City Of Merced Wastewater Collection System Master Plan

DRAFT ENVIRONMENTAL IMPACT REPORT

CHAPTER 3.6 GEOLOGY, SOILS, AND MINERAL RESOURCES

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3.6 GEOLOGY, SOILS, AND MINERAL RESOURCES

3.6.1 Basis for Analysis

The California Environmental Quality Act (CEQA) Guidelines' Appendix G Environmental Checklist was used during the Notice of Preparation (NOP) scoping process (included in Appendix A) to identify the Program components that have the potential to cause a significant impact. The following potential impacts were determined to warrant further evaluation within this Environmental Impact Report (EIR):

- Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving the following:
    - 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 or strong seismic ground shaking;
    - Seismic-related ground failure, including liquefaction;
    - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or offsite landslide, lateral spreading, subsidence, liquefaction or collapse;
- Be located on expansive soil, as defined in Table 3.6-1 from the Uniform Building Code (UBC) (1994), creating substantial direct or indirect risks to life or property;
- 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;
- Directly or indirectly destroy a unique paleontological resource, site, or geologic feature;
- 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; 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.

The remainder of this section describes the regulatory and environmental setting to support the evaluation of the potential impacts and describes the potential impacts to geology, soils, and mineral resources that may result from implementation of the Program, identifying mitigation for potentially significant impacts, where feasible.

3.6.2 Regulatory Framework

This section discusses the federal and state regulations and local policies and objectives that are related to geology, soils, and mineral resources and are relevant to the Program.

3.6.2.1 Federal

Clean Water Act

The Clean Water Act (CWA, 33 United States Code [USC] 1344) primarily focuses on waters of the United States (WOTUS) and is more thoroughly described in Section 3.4, Biological Resources, and Section 3.9, Hydrology and Water Quality. However, the CWA focuses on sediment control in three aspects. First, the United States Army Corps of Engineers (USACE) administers CWA Section 404, which regulates the discharge of fill into WOTUS. Secondly, the State Water Resources Control Board (SWRCB) administers CWA Section 401, which applies to stormwater discharges where erosion control is an integral part of achieving permit compliance. Third, under direction from the SWRCB, the Regional Water Quality Control Board (RWQCB) administers CWA Section 402, which regulates point and non-point source discharges requiring a general or individual permit based on discharge type and size through the National Pollutant Discharge Elimination System (NPDES) program.

Earthquake Hazards Reduction Act of 1977

The Earthquake Hazards Reduction Act of 1977 established the National Earthquake Hazards Reduction Program (NEHRP) "to reduce the risks of life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program." The four principal goals of the NEHRP are as follows:

- Develop effective practices and policies for earthquake loss reduction and accelerate their implementation;
- Improve techniques for reducing earthquake vulnerabilities of facilities and systems;
- Improve earthquake hazards identification and risk assessment methods, and their use; and
- Improve the understanding of earthquakes and their effects.

Many of the tools used to assess, as well as mitigate, earthquake hazards and impacts were developed under the NEHRP (FEMA 1977).

Uniform Building Code Chapter 18, Division 1 Section 1803.2 and 1804.5

The UBC 1994, Chapter 18. Division 1 Section 1803.2 mandates that special foundation design consideration be employed if the soil expansion index is 20 or greater, in accordance with Table 3.6-1. The methodology and scope for a geotechnical investigation are described in UBC Section 1803 and requires an assessment of a variety of factors, such as slope stability, soil strength, adequacy of load-bearing soils, the presence of compressible or expansive soils, and the potential for liquefaction. The required content of the geotechnical report includes recommendations for foundation type and design criteria. These recommendations can include foundation design provisions that are intended to mitigate the effects of expansive soils, liquefaction, and differential settlement. In general, mitigation can be accomplished through a combination of ground modification techniques (i.e., stone columns, reinforcing nail and anchors, deep soil mixing, etc.), selection of an appropriate foundation type and configuration, and use of appropriate building and foundation structural systems. UBC Section 1804.5, Excavation, Grading, and Fill, requires the preparation of a geotechnical report where a building would be constructed on compacted fill (UBC 1994).

The International Building Code (IBC) replaced earlier regional building codes (including the UBC) in 2000 and established consistent construction guidelines for the nation. In 2006, the IBC was incorporated into the 2007 California Building Standards Code (CBC) (Section 3.6.2.2, State), and currently applies to all structures being

constructed in California. Therefore, the national model codes are incorporated by reference into the building codes of local municipalities. The CBC includes building design and construction criteria that take into consideration the state's seismic conditions.

Table 3.6-1: Classification of Potential Expansion of Soils Using Expansion Index

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-30	High
Above 130	Very High

Source: ASTM 2011; UBC 1994

Occupational Safety and Health Administration

The Occupational Safety and Health Act of 1970 created the Occupational Safety and Health Administration (OSHA), which is responsible for protecting the health of workers in events that could cause injury to workers. OSHA has created regulations to set federal standards of workplace safety including hazardous materials exposure limits, mandatory workplace training, accident and injury reporting, and safety procedures. These regulations are recorded in the Code of Federal Regulations (CFR) Title 29. Regulations specific to safety of trench work include: 29 CFR 1926.620, 29 CFR 1926.651, and 29 CFR 1926.652.

3.6.2.2 State

Alquist-Priolo Fault Zoning Act

The Alquist-Priolo Fault Zoning Act (AP Act), administered by the California Geological Survey (CGS), provides a mechanism for reducing losses from surface fault ruptures on a statewide basis. The AP Act requires the mapping of zones around active faults in California, in an effort to prohibit the construction of structures for human occupancy on active faults and minimize damage due to rupture of a fault. Active faults are those that have ruptured within the past 11,000 years. Where the AP Act identifies an Earthquake Fault Zone, a geologic investigation and report is necessary to prevent siting of buildings on active fault traces (CGS 2019a).

California Department of Transportation, Highway Design Manual Section110.6

California Department of Transportation (Caltrans) has developed roadway design standards, including those for seismic safety. Consideration of seismic risks and hazards in roadway design is detailed in the Caltrans Highway Design Manual Section 110.6, Earthquake Consideration. Construction within local highways and roads (including removing and replacement of existing roadways) would be required to adhere to Caltrans' engineering standards to minimize settlement (Caltrans 2018).

California Standard Building Code

Title 24, Part 2 of the CBC of the California Code of Regulations (CCR) contains specific requirements for construction with respect to earthquakes and seismic hazards intended to be protective of public health. Chapter 16 Section 1613, Earthquake Loads, of the 2016 CBC (effective January 1, 2017) deals with structural design and requires that every structure and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions (Caltrans 2018). For pipelines and other Program infrastructure, structural stability is guided by ASCE-7, Minimum Design Loads for Buildings and Other Structures, which is produced by the American Society for Civil Engineers and adopted into CBC design standards. ASCE-7 sets standards for above-ground facilities such as pump stations and WWTRF facilities.

Government Code Section 65302(g)

Government Code Section 65302(g) discusses the elements of safety for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence; liquefaction; and other seismic hazards identified pursuant to Chapter 7.8, Division 2 of the Public Resources Code (PRC); as well as other geologic hazards known to the legislative body. This code requires mapping of known seismic areas and other geologic hazards. It also addresses evacuation routes, military installations, water supply requirements, and minimum road widths and clearances around structures as those items relate to identified geologic hazards (California Government Code, Title 7, Division 1, Chapter 3, Article 5, Local Planning [65100-65763]).

Paleontological Resources

CEQA includes in its definition of historical resources “any object [or] site …that has yielded or may be likely to yield information important in prehistory” (14 CCR 15064.5[3]), which is typically interpreted as including fossil materials and other paleontological resources. More specifically, destruction of a “unique paleontological resource or site or unique geologic feature” constitutes a significant impact under CEQA per CEQA Guidelines Appendix G. Treatment of paleontological resources under CEQA is generally similar to treatment of cultural resources, requiring evaluation of resources in the project; assessment of potential impacts on significant or unique resources; and development of mitigation measures for potentially significant impacts, which may include monitoring combined with data recovery excavation and/or avoidance.

Seismic Hazard Mapping Act

The Seismic Hazard Mapping Act of 1990 governs the responsibilities of city, county, and state agencies in identifying and mapping seismic hazard zones and mitigation seismic hazards to protect public health and safety in accordance with the provision of the California PRC, Division 2, Chapter 7.8, Geology, Mines and Mining, Seismic Hazards Mapping. The publication delineates zones where earthquakes could cause hazardous ground shaking and ground failure, including liquefaction and landslides (CGS 2019b). Currently, zones near the San Andreas Fault in the urban centers of the greater San Francisco Bay Area and Los Angeles have been delineated. Local cities and counties within these zones regulate construction to minimize loss associated with these seismic hazards.

Surface Mining and Reclamation Act

The California Surface Mining and Reclamation Act of 1975 (SMARA) was enacted in response to land use conflicts between urban growth and essential mineral production. SMARA (PRC Section 2710 et seq., subsequently amended) is the primary regulation for onshore surface mining in the state. SMARA mandated that aggregate resources throughout the state be identified, mapped, and classified by the state geologist so that local governments could make land use decisions in light of the presence of aggregate resources and the need to preserve access to those resources. Local jurisdictions are required to enact specific plan procedures to guide mineral conservation and extraction at particular sites and to incorporate mineral resource management policies into their general plans. The State Mining and Geology Board has prepared Mineral Land Classification Maps for aggregate resources. The Mineral Land Classification Maps designate four different types of resource sensitivities. The four Mineral Resource Zone (MRZ) sensitivity types are as follows:

- **MRZ-1:** Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood for their presence exists;
- **MRZ-2:** Areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists;
- **MRZ-3:** Areas containing mineral deposits the significance of which cannot be evaluated from available data; and
- **MRZ-4:** Areas where available information is inadequate for assignment of any other MRZ zone.

3.6.2.3 Local

Merced Vision 2030 General Plan

The City of Merced (City) Merced Vision 2030 General Plan (2030 General Plan), adopted January 3, 2012 (City of Merced 2012), contains several policies that directly or indirectly pertain to geology, soils, and mineral resources, including the following:

Goal Area OS-5: Conservation of Resources

- **Policy OS-5.2.** Protect soil resources from the erosive forces of wind and water.

Goal Area S-2: Seismic Safety

- **Policy S-2.1.** Reduce the potential danger from earthquake and seismic-related activity from existing buildings where necessary.
- **Policy S-2.2.** Encourage the improvement of all public facilities and infrastructure such as natural gas, fuel, sewer, water, electricity, and railroad lines and equipment with up-to-date seismic safety features.
- **Policy 2.3-** Restrict urban development in all areas with potential for ground failure characteristics.

City of Merced Municipal Code

Title 15, Division III-Storm Water System, Chapter 15.50.120 (B) Storm Water Management and Discharge Control Code states that:

> *"Any person performing construction activities in the City shall prevent pollutants from entering the storm water conveyance system and comply with all the applicable Federal, State, and local laws, ordinances, or*

> *regulations, including, but not limited to, the current California NPDES General permit for storm water discharges associates with construction activities (Construction General Permit) and the City Storm Water Management and Discharge Control Chapter. All construction projects, regardless of size, having soil disturbance or activities exposed to storm water must, at a minimum, implement BMPs for erosion and sediment controls, soil stabilization, dewatering, source controls, pollution prevention measures, and prohibited discharges. Any person subject to a construction activities NPDES storm water discharge permit shall comply with all provisions of such permit"*

City of Merced Standard Designs of Common Engineering Structures

The City's Engineering Department has developed standard design requirements for common engineering structures that are frequently installed as part of improvements in the City. The standards include requirements for the design of streets, driveways, sidewalks, trenching, storm drains, water systems, bikeways, refuse facilities, landscaping grading, traffic control, fences, and sewer systems. Sewer system design standards are included in sheets S-1, through S-18 of the standards and include specifications for stability of pipelines, manhole requirements, and testing of newly installed sewer systems (City of Merced 2020).

3.6.3 Environmental Setting

3.6.3.1 Regional Geology

The Program Study Area is located approximately 115 miles southeast of the City of Sacramento along the west side of the southern portion of the Great Valley Geomorphic Province, more commonly referred to as the San Joaquin Valley. The Great Valley is a broad interior lowland (i.e., flat area in central part of the State of California), that is bounded by the Sierra Nevada mountain range to the east and the Coastal Ranges to the west (City of Merced 2010), and as such, is a basin valley formed between mountain ranges (San Joaquin Valley Geology 2015). This region's geology dates to the Pliocene-Pleistocene Period transition, and into the more recent Quaternary Period. The region is comprised primarily of sedimentary and metasedimentary rock substrates, including Great Valley Fan and Basin Deposits, and other non-marine deposits.

3.6.3.2 Local Geology

The Program Study Area is located within the U.S. Geological Survey (USGS) Merced 7.5-Minute Quadrangle. Site topography is nearly flat, with elevations within the Program Study Area ranging from 153 feet above mean sea level (amsl) near the City's Wastewater Treatment and Reclamation Facility (WWTRF), to 208 feet amsl near the junction of State Route (SR) 140 and Kibby Road.

A review of the geologic maps indicate that the vicinity of the Program Study Area is primarily underlain by Laguna, Mehrten, Modesto, and Riverbank Formations. The Laguna Formation was developed during the Pliocene. The Laguna Formation is a heterogeneous mixture of interbedded alluvial gravel, fine sand, silt, and clay of granitic and metamorphic origin. The Mehrten Formation was developed during the Miocene and Pliocene. The Mehrten formation is made up of sandstone, laminated siltstone, conglomerate, and tuff breccia that is composed almost entirely of andesitic material, with only small amounts of igneous and metamorphic rock fragments (Arkley 2016; Burrow et. al. 2004). The Modesto and Riverbank Formations developed during the Pleistocene and Holocene, with alluvium from drainages being deposited (i.e., floodplain deposits, unconsolidated soils, and sediment). The Modesto and

Riverbank Formation deposits are specifically characterized by sand and silt alluvium derived from weathering of rocks, which generally forms a thin layer of sedimentary materials over bedrock unit's underneath (City of Merced 2010; San Joaquin Valley Geology 2015).

3.6.3.3 Program Area Soils

Based on the United States Department of Agriculture's (USDA's) Natural Resources Conservation Service (NRCS) Web Soil Survey, there are 24 different soils series present within the Program Study Area (USDA 2019a; NRCS 2019). A complete summary of the soil series that occur in the Program Study Area are outlined in Table 3.6-2.

The soils in this region generally consist of poorly sorted gravel, sand, silt, and clay and are acidic with low fertility. The soils have a moderate shrink-swell potential, with a granular, clayey, and relatively consolidated and cemented nature, and as such the soils in the Program Study Area are regarded as moderately expansive, with low to moderate erosion potential (City of Merced 2010).

Table 3.6-2: Program Study Area Soils Summary

Soil Series Name	Typical Program Study Area Pedon	Slope (%)	Drainage	Permeability	Runoff
Alamo	Clay	0–1	Poor	Very slow	Ponded - Very slow
Anderson	Gravel	0–3	Excessive	Moderate – Rapid	Slow - Medium
Bear Creek	Clay, Loam	0–3	Poor - Moderate	–	Low - Very low
Burchell	Silt, Clay, Loam, Saline-Alkali	0–1	Poor	Slow – Moderately slow	Slow - Medium
Corning	Gravel, Loam, Sand	0–8	Well - Moderate	Very slow – Slow	Very high
Greenfield	Sand, Loam	0–3	Well	Moderate – Rapid	Slow - Medium
Honcut	Silt, Clay, Loam	0–1	Well	Moderate – Rapid	Slow - Medium
Hopeton	Gravel, Clay, Loam	0–8	–	–	–
Keyes	Gravel, Clay, Loam	0–8	Well - Moderate	Very slow	Slow - Medium
Landlow	Silt, Clay, Loam, Alkali	0–1	Poor	Slow	Slow
Lewis	Silt, Clay, Loam, Saline-Alkali	0–1	Well	Slow	Medium - High
Marguerite	Silt, Clay, Loam	0–1	–	–	–
Montpellier	Sand, Loam	0–8	Well - Moderate	Slow – Moderate	Slow - Medium
Pentz	Gravel, Clay, Loam	0–30	Well drained	–	–
Peters	Clay	0–8	Well drained	–	–
Porterville	Clay	0–3	Well drained	Slow	Very slow - Rapid
Raynor	Clay, Cobbly	0–8	–	–	–
Redding	Gravel, Loam	0–30	Well - Moderate	Very slow – Slow	Very low - High
Rocklin	Loam, Sand	0–8	Well drained	Very slow – Slow	Very slow - Medium
Ryer	Clay, Loam	0–8	Well drained	Slow	Very slow - Medium

Soil Series Name	Typical Program Study Area Pedon	Slope (%)	Drainage	Permeability	Runoff
San Joaquin	Loam, Sand	0–8	Well - Moderate	Very slow	Medium - Very high
Whitney	Sand, Loam	0–8	Good	Moderate – Rapid	Slow - Medium
Wyman	Clay, Loam	0–3	Well drained	Slow – Moderate	Slow - Medium
Yokohl	Clay, Loam	0–3	Well drained	Very slow – Slow	Very slow - Rapid

Note:
- = No data for soil series
Source: USDA 2019b, NRCS 2019

3.6.3.4 Mineral Resources

Mineral resources are generally finite and occur in sporadic deposits, which often create a relative scarcity and a need to protect access to supplies. Many mineral resources are important to global, national, state, and local economies. In 2015, California had approximately 717 active mines, which are responsible for approximately 4.2 percent of the United States non-fuel mineral production (CGS 2015). The largest component of this production was derived from sand and gravel mining.

Primary mineral resources within the region of the City generally include antimony, diatomite, copper, gold, gravel, gypsum, magnesium, manganese, mercury, sand, and stone. A desktop review of Mineral Land Classifications and Historic Mines and Prospects was conducted for the Program Study Area. Approximately five historic mines were identified within the vicinity (i.e., within approximately 10 miles) of the City. This includes sand and gravel pits known as Borrow, Sunset, George, Jordan, and Bear Creek near Atwater and Planada. Approximately five permitted mines were also identified within the vicinity of the City, including Hailey Pit, Olive Avenue Pit, WCR Mine, Central Pit, and Sunset Pit. Specifically, the States Mining and Geology Board found no areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists (i.e., MRZ-2), no active mining sites, and no Aggregate Resources Areas within the City (Clinkenbeard 1999).

3.6.3.5 Environmental Hazards

Seismic Activity

Seismic activity originates as movement or slippage occurring along an active fault. A fault is fracture along which the blocks of crust move relative to one another parallel to the fracture. These movements generate shock waves that result in ground shaking (i.e., seismic activity, earthquakes) (USGS 2019). Seismic activity is generally measured by type, frequency, and duration. It is assumed that those faults that have been recently active are the most likely to be active in the future, although even inactive faults may not be “dead.” “Potentially Active” faults are those that have been active during the past two million years, or during the Quaternary Period. “Active” faults are those that have been active within the past 11,000 years (City of Merced 2010). Seismic activity is considered the first of “primary” hazards, in that it is caused by the direct interaction of seismic wave energy with the ground (Branz 2019).

Based on a desktop evaluation of fault activity maps of the Merced region, there are 13 known faults within approximately 60 miles of the City (CGS 2010). No AP Act earthquake fault zones were identified within the Program Study Area (CGS 2019c). Table 3.6-3 summarizes the regional "active" faults within approximately 60 miles of the Program Study Area.

Table 3.6-3: Regional Active Faults within Approximately 60 Miles of the Program Study Area

Fault Name	Fault Type	Average Fault Age	Approximate Distance From Program Study Area (miles)
Black Butte Fault	Certain (ball and bar)	Quaternary (age undifferentiated)	60
Bowie Flat Fault	Certain	Late-Quaternary	50
Clovis Fault	Concealed	Pre-Quaternary	60
Green Springs Run Fault	Certain (ball and bar)	Late-Quaternary	50
Kings Canyon Lineament	Concealed	Pre-Quaternary	20
Melones Fault Zone	Certain	Pre-Quaternary	40
Midway Fault	Approximate	Late-Quaternary (fault displacement)	60
Negro Jack Point Fault	Approximate	Late-Quaternary	50
Panoche Hills Fault	Concealed	Quaternary (age undifferentiated)	60
O'Neill Fault	Concealed	Late-Quaternary (fault displacement)	50
Ortigalita Fault	Certain	Holocene (fault displacement)	60
San Joaquin Fault	Concealed	Holocene (fault displacement)	40
Vernalis Fault	Concealed	Quaternary (age undifferentiated)	40

Fault Type

Approximate = General location with uncertainty.

Ball and Bar = Downthrown side of fault.

Certain = Location of fault with no uncertainty.

Concealed = Buried under many layers of younger rock/ sedimentary materials and/or hydrologic feature (e.g., lake or bay).

Average Fault Age

Pre-Quaternary = Prior to 1.6 million years ago.

Quaternary = Faults with undivided Quaternary displacement (last 1.6 million years).

Late Quaternary = Faults with late Quaternary displacement (last 750,000 years).

Source: CGS 2010

The results of the desktop evaluation of fault activity maps for the Merced region indicate that Kings Canyon Lineament and the San Joaquin Fault are the closest sources of potential ground motion (CGS 2010). These fault systems are not considered "active" by the California Division of Mines and Geology; however, in some areas there is

evidence of geomorphic processes that indicate that there has been fault movement as recently as the Pleistocene, and as such, these faults can be considered as "potentially active" (Bartow 1991). Although there are no known faults within the City limits, shaking has occurred within the City in the past associated with earthquakes throughout Central California, the Sierra, and the Bay Area. These shaking events depend on the magnitude and intensity of the surrounding earthquakes. The potential for ground shaking in the event of a major earthquake within the Program along these faults or from other fault areas is possible; however, shaking would not likely be substantial (City of Merced 2010).

USGS ranks the California Central Valley around and in Merced as having a moderate hazard potential on the 2018 Long-term National Seismic Hazard Map. Showing a general earthquake hazard potential from a regional perspective. The earthquake hazard map shows peak ground accelerations having greater than a 2 percent probability of being exceeded in 50 years for a firm rock site. The map is based on the most recent USGS models for the conterminous U.S. (2018). The CGS further maintains a similar map titled the Probabilistic Seismic Hazards Assessment Peak Ground Acceleration Map that provides data specific California's seismic shaking hazards. For the region surrounding the Program Study Area, the Peak Ground Acceleration, which has a 10-percent probability of being exceeded within the next 50 years, ranges from approximately 10 to 20 percent of acceleration of gravity (g) (i.e., the force caused by shaking) (CGS 2019d). While Peak Ground Acceleration is useful for the regional comparisons of potential effects of fault activity, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the Program Study Area (City of Merced 2010).

Additionally, a desktop review of regulatory maps within the CGS Information Warehouse provide delineated "zones of required investigation" to reduce the threat to public health and safety and minimize the loss of life and property posed by an earth-triggered quakes were reviewed. The review results indicated no regulatory information, evaluation and/or fault evaluation reports, no hazard zones have been recorded in the Program Study Area under the Seismic Hazard Mapping Act (CGS 2019e).

Ground Failure

Ground failure includes ground shaking, ground settlement and surface rupture. Ground shaking is the vibration that radiates from the epicenter of an earthquake (City of Merced 2010). Ground shaking can vary over an area as a result of factors such as topography, bedrock type, and the location and orientation of a fault rupture due to seismic activity. Ground settlement (i.e., subsidence) is the lowering of the ground surface during seismic activity and is caused by consolidation of the underlying sediments, densification of soil material, or liquefaction (discussed below). Surface rupture is when some ground is raised or lowered leaving a visible crack in the earth surface. Ground failure can cause serious direct damage or collapse of infrastructure caused by seismic activity and is considered the second "primary" earthquake hazard. The severity of ground failure depends on the strength and depth of the earthquake, but there are several other contributing factors, such as the regional geology, local topography, and the site-specific ground characteristics within the Program Study Area (Branz 2019). Specifically, the intensity of the vibration or shaking and its potential impact to buildings and other development in the Program Study Area is determined by several factors (City of Merced 2010):

- The nature of the underlying materials, including rock and soil;
- Structural characteristics of a building;
- Quality of workmanship and materials used in its construction;
- Location of the epicenter and the magnitude of the earthquake; and

- Duration and character of the ground motion.

The Program Study Area could be subjected to ground failure in the event of a major earthquake along the faults mentioned above or other area faults.

Landslides and Lateral Displacement

Any slope where relatively large masses of material are supported by soil that is likely to soften under strain is prone to a landslide. The risk increases in areas where the ground is steep, weak, or fractured; is saturated by heavy rain; or is compromised by historical ground movements (Branz 2019). Landslides occur most frequently during or following large storms or seismic activity and is most likely to take place in areas where large storms or seismic activity have previously occurred.

Lateral movement (i.e., displacement, spreading, etc.) occurs when seismic shaking causes a mass of soil to lose cohesion and move relative to the surrounding soil. Lateral movement can be entirely horizontal and can occur on flat ground, but it is more likely to occur on or around sloping ground, such as adjacent to hillsides and waterways (Branz 2019).

In general, the potential for land sliding, slope failure, and lateral displacement in the Program Study Area in its current condition is very low due to the overall topography, slope, and compositions of soils. A desktop review of Landslide Maps and Report Indices was conducted for the Program Study Area. The review results indicated no landslide information or reports, and as such there is no potential areas for landslides within the Program Study Area (CGS 2019f).

Liquefaction

Soil liquefaction occurs when ground shaking from an earthquake causes a sediment layer saturated with groundwater to lose strength and take on the characteristics of a fluid, thus becoming similar to quicksand. Factors determining the liquefaction potential are soil type, the level and duration of seismic ground motions, the type and consistency of soils, and the depth to groundwater. Loose sands and peat deposits, along with recent Holocene age deposits, are more susceptible to liquefaction, while older deposits of clayey silts, silty clays, and clays deposited in freshwater environments are generally stable under the influence of seismic ground shaking.

Liquefaction can damage buildings, roads, and pipelines through loss of structural support capabilities and subsequent destabilization of soils. The Program Study Area primarily consists of well drained, coarse-loamy soils that have a low potential for liquefaction or ground failure to occur. Groundwater levels within the City fluctuate regularly depending on the location within the City and time of year. Generally, groundwater levels within the Mehrten Formation are located at a depth of approximately 300 feet, while groundwater levels within shallower aquifers in the City can be accessed as close as 1 to 15 feet in depth (City of Merced 2010). Therefore, the liquefaction potential within the City varies from low to moderate depending on the location within the City and due to the low potential for ground shaking to occur within the City (City of Merced 2010).

3.6.4 Environmental Impacts

This section analyzes the Program's potential to result in significant impacts to geology, soils, and minerals. When a potential impact is determined to be potentially significant, mitigation measures (MMs) were identified that would reduce or avoid that impact.

3.6.4.1 Impact Analysis

Impact GEO-1 **Potential to directly or indirectly expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:**

- **Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State geologist for the area or based on other substantial evidence of a known fault as defined by the Division of Mines and Geology Special Publication 42 or strong seismic ground shaking;**
- **Seismic-related ground failure, including liquefaction; or**
- **Landslides.**

Impact GEO-1 Analysis
Program Impacts

Construction and Operation

Rupture of a Known Earthquake Fault or Strong Seismic Ground Shaking

There are no known faults within the Program Study Area. Further, a review of seismic ground shaking probability identifies the Program Study Area to have a moderate potential for ground shaking having a Peak Ground Acceleration range of 10 to 20 percent acceleration of gravity with a 10 percent probability of being exceeded within the next 50 years (USGS 2018; CGS 2019d). Consistently, the Program Study Area has historically experienced low levels of ground shaking from earthquakes occurring on surrounding faults. As recently as June 2020, a 5.8 intensity earthquake in Lone Pine, California was felt at City offices. The Kings Canyon Lineament (i.e., approximately 20 miles from the Program Study Area) and the San Joaquin Fault (approximately 40 miles from the Program Study Area) are the closest potentially active sources of ground shaking to the Program Study Area (USGS 2020).

The Program would be developed in accordance with current design standards and codes (Section 3.6.2, Regulatory Framework: Uniform Building Code, California Standard Building Code, City of Merced Municipal Code, and City of Merced Standard Designs of Common Engineering Structures) which account for the generally high seismic probability within the state and the moderate ground shaking potential of the Program Study Area. Program design plans would require a stamp by a licensed civil and/or structural engineer whose professional licensures ensure implementing structural standards accounting for seismic hazards thus limiting the potential for placing people or infrastructure at risk of substantial adverse effects from rupture or ground shaking from a known earthquake fault. Additionally, none of the Program components would include uses for human habitation, although a few structures

would occasionally be occupied by City personnel. As stated, the facilities built as part of the Program would meet the necessary design requirements to limit the risk of injury, loss, or death as a result of failure of Program facilities.

Additionally, the majority of the Program components would be located underground and would not pose a risk related to injury, loss, or death. To date, the existing collection system has not experienced rupture, failure, or release of raw sewage as a result of ground shaking from an earthquake, indicating that the construction and operation of additional similar wastewater facilities would not further expose people or structures to potential substantial effects as a result of the Program. Construction and operation of the improved wastewater collection system would be similar to the existing system related to structural stability and installation methods, and therefore, the potential for rupture of a known earthquake fault or seismic shaking that could expose people or structures to risk from implementation of the Program is less than significant.

Seismic-Related Ground Failure

As stated above, there are no known faults within the Program Study Area; however, ground shaking has been observed in Merced from faults in the Sierra Nevada mountains. The Program Study Area has the potential to be subject to ground failure in the event of a major earthquake caused by one of the region's potentially active faults. The Program Study Area consists primarily of well-drained, coarse-loamy soils that have a low potential for liquefaction or ground failure due to liquefaction. Similar to the discussion of seismic ground shaking above, the Program components would be designed in accordance with current codes and design standards (Section 3.6.2, Regulatory Framework: Uniform Building Code, California Standard Building Code, City of Merced Municipal Code, and City of Merced Standard Designs of Common Engineering Structures). These standards include structural stability requirements such as foundation support, grading and earthwork specifications, and testing and start-up of newly installed facilities. The design plans would be approved and stamped by a licensed engineer in conformance with these applicable building codes and key design standards (i.e., ASCE-7 and the City's standards for common engineering structures). Therefore, the potential for implementation of the Program to expose people or infrastructure to potentially adverse effects related to liquefaction or ground failure is considered less than significant.

Landslides

According to the assessment of the CGS Landslide Maps and Report Indices reviewed for the Program Study Area, no active landslide deposits have been identified in the Program Study Area. That means, in addition to the fact that the Program Study Area is relatively flat and is not surrounded by any topographic features (e.g., hills or mountains) that have slopes steep enough to cause landslides, that the potential for a landslide to occur in the area is very low. While localized landslides associated with construction requiring trenching or digging could occur even with low potential for landslides in the area, construction safety precautions, such as shoring or other trench stabilization measures, would be implemented as a part of OSHA regulations, specifically, 29 CFR 1926.620, 29 CFR 1926.651, and 29 CFR 1926.652 (Section 3.6.2.1 Regulatory Framework), and would not directly or indirectly expose people or structures to the threat of landslide. Therefore, the potential for landslides to occur and cause substantial harm or threat to persons or structures as a result of implementation of the Program would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: New Trunk Sewer Infrastructure Impacts

Construction and Operation

As described for the Program above, the Program Study Area is not located near a fault zone, and the potential for rupture of a known earthquake fault or ground failure, which could expose people or structures to risk from the new trunk sewer infrastructure, is considered low. The new pump station associated with the Northern Trunk Sewer would be located in an above-ground, enclosed structure, and therefore would be required to comply with ASCE-7, Minimum Design Loads for Buildings and other Structures, to ensure that the structure would withstand seismic shaking or fault ruptures through the stabilization of underlying soils, foundation support specifications, and the use of appropriate building materials and support for the new building, limiting any potential risk of placing employees at risk of seismic related structure failures to a less than significant level.

The new pipelines for the Northern and Southern Trunk Sewers would be designed and built in accordance with the City's standards for common engineering structures, which includes stability specifications for sewer systems. These standards would limit the potential for failure of the new wastewater collection system infrastructure through the use of appropriate construction materials and installation methods, and the stabilization of underlying soils and would limit the potential for risk of structure or pipeline failure during a ground shaking event.

Further, as described for the Program, construction of trenches or excavations for the new facilities (i.e., pump station or pipelines) associated with the new trunk sewers could result in localized land sliding, bank collapse, or other ground failure but worker safety regulations (Section 3.6.2.1 Regulatory Framework) provide procedures that would be followed during construction, which would make this impact less than significant. Additionally, none of the new trunk sewer infrastructure components are meant for human habitation; therefore, there would be no potential for injury, loss, or death related to rupture of a fault or ground shaking. Therefore, impacts related to ground shaking or failure as a result of implementation of the new trunk sewer infrastructure would be less than significant.

The new trunk sewer infrastructure would not trigger landslides or result in different conditions from those described above. Therefore, the potential for landslides to occur as a result of the new trunk sewer infrastructure would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: WWTRF Expansion Impacts

Construction and Operation

As described for the Program above, the Program Study Area is not located near a fault zone, and the potential for rupture of a known earthquake fault or ground failure, which could expose people or structures to risk from the expansion to the WWTRF, is considered low. Similar to the new trunk sewer infrastructure and the discussion for the

overall Program above, expansion of the WWTRF would require new structures that would be built in conformance with the ASCE-7, Minimum Design Loads for Buildings and other Structures and required to be stamped by a licensed civil or structural engineer, which includes specifications for stabilization of underlying soils, foundation support; use of appropriate building materials and support for any of the new structures required for the WWTRF expansion; and design plans that meet current design standards and regulations. Therefore, impacts related to ground shaking as a result of implementation of the WWTRF expansion would be less than significant.

The expansion of the existing WWTRF would not trigger landslides or result in different conditions from those described above. Therefore, the potential for landslides to occur as a result of the expansion of the WWTRF would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Impact GEO-1 Findings

Impact GEO-1 Overall Level of Significance Prior to Mitigation: Less than Significant

Impact GEO-1 Mitigation Required: None Required

Impact GEO-1 Overall Level of Significance After Mitigation: Less than Significant

Impact GEO-2 Potential to result in substantial soil erosion or the loss of topsoil.

Impact GEO-2 Analysis

Program Impacts

Construction

Due to the relatively flat nature of the Program Study Area, substantial soil loss from precipitation or secondary stormwater runoff is not anticipated. However, construction activities associated with the Program, including for the new pipelines, pump stations, and WWTRF expansion, would include the excavation and the movement of soil, which could result in the loss of topsoil if not properly handled. This is anticipated for areas of the Program that would not occur in the paved right-of-way (ROW) or previously disturbed areas. Temporary stockpiles of soil have the potential to result in loss of topsoil during construction when soils are exposed and being transported and could potentially result in a significant impact if not appropriately stored and handled. However, implementation of the Program would comply with MM GEO-1, Prepare an Erosion Control and Stormwater Pollution Prevention Plan (SWPPP), and Title 15, Division III, Chapter 15.50 of the City's Municipal Code related to discharge control for construction projects. This Code includes requirements for obtaining a grading permit, obtaining a CWA Section 402 NPDES General Construction Permit, and general design standards, as well as best management practices (BMPs) for construction-related grading and drainage activities. MM GEO-1 would incorporate the principles outlined in the City Code requirement for the City and the Contractor to follow, which would minimize the potential erosion and loss of topsoil from the Program construction activities. The Erosion Control Plan and SWPPP would include other requirements

from the NPDES Permit related to stormwater, erosion, and sediment control. Therefore, construction-related erosion and loss of topsoil would be considered less than significant with MM GEO-1 incorporated.

All topsoil exposed as a part of implementation of the Program would be restored to pre-existing contours to the extent possible and revegetated or stabilized as required by MM GEO-1. As such, the potential for substantial erosion would be limited since the site would be revegetated, and site grading would be designed for adequate drainage, limiting exposed soils that could be subject to erosion. Therefore, operational impacts resulting from implementation of the Program related to erosion and loss of topsoil would be considered less than significant with mitigation incorporated.

Through the implementation of MM GEO-1, impacts associated with substantial soil erosion or the loss of topsoil would be less than significant with mitigation incorporated.

Operation

There would be no operational impacts related to loss of topsoil because once constructed, Program components would be stationary and would not result in substantial movement of soils and above-ground sites would be regulated by City stormwater permits. Therefore, impacts from operation would be less than significant.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-1

Level of Significance After Mitigation: Less than Significant

Proposed Project: New Trunk Sewer Infrastructure Impacts

Construction

Similar to the discussion for the Program above, construction activities associated with the new trunk sewer infrastructure would consist of the excavation and movement of soil, which could result in the loss of topsoil and increase erosion potential in the construction area if not properly handled. Movement of soils could occur through the placement of facilities such as the new pipelines associated with the Northern and Southern Trunk Sewers as well as at the new pump station associated with the Northern Trunk Sewer. As such, all topsoil exposed as a part of the activities related to new trunk sewer infrastructure would be restored to pre-existing contours to the extent possible and revegetated as required by MM GEO-1. MM GEO-1 would be required for the new trunk sewer infrastructure, which includes the preparation and implementation of an Erosion Control Plan and SWPPP, along with the appropriate BMPs, and the new trunk sewer infrastructure would be inspected throughout the construction process. Therefore, with the implementation of MM GEO-1, the potential for erosion and loss of topsoil during construction would be reduced to a less than significant impact.

Operation

There would be no operational impacts related to loss of topsoil because once constructed, the new trunk sewer infrastructure components would be stationary and would not result in a substantial amount of soil movement. Therefore, impacts would be less than significant.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-1

Level of Significance After Mitigation: Less than Significant

Proposed Project: WWTRF Expansion Impacts

Construction

Similar to the discussion for the Program above, the expansion of the existing WWTRF would consist of excavation and movement of soil, which could result in the loss of topsoil and increase the potential for erosion at the WWTRF if not properly handled, potentially creating a significant impact. Although the majority of the existing WWTRF consists of previously disturbed areas and paved and gravel pathways, the construction of the expansion would involve work on topsoil currently used for agricultural operations. As such, all topsoil exposed as a part of the construction activities related to the WWTRF expansion would be restored to pre-existing contours to the extent possible and revegetated or converted to paved or gravel areas as required to accommodate a design to limit erosion potential as required by MM GEO-1. MM GEO-1 would include the preparation and implementation of an Erosion Control Plan and SWPPP, which would implement appropriate BMPs and call for inspections throughout the construction process. Therefore, with the implementation of MM GEO-1, the potential erosion and loss of topsoil would be reduced to a less than significant impact.

Operation

There would be limited operational impacts related to loss of topsoil because once constructed, WWTRF expansion components would be stationary and would not result substantial movement of soils. Therefore, there would be a less than significant impact.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-1

Level of Significance After Mitigation: Less than Significant

Impact GEO-2 Findings

Impact GEO-2 Overall Level of Significance Prior to Mitigation: Potentially Significant

Impact GEO-2 Mitigation Required: MM GEO-1

Impact GEO-2 Overall Level of Significance After Mitigation: Less than Significant

Impact GEO-3 Potential to 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 GEO-3 Analysis

Program Impacts

Construction and Operation

The City is located on four geologic formations, which include a mixture of interbedded alluvium with a mixture of sedimentary and metamorphic deposits. The soils in this region primarily consist of poorly sorted gravel, sand, silt, and clay, with a low to moderate erosion potential. As discussed in Impact GEO-1, there is a low potential for ground failure, lateral spreading, subsidence, liquefaction, or collapse to occur within the Program Study Area due to the low likelihood of seismic activity of a significant magnitude. There is no potential for landslides to occur in the Program Study Area due a relatively flat topography in the area. In addition, there is a very low to nonexistent potential for soils and underlying geology to become unstable due to Program activities because the Program components would be built in accordance with state and local standards, including ASCE-7, Minimum Design Loads for Buildings and other Structures, for above-ground Program components such as pump stations or WWTRF facilities and with the City's standards for common engineering structures, which include stability specifications for sewer systems, such as pipelines. These standards would limit the potential for failure of the new wastewater collection system infrastructure through the use of appropriate construction materials and installation methods, and the stabilization of underlying soils. Further, as required to meet these design standards, site-specific geotechnical investigations would be performed prior to the start of any construction activities associated with Program activities to identify any possible unstable soils, and design modifications would be required to address these soils (i.e., soil stabilization for pipelines or reinforced concrete foundations for buildings). While localized landslides or unstable soils associated with excavation of trenches and foundations could occur even with the low potential for landslides in the area, construction safety precautions, such as shoring or other trench stabilization measures, would be implemented as a part of OSHA regulations (Section 3.6.2.1, Regulatory Framework) and would not directly or indirectly expose people or structures to threat of unstable soils. Therefore, impacts related to unstable soils would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: New Trunk Sewer Infrastructure Impacts

Construction and Operation

As described for the Program above, there is low potential for ground failure, lateral spreading, subsidence, liquefaction, or collapse to occur within the area due to seismic activity. There is low potential for landslides to occur in the Program Study Area due to gentle slopes and soil types. In addition, there is a very low to nonexistent potential for soils and underlying geology to become unstable due to the installation of new trunk sewer infrastructure. As described previously, design and construction of Program facilities would comply with ASCE-7, Minimum Design

Loads for Buildings and other Structures. Design and construction of Program facilities would also comply with the City's standards for common engineering structures, which includes stability specifications for sewer systems and the new pipelines. These standards would limit the potential for failure of the new wastewater collection system infrastructure through the use of appropriate construction materials and installation methods, and the stabilization of underlying soils. Further, as described above, excavation of trenches and foundations associated with construction could result in bank collapse, but OSHA worker safety regulations would provide procedures that would be followed during construction, which would make this impact less than significant. Therefore, landslides, lateral spreading, subsidence, liquefaction, or collapse during construction or the operation of the new trunk sewer infrastructure is not expected, and impacts would be considered less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: WWTRF Expansion Impacts

Construction and Operation

As described for the Program above, there is low potential for ground failure, lateral spreading, subsidence, liquefaction, or collapse to occur within the Program Study Area due to seismic activity. There is no potential for landslides to occur in the Program Study Area other than in excavation areas. In addition, there is a very low to nonexistent potential for soils and underlying geology to become unstable due to expansion of the existing WWTRF. The expansion of the WWTRF would be built in conformance with ASCE-7, Minimum Design Loads for Buildings and other Structures, which would include specifications for the use of appropriate construction materials and installation methods, and the stabilization of underlying soils. Therefore, landslides, lateral spreading, subsidence, liquefaction or collapse during construction or the operation of the expansion of the WWTRF would not be expected, and impacts would be considered less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Impact GEO-3 Findings

Impact GEO-3 Overall Level of Significance Prior to Mitigation: Less than Significant

Impact GEO-3 Mitigation Required: None Required

Impact GEO-3 Overall Level of Significance After Mitigation: Less than Significant

Impact GEO-4	**Potential to 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 GEO-4 Analysis
Program Impacts

Construction and Operation

Expansive or collapsible soils are characterized by the ability to undergo significant volume change (e.g., shrink and swell) as a result of variation in soil moisture content. Specifically, the causes of soil expansion or collapse are related to the type and amount of clay minerals in the soil, conditions under which the clay originated, and the original density of the soil. Clay minerals can form in-place by weathering of rocks, or they can be transported and deposited by water or wind. A change in the moisture content of a soil can cause clay minerals to shrink or expand (i.e., swell) (Arizona Geological Survey 2019). Soil moisture content can change due to many factors, including perched groundwater, landscape irrigation, rainfall, and utility leakage. Engineering standards govern expansion potential evaluations and the expansion index (Table 3.6-1). Section 1803.2 of the 1994 UBC directs expansive soil tendency be graded by this method. The UBC mandates that “special [foundation] design consideration” be employed if the expansion index is 20 or greater.

The soils in the Program Study Area generally consist of poorly sorted gravel, sand, silt, and clay and are acidic with low fertility. The soils have a moderate shrink-swell potential, with a granular, clayey, and relatively consolidated and cemented nature, and as such, the soils in the Program Study Area are regarded as moderately expansive, with a low to moderate erosion potential (City of Merced 2010). Program components would be built in accordance with state and local standards, including ASCE-7, Minimum Design Loads for Buildings and other Structures, and with the City’s standards for common engineering structures, which would limit the potential for failure of the new wastewater collection system infrastructure from being located on potentially expansive soils through the use of appropriate construction materials and installation methods, and the stabilization of underlying soils. Further, as required to meet these design standards, site-specific geotechnical investigations would be performed prior to the start of any construction activities associated with Program activities in order to identify any possible unstable soils and design modifications that would be required to address these soils (i.e., soil stabilization for pipelines or reinforced concrete foundations for buildings). Therefore, the impact associated with expansive soils in conjuncture with the implementation of the Program would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: New Trunk Sewer Infrastructure Impacts

Construction and Operation

As described for the Program above, the soils in the Program Study Area consist of poorly sorted gravel, sand, silt, and clay. These soils have a moderate shrink-swell potential, and as such, the soils in the Program Study Area are regarded as moderately expansive (City of Merced 2010). The New Trunk Sewer Infrastructure would be constructed with ASCE-7, Minimum Design Loads for Buildings and other Structures, and with the City’s standards for common engineering structures, which would limit the potential for failure of the new wastewater collection system

infrastructure from potentially expansive soils through use of construction materials, installation methods, and stabilization of underlying soils. Therefore, the impact associated with expansive soils in conjuncture with the new trunk sewer infrastructure would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Proposed Project: WWTRF Expansion Impacts

Construction and Operation

As described for the Program above, the soils in the Program Study Area consist of poorly sorted gravel, sand, silt, and clay. These soils have a moderate shrink-swell potential, and as such, the soils in the Program Study Area are regarded as moderately expansive (City of Merced 2010).T The expansion of the WWTRF would be built in conformance with ASCE-7, Minimum Design Loads for Buildings and other Structures, which would include specifications for the use of appropriate construction materials and installation methods, and the stabilization of underlying soils. Therefore, the impact associated with expansive soils in conjuncture with the expansion to the existing WWTRF would be less than significant.

Level of Significance Prior to Mitigation: Less than Significant

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Impact GEO-4 Findings

Impact GEO-4 Overall Level of Significance Prior to Mitigation: Less than Significant

Impact GEO-4 Mitigation Required: None Required

Impact GEO-4 Overall Level of Significance After Mitigation: Less than Significant

Impact GEO-5	**Potential to 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.**

Impact GEO-5 Analysis

Combined Program/Proposed Project Impacts

Construction and Operation

The Program proposes to provide wastewater collection services to areas within the SUDP/SOI that are currently not served by sewer collection systems and are typically reliant on septic systems, which would reduce the reliance on

septic systems and does not include installation or use of septic systems or other alternative disposal systems. As such, implementation of the Program would not affect the use of septic tanks or alternative wastewater disposal systems. Therefore, there would be no impact to soils incapable of adequately supporting septic tanks or alternative wastewater disposal systems.

Level of Significance Prior to Mitigation: No Impact

Mitigation Required: None Required

Level of Significance After Mitigation: Less than Significant

Impact GEO-5 Findings

Impact GEO-5 Overall Level of Significance Prior to Mitigation: No Impact

Impact GEO-5 Mitigation Required: None Required

Impact GEO-5 Overall Level of Significance After Mitigation: No Impact

Impact GEO-6 Potential to directly or indirectly destroy a unique paleontological resources or site or unique geologic feature.

Impact GEO-6 Analysis

Program Impacts

Construction

The Program Study Area lies within an area of both Neogene and Quaternary Periods (i.e., Cenozoic Era) deposits. The paleontological potential of the Program Study Area is high. The Mehrten Formation, one of the four geologic formations occurring in the Program Study Area, is a sedimentary unit known for its fossil plant and vertebrate localities. According to the Society of Vertebrate Paleontology (SVP) guidelines, this rock unit has a high potential to yield significant paleontological resources. Given the high paleontological potential of rock units in the Program Study Area, there is the potential for ground-disturbing construction activities from installation of Program facilities to unearth potentially significant paleontological resources in previously undisturbed areas. Therefore, in order to ensure that construction personnel are trained in appropriate identification and treatment procedures for these potentially significant resources, MM GEO-2 would be required and would include the development of a Worker Environmental Awareness Training Program (WEAP) for paleontological resources. Further, if previously undiscovered paleontological resources are encountered on a Program facilities site, MM GEO-3 would also be required to properly handle and treat these resources in compliance with federal regulations and SVP guidelines. Proper handling of these previously undiscovered resources identified in MM GEO-3 would include stopping all work within 100 feet of the discovery, notifying City staff, retaining a qualified geologist or paleontologist to evaluate the resource, and implementing further treatment measures as prescribed by professional standards, and if a significant resource, consulting with the resource agencies. For trenchless installations of the pipelines (i.e., under major highways, railways, or waterways), impacts to paleontological resources would likely be avoided due to the small drilling footprint of these methods. However, if visible paleontological resources, such as bone fragments, are witnessed in

the drilling slurry, then MM GEO-3 would be employed. Implementation of MM GEO-2 and MM GEO-3 would develop treatment measures to effectively eliminate potentially significant impacts to resources related to undiscovered paleontological resources, and therefore, the impact would be considered less than significant with mitigation incorporated.

Operation

Once operational, the Program components would involve limited and non-substantial ground disturbing activities that would have limited potential to impact to paleontological resources. Therefore, there would be a less than significant impact.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-2 and MM GEO-3

Level of Significance After Mitigation: Less than Significant

Proposed Project: New Trunk Sewer Infrastructure Impacts

Construction

As described for the Program above, the Mehrten Formation occurring the Program Study Area has the potential to yield undiscovered paleontological resources during construction of the new trunk sewer infrastructure. Pipeline and pump station construction and installation would involve excavation and open trenches, and thus, construction could potentially disturb previously undiscovered paleontological resources and result in a potentially significant impact prior to mitigation. As such, MM GEO-2 and MM GEO-3 would be required to ensure that construction personnel are properly trained on the identification of paleontological resources, should they be encountered during the construction and to ensure that the proper treatment measures are implemented if paleontological resources are encountered, including stopping all work within 100 feet of the discovery, notifying appropriate and qualified personnel, and further treatment measures (should the resource be identified as a potentially significant paleontological resource. Construction of both the Northern and Southern Trunk Sewers would also involve several trenchless pipeline installations to go under major highways (i.e., SR 99 and Santa Fe Drive), railways, and waterways. These trenchless pipeline installations would involve limited work zones, and the underground impacts would be limited to approximately the circumference of the drill pipe. Although it is difficult to distinguish potential paleontological resources in drilling slurry, the workers would be trained through MM GEO-2 on identification of paleontological resources and would employ MM GEO-3 if any potential paleontological resources are witnessed in the drilling slurry. If paleontological resources are witnessed, all work within the trenchless work area would cease until a qualified geologist or paleontologist evaluates the resource, and further treatment measures would be implemented if the identified resource is determined to be significant. Therefore, with the implementation of these mitigation measures, impacts resulting from the construction of the new trunk sewer infrastructure would be reduced to a less than significant level.

Operation

Once operational, the new trunk sewer infrastructure would involve limited and non-substantial ground disturbing activities that would have limited potential to impact to paleontological resources. Therefore, there would be a less than significant impact.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-2 and MM GEO-3

Level of Significance After Mitigation: Less than Significant

Proposed Project: WWTRF Expansion Impacts

Construction

As described for the Program above, one of the rock formations occurring the Program Study Area has the potential to yield paleontological resources during construction of the WWTRF expansion. The WWTRF is considered a previously disturbed area; however, there would still be a possibility that previously undiscovered paleontological resources could be encountered during construction of the WWTRF expansion. As such, MM GEO-2 and MM GEO-3 would be required to ensure that construction personnel are properly trained on the identification of paleontological resources, should they be encountered and ensure that the proper treatment measures are implemented, including stopping all work within 100 feet of the discovery, notifying appropriate and qualified personnel, and implementing further treatment measures as required. Therefore, with the implementation of these mitigation measures, impacts resulting from the construction of the expansion of the WWTRF would be reduced to a less than significant level.

Operation

Once operational, the expansion of the WWTRF would involve operation of stationary structures that would not involve any ongoing impacts to paleontological resources. Therefore, there would be no operational impacts.

Level of Significance Prior to Mitigation: Potentially Significant

Mitigation Required: MM GEO-2 and MM GEO-3

Level of Significance After Mitigation: Less than Significant

Impact GEO-6 Findings

Impact GEO-6 Overall Level of Significance Prior to Mitigation: Potentially Significant

Impact GEO-6 Mitigation Required: MM GEO-2 and MM GEO-3

Impact GEO-6 Overall Level of Significance After Mitigation: Less than Significant

Impact GEO-7 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.

Impact GEO-7 Analysis
Combined Program/Proposed Project Impacts

Construction and Operation

The Program Study Area is not located in a designated MRZ, which is a land classification created by the CGS that is used to designate sites with known deposits of commercially viable mineral or aggregate material. Therefore, the potential for the loss of availability of known mineral resources resulting from the implementation of the Program is not anticipated. Additionally, construction and placement of Program components, including the new pipelines, would largely occur within developed roads, or roads easements that are planned for future development. Therefore, installation of these features would not be expected to limit access to any mineral resources that are of value to the region or the residents of the state. Implementation of the Program would not require a substantial amount of mineral resources that 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. Therefore, no impact would occur.

Level of Significance Prior to Mitigation: No Impact

Mitigation Required: None Required

Level of Significance After Mitigation: No Impact

Impact GEO-7 Findings

Impact GEO-7 Overall Level of Significance Prior to Mitigation: No impact

Impact GEO-7 Mitigation Required: None Required

Impact GEO-7 Overall Level of Significance After Mitigation: No Impact

Impact GEO-8 Potential to result in the loss of availability of a local-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

Impact GEO-8 Analysis
Combined Program/Proposed Project Impacts

Construction and Operation

Similar to Impact GEO-7, there are local-important mineral resource recovery sites delineated within the Program Study Area (City of Merced 2010) and the Program would not involve substantial amounts of locally important mineral resources. Thus the Program would not result in the loss of a recovery site delineated on a local general plan, specific plan, or other land use plan or substantial amounts of locally important mineral resources. There are no other aspects of construction or operation of the Program that would prevent access to a resource recovery site in the region. Therefore, the Program would have no impact.

Level of Significance Prior to Mitigation: No Impact

Mitigation Measure: None Required

Level of Significance After Mitigation: No Impact

Impact GEO-8 Findings

Impact GEO-8 Overall Level of Significance Prior to Mitigation: No Impact

Impact GEO-8 Mitigation Required: None Required

Impact GEO-8 Overall Level of Significance After Mitigation: No Impact

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3.6.5 Geology, Soils, and Minerals Mitigation

Mitigation Measure GEO-1: Prepare an Erosion Control Plan and Stormwater Pollution Prevention Plan

To reduce the potential for erosion and sedimentation resulting from construction activities, the City shall require that the selected contractor prepare an Erosion Control Plan and Stormwater Pollution Prevention Plan (SWPPP) prior to the start of construction. The SWPPP would include a risk-level determination based on sediment transport and receiving water risk, in addition to specifications for best management practices (BMPs) that would be implemented during construction of Program facilities to reduce or eliminate impacts to surface water. BMPs have been defined by the Regional Water Quality Control Board (RWQCB) in the California Quality Association Construction Handbook, and include erosion and sediment control, non-stormwater and materials management, and waste management and materials pollution control. Additionally, the SWPPP would describe the effluent limits and sampling and analysis requirements during construction (if applicable) and post-construction measures to prevent or control runoff degradation once construction is complete.

The Erosion Control Plan shall provide, at a minimum, measures and BMPs to trap sediment, stabilize excavated soil, and stabilize and revegetate any disturbed areas with native plants. Straw bales, coir rolls, hydroseeding, and other BMPs shall be used in areas of bare soil to prevent long-term land scarring and in drainages near all areas of disturbance to reduce surface runoff velocities and to prevent sediment from entering drainages. Maintenance of erosion and sediment control measures shall be conducted on a weekly basis, at minimum, during active construction activities. The revegetation of all graded and disturbed areas of bare soil shall be completed within 6 months after construction is complete. Seed mixes shall be used to replicate the naturally occurring vegetation, with the exception of any irrigated areas associated with the Wastewater Treatment and Reclamation Facility (WWTRF) operations. These plans shall be implemented and inspected by the City accordingly throughout the construction process.

The contractor under the City's authority shall apply for coverage under California's General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (General Permit), State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ for construction activities that will disturb more than 1 acre. The General Permit requires that a SWPPP shall be prepared before construction begins.

Mitigation Measure GEO-1 Implementation

Responsible Party: The contractor and the City's Qualified SWPPP Developer (QSD).

Timing: Prior to, during, and post-construction activities.

Monitoring and Reporting Program: SWPPP inspections.

Standards for Success: No SWPPP violations.

Mitigation Measure GEO-2: Pre-Construction Worker Environmental Awareness Training (Paleontological Resources)

The purpose of a Worker Environmental Awareness Program (WEAP) is to educate personnel (i.e., construction workers) about the existing onsite and surrounding resources and the measures required to protect these resources as well as avoidance and potential hazards within these sites. The WEAP, developed by the City, shall include materials and information on potentially sensitive biological and cultural resources, paleontological resources, air quality protection measures, and potential hazards resulting from construction within the Program Study Area and applicable precautions personnel should take to reduce potential impacts.

The WEAP presentation shall be given to all personnel who may harm sensitive environmental resources as identified within the WEAP mitigation measures (i.e., paleontological resources,). The WEAP presentation shall be given prior to the start of construction and as necessary throughout the life of the Project as new personnel arrive onsite. The City and the contractor are responsible for ensuring that all onsite personnel attend the WEAP presentation, receive a summary handout, and sign a training attendance acknowledgement form to indicate that the contents of the program are understood and to provide proof of attendance. Each participant of the WEAP presentation shall be responsible for maintaining their copy of the WEAP reference materials and making sure that other onsite personnel are complying with the recommended precautions. The contractor shall keep the sign-in sheet onsite and submit copies of the WEAP sign-in sheet to the City's Project Manager, who shall keep it on file at City offices.

Paleontological resources include any remains, traces, or imprints of a plant or animal that has been preserved in the Earth's crust since some past geologic time and may include fossil materials such as bones, leaf impressions, and other carbonized remains and shells of invertebrates such as snails and clams. For the paleontological materials portion of the WEAP presentation, the following information and implementation steps shall be prepared, presented, and executed prior to and during construction to prevent exposure and raise awareness of potential impacts to unknown paleontological resources:

- The City shall retain qualified Geologist or Paleontologist to conduct the pre-construction paleontological resource and/or unique geologic feature portion of the construction worker awareness training; and
- Construction personnel shall be informed of the possibility of such resources within the Project area and the protocol to be followed if a resource is encountered as detailed in MM GEO-3.

Mitigation Measure GEO-2 Implementation

Responsible Party: The City and contractor

Timing: Prior to construction activities and throughout construction activities as new personnel arrive on a proposed Project construction site

Monitoring and Reporting Program: Development of a WEAP presentation and handout packet in accordance with this mitigation measure and any other resource specific WEAP requirements. A sign-in sheet shall be completed for all workers on the construction site and kept on file at the proposed Project construction site, and copies shall be submitted to the City's Project Manager to be kept on file at City offices.

Standards for Success: The prevention of paleontological resources from being disturbed or destroyed by proposed Project construction without proper documentation and recordation.

Mitigation Measure GEO-3: Proper Handling of the Unanticipated Discovery of Paleontological Resources or Unique Geologic Features

If paleontological resources (i.e., fossils) and/or unique geologic features are encountered during construction, compliance with federal regulations (16 USC Chapter 1C sections 470aa through 470aaa-11) and guidelines (Society of Vertebrate Paleontology [SVP] guidelines) regarding the treatment of such resources shall be required. If paleontological resources or unique geologic features are encountered during ground disturbing activities, work within 100 feet of the discovery shall be halted until the City notifies a qualified geologist or paleontologist to evaluate the significance of the find. If the find is determined to be significant, the City shall determine the appropriate avoidance measures or other appropriate mitigation in consultation with a qualified geologist or paleontologist and landowner, such as site salvage. Significant paleontological resources recovered shall be subject to scientific analysis, professional museum curation, and a report prepared by the qualified paleontologist according to current professional standards. The SVP provides guidelines on assessment and mitigation of adverse impacts to paleontological resources.

Mitigation Measure GEO-3 Implementation

Responsible Party: The City and the chosen contractor

Timing: During all ground-disturbing activities

Monitoring and Reporting Program: If any find is determined to be significant, representatives of the City shall document consultation with the qualified geologist or paleontologist and document the determination of recommended protection and avoidance measures or other appropriate mitigation. The City shall prepare a brief memorandum incorporating notes and records from the Contractor and qualified geologist or paleontologist to document steps taken to comply with the avoidance measures or other appropriate mitigation. The memorandum shall be kept on file at the City's offices.

Standards for Success: The evaluation and recording of any newly identified paleontological resources and unique geologic features, and treatment by avoidance, protection, or documentation of any discovered resource that qualify as significant**.**

3.6.6 Abbreviations

amsl	above mean sea level
AP Act	Alquist-Priolo Fault Zoning Act
BMP	best management practice
Caltrans	California Department of Transportation
CBC	California Building Code
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
City	City of Merced
CWA	Clean Water Act
EIR	Environmental Impact Report
g	Percent of acceleration of gravity
General Permit	General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities
IBC	International Building Code
MM	Mitigation Measure
MRZ	Mineral Resource Zone
NEHRP	National Earthquake Hazards Reduction Program
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSHA	Occupational Safety and Health Administration
PRC	Public Resources Code
QSD	Qualified SWPPP Developer
ROW	right-of-way
RWQCB	Regional Water Quality Control Board
SMARA	Surface Mining and Reclamation Act
SR	State Route
SVP	Society of Vertebrate Paleontology
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
UBC	Uniform Building Code
USACE	United States Army Corp Of Engineers
USC	United States Code
USGS	United States Geologic Survey

USDA	United States Department of Agricultural
WEAP	Workers Environmental Awareness Program
WOTUS	Waters of the United States
WWTRF	Wastewater Treatment and Reclamation Facility
2030 General Plan	Merced Vision 2030 General Plan

3.6.7 References

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