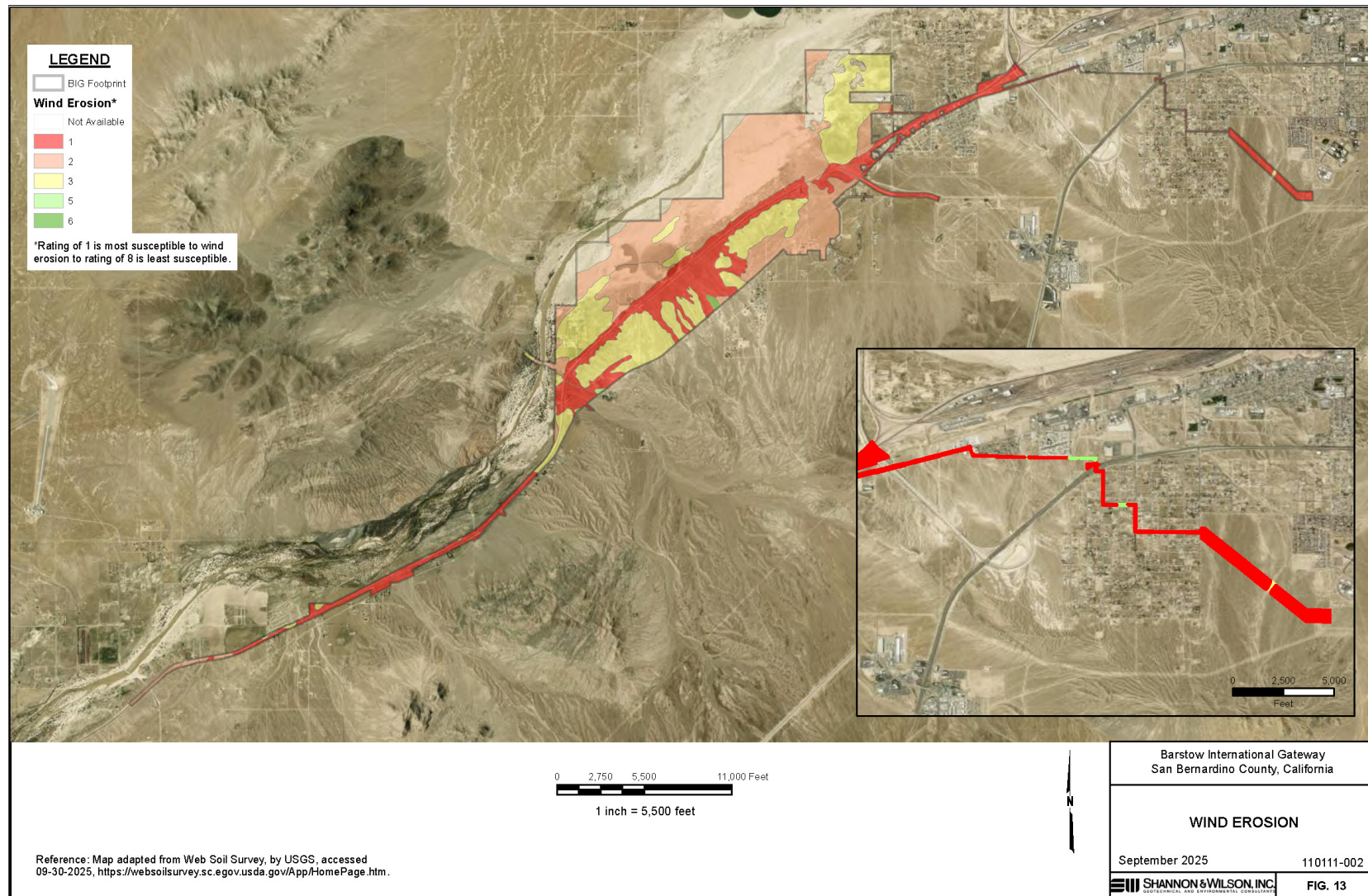
The second form of ground subsidence is from regional withdrawal of groundwater, petroleum, or geothermal resources from sediments, which can cause the collapse of the pore space previously occupied by the removed fluid. The Mojave River and Morongo groundwater basins in San Bernardino County are known for historical ground subsidence due to the withdrawal of subsurface groundwater. The Mojave River groundwater basin has undergone continuous groundwater withdrawal since the early 1900s, causing groundwater levels in nearby wells to decline more than 100 feet between the 1950s and 1990s. Lowering of the groundwater level has resulted in localized subsidence near dry lakebeds in the areas studied, including Harper Lake approximately six miles northwest of the BIG footprint. Regional groundwater management and active groundwater recharge in the Mojave River basin may reduce the potential for future subsidence in the region. Therefore, there is low potential for ground subsidence in the BIG footprint due to withdrawal of groundwater based on current regional groundwater management.

Soil Characteristics

Big footprint's soil characteristics are discussed below.

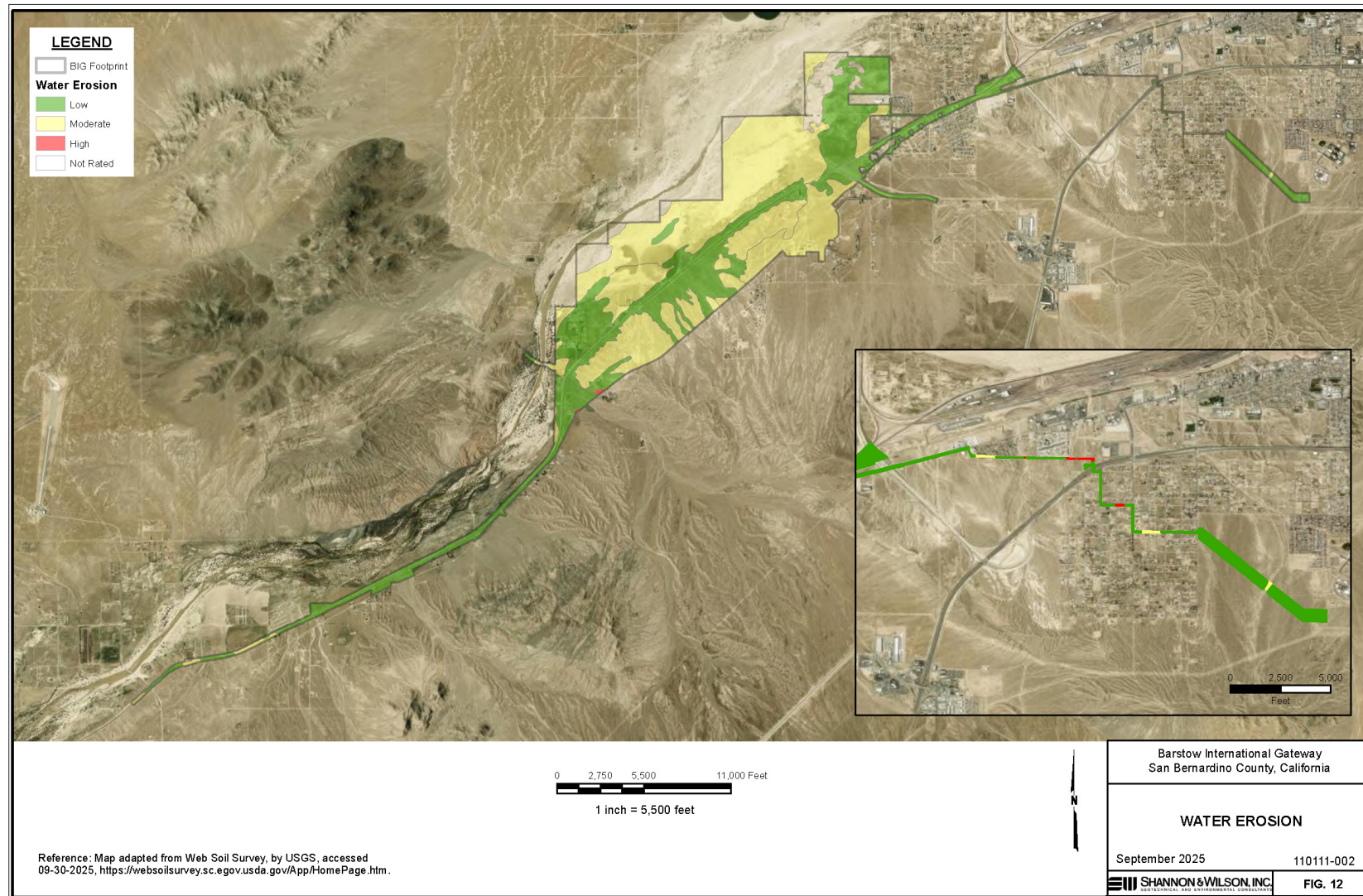
Erodible Soils. Figure 5.7-8: Wind Erosion Potential – BIG, which depicts County areas with low, low-medium, medium, medium-high, and high wind erodibility potential based on County Policy Map HZ-11 Wind Erosion Hazards, indicates the BIG footprint contains areas with high, medium-high, and medium wind erodibility potential.

Figure 5.7-9: Water Erosion Potential – BIG identifies areas within the BIG footprint that are the least and most susceptible to water erosion.



Source:
Shannon & Wilson. (2025). Appendix 5.7 BIG-1.

Figure 5.7-8
Wind Erosion Potential – BIG



Source:
Shannon & Wilson. (2025). Appendix 5.7 BIG-1.

Figure 5.7-9
Water Erosion Potential – BIG

Collapsible Soils. There were no references noting collapsible soils within the County near the BIG footprint when analyzed based on the NRCS (2022) soils data and the BIG footprint’s geologic conditions. Because the BIG footprint is at the junction of the Mojave River floodplain and adjacent alluvial fans, there may be underlying deposits of soil that are susceptible to collapse. One exploration test pit in the Mojave River floodplain at a depth of 10 feet bgs within BIG’s grading limits, however, this material is limited to one location and was not encountered at other exploration locations. Thus, testing indicated that collapse potential of soils in the upper 10-15 feet of the BIG footprint is localized, and the risk potential is considered low.²

Expansive Soils. The BIG footprint is in an area where many of the superficial soils consist of coarser-grained materials with low and moderate shrink-swell potential. **Figure 5.7-10: Shrink Swell Potential – BIG** shows the NRCS soil types within the BIG footprint have low and moderate shrink swell potential.

Paleontological Resources

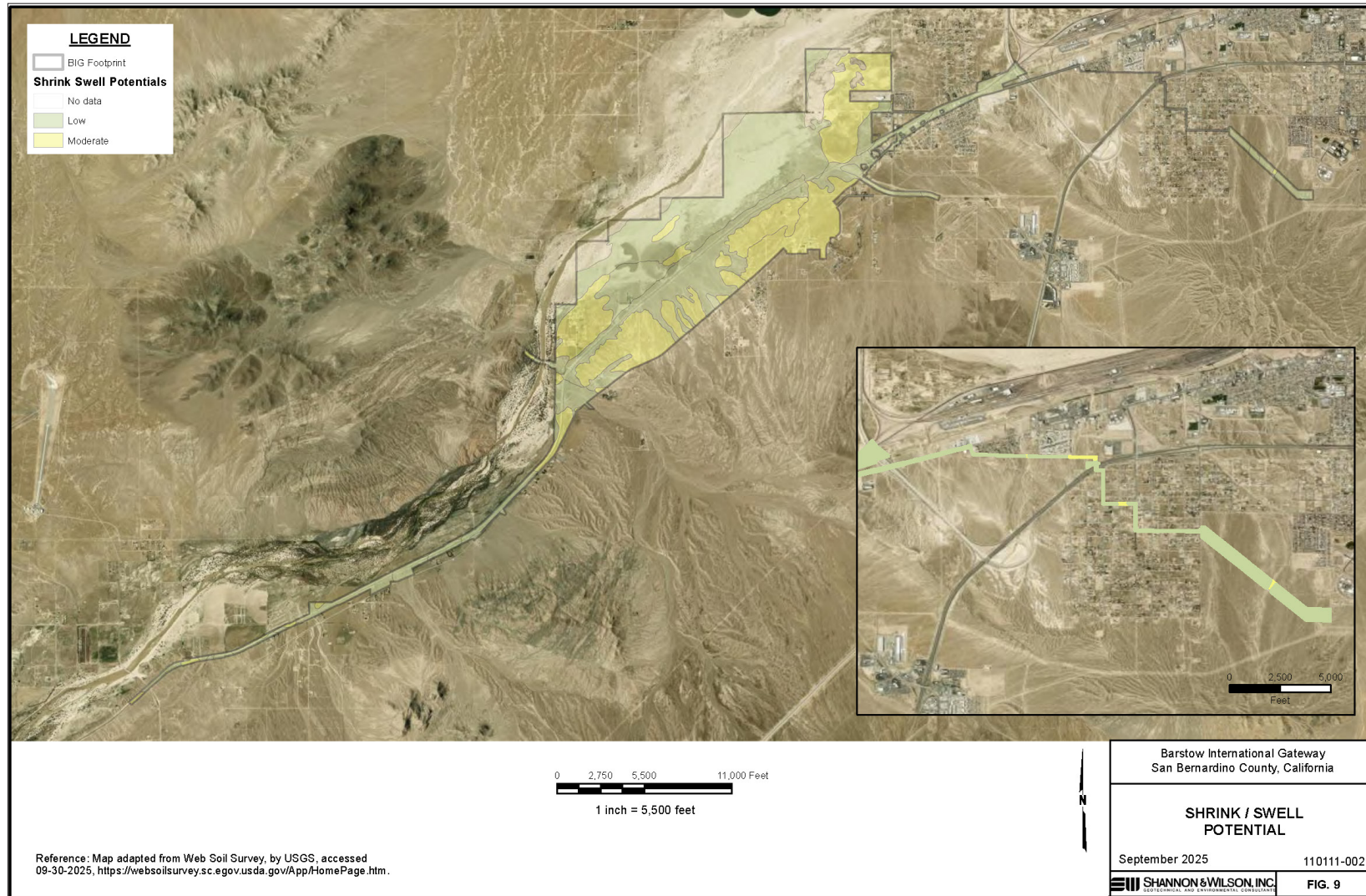
The BIG footprint is located at the junction of the Mojave River floodplain and adjacent ascending elevated alluvial plains. The geologic units underlying the BIG footprint in particular is mapped as a mix of Holocene and Pleistocene alluvial deposits, along with smaller deposits of Pliocene-Miocene sandstone and limestone. The northern portion of the BIG footprint is relatively level with localized sand dunes while the east and west portions contain relatively level terrain at the southern edge of the Mojave River plain. From the river plain, the topography ascends an elevated alluvial plain to the southeast with the highest elevations adjacent to Main Street. The climate in the area varies based on elevation with sparse precipitation supplemented by rain events caused by winter storms and summer monsoons. Impacts to the local landscape as a result of heavy rain events is noted via various small channels and redeposited soils within the BIG footprint.

Mineral Resources

MRZ Classifications. The BIG footprint is shown in CGS’s 2006 Geological Survey, “Aggregate Availability in California,” under the “Barstow Victorville P-C Region,” which contains 133 million tons of permitted aggregate resources as of January 1, 2006 (CGS, 2006). The State, County, and City MRZ classifications are discussed in detail above and summarized below.

State. CGS classifies the BIG footprint as MRZ-2b (approximately 905 acres) and MRZ-3a (approximately 4,090 acres), specifically for concrete aggregate resources (see **Figure 5.7-1**). As defined above, MRZ-2b areas are underlain by mineral deposits where geologic information indicates that significant inferred resources are present, and MRZ-3a, areas contain known mineral deposits that may qualify as mineral resources. MRZ classification surrounding the BIG footprint is primarily MRZ-1, which are areas where adequate geologic information indicates that no significant mineral deposits are present.

² Ibid



Source:
Shannon & Wilson. (2025). Appendix 5.7 BIG-1.

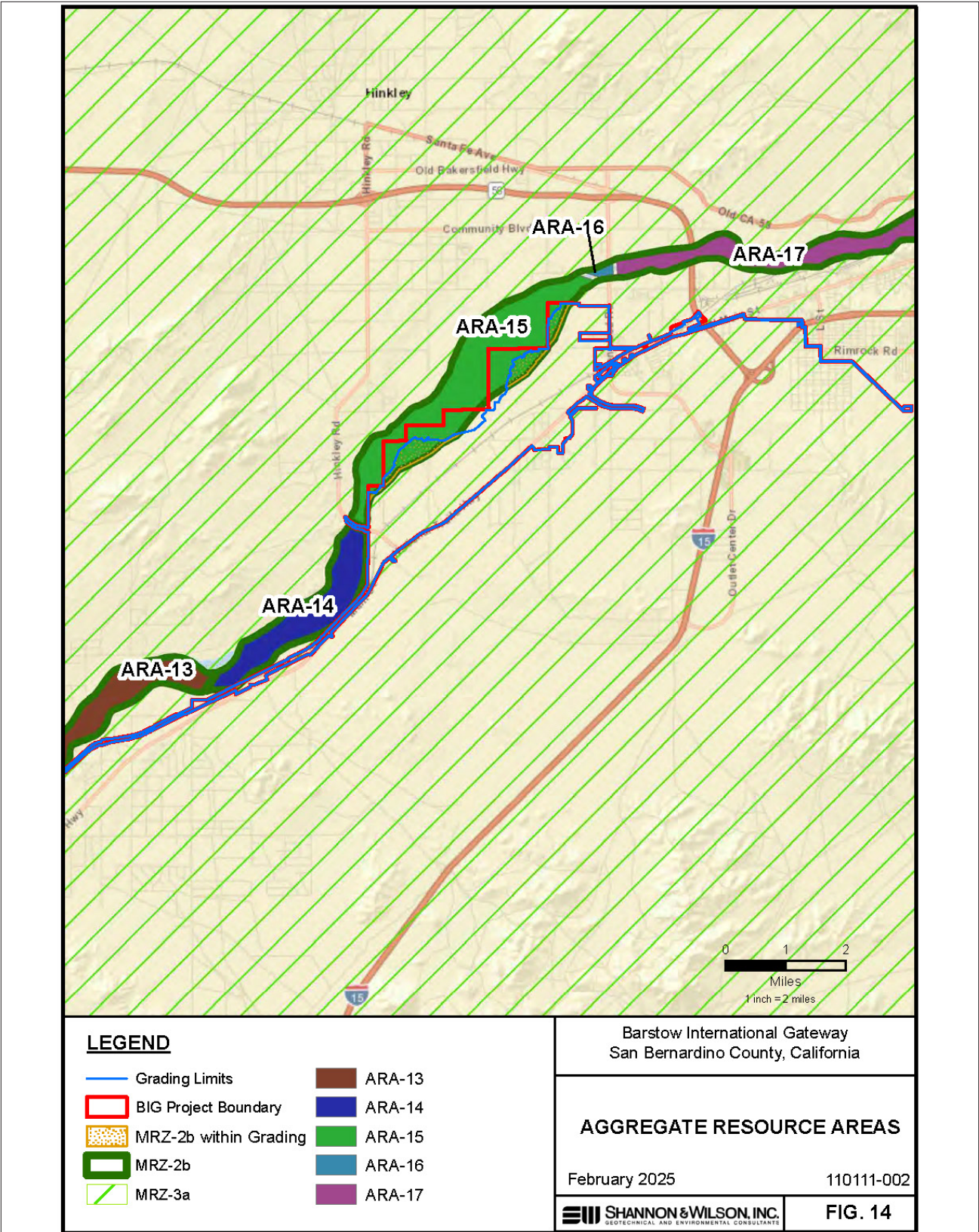
Figure 5.7-10
Shrink Swell Potential – BIG

County. The County is the lead agency for mining activity on all private and public lands in unincorporated areas and facilitates the extraction of mineral resources while minimizing adverse effects on the environment and communities (County of San Bernardino, 2020). **Figure 5.7-1** depicts County areas with either MRZ Class 2 (Known or Highly Likely Location) or MRZ Class 3 (Moderate Potential or Possible Location) for various mineral deposits based on CWP Policy Map LU-4: Mineral Resource Zones. This figure shows which mineral resources have potential to occur within the MRZ-2 and MRZ-3 zones and indicates none are present within the BIG footprint except for aggregate resources. However, the County map (**Figure 5.7-1**) does not illustrate complete State data. As depicted on this figure, the County-delineated MRZ nearest the BIG footprint is MRZ-3a, located approximately 2.3 miles to the west, and identified as Industrial Minerals and Hydrothermal Deposits, both with Moderate Potential or Possible Location.

City. The City does not delineate MRZs on a map but does report the City's MRZs "where significant mineral resources have been determined or inferred to be present are located primarily along the Mojave River and south of U.S. I-40. Most of the City, as well as the annexation areas, have been mapped within MRZs containing known mineral deposits of undetermined significance" (City of Barstow, 2015). Based on these General Plan descriptions and the State's MRZ classification definitions, it can be inferred that the City contains MRZ-2b and MRZ-3a areas. The General Plan also reports that the only mineral resource the State identifies as actively being utilized within the General Plan's study area is aggregate for the manufacture of concrete.

Aggregate Resource Areas. The ARAs for the Barstow-Victorville area were last classified by Miller (1993) and those within and near the BIG footprint are shown in **Figure 5.7-11: Aggregate Resource Areas – BIG**. As previously noted, ARAs are areas classified MRZ-2a or MRZ-2b for construction aggregate. As shown in the figure and discussed below, there are two ARAs within the BIG footprint and both are comprised of MRZ-2b. It is noted that the ARA-14 and ARA-15 boundaries match MRZ-2b boundaries shown in **Figure 5.7-1**.

- **ARA-14.** ARA-14 is comprised of MRZ-2b land and totals approximately 1,166 acres. This part of the Mojave River MRZ-2b is between the Hinkley Road crossing and a pipeline crossing approximately 1.7 miles to the west. The aggregate resources in ARA-14 are approximately 45 feet thick, based on area well logs. ARA-14 is rated as Highly Significant. The highest probable use of material from the ARA-14 deposit is concrete aggregate. An approximately 13-acre portion of the BIG grading footprint is within ARA-14 and is estimated to contain approximately 1.60 million tons of aggregate.
- **ARA-15.** ARA-15 is comprised of MRZ-2b land and totals approximately 2,604 acres. This part of the Mojave River MRZ-2b is between the Hinkley Road crossing and a pipeline crossing approximately six miles downstream. The aggregate resources in ARA-15 are approximately 54 feet thick, based on area well logs. ARA-15 is rated as Highly Significant. The highest probable use of material from the ARA-15 deposit is concrete aggregate. An approximately 358-acre portion of the BIG grading footprint is within ARA-15 and is estimated to contain approximately 50.50 million tons of aggregate.



Source: Shannon & Wilson. (2025). Appendix 5.7 BIG-2.

Figure 5.7-11
Aggregate Resource Areas – BIG

Table 5.7-4: Maximum Aggregate Resource in ARA – BIG presents the maximum aggregate resources available within the BIG grading footprint within the two ARAs. The maximum aggregate resources within the BIG footprint are based on the percentages of the BIG grading footprint within MRZ-2b. As indicated in **Table 5.7-4**, the maximum aggregate resources available within the BIG grading footprint (both ARAs) is approximately 52.10 million tons of aggregate.

Table 5.7-4: Maximum Aggregate Resource in ARA – BIG					
ARA No.	Assumed Density (Tons per Cubic Foot)	Assumed Waste (Percent)	Total Aggregate Resources in ARA (Million Tons)	Maximum Aggregate Resources in BIG Grading Footprint (Million Tons)	Approximate Cost of Construction Materials in ARA (Millions of Dollars)¹
ARA-14	0.06	0	137	1.6	14 to 32
ARA-15	0.06	0	368	50.5	455 to 1,010
Note: 1. Approximate Cost of Construction Materials in ARAs is based on the 2018 per ton costs for aggregate in California of \$9 to \$20. Source: Appendix 5.7 BIG-2: Mineral Resources Assessment.					

5.7.5 IMPACT THRESHOLDS AND SIGNIFICANCE CRITERIA

State CEQA Guidelines **Appendix G: Environmental Checklist Form** includes questions concerning geology, soils, and mineral resources. The issues presented in the Environmental Checklist Form have been used to formulate thresholds of significance in this section. Accordingly, the Project would have a significant effect concerning geology, soils, and mineral resources if it would:

The Project would have a significant effect concerning geology, soils, and mineral resources if it would:

- **Impact 5.7-1:** Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to California Geological Survey Special Publication 42.
- **Impact 5.7-2:** Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.
- **Impact 5.7-3:** Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction.
- **Impact 5.7-4:** Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.
- **Impact 5.7-5:** Result in substantial soil erosion or the loss of topsoil.
- **Impact 5.7-6:** Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

- **Impact 5.7-7:** Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.
- **Impact 5.7-8:** Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater; or
- **Impact 5.7-9:** Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
- **Impact 5.7-10:** Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State.
- **Impact 5.7-11:** Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

5.7.6 PROJECT IMPACTS AND MITIGATION MEASURES

Applicable Proposed General Plan Policies

The proposed General Plan goals and policies relevant to geology, soils, and mineral resources are listed below.

Open Space Conservation Element

- **Policy OSC-6.1 Mining operations and reclamation.** Coordinate with the County to ensure that the operation and reclamation of mined lands is consistent with the State Surface Mining and Reclamation Act of 1975 (SMARA).
- **Policy OSC-6.2 Mineral resource areas.** Designate and permit the development of land classified as Mineral Resource Zone (MRZ) 2a, 2b, or 3a in a manner that preserves future mining opportunities of non-aggregate mineral resources that would be of economic value to the region and the residents of the state.
- **Policy OSC-6.3 Construction aggregate.** Encourage the use of on-site aggregate when new development is proposed in an area containing aggregate resources.
- **Policy OSC-7.7 Paleontological and archaeological resources.** Protect paleontological and archaeological resources from loss or destruction by requiring that new development include appropriate mitigation to preserve the quality and integrity of these resources. Require new development to avoid paleontological and archeological resources whenever feasible. If avoidance is not feasible, require the appropriate treatment of paleontological and archeological resources.

Safety Element

- **Policy S-1.10 New development in seismic and geologic hazard zones.** Discourage new development in Alquist-Priolo Fault Zones, and liquefaction, subsidence, and landslide hazard zones to the extent feasible. For development that does occur in these areas, require submittal of a geotechnical report and ensure measures are incorporated into the project design to reduce risks to an acceptable level. Prohibit the construction of new critical facilities in these areas.

- **Policy S-1.11 Seismic safety retrofits.** Encourage efforts to seismically retrofit existing structures, prioritizing structures constructed prior to 1980, structures in the Alquist-Priolo Fault Zone, and homes of low-income households. Encourage seismic retrofitting for structures undergoing major expansions or renovations. The City will also adhere to applicable California Building Codes.
- **Policy S-2.4 Community emergency preparation.** Engage the community in emergency planning through working with local community-based organizations, health care providers, and contractors to expand education about natural hazard preparation, emergency response, and recovery resources. Provide educational materials that reflect Barstow’s language diversity and in formats that are accessible to all community members.

Public Facilities and Services

- **Policy PFS-2.2 Community awareness.** Promote public safety by maintaining and enhancing police, disaster, and emergency preparation education and outreach programs in multiple languages and methods to be inclusive of those with access and functional needs.

Impact 5.7-1 *Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.*

Proposed General Plan

There are Alquist-Priolo and earthquake fault zones that traverse and are proximate to the proposed General Plan area. However, there is no development within the Alquist-Priolo Zones (see **Figure 5.7-1**). The CBC does not allow structures to cross fault lines. As a part of future development proposals, the City would require a soils report to accompany a development application, including identifying an appropriate setback for buildings from the fault.

Per the Alquist-Priolo Earthquake Fault Zoning Act, before a project can be permitted, the City would require a geotechnical investigation to demonstrate that the proposed human occupancy structures would not be constructed across active faults. If an active fault is found, a structure cannot be placed over the trace of the fault and must be set back from the fault (typically at least 50-foot setbacks are required).

The potential for substantial risk to construction workers involving fault rupture would be minimized through compliance with the established regulatory framework, including the California Division of Occupational Safety and Health (CAL/OSHA), which has numerous requirements regarding trenching, shoring, and deep excavations, including prohibiting excavations greater than 5 feet without shoring. Further regulations which would minimize potential impacts from strong seismic shaking include Caltrans for any development which would include roadway modifications or improvements, American Society of Civil Engineers and the International Building Code (IBC) for managing potential risks from soils.

Furthermore, standard construction practices such as placement of compacted fill under foundations would stabilize buildings from potential seismic shaking.

Building designs to address seismic events can include modified foundations, reinforcement of framing, and additional shear reinforcement to help the building survive ground shaking. The design to protect against seismic events varies by building site and intended use of the building and is verified during the building plan inspection phase and inspected by the City during construction. The requirement for buildings to be designed for potential seismic events is part of the CBC which is independent of the CEQA process. Therefore, the requirements apply to all building permits issued by the City. While new structures may suffer potential damage requiring closure and replacement after a seismic event, compliance with the CBC would reduce potential seismic-related hazards on residents and visitors.

Additionally, the proposed policies would reduce impacts associated with Alquist-Priolo Fault Zones. For example, General Plan Policy S-1.10 would discourage new development in Alquist-Priolo Fault Zones to the extent feasible and require a geotechnical report and appropriate mitigation measures for development that does occur in these areas. General Plan Policy S-1.11 would encourage seismically retrofitting existing structures in the Alquist-Priolo Fault Zones. Implementation Measure S-5 would develop a program to connect lower-income households with resources for seismic retrofitting.

With compliance with local, State, and federal regulations that govern the construction of development in geologically hazardous areas, such as the CBC, Caltrans requirements, IBC, and Barstow Code Title 15, as well as the proposed General Plan policies, impacts would be less than significant.

Impact 5.7-1: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-1: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-1: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

The BIG footprint is not within an Alquist-Priolo Earthquake Fault Zone. The fault traces as presently mapped are shown in **Figure 5.7-7**. Surface fault rupture and associated ground deformation during construction of BIG is low given the temporary nature of construction activities. Notwithstanding, BIG construction activities would occur over approximately 3 years and generate approximately 8,188 direct construction jobs. The potential for substantial risk to construction workers involving fault rupture would be minimized through compliance with the established regulatory framework, including CAL/OSHA, which has numerous requirements regarding trenching, shoring, and deep excavations, including prohibiting excavations greater than 5 feet without shoring. If fault rupture occurs during construction, impacts could be minimized with track realignment and additional grading. The actual measures taken would depend on the earthquake's severity and the extent of ground deformation. Shutting down construction temporarily during/after a potentially damaging earthquake would minimize the risk of construction personnel or equipment encountering structures that have been compromised by seismic activity.

BIG's components would be designed in accordance with commonly accepted geotechnical engineering procedures. Off-site improvements (e.g., Tortilla substation improvements and electrical infrastructure

from Tortilla substation to the BIG footprint) would involve excavations up to 6.0 feet deep, and which would be conducted in accordance with relevant CAL/OSHA standards prohibiting excavations greater than 5.0 feet deep without shoring. BIG design and construction would also comply with applicable current federal, State, and local regulations regarding building and seismic design as identified below, which would minimize the effects from ground surface fault rupture, as well as the effects of other seismic and geologic hazards discussed below. Refer to Section 5.2 in **Appendix 5.7 BIG-1** for additional information concerning the applicable current building and seismic design guidelines and standards with which BIG would comply:

- The American Association of State Highway and Transportation Officials 2014 AASHTO Load Resistance Factor Design Bridge Design Specifications (7th edition with 2015 and 2016 interim revisions) and the 2011 American Association of State Highway and Transportation Officials Guide Specifications for LRFD Seismic Bridge Design (2nd Edition with 2012, 2014, and 2015 Interim revisions)
- Federal Highway Administration Circulars and Instructions No. 10 (hereafter “BNSF Systems Instructions”)

Following compliance with the established regulatory framework, BIG construction activities would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. A less than significant impact would occur, and no mitigation is required.

Operations

While the BIG footprint does not lie within an Alquist-Priolo Earthquake Fault Zone, the eastern lead track extensions and proposed transload warehouse center of BIG cross an area that is in-line with the general trend of the Lenwood-Lockhart fault system that is potentially Holocene active. The existing and proposed structures within the area of potential fault crossings include:

- Existing and proposed bridges at Milepost 4.3C and 4.3D
- Proposed retaining wall at Milepost 4.5
- Proposed warehouses and associated improvements including access roads and parking lots
- Proposed culverts
- Existing and Proposed tracks

No portion of the transload warehouse center or rail yard would traverse the Lenwood-Lockhart fault zone; although, the transload warehouse center would be approximately 0.3 mile south of the fault and the rail yard would be approximately 1.3 miles west of the fault. The fault zone is part of a larger fault system that is potentially active and could result in surface ground rupture across the BIG footprint during an earthquake on the fault system. If fault surface rupture were to occur during an earthquake on the Lenwood-Lockhart fault zone, it could result in more substantial ground surface displacement across the BIG footprint alignment and require substantial repair and realignment.

BIG would comply with current building and seismic design guidelines and standards, as discussed above, which would minimize the potential for substantial adverse effects from ground surface fault rupture.

Refer to Section 5.2 in **Appendix 5.7 BIG-1** for additional information concerning the applicable current building and seismic design guidelines and standards with which BIG would comply. Further, if an earthquake were to occur, BNSF's earthquake monitoring systems would notify the train operator of earthquake activity. Upon notification of an earthquake, the train dispatcher would initiate a response pursuant to the requirements outlined in BNSF Systems Instructions. The BNSF Systems Instructions provide rules and instructions for train dispatchers, operators, and control operators and are designed to establish uniform methods and practices over the entire system. The response initiated by the train dispatcher would require all trains within 150 miles of the reporting location to slow down or temporarily shut down operations during or after a potentially damaging earthquake. BNSF ground motion data instruments, instrumentation, and a controls system would be used together to temporarily shut down operations in the event of an earthquake. Temporarily shutting down operations during or after an earthquake would minimize the risk of a moving train encountering structures that have been compromised by seismic activity. See Attachment A of **Appendix 5.7 BIG-1** for BNSF Systems Instructions.

In addition to the BNSF Systems Instructions, the BNSF Engineering Instructions (BNSF, 2022) require special track inspections when an earthquake is reported with a magnitude 5.0 or greater. These instructions require trains to proceed at restricted speeds or stop entirely, depending on the magnitude and distance to the earthquake. BNSF would also comply with AREMA, which provides general guidelines for post-earthquake inspection of facilities and infrastructure. Post-earthquake inspection of bridges requires following AREMA Bridge Inspection Handbook Chapter 14 procedures.

As discussed in **Appendix 5.7 BIG-1**, a historical example of BNSF's implementation of the BNSF Systems Instructions and the BNSF Engineering Instructions occurred when BNSF performed post-earthquake assessments of track and facilities following the 1999 magnitude 7.1 Hector Mine earthquake. Track and bridge damages were encountered within 15 miles of the epicenter of the earthquake. BNSF completed their post-earthquake serviceability inspections within eight hours of the event.

BIG proposes the transload warehouse center and rail yard, which would be occupied by employees. All proposed buildings would be designed in accordance with applicable CBC standards and requirements to minimize potential hazards from surface fault rupture. Additionally, the City would review transload warehouse center plan sets and perform inspections during construction to ensure that buildings are constructed in accordance with the required seismic standards. Further, BNSF Systems Instructions would require slowing down or shutting off operations temporarily, during, or after a potentially damaging earthquake, and BNSF Engineering Instructions would require special track inspections, to reduce risks to personnel and property.

Implementation of the guidelines and standards described above, and City review of the transload warehouse center building plans would minimize potential impacts associated with rupture of a known earthquake fault. Thus, BIG operations would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. A less than significant impact would occur.

Impact 5.7-1: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-1: BIG Mitigation Measures: No mitigation required.

Impact 5.7-1: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-2 ***Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?***

Proposed General Plan

Ground shaking is responsible for most of the damage from earthquakes and can damage or destroy buildings, structures, pipelines, and other infrastructure. The intensity of shaking depends on the type of fault, distance to the epicenter, magnitude of the earthquake, and subsurface geology. As stated in **Impact 5.7-1: General Plan**, there are Alquist-Priolo and earthquake fault zones that traverse and proximate to the proposed General Plan area (see **Figure 5.7-1**). These faults have the potential to create ground shaking that could damage a variety of buildings and infrastructure. All buildings that would be constructed under the proposed General Plan would be designed to meet design standards as required in the latest CBC and would be required to implement the proposed General Plan policies, such as Policy S-1.10, which calls for discouraging new development in Alquist-Priolo fault zones.

Therefore, the Project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. Impacts would be considered less than significant.

Impact 5.7-2: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-2: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-2: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

As described above, the BIG footprint is within the seismically active southern California region and is near two active faults: the Lenwood-Lockhart fault and the Helendale fault. Therefore, strong ground shaking across the BIG footprint could occur during BIG construction.

The potential for substantial adverse effects involving strong seismic ground shaking during construction is relatively low given the temporary nature of construction activities. Additionally, the City would review transload warehouse center plan sets and perform inspections during construction to ensure that buildings are constructed in accordance with the required seismic standards. To protect personnel and property safety and project integrity in case of earthquake during construction, BNSF through their BNSF Engineering Instructions (BNSF, 2022) and BNSF Systems Instructions must perform facility inspections when an earthquake is reported. Shutting down construction temporarily during or after a potentially damaging earthquake would minimize the risk of a construction personnel or equipment encountering structures that have been compromised by seismic activity. Finally, the potential for substantial risk to construction workers involving strong seismic ground shaking would be minimized through compliance with the established regulatory framework, including CAL/OSHA, which has numerous requirements

regarding trenching, shoring, and deep excavations, including prohibiting excavations greater than 5 feet without shoring.

Therefore, BIG construction activities would not directly or indirectly cause potential substantial adverse effects, including risk of loss, injury, or death involving strong seismic ground shaking. A less than significant impact would occur, and no mitigation is required.

Operations

Due to the BIG footprint's proximity to the Lenwood-Lockhart fault and the Helendale fault, strong seismic ground shaking could occur during BIG operations. The intensity of ground shaking within the BIG footprint would depend upon the earthquake's magnitude, distance to the epicenter, and geology of the area between BIG and the epicenter. BIG would comply with regulatory controls to address potential seismic hazards, as discussed below. The types of construction that could result in seismically induced ground shaking include inserting wastewater into wells, placing heavy loads on unstable fault structures, extracting substantial groundwater, or creating unstable seismic conditions or stresses in the earth's crust. BIG does not propose these types of construction.

BIG proposes the transload warehouse center and rail yard, which would be occupied by employees. BIG would comply with current building and seismic design guidelines and standards, as discussed in **Impact 5.7-1: BIG**, which would minimize the potential for substantial adverse effects involving strong seismic ground shaking and other seismic and geologic hazards. The proposed buildings would be designed in accordance with applicable CBC standards and requirements to minimize potential hazards. During operations, BNSF Systems Instructions would minimize risks from strong seismic ground shaking as described in **Impact 5.7-2: BIG** that would minimize risks should an earthquake occur. Existing operating procedures would slow or shut down operations temporarily during or after a potentially damaging earthquake, to reduce risks to personnel and property safety and Project integrity in case of an earthquake described above. The measures taken would be dependent upon the severity of the ground shaking. Shutting down operations temporarily during or after a potentially damaging earthquake would minimize the risk of a moving train encountering structures that have been compromised by seismic activity.

Therefore, BIG operations would not directly or indirectly cause potential substantial adverse effects, including risk of loss, injury, or death involving strong seismic ground shaking. A less than significant impact would occur, and no mitigation is required.

Impact 5.7-2: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-2: BIG Mitigation Measures: No mitigation required.

Impact 5.7-2: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-3	<i>Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?</i>
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Proposed General Plan

Secondary effects of earthquakes are nontectonic processes such as ground deformation, including fissures, settlement, displacement, and loss of bearing strength, and are the leading causes of damage to structures during a moderate to large earthquake. Secondary effects could lead to ground deformation including liquefaction, lateral spreading, seismically induced landslides, and ground lurching. The CBC requires that building design take seismic events into account. Provisions are checked as part of the initial application, review phase, and building permit process. Finally, the potential for substantial risk to construction workers involving strong seismic ground shaking would be minimized through compliance with the established regulatory framework, including CAL/OSHA, which has numerous requirements regarding trenching, shoring, and deep excavations, including prohibiting excavations greater than 5.0 feet deep without shoring.

Liquefaction is when ground shaking, loose soils, and a water table at or near the surface combine to result in loss of ground strength. This can result in buildings sinking into the soil, which can cause damage and often failure of the structure. While loose sandy soil is prevalent in Barstow, the depth of groundwater is generally 25 feet or more below the surface, and the proposed General Plan area is not identified as being within a liquefaction zone (CGS, 2023, DWR, 2023). The potential for liquefaction is addressed in the soils report that is part of the building permit application process. The proposed General Plan area does not have the soil and high groundwater necessary for liquefaction and is not within a liquefaction zone; all structures constructed under the proposed General Plan would be designed in accordance with current seismic design standards as found in the CBC (CGS, 2023). With compliance with local, State, and federal regulations that govern the construction of development in geologically hazardous areas, such as the CBC and Barstow Code Title 15, this impact would be less than significant and no mitigation is required.

Impact 5.7-3: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-3: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-3: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

The potential for seismically-induced ground failure was evaluated in the western portion of the BIG footprint, where the rail yard and transload warehouse center are proposed, and along the railroad bridge alignments. The geotechnical analyses used a screening procedure to identify soil conditions potentially susceptible to liquefaction. Susceptibility to liquefaction is greatest where loose granular soils, such as sand and non-plastic silt, are present below groundwater at depths shallower than 50 feet. The soils evaluated along the alignment at railroad bridges and the Hinkley Road grade separation are not considered susceptible to liquefaction. The transload warehouse center is in an area underlain by loose to very loose soils that are within the upper 15 feet of the ground surface. However, groundwater is below 50 feet bgs so liquefaction is not anticipated to be a concern.

BNSF would design structures to withstand design seismic hazards in accordance with the previously discussed guidelines and standards (see **Impact 5.7-1: BIG**), minimizing the risks associated with liquefaction and other seismically-induced ground failure. Construction activities would not cause a regional increase in groundwater elevations or reduce the strength of underlying soil deposits.

BIG construction activities would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction. A less than significant impact would occur, and no mitigation is required.

Operations

In addition to designing the rail yard facilities and transload warehouse center for potential seismic activity, to protect personnel and property, BNSF Systems Instructions would require slowing down or shutting off operations temporarily, during, or after a potentially damaging earthquake to reduce risks to personnel and property. The measures taken would depend on the earthquake's severity, but they would minimize the risk to personnel, equipment, or moving trains encountering structures that have been compromised by liquefaction and ground failure.

Therefore, BIG operations would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction. A less than significant impact would occur, and no mitigation is required.

Impact 5.7-3: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-3: BIG Mitigation Measures: No mitigation required.

Impact 5.7-3: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-4	<i>Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?</i>
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Proposed General Plan

Portions of the proposed General Plan area are susceptible to landslides, particularly in the eastern portion (see **Figure 5.7-4**). Development would occur in areas that are more susceptible to landslides under the Project. All development would be designed in accordance with the standards of the CBC and required soils analysis, which would address the potential for landslides and would include design elements to reduce risks. Additionally, General Plan Policy S-1.10 would discourage development in landslide hazard zones, as applicable; a geotechnical report would be required to be prepared if development is proposed in landslide hazard zones. Upon compliance with local, State, and federal regulations that govern the construction of development in geologically hazardous areas, such as the CBC and Barstow Code Title 15, impacts would be less than significant, and no mitigation is required.

Impact 5.7-4: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-4: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-4: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

Due to the BIG footprint's relatively level terrain, existing landslides are not present and there would be no exposure to slope failure hazards associated with existing landslides. Temporary construction effects from grading in soft or loose soils could result in on-site or off-site slumps and small slope failures at stream crossings, instability of cut-and-fill slopes, or collapse of retaining structures used for retained fills or retained cuts. Engineered ground improvement such as regrading or groundwater controls would stabilize soft or loose soils wherever they occur on the BIG footprint. The design would improve the stability of deep unstable soils by replacing them with competent soils, strengthening replacement materials with geosynthetics, and placing stone columns or vertical drains.

BIG geotechnical design would improve loose and unstable soils or would use alternative designs to avoid effects on graded cuts, fill embankments and structures. All grading within the BIG footprint would be designed and performed in accordance with Barstow Code Chapter 15.12, Grading, as well as CBC requirements and standard engineering practices that would result in stable slope conditions and eliminate potential slope stability hazards.

Therefore, BIG construction would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides. A less than significant impact would occur, and no mitigation is required.

Operations

If an earthquake were to occur during BIG operations, potential landslide impacts could range from no effect to the built structures to slope failure. BIG components would be designed in accordance with commonly accepted geotechnical engineering procedures and follow the established regulatory framework, including guidelines in the AREMA Manual (2018) and then-current CBC requirements. To protect personnel and property, BNSF Systems Instructions would require slowing down or shutting off operations temporarily during, or after a potentially damaging earthquake to reduce risks to personnel and property. The measures taken in accordance with the Systems Instructions would depend on the severity of the earthquake, but they would minimize the risk of personnel, equipment, or moving trains encountering structures that have been compromised by landslides.

The impact would depend on the intensity of ground shaking from the earthquake and proximity to structures and track from cut of fill slopes. Most of the rail yard and transload warehouse center areas and structures would be within relatively level terrain and landslides would not be a hazard. The potential for landslides in the cut and fill slopes constructed on the margins of the level areas would likely be minimal due to the geotechnical design measures of the graded cut and fill slopes. Cut and fill slopes would be designed in accordance with commonly accepted geotechnical engineering procedures. Therefore, BIG operations would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides. A less than significant impact would occur, and no mitigation is required.

Impact 5.7-4: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-4: BIG Mitigation Measures: No mitigation required.

Impact 5.7-4: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-5	<i>Would the Project result in substantial soil erosion or the loss of topsoil?</i>
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<i>Proposed General Plan</i>

Soils are particularly prone to erosion during the grading and construction phase of development, especially during wind events and/or heavy rains. If exposed soils are not protected from wind or water erosion, such as when vegetation is cleared for work areas and material stockpiles, both the exposed work areas and any stockpiles could erode and result in decreased air and water quality and loss of high-value soil. Therefore, during construction, future development would comply with Barstow Code, Chapter 15.12 – Grading, which requires that BMPs be incorporated into a grading plan. Construction-related soil erosion can be minimized through adherence to relevant transportation and building agency guidelines, previously described in **Impact 5.7-1: General Plan**, and standards and through design measures including implementation of BMPs. Future development would also implement a dust control plan in accordance with the Mojave Desert Air Quality Management District rules and regulations to minimize wind erosion. Standard construction practices that would consider the soil properties and minimize soil erosion hazards include soil stabilization, watering for dust control, perimeter silt fences, and sediment basins. Implementation of local and State regulations regarding soil erosion, such as stormwater BMPs and temporary soil erosion guidelines, would be followed during future design and construction. Design measures would minimize wind and water erosion through the adoption of BMPs, including use of stabilizers, mulches, revegetation, and covering areas with biodegradable geotextiles.

Compliance with the Storm Water Pollution Prevention Plan for projects disturbing one or more acres, which specifies BMPs for temporary erosion control, would reduce the potential for erosion during construction activities. Examples of standard erosion control measures include regular watering, covering of loads, interim landscaping, restriction of grading during high wind or rain events, dust control soil binders, chemical dust suppressants, temporary gravel, synthetic covers, jute bales, and siltation ponds that slow the velocity of water and allow for cleanout after storm events. Standard erosion control measures would be implemented as part of a Storm Water Pollution Prevention Plan (SWPPP) for proposed projects within the City and SOI to minimize the risk of erosion or sedimentation during construction. The SWPPP must include an erosion control plan that prescribes measures, such as phasing grading, limiting areas of disturbance, designating restricted-entry zones, diverting runoff from disturbed areas, protective measures for sensitive areas, outlet protection, and provisions for revegetation or mulching.

For all other projects disturbing less than one acre, compliance with Barstow Code Chapter 15.12, Grading, which requires soils and geology reports, as well as compliance with the CBC and Mojave Desert Air Quality Management District rules and regulations, would ensure impacts would be less than significant.

Impact 5.7-5: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-5: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-5: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

Accelerated soil erosion, including the loss of topsoil, could occur as a result of BIG construction activities. There is a possibility of soil erosion in the BIG footprint and particularly within the susceptible areas (see **Figure 5.7-8** and **Figure 5.7-9**). Soil erosion can be accelerated by construction when vegetation is removed, and soils are left unprotected and exposed to wind and water. Increased surface water runoff can also result from temporary, impermeable work surfaces.

If exposed soils are not protected from wind or water erosion, such as when vegetation is cleared for work areas and material stockpiles, both the exposed work areas and any stockpiles could erode and result in decreased air and water quality and loss of high-value soil. Therefore, during construction, BIG's components in the City and annexation areas would comply with Barstow Code Chapter 15.12 – Grading, which requires that BMPs be incorporated into a grading plan. The off-site improvement areas that would not be annexed would be required to comply with County erosion control measures that are incorporated into an erosion control plan. Construction-related soil erosion can be minimized through adherence to relevant transportation and building agency guidelines, previously described in **Impact 5.7-1: BIG**, and standards and through design measures including implementation of BMPs. BIG would also implement a dust control plan in accordance with the Mojave Desert Air Quality Management District rules and regulations to minimize wind erosion in the BIG footprint. Standard construction practices that would consider the soil properties and minimize soil erosion hazards include soil stabilization, watering for dust control, perimeter silt fences, and sediment basins. Implementation of local and State regulations regarding soil erosion, such as stormwater BMPs and temporary soil erosion guidelines, would be followed during BIG design and construction. Design measures would minimize wind and water erosion through the adoption of BMPs, including use of stabilizers, mulches, revegetation, and covering areas with biodegradable geotextiles. Therefore, BIG construction would result in a less than significant impact concerning soil erosion and the loss of topsoil; no mitigation is required.

Operations

There is potential for soil erosion and loss of topsoil as a result of BIG operations and long-term effects related to maintenance, landscaping, and improvements. Continued maintenance of the designed drainage features would minimize wind and water erosion through the adoption of BMPs including the use of stabilizers, mulches, revegetation, and covering areas with biodegradable geotextiles. BMPs would also be incorporated into the facility design plans for the control of stormwater runoff. BMPs are described above. Standard maintenance practices during BIG operations such as maintaining soil stabilization and vegetation in the operations area and controlling erosion while the vegetation is established would also reduce soil erosion. Therefore, BIG operations would result in a less than significant impact concerning soil erosion and the loss of topsoil, and no mitigation is required.

Impact 5.7-5: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-5: BIG Mitigation Measures: No mitigation required.

Impact 5.7-5: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-6 *Would the Project be on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on-site or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?*

Proposed General Plan

Settlement and Collapse

Settlement and collapse are the vertical movement of soil typically under stress either in the soil or on the surface. Sometimes the soil moves from one area to another causing the ground surface to settle, or in some instances it can compress resulting in a similar effect on the surface. Although settlement and collapse, and hydrocollapse³ can occur in naturally occurring soils, such as in alluvial soils, it is more common to see settlement and collapse in artificial fill such as used to level or raise a building site. Settlement can damage, or in extreme cases, destroy structures. Construction compatibility for small commercial buildings on various soil types within the proposed General Plan area including the compressibility and resultant settlement and collapse of the different soil types. While some of the soil types in the proposed General Plan area do not have soils that are naturally suitable for development, all soil types would be suitable for development upon compliance with the CBC and recommendations listed in project-specific geotechnical reports. Typical engineering measures identified in geotechnical reports include removal of loose soils until reaching competent materials (as identified by site-specific geotechnical analyses), placement of artificial fill that is properly compacted underneath proposed foundations, constructing pile foundations, inserting concrete slurry into the subgrade, and excavating to reach competent soils. Other construction and engineering practices may be employed based on future development design and site-specific geotechnical studies. Projects would comply with the measures identified in the geotechnical studies and comply with CBC requirements to minimize potential impacts from unstable soils.

Compliance with the CBC requires that structures be designed to mitigate compressible soils. Methods that could be used to reduce the impact of compressible soils include transferring the load to underlying non-compressible layers with piles and over excavation of compressible soil and compaction of new soil overseen by a qualified engineer. Adherence to the CBC and the project-specific measures in the soils report submitted as part of the initial application, review phase, and building permit process, will ensure that the impact of compressible soils and the potential for settlement and collapse is less than significant.

Liquefaction and Lateral Spreading

A discussion of the impacts of liquefaction can be found in **Impact 5.7-3: General Plan**.

³ Hydrocollapse is a condition that occurs when a dry soil that is able to withstand increased load in a dry condition collapses upon saturation.

Lateral spreading is a liquefaction-induced ground failure that occurs on gentle slopes adjacent to a free face. Because there are no areas of liquefaction in the City and SOI, lateral spreading is unlikely to occur. The potential for lateral spreading is addressed in the soils report that is part of the building permit application process, and all structures constructed under the Proposed General Plan would be designed in accordance with current seismic design standards as found in the CBC (CGS, 2023). With compliance with local, State, and federal regulations that govern the construction of development in geologically hazardous areas, such as the CBC and Barstow Code Title 15, this impact is less than significant.

Landslides

A discussion of the impacts of landslides can be found in **Impact 5.7-4: General Plan**.

Subsidence

Subsidence is the gradual or sudden sinking of the surface due to removal or displacement of subsurface materials such as during a rain event, groundwater withdrawal, or mining. Emergency subsidence can occur due to breaks in waterlines, or erosion during storm events, however the proposed General Plan area is not considered susceptible to subsidence due to the low groundwater table and lack of subsurface mining. Compliance with the CBC and project specific soil report, as well as the General Plan policies such as Policy S-1.10, will ensure that the impact from subsidence is less than significant.

Impact 5.7-6: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-6: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-6: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

The BIG footprint is within a relatively level to gently sloping terrain and would be constructed so that any cut and fill slopes would not be susceptible to landslide or cause significant erosion that would result in a landslide. Additionally, as discussed in **Impact 5.7-3: BIG**, the risk of liquefaction is considered low and geotechnical design measures would reduce the potential for liquefaction to even lower levels. For liquefaction, localized exceptions are noted in areas of higher groundwater near the Mojave River towards the western portion of BIG. Given this, and the relatively level terrain along the Mojave River reduces the potential for lateral spread to negligible levels. Where liquefaction occurs in areas of structures (e.g., bridges and warehouses), specific recommendations such as over-excavation, shoring, engineered soil, drainage systems, and foundation design would be provided. Regional groundwater management and active groundwater recharge in the Mojave River Basin and Morongo Basin may reduce the potential for future subsidence in the region. Previous studies conducted in the Mojave River vicinity did not indicate evidence of subsidence in the BIG footprint (**Appendix 5.7 BIG-1**), thus, the potential for future ground subsidence at the BIG footprint is considered low.

Soils underlying the rail yard, bridges, and transload warehouse center would not become unstable as a result of the BIG. Grading excavations and associated cut and fill earthwork will be performed to remove

the impact of unstable soils, if present, including the loose to very loose alluvium underlying the transload warehouse center. BIG is in relatively level to gently sloping terrain and will be constructed so that graded cut and fill slopes in the underlying alluvial and older alluvial soils underlying the rail yard would not be susceptible to landslide or cause significant erosion that would result in a landslide.

BIG construction would conform to guidelines specified by relevant transportation and building agencies and codes described in **Impact 5.7-1: BIG**. Contractors for BIG would account for geotechnical properties during BIG design and construction that would reduce the risks associated with on-site or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. With geotechnical design measures and practices (e.g., the use of geosynthetics, stone columns, or vertical drains, etc.), construction of BIG would neither directly or indirectly cause substantially adverse effects because of landslides, lateral spreading, subsidence, liquefaction, or collapse. A less than significant impact would occur.

Operations

BIG operations would neither directly nor indirectly cause or accelerate the potential for unstable soils underlying constructed works. BIG and operations would conform to guidelines specified by relevant regulatory agencies and codes described in **Impact 5.7-1: BIG**. Contractors for BIG would account for geotechnical properties during BIG design and construction that would reduce the risks associated with on-site or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. With design measures and practices, BIG would neither directly or indirectly cause substantially adverse effects because of landslides, lateral spreading, subsidence, liquefaction, or collapse. A less than significant impact would occur.

Impact 5.7-6: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-6: BIG Mitigation Measures: No mitigation required.

Impact 5.7-6: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-7	<i>Would the Project be on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?</i>
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Proposed General Plan

Shrink-swell is movement of a clay rich soil that expands or contracts in the presence of moisture. Building on soils susceptible to shrink-swell can be challenging because the soils can disrupt the foundation, cause sidewalk and other pavement to lift and crack. Most of the proposed General Plan area has a low shrink-swell potential (see **Figure 5.7-10**). However, expansive soils are possible wherever clays and elastic silts may be present in areas that include alluvial soils and weathered granitic and fine-grained sedimentary rocks. Compliance with the CBC requires that structures be designed to mitigate for expansive soils. Methods that could be used to reduce the impact of expansive soils include drainage control devices to limit water infiltration near foundation, over-excavation and recompaction of engineered fill method, or support of the foundation with piles. Design would avoid effects of soils with moderate shrink-swell

potential through adherence to standard construction practices that address the risks associated with expansive soils. Although not anticipated, in locations where expansion potential is moderate, soil additives may be mixed with existing soil to reduce the expansion potential, or soil layers that exhibit moderate expansion potential may be mixed with soils of low expansion. Additionally, the contractor would document the incorporation of standards specified by regulatory agency codes, including the most current CBC requirements, into design and construction in accordance with the best available practices. Compliance with the CBC and the recommendation of the soils report that accompanies the building permit application, or pavement project, would ensure that impacts from shrink-swell soils are less than significant, and no mitigation is required.

Impact 5.7-7: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-7: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-7: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

The shrink-swell potential of a soil type is a gauge of their ability to undergo substantial volume changes due to variations in moisture content. The NRCS Soil Survey shows that mapped soils within the BIG footprint generally have low shrink-swell potential, and few have moderate shrink-swell potential interlayered with low-shrink swell potential layers. Due to this and the lack of highly expansive soils, the effects from expansive soils are considered low. Design would avoid effects of soils with moderate shrink-swell potential through adherence to standard construction including adherence with best available practices as specified by relevant transportation and building agencies and adherence to the most current CBC requirements that address the risks associated with expansive soils. Although not anticipated, in locations where expansion potential is moderate, soil additives may be mixed with existing soil to reduce the expansion potential, or soil layers that exhibit moderate expansion potential may be mixed with soils of low expansion. Additionally, the contractor would document the incorporation of standards specified by regulatory agency codes, including the most current CBC requirements, into design and construction to build BIG in accordance with the best available practices. BIG would not be on expansive soils as defined in Table 18-1-B of the Uniform Building Code (1994) and would not create substantial direct or indirect risks to life or property. Therefore, a less than significant impact would occur, and no mitigation is required.

Operations

Risk from expansive soil would be minimized through proper construction practices, as described above, and in conformity with standards specified by regulatory codes. Upon implementation of these construction practices, and compliance with regulatory requirements, risks to life or property from expansive soils during BIG operations would be less than significant, and no mitigation is required.

Impact 5.7-7: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-7: BIG Mitigation Measures: No mitigation required.

Impact 5.7-7: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-8 *Would the Project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?*

Proposed General Plan

While development is concentrated within the center of the City, other portions of the proposed General Plan area are sparsely developed. Development in these areas may not have access to a City sewer connection and would require a septic system to dispose of waste.

According to the Local Agency Management Program (LAMP), the soils within the City are predominantly silty sands and sandy silts with high runoff coefficients and fast percolation. Though variations would occur on different sites, the higher the percolation rate the more the soil is capable of supporting septic tanks and alternative wastewater disposal systems. As such, any potential use of a septic tank or an alternative wastewater disposal systems must comply with the testing requirements found in the LAMP (Barstow, 2018).

According to Section 13.08.040 of the Barstow Code, any development that is located on a street, alleyway, or right-of-way in the City where a public sanitary sewer is located or may be located in the future, is required to connect to the public sewer provided it is within 100 feet of the property line. According to Section 13.08.050 of the Barstow Code, where a public sanitary sewer is not available, a private sewage disposal system complying with the City's building and plumbing code and the City's LAMP is required.

Any septic tank that is constructed must comply with the requirements found in the LAMP, such as ensuring the tank is water-tight, properly vented, and made out of durable and non-corrosive material (Barstow 2018). Section 13.08.070 of the Barstow Code requires that any development installing a septic system must connect to the City's sewer system once it is available. With requirements found in the LAMP and the City's approval process, impacts would be less than significant, and no mitigation is required.

Impact 5.7-8: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-8: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-8: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction and Operations

BIG proposes to connect to City wastewater services, thus, does not propose septic or alternative wastewater disposal systems. BIG would not result in impacts concerning soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems. Therefore, no impact would occur.

Impact 5.7-8: BIG: Level of Significance Before Mitigation: No Impact.

Impact 5.7-8: BIG Mitigation Measures: No mitigation required.

Impact 5.7-8: BIG Level of Significance After Mitigation: No impact would occur.

Impact 5.7-9 ***Would the Project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?***

Proposed General Plan

While preconstruction surveys can discover geologic or paleontological resources visible on the surface, resources are more likely to be discovered during construction activities such as grading or trenching that go below the ground surface. The potential for resources can be estimated using sensitivity maps that consider the age of soils and whether they have the potential to have paleontological resources and prior documentation of paleontological resources. Much of the proposed General Plan area is considered to have a high potential for resources; in other areas, the sensitivity is less certain.

As the existence of paleontological resources is typically unknown at the time of project application, the City relies upon monitoring during construction and excavation to determine if resources exist. A Phase I paleontological resources study or due diligence could determine if there are paleontological resources on site. Additionally, a geotechnical report would identify the soils underlying individual properties and determine if the soils are Pleistocene deposits, or older, indicating the potential for paleontological resources. Should a paleontological resource be discovered during construction, work would be halted, and the extent of the resource evaluated. In the case of a find, construction would be diverted around the resource until it can be professionally recovered. Monitoring may not be required for sites that have already been disturbed with construction and where excavation does not extend past the previous disturbance. Because this is a project-specific determination, a blanket policy to require monitoring would be excessive and needlessly add to the cost and complexity of construction. In the event that paleontological resources are discovered, Policy OSC-7.7, which protects paleontological resources by requiring new development to implement mitigation to avoid paleontological resources whenever possible, and, if unavoidable, require the appropriate treatment of paleontological resources, would be implemented. By implementing Policy OSC-7.7, this would reduce impacts to less than significant.

Impact 5.7-9: General Plan: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-9: General Plan: Mitigation Measures: No mitigation required.

Impact 5.7-9: General Plan: Level of Significance After Mitigation: No significant impact would occur.

Barstow International Gateway

Construction

USGS geologic maps show that the BIG footprint is underlain by very late Pleistocene and recent young alluvium (Qa), Pleistocene-aged older alluvium (Qoa), Older fanglomerate gravels (Qof), and Older clay (Qoc) deposits. The area north of the existing BNSF mainline is underlain by wind-blown dune sand (Qs)

and Mojave-River channel sand (Qrs). The results of the record searches from the NHMLAC and WSC were both negative for known specimens within both the BIG footprint and the one-mile buffer. However, both repositories cited high paleontological sensitivity for the BIG paleontological study area based on the age and composition of the native soils and sediments across the site and positive findings in similar sediment deposits within California. WSC noted they had no specimens mapped for the general region, though NHMLAC provided a list of specimens recorded in similar contexts in the nearby Los Angeles and San Bernardino county deserts. **Table 5.7-5: Paleontological Records Search Findings** summarizes the closest known findings within NHMLAC records.

No paleontological resources were identified within the BIG study area for paleontological resources. However, the age and composition of soils and sediments across the study area, combined with the knowledge of paleontological resources identified within similar sediment deposits in southern California, indicate a moderate-to-high sensitivity for paleontological resources. Further, as only a very small percentage of the BIG footprint has been subject to prior disturbance, there is the potential for paleontological resources to exist. Because there is the potential to destroy a unique paleontological resource or unique geologic feature, there would be a potentially significant impact and mitigation measures (**MM**) **BIG GEO-1** through **MM BIG GEO-3** would be implemented.

Table 5.7-5: Paleontological Records Search Findings					
Repository	Locality Number	Location	Formation	Taxa	Depth
NHMLAC	LACM VP 1184	Vitrilite Marl quarry; 3 miles northwest of Wild Siding, Helendale	Unknown (Pleistocene, green silty sandstone)	Uncatalogued vertebrates	Unknown
NHMLAC	LACM VP 5559	Black Mountain, 20 miles northwest of Barstow	Unknown (Pleistocene)	Fish (<i>Fundulus</i>)	Unknown
NHMLAC	LACM IP 4736	Harper Dry Lake	Unknown formation (Pleistocene)	Peaclam (<i>Pisidium compressum</i>)	Unknown
NHMLAC	LACM VP CIT 209	10 miles north, 1 mile west of Victorville; bluffs on west side Mojave River	Shoemaker Gravel Formation	Mammoth (<i>Mammuthus</i>); Horse (<i>Equus</i>)	Unknown
NHMLAC	LACM VP 7786	Southern California Logistics Airport	Alluvium (Pleistocene, moderately indurated fine to medium grained silty sandstone)	Vole (<i>Microtus mexicanus</i>)	10-11 feet bgs
NHMLAC	LACM VP 5942-5950	Along Avenue S from Palmdale to Lake Los Angeles	Unknown formation (Holocene)	Kingsnake (<i>Lampropeltis</i>), Lizard (<i>Lacertilia</i>), leopard lizard	0-9 feet bgs
Note: VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface					
Source: See Appendix 5.7 BIG-3: Paleontological Resources Assessment .					

MM BIG GEO-1 requires the applicant to submit a Paleontological Resources Impact Mitigation Program (PRIMP) prepared by a qualified paleontologist. **MM BIG GEO-2** requires a qualified paleontologist to attend preconstruction meetings, monitor all ground disturbing activities associated with the construction of BIG, and recover any fossils or paleontological resources that are discovered and temporarily direct,

divert, or halt grading in the vicinity. Additionally, **MM BIG GEO-2** also requires all on-site construction personnel to receive Worker Education and Awareness Program training prior to the commencement of excavation work. Finally, **MM BIG GEO-3** requires that any paleontological resources that are discovered during construction activities be cleaned, repaired, sorted, and catalogued in a scientific institution in San Bernardino County and a report be prepared documenting the results of the PRIMP. Therefore, implementation of **MM BIG GEO-1** through **MM BIG GEO-3** would reduce impacts to paleontological resources to a less than significant level.

Impact 5.7-9: BIG: Level of Significance Before Mitigation: Potentially Significant Impact.

Impact 5.7-9: BIG Mitigation Measures: **MM BIG GEO-1** through **MM BIG GEO-3** and the following measure are applicable.

MM BIG GEO-1 The implementing entity shall submit a Paleontological Resources Impact Mitigation Program (PRIMP) prepared by a qualified paleontologist to the City of Barstow (City) prior to construction commencing. A qualified paleontologist is defined as an individual with an M.S./M.A. or Ph.D. in paleontology or geology who is familiar with paleontological procedures and techniques, and who is knowledgeable in the geology and paleontology of the area. The PRIMP shall be consistent with the Society of Vertebrate Paleontology 2010 guidelines. The PRIMP shall include, but is not limited to, the requirements for preconstruction meeting attendance and worker environmental awareness training, where monitoring is required within the BIG footprint based on construction plans and/or geotechnical reports, procedures for adequate paleontological monitoring, discoveries treatment protocols and timelines, paleontological methods including any sediment sampling, reporting, and collections management/curation.

MM BIG GEO-2 A qualified paleontologist shall attend preconstruction meetings to consult with the grading and excavation contractors concerning planned depths, excavation schedules, paleontological field techniques, and safety issues. In addition, all on-site construction personnel shall receive Worker Education and Awareness Program training prior to the commencement of excavation work. All BIG construction occurring within previously undisturbed fossil bearing formations shall be monitored by a qualified paleontologist or qualified paleontological monitor. Detailed narrative and exhibit outlining areas and depths that require monitoring across the BIG footprint shall be included in the Paleontological Resources Impact Mitigation Program (PRIMP). A paleontological monitor is defined as an individual who has experience in the collection and salvage of fossil materials and works under the direction of a qualified paleontologist. If fossils are discovered, the paleontologist (or paleontological monitor) will recover them. In most cases, this fossil salvage can be completed in a short period of time; however, some fossil specimens, such as a complete large mammal skeleton, may require an extended salvage period. In these instances, the paleontologist (or paleontological monitor) will be allowed to temporarily direct, divert, or halt grading in the vicinity to allow recovery of fossil remains in a timely manner, which will be outlined and defined in the PRIMP. Because

of the potential for the recovering of small fossil remains, such as isolated mammal teeth, it may be necessary to set up a screen-washing operation on site.

MM BIG GEO-3 Fossil remains collected during the monitoring and salvage portion of the Paleontological Resources Impact Mitigation Program (PRIMP) shall be cleaned, repaired, sorted, and catalogued. Prepared fossils, along with copies of all pertinent field notes, photos, and maps, will be deposited (as a donation) in a scientific institution with permanent paleontological collections located within San Bernardino County (or, if no repository is available, adjacent Counties). A final data recovery report shall be completed by a qualified paleontologist that outlines the results of the paleontological monitoring program. This report shall include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils. The report shall be submitted to the implementing entity and City upon completion.

Impact 5.7-9: BIG Level of Significance After Mitigation: Less than significant with Mitigation Incorporated.

Impact 5.7-10 *Would the Project result in the loss of availability of a known mineral resource that would be of economic value to the region and the residents of the State?*

Proposed General Plan

The proposed General Plan area is primarily underlain by MRZ-3a lands, which are areas with moderate potential or possible location of aggregate resources (see **Figure 5.7-5**). As of January 1, 2017, the Barstow-Victorville Production-Consumption Region, a region that includes one or more aggregate production districts and the market area that those districts serve, had 117 million tons of permitted aggregate reserves (CGS, 2018).

Chapter 15.28, Surface Mining, of the Barstow Code, calls for ensuring that the continued availability of important mineral resources is secured while ensuring that adverse environmental effects are prevented or mitigated, and that mined lands are reclaimed to a usable condition readily adaptable for alternative land uses. Aggregate is recovered through open-pit quarries that can be noisy, dusty, and large in area. The value of the aggregate is such that it is unlikely that new quarries would be created in areas designated for urban development, although industrial areas could accommodate both quarries and adjacent industrial uses. Under the proposed General Plan, Policy OSC-6.2 Mineral resource areas. Designate and permit the development of land classified as Mineral Resource Zone (MRZ) 2a, 2b, or 3a in a manner that preserves future mining opportunities of non-aggregate mineral resources. The policy requires that development project on land that was previously undeveloped must determine the existence and value of any mineral or aggregate deposit(s). If resources are determined to be substantive and valuable in the context of the City and the region as a whole, the City would ensure that operation and reclamation is consistent with SMARA of 1975 (Policy OSC-6.1).

Given the location of the MRZ-1 and MRZ-2b lands, and the City and County's land use designations in these areas, development is likely to occur that would impact MRZ-1 and MRZ-2b lands, thereby reducing

the potential for mining of the resource. Additionally, BIG would be developed on lands that contain aggregate resources and hydrothermal deposits. While the proposed General Plan includes policies that permit the development of land classified as MRZ-2a, 2b, or 3a in a manner that preserves future mining (Policy OSC-6.2) and encourages the use of on-site aggregate (Policy OSC-6.3), the result of development will be a reduction in the ability to extract aggregate. Although the aggregate would remain underneath the future development, the inability to extract the resource is considered a significant and unavoidable impact.

Impact 5.7-10: General Plan: Level of Significance Before Mitigation: Potentially Significant Impact.

Impact 5.7-10: General Plan: Mitigation Measures: No feasible mitigation.

The only feasible mitigation would be to preclude development on these sites in order that extraction of the mineral(s) could occur in the future. While it is possible that a development could be redesigned to accommodate mineral extraction (most typically in an open-pit quarry), it is unlikely given the visual, dust, noise, heavy vehicle, and vibration impacts associated with such a land use. Therefore, preclusion of development within mineral resource zones is not a feasible mitigation and the impact would remain significant and unavoidable.

Impact 5.7-10: General Plan: Level of Significance After Mitigation: Significant and Unavoidable impact.

Barstow International Gateway

Construction and Operations

The State classifies portions of the BIG footprint as MRZ-2b and MRZ-3a (see **Figure 5.7-1**). MRZ-2b portion is also included within ARA-14 and ARA-15.

MRZ-2b (approximately 905 acres). MRZ-2b areas are underlain by mineral deposits where geologic information indicates that significant inferred resources are present. Areas classified MRZ-2b contain discovered deposits that are either inferred reserves or deposits that are presently sub-economic as determined by limited sample analysis, exposure, and past mining history. Further exploration work and/or changes in technology or economics could result in upgrading areas classified MRZ-2b to MRZ-2a.

MRZ-3a (approximately 4,090 acres). MRZ-3a areas contain known mineral deposits that may qualify as mineral resources. MRZ-3a areas are considered to have a moderate potential for the discovery of economic mineral deposits. Further exploration work within these areas could result in the reclassification of specific localities into MRZ-2a or MRZ-2b.

Therefore, because the BIG footprint contains mineral deposits where significant inferred resources are present and/or known mineral deposits that may qualify as mineral resources, development of BIG could result in the loss of availability of a known mineral resource that may be of economic value to the region and the State's residents. As discussed in **Section 3.0: Project Description**, and in **Appendix 5.7 BIG-2**, BIG grading would extend throughout approximately 4,275 acres of the total approximately 5,000-acre footprint; thus, 650 acres would remain ungraded. Areas outside of the BIG grading footprint would not result in the loss of availability of aggregate resources. As discussed above, further exploration work

and/or changes in technology or economics could result in upgrading areas classified MRZ-2b and MRZ-3a. Therefore, a Mineral Resource Assessment (see **Appendix 5.7 BIG-2**) was conducted to determine if the BIG grading footprint contains a specialty commodity and the significance and economic viability of mining the resource.

MRZ-2b Classified Lands. As previously noted, ARAs are areas classified as MRZ-2a or MRZ-2b. The purpose of determining ARAs is to “provide a semi-quantified estimate of construction aggregate resources which are likely to be available to satisfy society’s needs during the 50-year period following the classification of an area” (CGS, ND). As discussed above, MRZ-2b classified lands within the BIG grading footprint include approximately 13.3 acres within ARA-14 and approximately 423 acres within ARA-15. These lands have a potential for producing concrete aggregate-grade sand and some concrete aggregate-grade gravel.

The BIG grading footprint within ARA-14 contains approximately 1.6 million tons of aggregate (see **Table 5.7-4: Maximum Aggregate Resource in ARA – BIG**). Based on 2018 per ton costs for aggregate in California of \$9 to \$20, there are between \$14 million and \$32 million in aggregate within the BIG grading footprint in ARA-14. Thus, the ARA-14 area within the BIG grading footprint would not be below the 1998 minimum threshold value of \$12.5 million for construction materials. Therefore, BIG would result in the loss of availability of a known mineral resource within MRZ-2b/ARA-14 that would be of economic value to the region and the residents of the State.

The BIG grading footprint within ARA-15 contains approximately 50.5 million tons of aggregate (see **Table 5.7-4**). Based on 2018 per ton costs for aggregate in California of \$9 to \$20, there is between \$455 million and \$1,010 million in aggregate within the BIG grading footprint in ARA-15. Therefore, the ARA-15 area within the BIG grading footprint would exceed the 1998 minimum threshold value of \$12.5 million for construction materials. Therefore, BIG would result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State. However, there are no established current economic operations for concrete aggregate extraction within or near the BIG footprint. Other sources are present and favorably located within the City’s SOI and regionally within the County within the Mojave River.

Mining of land designated within MRZ-2b would result in additional costs due to other environmental impacts within the Mojave River channel. Any disturbance of State and federal aquatic features (i.e., the Mojave River or any dry streambed connecting to the Mojave River) would need to be mitigated at a minimum 3:1 ratio, with each credit costing approximately \$70,000. Every acre of impact to aquatic features costs would thus cost approximately \$210,000 in aquatic mitigation. These fees do not take into consideration the additional biological mitigation fees, permit preparation, and compliance. The MRZ-2b and MRZ-3a areas are almost entirely within the Mojave River. Given there are approximately 750 acres of MRZ-2b land within aquatic jurisdictional areas, mining in this area would cost approximately \$158 million in mitigation fees alone, in addition to land costs, equipment, permitting, labor, and more. Furthermore, it is unlikely that a mine would be built within the Mojave River given it is within the floodplain. Therefore, because the MRZ-2b and MRZ-3a zones are almost entirely within the Mojave River, the aggregate resources are not considered valuable to the region.

The following would preclude the ARA-designated land within the BIG grading footprint from future use as an aggregate resource area:

- Recent subsurface explorations (Shannon & Wilson, 2024a) and evaluation of historical aerial photos (Shannon & Wilson, 2019, 2024) show that the areas to be developed within ARA-15 were disturbed in the upper 5 feet by agricultural land use. Recent subsurface explorations in these disturbed areas (Shannon & Wilson, 2024a) encountered fine aggregates found to be of varying quality (Shannon & Wilson, 2024b). Preliminary soil testing in the upper 5 feet of ARA-15 indicates that some soils are not suitable for concrete-grade aggregate due to inorganic impurities and lean clays interbedded with sands. Additional processing would be required to create useable concrete-grade aggregates.
- Review of recent geologic mapping (Miller and others, 2020) shows that the most recent and undisturbed Mojave River sand deposits are within the ARA areas located north of the BIG footprint.
- Previously unmapped young Mojave River sand deposits (Miller and others, 2020) are located outside and north of the ARA zones mapped in Miller (1993). These younger deposits would be a potential source of concrete-grade aggregate.
- ARA-14 is located where current (2024) groundwater encountered in subsurface exploration is within 9 and 17 feet below the ground surface (Shannon & Wilson, unpublished data). Historical groundwater levels near these 2024 subsurface exploration locations show groundwater elevations at 4 and 11 feet below the exploration ground surface elevation, respectively (DWR, 2024). These high groundwater elevations would make these areas unsuitable for surface mining.
- ARA-15 is located where current (2024) groundwater encountered in subsurface exploration is within 17 and more than 50 feet below the ground surface (Shannon & Wilson, unpublished data). Historical groundwater levels near these 2024 subsurface exploration locations show groundwater elevations at 24 and 16 feet below the exploration ground surface elevations, respectively (DWR, 2024). These high groundwater elevations would limit these areas for surface mining.

Mining in ARAs located within the BIG grading footprint would encroach into the Mojave River floodplain and surface mining would likely affect flows of surface waters of the Mojave River and may adversely affect adjacent or downstream properties. Mineral deposits within the BIG footprint are not available for mining, given the location within and adjacent to the Mojave River, and groundwater being generally between 4 and 17 feet below ground surface. Therefore, despite the BIG footprint containing ARAs, development of these lands would not result in a loss of availability of a known mineral resource.

MRZ-3a Classified Lands. The Mineral Resources Assessment concluded that MRZ-3a classified lands within the BIG footprint do not have established current economic operations for concrete aggregate sand or gravel within or near the Parcels. Also, other sources are present and more favorably located within ARA-14 and ARA-15 (MRZ-2b) within the Mojave River channel. Therefore, BIG would not result in the loss of availability of a known mineral resource within MRZ-3a that would be of economic value to the region

and the residents of the State. A less than significant impact would occur in this regard, and no mitigation is required.

Impact 5.7-10: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-10: BIG Mitigation Measures: No mitigation required.

Impact 5.7-10: BIG Level of Significance After Mitigation: No significant impact would occur.

Impact 5.7-11	<i>Would the Project result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?</i>
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Proposed General Plan

See analysis under **Impact 5.7-10: General Plan**.

Impact 5.7-11: General Plan: Level of Significance Before Mitigation: Potentially significant impact.

Impact 5.7-11: General Plan: Mitigation Measures: No feasible mitigation.

Impact 5.7-11: General Plan: Level of Significance After Mitigation: Significant and Unavoidable impact.

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Construction and Operations

As previously mentioned, **Figure 5.7-1** depicts the County's mineral resources and MRZ mineral deposits and indicates portions of the BIG grading footprint are within a County delineated MRZ (i.e., per Policy Map LU-4). However, because the City proposes to annex the BIG Specific Plan area, including where the MRZs are present, the County's CWP policies would not apply to this area. Further, as discussed in **Impact 5.7-10: BIG**, there are MRZ-2b and MRZ-3a resources within the BIG grading footprint. However, development of MRZ-2b and MRZ-3a resources within the BIG footprint are extremely unlikely given it is almost entirely within the Mojave River. As discussed above, depth to groundwater within the Mojave River is shallow (7 to 40 feet bgs), which would preclude mining operations. A less than significant impact would occur.

The proposed General Plan does not delineate the City's mineral resource recovery sites, but it reports the City's MRZs where significant mineral resources have been determined or inferred to be present. The proposed General Plan notes that mineral resources are located or likely located primarily along the Mojave River and south of Interstate 40. Most of the City has been mapped within MRZs containing known mineral deposits of undetermined significance. Based on these General Plan descriptions and the State's MRZ classification definitions, it can be inferred that the City contains MRZ-2b and MRZ-3a areas. The proposed General Plan describes that the only mineral resource identified by the State and actively being utilized within City is aggregate for the manufacture of concrete.

As previously noted, ARAs are areas classified as MRZ-2a or MRZ-2b for construction aggregate. The BIG grading footprint within ARA-15 is approximately 358 acres and is within the City's SOI. This acreage is included in the City of Barstow land use areas with currently adopted land use designations of Estate Residential and General Industrial (City of Barstow, 2015, p. LU-4). Under these existing land use designations, the ARA-15 area within the BIG footprint would be considered incompatible with mining and excluded from an ARA, as mining operations are not permitted within the Estate Residential zone. As previously addressed in **Impact 5.7-10: BIG**, there are no established current economic operations for concrete aggregate extraction within or near the BIG footprint. Other sources are present and favorably located within the City's SOI and regionally within the County within the Mojave River. The mineral resources within the BIG footprint have a shallow depth to groundwater that would preclude mineral resource mining.

Finally, BIG would be in compliance with proposed General Plan Policy OSC-6.1, Mining operations and reclamation, which ensures that the operation of mined lands is consistent with SMARA; Policy OSC-6.2, Mineral resource area, which designates and permits the development of land classified as MRZ 2a, 2b, or 3a in a manner that preserves future mining of non-aggregate mineral resources; and Policy OSC-6 -3, Construction aggregate, which encourages the use of on-site aggregate when new development is proposed in an area containing aggregate resources.

Because the County's CWP policies would not apply to the BIG footprint after it is annexed into the City and because mining the ARA-15 area within the BIG footprint would be considered incompatible, BIG would not result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. A less than significant impact would occur.

Impact 5.7-11: BIG: Level of Significance Before Mitigation: Less than Significant Impact.

Impact 5.7-11: BIG Mitigation Measures: No mitigation required.

Impact 5.7-11: BIG Level of Significance After Mitigation: No significant impact would occur.

5.7.7 SIGNIFICANT UNAVOIDABLE IMPACTS

Proposed General Plan

The proposed General Plan would result in a significant unavoidable impact concerning mineral resources, but no significant unavoidable impact concerning geology and soils. Because significant mineral resources may potentially be prevented from extraction due to urban development under the General Plan, and in particular aggregate resources, impacts to mineral resources would remain significant and unavoidable.

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No significant unavoidable impacts concerning geology, soils, and mineral resources would occur as a result of BIG.

5.7.8 REFERENCES

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