4.7 Cultural Resources

4.7 Cultural Resources

Cultural resources include paleontological resources, archaeological resources, historical resources, and human remains. This section provides a program-level assessment of potential WSIP impacts on historical, paleontological, or archaeological resources that might be present in the vicinity of the WSIP projects and/or historic water system facilities. Programmatic mitigation measures to reduce or eliminate potentially significant impacts on these cultural resources are identified in this section and presented in detail in Chapter 6. This analysis does not identify specific cultural resources at each of the 22 WSIP facility project sites, although some previously identified cultural resources are located at or near those project sites. Site-specific analysis will be conducted as part of separate, project-level CEQA review for individual WSIP projects.

4.7.1 Setting and Resource Types

Paleontological Setting

Paleontological resources within the WSIP study area consist of the fossilized remains of plants and animals, including vertebrates (animals with backbones) and invertebrates (e.g., starfish, clams, ammonites, and coral marine). Fossils of microscopic plants and animals, or microfossils, are also considered in this analysis. The age and abundance of fossils depend on the location, topographic setting, and particular geologic formation in which they are found. The geologic formations containing the majority of fossils in the WSIP study area are considered geologically young; the oldest fossil-bearing formation dates to the Paleocene epoch (65 million years old). Most of the fossil-bearing geologic units in the WSIP study area were formed in ancient marine environments such as inland embayments, coastal areas, and extensive inland seas. However, in the eastern portion of the study area, some vertebrate fossils have been found in non-marine formations consisting of sand, gravel, and mudflow deposits.

San Joaquin Region

Paleontological resources in the San Joaquin Region are most prevalent in geologic formations located along the western margin of the San Joaquin Valley. These formations include the marine sandstone, mudstone, siltstone, and shale of the San Pablo Formation (including units of the Neroly Sandstone, Cierbo Sandstone, and Briones Sandstone); various undivided conglomerate, sandstone, and siltstone units (including the Carbona and Oro Loma Formations); and the Moreno Formation. The Moreno Formation, which is present along the western margin of the Great Valley as an elongated and continuous, northwest-trending unit, consists of shale, sandstone, and siltstone that were once deposited in a deep-marine environment. The Moreno Formation contains abundant fossils, including a variety of marine reptiles, fish skeletons, and various marine invertebrates; plant remains such as wood, leaves, and needles; and the remains of dinosaurs (USFWS/CDFG, 2006). Dinosaurs are rarely found in California, but many of the plesiosaurs and mosasaurs found in the state come from the Moreno Formation (USFWS/CDFG, 2006).

The University of California Museum of Paleontology Collections Database lists 81 fossil localities in San Joaquin County; the majority of these sites are along the western boundary of the San Joaquin Valley. Several fossil localities are grouped in the San Pablo and Moreno Formations west of Vernalis near the Tesla Portal of the Hetch Hetchy Aqueduct (UCMP, 2006). These fossils include an extinct horse, mammoth, and boney fish dating to the Pleistocene epoch, about 1.8 million years ago. The Collections Database includes a fossil locality at the Hetch Hetchy Tunnel (Locality No. 3315), which is listed as a discovery site for a prehistoric camel (up to 1.8 million years old). Only a few fossil localities have been identified in the younger alluvial deposits throughout the central portion of the San Joaquin Valley. Fossil localities appear again on the east side of the San Joaquin Valley near Oakdale, where the Hetch Hetchy Aqueduct extends through the Mehrton Formation, a non-marine formation ranging in age from 24 to 5 million years old (Miocene). Fossils found at sites in the Mehrten Formation near Oakdale include early (Miocene age) turtles, tortoises, kangaroo rats, single-hoofed horses, and mammoths.

Sunol Valley and Bay Division Regions

Many fossil localities in the Sunol Valley and Bay Division Regions occur in marine and non-marine deposits ranging in age from 10,000 to 5.3 million years old.[1] These geologic formations include non-marine sediments of the Santa Clara Formation, Livermore Gravels, and Irvington Gravels. Marine fossil-bearing geologic deposits include the Cierbo Sandstone found in the San Pablo, Monterey, Santa Margarita, and Panoche Formations, and in the older (55 to 34 million years old) Domengine Formation. The majority of the fossils found in the Sunol Valley and Bay Division Regions are vertebrate fossils, including extinct bison, camels, boney fish, mammoths, and horses, although some localities contain marine invertebrate fossils such as bivalves (clams). A fossil of a mastodon from the Pleistocene epoch was discovered in Sunol (Locality No. 6535), while an unidentified vertebrate fossil was discovered in the vicinity of Calaveras Dam (Locality No. 3937) (UCMP, 2006).

The distribution of fossil localities and the location of corresponding geologic units indicate that most of the paleontological resources in the Sunol Valley Region are east and south of Interstate 680 in the upland foothills of the Diablo Range. Fossil localities diminish west of Interstate 680, towards the Santa Clara Valley and the central portion of the Bay Division Region, because the Santa Clara Valley and the south San Francisco Bay margin is underlain by much younger alluvial and basin deposits that do not contain abundant fossil remains. There are 280 fossil localities in Alameda County, but only 36 in Santa Clara County (UCMP, 2006). Some of the fossil localities in Santa Clara County contain vertebrate fossils, including a bison and another mammal that appears to be an ancient descendant of an elephant or sea cow.

1 The age range of these deposits is referred to as the Plio-Pleistocene, which is the period of time that spans the Pliocene epoch (5.3 to 1.8 million years ago) and the Pleistocene epoch (1.8 million to 10,000 years ago).

Peninsula and San Francisco Regions

There are few fossil localities in the Peninsula and San Francisco Regions. Most fossils are found along the Pacific Coast in the younger (Pliocene, 5.3 to 1.8 million years ago) marine units, such as the Purisima Formation, Monterey Formation, Butano Formation, Colma Formation, and Merced Formation, and in locations within the outcropping marine units in the Santa Cruz Mountains, west of the WSIP regions. Fossils found along the coast include vertebrates (e.g., extinct camels, horses, and sea mammals) and invertebrates (e.g., clams and corals). Fossil localities diminish along the eastern flank of the Santa Cruz Mountains, likely due to the presence of chaotically mixed and severely fractured Franciscan Complex bedrock and geologically younger alluvial deposits in the upland foothills.[2] No fossil localities were identified in the Crystal Springs Reservoir or San Andreas Reservoir areas. The lack of fossil localities is partly due to the Franciscan Complex bedrock surrounding the reservoirs and the degree of fracturing in this bedrock unit caused by the San Andreas Rift Zone. The closest fossil locality south of the WSIP study area is an extinct sea mammal, an ancestor of the sea lion (UCMP, 2006). To the north, the closest fossil locality to the study area is an extinct horse from the Pleistocene epoch (1.8 million to 10,000 years ago).

Archaeological / Prehistoric-Period Setting

Both prehistoric and historic resources are considered archaeological resources. This discussion of prehistoric archaeology addresses cultural patterns in the WSIP study area through the time of European contact. Historic archaeological resources, starting with the Mission era, are discussed below under “Historic-Period Setting.”

Numerous prehistoric archaeological sites have been identified in a variety of environments within the WSIP study area. In many cases, these sites are buried by alluvial deposits at or near former or existing wetland boundaries, along seasonal and perennial watercourses and other sources of fresh water such as springs, at the base of foothills, or at or near vegetation ecotones (i.e., a region between two neighboring but dissimilar plant communities). Many of the sites are deposits of stone tools, while others are large habitation sites that represent years of layered subsurface material or residues that chronicle the behavior of the inhabitants.

Efforts to reconstruct the prehistoric period into broad cultural stages (e.g., the Windmiller, Berkeley, and Augustine Patterns, as discussed below) allow researchers to describe a wide variety of sites with similar cultural patterns during a given period of time, thereby creating a regional chronology. In some cases, regional patterns in material culture are reflected in areas that are broader than the WSIP regions. For example, the greater San Francisco Bay Area is often discussed as a single region in terms of archaeological sequences (Moratto, 1984). As a result, a broad discussion of the region that encompasses the Bay Area would include the Bay Division, Peninsula, and San Francisco Regions, in addition to elements of the Sunol Valley Region,

2 Fossils are rarely found in the Franciscan Complex bedrock of the Coast Range Province; any fossil remains originally present in the rock would not likely remain because the Franciscan Complex in this area is a chaotically mixed and fragmented mass of rock in a sheared matrix.

although some Central Valley regional patterns can be associated with the Sunol Valley and inland Alameda County in general.

San Joaquin Region

Although the Sacramento and San Joaquin Valleys were likely inhabited by humans as early as 10,000 years ago, any evidence of this time period is buried by alluvial deposits that have accumulated during the last several thousand years. Later periods are better understood because there is more representation in the archaeological record. Central California archaeology has been described as a series of patterns. Fredrickson (1973) defines these patterns as general modes of living shared by people within a given geographic region. Three such patterns, which overlap somewhat in adjoining areas, are recognized for central California: the Windmiller, Berkeley, and Augustine Patterns.

The Windmiller Pattern, which may represent the advent of early Penutian-speaking populations, extends from about 4,500 to 3,000 years ago. This pattern primarily encompasses the lower Central Valley and Delta regions and reflects the influence of a lacustrine or marsh adaptation (i.e., adaptation to settlement near lakes and marshes). This pattern may have pre-adapted the Windmiller people to the environment of the lower Sacramento–San Joaquin Valley and Delta; it is possible that these people entered the region with this adaptation more or less fully developed.

The Berkeley Pattern extends roughly from 3,000 to 1,500 years ago and became more widespread, or at least more archaeologically visible, than the previous pattern. The Berkeley Pattern places a greater emphasis on the exploitation of the acorn as a staple. The Berkeley Pattern may represent the spread of proto-Miwok and Costanoans, collectively known as Utians, from their hypothesized lower Sacramento Valley/Delta homeland.

The last complex in this sequence, the Augustine Pattern, extended from about 1,500 years ago to the time of European contact. The Augustine Pattern initially appears to be an outgrowth of the Berkeley Pattern, but may have become a blend of Berkeley traits with those carried into California during the migration of Wintuan populations from the north (Moratto, 1984).

Sunol Valley Region

The Sunol Valley Region was a favorable setting for prehistoric and early settlement. The diverse habitats and numerous creeks within Alameda watershed lands and surrounding areas support an abundance of animal and plant resources that would have encouraged permanent and seasonal habitation. There is evidence of settlement in this region from about 2,300 years ago, with numerous documented sites, including sites in Pleasanton and the Sunol Regional Wilderness. The Sunol Regional Wilderness Area Site (CA-Ala-428H) consists of a midden (i.e., refuse) deposit and associated bedrock mortars. Site occupation is dated from approximately 2,349 to 276 years ago (343 BC to AD 1730) (Leventhal et al., 1989; as cited in Chavez, 1994).

When Europeans first came to the general area, in about 1769, the land was inhabited by the Ohlone people (also known as the Costanoans). The tribe controlled the present-day East Bay, from Richmond to San Jose, and the Livermore Valley to the east. It is estimated that approximately 2,000 people inhabited this area at the time of European contact. Near the Alameda watershed lands, villages would have been situated adjacent to major and minor creeks and the prehistoric marsh located in the Pleasanton area, with both permanent villages and temporary camps for seasonal resources. Within the Alameda watershed lands, at least one prehistoric village, El Molino, located near the present-day Sunol Water Temple, is known to have existed (San Francisco Planning Department, 2000a).

Bay Division Region

Toward the end of the Pleistocene epoch (2 million to 10,000 years ago), the present-day San Francisco Bay region and central California coast experienced gradual shifts in coastal environmental conditions as sea levels rose in response to a general warming trend in climate (Fagan, 2003). Slowly, as human settlements began coping with the changing climate and landscape, the marshland biotic communities[3] along the edges of bays and channels, in contrast to earlier vegetal food sources, became the principal source for subsistence in the bay region.

Many of the original surveys of archaeological sites in the San Francisco Bay region, including the East Bay, were conducted between 1906 and 1908; these surveys yielded the initial documentation of nearly 425 “earth mounds and shell heaps” along the bay shoreline (Nelson, 1909). The most notable of these sites were excavated, such as the Emeryville shellmound (CA-Ala-309), the Ellis Landing site (CA-CCo-295) in Richmond, the Fernandez site (CA-CCo-259) in Rodeo Valley, and the West Berkeley site (CA-Ala-307) (Morrato, 1984). These dense midden sites, such as CA-Ala-309, have been carbon-14 dated to be 2,310 (±220 years) old, but other evidence from around the bay suggests that human occupation in the region dates back farther, to about 7,000 years ago (Davis and Treganza, 1959). Many of the earliest sites suggest less emphasis on shellfish than on hunting and vegetal food processing. These sites provide the basis for understanding cultural chronologies and evolution in the Bay Area.

Another site of equal importance, the West Berkeley site (CA-Ala-307)—occupied from 4,000 to 1,700 years ago (2000 BC to AD 300)—reflected a change in socioeconomic and technological complexity and settlement patterns from the Windmiller Central Valley influence to the more uniquely local Berkeley Pattern (Wallace and Lathrap, 1975; Fredrickson, 1973). This artifact pattern is characterized by minimally shaped cobble mortar and pestle, dart and atlatl,[4] and bone industry. Given the size of these settlements, it is probable that the populations were denser and more sedentary yet continued to exploit a diverse resource base, from woodland, grassland, and marshland to bay-shore resources throughout the San Francisco Bay region (Bickel, 1978; King, 1974).

While the bay shellmounds tend to dominate East Bay archaeology, a number of important sites have been investigated in the interior valleys of Alameda County. For example, the Santa Rita Village site (CA-Ala-413) in Pleasanton yielded numerous artifacts, burials, and plant and animal

3 A large ecosystem that supports a particular assemblage of plants and animals.
4 An Aztec term for spear thrower; a wooden device with a handle at one end and a hook or spur at the other that fits to the end of a dart or projectile.

remains. The site contains two stratigraphic components indicating occupation from 2,400 to 2,000 years ago (400 BC to AD 100); the later component revealed evidence of technological influence derived from the Delta region (Chavez, 1994).

Peninsula Region

The Peninsula Region was intensively occupied during prehistoric times due to the variety and proximity of resources from San Francisco Bay, the interior foothills and valleys, and the Pacific Ocean as well as the relatively easy access to these areas. Creeks and springs in the area also provided drinking water and riparian resources. Evidence indicates that the area was inhabited as early as 5,400 years ago and was likely associated with a pre-Ohlone/Costanoan, and possibly Esselen, population. Archaeological sites are documented in coastal areas west of this region as well as along the bay in areas east of this region.

San Francisquito Creek, which flows through Palo Alto, represents one of the most densely occupied watersheds along the San Francisco Peninsula. Two or more Ohlone tribelets may have occupied this watershed and would have relied on a variety of local resources, from mammals to shellfish (Bocek, 1992). Of the approximate 170 site locations discovered on the southern peninsula, about 75 percent are located within 100 meters of a creek or former creek bed (Bocek, 1992). Given the attractiveness of the riparian corridor along San Francisquito Creek to prehistoric inhabitants, areas along this corridor—even in currently urbanized settings—are more likely to yield both known and previously unidentified historic resources or unique archaeological resources. The sites contain extensive artifacts, cultural materials, and evidence of human burials (which is considered a rare finding in San Mateo County) and may be of cultural importance to the local Native American community. There is a potential for additional prehistoric cultural resources to exist within this region, including areas submerged by the reservoirs (San Francisco Planning Department, 2001).

San Francisco Region

Many areas of what is now San Francisco presented favorable conditions for the settlement of Native Americans. Previous archaeological research in San Francisco suggests that prehistoric resources may be encountered in remarkably diverse conditions. Sites have been found along beachfront as well as inland areas of the city. Only a small percentage of the total prehistoric sites in San Francisco have been systematically recorded. It is probable that many sites were covered rather than destroyed. Recent archaeological work reveals that numerous, relatively intact prehistoric deposits throughout San Francisco appear to have been buried beneath the region’s sand dunes long before the beginning of the historic era. These sites are generally buried deep enough below the present ground surface to have avoided being disturbed by development. (This information is summarized from the *San Francisco Draft Water Recycling Master Plan Cultural Resources Evaluation 92.371E,* January 13, 1993.)

Historic-Period Setting

For the purpose of this analysis, the historic period begins with the Mission era and extends through the Gold Rush for each region. The historical setting of each region is described below. The historical context of the water system (from 1856 to the present) is described after these regional descriptions of earlier history.

The sections below are organized into the various geographic regions that are addressed in this PEIR. The regions are presented geographically from east to west in the order they are physically crossed by the Hetch Hetchy pipelines. Chronologically, however, European settlement and development in these regions generally occurred in the opposite order, beginning around the San Francisco Bay and spreading eastward toward the Sierra Nevada.

San Joaquin Region

Native American groups known as the Yokuts and Miwoks originally inhabited the San Joaquin Region. Many individual tribes within the larger Yokut and Miwok groups were scattered throughout the region, living primarily near rivers and creeks. It was not until the late 1770s that European influence made its way inland to the San Joaquin Valley. The first European party to visit the area was a Spanish military expedition lead by Jose Joaquin Moraga in 1776. The party followed the San Joaquin River into Stanislaus County and the vicinity of present-day Modesto. A second expedition, lead by Moraga's son Gabriel in 1806, made a foray into the area and traveled as far east as the location of Knight's Ferry. Gabriel Moraga led another expedition into the area in 1810.

As Spanish missions began to be established, primarily in the coastal regions of California, the Yokuts of the inland San Joaquin Valley were relocated to the nearest missions, including Mission San Jose, Mission San Francisco, and San Juan Bautista. These missions undertook efforts to convert the local Native Americans to Catholicism and a European style of farming and labor. Many Native Americans were the victims of diseases brought by the Spanish, including those who managed to remain outside the mission system. The land that had previously been inhabited by the Yokuts and Miwoks was thus left in the hands of the Catholic Church, which owned vast tracts throughout California at the height of the Mission era.

With secularization, the lands in the San Joaquin Region were divided into privately owned ranchos, initially consisting of the Rancheria del Rio Estanislao, Rancho El Pescadero, Rancho del Puerto, Rancho Orestimba, and Thompson's Rancho. These huge ranchos were later sold and resold in increasingly smaller parcels as people flocked to the region to mine gold in the mid-1800s, and later turned to farming once the Gold Rush had ended (Tatam, 1994).

Sunol Valley Region

In 1797, Spanish Franciscan missionaries established Mission San Jose in present-day Fremont. Native Americans, primarily of the Ohlone tribe, were brought to the mission, converted to Catholicism, and taught to farm. With the 1836 Secularization Act, many of the Native Americans left Mission San Jose and settled on a rancheria know as Alisal, near Castlewood. This site is still owned by the City and County of San Francisco (CCSF). Elsewhere, Mexican and European settlers filed land grants, and vast ranchos became established throughout the region. Rather than selling land near the mission to private parties after secularization, the Catholic Church held the land in stewardship for the missionized Native Americans, hoping they would continue the mission way of life. However, this land tended to attract squatters—particularly those journeying west from the United States—because of its uncertain ownership and the lack of recognition of the Indians' claim to the land. Despite their mission training, the Indians were not prepared for the responsibility of land ownership and often lost their holdings to these squatters through gambling and other fraud.

The population of the Sunol Valley Region grew once California was admitted to the United States, in 1848, and as the Gold Rush brought prospectors west during this period. Those who did not find their fortune often settled as farmers in rural areas of California, many of them close to the community that had developed around the former Mission San Jose. The squatters farmed and established businesses and settlements on the land. Mexican land grants were often disputed, and most of the rancho properties in the area were sold and redistributed to new settlers, both Anglo-American as well as Mexican landholders, who managed to retain portions of their original holdings. In 1858, the United States government returned the mission buildings and a small portion of adjacent land to the Catholic Church (Krell, 1979). Shortly thereafter, around 1867, the squatters obtained official title to the land on which they were living.

By the late 1800s, the prosperity of the area was further stimulated by the arrival of the Western Pacific and South Pacific Coast Railroads, which led to the establishment of towns and influenced the growth of many settlements. The railroads provided for easy transport of people and goods to the Sunol Valley and Niles Canyon from San Jose and other areas south of the bay. Because the area was such a large agricultural producer, railroads were critical to the transportation of produce from farms to consumers in the more metropolitan Bay Area cities. Grain and vegetables were the dominant crops in the area, but were replaced by vineyards and orchards later in the 19th century. This shift in agricultural trends met with opposition when blight and prohibition decreased both the productivity and demand for vineyard crops. Drought was also a problem in the early 20th century, and the Depression later limited the sale of crops. However, the existence of natural hot springs in the area attracted recreational travel to the region, and the area continued to gain popularity for vacationing and seasonal living until the years of World War II. The Sunol Valley continued on its agricultural path and experienced prosperity because of the significant demand on production created by the war. During the post-war decade, an increasing number of people permanently settled in the Fremont and Sunol areas because of housing shortages throughout the Bay Area, leading to a population boom that continues today.

Bay Division and Peninsula Regions

The areas referred to in the PEIR as the Peninsula Region, located south of San Francisco, and the Bay Division Region, located at the southern end of San Francisco Bay, were once inhabited by the Ohlone/Coastanoan people. Today the area comprises San Mateo and Santa Clara Counties and a portion of Alameda County. In 1776, Spanish missionaries established the Mission Santa Clara de Asis at the southern end of the bay along Guadalupe Creek, and a settlement of colonists from Mexico soon followed. The mission settlement and the colonists' pueblo grew into the neighboring cities of Santa Clara and San Jose. In 1793, an outpost of Mission Dolores in San Francisco was established in the area of present-day San Mateo, which allowed the Spanish missionaries to maintain better contact with the Native American converts of the region and oversee their herding and food-producing activities. The majority of the Native Americans in the region became converts at the mission and were subjects of the Catholic Church until secularization in 1836. At that time, the mission passed from the church's possession and, in 1851, the mission site was gifted to the Jesuit order for the establishment of a university, which is today Santa Clara University.

With secularization, the Mexican government seized former mission lands and divided the Peninsula Region into a number of large ranchos, including Rancho San Mateo, granted in 1846 to Cayetano Arenas, and Rancho de las Pulgas, granted in 1835 to Luis Antonio Arguello, a former governor of Alta California. Other lands in the Bay Division Region were granted to private owners, and many ranchos were established throughout the region.

The construction of railroads stimulated growth and development in the Bay Division and Peninsula Regions by connecting these areas to distant agricultural markets. The industries of agriculture, viticulture, lumber, and even oil drilling supported the economic growth of these regions in the latter half of the 19th century and the early 20th century. As in other areas, a building boom in the 1920s was followed by the Depression; however, the high demand for various products during the years of World War II led to another economic resurgence. These products included ships, many of which were produced in the ports at the southern end of San Francisco Bay.

San Francisco Region

The following information is summarized from the *San Francisco Draft Water Recycling Master Plan Cultural Resources Evaluation 92.371E,* January 13, 1993, unless otherwise noted.

The Spanish first explored Northern California during the latter part of the 18th century. The Spanish began colonizing California as early as the 1760s. It is estimated that, at the time of European contact, between 7,000 and 10,000 Native Americans inhabited the coastal area between Point Sur, in Monterey County, and San Francisco Bay. Native American shellmounds once dotted the shoreline of the bay. According to site records on file at the Northwest Information Center, Sonoma State University, about 35 prehistoric sites have been officially recorded within San Francisco; about one-third of these were found in the Hunters Point–Islais Creek area. Prehistoric sites have also been found in the South of Market/Civic Center area, and in and around Fort Mason and the Marina District (Archeo-Tec, 1995). These sites consist mostly of a variety of shellmounds, but some of the sites on the east side have included prehistoric human remains (burial sites) and midden deposits. Like the Bay Division and Peninsula Regions (see above), the San Francisco Region was inhabited by Native Americans of the Ohlone/Costanoan tribe.

As Spanish missions were established, primarily in the coastal regions of California, the Native Americans were relocated to the nearest missions. In 1776, Mission Dolores (also known as Mission San Francisco de Asis) was founded along with the Presidio, in present-day San Francisco. At the missions, Native Americans were converted to Catholicism and introduced to a European style of farming and labor, which were much different from their own hunting and gathering practices. However, Mission Dolores had a difficult time retaining its converts.

The 1836 Secularization Act, enacted by the presiding Mexican government, disbanded the mission system, granted church lands to private citizens, and allowed Native Americans to leave the missions and establish their own settlements. Now familiar with the areas around the missions, many Native Americans presumably stayed in those areas and did not return to their original lands. The influence of Mission Dolores declined rapidly after the land was granted to Jose Galinda in 1835; he established the Rancho Laguna de Merced, which was purchased by Francisco de Haro in 1837. During the 1830s, the pueblo of Yerba Buena Cove developed on the original waterfront of what is now downtown San Francisco. DeHaro became the first *alcalde*, or mayor, of Yerba Buena in 1834 and served in that post again from 1838 to 1839 (Alexander and Heig, 2002).

In 1846, the United States Navy sailed into San Francisco Bay and took control of the pueblo of Yerba Buena, which was renamed San Francisco in 1847. California became part of the United States by conquest and treaty in 1848 and was admitted to the Union as a state in 1850. The Gold Rush brought hundreds of thousands of prospectors and other settlers from around the world to California during this period. During this time, the area surrounding the mission became a venue for gambling and taverns due to its distance from the pueblo. With the influx of gold miners after 1848, the city of San Francisco soon expanded to surround the mission and dominate the tip of the peninsula.

The population in San Francisco rose drastically in the years leading up to the Gold Rush. The small population of 500 in 1847 rose to 1,000 by early 1848 and doubled again by early 1849. In that year alone, the population soared to 20,000. The physical city grew quickly in response to this population explosion, and heavy demands were placed on its infrastructure. At least six major fires destroyed much of the city in the years immediately after the Gold Rush; these devastating fires—along with the general needs of such a rapidly growing population—served as an early indication of San Francisco's need for a reliable water supply.

San Francisco's population was as high as 50,000 in 1850 and, at the time of the 1906 earthquake, had reached 375,000. The earthquake became a major factor in reshaping San Francisco's future growth and unleashing an era of progressive municipal politics. Not only did the earthquake spark fires that decimated much of the city, it also broke the existing water delivery systems that may have made controlling the fires possible. Failure of the city's private water system gave impetus to the drive for a municipal water supply that would be drawn from distant Hetch Hetchy in Yosemite National Park.

San Francisco's downtown was largely rebuilt within three years of the disaster, and the city as a whole recovered within the following decade. The city's hosting of the 1915 Panama Pacific

International Exposition prompted further development on a grand scale leading up to the event. Though the earthquake and fire were devastating, they allowed the city a fresh start and an opportunity to grow beyond its previous size and complexity. By the time of the Exposition, the population of the city was approximately 500,000 people (Richards, 1997).

History of the SFPUC Regional Water System

The Need for a Water System

The transformation of San Francisco's water system from a local, private concern, to a regional private water company, to a municipally owned and operated system was part of a national trend that began before the Civil War on the east coast, and in major Midwestern and California cities in the later decades of the 19th century and early decades of the 20th century. For San Francisco, the resulting history can be seen as two major historical contexts that intersect: the history of the plans and developments of the Spring Valley Water Company; and later, the push for municipal control and development of the Hetch Hetchy system.[5]

The development of San Francisco's municipal water system in the history of urban water development has themes in common with many other major urban areas that made the same transformation:

- Gradual development of more distant and purer supplies, typically through systems relying on gravity for delivery
- Development of specific water supply and delivery plans, by both private and public entities, to assure supplies would continue to meet growing demand
- Transformation of private water companies into public entities
- Interrelationship of science, engineering, and political reform, and the role of trained engineers in developing water systems
- Transformation of municipal or other government agencies' ability to finance public works projects

Cities around the nation have, since the early decades of the 19th century, sought to improve their water supply systems, both in quality and quantity. Most rapidly growing cities soon found they were faced with a double—and related—dilemma: handling the vast amounts of waste produced in cities without sanitary sewer systems; and assuring their citizens ample supplies of water. The production of sewage and other waste had a direct impact on local supplies, because city wells and local streams flowing through urban areas were often fouled by animal waste, garbage, local privy pits, cesspools, and sewage vaults. While the direct connection between unsanitary waste handling and disease was not scientifically understood until late in the 19th century, the

[5] The entire San Francisco water system is sometimes referred to in the press or other general publications as the Hetch Hetchy system. This usage is historically inaccurate and, in this chapter, references to and discussion of the "Hetch Hetchy system" or "Hetch Hetchy Project" refer specifically to the portion of San Francisco's water system directly related to the city's municipal development of delivering water from the Hetch Hetchy Valley to San Francisco that occurred in the 20th century.

relationship between pollution and disease, and the need for purer water, was generally recognized if not accurately attributed.

New York City was among the first to build a system to bring water to the city from an outside watershed. In 1842, it completed the Croton Project to supply additional water from the Croton River in Westchester County to the growing city. Water flowed into the city through what is now known as the Old Croton Aqueduct. Boston followed soon thereafter with its Long Pond / Lake Cochituate system, completed in October 1848.[6] In both instances, specific plans provided for local supplies to be replaced or augmented by water from more distant sources that were of higher quality, and in both cases private companies were replaced by city-owned systems. Historian Letty Anderson's study of New England systems also pointed out that the use of gravity to deliver water was a consistent goal of engineers establishing such systems, because it provided a constant flow at regular pressures, avoided the need to buy costly pumping equipment, and did not incur substantial and continuing operation and maintenance costs.[7]

Anderson's examination of urban water supplies also showed that in 1800, only 6.3 percent of water utilities in the United States were publicly owned. By 1850, that percentage had grown to 39.7 percent, and by 1897 reached 53.2 percent. Of course, the number of water utilities of all kinds had also grown, from only 16 in 1800, to 83 in 1850, to 3,196 in 1897.[8] In most California cities, the conversion of private water systems to public entities occurred later, often in the 20th century.

Nelson Blake, in his seminal history of urban water systems entitled *Water for the Cities* (1956), noted that by 1860, of the nation's 16 largest cities, 12 had municipal systems; only San Francisco, New Orleans, Buffalo, and Providence had privately owned systems. Private systems were characteristically located in smaller cities and towns; of the 136 water works in existence in 1860, noted Blake, 58 percent were privately owned. Water consumption on a per-capita basis was also increasing during this period, in large part due to the introduction of water closets, showers, and bathtubs connected to indoor plumbing. While such arrangements were not common in the last decades of the 19th century, their introduction over the decades had a profound effect. Blake reported that by the years just before World War II, per-capita use in major European cities averaged around 39 gallons a day; in the United States the rate was 155 gallons a day.[9]

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6 The story of the Old Croton System is described on the New York Department of Environmental Protection's website, http://www.ci.nyc.ny.us/html/dep/html/history.html, accessed April 21, 2007. Other sources on the development of the New York system include Nelson Blake's *Water for the Cities: A History of the Urban Water Supply Problem in the United States* (Syracuse University Press, 1956). The history of Boston's fight for pure water, and the themes and factors leading to development of its system, is explored in Michael Rawson, "The Nature of Water: Reform and the Antebellum Crusade for Municipal Water in Boston." *Environmental History*, 2004, 9(3): 411-435.

7 Letty Anderson, "Hard Choices: Supplying Water to New England Towns." *Journal of Interdisciplinary History*, xv:2 (Autumn, 1984), 211-234. Anderson focused on New England's experience, but placed it in a national context.

8 Anderson, "Hard Choices." *Journal of Interdisciplinary History*, 1984, 211-234.

9 Nelson M. Blake, *Water for the Cities: A History of the Urban Water Supply Problem in the United States*. (Syracuse University Press, 1956); see 267.

Blake also summarized the development of major urban systems in New York, Boston, Philadelphia, and Baltimore. Each followed the paradigm of an original private local system being integrated into a much larger set of public facilities, sequentially planned and constructed to meet demand, and that brought water to the urban area from distant supplies.

In New York, after completion of the Croton Aqueduct, the city quickly faced increased water use and a concomitant growth in demand that led to acquisition of additional sources of supply. It designed the Second Croton Aqueduct, completed in 1893, which brought water from 31 miles away through a system of tunnels. As New York expanded its boundaries to include Brooklyn, Queens, Richmond, and additional portions of the Bronx, it required new sources of supply to meet demand. In 1905, after an attempt to incorporate a private company's system, the city—with the approval of the state legislature—established the Board of Water Supply, which had "broad powers to plan and build new reservoirs and aqueducts." It was this board that planned and built the Catskill Aqueduct between 1907 and 1917, which brought water from Ashokan Reservoir in the Catskills 120 miles to the city. Some of the construction involved substantial engineering skills. "Picturesque arched bridges across rivers and valleys were now a thing of the past," Blake observed. "Instead, the aqueduct was carried through pressure tunnels bored deep in the solid rock. Thus the water was conveyed under the Hudson River near Storm King Mountain by the Roundout Siphon, 1,114 feet below sea level. The main artery of the city distributing system was a pressure tunnel from 200 to 750 feet below the street level." This system was again enlarged in 1927, and from 1921 through 1964 the Board of Water Supply planned and constructed a system to tap the Delaware River.[10]

Boston's system underwent a similar transformation. By 1869, it had become clear that the Cochituate system was inadequate, so the city added a 17-mile-long aqueduct to provide water from reservoirs on the Sudbury River. As the city annexed small towns on its periphery, the need for additional water grew, leading the city and state to organize the Metropolitan Water District. This body arranged for the construction of Wachusett Reservoir and Aqueduct, which fed the Sudbury system, in 1906. By 1922, the district recommended adding a connection to the Ware and Swift Rivers, requiring the construction of Quabbin Aqueduct and a later aqueduct to tap the two rivers. Later, the district built Quabbin Reservoir, which, Blake noted, was "designed to impound the entire flow from a watershed of 186 square miles," and nearly tripled the district's safe yield. The new works also allowed for the old Cochituate system to be retired in 1931, because development in its watershed had the potential to compromise its purity. Similarly, during the last decades of the 19th century, and well into the 20th century, both Baltimore and Philadelphia made similar improvements to their water supplies. In both cases the cities tapped distant supplies, building large storage dams and aqueducts to deliver the stored water. These series of projects were also developed through a set of specific plans. Both cities' systems utilized pressure tunnels; for example, Philadelphia's diversion of the Delaware River used a gravity-fed pressure tunnel some 80 miles long.[11]

[10] Blake, *Water for the Cities*, 280-285; http://www.ci.nyc.ny.us/html/dep/html/history.html, accessed April 21, 2007.
[11] Blake, *Water for the Cities*, 272-276.

Analogues to these urban systems existed in California. For example, Los Angeles' private water company had appeared to reach its capacity in the last decade of the 19th century, and its superintendent, William Mulholland, with local businessmen, turned to the Owens Valley to tap the river for the city's use. The story of Los Angeles' acquisition of water rights and water, and construction of the Los Angeles Aqueduct, is an oft-told tale and will not be recounted here in detail.[12] By 1903, the city acquired the existing local private water company. Like New York, Boston, Baltimore, and Philadelphia, and at much the same time, Los Angeles acquired its enhanced supply from a distant watershed, and brought water through an aqueduct fed by gravity to its terminal reservoir. Moreover, after its initial completion in 1913, the city's Department of Water and Power later made extensions to enhance its supply by designing separate projects, like the Mono Basin extension, to bring more water to the system. In addition, in 1928, the southern California region, including Los Angeles, formed the Metropolitan Water District. Its aim was to tap another distant source, the Colorado River, and transport the water 242 miles through an aqueduct to Lake Matthews, its terminal reservoir. The Colorado River Aqueduct was completed in 1941.[13]

The cities of the East Bay also sought a larger supply of better quality water after the turn of the 20th century. By 1910, the small reservoirs were seen as insufficient to keep up with demand, and by 1915 it had become apparent to the area's citizens that new sources of water were needed. Dissatisfaction with private water companies, particularly the East Bay Water Company, was led by the Progressives in the East Bay, who focused their anger on private utilities as inefficient and often the sources of graft and corruption of local officials. This led at first to the passage of the Municipal Water District Act of 1911, followed by the Public Utilities Act, which put private utilities under the jurisdiction of the California Railroad Commission (later the Public Utilities Commission). It also led to a movement in the East Bay to establish a municipal utility district, a special district provided for by the Municipal Utility District Act in 1921. The act provided for districts that could straddle county lines and include incorporated cities and unincorporated areas; importantly, they could also issue revenue bonds to fund construction and development. The district was seen as a victory for regionalism over parochial local development that would allow for more efficient and comprehensive development. The East Bay Municipal Utility District was the first such district formed under the act, through an election in May 1923.[14]

Upon formation, the district immediately hired staff and engineers, including Arthur P. Davis (who had for many years been an engineer for the U.S. Bureau of Reclamation) as chief engineer, and established an advisory consultant team of George W. Goethals (chief engineer of the

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12 There are a large number of books and articles written on the subject of Los Angeles's acquisition of water in the Owens Valley. William Karhl's *Water and Power* is one of the best known; it is also described in Norris Hundley's *The Great Thirst*.

13 Blake, *Water for the Cities*, 285-287; Remi Nadeau, "The Water War." *American Heritage*, 1961, 13(1), 30-35, 103-107; William L. Kahrl, "The Politics of California Water: Owens Valley and the Los Angeles Aqueduct, 1900-1927." *California Historical Quarterly*, 1976, 55(1): 2-25.

14 Susan S. Elkind, *Bay Cities and Water Politics: The Battle for Resources in Boston and Oakland* (Lawrence, Kansas: University Press of Kansas, 1998); East Bay Municipal Utility District, *The Story of Water: A Brief History of the East Bay Municipal Utility District* (EBMUD, 1931?), 1-7; John H. Plumb, "Summary of the History of Municipal Utility Districts in California and of the Municipal Utility District Act," November 13, 1974. MS, WRCA, G4084/K4-4.

Panama Canal) and William Mulholland of Los Angeles. The district initially considered asking to join with San Francisco in its Hetch Hetchy Project, but soon decided to seek an independent supply. After considering a number of sources, the district settled on the Mokelumne River, and over the next years planned a system that stored water behind Pardee Dam and delivered it to the district through 93 miles of pipe and tunnels. The district noted, "by taking the water out through the tunnel 170 feet above the bottom of the dam it is possible to operate the pipe line to its entire capacity by gravity as far as Walnut Creek and even to carry over forty million gallons a day by gravity all the way into the District." The district described its aqueduct as "one of the great pipe lines of the world," which began deliveries in June 1929. Water flowing through the system replenished the nearly-empty reservoirs built by the original private water company that had been acquired by the district.[15]

The ability to fund such systems with municipal bonds was a key to their development. In the years following the massive bank failures associated with the Panic of 1873, the majority of municipalities around the nation could not go into debt to pay for municipal systems, and thus relied on private capital and private enterprise to build enlarged systems, usually under an exclusive franchise. Historian Anderson noted, "a city typically had two major problems with a private water company: rates and service." Rates were often well above those charged in municipally owned systems, and private companies often concentrated on profitable areas in their service area to the exclusion of poor or outlying areas.[16] Mechanisms such as the Municipal Water District Act or the Municipal Utility District Act, or other bonding provisions created by changes to other state laws, allowed for cities to take on debt to build their own systems.

Interestingly, these themes worked their way down to smaller cities and towns during the early decades of the 20th century; many underwent similar transformations from private to public ownership, and set about acquiring water from more distant sources. In addition, technological advances made by engineers working in the larger cities, such as in pumps, pipes, engineering, purification systems, and so on, worked their way down to the smaller cities and towns.[17] An example of this process within the Bay Area can be found in the story of the Marin Municipal Water District. Areas within Marin County had been served since the 1870s by private water companies such as the Marin Water Company (later called the Marin Water and Power Company), North Coast Water Company, and other, smaller enterprises. These companies built a number of reservoirs, large and small, to serve their customers, and added reservoirs as demand grew. However, by the first decades of the 20th century, poor service led to public acquisition of the systems by Marin Municipal Water District, formation of which was made possible by the passage of the Municipal Water District Act of 1911. This act, made during a period of Progressive reform in the state, allowed for the formation of municipal water districts. Between 1914 and 1918, the new district acquired the private companies within its boundaries. Soon

15 Elkind, *Bay Cities and Water Politics*, 120-133; East Bay Municipal Utility District, *The Story of Water*, 1-7, 12; Plumb, "Summary of the History of Municipal Utility Districts."
16 Anderson, "Hard Choices." *Journal of Interdisciplinary History*, 1984, 218-221.
17 Anderson, "Hard Choices." *Journal of Interdisciplinary History*, 1984, 212.

thereafter it began improving the acquired systems and planning for new construction to meet growing demand.[18]

An important related factor in the construction of major systems, whether public or private, was the role of professional engineers in their planning, construction, and development, and the fact that many of the most prominent and influential engineers worked on projects around the nation. Particularly after the last decades of the 19th century, trained and experienced engineers not only brought technical skills to their work, but also an ethos of disinterested neutrality and rationalism. Historians Stanley K. Schultz and Clay McShane noted that city engineers "contributed to the rationalization of fiscal techniques," and labeled themselves "neutral experts" who "professed to work above the din of local politics. Usually they tried to isolate themselves from partisan wrangles, and often succeeded." More than that, they were often typified by long tenure of position and were praised as "models of efficient bureaucrats." They were also prone to employing consultants, experts who moved around the country working on major projects. Schuyltz and McShane stated:

> As an emerging 'strategic elite,' in sociologist Suzanne Keller's telling phrase, engineers secured job tenure through professionalization. At a time when few if any clearinghouses for the exchange of ideas and practices benefited cities nationwide, the engineers built up a remarkable communications network among themselves. Their common training, whether in the relatively few engineering schools of the period or in shared apprenticeships, usually on the major railroads, bound them together. The practice of review by outside consultants reinforced these connections. Engineers belonged to the same national organizations. The majority held membership in the American Society of Civil Engineers that frequently published papers on municipal engineering with appended comments from experts throughout the nation. They also belonged to local professional clubs that corresponded with one another, publishing and exchanging reports about conditions in their individual cities.

These engineers contributed to debate and discussion in professional journals and discussed legal and administrative issues faced by their group. They also disseminated information about how similar problems were solved in other cities around the world.[19] Many of the engineers who worked on water supply systems in eastern cities, such as John R. Freeman, or had experience in California systems, like William Mulholland, or worked on federal irrigation systems, like A.P. Davis, also worked on Bay Area systems. Thus, it is not surprising that obstacles confronted by engineers might be surmounted through similar means in different projects, or that knowledge regarding the benefits and efficacy of certain designs might be widely distributed.

In all these cases, from New York to Boston, the East Bay, Marin County, and Los Angeles, the conversion from private to public entities resulted in the absorption of existing local private facilities into larger public systems. Historian Susan Elkind noted that this was a common process, if not always the most efficient. "But regional networks also retained the characteristics

[18] JRP Historical Consulting, "Historic Resources Inventory and Evaluation Report, Chlorinator House at Alpine Lake, Alum House at Alpine Lake, and Weir House at Lake Lagunitas." Prepared for MMWD, July 2005.

[19] Stanley K. Schultz and Clay McShane, "To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late-Nineteenth-Century America." *The Journal of American History*, 1978 65(2): 389-411. See especially 400-403.

of their municipal and private antecedents because regional officials saved enormous amounts of time and money simply by grafting bigger sewer mains and water supplies onto existing service networks," she reported. "The adaptation of existing infrastructure physically locked regional officials into established water supply and sewerage practices."[20]

San Francisco's water system followed this paradigm. The Spring Valley Water Company system grew organically within the city to provide local service, and then reached out to ever more distant sources through a series of specific plans to enhance and increase supply, the execution of which provided the means to keep up with demand and assure a growing supply. These plans were developed by expert engineers with wide experience. Finally, over the years, public dissatisfaction with this private system increased, and reform-minded citizens led the demand for conversion from a private to public water supply.[21]

The San Francisco Water System

The history of the SFPUC water system starts with a driving need for water in an area that is often described as a semi-arid peninsula. Though surrounded by the salt water of the ocean and bay, San Francisco had very little fresh water. The few creeks and springs that existed were sufficient to support early settlements, but as the area developed the need for water became critical. The Gold Rush of the mid-1800s brought the need for a water system to the forefront. As the population of San Francisco boomed with the influx of fortune seekers, the existing water supply proved to be inadequate. At that time, water was transported in barrels, sometimes from the other side of the bay, and sold at exorbitant prices to San Franciscans, who had little choice but to pay for it.

Before the establishment of an official water company in 1856 (as described below), one company attempted to provide San Francisco with an adequate water supply. In 1851, the Mountain Lake Water Company formed to distribute water from Mountain Lake in the Presidio, but its methods were inadequate and its finances shaky. It was granted a few time extensions to bring its business up to caliber, but it eventually folded in 1865.

The early history of the City Distribution System / Spring Valley Water Company, and the Peninsula and Alameda Systems are described below. The CCSF attempted to buy the Spring Valley Water Company during the 1870s, and eventually purchased it in 1930 (as further described under "Hetch Hetchy System").

20 Elkind, *Bay Cities and Water Politics*: 164.
21 The history of the transformation of San Francisco's water system from the control of a private corporation to a public entity is the subject of a recent dissertation by David R. Long, "The Flume Wildcatters: San Francisco, Private Waterworks, and Urban Development in the American West's Hydraulic Society, 1850-1930," (University of North Carolina, Chapel Hill, 2004).

City Distribution System / Spring Valley Water Company (1856–1877)

The San Francisco Water Works was formed in 1856 by an official city order and spearheaded by engineer Alexei Waldemar von Schmidt. The first water system was formed by a dam on Lobos Creek, a system of flumes and tunnels, a pumping station, and the Francisco and Lombard Reservoirs. The company was one of several, such as the Islais and Salinas Water Company and the Bensley Water Company, which competed within the city and supplied water to various service areas. San Francisco's private companies underwent a period of consolidation that mirrored similar experiences in other urban areas.

Soon, the San Francisco Water Works met with competition from the Spring Valley Water Company, founded by George H. Ensign in 1860, which used a spring at Mason and Washington Streets as its initial water source. It was this spring that gave the company its name. Though its beginnings were small, the Spring Valley Water Company soon came to dominate the city's water distribution. It began to consolidate its position, and bought out the Islais and Salinas Water Company and incorporated water from Islais Creek into the Spring Valley system, using a reservoir on Potrero Hill to hold the water. It also took over the competing Bensley Company's supply from Lobos Creek. The Spring Valley Water Company was especially successful because of the help of Von Schmidt, who, after a dispute with the San Francisco Water Works, gave his allegiance to the opposition in 1860. The resulting failure of the San Francisco Water Works left Spring Valley in a strong position. In 1864, the Spring Valley Water Company hired an engineer named Hermann Schussler, who in 1866 made his mark by raising Pilarcitos Dam. Schussler stayed with the company well into the 20th century and designed some of its most important components.

By 1868, Spring Valley had commenced negotiations to purchase Lake Merced from another local competitor—the Lake Merced and Clear Lake Water Company—and by 1877 integrated this spring-fed, natural reservoir into its system. Spring Valley dammed the outflow of Lake Merced, which had originally flowed northwest to the ocean. The company constructed Laguna Honda Reservoir in 1865 and incorporated it into the supply system; the north basin of University Mound Reservoir was constructed in 1885 and improved in 1924. These improvements are discussed below.

Peninsula System (1861–1898)

The Pilarcitos development, started in 1861, completed in 1863, and raised in 1866, was the first of a succession of large-scale projects planned and constructed by the Spring Valley Water Company. It was designed by company engineer Alexis von Schmidt. Pilarcitos Creek was the first source outside of San Francisco to be tapped as a water supply, and it proved to be the most productive of the dams and reservoirs on the Peninsula owing to high local rainfall. Pilarcitos Dam was a rolled earth dam with a puddle core and, at 70 feet high, was a large dam for the period. Its associated Tunnel No. 1 through Cahill Ridge to San Mateo Creek was a major construction project in its own right. The subsequent Pilarcitos Reservoir supplied water, via a gravity-fed system, to Laguna Honda Reservoir, which was constructed in San Francisco in 1865. Von Schmidt left Spring Valley in 1864 and was replaced by Hermann Schussler, a Swiss engineer trained at the Universities of Karlsruhe and Zurich. Schussler's long career as an engineer with Spring Valley was typified by a succession of plans, each of which served to increase the company's supply.

Schussler identified the San Andreas Valley as a prime reservoir site for the company's next plan of development. In 1868, he relocated the Pilarcitos pipeline and began constructing a dam to flood the valley. San Andreas Dam was a straight-crest gravity dam of earthen construction and was larger than Pilarcitos Dam, which used the same construction method. A tunnel through Buri Buri Ridge carried water from San Andreas Reservoir to Millbrae and then into San Francisco's network of mains and pipes through a gravity-flow system. By 1870, these facilities were supplying water to the city and had increased the amount sixfold. The dam was raised in 1874, and again in 1928, to a final height of 105 feet. It contributed up to 80 or 90 percent of San Francisco's water supply from the Peninsula system, greatly reducing the strain on sources within the city.

Stone Dam and Reservoir was the company's next system on the Peninsula. Relatively small, it collected the excess water from Pilarcitos Creek that was not impounded by Pilarcitos Reservoir and carried it by flume to San Andreas Reservoir. Stone Dam was also the receiving point for water from Lock's Creek flume, which brought water from Nuff Creek, Corinda Los Trancos, Apanolia Creek, Frenchman's Creek, and Lock's Creek through a tunnel to the reservoir. Stone Dam, built in 1871, was an engineering achievement despite its small size. It was the first dam of its type, and Schussler designed it of rubble masonry, blocks of local granite, and a herring-bone brick coping in a thin-arch configuration. The dam impounded nearly 5 million gallons of water.

The continuing increase in demand led Spring Valley Water Company to design and build its next system in Crystal Springs Canyon. From 1873 to 1877, the company installed an earthen dam with a puddle clay core across Laguna Creek. The water impounded behind it became Upper Crystal Springs Reservoir, the outlet of which consisted of a brick-lined, horseshoe-shaped tunnel. Upper Crystal Springs Dam was raised in 1891 to increase the capacity of its corresponding reservoir.

Spring Valley built Lower Crystal Springs Dam in 1890; the dam, credited to Schussler's design and plan, was an engineering achievement and, when completed, was the largest concrete dam in the world. The gravity-arch dam, made of poured-in-place interlocking blocks and reaching 150 feet high, dammed San Mateo Creek and created Lower Crystal Springs Reservoir. The dam was raised in 1890 and again in 1911. In 1976, the American Society of Civil Engineers listed Lower Crystal Springs Dam as a California Historic Civil Engineering Landmark, in part for Schussler's development of a number of innovative construction techniques that included washing the aggregate, machine-mixing the concrete, roughening the existing surfaces to ensure adhesion, curing the concrete by covering and wetting, and staggering the joints between the concrete blocks. An 1880s pump station designed by Willis Polk raised water to San Andreas Reservoir when Lower Crystal Springs Reservoir was experiencing low water levels.

During the Peninsula system era, Spring Valley also constructed the north basin of University Mound Reservoir in San Francisco to receive and store the new supplies of water coming into the city from the various dams and reservoirs. Development and construction of the Peninsula system continued after construction of the Crystal Springs dams. In 1898, Spring Valley built San Mateo Creek Dams Nos. 1 and 2 to collect more water for San Andreas Reservoir. Davis Tunnel also diverted water from San Mateo Creek into San Andreas Reservoir. This reservoir was fed with water from the Crystal Springs Reservoirs via the Crystal Springs/San Andreas Pipeline, which was constructed in portions in 1898 and 1932. This pipeline incorporates the Crystal Springs Pump Station, originally constructed in 1933, which is necessary to raise the water between the reservoirs.

Alameda Creek System (1875–1925)

At the same time that the company had dams under construction on the Peninsula, it also looked eastward across the bay to seek additional water, turning to sources in Alameda County. The company acquired land in the Calaveras Valley and a dam and mill property near Niles. In 1874, a report prepared by engineer T.R. Scowden recommended the Calaveras Valley as a source of water for a potential San Francisco municipal utility. The Spring Valley Water Company bought Calaveras Valley from the Alameda Water Company in 1875, ensuring its control of this source until the 1930s.

Niles Dam was the diversion point for a 1840s water right used to grind flour at the mill of Jose de Jesus Vallejo. The first project undertaken by Spring Valley on Alameda Creek, in 1887 and 1888, raised and adapted the Niles Dam system to divert water from the creek to San Francisco via the transbay pipelines at Dumbarton. The transbay pipelines carried the creek's water that was pumped from Dumbarton at the Belmont Pump Station into San Francisco.

In 1900, Spring Valley completed construction of the Sunol Filter Beds, Dam, and Aqueduct on Alameda Creek in the Sunol Valley area. Another Schussler plan, Sunol Dam did not form a reservoir, but rather backed shallow groundwater into the gravels upstream for diversion into the filter galleries. The water then passed into the greater water system through large concrete pipes and the Niles Canyon Aqueduct. These filter gallery diversions, plus withdrawals at Pleasanton, enabled the Spring Valley Water Company to divert in excess of 21.5 million gallons per day (mgd) to San Francisco from the Alameda Creek watershed. Additional transbay pipelines were added in 1903. As it had with Crystal Springs Dam, the American Society of Civil Engineers identified this system as an engineering landmark in 1976.

More groundwater was collected from artesian wells in the Livermore Valley, where the company created the Pleasanton Well Field. Under this plan, the company had a series of trenches dug in Pleasanton to feed artesian water into Arroyo de la Laguna; as water levels dropped, additional lines of deeper wells were dug and pumped for export. The 30-inch-diameter Pleasanton-Sunol Pipeline, constructed in 1909 and feeding into the Sunol Water Temple, eventually replaced Arroyo de la Laguna as the diversion method. The wells were regularly used from 1898 to 1930, at which time the CCSF purchased Spring Valley Water Company and stopped exporting water from the Livermore Valley. The system had become unnecessary because of the availability of water from Hetch Hetchy Reservoir. The CCSF used the wells again for a brief period during the 1949 drought. In the interim, water levels in Pleasanton returned to the artesian flows of earlier years. The Sunol Filter Beds are now operated intermittently as one of the sources supplying San Antonio Reservoir, and the Pleasanton Wells are operated to supply the Castlewood community south of Pleasanton.

The only substantial groundwater supplies in the Alameda Creek watershed above Niles were in the Livermore Valley. Shallow groundwater in the Sunol Valley was highly influenced by flood flows from Alameda Creek and was used during the rainy season, after which the Pleasanton Wells could pick up the slack and keep the transbay pipelines full over the summer months.

The Sunol Water Temple is a monument of high architecture that stands at the convergence of the three water sources within the Alameda Creek system: the creek itself, the Sunol Filter Beds, and the Pleasanton Wells. The temple, designed by Willis Polk in 1910, exhibits a Classical style. Consisting of a circle of Corinthian columns that support a wide entablature and conical roof of red tile, the temple shelters an oculus that allows viewers to see water flowing through the tunnel beneath it.

The other element of the Alameda Creek system is Calaveras Dam and Reservoir. The dam, located upstream of the Sunol Valley, effectively collected water from a number of sources, including Arroyo Hondo. Schussler retired from the company in 1909 and was replaced in 1911 by Fred C. Herrman. Spring Valley began construction of Calaveras Dam in 1913; after a structural failure in March of 1918, the dam was completed in 1925. A 1918 engineering study indicated that the dam had not been properly compacted, which left voids in the structure and caused the upstream face to collapse and the water gate tower to be destroyed. Although he was not part of the project, San Francisco's city engineer, Michael O'Shaughnessy, who at the time was playing an integral role in the Hetch Hetchy water system's construction, monitored the project with the forethought that it would someday be part of the larger municipal water system (CCSF, 2007).

Calaveras Dam incorporated hydraulic fill in its lower portions and was topped with rolled clay and rubble fill. When it was completed in 1925, it stood 215 feet tall and was reputedly the tallest dam the world (although it was only slightly taller than Upper San Leandro Dam, a 190-foot hydraulic-fill dam, built in 1926; Lake Arrowhead's 190-foot hydraulic-fill dam, built in 1922; or the City of Los Angeles' Stone Canyon Dam, a 185-foot earthen dam, built in 1925). These dams were soon surpassed by structures such as San Gabriel No. 1, an earth and rock dam built in 1938 to a height of 320 feet.

The corresponding Calaveras Reservoir was a major East Bay addition to the company's water system. It delivered water to San Francisco through the Niles Canyon Aqueduct and the city's Bay Division Pipeline No. 1, which was built in 1925 and ran across the southern end of San Francisco Bay. The CCSF built Bay Division Pipeline No. 1 as part of the Hetch Hetchy Project, but Spring Valley Water Company leased the pipeline for delivery of Calaveras water to Crystal Springs under a Railroad Commission order negotiated by San Francisco's engineers and attorneys. In order to convey the additional yield from Calaveras Reservoir to San Francisco, Spring Valley enlarged the Sunol Aqueduct in 1924 to carry 70 mgd, and also built Niles

Regulating Reservoir and Niles/Irvington Pipeline and Pump Station to boost Calaveras Dam and Sunol Filter Bed water into Bay Division Pipeline No. 1 (URS, 2004).

Hetch Hetchy System (1914–1934)

The CCSF's planning and development of the Hetch Hetchy system represents a second major context in which to understand the development of the regional water system. The Hetch Hetchy system was planned as a major part of the movement to wrest control of the water supply from Spring Valley Water Company; while parts of the systems overlap or were temporarily used by the Spring Valley Water Company (like Bay Division Pipeline No. 1), the overwhelming acceptance of the Hetch Hetchy system by the citizens of San Francisco represents a distinct break from the reliance on private water company developments to provide San Francisco with its municipal water supply.

The centerpieces of the Hetch Hetchy system—O'Shaughnessy Dam and Hetch Hetchy Reservoir—were hard won, and much controversy surrounded their construction. The effort began in 1890, when the Tuolumne River was surveyed as a potential water source for San Francisco and the Hetch Hetchy Valley as a potential reservoir site. The Sierra Club contested the damming of the Tuolumne River under the leadership of its first president, John Muir. Muir, one of the nation's best-known conservationists, first visited Hetch Hetchy Valley in 1871 and equated its damming to turning a cathedral into a water tank. He waged an eight-year campaign to thwart the valley's development, but was eventually defeated by a number of government decisions ending with the Raker Act in 1913.

Beginning in 1903, San Francisco sought permission from successive secretaries of the interior to build a dam in the Hetch Hetchy Valley and to use other federal lands in Yosemite National Park and Stanislaus National Forest to deliver the water to the Bay Area. Secretary of the Interior Ethan Allen Hitchcock denied the first request in 1903.

San Francisco's efforts to dam Hetch Hetchy gained momentum following the destructive fires associated with the 1906 San Francisco earthquake, during which there was limited water for firefighting because of breaks in water lines in the city and throughout the water distribution system. Two years after the 1906 earthquake and fire, Secretary of the Interior James R. Garfield granted San Francisco the so-called "Garfield Permit," many provisions of which anticipated the 1913 Raker Act. In 1909, the CCSF purchased much of the patented land in the Hetch Hetchy Valley from private owners. With the election of President William Howard Taft, new Secretary of the Interior R.A. Ballinger issued a 1910 "Order to Show Cause" directing San Francisco to establish why it required water from its proposed Hetch Hetchy Valley reservoir, as opposed to diverting water from Cherry and Eleanor Creeks. Also in 1910, the CCSF acquired competing rights to divert at Cherry and Eleanor Creeks from William Hammond Hall's Tuolumne Water Supply Company.

Ballinger asked the U.S. Army Corps of Engineers to prepare a report on other potential sources of supply available to San Francisco, including the Eel River, Mount Shasta, Clear Lake, Cosumnes River, and other sources. The Corps concluded that the Tuolumne River was the best available source for San Francisco for several reasons: it was comparatively free of conflicting claims to water rights; could be economically developed; could generate power as a valuable byproduct of water deliveries; could provide a pure water source that was unlikely to be compromised by future human activity because the watershed was protected in a national park; and had sufficient water to accommodate the future demands of the Bay Area. With another change of presidential administrations, former San Francisco City Attorney Franklin Lane became secretary of the interior under President Woodrow Wilson. To avoid the appearance of conflict, Secretary Lane did not approve the Hetch Hetchy permit, but rather recommended that the CCSF seek congressional approval. This move also avoided the potential for revocation of any permit by succeeding secretaries of the interior.

On President Taft's advice, the city needed to prove its need for more water. It hired influential consulting hydraulic engineer John R. Freeman to make the case for Hetch Hetchy before the Corps. His report was instrumental in pushing the project through to approval. An engineer from Rhode Island, Freeman was a consulting engineer on the early 20th century expansion of the municipal water supply of Boston and had consulted on the plan for the Los Angeles Aqueduct in 1906. He worked with California-based hydraulic engineers C.E. Grunsky and Marsden Manson, expanding on their initial concepts for the Hetch Hetchy Project.

Freeman's 1912 report called for the delivery of 160 mgd from Hetch Hetchy to San Francisco, with the prospect of increasing that amount to 400 mgd, an amount sufficient to serve the entire Bay Area. The plan also allowed for construction of powerhouses to supply electricity for the project and later, for the city. With this vast municipal water supply secured from the upper Tuolumne watershed, Freeman envisioned a booming metropolis developing around the bay. He treated the various parts of the upper drainage basin (those associated with Lake Eleanor, Hetch Hetchy Valley, and Cherry Valley) as part of the city's water system, adding them to the existing facilities of the Spring Valley Water Company. Promoting the "urban destiny" of the Bay Area, Freeman compared San Francisco's Hetch Hetchy development to the water systems that supported the industrial and population growth of other major metropolitan areas, including Boston, New York, London, and Oslo, Norway. Lastly, he argued that the reservoir created by damming Hetch Hetchy Valley would attract as many visitors, if not more, than if the valley were kept in its natural state. With a good network of mountain roads established by the construction project, Freeman envisioned Hetch Hetchy and the upper Tuolumne River watershed as a popular tourist destination high in the Sierra Nevada mountains. These various arguments favoring conservation and use of Hetch Hetchy eventually proved to be major contributing factors in the approval of the Hetch Hetchy Project.

The 1913 Raker Act succeeded in gaining the CCSF a congressional grant of right-of-way, construction, and use privileges in Hetch Hetchy Valley, which ultimately allowed the Tuolumne River to be dammed and the valley flooded. The act passed despite determined opposition from those in favor of preserving the valley, and from individual landowners in the Turlock and Modesto Irrigation Districts (TID and MID) who disagreed with the district boards' decisions to support San Francisco. Congress supported the act as an example of "conservation for use," believing it served a public need that outweighed any detriment to the natural environment.

(Readers interested in the Hetch Hetchy controversy, and the Raker Act's legislative history and passage through Congress, can find a large number of articles and books on the subject, some of which are included in this report's bibliography.)

Opposition to construction of the Hetch Hetchy project came from a variety of interests. Understandably, the Spring Valley Water Company opposed this project, which effectively ended the company's role as the utility company supplying San Francisco with its municipal and domestic water.[21a] The Hetch Hetchy project was designed to transmit electrical power to San Francisco from a power plant at Moccasin. A politically charged conflict over this electric power and associated revenue pitted public power advocates against the privately financed electric power industry. Opposition came from electrical power generating companies like Pacific Gas and Electric Company (PG&E) and Great Western Power Company (GWP), two utilities that served San Francisco and the Bay Area. These private power companies opposed the competing generation and sale of electricity by public agencies, which was a provision of the Raker Act. The CCSF planned to acquire PG&E and GWP's distribution systems within its service area, but between 1927 and 1941 the public consistently rejected bond issues required to fund their acquisition; allegedly, this opposition to the bond measures was largely funded by PG&E.[21b] The CCSF's agreements to have PG&E (which had acquired GWP in the 1930s) wheel its power through the company's existing transmission and distribution systems for delivery to San Francisco agencies, and its purchase of city power for resale, caused a longstanding controversy between the federal government, public power advocates, and the CCSF.[21c]

Perhaps the most prominent name associated with development of the Hetch Hetchy water and power system was that of Michael O'Shaughnessy, San Francisco's city engineer (1912–1934) and ex-officio city planner. Working under the direction of Mayor James Rolph, O'Shaughnessy had many of the state's best engineers in his work force. The rebuilding efforts following the 1906 earthquake had brought many skilled engineers and construction laborers to the area, and they were eager for more work, especially under the leadership of the well-respected O'Shaughnessy.

As the congressional act required, development of the gigantic Hetch Hetchy undertaking began in earnest after passage of the Raker Act in 1913. In 1918, Lower Cherry Diversion Dam and Aqueduct, the first major facilities in the system, were completed, enabling the generation of power at Early Intake Powerhouse on the Tuolumne River. This network of facilities was critical to development of the rest of the Hetch Hetchy system, as it supplied electricity to power construction efforts. Lower Cherry Diversion Dam and Aqueduct are still in use and available to provide additional water during droughts. Early Intake Powerhouse was demolished in 1967.

[21a] Elmo R. Richardson, "The Struggle for the Valley: California's Hetch Hetchy Controversy, 1905–1913," *California Historical Society Quarterly*, Vol. 38, 1959.

[21b] Norris Hundley, *The Great Thirst: Californians and Water, 1770s–1990s.* University of California Press, pp. 187–189, 1992; and Stephen P. Sayles, "Hetch Hetchy Reversed: A Rural Urban Struggle for Power." *California History*, 64:4, p. 256, Fall 1985.

[21c] [21c]San Francisco Public Utilities Commission (SFPUC), *San Francisco Water and Power,* pp. 57–61, June 1949.

The Hetch Hetchy system, in some elements of its concept and engineering design, mirrored similar developments made by other urban centers at much the same time. Part of the challenge of building the system was its remote location, which required construction of an array of supporting facilities in the vicinity of the project; these included a railroad for transporting materials and workers to the dam site, a sawmill to produce lumber, and a powerhouse to generate electricity for construction equipment.

Multi-purpose dam and water conveyance projects proliferated within river basins throughout America in the early decades of the 20th century. The projects were built for a variety of purposes: municipal water supplies, federal land reclamation, irrigation, and electric power generation. Thousands of workers contributed to this construction work, often under tight schedules and difficult, even dangerous, conditions. Hetch Hetchy water project contract workers and wage laborers consisted of a varied group of individuals stratified by skill, race, and ethnicity. The largest proportion was low-paid, unskilled laborers, both native-born and immigrants. Above them were the better-paid skilled workers and craftsmen, and at the top was a smaller group consisting of managers, supervisors, administrative personnel, and skilled professionals such as civil and electrical engineers, hydrographers, and surveyors. Over more than 25 years of construction activity, the Hetch Hetchy project provided employment to many thousands of workers in many fields of industrial labor; these workers built everything from mountain roads, railroads, labor camps, buildings, bridges, and trestles that served as project infrastructure, to dams, tunnels, pipelines, siphons, and penstocks that stored and conveyed municipal water. Many of the lesser-skilled construction laborers were highly migratory, non-unionized workers whose employment was seasonal, with peak employment coming during the summer and autumn and minimal opportunities in winter and spring.

While some workers were more sedentary and lived in towns or work camps with their families, the majority of the workers—who were predominantly unmarried, mobile, and male—resided in boardinghouses or labor camps near their work sites. The ethnic makeup of the workingmen's boarding houses was often quite diverse, according to 1920 census records. For example, one lumber camp near Groveland was operated by an American civil engineer whose wife kept house with the assistance of one cook. Twenty-five boarders lived there, including painters, carpenters, contractors, lumberjacks, millwrights, and the lumberyard foreman. While the nationality of the boarders was predominately native-born, there were also Hungarians, Poles, Swedes, Germans, and Italians represented among the lodgers. Similarly, a tunnel camp in Groveland Precinct in 1920 contained boarding houses operated by a Swedish immigrant and a Canadian-born mine superintendent. While the Swedish-run operation catered mostly to about 20 Swedish, Norwegian, and native-born tunnel workers, the Canadian establishment lodged a diverse clientele of 22 workers, including tunnel miners and laborers, blacksmiths, foremen, and electricians. They were a diverse lot by nationality, including Canadians, native-born Americans, Spanish, German, Swedish, Italian, Irish, and Austrian workers. This pattern of boarding house occupation by workers of various nationalities was borne out at other tunnel camps and dam construction camps located outside the town of Groveland and at Lake Eleanor.[21d]

[21d] U.S. Census Bureau, MSS Population, Groveland Precinct, Tuolumne County, CA, 1920.

Unsafe working conditions and inadequate wages were issues that periodically contributed to labor strife and fostered efforts to unionize the rural industrial labor force assembled to construct the Hetch Hetchy project. During August of 1920, workers at some of the city's construction camps, particularly in the Mountain Tunnel Division, staged a general strike that lasted until May 1921. City officials, particularly O'Shaughnessy, had expressed general support for trade or craft unionism, but objected to "radicals" who organized the day laborers/construction workers hired by the CCSF and advocated worker solidarity, class conflict, and direct action (strikes) at the point of production. These radical labor leaders included representatives of the Industrial Workers of the World (I.W.W., or "Wobblies"), which variously functioned as an umbrella labor organization and revolutionary social movement, and the International Union of Mine, Mill & Smelter Workers, a labor union with militant roots in the copper, nickel, lead, and gold mines of the American West and British Columbia. During the 1920s and 1930s, Mine and Mill, as the union was known, made concerted efforts to organize unskilled national minorities such as Mexican-Americans and African-Americans in the American Southwest. City records indicated that Swedish/Finnish tunnel crews and Mexican laborers were among the more ardent supporters of the radical unionization effort.[21e]

Construction of Hetch Hetchy Dam, ancillary water storage structures, the city's extensive water conveyance system, and its power plant at Moccasin proceeded over several decades, from 1913 into the late 1930s. In 1925, in his report to the CCSF on Hetch Hetchy's progress, O'Shaughnessy made little mention of labor problems or strife over organizing, and no comments related to national groups and/or the ethnic composition of the workforce. He reported that the total number of "men" productively employed on the project between 1914 and mid-1925 ranged from over 500 at the end of 1914, less than a hundred at the beginning of 1915, and then a gradual increase (with ebbs and flows) to about 750 in 1919. Thereafter the numbers increased quickly, reaching over 2,000 in 1922, before dropping off again to less than 400 by mid-1925.[21f] After 1925, the bulk of the construction effort shifted to the Foothill and Coast Range Tunnels and installation of the San Joaquin Pipeline, leading eventually to the delivery of Hetch Hetchy water into the city in October 1934.[21g]

In the end, the Hetch Hetchy system included multiple dams and reservoirs, conduits, power plants, and 150 miles of aqueduct to transport water from high in the mountains down to the coastal city of San Francisco near sea level. Like other major urban systems on the East Coast, facilities within the system were sited to maintain a gravity flow of water from Hetch Hetchy Reservoir and O'Shaughnessy Dam to the various storage reservoirs and places of use in and near San Francisco. O'Shaughnessy Dam, named after the engineer who oversaw its construction, was of cyclopean concrete construction, consisting of large granite blocks embedded in concrete. It

[21e] Ted Wurm, *Hetch Hetchy and its Dam Railroad*, Trans-Anglo Books, Glendale, CA, pp. 121–122, 1973; Melvyn Dubofsky, *We Shall Be All: A History of the Industrial Workers of the World*, Urbana: University of Illinois Press, 1988; Mario T. Garcia, *Mexican Americans: Leadership, Ideology and Identity, 1930–1960*, Urbana: Yale University Press, pp. 175–198, 1989; City and County of San Francisco (CCSF), Moccasin Archives, n.d.

[21f] M.M. O'Shaughnessy, *Hetch Hetchy Water Supply*, Bureau of Engineering of the Department of Public Works, report prepared for the City and County of San Francisco, p. 42, October 1925.

[21g] Hanson, Warren D., *San Francisco Water and Power: A History of the Municipal Water Department and Hetch Hetchy System*, City and County of San Francisco, pp. 55–56, 1994.

had an arch-gravity configuration with a 101-foot-deep foundation. At 226.5 feet high, it was a major structure on the West Coast when it was completed in 1923. Its construction took four years and employed laborers around-the-clock, which was uncommon at that time. Utah Construction Company built the $17 million O'Shaughnessy Dam,[22] which was one of the company's early major dam projects. The company went on to become one of the major dam builders in the American West, being credited with construction of at least 58 large dams between 1916 and 1969, including the colossal Hoover Dam on the Colorado River.

22 Founded in 1900, Utah Construction Company began as a railroad builder in the inter-mountain West. Among its projects was Western Pacific's Feather River Canyon Route (1911) on the Oakland to Salt Lake City line.

At the same time that O'Shaughnessy Dam was nearing completion, the city had another auxiliary dam and reservoir under construction. In 1923, Priest Dam and Regulating Reservoir was built to regulate the flow of water to the city's Moccasin Powerhouse. The following year, the city built Early Intake Diversion Structure, which was the major diversion point for the project. It took water spilled from Hetch Hetchy Reservoir and diverted it through Mountain Tunnel (1925). The tunnel traveled through solid granite and was a concrete-lined, horseshoe-shaped passage that conveyed water to Priest Reservoir and subsequently to the Moccasin facility. The water flowed through Moccasin Power Tunnel, down the penstock, and to Moccasin Powerhouse, where electricity was generated primarily during peak hours. In 1925, a switchyard, other facilities, and a small city-owned town, originally known as Moccasin Camp, sprang up around the powerhouse. The town and associated buildings, and the powerhouse, were designed in a uniform Mission Revival architectural style.

The Red Bar Mountain Siphon, a portion of Foothill Tunnel, was also constructed at this time to carry water across the Tuolumne River Canyon. Foothill Tunnel was constructed in 1928 and conducted water to the Central Valley, releasing it into the San Joaquin Pipelines.

In the San Joaquin Valley, Tesla Portal was added in 1928, providing a connection between the San Joaquin Pipelines (the first of which was constructed in 1932) and the Coast Range Tunnel (completed in 1934). In 1934, at the other end of the Coast Range Tunnel, the city constructed the first Alameda Siphon and Irvington Tunnel to carry water through to the Bay Division Pipelines. Alameda Creek Diversion Dam and Tunnel were begun in 1925 by Spring Valley Water Company and finished in 1931 by the CCSF. Located on Alameda Creek upstream of the Alameda Siphons, the dam diverted water from Alameda Creek through the diversion tunnel and into Calaveras Reservoir. The Alameda Creek Diversion Dam and Tunnel added 35 square miles of watershed area to the system (SFPUC, 2004).

O'Shaughnessy Dam was designed and built in a manner that would allow it to be raised. In the 1930s, President Franklin D. Roosevelt sought to provide America with a New Deal, a government-sponsored socioeconomic initiative that among its most prominent programs included dam construction projects as massive public works. Not long after Roosevelt's election (November 1932) and the start of the New Deal (after his inauguration in March 1933), the CCSF received a grant from the federal government covering 30 percent of the cost of labor and materials for raising O'Shaughnessy Dam. The money came from the National Recovery Administration, which was formed by the National Industrial Recovery Act of June 1933. The SFPUC reported that on November 7, 1933, the citizens of San Francisco passed a bond measure for $3.5 million to cover the city's portion of the cost of enlarging O'Shaughnessy Dam. The federal grant also stipulated that all available unemployed workers in Tuolumne County had to be put to work before unemployed people from San Francisco could be used. Soon thereafter, the state requested that the CCSF use 500 to 600 unemployed laborers it had available for "maintenance of municipal property" under the State Emergency Relief Act (SERA). By March 1934, the CCSF had erected seven SERA work camps capable of housing and feeding nearly 700 workers. Later, the state's SERA program for unemployment relief was absorbed into the federal

Works Progress Administration. The CCSF issued the contract for the Hetch Hetchy Dam enlargement project onApril 8, 1935 to the Transbay Construction Company, and the dam's raising was completed more than three years later, on July 1, 1938.[22a]

In 1926, Pulgas Tunnel was constructed to carry water from the Bay Division Pipelines to Upper Crystal Springs Reservoir. The Crystal Springs/San Andreas Pipeline, constructed in 1932, connected Crystal Springs Reservoirs to San Andreas Reservoir. In 1934, the arrival of Hetch Hetchy water at Crystal Springs was commemorated with construction of the Beaux Arts–style Pulgas Water Temple. The temple was designed by William Merchant, a San Francisco architect who trained under Bernard Maybeck, in a style sympathetic to the Sunol Water Temple. Completion of this pipeline allowed water to travel continuously by gravity flow from Hetch Hetchy Reservoir to the city of San Francisco, a total of over 170 miles.

During construction of the Hetch Hetchy system, the city finally completed the long process of acquiring Spring Valley Water Company. Citizens of the city had strongly supported the Hetch Hetchy system, regularly passing bond measures to fund its construction. Acquisition of the Spring Valley system proved more difficult. The city's board of supervisors put measures to acquire the system on the ballot five times between 1910 and 1928; it was only in 1928 that the voters finally approved its acquisition. While some of the elections nearly reached the required

[22a] San Francisco Public Utilities Commission (SFPUC), *San Francisco Water and Power*, pp. 59–60, June 1949; Ted Wurm, *Hetch Hetchy and its Dam Railroad*, Trans-Anglo Books, Glendale, CA, p. 251, 1973.

two-thirds majority, the 1928 vote in favor of purchase reached 82 percent.[23] The city then entered into negotiations to set a purchase price, and finally acquired the Spring Valley Water Company in 1930 for $39.96 million, at last converting the private utility into a public agency. This led to the creation of the San Francisco Water Department under the Department of Public Works. The first delivery of water from Hetch Hetchy to San Francisco occurred in 1934.

Expansion and Improvements (1934–1955)

Although San Francisco's water system was completed to its fullest geographic extent with the construction of Hetch Hetchy Reservoir, the city made later separate improvements and expansions to its municipal water system and undertook major maintenance projects to improve facilities already in use. Among the most notable of these improvement and expansion projects was raising O'Shaughnessy Dam by 85.5 feet in 1938.

In 1934, the city completed Moccasin Dam, forming Moccasin Reregulating Reservoir; the dam formed an afterbay that assisted in making the flow of water downstream from the Moccasin Power Plant facility more consistent, because the generators at the powerhouse operated in cycles and created varying water flow levels into the afterbay. That same year, the city installed the first of the Alameda Siphons to assist in carrying water under Alameda Creek, between the Coast Range Tunnel and Irvington Tunnel. Merced Manor Reservoir was constructed in 1936 in San Francisco to store water for the residential area surrounding it and to supply Central Pump Station, which pumps water to other reservoirs in the city. In addition, the south basin of University Mound Reservoir, constructed in 1937, and the north basin of Sunset Reservoir, constructed in 1938, greatly improved the capacity of city-based water storage facilities. The city constructed an additional Sunset Reservoir basin in the 1950s. The Sunset Wells in San Francisco were added to the system from 1930 to 1936, just after the city bought Spring Valley. The water department added and improved pipelines that enhanced the amount and dependability of the water supply. In 1936, the city constructed a second Bay Division Pipeline, parallel to the first, and in 1952, added a third Bay Division Pipeline. It skirted the southern end of the bay rather than crossing it. In addition, the city built a second San Joaquin Pipeline and a second Alameda Siphon in 1953.

Between 1953 and 1955, the city built Cherry Dam and created Lake Lloyd near Lake Eleanor Dam, high in the Sierras, adding to the facilities already associated with Cherry Creek. The city also constructed additional power tunnels and powerhouses in this portion of the system. Although Cherry Dam contributes to the system, it primarily provides water to TID and MID, as well as generating hydroelectric power for the city of San Francisco. Water comes into Lake Lloyd from Lake Eleanor via the Cherry-Eleanor Tunnel and Pump Facility. Water is transported out of Lake Lloyd via the Cherry Power Tunnel (1955), which conveys it to Holm Powerhouse (1960).

[23] David R. Long, "Pipe Dreams: Hetch Hetchy, the Urban West, and the Hydraulic Society Revisited." *Journal of the West*, 1995 34(3): 19-31; see especially 26-27.

Modernization (post-1955)

Creative engineering aimed at solving specific problems sustained a later period of system development in the 1960s and 1970s, focused primarily on water quality issues. This period was typified by construction of Pulgas Pump Station and Balancing Reservoir, Pulgas Bypass Tunnel, Crystal Springs Bypass, San Andreas Treatment Plant, Sunol Valley Water Treatment Plant (WTP), and San Antonio Pump Station, Pipeline, and Reservoir, which were designed based on a specific set of plans to make the system more modern and efficient.

In the 1960s and 1970s, water quality issues became more of a concern on a national level, as well as statewide and local levels, than it had been in the early years of municipal water system development. Water quality became the focus of federal legislation in the 1970s; congress passed the landmark Clean Water Act in 1972, focusing primarily on the treatment of wastewater, and the Safe Drinking Water Act in 1974, which set standards for water quality around the nation. Accordingly, the city put into service facilities like the Sunol Valley WTP, serving Calaveras Reservoir, and the Harry Tracy WTP, serving San Andreas Reservoir. These facilities filter, disinfect, and introduce additives to the water before it is delivered to consumers.

In the mid-1960s, the city built Turner Dam and San Antonio Reservoir, the most recent of the major water system facilities. The dam and reservoir had been under consideration early in the system's history; in fact, these facilities were originally sited by the Spring Valley Water Company in 1875 and presented in the Freeman report of 1912, but were never built under any plan until the city did so. Finally completed in 1965, these facilities provided a needed water collection and storage point. In addition, the city had the upstream face of Pilarcitos Dam repaired in 1972, and strengthened Calaveras Dam in 1975.[24]

Many other mechanical facilities and stretches of pipeline have been constructed over the years. These various engineering facilities and structures, which were conceived, designed, and built during discrete periods and by separate plans, work together to unite the dispersed larger elements of the system, such as Peninsula, Alameda, and Tuolumne watershed dams and reservoirs, and make the SFPUC water system operate as an efficient whole.

Resource Types

The following discussion describes the types of cultural resources that might occur within the WSIP study region.

Paleontological Resource Types

Invertebrate fossils found in young marine sediments are usually not considered by paleontologists to be significant resources because they are often widespread, abundant, fairly well preserved, and present in predictable locations; the same or similar fossils can be located at

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24 During this time, TID and MID constructed New Don Pedro Dam (1967–1971). It replaced a smaller, 1923 dam in the same area and created Don Pedro Reservoir from the waters of the Tuolumne River. New Don Pedro Dam, while partially financed by the SFPUC (acting on behalf of the CCSF), is owned and operated by TID and MID as a part of their systems; it plays no direct role in the provision of water to San Francisco.

any number of sites throughout California. Most limestone deposits are prolific with invertebrate skeletal material; organic mudstones are also rich with invertebrate fossils. However, a new marine invertebrate fossil discovery that might provide a better understanding of a geologic unit or shed light on a new genus or species would be considered an important scientific discovery. Fossil remains of vertebrates are common in Pleistocene (1.8 million to 10,000 years ago) units throughout California, and units of alluvium, in particular, can contain diverse animal fossils that represent key evolutionarily significant specimens.

Archaeological Resource Types

Prehistoric Archaeological Resources

Prehistoric archaeological site types in the WSIP study areas include village sites, temporary campsites, milling sites, petroglyphs, stone or rock scatters, quarry sites, shell and ash middens, and burial sites. Prehistoric sites are more likely to be intact in areas that are not fully developed or farmed, or are beneath alluvial fans that have not been extensively plowed. Although buried deposits can occur in urbanized settings, substantial commercial and residential development has disturbed or destroyed many of these sites. For example, the Central Valley has undergone substantial change since prehistoric times due to its agricultural development, but it is possible to encounter paleontological resources when they become exposed due to soil erosion. Deeply buried prehistoric sites have also been found in San Francisco and the East Bay Hills; permanent settlements were common in the San Francisco Bay region, and prehistoric sites are likely to occur throughout much of the area.

Historic Archaeological Resources

Historic archaeological sites in the Central Valley are characterized by artifacts associated with mid-19th-century ranching and agricultural settlements, which may have also left behind farming landscapes, homesteads, corrals, fences, and canal and irrigation features. The historic archaeological resources in the San Francisco Bay Area include recreational sites, mining-related sites, early military sites, and refuse deposits, such as artifact-filled privies or wells. Of particular interest are those sites related to Mission-era activities, including dwellings or house depressions, cairns,[25] rock alignments, and household features such as hearths, pits, and fire-cracked rock. Throughout the WSIP study area, historic railroad properties remain, including railroad segments, campsites, berms, trestles, material dumps, and associated structural ruins (see Chapter 2, Existing Regional Water System, Table 2.1, for a listing of major SFPUC facilities).

Traditional Cultural Properties

Traditional Cultural Properties (TCPs), or sacred lands, are holy places, ceremonial sites, and other important places for Natives Americans. TCPs and other sacred lands may be eligible for listing in the National Register of Historic Places under the National Historic Preservation Act (Section 101[d][6][a]). TCPs may also be eligible for listing in the California Register of Historical Resources under Section 15064.5[a][3] of CEQA. In the WSIP study area, TCPs often consist of natural or geologic features that are traditionally considered sensitive or sacred. For

[25] A rock pile, cache, or suspected burial.

example, Mount Diablo and Mount Tamalpais are landmarks considered to be TCPs for their religious and ceremonial significance to several Native American groups. However, not all TCPs are necessarily mountaintops or overt features of the landscape. The California Native American Heritage Commission maintains a database of known sacred lands and distributes information concerning these properties upon request.

Historic Architectural Resource Types

In a complicated hydraulic facility such as the SFPUC regional water system, each individual element contributes in some way to the overall function, which in this case is to capture, store, treat, and transport water from reservoirs to the city distribution system and ultimately to consumers. One useful document in identifying, assessing, and evaluating features of water conveyance systems, such as those in the regional water system, is *Water Conveyance Systems in California* (JRP Historical Consulting Services and Caltrans, 2000).

Some major facilities in water conveyance systems (such as certain dams and aqueducts) play more central roles and may have surmounted substantial engineering challenges through innovative solutions, warranting recognition as important examples of hydraulic engineering under the contexts of municipal water systems. Others (such as certain pumping plants, distribution reservoirs, and wells) perform more ancillary or subsidiary services and may be of well-known and common designs. Generally, these elements can be classified as either structures that physically manipulate the movement of water, or structures that house mechanisms or facilities for treating water.

Physically, each of the architectural resource types described below—as dictated by its function and period of construction—have distinct forms and materials. In addition, variations exist within each type according to the function it needed to fulfill, the preferences and skills of the designing engineers, and the technology and construction practices that were common when it was built. A number of resource types within the regional system may possess historical significance and still be active in the water system, while others are partially or no longer active. The following is a list of historic resource types, with variations described. Generally, these resource types take many diverse forms, not only among the resource types but also within those types. Therefore, resources must be assessed on an individual basis. The generalized descriptions given above provide a context for determining possible historic resources; however, the final determination is made based on the historical significance and historic integrity of the resource within a specific historical context, identified with a specific period of significance.

- Dams. A dam is a structure confining a body of water, or any barrier constructed across a waterway to control the flow or raise the level of water. Historic dams within the water system come in a number of configurations and materials, including: concrete buttressed arch dams, earth- and rock-fill dams, concrete gravity arch dams, earth and rock hydraulic fill dams, earth dams, masonry arch dams, and earth-fill clay core dams. Some of the dam designs may be considered innovative and pioneering for their eras of construction. Dams in the regional system range in height from 4 feet to 330 feet. While the size of a dam alone is not a sufficient measure of its potential historical significance, it can be a contributing attribute when combined with other design factors. The regional system dams of interest for the WSIP are those in the Sunol Valley and Peninsula Regions: the Calaveras, Turner, San Antonio, and Lower Crystal Springs Dams. Of those, only Calaveras and Lower Crystal Springs Dams would be directly affected by WSIP projects.

- *Reservoirs*. A reservoir is any natural or artificial pond or lake used for the storage and regulation of water. A reservoir is usually created by the installation of a dam, which forces water to collect behind it. Many reservoirs within the water system consist of natural depressions in the earth that are flooded with water from streams or creeks flowing into the valley. Historic reservoirs within the water system include flooded valleys, existing lakes, and man-made ponds. Reservoirs can be covered or uncovered. Smaller urban distribution reservoirs hold as little as 9.5 million gallons, while larger rural storage reservoirs hold as much as 117.4 million gallons. The proposed WSIP projects would affect the Calaveras, San Antonio, Lower Crystal Springs, and Pilarcitos Reservoirs.

- *Tunnels*. Tunnels are water-conveying structures that pass through topographic features or below the ground surface, and thus are surrounded by solid material like stone or soil. They can take the shape of a horseshoe, circle, or "U" and can be either unlined (the walls of the tunnel consisting of the surrounding material, typically stone) or lined with concrete, steel, or gunite. Historic tunnels in the regional system range from approximately 4 feet to 14.5 feet in diameter. Power tunnels are specific in their function only (i.e., delivering water to a powerhouse). The proposed WSIP projects would affect the Irvington Tunnel.

- *Aqueducts/Flumes*. An aqueduct (or, on a smaller scale, a flume) is an open channel designed to transport water, usually via gravity flow. The only operating historic aqueduct within the water system is the Lower Cherry Diversion Aqueduct, which is a concrete canal measuring 7.5 feet wide and 7.5 feet deep. Remnants of pre-1906 flumes built by the Spring Valley Water Company also remain near Crystal Springs Reservoir and Pilarcitos Reservoir. The WSIP would not affect the regional system's aqueducts or flumes.

- *Pipelines*. A pipeline is a conduit of pipe used to convey water. It can run above or below ground. Along with tunnels, aqueducts, and other conveyance arteries, pipelines connect reservoirs and other facilities within the water system. Pipelines from the historic period in this system consist of steel pipe, riveted steel pipe, wrought steel pipe, welded steel pipe, steel pipe that is cement-lined and coated, steel pipe that is cement-lined and coal-tar coated and wrapped, reinforced-concrete cylinder pipe, or prestressed concrete cylinder pipe. The pipelines in the regional system generally measure from 54 to 72 inches in diameter and can carry between 37 and 300 mgd of water. The proposed WSIP projects would affect the San Joaquin, Bay Division, and other pipelines.

- *Towers*. Towers have a variety of functions within the water system but have been grouped together as a single historic resource type. Surge towers are designed to reduce the damage to piping in the event of pump failure, which could cause water to surge backward from a pump station. Intake and outlet towers are located above the openings of reservoir intake and outlet pipes, and house controls that regulate the flow of water through the pipes. Intake/outlet towers are tall structures that are usually located in the water of a reservoir and are connected to shore by a catwalk. Within this system, the historic towers appear to be constructed primarily of poured concrete and have various shapes and detailing, some with notable architectural merit. The proposed WSIP projects would affect towers at Calaveras and Lower Crystal Springs Dams.

- *Powerhouses*. Powerhouses use water passing through them to generate electricity through the movement of a turbine. The water system's secondary function (after providing water to the city) is providing hydroelectric power. Powerhouses are typically large structures located below a reservoir or along the course of a waterway. The only extant historic powerhouse in the system is the Old Moccasin Powerhouse, which is a steel frame and concrete building measuring 225 by 98 feet and 67 feet high. It was built in the California Mission style with a tile roof, arcades, and other architectural details. The WSIP would not affect powerhouses in the regional water system.

- *Penstocks*. Also associated with powerhouses, penstocks are the pressure pipes that carry water from a forebay reservoir to the turbine. The Moccasin Penstocks are the only penstocks from the historic period. They are relatively small-diameter pipes that run parallel to one another over a distance of 5,625 feet and carry 800 mgd of water. The WSIP would not affect penstocks in the regional water system.

- *Switchyards*. Switchyards manage the electric power generated by the hydroelectric powerhouse. The Moccasin Switchyard is the only switchyard from the historic period. It contains various pieces of equipment, such as electrical transformers. The switchyards handle the maximum 102 kilowatts of electricity that the Moccasin facility can produce. The WSIP would not affect switchyards in the regional water system.

- *Siphons*. Siphons are pipelines used to convey water across a range of elevations (or topography) without the need for pumping. Siphons can be used when the starting elevation is higher than the final elevation, regardless of intervening changes in elevation, due to the force of water pressure; in this way, they are able to carry water across canyons or under riverbeds. Like pipelines, siphons can be located above or below ground. Essentially made of the same materials as pipelines, historic-period siphons in the SFPUC water system are made of riveted steel pipe, steel cylinder reinforced-concrete pipe, or steel plate with tar lining and coating and wrapped in felt. They range from 5.75 to 9.5 feet in diameter and generally convey from 70 to 150 mgd of water. The WSIP would affect the Alameda Siphons.

- *Portals*. Portals are the connecting points between pipelines and tunnels. The main feature of a portal is the tunnel mouth and connecting pipeline. Historically, portals typically consisted of a steel manifold that emerged from the tunnel mouth and connected to the pipeline(s) by way of multiple apertures. Portals often incorporate a small complex of facilities, including valve houses, storage tanks, equipment buildings, and caretaker residences. In some instances, these utility buildings and residences have some notable architectural merit. Valve houses are typically small, one-room structures made of concrete, and their number at each portal facility usually corresponds to the number of pipelines coming into or out of the associated portal. Most other utility buildings at portal facilities follow similar construction guidelines, being of modest size and made of utilitarian materials (typically concrete). In some instances, these buildings have some notable architectural merit, most typically in the Mission Revival style. The proposed WSIP projects would affect the Irvington, Alameda West, Alameda East, Tesla, and Oakdale Portals.

- *Pump Stations*. Pump stations function to pump water from a lower elevation to a higher elevation through mechanical means. The majority of the water system functions through gravity, with water flowing downward to facilities at progressively lower elevations; however, in some instances, when the water level is particularly low in any given reservoir or the topography rises along the water's path, a pump station will raise it to the desired elevation. The only historic pump station in the system is the Crystal Springs Pump Station; this large building houses four pump mechanisms and has some notable architectural merit. A 60-inch pipe serves the pumping station, and the station pumps 80 mgd of water. The proposed WSIP projects would affect the Crystal Springs Pump Station.

- *Water Temples*. Water temples are unique structures with notable architectural merit that serve a primarily aesthetic function, though they also mark the confluence of certain water routes within the water system. Designed as circular temples in the Classical style, with fluted columns, wide entablatures, and expressive murals, they shelter an oculus that looks down into the tunnels that pass below them. The water temples are round, 60-foot tall structures surrounded by park-like open space. There are two water temples in the regional water system, Spring Valley's Sunol Water Temple and the SFPUC's Pulgas Water Temple. A proposed WSIP project would be adjacent to Pulgas Water Temple and could affect it.

- *Residences*. There are historic residences associated with water system facilities throughout the water system. Some portal facilities have caretaker cottages, while a notable neighborhood of employee residences, known as Moccasin Camp, is located near the Moccasin Powerhouse complex. This complex, typified by a unified architectural design, includes a historic administration building and powerhouse, as well as a core area of California Mission-style houses dating to the 1920s. It should be noted, however, that there are other residences in the town of Moccasin adjacent to this original core that were built in later decades. Historic houses within the water system are of various construction types and styles. Most are utilitarian in design, but some have notable architectural styling such as the residences at Moccasin Camp, which are in the California Mission style. Historic water system residences are typically modest in size. The proposed WSIP projects would affect residences, or former residences, at the Calaveras Dam and Tesla Portal sites. The residence at Calaveras Dam would be vacated during construction, but would not otherwise be affected.

- *Roads*. Roads are necessary to access facilities and water-conveying arteries throughout the system. Historic roads may still remain as accessways to historic resources, and can take the form of paved or unpaved roadways of varying lengths and widths built to fit the terrain and distance of resources from access points. Such roads are commonly subject to regular maintenance and improvement. The proposed WSIP projects would affect roads to the project sites.

4.7.2 Regulatory Framework

Federal, state, and local government laws and regulations protect significant cultural resources. As discussed below, the CEQA statute and guidelines include procedures for identifying, analyzing, and addressing potential impacts on cultural resources, and CEQA takes into account federal laws and regulations that pertain to paleontological, archaeological, and historic resources. CEQA also takes into account the laws and procedures of local California jurisdictions, such as the CCSF, that pertain to cultural resources.

The federal government, California state government, and local governments have published guidelines and standards for identifying and addressing archaeological and historical resources. Among these publications that would be useful for cultural resources studies related to the WSIP projects are the National Park Service's National Register Bulletins; the "Instructions for Recording Historical Resources" (Office of Historic Preservation, 1995); *Water Conveyance Systems in California* (JRP Historical Consulting Services and Caltrans, 2000); and "San Francisco Preservation Bulletin No. 16, CEQA Review Procedures for Historic Resources" (CCSF, 2004).

Federal

The Antiquities Act of 1906 (United States Code, Title 16, Sections 431–433) provides for fines or imprisonment of any person convicted of appropriating, excavating, injuring, or destroying any historic or prehistoric ruin or monument or other object of antiquity that falls under the jurisdiction of the federal government. According to the *Standard Environmental Reference of the California Department of Transportation* (Caltrans, 2007), the National Park Service, Bureau of Land Management, U.S. Forest Service, and other federal agencies have interpreted "objects of antiquity" to include fossils. The Antiquities Act provides for the issuance of permits to collect fossils on lands administered by federal agencies and requires projects involving federal lands to obtain permits for both paleontological resource evaluation and mitigation efforts.

Paleontological Resources Preservation Act

The federal Paleontological Resources Preservation Act of 2002 was enacted to codify the generally accepted practice of limiting the collection of vertebrate fossils and other rare and scientifically significant fossils to qualified researchers; these researchers must obtain a permit from the appropriate state or federal agency and agree to donate any materials recovered to recognized public institutions, where they will remain accessible to the public and to other researchers (USFWS/CDFG, 2006). The Paleontological Resources Preservation Act incorporates the following key findings of a recent report issued by the Secretary of the Interior, with input from staff of the Smithsonian Institute, U.S. Geological Survey, various federal land management agencies, paleontological experts, and the public (Society of Vertebrate Paleontology, 2003; as cited in USFWS/CDFG, 2006).

- Most vertebrate fossils and some fossils of other types (invertebrates, plants) represent a rare resource.
- Illegal collection and theft of fossil materials from public lands is a serious problem; penalties for fossil theft should be strengthened.
- Effective stewardship requires accurate information; federal fossil collections should be preserved and made available for research and educational use.
- Federal management of fossil resources should emphasize opportunities for public involvement.

National Register of Historic Places

The National Register of Historic Places is the official federal list of significant historic resources. The National Park Service administers the National Register in conjunction with the State Historic Preservation Officers. The National Register includes buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archaeological, or cultural significance at the national, state, or local level. The National Register criteria and associated definitions are presented in *National Register Bulletin Number 15: How to Apply the National Register Criteria for Evaluation*.

To qualify for the National Register, a property must meet at least one of the National Register criteria and retain sufficient historic integrity of convey its significance. A property that is significant under one or more of the National Register criteria must be associated with an important historical context *and* be significant within that historical context. Determining this significance is accomplished through physical examination of a property combined with thorough documentary research. National Register Bulletin 15 outlines the sequence for evaluating properties for eligibility to, and listing in, the National Register. A property must be classified as a specific property type (i.e., a building, structure, object, site, or district). Then one must identify the proper historical context (or prehistorical context) that the property represents, evaluate the property under the National Register criteria, conduct further evaluation (if necessary) for properties that are usually excluded from the National Register, and assess the historic integrity of the property.

The National Park Service uses specific definitions for property type categories. *Buildings* are used principally to shelter human activity. *Structures* are functional constructions, such as engineering features, for purposes other than creating human shelter. *Objects* are constructions that are artistic in nature, such as monuments or statuary, or simple features such as boundary markers. *Sites* are the locations of significant events that may or may not contain buildings, structures, objects, or archaeological resources. The resource boundaries of buildings, structures, and objects are limited to the resource itself, along with any setting that may contribute to its significance. *Districts* include more than one resource and “possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.”[26]

Historic districts derive their importance from being unified entities, and can include a few types of resources or a diverse set of resources. The unified quality of historic districts is a result of the interrelationships among resources, which often convey an overall visual sense of the historic environment to which the resources are associated. Districts can also be an arrangement of historically or functionally related properties, as well as a grouping of archaeological sites related by common components. Historic districts can include individually distinctive resources and/or resources that lack individual distinction but contribute to a significant or distinguishable entity or grouping of resources. This property type must be located in a definable geographic area that is distinguished from its surroundings, and these boundaries must be based on the shared relationship of the properties that constitute the district. A majority of resources in a historic district’s boundaries must retain sufficient historic integrity to convey the district’s significance as a whole.

Historic districts include contributors and non-contributors. A “contributor” is a building, site, structure, or object that adds to the historic associations or historic architectural qualities for which the district is significant. A “non-contributor” does not add to the historic associations or historic architectural qualities, as it was not present during the period of significance or has been altered in a manner that it no longer retains the historic integrity to convey the district’s significance. Besides commercial areas and residential neighborhoods, historic districts can also

[26] National Register Bulletin 15, 5.

be located in industrial or rural locations as well as in areas with a concentration of resources that are significant within a specific context, such as may be identified in portions of the SFPUC regional water system. It is possible to have discontiguous historic districts that are united in historical significance but are located in more than one definable area and separated by non-significant areas. The use of discontiguous historic districts is limited to situations where, for example, the elements of the district are spatially discrete, the spaces between elements of the district are not related to its significance, and where visual continuity is not a factor in the significance. For example, a group of dams united in a water system by plan, design, and distinct period of significance, but spatially separated from one another, could be considered a discontiguous district.[27]

When evaluating a resource under National Register criteria, one must evaluate and clearly state the significance of that resource to American history, architecture, archaeology, engineering, or culture. In this process, one must identify the historical context, or facet of history, to which a resource is associated and identify whether that context is significant. Then one can identify the resource's relative importance within that context, assess how the resource illustrates that history, and identify whether the resource has the physical features necessary to convey the history to which it is associated.

According to National Register guidelines, a historic resource's "quality of significance in American history, architecture, archeology, engineering and culture" is determined based on whether it meets at least one of four main criteria. Resources may be significant at the local, state, or national level:

> *Criterion A*: Association with events or trends significant in the broad patterns of our history.
>
> *Criterion B*: Association with the lives of significant individuals.
>
> *Criterion C*: A property that embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or that possesses high artistic values.
>
> *Criterion D*: Has yielded or is likely to yield information important to history or prehistory.

A resource may be considered eligible for listing in the National Register if it meets one or more of the above-listed criteria for significance and it possesses historic integrity. Historic properties must retain sufficient historic integrity to convey their significance. The assessment of historic integrity must be grounded in an understanding of the resource's physical features and how they relate to its significance. The National Register recognizes seven aspects or qualities that define historic integrity. They are as follows:

- *Location*. The place where the historic property was constructed or the place where the historic event occurred.

[27] National Register Bulletin 15, 5-6.

- *Design*. The combination of elements that create the form, plan, space, structure, and style of a property.
- *Setting*. The physical environment of a historic property.
- *Materials*. The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- *Workmanship*. The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- *Feeling*. A property's expression of the aesthetic or historic sense of a particular period of time.
- *Association*. The direct link between an important historic event or person and a historic property.

Certain properties and resources are usually excluded from consideration for eligibility to or listing in the National Register, but can be considered if they meet special requirements in addition to meeting the regular criteria. The following are the seven Criteria Considerations that deal with properties usually excluded from listing in the National Register:[28]

Consideration A: Religious properties

Consideration B: Moved properties

Consideration C: Birthplaces and graves

Consideration D: Cemeteries

Consideration E: Reconstructed properties

Consideration F: Commemorative properties

Consideration G: Properties that have achieved significance within the past 50 years

The WSIP is unlikely to affect most of the types of properties or resources that are usually excluded from listing in the National Register. The two criteria considerations most likely to be applied to resources that could be affected by the WSIP are Criteria Consideration B, for moved properties, and Criteria Consideration G, for properties that have achieved significance within the past 50 years. The latter criteria consideration, as discussed below in Section 4.7.3, also frames the standard to which survey populations of known and potential historic resources are identified.

Resources moved after their period of significance are usually not eligible for listing in the National Register because they have lost the relationship with their original setting and the direct association with their original location. A moved resource could be eligible for listing in the National Register, under the standards of Criteria Consideration B, if its significance is primarily architectural or if it is the sole surviving resource associated with a historic person or event.

[28] USDI, National Park Service, "How to Apply the National Register Criteria for Evaluation," *National Register Bulletin 15*, 25, 41-43; USDI, National Park Service, "Guidelines for Evaluating and Nominating Properties that have Achieved Significance within the Last Fifty Years," *National Register Bulletin No. 22* (Washington, D.C.: Government Printing Officer, 1979, revised 1990 and 1996).

Resources that are less than 50 years old are usually not eligible for listing in the National Register, unless they can be shown, under the standards of Criteria Consideration G, to be of exceptional importance.[29]

The following properties, which are known to exist as part of or related to the SFPUC water system, are either listed, or have been determined to be eligible for listing, in the National Register:[29a]

- Delia Fleishhacker Memorial Building (listed in the National Register. This site is near one of the potential locations of a recycled water treatment facility under the Recycled Water Projects, SF-3, in San Francisco.)
- Lower Crystal Springs Dam (individually eligible for listing)
- Sunol Aqueduct (individually eligible for listing)
- Sunol Dam (individually eligible for listing)[30]
- Vallejo / Spring Valley Water Company's Niles Dam (individually eligible for listing)[31]
- Spring Valley Water Company's Alameda Creek System Historic District (eligible for listing)

National Historic Preservation Act

Federal involvement in a local project through permitting, approval, or funding requires project compliance with the Code of Federal Regulations (CFR), Section 36, Part 800, Protection of Historic Properties. Several WSIP projects would require a permit from the U.S. Army Corps of Engineers. Compliance with federal regulations regarding the protection of historic properties requires completion of cultural resource studies in compliance with Section 106 of the National Historic Preservation Act. Results of these studies would require concurrence from the State Historic Preservation Officer (SHPO) and would be supplied to the Corps. A federal lead agency may also enter into a Programmatic Agreement with the SHPO to address multiple projects within a program such as the WSIP.

As mentioned previously, TCPs may be eligible for listing in the National Register under the National Historic Preservation Act (Section 101[d][6][a]), which states that "Properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the National Register."

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29 National Park Service, "How to Apply the National Register Criteria for Evaluation," *National Register Bulletin 15*, 25, 29-31, and 41-43; National Park Service, "Guidelines for Evaluating and Nominating Properties that have Achieved Significance within the Last Fifty Years," *National Register Bulletin No. 22* (Washington, D.C.: Government Printing Officer, 1979, revised 1990 and 1996).

29a These properties have been determined eligible for listing in the National Register through consensus between a federal agency and the State Historic Preservation Officer. Information regarding National Register eligibility was acquired through a records search conducted at the Northwest Information Center at Sonoma State University, which is one of regional offices of the California Historical Resources Information System established by the California Office of Historic Preservation.

30 This property was removed by the SFPUC in September 2006.

31 This property was removed by the SFPUC in September 2006.

State

California Public Resources Code

Several sections of the California Public Resources Code (PRC) protect paleontological resources. Section 5097.5 prohibits "knowing and willful" excavation, removal, destruction, injury, and defacement of any paleontologic feature on public lands (lands under state, county, city, district, or public authority jurisdiction, or the jurisdiction of a public corporation), except where the agency with jurisdiction has granted permission. Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands. The sections of the California Administrative Code pertaining to the State Division of Beaches and Parks afford protection to geological features and "paleontological materials," but grant the director of the state park system authority to issue permits for specific activities that may result in damage to such resources, if the activities are in the interest of the state park system and for state park purposes (California Administrative Code Sections 4307–4309; as cited in USFWS/CDFG, 2006).

The Public Resources Code also addresses archaeological resources. Archaeological resources that are not "historical resources" may be "unique archaeological resources" as defined in PRC Section 21083.2, which also generally provides that "non-unique archaeological resources" do not receive any protection under CEQA. PRC Section 21083.2 (g) defines "unique archaeological resource" as an archaeological artifact, object, or site that does not merely add to the current body of knowledge, but has a high probability of meeting any of the criteria identified in this section. If an archaeological resource is neither a unique archaeological nor a historical resource, the effects of the project on that resource will not be considered a significant effect on the environment. It is sufficient that the resource and the effects on it be noted in the EIR, but the resource need not be considered further in the CEQA process.

Additional sections of the Public Resources Code that are applicable to the proposed program are as follows:

- *Section 5097.5*. Provides that any unauthorized removal or destruction of archaeological or paleontological resources on sites located on public lands is a misdemeanor.
- *Section 5097.98*. Prohibits obtaining or possessing Native American artifacts or human remains taken from a grave or cairn, and sets penalties for such acts.
- *Section 5097.5*. Provides that any unauthorized removal of archaeological resources on sites located on public lands is a misdemeanor. As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

California Register of Historical Resources

The California Register of Historical Resources is a statewide program of similar scope to the National Register. All resources listed in or formally determined eligible for the National Register are also eligible for listing in the California Register. In addition, properties designated under municipal or county ordinances are also eligible for the California Register. A historical resource must be significant at the local, state, or national level under one or more of the following criteria defined in the California Code of Regulations, Title 14, Chapter 11.5, Section 4850, identified as Criteria 1 through 4.

1. It is associated with events or patterns of events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; or

2. It is associated with the lives of persons important to local, California, or national history; or

3. It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values; or

4. It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

The California Register definition of integrity and its special considerations for certain properties are slightly different than those for the National Register. Integrity is defined as "the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance." The California Register further states that eligible resources must "retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance," and lists the same seven aspects of integrity used for evaluating properties under the National Register criteria. The California Register's special considerations for certain properties types are limited to: (1) moved buildings, structures, or objects; (2) historical resources achieving significance within the past 50 years; and (3) reconstructed buildings.

The following properties, which are known to exist as part of or related to the SFPUC water system, are either listed or have been determined to be eligible for listing in the California Register:

- *Delia Fleishhacker Memorial Building*. This building is listed in both the National and California Registers.
- *Sunol Aqueduct*. This facility is eligible for listing in both the National and California Registers.
- *Lower Crystal Springs Dam*. This dam is listed as a California Historic Civil Engineering Landmark and in the California Inventory of Historical Resources; it is eligible for listing in the California Register.
- *Hetch Hetchy Coast Range Tunnel*. This facility is listed as a California Historic Civil Engineering Landmark and appears to meet the criteria or listing in the National and California Register.
- *Stone Dam*. This dam is eligible for landmark status (San Francisco Department of Public Works, 1999) and is eligible for listing in the California Register.

Niles and Sunol Dams were removed in August and September 2006, respectively. Section 106 consultation was completed in August 2006 prior to the removal of Niles Dam. The EIR for this project concluded that the demolition created a significant unavoidable impact on these historical resources.

California Environmental Quality Act Statute and Guidelines

The CEQA Statute and Guidelines include procedures for identifying, analyzing, and disclosing potential adverse impacts on cultural resources, which include all resources listed in or formally determined eligible for the National Register, the California Register, or local registers.

CEQA requires the lead agency to consider the effects of a project on archaeological resources and to determine whether any identified archaeological resource is a historical resource (i.e., if the archaeological resource meets the criteria for listing in the California Register) (CEQA Guidelines Sections 15064.5[a][1] and [3] and [c][1] and [2]). An archaeological resource that qualifies as a historical resource under CEQA generally qualifies for listing under Criterion 4 of the California Register (CEQA Guidelines Section 15064.5[a][3][D]) (National Register Criterion D). An archaeological resource may qualify for listing under Criterion 4 when it can be demonstrated that the resource has the potential to significantly contribute to questions of scientific or historical importance. Archaeological resources that are not historical resources according to the above definitions may be “unique archaeological resources,” as defined in PRC Section 21083.2, which generally provides that “non-unique archaeological resources” do not receive any protection under CEQA. If an archaeological resource is neither a unique archaeological resource nor a historical resource, the effects of a project on those resources are not considered significant.

CEQA defines a historical resource as a resource that meets any of the following criteria:

- A resource listed in, or determined to be eligible for listing in, the National Register or California Register.
- A resource included in a local register of historical resources, as defined in PRC Section 5020.1(k), unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
- A resource identified as significant (e.g., rated 1 through 5) in a historical resource survey meeting the requirements of PRC Section 5024.1(g) (Department of Parks and Recreation Form 523), unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
- Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the determination is supported by substantial evidence in light of the whole record. Generally, a resource is considered “historically significant” if it meets the criteria for listing in the California Register (CEQA Guidelines Section 15064.5).
- A resource that is determined by a local agency to be historically or culturally significant even though it does not meet the other four criteria listed here (e.g., Article 10 and Article 11 of the San Francisco Planning Code).

According to the CEQA Guidelines (Section 15064.5[a][3]), a resource is generally considered historically significant if the resource meets the criteria for listing in the California Register (PRC Section 5024.1, California Code of Regulations, Title 14, Section 4852). A historical resource is defined as any site that:

1. Is listed in or determined to be eligible by the State Historical Resources Commission for listing in the California Register, or is determined to be significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, or cultural annals of California; and

2. Is eligible for listing in the California Register (criteria noted above); or

3. Is included in a local register of historical resources, as defined by PRC Section 5020.1(k), or identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.l(g), is presumed to be historically or culturally significant.

Archaeological resources may be historical resources under CEQA. TCPs may also be eligible for the California Register under Section 15064.5[a][3]. CEQA Guidelines Section 15064.5 provides that, in general, a resource not listed in state or local registers of historical resources shall be considered by the lead agency to be historically significant if the resource meets the criteria for listing in the California Register. Section 15064.5(b) states that “a project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment.” This section also provides standards for determining what constitutes a “substantial adverse change” on archaeological or historical resources, including physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the historical resource would be materially impaired (CEQA Guidelines Section 15064.5[b][1]). The significance of a historical resource is considered to be materially impaired when a project demolishes or materially alters in an adverse manner those characteristics that convey its historical significance and that justify its inclusion on a historical resource list (CEQA Guidelines 15064.5[b][2]).

California Health and Safety Code

The proposed program is also subject to the provisions of the California Health and Safety Code with respect to the discovery of human remains. Health and Safety Code Section 7050.5 states that “Every person who knowingly mutilates or disinters, wantonly disturbs, or willfully removes any human remains in or from any location other than a dedicated cemetery without authority of law is guilty of a misdemeanor, except as provided in Section 5097.99 of the Public Resources Code.” PRC Section 5097.98, as amended by Assembly Bill 2641, states:

(a) Whenever the commission receives notification of a discovery of Native American human remains from a county coroner pursuant to subdivision (c) of Section 7050.5 of the Health and Safety Code, it shall immediately notify those persons it believes to be most likely descended from the deceased Native American. The descendents may, with the permission of the owner of the land, or his or her authorized representative, inspect the site of the discovery of the Native American human remains and may recommend to the owner or the person responsible for the excavation work means for treatment or disposition, with appropriate dignity, of the human remains and any associated grave goods. The descendents shall complete their inspection and make recommendations or preferences for treatment within 48 hours of being granted access to the site.

(b) Upon the discovery of Native American remains, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section, with the most likely descendents regarding their recommendations, if applicable, taking into account the possibility of multiple human remains. The landowner shall discuss and confer with the descendents on all reasonable options regarding the descendents' preferences for treatment.

City and County of San Francisco

Planning Code, Articles 10 and 11

The CCSF reviews the historic resources described under Articles 10 and 11 of the San Francisco Planning Code when it evaluates impacts on historic resources (see "Significance Criteria" below). Article 10 describes procedures regarding the preservation of sites and areas of special character or special historical, architectural, or aesthetic interest or value, such as officially designated city landmarks and buildings included within locally designated historic districts. Article 11 of the Planning Code designated six downtown conservation districts.

Historical Resources in the WSIP Study Area under Articles 10 and 11. There are no designated city landmarks or properties that contribute to designated historic districts in the WSIP study area.

Planning Department, CEQA Review Procedures for Historic Resources

The San Francisco Planning Department prepared the *CEQA Review Procedures for Historic Resources* (Final Draft, October 8, 2004, subject to change) (also referred to as San Francisco Preservation Bulletin No. 16) to determine whether a potential property or structure fits the definition of a historical resource as defined in the CEQA Statutes and Guidelines. Three categories of properties are defined.

- Category A. Category A has two sub-categories:
  - *Category A.1*. Resources listed in or formally determined to be eligible for the California Register.
  - *Category A.2*. Resources listed in adopted local registers, or properties that appear eligible, or may become eligible, for the California Register.
- Category B. Properties requiring further consultation and review.
- Category C. Properties determined not to be historical resources, or properties for which the city has no information indicating that the property is a historical resource.

Planning Department Citywide Survey (1976)

Between 1974 and 1976, the San Francisco Planning Department conducted a citywide inventory of the city's approximately 170,000 structures to determine their architectural importance. The physical appearance of both contemporary and older buildings was surveyed, but historical associations were not included in the study. An advisory review committee of architects and architectural historians determined that 10,000 of these buildings were eligible for inclusion in the survey based on various factors such as architectural design, urban design context, and overall environmental significance. These buildings represent roughly 10 percent of the city's entire building stock. Buildings included in the survey are rated from a low of 0 (least significant) to a high of 5 (most significant).

1976 Survey Properties in the WSIP Study Area. There are no WSIP facilities rated in the 1976 survey.

Other Cities and Counties

CEQA guidelines state that a resource does not need to be listed in or determined eligible for listing in the California Register for it to be considered a historical resource for the purposes of compliance under CEQA. Section 15064.5(a)(4) of the CEQA Guidelines provides for a lead agency to identify resources that are of historical significance and to categorize those resources as historical resources. This is usually accomplished with a city or county list of designated historic landmarks. In addition, some local governments identify historical resources to include previously recorded resources that were determined to have some measure of historical significance. Jurisdictions adjacent to the WSIP facility improvement projects, outside of San Francisco, may identify historical resources differently from one another.

Some WSIP projects have the potential to affect properties outside of the SFPUC right-of-way in areas outside of San Francisco. In locations where the study area of a WSIP project extends beyond the water system right-of-way in areas outside of San Francisco, CEQA compliance documentation related to historical resources should identify whether there are buildings, structures, objects, sites, or districts that the adjacent jurisdiction would consider to be historical resources. This effort would include verifying that resources other than SFPUC water system resources are neither local historical landmarks nor have been identified in some manner as potential historical resources. In addition to evaluating resources under National Register and California Register criteria, it may also be appropriate for WSIP project-level analyses to evaluate buildings, structures, objects, sites, and/or districts situated outside of the SFPUC right-of-way, in areas outside of San Francisco, under the historic landmarks and historical resources criteria of those adjacent jurisdictions.

4.7.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to cultural resources, but generally considers that implementation of the proposed program would have a significant impact on cultural resources if it were to:

- Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5, including those resources listed in Article 10 or Article 11 of the San Francisco Planning Code (Evaluated in this section)
- Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to Section 15064.5 (Evaluated in this section)
- Directly or indirectly destroy a unique paleontological resource or site or unique geological feature (Evaluated in this section)
- Disturb any human remains, including those interred outside of formal cemeteries (Evaluated in this section)

Approach to Impact Analysis

The WSIP study area was screened at a programmatic level to determine the potential for WSIP projects to encounter historical resources as well as paleontological and archaeological resources. The evaluation of paleontological impacts (Impact 4.7-1) considered areas with known fossil localities and fossil-bearing geologic units. The evaluation of archaeological sensitivity (Impact 4.7-2) focused on areas favorable to human settlement.

The WSIP has the potential to cause substantial adverse changes in the historical significance of historical resources, as defined in CEQA Guidelines Section 15046.5. An analysis to assess whether the program would cause a substantial adverse change is only required for those resources that are or should be considered historical resources for the purposes of CEQA. Historical resources that could be affected by the WSIP include both individual resources and historic districts. There are three categories of impacts on historical resources, as follows:

- Impacts on a historic district or a contributor to a historic district (Impact 4.7-3)
- Impacts on individual resources that are part of the water system (Impact 4.7-4)
- Impacts on individual resources located adjacent to a WSIP facility improvement project (Impact 4.7-5)

These resources are assessed in this PEIR at a programmatic level. This review will be further refined, based on site-specific information, during separate project-level CEQA review of individual WSIP projects. The following text provides guidance in addressing the identification of historical resources that could be affected by the WSIP. This introduction is followed by a discussion of impacts on known or potential cultural resources, organized by WSIP region.

Table 4.7-1 lists potential impacts of the WSIP on paleontological, archaeological, and historical resources, divided into the three categories. Further identification of these resources will occur as part of the project-level analysis for individual WSIP projects. These project-level analyses will require identification of an appropriate study area and identification of known and potential historical resources that could be affected by the WSIP projects. Potential impacts could include direct, indirect, and cumulative impacts. In urban areas, it may be appropriate for the study area to include parcels or properties that are adjacent to a proposed facility improvement project. In rural areas, it would not likely be necessary for the study area to encompass entire large parcels if the WSIP project would only affect a portion of that property. Following standard cultural resources practices, which allow for time between environmental review and actual construction, resources that are more than 45 years old within the study area of a WSIP project will be considered part of the survey population of potential historical resources.[32] The inventory and evaluation process for project-level analyses will include the following tasks:

- Further refine the historical context(s) for the resources in the project study area
- Evaluate resources under National Register, California Register, CCSF historic landmarks, and other local landmarks criteria (if appropriate)
- Identify appropriate potential historical periods of significance for resources in a study area
- Identify character-defining features of individual properties and historic districts that should be considered historical resources for the purposes of CEQA compliance

Analysis regarding the potential impacts of a project on historical resources and the identification of mitigation measures to reduce the impacts depend on the identification of an appropriate period of significance, along with identification of the character-defining features that help convey the significance of the individual historical resources or historic districts. An appropriate historical context and period of significance for resources will be determined during the project-level CEQA analyses, based on an understanding of the history and importance of the components of the water-delivery system. This programmatic analysis lays the foundation for these project-level analyses.

Impact Summary by Region

Table 4.7-1 provides a summary of the cultural resources impacts associated with implementation of the WSIP.

[32] The California Office of Historic Preservation's guidelines for project review and planning call for the identification and evaluation of resources more than 45 years old to account for the passage of time between the period of project review and project completion. See Office of Historic Preservation, "Instructions for Recording Historical Resources," March 1995, 2.

TABLE 4.7-1
POTENTIAL IMPACTS AND SIGNIFICANCE – CULTURAL RESOURCES

Projects	Project Number	Impact 4.7-1: Impacts on paleontological resources	Impact 4.7-2: Impacts on archaeological resources	Impact 4.7-3: Impacts on historical significance of a historic district or a contributor to a historic district	Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration	Impact 4.7-5: Impacts on adjacent historic architectural resources
San Joaquin Region						
Advanced Disinfection	SJ-1	PSM	PSM	PSM	PSM	LS
Lawrence Livermore Supply Improvements	SJ-2	LS	PSM	N/A	N/A	LS
San Joaquin Pipeline System	SJ-3	PSM	PSM	PSM	PSM	PSM
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	PSM	PSM	PSM	PSM	PSM
Tesla Portal Disinfection Station	SF-5	PSM	PSM	N/A	N/A	PSM
Sunol Valley Region						
Alameda Creek Fishery Enhancement	SV-1	PSM	PSM	N/A	N/A	LS
Calaveras Dam Replacement	SV-2	PSM	PSM	PSU	PSU	PSM
Additional 40-mgd Treated Water Supply	SV-3	PSM	PSM	N/A	N/A	LS
New Irvington Tunnel	SV-4	PSM	PSM	PSM	PSU	PSM
SVWTP – Treated Water Reservoirs	SV-5	PSM	PSM	N/A	N/A	LS
San Antonio Backup Pipeline	SV-6	PSM	PSM	PSM	PSM	PSM
Bay Division Region						
Bay Division Pipeline Reliability Upgrade	BD-1	LS	PSM	PSM	PSM	PSM
BDPL Nos. 3 and 4 Crossovers	BD-2	LS	PSM	PSM	PSM	PSM
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	PSM	PSM	PSM	PSM	PSM
Peninsula Region						
Baden and San Pedro Valve Lots Improvements	PN-1	PSM	PSM	N/A	N/A	LS
Crystal Springs/San Andreas Transmission Upgrade	PN-2	LS	PSM	PSU	PSU	PSM
HTWTP Long-Term Improvements	PN-3	PSM	PSM	N/A	N/A	LS
Lower Crystal Springs Dam Improvements	PN-4	LS	PSM	PSM	PSU	PSM
Pulgas Balancing Reservoir Rehabilitation	PN-5	PSM	PSM	N/A	N/A	PSM
San Francisco Region						
San Andreas Pipeline No. 3 Installation	SF-1	PSM	PSM	PSM	PSM	PSM
Groundwater Projects	SF-2	PSM	PSM	N/A	N/A	LS
Recycled Water Projects	SF-3	PSM	PSM	N/A	LS	PSM

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant Unavoidable impact
SU = Significant Unavoidable impact
N/A = Not Applicable

Paleontological Resources

Impact 4.7-1: Impacts on paleontological resources.

This paleontological analysis identifies the potential to encounter paleontological resources (i.e., plant, animal, or invertebrate fossils or microfossils) in each WSIP region based on the following factors: the number of known fossil localities, the geologic formations (units) where these fossils occur, and the presence of fossil-bearing geologic units relative to WSIP facility locations. This analysis was conducted using local, available paleontology information provided through the University of California Museum of Paleontology Collections Database. The geological setting of the known fossil localities was determined using the geological map of the San Francisco–San Jose quadrangle prepared by the California Geological Survey (Wagner et al., 1991). By applying the fossil locality data and geological information from these sources, the distribution and abundance of fossil localities within fossil-bearing units in each WSIP region were determined. Based on this information, the paleontological sensitivity (or potential for discovery of paleontological resources during implementation) was determined for each WSIP project. The determination of whether a certain project has the potential to encounter a paleontological resource was based on the following criteria:

- The project is located in an area underlain by geologic materials known to contain fossils or microfossils of animals, invertebrates, or plants. In the WSIP study area, these geologic units are primarily marine sedimentary deposits ranging in age from 65 million years old (Paleocene epoch) to 10,000 years old (Pleistocene epoch).
- A fossil locality is within the project site, or the project site is in proximity to other fossil localities within the same or similar geologic unit.

These criteria were applied to the WSIP project information provided in Chapter 3, Program Description, and Appendix C to determine whether the WSIP projects would have the potential to disturb or destroy a paleontological resource and thus cause a significant impact. If the proposed project would be located in a fossil-bearing geologic unit or there are several nearby or regional fossil localities in the same geologic unit, the potential to encounter paleontological resources would be high. If the proposed project would be located in a geologic formation that is not typically fossil-bearing and no or very few recorded fossil localities exist in the geologic material, there would be a low potential to encounter paleontological resources. **Figure 4.7-1** generally indicates areas of paleontological sensitivity in the vicinity of WSIP facilities.

Paleontological resources could be disturbed during project excavation, deep grading, and tunneling. Destruction of a paleontological resource during construction of any of the WSIP projects would be considered a significant impact. **Table 4.7-2** indicates the geologic formation in which each WSIP project is located, whether fossils have been identified in the project area, the potential to encounter paleontological resources, and a determination of impact significance. As shown in this table, there is a high potential for the occurrence of paleontological resources in all five of the regions within the WSIP study area. Potential project impacts are discussed by region below. SFPUC Construction Measure #9 (cultural resources) requires that a qualified paleontologist or state-registered geologist conduct a preconstruction screening for paleontological resources, that impacts on identified cultural resources be avoided to the extent feasible, and that soil-disturbing construction work be immediately suspended if there is any indication of a paleontological resource. Table 4.7-2 describes the WSIP projects as having either a high potential or a low potential for impacts on paleontological resources. The preconstruction screenings required under Construction Measure #9 would analyze site-specific information, which would either confirm these program-level determinations or provide a basis to revise them.

For projects with a low potential to encounter paleontological resources, the implementation of SFPUC Construction Measure #9 (cultural resources) would ensure that impacts are less than significant.

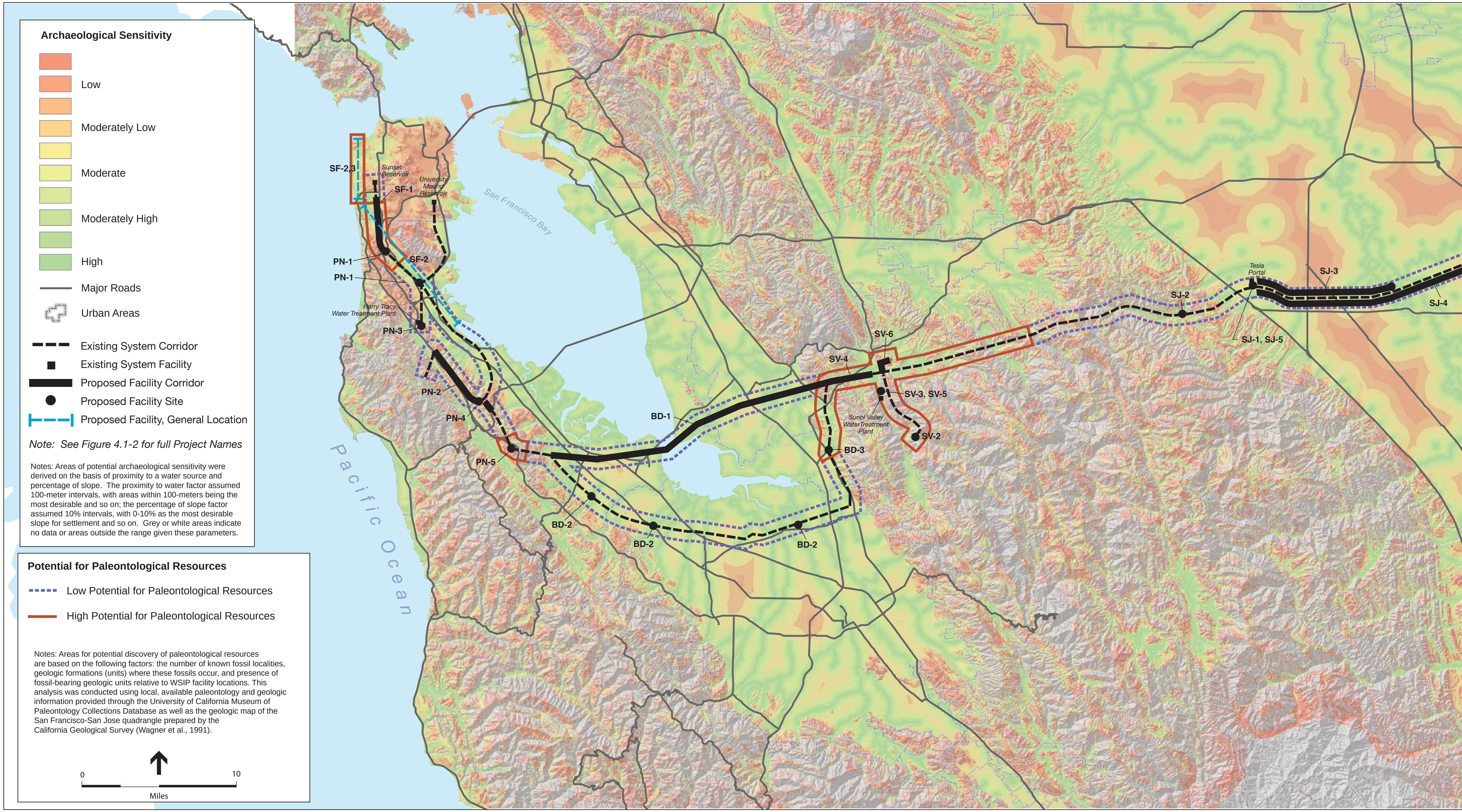
For projects that would require subsurface disturbance in areas with a high potential to encounter paleontological resources, the impact would be potentially significant and would require additional mitigation to protect the resources. If a paleontological resource is encountered, it would be necessary to suspend work and have the site inspected by a qualified paleontologist (Measure 4.7-1), which would reduce this impact to a less-than-significant level.

San Joaquin Region

Impact 4.7-1: Impacts on paleontological resources		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

In the San Joaquin Region, the Advanced Disinfection (SJ-1), SJPL System (SJ-3), SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5) projects would have the highest potential for encountering and disturbing paleontological resources because they overlie fossil-bearing marine sedimentary rocks and are located in areas that have several existing recorded fossil localities. The Advanced Disinfection and Tesla Portal Disinfection project sites at Tesla Portal are underlain by geologic units that are known to contain fossil remains (in this case, possibly the San Pablo Group or other closely related fossil-bearing sandstone or siltstone deposits). A fossil locality has been identified (Locality No. 3315) at or very near the Advanced Disinfection project site. The proposed SJPL System and SJPL Rehabilitation projects would require excavation into the Mehrten Formation, a geologic unit that is known to contain fossil remains. Given the high likelihood that these projects could affect paleontological resources, this impact would be *potentially significant*, but could be reduced to a less-than-significant level by suspending work if a paleontological resource is identified and having the site inspected by a qualified paleontologist (Measure 4.7-1).

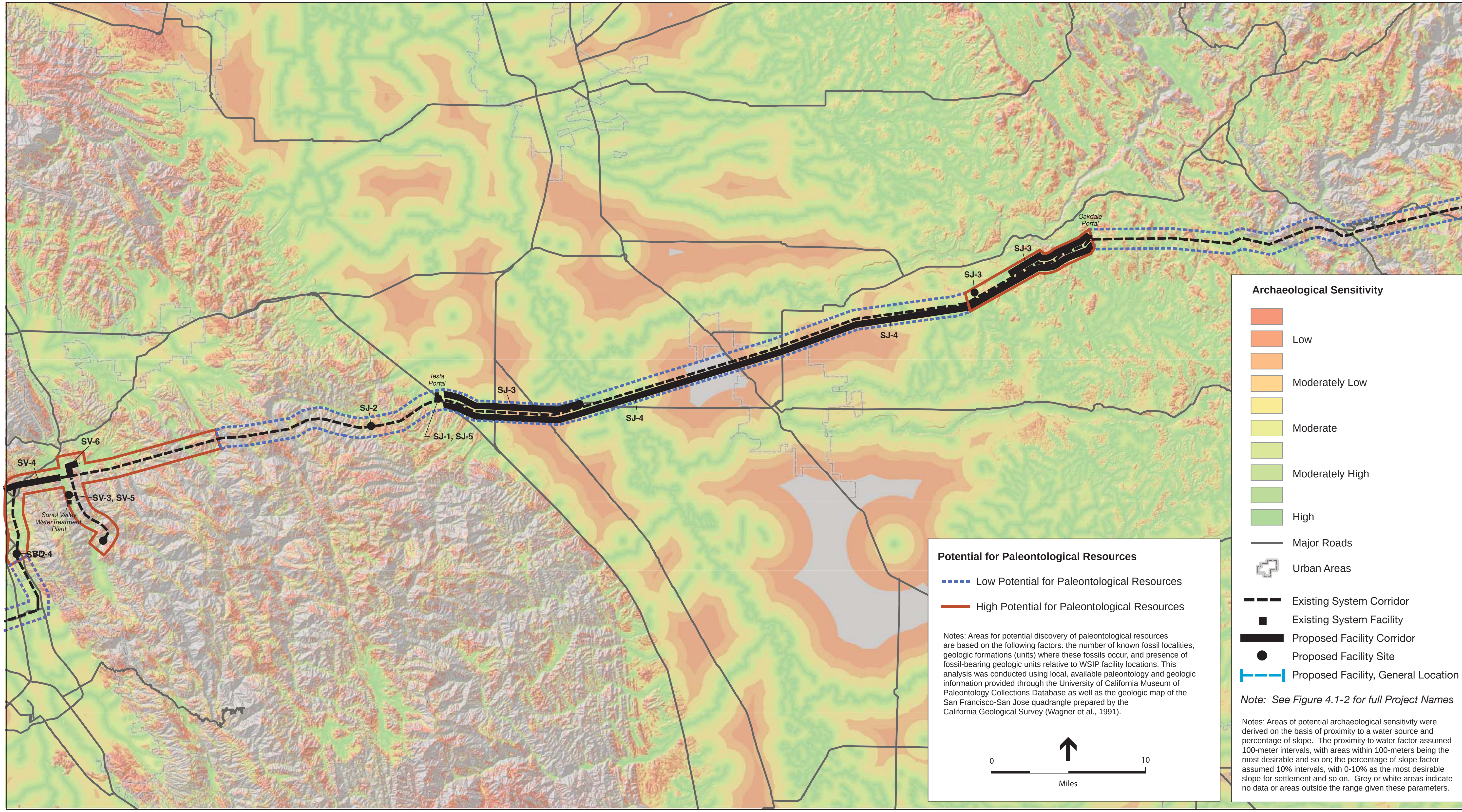
The proposed Lawrence Livermore project (SJ-2) is located in an area underlain by the Franciscan Complex, and fossil remains are not likely present. With implementation of SFPUC Construction Measure #9 (cultural resources), which includes a preconstruction paleontological screening and suspension of construction work if a paleontological resource is identified, impacts from the Lawrence Livermore project would be *less than significant*.



SOURCE: ESA + Orion; SFPUC, 2007

SFPUC Water System Improvement Program . 203287

Figure 4.7-1a
Archaeological Sensitivity and Potential for Paleontological Resources in the WSIP Study Area



SOURCE: ESA + Orion; SFPUC, 2007

Figure 4.7-1b
Archaeological Sensitivity and Potential for Paleontological Resources in the WSIP Study Area

TABLE 4.7-2
POTENTIAL FOR PALEONTOLOGICAL IMPACTS

Project No.	Project Name	Would the WSIP project be located in an area of geologic formations where there is a high likelihood of paleontological impact?[a]	Have fossil localities been identified at other locations within the geologic formation?[a]	What is the potential for impacts on paleontological resources?	Impact significance
San Joaquin Region					
SJ-1	Advanced Disinfection	Yes, San Pablo Group, other marine deposits	Yes	High	PSM
SJ-2	Lawrence Livermore Supply Improvements	No, Franciscan Complex	No	Low	LS
SJ-3	San Joaquin Pipeline System	Yes, Mehrten Formation	Yes	High	PSM
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	Yes, Mehrten Formation	Yes	High	PSM
SJ-5	Tesla Portal Disinfection Station	Yes, San Pablo Group, other marine deposits	Yes	High	PSM
Sunol Valley Region					
SV-1	Alameda Creek Fishery Enhancement	Yes, possible marine sedimentary rocks	Yes	High	PSM
SV-2	Calaveras Dam Replacement	Yes, Monterey Formation, Panoche Formation, other sedimentary rocks	Yes	High	PSM
SV-3	Additional 40-mgd Treated Water Supply	Yes, Monterey Formation, Panoche Formation, other sedimentary rocks	Yes	High	PSM
SV-4	New Irvington Tunnel	Yes, possible Panoche Formation, other sedimentary rocks	Yes	High	PSM
SV-5	SVWTP – Treated Water Reservoirs	Yes, Monterey Formation, Panoche Formation, other sedimentary rocks	Yes	High	PSM
SV-6	San Antonio Backup Pipeline	Yes, marine sedimentary rocks	Yes	High	PSM
Bay Division Region					
BD-1	Bay Division Pipeline Reliability Upgrade	No, young valley basin alluvium	No	Low	LS
BD-2	BDPL Nos. 3 and 4 Crossovers	No, young valley basin alluvium	No	Low	LS
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Potentially yes, in either Plio-Pleistocene Santa Clara or Livermore/Irvington Gravels, or in young valley basin alluvium	Yes	High	PSM
Peninsula Region					
PN-1	Baden and San Pedro Valve Lots Improvements	Yes, Butano Sandstone/Whiskey Hill Formation	Yes	High	PSM
PN-2	Crystal Springs/San Andreas Transmission Upgrade	No, Franciscan Complex	No	Low	LS

TABLE 4.7-2 (Continued)
POTENTIAL FOR PALEONTOLOGICAL IMPACTS

Project No.	Project Name	Would the WSIP project be located in area of geological formations where there is a high likelihood of paleontological impact?	Have fossil locations been identified at other locations within the geologic formation?	What is the potential for impacts on paleontological resources?	Impact significance
Peninsula Region (cont.)					
PN-3	HTWTP Long-Term Improvements	Yes, marine deposits, possible Merced Formation	Yes	High	PSM
PN-4	Lower Crystal Springs Dam Improvements	No, Franciscan Complex	No	Low	LS
PN-5	Pulgas Balancing Reservoir Rehabilitation	Yes, marine deposits, possible Butano Formation and other marine sandstones and shale	Yes	High	PSM
San Francisco Region					
SF-1	San Andreas Pipeline No.3 Installation	Yes, marine sedimentary rocks	Yes	High	PSM
SF-2	Groundwater Projects	Yes, marine sedimentary rocks	Yes	High	PSM
SF-3	Recycled Water Projects	Yes, possible marine deposits	Yes	High	PSM

[a] Based on the information provided in Figure 4.7-1.
[b] Based on the information provided in Appendix C, Table C.4, all WSIP projects would either involve some level of excavation, or excavation is yet to be determined. For this analysis, a conservative assessment is made that excavation will occur and have an impact on paleontological resources.

Sunol Valley Region

Impact 4.7-1: Impacts on paleontological resources		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

Projects in the Sunol Valley Region would be located, for the most part, in an area underlain by marine sedimentary rocks, including the Panoche Formation, Monterey Formation, and other fossil-bearing, marine and non-marine sandstone, siltstone, or gravel deposits. Fossil localities have been identified in the Sunol Valley and surrounding area (UCMP, 2006).

Construction and excavation required for the Alameda Creek Fishery project (SV-1) could encounter paleontological resources in the Sunol Valley, an area where geologic conditions and recorded localities indicate the likely presence of fossils. Considering the amount of excavation and grading for the Calaveras Dam project (SV-2), and the discovery of a nearby fossil locality (Locality No. 3937), the potential to encounter paleontological resources during this project is considered high. The 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) sites are underlain by the sedimentary, fossil-bearing Monterey and Panoche Formations, so the potential for encountering paleontological resources is also considered high. The New Irvington Tunnel project (SV-4) would likely bore through sedimentary geologic formations, including the Panoche Formation, that contain fossil remains; therefore, this project is considered to have a high potential for encountering and disturbing paleontological resources. Construction and excavation work associated with the SABUP project (SV-6) would take place in marine sedimentary rocks at the southwest end of San Antonio Reservoir and could encounter paleontological resources.

Given the high likelihood that the projects in this region could affect paleontological resources, this impact would be *potentially significant*, but could be reduced to a less-than-significant level by suspending work if a paleontological resource is identified and having the site inspected by a qualified paleontologist (Measure 4.7-1).

Bay Division Region

Impact 4.7-1: Impacts on paleontological resources		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Two WSIP projects in the Bay Division Region (BDPL Reliability Upgrade, BD-1, and BDPL 3 and 4 Crossovers, BD-2) would be located in areas of the Santa Clara Valley that are underlain by young alluvial deposits. The deposits include unconsolidated basin deposits containing geologically young gravel, sand, silts, and clays as well as intertidal deposits such as soft mud and peat. There is a low likelihood that notable paleontological resources would be encountered during excavation and grading for these projects because of the relatively young geologic age of these deposits. In Santa Clara County, the majority of fossil localities are in geologically older sandstones, siltstones, and shale found in the uplands surrounding the Santa Clara Valley, a considerable distance from these WSIP projects.

With implementation of SFPUC Construction Measure #9 (cultural resources), which includes a preconstruction paleontological screening and suspension of construction work if a paleontological resource is identified, potential impacts would be *less than significant* for these two projects.

Due to the relative complexity of the surrounding geology, the third WSIP project in this region, BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3), could be underlain by a fossil-bearing, non-marine formation (either the Santa Clara Formation or Livermore/Irvington Gravels) or a young valley alluvium that would be less likely to contain paleontological resources. Due to the presence of fossil-bearing, non-marine sedimentary deposits, there is a high potential to encounter paleontological resources at this project site. This determination, as with other WSIP projects, would be reevaluated based on site-specific information as part of separate, project-level CEQA review. Given the high likelihood that this project could affect paleontological resources, the impact would be *potentially significant*, but could be reduced to a less-than-significant level by suspending work if a paleontological resource is identified and having the site inspected by a qualified paleontologist (Measure 4.7-1).

Peninsula Region

Impact 4.7-1: Impacts on paleontological resources		
Baden and San Pedro Valve Lots	PN-1	PSM
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	PSM

Paleontological resources could be encountered during construction work for the Baden and San Pedro Valve Lots (PN-1), HTWTP Long-Term (PN-3), and Pulgas Balancing Reservoir (PN-5) projects. These project areas overlie marine sedimentary geologic units that have recorded fossil localities. The HTWTP Long-Term project overlies the Merced Formation, a marine sandstone, siltstone, claystone, and conglomerate deposit that contains numerous invertebrate fossil localities throughout the San Francisco Peninsula. The Pulgas Balancing Reservoir and Baden and San Pedro Valve Lots Improvements projects include construction at the southern end of Crystal Springs Reservoir, in areas underlain by Butano Formation sandstone/Whiskey Hill Formation[32a] and other fossil-bearing marine sandstones and shales. The Butano Formation/Whiskey Hill Formation contains numerous fossil localities throughout San Mateo County (UCMP, 2006). Given the high likelihood that these projects could affect paleontological resources, this impact would be *potentially significant*, but could be reduced to a less-than-significant level by suspending work if a paleontological resource is identified and having the site inspected by a qualified paleontologist (Measure 4.7-1).

[32a] The Whiskey Hill Formation was previously mapped as the Butano sandstone. However, in 1993 the USGS determined that the Butano sandstone was actually composed of two similar sandstones indistinguishable in lithology and age but separated by the San Andreas-Pilarcitos fault system and having different stratigraphic relations to other geologic units. As a result of this determination, the geologic unit in the vicinity of the southern end of Crystal Springs Reservoir is now identified as the Whiskey Hill Formation, but references prepared prior to 1993 (including the University of California Museum of Paleontology Collections Database) refer to the Butano sandstone instead of the Whiskey Hill Formation. For this reason, the formation is referred to as the Butano sandstone/Whiskey Hill Formation in this analysis.

The CS/SA Transmission (PN-2) and Lower Crystal Springs Dam (PN-4) projects would be located in areas underlain by the chaotically mixed Franciscan Complex rocks. There are few, if any, recorded fossil localities in this area of the Santa Cruz Mountains. Proposed construction excavation and grading work at these project sites would not likely encounter paleontological resources. With implementation of SFPUC Construction Measure #9 (cultural resources), which includes a preconstruction paleontological screening and suspension of construction work if a paleontological resource is identified, potential impacts would be *less than significant* for these two projects.

San Francisco Region

Impact 4.7-1: Impacts on paleontological resources		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

All three projects in the San Francisco Region would be located in areas mapped as marine sedimentary deposits, including the Merced and Colma Formations. Several fossil localities have been recorded in the Merced Formation and, to a lesser degree, the Colma Formation. Excavation, grading, and well drilling work in these areas could encounter and disturb paleontological resources, such as invertebrate fossils and microfossils. The SAPL 3 Installation project (SF-1) would involve excavation to remove historic pipes and install pipes within new alignments, which could affect subsurface paleontological resources. Project-level studies would be conducted to evaluate the likelihood of buried sites along the alignment as part of separate, project-level CEQA review. The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could also involve excavation. Given the high likelihood that these projects could affect paleontological resources, the impacts would be *potentially significant*, but could be reduced to a less-than-significant level by suspending work if a paleontological resource is identified and having the site inspected by a qualified paleontologist (Measure 4.7-1).

Archaeological Resources

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources.

This analysis provides a programmatic assessment of potential impacts on important archaeological resources that could result from the WSIP projects. Due to the geographic scale of the WSIP study area and the wide range of actions that fall within the scope of the WSIP, impacts on specific archaeological resources at each project site are not addressed in this PEIR, but would be assessed as part of separate, project-level CEQA review for each WSIP project. During these project-level reviews, cultural resource sites that have been previously identified and recorded would be reevaluated in accordance with Section 15064.5(a)(2)(3) of the CEQA Guidelines, if appropriate, using the criteria outlined in PRC Section 5024.1. Project-level reviews would also include communication with the Native American Heritage Commission. (This work must be performed on a project rather than program level, since the commission requires specific location information to effectively search its database of sacred lands.)

To identify areas within the WSIP study area where archaeological resources might be found, a predictive model was developed using a geographic information system (GIS). The purpose of a predictive model is to project known patterns and relationships into unknown areas. In the case of archaeological predictive modeling, the primary assumption is that archaeological sites tend to be found in areas favorable to human settlement. Although the focus of this model is to predict prehistoric settlements, the model might also be useful in studying younger historic resources, because areas favorable to settlement in the prehistoric era are likely to have continued as such during the historic period.

Given the size of the WSIP study area and the limitations on available datasets, only two dominate variables were considered for this model: distance-cost to water and slope percentage. In general, this model assumes that prehistoric people settled fairly close to water, as described previously under "Archaeological / Prehistoric-Period Setting," and tended to live on relatively level ground. Other datasets were not useful as screening tools for determining archaeological sensitivity on a regional scale. For example, soil type was not considered due to the wide variability of soils in the study area. Consequently, the model is highly conservative in predicting whether sites would likely be located within a given geographic area. Figure 4.7-1 generally indicates the archaeological sensitivity of areas in the vicinity of WSIP facilities.

After areas of potential archaeological sensitivity were identified, the potential impacts from projects were evaluated. In general, projects that entail minor surface disturbance would likely result in less-than-significant impacts on archaeological resources. Projects on sites that are already surfaced, drained, or otherwise modified from native conditions also have a lower potential to affect archaeological resources. Projects that require the movement of large quantities of sediment would have the potential to cause more significant impacts. Any physical disturbance of significant historic and prehistoric archaeological resources could result in the permanent loss of scientific information that could contribute to our understanding of the past.

Potential impacts on archaeological resources are generally described below for the types of facilities and facility projects that would be implemented under the WSIP. Following this overview is a discussion of each WSIP project by region.

Pipelines. The standard pipeline installation method proposed for the WSIP projects is the open-cut trench method. With this method, the construction area would extend for the length of the pipeline and would have a width dependent on the size of the pipe. In archaeologically sensitive areas where known site locations would be directly affected, "trenchless" construction techniques such as jack-and-bore or microtunneling could be used to minimize impacts. Where pipeline installation or replacement is not required, sliplining might be possible. For trenchless pipeline construction and sliplining, vehicle access and a work area would be required for each pit or entry point. Some land would be temporarily used for construction or staging areas, while a small amount would be permanently committed to accessways, valves, and other control structures. In some cases, the disturbance of a surface area for staging activities could adversely affect archaeological deposits at the surface.

Tunnels. Impacts on archaeological resources could occur at portals and shaft openings. The construction area at the entry portal would be the largest, as it must accommodate the portal/shaft entry, vehicles, spoils, equipment, and materials storage. Construction areas at exit portals and shaft openings would require vehicle access and a smaller work area. A portion of the work area at both portals and shafts would be permanently committed to access, control, and maintenance structures, which could adversely affect archaeological resources if they were present within these project areas.

Valves, Valve Lots, and Crossovers. Valves, valve lots, and crossovers are located along existing pipelines and already have developed vehicular access. Projects sited in existing maintenance areas that are paved and graded are not likely to encounter intact, significant archaeological deposits. Moreover, these areas are less conducive to archaeological survey because the native surface has been modified or is obscured by concrete or asphalt. New crossover facilities must be sited near creeks so that water can be discharged into the watercourse during regular maintenance or emergency situations. Proximity to permanent or ephemeral water sources increases the probability that archaeological resources are present.

Pump Stations. New pump stations that would replace existing pump stations (on sites that are surfaced, drained, and maintained free of vegetation) would not likely affect archaeological resources. The construction of new stations on previously undeveloped, native topography could result in adverse effects on archaeological resources.

Treatment Facilities. WSIP treatment facility projects in developed areas (on sites that are surfaced and graded) would not likely affect intact, significant archaeological resources. If new buildings or facilities are constructed in previously undisturbed areas, the potential to encounter intact archaeological deposits is greater. If pipelines are required to connect treatment facilities to the rest of the Hetch Hetchy system, impacts on archaeological resources could result.

Storage Facilities. WSIP storage facility projects consist of the construction or improvement of storage reservoirs and dams. Improvements to below-grade storage reservoirs would require extensive grading and structural work, and it could be necessary to haul material offsite for disposal. Construction activity in natural topography could result in impacts on archaeological resources. Dam improvements would involve extensive earthmoving activities around the dam in addition to the development of borrow areas, disposal areas, and access roads. These project activities could cause adverse impacts on archaeological resources.

Table 4.7-3 indicates the potential for archaeological resources to be present at the WSIP project sites based on the distance to water and slope of the sites; each project site was evaluated as having a low, low-to-moderate, moderate, or high potential to affect known or unknown archaeological resources. Impacts from small, low-intensity, non-ground-disturbing project actions proposed in heavily disturbed settings are considered less than significant. Major construction operations that require substantial excavation pose a greater risk of impact on archaeological resources and would result in potentially significant impacts if they occur in areas of moderate to high potential for archaeological resources. SFPUC Construction Measure #9 (cultural resources) would require a qualified archaeologist to perform a preconstruction screening of each WSIP project site and its vicinity to determine whether archaeological resources could be affected by construction activities and to ensure that effects on cultural resources are avoided to the extent feasible. This measure also requires that construction be halted if an archaeological resource is discovered and, in the event that further investigation is necessary, would ensure that the SFPUC complies with all requirements for the investigation, analysis, and protection of cultural resources.

TABLE 4.7-3
POTENTIAL FOR ARCHAEOLOGICAL IMPACTS

Project No.	Project Name	Area of Archaeological Sensitivity?[a]	Potential for Impacts on Archaeological Resources?[b]	Impact Significance
SJ-1	Advanced Disinfection	Moderate	Yes	PSM
SJ-2	Lawrence Livermore Supply Improvements	Moderate	Yes	PSM
SJ-3	San Joaquin Pipeline System	Low to Moderate	Yes	PSM
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	High	Yes	PSM
SJ-5	Tesla Portal Disinfection Station	Moderate	Yes	PSM
SV-1	Alameda Creek Fishery Enhancement	High	Yes	PSM
SV-2	Calaveras Dam Replacement	High	Yes	PSM
SV-3	Additional 40-mgd Treated Water Supply	Moderate to High	Yes	PSM
SV-4	New Irvington Tunnel	Low to Moderate	Yes	PSM
SV-5	SVWTP – Treated Water Reservoirs	Moderate to High	Yes	PSM
SV-6	San Antonio Backup Pipeline	High	Yes	PSM
BD-1	Bay Division Pipeline Reliability Upgrade	High	Yes	PSM
BD-2	BDPL Nos. 3 and 4 Crossovers	Low to Moderate	Yes	PSM
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Moderate	Yes	PSM
PN-1	Baden and San Pedro Valve Lots Improvements	Moderate	Yes	PSM
PN-2	Crystal Springs/San Andreas Transmission Upgrade	Moderate	Yes	PSM
PN-3	HTWTP Long-Term Improvements	Low to Moderate	Yes	PSM
PN-4	Lower Crystal Springs Dam Improvements	High	Yes	PSM
PN-5	Pulgas Balancing Reservoir Rehabilitation	High	Yes	PSM
SF-1	San Andreas Pipeline No. 3 Installation	Moderate	Yes	PSM
SF-2	Groundwater Projects	Low to Moderate	Yes	PSM
SF-3	Recycled Water Projects	Low to Moderate	Yes	PSM

[a] Based on the information provided in Figure 4.7-1.
[b] Based on the information provided in Appendix C, Table C.4, all WSIP projects would either involve some level of excavation, or excavation is yet to be determined. For this analysis, a conservative assessment is made that excavation will occur and have an impact on archaeological resources.

If any WSIP projects were located in areas with a low potential to encounter archaeological resources, implementation of SFPUC Construction Measure #9 (cultural resources) would ensure that impacts are less than significant. However, in this program-level evaluation, it does not appear that any of the WSIP projects would be located in areas of low archaeological sensitivity.

Table 4.7-3 identifies the WSIP projects as having a low-to-moderate, moderate, or high potential for archaeological sensitivity. The preconstruction screenings under Construction Measure #9 would analyze site-specific information, which would either confirm these program-level determinations or provide a basis to revise them.

Because projects in areas of low-to-moderate, moderate, or high archaeological sensitivity would have an increased likelihood to encounter archaeological resources during soil-disturbing activities, impacts on archaeological resources would be potentially significant and would require additional mitigation to protect these resources. In such cases, implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b) would reduce impacts from the WSIP projects to a less-than-significant level.

San Joaquin Region

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

All five WSIP projects in this region would have the potential to adversely affect archaeological resources.

The SJPL System project (SJ-3) would install approximately 16 to 22 miles of new pipeline and construct two crossovers, while the SJPL Rehabilitation project (SJ-4) would rehabilitate the existing pipelines at discrete locations. These projects would be located in areas of low-to-moderate archaeological sensitivity. Some segments of both projects would be conducted in the vicinity of the San Joaquin River, an attractive location for prehistoric settlement and thus of greater sensitivity for archaeological resources. The pipeline construction area for both projects would be partially located in previously disturbed areas, but because the work area must be located to the side of existing pipelines, it could be partially located in undisturbed parts of the right-of-way. The SJPL System project would entail a greater degree of excavation—the primary construction activity that causes impacts on archaeological resources—than the SJPL Rehabilitation project.

The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects would be located in the vicinity of Tesla Portal within largely developed areas of moderate archaeological sensitivity. The Lawrence Livermore project (SJ-2), which would also be located in an area of moderate archaeological sensitivity, could affect archaeological resources at the facility sites or along access roads if they required improvements. However, potential impacts associated with these three projects would be minimal due to the small areas involved (approximately two acres at the Tesla Portal facility for the Advanced Disinfection and Tesla Portal Disinfection projects).

All five projects in this region would be subject to separate, project-level CEQA review, which would evaluate potential impacts in more detail and determine appropriate mitigation measures based on the presence and type of archaeological resources identified. Given the likelihood that these projects could affect archaeological resources, impacts would be *potentially significant*, but could be reduced to a less-than-significant level with implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b).

Sunol Valley Region

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

All of the projects in this region would have the potential to affect archaeological resources. The Alameda Creek Fishery project (SV-1) would involve the construction of pipelines, pumps, collection wells, control structures, and a water recapture facility. This project would be situated in and near Alameda Creek and thus would have a greater potential to adversely affect archaeological resources.

The Calaveras Dam project (SV-2) would be located in an area of high archaeological sensitivity. The project would affect approximately 660 acres in the dam construction area, including portions of Alameda and Calaveras Creeks downstream from the existing dam, and the excavation of borrow areas could affect archaeological resources. Anecdotal evidence indicates that a number of burial sites were identified during construction of the Calaveras Dam (O'Shaughnessy, 1915), suggesting that the area surrounding the dam may be sensitive for significant archaeological resources. (If human remains are found at this or any WSIP project site, Measure 4.7-2a provides direction for the treatment of human remains and funerary objects.)

The 40-mgd Treated Water project (SV-3) would install approximately 1.5 to 2 miles of new pipeline. These pipelines would be situated on or near the Sunol Valley WTP and would be located primarily in previously disturbed grasslands. Thus, it is unlikely that this project would affect intact, significant archaeological deposits. However, the proposed two-mile pipeline to the Alameda Siphons or Irvington Tunnel as part of this project could affect archaeological resources along several ephemeral streams where there may have been prehistoric use for resource procurement. The archaeological sensitivity of this area is considered to be moderate to high.

The New Irvington Tunnel project (SV-4) could affect archaeological resources at permanent facilities proposed to be located at the new tunnel's portals in the Sunol Valley and Fremont. The project could also affect archaeological resources near Alameda Creek, where two new bridges would be built, and in the surrounding area required for access roads, shafts, control structures, and spoils disposal. The construction footprint at the tunnel's Sunol Valley portal (West Portal) would be located primarily on slopes, which would be less likely to yield archaeological resources; however, because the location of the spoils disposal area has not been designated, an impact assessment cannot be performed at this time. This project is in an area of low-to-moderate archaeological sensitivity.

The Treated Water Reservoirs project (SV-5) would have a construction footprint of approximately 10.5 acres and a pipeline alignment of approximately 0.3 mile. Depending on the location of the construction relative to identified archaeological resources, this project could have an adverse impact on these resources. The project is located in an area of moderate to high archaeological sensitivity.

The SABUP project (SV-6) would closely parallel San Antonio Creek but would not cross the creek itself. An outlet/energy dissipation structure would be located at the east channel of Alameda Creek, which could result in potential impacts on archaeological resources due to the project's proximity to a watercourse. The project is in an area of high archaeological sensitivity.

The projects in the Sunol Valley Region would be subject to separate, project-level CEQA review, which would evaluate potential impacts in more detail and determine appropriate mitigation measures based on the presence and type of archaeological resources identified. Given the likelihood that these projects could affect archaeological resources, the impacts would be *potentially significant*, but could be reduced to a less-than-significant level with implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b).

Bay Division Region

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

All of the projects in this region would have the potential to affect archaeological resources. The BDPL Reliability Upgrade project (BD-1) would install approximately 16 miles of pipeline and 5 miles of tunnel. The pipeline segment would cross several modified creek channels and artificial flood control channels between the Irvington Portal in Fremont and the Newark Valve House. While it appears that this construction activity would occur in previously disturbed areas, it is possible that intact, significant archaeological resources may exist in this area due to the project's proximity to bay and freshwater sources (i.e., in an area of high archaeological sensitivity).

The BDPL 3 and 4 Crossovers project (BD-2) is located in an area of low-to-moderate archaeological sensitivity near creeks, an attractive location for prehistoric settlement.

The BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would provide for the planning, design, and construction of upgraded, seismically resistant sections of the Bay Division Pipelines Nos. 3 and 4 where they cross the Hayward fault. The replacement pipelines would be located between the two new crossover/isolation valves. This project is also in proximity to bay and freshwater sources, in an area of moderate archaeological sensitivity.

All three projects in this region would be subject to separate, project-level CEQA review, which would evaluate potential impacts in more detail and determine appropriate mitigation measures based on the presence and type of archaeological resources identified. Given the likelihood that these projects could affect archaeological resources, impacts would be *potentially significant*, but could be reduced to a less-than-significant level with implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b).

Peninsula Region

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources		
Baden and San Pedro Valve Lots	PN-1	PSM
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

All of the projects in this region would have the potential to affect archaeological resources. The Lower Crystal Springs Dam project (PN-4) could adversely affect significant archaeological resources near San Mateo Creek if work areas are needed at the base of the dam. The Pulgas Balancing Reservoir project (PN-5) is located near the Pulgas Channel and Laguna Creek, which increases the potential for intact archaeological resources. These projects, both of which would be located in areas of high archaeological sensitivity, would be subject to separate, project-level CEQA review, which would further evaluate potential impacts on archaeological resources found during the cultural resources screening survey.

It is unlikely that the Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), and HTWTP Long-Term (PN-3) projects would adversely affect significant archaeological resources, because the majority of the proposed activities would be conducted within existing facilities that have been previously disturbed, graded, or paved. Extant cultural resources are likely to be obscured or deeply buried beneath the native surface. However, because the Baden and San Pedro Valve Lots and CS/SA Transmission projects would be located in areas of moderate archaeological sensitivity, and the HTWTP Long-Term project would be located in an area of low-to-moderate sensitivity, the potential exists to adversely affect archaeological resources.

Given the likelihood that these projects could affect archaeological resources, the impacts would be *potentially significant*, but could be reduced to a less-than-significant level with implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b).

San Francisco Region

Impact 4.7-2: Impacts on unknown and known prehistoric and historic archaeological resources		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

All of the projects in this region would have the potential to affect archaeological resources. The SAPL 3 Installation project (SF-1) would remove historic pipes and lay pipes along new alignments, which could affect subsurface archaeological resources. Preliminary investigation indicates that the general area around the alignment was inhabited prehistorically; therefore, the area is considered to be of moderate archaeological sensitivity. Project-level studies would be conducted to evaluate the likelihood of buried cultural sites along the alignment.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could affect Lake Merced by raising its water level, which could result in impacts on archaeological resources. The projects would be located in areas of low-to-moderate archaeological sensitivity. In addition, the Groundwater Projects would construct new wells and associated facilities, and the Recycled

Water Projects would construct approximately 20 miles of pipeline on five to seven acres. Depending on the amount of increase in the lake's water level and the locations of the new facilities, these projects could adversely affect archaeological resources.

The projects in this region would be subject to separate, project-level CEQA review, which would further evaluate potential impacts on archaeological resources found during the cultural resources screening survey. Given the likelihood that these projects could affect archaeological resources, impacts would be *potentially significant*, but could be reduced to a less-than-significant level with implementation of archaeological testing, monitoring, and treatment of human remains (Measure 4.7-2a) and accidental discovery measures (Measure 4.7-2b).

Historic Architectural Resources

As previously stated, this PEIR identifies three categories of potential impacts on historic architectural resources. These categories are as follows:

- Impacts on a historic district or a contributor to a historic district (Impact 4.7-3)
- Impacts on individual resources that are part of the water system (Impact 4.7-4)
- Impacts on individual resources located adjacent to a WSIP facility improvement project (Impact 4.7-5)

As noted above, identification of historical resources that could be affected by the WSIP will also be conducted during project-level CEQA review of the individual facility improvement projects. Assumptions were made for the purposes of this programmatic analysis regarding the potential for historical resources to be located in the study areas of specific WSIP facility improvement projects. The analysis presented in this section assumes that all water system facilities constructed during their period(s) of potential historical significance have retained historic integrity. Although this assumption has not been verified as part of this program-level analysis, it provides a conservative approach to evaluating potential impacts. Again, an appropriate historical context and period of significance for resources will be determined during the project-level CEQA analyses, based on an understanding of the water system's history and importance of the components of the water-delivery system. Table 4.7-1 summarizes the conclusions of this PEIR regarding the potential for WSIP facility improvement projects to affect historical resources. **Table 4.7-4** describes the potential impacts of the WSIP projects on historical resources in the regional water system.

This program-level analysis is based on information presented in Chapter 3, Program Description, and Appendix C, as well as on site visits to some of the SFPUC facilities. The site visits verified whether other buildings, structures, or objects are located at or near proposed WSIP facilities. It should be noted that this analysis is not a comprehensive evaluation of all historical resources in the WSIP study area. Detailed evaluations of historic architectural resources would be conducted as part of separate, project-level CEQA review, where warranted, to further define potential

TABLE 4.7-4
HISTORIC ARCHITECTURAL RESOURCES IMPACT POTENTIAL ON REGIONAL WATER SYSTEM FACILITIES

WSIP Facility Improvement Project	Construction Date of Potentially Affected Facilities	Would the project affect a potential historic district?	Significance determination for impacts on the historical significance of a potential historic district[a]	Would the project demolish or alter the historic fabric or function of a specific existing facility?	Significance determination for impacts on the historical significance of the individual facility[a]
SJ-1: Advanced Disinfection	Tesla Portal: 1928	Yes, the existing Tesla Portal could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. The existing Tesla Portal would be modified as part of this project, which would result in a potentially significant impact on the potential historic district. This impact could likely be reduced to a less-than-significant level.	PSM	Yes, the existing Tesla Portal would be modified as part of this project. If the portal were considered to be an individual historical resource for the purposes of CEQA compliance, this project would result in a potentially significant impact on the potential historic facility. This impact could likely be reduced to a less-than-significant level.	PSM
SJ-2: Lawrence Livermore Supply Improvements	N/A (new construction)	No, new facilities would be added near non-historic facilities.	N/A	No, new facilities would be associated with non-historic facilities.	N/A
SJ-3: San Joaquin Pipeline System	Pipeline No. 1: 1932 Pipeline No. 2: 1953[b] Pipeline No. 3: 1968 Oakdale Portal: 1928	Yes, the proposed work on the existing pipelines and the modification of the existing Oakdale Portal could have a potentially significant impact on a potential historic district associated with the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. However, because the project would add new portions of pipelines and crossovers, and direct impacts on the existing pipelines and portal would be limited, it is likely that such impacts could be reduced to a less-than-significant level.	PSM	Yes, the existing Oakdale Portal would be modified as part of this project. If the portal were considered to be an individual historical resource for the purposes of CEQA compliance, this project would result in a potentially significant impact on the potential historic facility. This impact could likely be reduced to a less-than-significant level.	PSM
SJ-4: Rehabilitation of Existing San Joaquin Pipelines	Pipeline No. 1: 1932 Pipeline No. 2: 1953[b] Pipeline No. 3: 1968 Tesla Portal: 1928	Yes, the proposed work on the existing pipelines could have a potentially significant impact on a potential historic district associated with the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. However, because direct impacts on the existing pipelines would be limited, it is likely that such impacts could be reduced to a less-than-significant level.	PSM	Yes. Although the pipeline system would retain its historical function, the pipelines themselves could be altered enough to cause a substantial adverse change in their historical significance, if they were considered eligible. This would be a potentially significant impact. It is expected that the impact could be reduced to a less-than-significant level with mitigation.	PSM
SJ-5: Tesla Portal Disinfection Station	Approximately 1928	No, would replace and upgrade an existing non-historic disinfection facility.	N/A	No, would replace and upgrade an existing non-historic facility.	N/A

TABLE 4.7-4 (Continued)
HISTORICAL RESOURCES IMPACT POTENTIAL FOR WSIP PROJECTS

WSIP Facility Improvement Project	Construction Date of Potentially Affected Facilities	Would the project affect a potential historic district?	Significance determination for impacts on the historical significance of a potential historic district[a]	Would the project demolish or alter the historic fabric or function of a specific existing facility?	Significance determination for impacts on the historical significance of the individual facility[a]
SV-1: Alameda Creek Fishery Enhancement	N/A (new construction or nonstructural water recovery alternatives)	No. One alternative would construct a new water recapture facility near non-historic facilities. Other alternatives would not include construction.	N/A	No, new facility.	N/A
SV-2: Calaveras Dam Replacement	1925	Yes. Because the project requires demolition of Calaveras Dam and its associated structures, the project would have a potentially significant unavoidable impact on a historic district (if one exists) that may include Calaveras Dam and its associated structures.	PSU	Yes. Because the project requires demolition of Calaveras Dam and its associated structures, the project would have a potentially significant unavoidable impact on the complex as a historical resource.	PSU
SV-3: Additional 40-mgd Treated Water Supply	Sunol Valley Water Treatment Plant: 1966, upgraded 1976, 1990, 2001–2003	No, would upgrade an existing non-historic facility.	N/A	No, would upgrade an existing non-historic facility.	N/A
SV-4: New Irvington Tunnel	Irvington Tunnel: 1934 Irvington Portal: 1934 Alameda West Portal: 1934 Coast Range Tunnel: 1934	Yes, the existing Irvington Tunnel and the Irvington and Alameda West Portals could be contributors to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. Because the existing Irvington Tunnel and Alameda West Portal would continue as originally designed, and the project would create a new component of the system (a new, redundant tunnel) rather than eliminate the existing tunnel, the impact on such a potential historic district would be less than significant. However, the existing Irvington Portal would be demolished as part of this project, which would result in a potentially significant impact on the potential historic district. This impact could likely be reduced to a less-than-significant level.	PSM	Yes, the project would demolish the unique spherical Irvington Portal (in Fremont) that was built in the 1930s. Since retaining the portal is not feasible due to safety concerns, the impact on the historic facility would be potentially significant and unavoidable, if the portal were determined to be a historical resource for the purposes of CEQA compliance.	PSU
SV-5: SVWTP – Treated Water Reservoirs	1966, upgraded 1976, 1990, 2001–2003	No, would upgrade an existing non-historic facility and construct new treated water reservoirs.	N/A	No, would upgrade an existing non-historic facility.	N/A

TABLE 4.7-4 (Continued)
HISTORICAL RESOURCES IMPACT POTENTIAL FOR WSIP PROJECTS

WSIP Facility Improvement Project	Construction Date of Potentially Affected Facilities	Would the project affect a potential historic district?	Significance determination for impacts on the historical significance of a potential historic district[a]	Would the project demolish or alter the historic fabric or function of a specific existing facility?	Significance determination for impacts on the historical significance of the individual facility[a]
SV-6: San Antonio Backup Pipeline	Alameda East Portal Vent Overflow Pipeline: 1934 Alameda East Portal: 1934 New pipelines to be built from San Antonio Reservoir (1965) to San Antonio Pump Station (1968)	Yes, the existing Alameda East Portal could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. The existing Alameda East Portal would be modified as part of this project, which would result in a potentially significant impact on the potential historic district. This impact could likely be reduced to a less-than-significant level.	PSM	Yes, the existing Alameda East Portal would be modified as part of this project. If the portal were considered to be an individual historical resource for the purposes of CEQA compliance, this project would result in a potentially significant impact on the potential historic facility. This impact could likely be reduced to a less-than-significant level.	PSM
BD-1: Bay Division Pipeline Reliability Upgrade	Pipeline No. 1: 1925 Pipeline No. 2: 1935–1936 Pipeline No. 3: 1952[b] Pipeline No. 4: 1967–1973	Yes, one or more of the Bay Division Pipelines could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. This project could have a significant impact on this potential historic district. The nature of the project and the fact that at least portions of the existing pipeline would remain following construction indicate that the impact could be reduced to a less-than-significant level.	PSM	Yes, impacts would be potentially significant if the pipelines were considered to be individual historical resources for the purposes of CEQA compliance. The impact on these resources is expected to be reduced to a less-than-significant level with mitigation.	PSM
BD-2: BDPL Nos. 3 and 4 Crossovers	Pipeline No. 3: 1952[b] Pipeline No. 4: 1967–1973	Yes, one or more of the Bay Division Pipelines could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. This project could have a significant impact on this potential historic district. The nature of the project and the fact that at least portions of the existing pipeline would remain following construction indicate that the impact could be reduced to a less-than-significant level.	PSM	Yes, impacts would be potentially significant if the pipelines were considered to be individual historical resources for the purposes of CEQA compliance. The impact on these resources is expected to be reduced to a less-than-significant level.	PSM

TABLE 4.7-4 (Continued)
HISTORICAL RESOURCES IMPACT POTENTIAL FOR WSIP PROJECTS

WSIP Facility Improvement Project	Construction Date of Potentially Affected Facilities	Would the project affect a potential historic district?	Significance determination for impacts on the historical significance of a potential historic district[a]	Would the project demolish or alter the historic fabric or function of a specific existing facility?	Significance determination for impacts on the historical significance of the individual facility[a]
BD-3: Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Pipeline No. 3: 1952[b] Pipeline No. 4: 1967–1973	Yes, one or more of the Bay Division Pipelines could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. This project could have a significant impact on this potential historic district. The nature of the project and the fact that the existing pipeline would remain following construction indicate that the impacts could be reduced to a less-than-significant level.	PSM	Yes, impacts would be potentially significant if the pipelines were considered to be individual historical resources for the purposes of CEQA compliance. The impact on these resources is expected to be reduced to a less-than-significant level.	PSM
PN-1: Baden and San Pedro Valve Lots Improvements	Non-historic	No, would upgrade existing non-historic facilities.	N/A	No, would upgrade existing non-historic facilities.	N/A
PN-2: Crystal Springs/San Andreas Transmission Upgrade	Upper Crystal Springs Dam: 1877 Lower Crystal Springs Dam: 1890 Crystal Springs Pump Station: 1933 Crystal Springs/San Andreas Pipeline: 1898–1932 San Andreas Reservoir: 1870	Yes, the pipeline and the pump station, and other associated structures that may be located near them, could be contributors to a potential historic district related to all or a portion of the Spring Valley Water Company's development of Crystal Springs Reservoir or San Andreas Reservoir. There could also be a historic district that includes the historical context related to San Francisco's incorporation of this portion of the former Spring Valley Water Company facilities into the municipal system.	PSU	Yes, the pipeline, and other associated structures that may be located near it, could be individually significant and considered to be historical resources for the purposes of CEQA. It is expected that many of the impacts could be reduced to a less-than-significant level, but impacts on the Crystal Springs Pump Station could be potentially significant and unavoidable.	PSU
PN-3: HTWTP Long-Term Improvements	1971, expansions in 1988, 1990	No, would alter and upgrade an existing non-historic facility, but would not affect its function or a nearby potential historic district.	N/A	No, would alter and upgrade an existing non-historic facility.	N/A

TABLE 4.7-4 (Continued)
HISTORICAL RESOURCES IMPACT POTENTIAL FOR WSIP PROJECTS

WSIP Facility Improvement Project	Construction Date of Potentially Affected Facilities	Would the project affect a potential historic district?	Significance determination for impacts on the historical significance of a potential historic district[a]	Would the project demolish or alter the historic fabric or function of a specific existing facility?	Significance determination for impacts on the historical significance of the individual facility[a]
PN-4: Lower Crystal Springs Dam Improvements	1890	Yes, this structure, and other associated structures, could be contributors to a potential historic district related to a portion of the Spring Valley Water Company's development of Crystal Springs Reservoir. Because the project would repair and upgrade portions of the historic dam rather than demolish or replace the dam, the impact could be reduced to a less-than-significant level.	PSM	Yes, could alter the historic fabric of the dam. Detailed project-level review may determine that effects could be mitigated, but until such determination, the impact is considered potentially significant and unavoidable.	PSU
PN-5: Pulgas Balancing Reservoir Rehabilitation	1975	No, would upgrade existing a non-historic facility.	N/A	No, would upgrade existing a non-historic facility.	N/A
SF-1: San Andreas Pipeline No. 3 Installation	Pipeline No. 1: 1870 (rebuilt in 1893 and taken out of service in 1983) Pipeline No. 2: 1927– 928 Pipeline No. 3: approx. 1928	Yes, the pipeline could be a contributor to a potential historic district associated with the development of a portion of the Spring Valley Water Company's system on the Peninsula or the SFPUC municipal water system. This project would remove and permanently decommission portions of the Baden-Merced Pipeline. This impact could be a potentially significant; however, it is expected that such an impact could be reduced to a less-than-significant level because portions of the original pipeline would remain following construction of the project.	PSM	Yes, because portions of the existing Baden-Merced Pipeline would be removed, this impact would be potentially significant if the pipeline were considered to be a historical resource for the purposes of CEQA compliance. The project's impact on these pipelines could be reduced to a less-than-significant level with mitigation.	PSM
SF-2: Groundwater Projects	N/A (new construction)	No, new facilities (including wells) would be added.	N/A	No, new facilities would be added to the system, but final facility locations have not yet been determined.	N/A
SF-3: Recycled Water Projects	N/A (new construction)	No, new facilities would be added.	N/A	No, new facilities would be added to the system, but final facility locations have not yet been determined.	N/A

[a] These are preliminary determinations that would be reviewed during project-level CEQA analysis.
[b] Detailed property evaluations of the facilities conducted during subsequent, project-level CEQA review would determine if these pipelines are historically significant facilities. If the pipelines are found to lack engineering merit or a strong association to historic events or people, they could be determined not historically significant. If so, that determination would not affect the potential historical significance of older pipelines in the same systems.

impacts on the water system and other cultural resources in the WSIP study area and to develop appropriate project-specific mitigation measures based on specific project design.

Implementation of SFPUC Construction Measure #9 (cultural resources) would ensure that a qualified historian conducts a preconstruction screening of each WSIP project site and its vicinity to determine whether historical resources could be affected by construction activities and to ensure that impacts on identified cultural resources are avoided to the extent feasible. This measure requires that soil-disturbing activities be immediately suspended if there is any indication of a cultural resource and, in the event that further investigation is necessary, would ensure that the SFPUC complies with all requirements for the investigation, analysis, and protection of cultural resources.

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district.

As discussed in Section 4.7.2, a historic district is an area that “possesses a significant concentration, linkage or continuity of sites, buildings, structures, or objects, united historically or aesthetically by plan or physical development.”[33] This analysis assesses impacts on potentially interrelated groups of facilities and resources, united by historic plan and function, which could be considered discrete historic districts. Historically significant historic districts that retain sufficient historic integrity to convey their significance are considered singular historical resources for the purposes of CEQA compliance and would include contributing and non-contributing elements. The WSIP would have an effect on potential historic districts within the water system if it were to remove or alter individual resources within a district in a manner that would diminish the district’s historic integrity, and thus its ability to convey its significance, purpose, or original appearance.

Potential historic districts usually conform with the following standards:

- Resources in the district are physically located in relatively close proximity to one another as a cohesive unit.
- Approximately two-thirds of the resources should be contributors to a potential district in order for that district to be readily supportable.
- Boundaries of the district should encompass but not exceed the extent of the significant resources.
- Districts should not include buffer zones or “donut holes” of low-integrity, non-contributing resources, or empty acreage. (Non-contributing resources surrounded by a majority of contributing resources should be included within the district as non-contributors, or a discontiguous district should be specified when large areas lacking contributing resources intervene.)

[33] National Park Service, “National Register Bulletin #15: How to Apply the National Register Criteria for Evaluation,” National Park Service: Washington DC, 1998.

- The majority of the district must retain historic integrity.
- Geographic, topographic, and historic boundaries should be considered when selecting district boundaries.

Historic districts may be identified as subsets of facilities within the regional water system. To qualify as a historic district, these facilities would also have to be united historically or aesthetically. These historic districts may be identified, for example, through common association with a specific and identifiable engineering plan implemented during a specific time in history.

A district could include water system facilities or a combination of system and non-system facilities, depending on the historical context of the resource. Resources within a potential district must be unified by historic plan and must work together to perform a specific function within the water system (acting as a subsystem, for instance). Resources within a potential district must share a historical timeframe that is specific to that district, during which facilities would have been built or modified. Groups of facilities might qualify as historic districts based on a specific aspect of their history, or, most importantly, through a plan of development that was designed and subsequently executed with a specific purpose in mind. Given the concentration of system facilities in the Sunol Valley and Peninsula Regions, there is greater potential for impacts on historic districts in these areas than in the other regions along the system (i.e., the San Joaquin, Bay Division, and San Francisco Regions), but the final determination will be made during project-level evaluation. For instance, the San Andreas Dam complex on the Peninsula, including its earthen dam, associated conveyance structures, and other structures and features, might be an example of a historic district, in which a collection of interrelated facilities represent a historical resource, in addition to the historical significance of some of the individual facilities.

As described in Section 4.7.1, facilities in various portions of the water system were built at different times: the Spring Valley Water Company's earliest facilities in the city were built between 1856 and 1877, the Peninsula facilities between 1861 and 1898, and the Alameda facilities between 1875 and 1925; the essential Hetch Hetchy system was built and became operative between 1914 and 1934. It is possible that there are historic districts with separate and distinct periods of significance within these areas and time periods that were united by plans of development or other direct historical associations. Alternatively, some resources may be individually eligible within their appropriate historical context, as discussed under Impact 4.7-4.

San Joaquin Region

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	N/A

The SJPL System project (SJ-3) would add new pipes at the west and east ends of the pipelines and would modify Oakdale Portal. The SJPL Rehabilitation project (SJ-4) would repair or rehabilitate existing pipelines. The Advanced Disinfection project (SJ-1) would modify Tesla Portal. All three of these projects could affect one or more of the San Joaquin Pipelines and would modify the Oakdale and Tesla Portals; these facilities could be contributors to a potential historic district associated with the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. These three projects could have a *potentially significant* impact on a historic district, but because of the nature of the projects, impacts would be reduced to a less-than-significant level with implementation of Measure 4.7-3, which requires evaluation of historic districts, and Measures 4.7-4a through 4.7-4f, which require historical surveys (Measure 4.7-4d), evaluation of alternatives and materials salvage to the extent feasible (Measure 4.7-4a), documentation of historical resources (Measure 4.7-4b), project design consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* to the extent feasible (Measure 4.7-4c), resource protection during construction (Measure 4.7-4e), and consideration of vibration effects (Measure 4.7-4f).

The Lawrence Livermore project (SJ-2) would construct new facilities, while the Tesla Portal Disinfection project (SJ-5) would replace and upgrade an existing facility that is not from the historic period. Therefore, this impact would *not apply* to these projects.

Sunol Valley Region

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	PSU
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	PSM

The Calaveras Dam project (SV-2) would replace the earth-fill dam (built in 1925) with a new earth-fill dam to meet the seismic and public safety requirements of the California Department of Water Resources, Division of Safety of Dams (DSOD). As described in Chapter 3, Program Description, the DSOD imposed operating restrictions on Calaveras Dam in 2001 that limit the reservoir to approximately 40 percent of its historical capacity, or 38,100 acre-feet. According to the *Calaveras Dam Replacement Project: Final Conceptual Engineering Report* (URS, 2005), the DSOD imposed this interim operating level to accommodate the SFPUC's water needs, with the understanding that the SFPUC would pursue an aggressive schedule to address the dam's safety issues. Under the project, a replacement dam would be built immediately downstream of the existing dam and would restore Calaveras Reservoir's capacity of 96,850 acre-feet.

The project would demolish the existing dam, including its intake and outlet towers and other related structures. The new reservoir would inundate the original dam's location. During construction of the project, the existing dam would be used as a cofferdam (i.e., a temporary structure to keep water away from the construction site). The existing dam would then be leveled off to an elevation approximately 50 feet below the water level of the refilled reservoir. The material removed from the existing dam would be placed between the original dam and the replacement dam.

The Spring Valley Water Company built Calaveras Dam and its complex of structures between the 1910s and 1940. The project could affect a potential historic district that includes the dam and its structures, which would be likely contributors. This potential historic district would be associated with the construction of Calaveras Dam, which was a distinct planned development that greatly expanded the delivery of water from the Alameda Creek portion of the Spring Valley system.

Unlike the other WSIP projects involving former Spring Valley facilities, the existing dam and all its appurtenant structures would be removed under this project. The Calaveras Dam project (SV-2) would have a *potentially significant unavoidable* impact on a historic district (if one exists) that could include Calaveras Dam and its associated structures. Total demolition of a historical resource, such a historic district or most of the contributors to a historic district, usually cannot be reduced to a less-than-significant level.

One mitigation option, however, would be to identify alternatives that eliminate or reduce the need for demolition (Measure 4.7-4a). A technical memorandum, *Development of Calaveras Dam Replacement Project* (URS, 2005), summarizes an evaluation of project alternatives. The alternatives considered were: remediating or replacing the dam for the same reservoir storage (96,850 acre-feet), remediating or replacing the dam for increased reservoir storage (up to 420,000 acre-feet), and remediating or replacing the dam for the same reservoir storage while retaining an option for future enlargement. The alternatives were evaluated for their environmental impacts, implementability, cost, dam safety approval, as well as operational flexibility, maintainability, and reliability. The alternative chosen as the preferred alternative at that stage of planning was to replace (instead of remediate) the existing dam with a new earth-fill dam to be located downstream of the existing dam and designed with an open-chute spillway. The DSOD wrote the SFPUC in July 2005 expressing its approval of the conceptual design for this alternative. The next stage of planning, to be conducted as part of the separate, project-level CEQA analysis, will further assess the feasibility of this mitigation.

Even with implementation of Measure 4.7-3 and Measures 4.7-4a through 4.7-4f, the Calaveras Dam project's impact on most, or all, of a historic district's resources and character-defining features that would contribute to a potential historic district in this project area would be significant and unavoidable. Impacts on the subsidiary structures associated with the dam, including its intake and outlet towers, could be reduced through implementation of Measures 4.7-4a through 4.7-4f, including consistency with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and project redesign (Measure 4.7-4c). Despite these mitigation actions, the impacts would remain significant.

The Irvington Tunnel was built in 1934 as a part of the Hetch Hetchy Project. Under the New Irvington Tunnel project (SV-4), a new tunnel would be built parallel to and just south of the existing Irvington Tunnel to convey water from the Hetch Hetchy system and the Sunol Valley WTP to the Bay Area. A new portal would be constructed at the east end adjacent to the existing Alameda West Portal in the Sunol Valley, with connections to the existing and proposed Alameda Siphons. A new portal would also be built at the west end adjacent to the existing Irvington Portal in Fremont, with connections to the existing Bay Division Pipelines as well as to pipelines installed under the BDPL Reliability Upgrade project (BD-1). The existing Irvington Tunnel and the Irvington and Alameda West Portals could be considered contributors to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. Because use of the existing Irvington Tunnel would continue as originally designed, and the project would create a new component of the system (a new, redundant tunnel) rather than eliminate the existing tunnel, the impact on such a potential historic district would be less than significant. However, the existing Irvington Portal would be demolished as part of this project, which would result in a *potentially significant* impact on the potential historic district; however, because of the nature of the projects, the impact would be reduced to a less-than-significant level with implementation of Measure 4.7-3, which requires evaluation of historic districts, and Measures 4.7-4a and 4.7-4f, which require surveys and documentation of historic resources. The removal of Irvington Portal and the modification of the Alameda West Portal would not likely disqualify a potential Hetch Hetchy historic district from being considered a historical resource for the purposes of CEQA. However, the determination of impact significance would be made during project-level CEQA review of the New Irvington Tunnel project.

The SABUP project (SV-6) would construct three new facilities: the San Antonio Backup Pipeline, the San Antonio Creek Discharge Facilities, and the Alameda East Portal Vent Overflow Pipeline. This project also includes modifications to the existing Alameda East Portal, which was built in 1934. This structure could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. The SABUP project would have a *potentially significant* impact on a historic district, but because the portal would continue to function, the impact would be reduced to a less-than-significant level with implementation of Measure 4.7-3, which requires evaluation of historic districts, and Measures 4.7-4b and 4.7-4d, which require documentation and surveys of historic resources. In addition, both projects would be carried out in a manner that is consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measure 4.7-4c).

The Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), and Treated Water Reservoirs (SV-5) projects would not affect historical resources because they would involve construction of new facilities or upgrades to non-historic facilities. Therefore, this impact would *not apply* to these projects.

Bay Division Region

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

The Bay Division Pipelines were completed between 1925 and 1952 (1925 for Pipeline No. 1; 1935–1936 for Pipeline No. 2; 1952 for Pipeline No. 3). Under the BDPL Reliability Upgrade project (BD-1), a new Bay Division Pipeline (No. 5) would be built from the Irvington Portal in Fremont to the Pulgas Tunnel near Redwood City. Portions of Pipeline No. 1 would be removed or decommissioned to repair the pipeline. Approximately 1.4 miles of pipeline between the Edgewood and Pulgas Valve Lots would be removed, and aboveground and submarine sections of Bay Division Pipelines Nos. 1 and 2 would be decommissioned. The BDPL 3 and 4 Crossovers project (BD-2) would construct three additional crossover facilities along the Bay Division Pipelines to provide operational flexibility for maintenance and emergencies. The BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would replace portions of the Bay Division Pipelines Nos. 3 and 4 with seismically resistant sections.

One or more of the Bay Division Pipelines could be a contributor to a potential historic district related to the implementation of John R. Freeman's plan for the development of the Hetch Hetchy system. All three projects in this region could have a *potentially significant* impact on this potential historic district. However, because of the nature of the projects, this impact would be reduced to a less-than-significant level with implementation of Measure 4.7-3, which requires evaluation of historic districts, and Measures 4.7-4b and 4.7-4d, which include surveys and documentation of historic resources. In addition, all three projects must be carried out in a manner that is consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measure 4.7-4c). It should be noted that portions of the existing pipelines would remain following construction.

Peninsula Region

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	PSU
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	N/A

The Spring Valley Water Company built Upper Crystal Springs Dam in 1877 and Lower Crystal Springs Dam in 1890. Crystal Springs/San Andreas Pipeline was built between 1898 and 1932 and may include portions built by the Spring Valley Water Company and portions built by the City of San Francisco. The Crystal Springs Pump Station, built in 1933, is also located in this vicinity.

These structures, and other associated structures that may be located near them, could be contributors to a potential historic district. It is unclear at this time to what specific historical context and planned development each of these resources may be associated. There could be a historic district related to all or a portion of the Spring Valley Water Company's development of Crystal Springs Reservoir or San Andreas Reservoir. There could also be a historic district that includes the historical context related to San Francisco's incorporation of this portion of the former Spring Valley facilities into the municipal system.

The CS/SA Transmission project (PN-2) would seismically improve existing facilities, including replacing or refurbishing the existing Crystal Springs Pump Station. Although it has not been determined at this time whether a district in this area exists or whether modification of the Crystal Springs/San Antonio Pipeline and demolition of the Crystal Springs Pump Station would significantly affect the historic integrity of such a potential district, this PEIR conservatively considers this impact on a historic district (if one exists) to be a *potentially significant unavoidable*. Even with protection of historic districts (Measures 4.7-3) and implementation of Measures 4.7-4a through 4.7-4f, which include historical surveys and documentation prior to demolition as well as compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measure 4.7-4c), the CS/SA Transmission project's impact on most, or all, of a historic district's resources and character-defining features that would contribute to a potential historic district in this project area could be significant.

Under the Lower Crystal Spring Dam project (PN-4), the existing dam would be repaired to comply with DSOD requirements, and the dam would continue to function as originally designed. This project could have a *potentially significant* impact on one or more historic districts. One of these historic districts may include the Lower Crystal Springs Dam, which is already listed in the National Register and would be considered an individual historical resource for the purposes of CEQA compliance. It is expected, however, that protection of historic districts (Measure 4.7-3), and implementation of Measures 4.7-4a through 4.7-4f, which include historical surveys, documentation, compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, and project redesign, could reduce this impact to a less-than-significant level, especially since most of the existing dam would remain following construction.

The other WSIP projects in this region (Baden and San Pedro Valve Lots, PN-1; HTWTP Long-Term, PN-3; and Pulgas Balancing Reservoir, PN-5) would affect non-historic facilities. Therefore, this impact would *not apply* to these projects.

San Francisco Region

Impact 4.7-3: Impacts on the historical significance of a historic district or a contributor to a historic district		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	N/A

The SAPL 3 Installation project (SF-1) would replace the existing Baden-Merced Pipeline, which was built in the late 1890s, and would construct a new pipeline extension of San Andreas Pipeline No. 3. Portions of the Baden-Merced Pipeline would be removed where its alignment merges with the San Andreas Pipeline No. 3 alignment.

It is unclear, at this time, to which planned development the Baden-Merced Pipeline is associated and to what potential historic district (if any) it could be a contributor. The structure could be a contributor to a potential historic district associated with the development of a portion of the Spring Valley Water Company's system on the Peninsula. The SAPL 3 Installation project (SF-1) would remove and permanently decommission portions of this pipeline, which would constitute a *potentially significant* impact. It is expected, however, that protection of historic districts (Measure 4.7-3), and implementation of Measures 4.7-4a through 4.7-4f, which include historical surveys, documentation, compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, and project redesign, could reduce this impact to a less-than-significant level, especially since at least portions of the existing pipeline would remain following construction.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) would add new facilities to the system or upgrade existing non-historic facilities. Because these projects would not affect historic components of the regional system, this impact would *not apply* to these projects.

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Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration.

Some of the WSIP projects have the potential to cause a substantial adverse change (i.e. an adverse impact) on the historical significance of individual facilities within the regional water system.

Implementation of the WSIP could result in two types of adverse impacts on the historical significance of individual facilities: demolition or alteration. The demolition or destruction of a facility with historical significance is considered a significant impact under CEQA. Development of alternatives to the project, such as relocating a proposed facility to avoid demolition (Measure 4.7-3), would reduce this significant impact to a less-than-significant level. However, if relocation were not feasible, this impact would likely be significant and unavoidable, even with historical documentation prior to demolition (Measure 4.7-4b).

Alteration of a historical resource includes directly modifying a facility with historical significance or making an alteration that physically connects new elements with a historic facility. Such effects are considered potentially significant, because the historic fabric of the facility could be altered. Implementation of SFPUC Construction Measure #9 (cultural resources evaluation) along with historical documentation (Measure 4.7-4b) and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measure 4.7-4c) would reduce potential impacts to a less-than-significant level.

Numerous WSIP projects would entail the replacement, repair, or alteration of water conveyance pipelines. Many of these facilities are old enough to be considered potential historical resources under CEQA. To be individually eligible, a pipeline would have to stand on its own merits as a resource that reaches the significance threshold under one or more National Register or California Register criteria. For example, for a pipeline to be considered under Criterion A / Criterion 1, it would have to be related to important events or processes beyond simply providing water to a city; water supply facilities are inherently important to the towns they serve, as are city streets, schools, hospitals, and other infrastructural elements. To avoid an overly broad characterization of water delivery pipelines as important historical resources, they must be demonstrably significant to our history beyond simply delivering water in support of urban growth. All municipal water systems possess this characteristic. Engineering structures and features are infrequently, if ever, found to be significant under Criterion B / Criterion 2. Important historic persons associated with engineering structures and features are usually involved with their design, thus making them significant under Criterion C / Criterion 3, as the "work of a master." Under Criterion C / Criterion 3, a pipeline would need to be significant in the context of municipal water system engineering as an innovative and important example of water conveyance or transfer technology within a distinct period of significance. Such a feature might also be significant as an important work of a master engineer or builder. Criterion D / Criterion 4 is rarely applied, as archival data are usually sufficient to provide information related to historic engineering features.

Historic resources are often aboveground and visible, and alteration of aboveground facilities, if sufficiently extensive, would be potentially significant. However, the SFPUC regional water system includes numerous underground pipelines. The report entitled *Water Conveyance Systems in California* (JRP Historical Consulting Services and Caltrans, 2000) indicates that to retain historic integrity, the "property's essential physical features, important elements that were present during the historic period, must be present and visible." However, for the purposes of this analysis, a conservative assumption has been made that impacts on all pipelines built during the historical period, whether visible or not, are potentially significant. The impact could be reduced to a less-than-significant level through implementation of Measures 4.7-4a through 4.7-4f. More detailed information about the historical significance of the individual facility, its integrity, and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* would be provided during separate, project-level CEQA review for each of the WSIP projects.

Some projects might alter or indirectly affect a historic facility, but impacts cannot be determined because the design or location of the proposed facility is not yet known. For these projects, implementation of SFPUC Construction Measure #9 (cultural resources), which requires preconstruction screening and further investigation/protection as necessary, is expected to adequately reduce potential impacts to a less-than-significant level.

To summarize, for the purposes of analyzing the potential impacts on the historical significance of individual facilities, a project is considered to have a potentially significant impact if it would demolish or make significant alterations to a presumed historic facility. A project would have a less-than-significant impact if work would be done on a historic facility, but the work would have a minimal effect on the qualities or characteristics that make the resource significant. This impact would not apply to projects that would either construct a new facility or replace or upgrade a non-historic facility.

San Joaquin Region

Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	N/A

Two of the San Joaquin Pipelines were built during the assumed period of historical significance of the Hetch Hetchy system (1932 for Pipeline No. 1, and 1953 for Pipeline No. 2). If this pipeline system were considered to be eligible for listing in the National Register or California Register, it would be considered a historical resource for the purposes of CEQA.

The SJPL Rehabilitation project (SJ-4) would rehabilitate existing pipelines. Although the pipeline system would retain its historical function, the pipelines themselves could be altered enough to cause a substantial adverse change in their historical significance. This impact would be *potentially significant*, even though some pipeline segments are underground. It is expected, however, that SFPUC Construction Measure #9 (cultural resource screening) along with mitigation measures, such as historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measures 4.7-4a through 4.7-4f), could reduce this impact to a less-than-significant level.

The SJPL System project (SJ-3) would add a new pipeline at the east and west ends of the San Joaquin Pipeline right-of-way, would modify the existing Oakdale Portal, and replace non-historic facilities. This impact would be *potentially significant*. It is expected, however, that SFPUC Construction Measure #9 (cultural resource screening) along with mitigation measures, such as historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measures 4.7-4a through 4.7-4f), could reduce this impact to a less-than-significant level.

The Advanced Disinfection project (SJ-1) would modify the existing Tesla Portal. This impact would be *potentially significant*. It is expected, however, that SFPUC Construction Measure #9 (cultural resource screening) along with mitigation measures, such as historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Measures 4.7-4a through 4.7-4f), could reduce this impact to a less-than-significant level.

The Lawrence Livermore project (SJ-2) would construct new facilities, and the Telsa Portal Disinfection project (SJ-5) would replace and upgrade an existing facility that is not historic. Therefore, this impact would *not apply* to these projects.

Sunol Valley Region

Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration

Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	PSU
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	PSU
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	PSM

Calaveras Dam was built in 1925 and is currently being evaluated for its eligibility for listing in the National Register and California Register. As described under Impact 4.7-3, the Calaveras Dam project (SV-2) would destroy the existing dam and associated structures and replace them with new dam structures downstream of the location of the original dam. This impact on the historic facility would be *potentially significant and unavoidable* if this complex of resources were considered to be a historical resource for the purposes of CEQA compliance. This impact would be unavoidable even with the application of Measures 4.7-4a through 4.7-4f, which include identification of alternatives and/or relocation of historic resources and documentation of historic sites prior to demolition.

Under the New Irvington Tunnel project (SV-4), the existing Irvington Tunnel would continue its historical role and would not be affected in terms of its function; however, this project would demolish the unique spherical Irvington Portal in Fremont and modify the Alameda West Portal. The impact on the Irvington Portal would be *potentially significant and unavoidable* if the Irvington Portal were determined to be eligible for listing in the National Register or California Register and if relocation of the historic portal were not feasible (Measure 4.7-4a). This impact would be potentially significant and unavoidable even with implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation prior to demolition. Impacts on the Alameda West Portal would be *potentially significant*. It is expected, however, that implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, could reduce the impact on the Alameda West Portal to a less-than-significant level.

The SABUP project (SV-6) would construct a new pipeline from the existing overflow outlet near Alameda East Portal to the discharge point on Alameda Creek and would modify the Alameda East Portal, which was built in 1934. If the Alameda East Portal were considered to be a historical resource for the purposes of CEQA compliance, this impact would be *potentially significant*. It is expected, however, that implementation of SFPUC Construction Measure #9 (cultural resource screening) along with Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, could reduce this impact to a less-than-significant level.

The Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), and Treated Water Reservoirs (SV-5) projects would not affect historical resources because they involve the construction of new facilities. Therefore, this impact would *not apply* to these projects.

All of the WSIP projects in the Sunol Valley are located in the *Alameda Watershed Management Plan* (Alameda WMP) area. The cultural resource policies and actions of the WMP would guide the implementation of these projects. The Alameda WMP's actions for cultural resources are:

1) Conduct appropriate levels of review in conjunction with the review process for proposed plans and projects, prior to operations and maintenance activities as well as construction activities involving surface disturbance and/or excavation to avoid damage to buried cultural resources in the vicinity of known sites and within mapped cultural sensitivity zones. Sensitivity zones generally include valley floors adjacent to water sources, other flat terrain near creeks and springs, and level areas along ridgetops. Guidelines include:

    A) Prior to any excavation activities, request a database check from the watershed GIS operator and the State of California database for any known cultural resources or sensitive areas within the vicinity of proposed exaction activity.

    B) Authorize archival research and field reconnaissance by a certified specialist or archaeologist of any project site and vicinity of proposed surface disturbance and/or excavation.

    C) Consult with the local Native American tribes as required by federal, state, and local requirements when considering subsurface testing and excavation of prehistoric and archaeological sites. All aspects of proposed actions shall be addressed, including the treatment of cultural materials and in particular the removal, study, and reinternment of Native American burials.

    D) Recommend project modifications or alternative sites that would avoid adverse effects to highly sensitive and significant cultural resource sites and features, including developing and implementing mitigation measures in accordance with all applicable state and federal laws.

2) Authorize data recovery by qualified professionals in circumstances where archaeological deposits cannot be preserved through avoidance or protection measures. (Guidelines are described in the watershed management plan.)

3) When considering demolition or alteration of a historic structure, consult with an architectural historian to determine the feasibility and suitability of relocation; although the integrity of setting would be lost, the structure would be preserved.

4) Evaluate and document the significance of cultural resources threatened by demolition or alteration through application of criteria set forth in the Secretary of the Interior's Standards and Guidelines, CEQA Guidelines, and the California Register of Historical Resources. Where applicable, recommend registration of cultural resources deemed to be eligible for the National Register of Historic Places and the California Register of Historical Resources.

5) Employ nondestructive methods when undertaking research activities, to the maximum extent feasible and where practical, to leave the features of sites and structures in place. Data, objects, and specimens recovered from research sites shall be conserved and curated according to legal requirements.

6) Suspend excavation activities in the event that suspected cultural resources are uncovered; consult with a qualified archaeologist regarding the significance, disposition, and treatment of artifacts; and revise, as necessary, excavation plans to avoid and/or minimize damage to known cultural resources.

7) Suspend excavation activities in the event that human remains are discovered, and immediately inform the county coroner. Consult with a qualified archaeologist to determine if the remains are of Native American origin, and if so, contact the California Native American Heritage Commission to identify most likely descendants for instructions regarding the treatment and disposition of human remains and associated grave artifacts.

8) When previously unknown cultural resources are discovered, report new findings to the California Historical Resources Information System using standard descriptive methods.

9) Implement protective measures, where necessary, to eliminate and minimize potentially negative effects of public access on cultural resources. (Guidelines are described in the watershed management plan.)

10) Prior to initiating new construction, consider reuse of existing historic structures for departmental uses. Prior to modifying historic structures, an architectural historian shall be consulted to determine the feasibility and suitability of any modifications.

11) Periodically inspect historic structures for pest damage and use Integrated Pest Management techniques to control pests in historic structures.

12) Periodically monitor known significant cultural resource sites for evidence of disturbance, damage, or vandalism.

Bay Division Region

Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

The Bay Division Pipelines were built between 1925 and 1936 as a part of the Hetch Hetchy Project. Under the BDPL Reliability Upgrade project (BD-1), a buried section of Bay Division Pipeline No. 1 between the Edgewood and Pulgas Valve Lots would be removed (approximately 1.4 miles) and replaced by a new buried pipeline (Pipeline No. 5). Although most of this pipeline is buried, short stretches are visible where it crosses the creek. The longer visible portions of the pipeline, from the Newark Valve House to the Ravenswood Valve House, would be decommissioned but kept in place. These impacts, on both the underground pipeline and the visible pipelines, would be *potentially significant* if the pipelines were considered to be individual historical resources for the purposes of CEQA compliance. With implementation of SFPUC Construction Measure #9 (cultural resources), as well as implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, the impact of this project would be reduced to a less-than-significant level.

The BDPL 3 and 4 Crossovers project (BD-2) would construct three additional crossover facilities along the Bay Division Pipelines. The BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) would remove and replace portions of Pipeline No. 3, which was built in 1952. Impacts from these projects would be *potentially significant* if the pipelines were considered to be individual historical resources for the purposes of CEQA compliance. However, implementation of SFPUC Construction Measure #9 (cultural resources), as well as implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, could reduce these impacts to a less-than-significant level.

Peninsula Region

Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	PSU
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	PSU
Pulgas Balancing Reservoir	PN-5	N/A

The Lower Crystal Springs Dam project (PN-4) would alter the historic fabric of the dam, which was built in 1890 as part of a separate plan of development by the Spring Valley Water Company. The Lower Crystal Springs Dam was previously determined eligible for listing in the National Register and would be considered a historical resource for the purposes of CEQA. The impact from this project would thus be potentially significant. Depending on the proposed extent of alteration, it is possible that impacts could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #9 (cultural resources), as well as implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic*

Properties. However, since the extent of the work on the historic dam is not yet known, this impact is conservatively considered to be *potentially significant and unavoidable*.

The Crystal Springs/San Andreas Pipeline was built between 1898 and 1932. The CS/SA Transmission project (PN-2) would upgrade or replace the existing Crystal Springs Pump Station. Approximately 144 feet of aboveground flume would be modified or replaced. Assuming for the purposes of this analysis that the building would be considered a historical resource for the purposes of CEQA compliance, alteration or replacement of the historic fabric of the pump station is conservatively considered to be *potentially significant and unavoidable*. However, depending on the proposed extent of alteration, it is possible that impacts could be reduced to a less-than-significant level with historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and project redesign (Measures 4.7-4b and 4.7-4c). This project would also remove and replace the existing Crystal Springs/San Andreas Pipeline. If the pipeline were considered to be a historical resource for the purposes of CEQA, the project's impact on the pipeline could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #9 (cultural resources), as well as implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.

The Lower Crystal Springs Dam (PN-4) and CS/SA Transmission (PN-2) projects are located within the *Peninsula Watershed Management Plan* (Peninsula WMP) area. The Peninsula WMP's cultural resource policies (which are the same as those presented above under the Sunol Valley Region for the Alameda WMP) and cultural resource actions provide guidelines for proposed construction associated with these projects.

The other WSIP projects in this region (Baden and San Pedro Valve Lots, PN-1; HTWTP Long-Term, PN-3; and Pulgas Balancing Reservoir, PN-5) would affect non-historic facilities. Therefore, this impact would *not apply* to these projects.

San Francisco Region

Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	LS

The SAPL 3 Installation project (SF-1) would replace the existing Baden-Merced Pipeline, which was built in the late 1890s, and would construct a new pipeline extension of San Andreas Pipeline No. 3. Portions of the Baden-Merced Pipeline would be removed where its alignment merges with the San Andreas Pipeline No. 3 alignment. Because portions of the existing pipeline would be removed, this impact would be *potentially significant* if the pipeline were considered to be a historical resource for the purposes of CEQA compliance. The project's impact on these pipelines could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #9 (cultural resources), as well as implementation of Measures 4.7-4a through 4.7-4f, which include historical documentation and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.

Because demolition under the Groundwater Projects (SF-2) would be limited to paved parking areas and playgrounds at the Francis Scott Key School Annex, and West and South Sunset Playgrounds, this impact would *not apply* to this project.

The Recycled Water Projects (SF-3) are not expected to affect historic water system facilities. If it is found after final facility locations are determined that historic resources could be adversely affected, implementation of SFPUC Construction Measure #9 (cultural resources) would ensure that impacts are *less than significant.*

Impact 4.7-5: Impacts on adjacent or nearby historic architectural resources.

Demolition, alteration, or other construction activities could also affect historic resources that are located near WSIP projects. These individual facilities or historic districts could include both SFPUC and non-SFPUC structures, and the types of impacts could be either direct or indirect. In particular, impacts on a nearby building associated with the Spring Valley Water Company could constitute significant impacts on potential historic districts united by plan and development. Impacts on non-SFPUC buildings near a WSIP project would not constitute significant impacts on the water system or its individual facilities, but would have to be evaluated in their own specific contexts at the project level.

Construction activities could cause indirect effects, such as damage due to vibration, staging and material storage, or the operation of construction equipment. With respect to vibration, construction activities could cause cosmetic or structural damage to buildings and structures (see Section 4.10, Noise and Vibration, for more discussion). Implementation of mitigation measures requiring the preparation of historic resources surveys and historic resource protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

This analysis identifies historic SFPUC facilities that could be indirectly affected by the WSIP because they are located in or adjacent to the WSIP study area. The following information is based on project information presented in Chapter 3, Program Description, and Appendix C. It does not include all of the historic SFPUC and non-SFPUC resources in the WSIP study area. Implementation of SFPUC Construction Measure #9 (cultural resources) would require preconstruction screening to determine whether adjacent historic resources could be affected by the WSIP projects.

San Joaquin Region

Impact 4.7-5: Impacts on adjacent historic architectural resources		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

Two of the existing San Joaquin Pipelines were built in 1932 and 1953 (1932 for Pipeline No. 1, and 1953 for Pipeline No. 2). The SJPL System project (SJ-3) would add a new pipeline at the west and east ends of the San Joaquin right-of-way. The SJPL Rehabilitation project (SJ-4) would rehabilitate existing pipelines. While direct impacts on these pipelines are addressed in the previous impact (Impact 4.7-4), construction activities associated with both of these projects could indirectly affect the adjacent existing pipelines. Potential impacts associated with these two projects would be *potentially significant*. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

The caretaker's residence associated with the Tesla Portal Disinfection project (SJ-5) could be altered or modified, depending on the design of proposed improvements. This residence is a potentially contributing feature to a historic district (San Francisco Planning Department, 2000), and impacts on this structure could be *potentially significant*. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

The Advanced Disinfection (SJ-1) and Lawrence Livermore (SJ-2) projects would construct new facilities and would replace and upgrade existing non-historic facilities. With implementation of SFPUC Construction Measure #9 (cultural resources), requiring preconstruction screening for historic resources adjacent to these projects, the impact of these two projects would be *less than significant*.

Sunol Valley Region

Impact 4.7-5: Impacts on adjacent historic architectural resources		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	PSM

The Calaveras Dam project (SV-2) could affect the tender's (or watershed keeper's) residence, barn, and other historic structures, if any, at the dam site. The New Irvington Tunnel project (SV-4) could affect the historic components of the portals and tunnel, including the Irvington and Alameda West Portal Valve Houses and the caretaker's house. The SABUP project (SV-6) would conduct work within the area of the existing Alameda East Portal, which was built in 1934. The potential impacts associated with these projects would be *potentially significant*. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

Implementation of SFPUC Construction Measure #9 (cultural resources), which would require preconstruction surveys to confirm the presence of historic resources adjacent to the Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), and Treated Water Reservoirs (SV-5) projects as well as further investigation and protection as necessary, would ensure that impacts are *less than significant.*

Bay Division Region

Impact 4.7-5: Impacts on adjacent historic architectural resources		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

As described above, the Bay Division Pipeline system was built between 1925 and 1936. While direct impacts on these pipelines are addressed in the previous impact (Impact 4.7-4), construction activities associated with these projects could indirectly affect the adjacent existing pipelines. Potential impacts associated with these projects would be *potentially significant*. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

Peninsula Region

Impact 4.7-5: Impacts on adjacent historic architectural resources		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

Facilities in the Lower Crystal Springs Dam vicinity were built during the historic period. The Lower Crystal Springs Dam was built in 1890. The Crystal Springs/San Andreas Pipeline was built between 1898 and 1932. The Crystal Springs Pump Station was built in 1933. In addition to potential direct impacts on these historic resources (addressed under Impact 4.7-4), the CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects could result in *potentially significant* impacts on adjacent historic resources, given the age of this portion of the regional water system. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans, vibration protection measures, and preconstruction surveys (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

The Baden and San Pedro Valve Lots (PN-1) and HTWTP Long-Term (PN-3) projects are upgrades of non-historic-era facilities. Implementation of SFPUC Construction Measure #9 (cultural resources), which would require preconstruction screening surveys to confirm the presence of historic resources adjacent to these projects as well as further investigation and protection as necessary, would ensure that impacts associated with these projects are *less than significant*.

San Francisco Region

Impact 4.7-5: Impacts on adjacent historic architectural resources		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	PSM

The facility locations for the Recycled Water Projects (SF-3) have not yet been determined. If the San Francisco Zoo is selected as a site for this recycled water treatment facility, the historic Fleishhacker Bath House, which was built in 1925, could be indirectly affected. Impacts of the Recycled Water Projects on this structure would be *potentially significant* and would be evaluated during separate, project-level CEQA review. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans and historical documentation (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

The SAPL 3 Installation project (SF-1) would extend an existing non-historic pipeline (San Joaquin Pipeline No. 3). This project would also remove or decommission portions of the existing Baden-Merced Pipeline, which was built in the late 1890s. Portions of the Baden-Merced Pipeline would be removed where its alignment merges with that of San Joaquin Pipeline No. 3. Where its alignment diverges from the San Joaquin Pipeline alignment, it would be capped and filled with slurry. Because portions of the existing Baden-Merced Pipeline would be removed and other portions decommissioned, the impact on the historical significance of the adjacent architectural resources would be *potentially significant*. In addition to SFPUC Construction Measure #9 (cultural resources), implementation of mitigation measures requiring the preparation of historic resources surveys and protection plans and historical documentation (Measures 4.7-4a through 4.7-4f), as appropriate, would reduce this potential impact to a less-than-significant level.

The Groundwater Projects (SF-2) would build new facilities or upgrade non-historic-era facilities. With implementation of SFPUC Construction Measure #9 (cultural resources), which would require preconstruction screening surveys to confirm the presence of historic resources near or adjacent to these projects as well as further investigation and protection as necessary, potential impacts on any adjacent or nearby historic resources would be *less than significant*.

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4.8 Traffic, Transportation, and Circulation

4.8 Traffic, Transportation, and Circulation

4.8.1 Setting

This section presents the existing transportation network for the five WSIP regions. Preferred and alternative sites for WSIP projects are located in seven counties, including unincorporated areas within these counties and 25 cities (see Table 3.8, Chapter 3). The roadway network that would be used for project construction and/or as access routes for construction workers and construction vehicles include regional highways and freeways, local arterials, local residential streets, as well as rural roadways.

Many regional highways and freeways serve more than one WSIP region; depending on the origin and destination of the construction-related vehicles, vehicle trips associated with a particular WSIP project could travel on regional facilities in multiple regions. For each region, the location of interchanges and daily traffic volumes are presented for facilities in the vicinity of the WSIP projects in that region. Average daily traffic volumes on these facilities are based on the most recent data published by the California Department of Transportation (Caltrans). **Table 4.8-1** summarizes the average annual daily traffic volumes on regional facilities serving the five WSIP regions.

San Joaquin Region

Regional and Local Roadways

Regional access to the San Joaquin Region is provided by Interstate 5 (I-5) and Highway 99, both major north-south freeways containing between four and eight travel lanes. I-5 runs between the Canadian border in Washington State to the north and the Mexican border in San Diego to the south. Highway 99 connects with I-80 near Sacramento to the north and I-5 in Bakersfield to the south. The nearest interchanges with local access roadways to WSIP projects are Highway 132 at I-5 and Highway 120 at Highway 99.

In addition, I-580 provides east-west access between the San Francisco–Oakland Bay Bridge to the west and I-5 in San Joaquin County to the east. I-580 is a four-lane freeway in the San Joaquin Region, with an interchange at Highway 132. The average daily traffic volumes on the regional freeways in the vicinity of the WSIP projects are about 23,000 vehicles on I-5, 126,000 vehicles on Highway 99, and 38,000 vehicles on I-580.

Highway 132 (Vernalis Road), Highway 108/120, and Highway 120 serve as access routes for the WSIP projects in the San Joaquin Region. These roadways generally contain two to four travel lanes and do not provide on-street parking. Average daily traffic volumes on these roadways range between 20,000 and 30,000 vehicles. Local roadways in the immediate vicinity of the project sites are primarily two-lane rural roadways.

In the cities of Modesto and Riverbank, McHenry Avenue, Standiford Avenue, Prescott Road, Kiernan Avenue (Highway 219)/Claribel Road, and Ladd Road/Patterson Road (Highway 108), as well as a number of rural and local residential roadways, provide local access to the

TABLE 4.8-1
DAILY TRAFFIC VOLUMES ON REGIONAL ROADWAYS IN THE WSIP REGIONS

Regional Roadways	Location	Daily Traffic (Vehicles Per Day)
Highway 99	Modesto, Junction at Highway 132	126,000
Highway 101	Menlo Park, Willow Avenue	180,000
Highway 101	South San Francisco, Oyster Point Boulevard	200,000
Highway 101	San Francisco, Third Street	213,000
I-5	Modesto, Junction Highway 132	23,200
I-280	Redwood City, Edgewood Road	113,000
I-280	San Mateo, Junction at Highway 35, Bunker Hill	114,000
I-280	San Francisco, Geneva/Ocean Avenues	193,000
I-580	Modesto, Junction at Highway 132	37,500
I-680	Sunol, Junction at Highway 84 West	149,000
I-680	Fremont, Washington Boulevard	152,000
I-880	Fremont, Mowry Avenue	189,000

SOURCE: Caltrans, 2005.

San Joaquin Pipeline right-of-way. The roadways generally contain two to four lanes and do not provide on-street parking. Average daily traffic volumes on the above-noted roadways in Modesto range between 20,000 and 40,000 vehicles, while average daily traffic volumes on the roadways in Riverbank range between 10,000 and 25,000 vehicles (Caltrans, 2005).

Transit Service

The San Joaquin Region is served by a number of transit service providers, including Stanislaus Regional Transit, Modesto Area Express, and Riverbank–Oakdale Transit Authority Trolley. In the vicinity of the San Joaquin Pipeline in Modesto and Riverbank, one or more transit routes run along Kiernan Avenue, Standiford Avenue, McHenry Avenue, and Patterson Road. There are no transit routes in the immediate vicinity of the WSIP project sites outside of the cities of Modesto and Riverbank (MAX, 2006).

Bicycle and Pedestrian Network

There are a number of intercity/interregional bicycle routes on roadways that could serve as haul routes for the WSIP projects. The majority of these routes are Class III facilities (e.g., signed bike routes on roadways that allow shared use by bicycles and vehicles). Highway 120, Highway 108, and Willms Road are bicycle routes in the eastern portion of the region, and Highway 33 and Kasson Road are bicycle routes in the western portion of the region. There are limited pedestrian facilities on roadways in the vicinity of the WSIP project sites. In Modesto, the SFPUC right-of-way between Semallon Drive (west of McHenry Avenue and the Union Pacific railroad tracks) and Standiford Avenue contains a bicycle/pedestrian path (Class I facility). Bicycle lanes (Class II facilities) are provided on Standiford Avenue, Prescott Road, Tully Road, and Coffee Road (City of Modesto, 2002).

Sunol Valley Region

Regional and Local Roadways

Regional access to the Sunol Valley Region is provided by I-680. I-680 is an eight-lane, north-south freeway that connects I-80 near Fairfield to the north with I-280 in San Jose to the south. I-680 interchanges near the WSIP project sites are provided at Highway 237 in Milpitas and Highway 84 in Sunol. I-680 in the vicinity of Highway 84 carries about 149,000 vehicles per day.

Local access between the project sites in the western portion of the region and I-680 is via Calaveras Road. Calaveras Road between I-680 and Geary Road is generally a two-lane roadway with average daily traffic volumes of about 1,400 vehicles. South of Geary Road, Calaveras Road is a one to two-lane, rural roadway serving the Sunol Regional Wilderness and Calaveras Reservoir and Dam, and connects with Highway 237 and I-680 in Milpitas. Mission Boulevard (Highway 238), a four-lane divided arterial, provides local access to I-680 in the western portion of the Sunol Valley Region. Mission Boulevard (Highway 238) has an average daily traffic volume of about 32,000 vehicles (Caltrans, 2005).

Transit Service

Alameda County (AC) Transit is the principal bus service provider in the county, while Santa Clara Valley Transportation Authority (VTA) is the primary transit provider in Santa Clara County. There is no bus service provided by either AC Transit or VTA along Calaveras Road. A number of AC Transit bus lines (140, 141, 180, 217, and 520) provide service along Mission Boulevard (Highway 238) in Fremont (AC Transit, 2007; VTA, 2007).

Bicycle and Pedestrian Network

Neither Calaveras Road nor Mission Boulevard (north of I-680) are part of the designated Alameda countywide bicycle network. However, the East Bay Bicycle Coalition has identified Calaveras Road between I-680 and Milpitas, and Mission Boulevard as on-road routes recommended for bicycle travel. Calaveras Road experiences considerable recreational bicycle travel on weekends. There are no pedestrian facilities on Calaveras Road. Mission Boulevard has sidewalks on both sides of the street (Alameda County Congestion Management Agency, 2006; East Bay Bicycle Coalition, 2005).

Bay Division Region

Regional and Local Roadways

Regional access to the Bay Division Region is provided by I-680 and I-880 serving the eastern portion of the region in Alameda County, and Highway 101 and I-280 serving the western portion of the region in San Mateo County. Within the Bay Division Region, I-680 is a six-lane, east-west freeway, with interchanges at Mission Boulevard (Highway 238) and at Washington Street. I-880 is an eight-lane, north-south freeway that connects I-580 in Oakland to the north and I-280 in San Jose to the south. Within the region, I-880 has interchanges at Stevenson Boulevard and

Mowry Avenue. The average daily traffic volumes are about 152,000 vehicles on I-680, and 189,000 vehicles on I-880.

Highway 101 runs between I-5 near the Washington border to the north and the east Los Angeles interchange to the south. Highway 101 in the vicinity of the program area is an eight-lane, north-south freeway with interchanges at University Avenue, Willow Road, and Marsh Road. I-280 runs between San Francisco to the north and Highway 101/I-680 in San Jose to the south. In the Bay Division Region, I-280 has an interchange at Edgewood Road. Average daily traffic volumes in the Bay Division Region are about 180,000 vehicles on Highway 101, and 113,000 vehicles on I-280.

Woodside Road (Highway 84), El Camino Real (Highway 82) and Mission Boulevard (Highway 238) also serve as major regional access routes within the region. These roadways contain four to six travel lanes and generally do not provide on-street parking. Average daily traffic volumes on these facilities range between 36,000 and 46,000 vehicles (Caltrans, 2005).

WSIP projects are located in the vicinity of numerous residential and commercial streets in this region. Minor arterials and local residential streets generally contain two travel lanes and parking on both sides of the street.

Transit Service

The Bay Division Region is served by two transit agencies: AC Transit and San Mateo County Transit District (SamTrans). AC Transit is the principal bus service provider in the Alameda County portion of this region, with a number of local routes along the roadways in the vicinity of WSIP projects. SamTrans serves San Mateo County with a number of express and local routes in this region. Mission Boulevard, Paseo Padre Parkway, El Camino Real, and Edgewood Road are among this region's roadways served by one or more AC Transit and SamTrans bus routes (AC Transit, 2007; SamTrans, 2007).

Bicycle and Pedestrian Network

There are a number of bicycle facilities on roadways in the vicinity of WSIP projects in this region. The eastern portion of the region in Alameda County has an established network of existing and proposed Class II (bike lanes striped within the paved area of roadways and established for the preferential use of bicycles) and Class III facilities. Many of the routes overlap with major arterials (e.g., Mission Boulevard, Paseo Padre Parkway). The East Bay Bicycle Coalition identifies most arterials as on-road bicycle routes. The western portion of the region in San Mateo County also has an established bicycle route network, primarily along major arterials (including Edgewood Road, Bay Road, El Camino Real, and Woodside Road) (Alameda County Congestion Management Agency, 2006).

The San Francisco Bay Trail has identified routes in both the eastern and western portions of the region. The Bay Trail is designed to create pathway links to the various commercial, residential, and industrial neighborhoods that surround San Francisco Bay. In the vicinity of WSIP projects in the Bay Division Region, the Bay Trail includes off-street paths along Highway 84, and on-road paths on University Avenue (Association of Bay Area Governments, 2003).

Most, but not all, roadways in the vicinity of the WSIP projects in the Bay Division Region have sidewalks on both sides of the street.

Peninsula Region

Regional and Local Roadways

Regional access to the Peninsula Region is provided by Highway 101 and I-280 in San Mateo County. Highway 101 in the Peninsula Region contains eight lanes and has interchanges at Millbrae Avenue and I-380. I-280 in the Peninsula Region contains eight lanes, with interchanges at Edgewood Road, Highway 92, Bunker Hill Drive, Hayne Road, and San Bruno Avenue. In the Peninsula Region, the average daily traffic volumes are about 200,000 vehicles on Highway 101, and 114,000 vehicles on I-280 (Caltrans, 2005).

El Camino Real (Highway 82) and Junipero Serra Boulevard also serve as access routes within the region, and Skyline Boulevard (Highway 35), Cañada Road, and Crystal Springs Road provide local access. These roadways contain two to four travel lanes. Skyline Boulevard is also part of the Scenic Highway System. El Camino Real and Junipero Serra Boulevard generally provide on-street parking.

Transit Service

Transit service in the Peninsula Region is primarily provided by the SamTrans, which offers a number of express and local routes along the arterials in the region, particularly along El Camino Real (Highway 82). There are no bus routes on Skyline Boulevard or Crystal Springs Road. The Peninsula Region is also served by the regional Bay Area Rapid Transit (BART) rail service to the San Francisco International Airport, and Caltrain commuter rail service between San Francisco and San Jose (SamTrans, 2007).

Bicycle and Pedestrian Network

The Peninsula Region has an established network of bicycle routes. The majority of these routes are Class III (signed routes only). Many of the routes overlap with major arterials (e.g., Mission Boulevard, Paseo Padre Parkway). Most, but not all, arterials and local streets in the vicinity of the WSIP projects in the Peninsula Region include sidewalks on both sides of the street (Alameda County Congestion Management Agency, 2006; San Mateo County, n.d.).

San Francisco Region

Regional and Local Roadways

Regional access to the San Francisco Region is provided by Highway 101 and I-280. Highway 101 in this region contains eight lanes and has interchanges at Millbrae Avenue, Oyster Point Boulevard, Third Street/Bayshore Boulevard, and Silver Avenue. I-280 in this region contains eight lanes, with an interchange at 19th Avenue/Highway 1. In the San Francisco Region, the average daily traffic volumes are about 213,000 vehicles on Highway 101, and 193,000 vehicles on I-280 (Caltrans, 2005).

A number of local roadways connect with the regional facilities, including El Camino Real (Highway 82) and Bayshore Boulevard in San Mateo County, as well as Ocean and Geneva Avenues in San Francisco. Local and regional access to the western portion of San Francisco is provided by 19th Avenue/Highway 1. These arterials generally contain four to six travel lanes, and most arterials provide for on-street parking on both sides of the street.

WSIP projects are located along and across numerous residential streets in both San Mateo and San Francisco Counties. Residential streets generally contain two travel lanes and on-street parking on one or both sides of the street.

Transit Service

Transit service in the San Francisco Region is primarily provided by the San Francisco Municipal Railway (Muni) (bus and light rail service in San Francisco), SamTrans, BART, and Caltrain. In the vicinity of the WSIP projects in this region, there are bus and/or light rail routes on 19th Avenue, Ocean Avenue, and Geneva Avenue. SamTrans provides a number of express and local bus routes along El Camino Real, and along local streets in Colma, San Bruno, Millbrae, and San Mateo. SamTrans provides some limited service in San Francisco (e.g., on Bayshore Boulevard) (Muni, 2005; SamTrans, 2007).

Bicycle and Pedestrian Network

The San Francisco Region has an established network of bicycle routes in both San Mateo and San Francisco Counties. In the vicinity of the WSIP project sites, most routes are Class III facilities (signed routes only) and overlap with major arterials (e.g., Geneva Avenue in San Francisco, and El Camino Real and Junipero Serra Boulevard in San Mateo County). Most, but not all, arterials and local streets in the vicinity of the WSIP projects in this region include sidewalks on both sides of the street (San Mateo County, n.d.).

Regulatory Framework

Transportation analysis in California is guided by policies and standards set at the state level by Caltrans as well as by local jurisdictions. There are no federal regulations that address transportation impacts associated with the WSIP projects.

Both Caltrans and local jurisdictions generally assess the impact of long-term, not short-term, traffic conditions. Plans and policies related to transportation aim to plan for and accommodate future growth and the vehicular, transit, pedestrian, and bicycle demand associated with that growth.

Policies regarding traffic service levels apply to long-term, not short-term, traffic conditions. These policies generally specify maintaining a level of service[1] (LOS) of LOS C or LOS D on major streets during the peak periods of traffic flow, and require mitigation measures when project-specific impacts would result in a level of service exceeding the threshold.

4.8.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to traffic, but generally considers that implementation of the proposed program would have a significant traffic impact if it were to:

- Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections) (Evaluated in this section)
- Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways (unless it is practical to achieve the standard through increased use of alternative transportation modes) (Not evaluated in this section, see Appendix B)
- Result in a change in air traffic patterns, including either an increase in traffic levels, an obstruction to flight, or a change in location, that results in substantial safety risks (Not evaluated in this section, see Appendix B)
- Substantially increase hazards due to a design feature (e.g., sharp curves at dangerous intersections) or incompatible uses, or interfere with existing transportation systems (including vehicular, pedestrian, and bicycle networks), causing substantial alterations to circulation patterns or major traffic hazards (Evaluated in this section)
- Result in inadequate emergency access (Evaluated in this section)
- Result in inadequate parking capacity that could not be accommodated by alternative solutions (Evaluated in this section)
- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc), or cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes (Not evaluated in this section, see Appendix B)

Since many of the WSIP facilities are located in roadways or cross roadways, a significance criterion that relates to interference with existing transportation systems (second half of fourth

[1] Level of service (LOS) is a qualitative description a facility's performance based on average delay per vehicle, vehicle density, or volume-to-capacity ratios. Levels of service range from LOS A, which indicates free-flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays.

bullet) has been added to the CCSF's standard list. This criterion has been applied in the past by the CCSF to development projects located in San Francisco.

Approach to Analysis

This program-level analysis presents a screening-level assessment of the potential transportation impacts associated with the WSIP projects. This assessment evaluates the potential for project-specific, short-term, construction-related impacts on roadways due to changes in roadway capacities or increases in construction-related traffic, as well as longer-term impacts due to the operation of WSIP facilities.

The impact assessment of construction-related impacts assumes that for all WSIP projects the contractor(s) would obtain any necessary road encroachment permits prior to construction and would comply with the conditions of approval attached to project implementation. In particular, the assessment assumes implementation of SFPUC Construction Measure #5 for traffic, which specifies that each contractor must prepare a traffic control plan to minimize traffic and on-street parking impacts on any streets affected by construction of a proposed project. As appropriate, the SFPUC or the contractor would consult with local traffic and transit agencies. The transportation impact assessment assumes that if multiple contracts for work within a project are issued, each individual project would prepare a traffic control plan, as applicable to the situation.

A number of the WSIP projects also include improvements to existing roads or construction of new temporary access roads between the project sites and public roadways serving as haul routes. The assessment assumes that any improvements at the intersection of existing or new temporary access roads with public roadways would be constructed to meet the applicable intersection design standards of the jurisdiction in which the facility is located. As appropriate, truck deceleration and acceleration lanes would be provided to facilitate truck access into and out of the project site, and to minimize conflicts between construction vehicles and adjacent traffic flow.

Impact Summary by Region

Table 4.8-2 presents a summary of the traffic and transportation impacts associated with implementation of the WSIP.

Construction-Related Impacts

Construction-related traffic impacts are not generally considered significant, because given their temporary nature, they are usually of limited duration. However, since construction of some WSIP projects could affect the transportation network for a longer duration (e.g., construction activities occurring for a two-year period), their impacts could be determined to be potentially significant. Construction activities that affect roadway operations are typically regulated through permits and construction requirements to ensure acceptable levels of traffic flow during the period of traffic disruption. Construction best management practices, including the preparation of a traffic control plan, are required to be in place to ensure the safety of construction workers, motorists, bicyclists, and pedestrians throughout project construction.

TABLE 4.8-2
POTENTIAL IMPACTS AND SIGNIFICANCE – TRAFFIC, TRANSPORTATION, AND CIRCULATION

Projects	Project Number	Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays	Impact 4.8-2: Short-term traffic increases on roadways	Impact 4.8-3: Impaired access to adjacent roadways and land uses	Impact 4.8-4: Temporary displacement of on-street parking	Impact 4.8-5: Increased traffic safety hazards during construction	Impact 4.8-6: Long-term traffic increases during facility operation
San Joaquin Region							
Advanced Disinfection	SJ-1	LS	PSM	LS	LS	PSM	LS
Lawrence Livermore Supply Improvements	SJ-2	LS	PSM	LS	LS	PSM	LS
San Joaquin Pipeline System	SJ-3	PSM	PSM	PSM	LS	PSM	LS
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	PSM	PSM	PSM	PSM	PSM	LS
Tesla Portal Disinfection Station	SJ-5	LS	PSM	LS	LS	PSM	LS
Sunol Valley Region							
Alameda Creek Fishery Enhancement	SV-1	LS	PSM	LS	LS	PSM	N/A
Calaveras Dam Replacement	SV-2	PSM	PSM	PSM	LS	PSM	N/A
Additional 40-mgd Treated Water Supply	SV-3	LS	PSM	LS	LS	PSM	LS
New Irvington Tunnel	SV-4	LS	PSM	LS	LS	PSM	N/A
SVWTP – Treated Water Reservoirs	SV-5	LS	PSM	LS	LS	PSM	LS
San Antonio Backup Pipeline	SV-6	PSM	PSM	LS	LS	PSM	N/A
Bay Division Region							
Bay Division Pipeline Reliability Upgrade	BD-1	PSM	PSM	PSM	PSM	PSM	LS
BDPL Nos. 3 and 4 Crossovers	BD-2	LS	PSM	PSM	LS	PSM	LS
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	PSM	PSM	PSM	PSM	PSM	LS
Peninsula Region							
Baden and San Pedro Valve Lots Improvements	PN-1	LS	LS	LS	LS	PSM	LS
Crystal Springs/San Andreas Transmission Upgrade	PN-2	PSM	PSM	LS	LS	PSM	LS
HTWTP Long-Term Improvements	PN-3	LS	PSM	LS	LS	PSM	LS
Lower Crystal Springs Dam Improvements	PN-4	PSM	PSM	PSM	PSM	PSM	LS
Pulgas Balancing Reservoir Rehabilitation	PN-5	PSM	PSM	LS	PSM	PSM	LS
San Francisco Region							
San Andreas Pipeline No. 3 Installation	SF-1	PSM	PSM	PSM	PSM	PSM	N/A
Groundwater Projects	SF-2	PSM	LS	PSM	PSM	PSM	LS
Recycled Water Projects	SF-3	PSM	PSM	PSM	PSM	PSM	LS

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

The construction impacts identified below for each type of facility have been developed to allow a general assessment of the nature and magnitude of potential construction impacts associated with each individual facility. The final construction scheduling of specific projects could result in overlapping impacts due to simultaneous construction of more than one facility. Since most transportation impacts associated with each facility would be specific to each facility site, overlapping impacts would be limited to impacts at adjoining construction sites or along common haul routes, where overlapping schedules for two or more facilities could result in combined traffic impacts.

Short-Term Impacts of Construction Traffic

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays.

Impacts of WSIP project construction on the availability of travel lanes could result if facility construction occurs within or adjacent to a public roadway, and a portion of the pavement is required for construction purposes. Construction could then result in a temporary reduction in the number of travel lanes or the available width of travel lanes, and subject vehicles (including transit) using the affected roadways to increased congestion and delays. Road closures would require drivers to detour to other, potentially less convenient routes to access their destinations. Impacts would be significant and unavoidable if roadways would be closed and no detour routes provided, or if through-traffic or access to adjacent land uses would be restricted for a substantial duration. The actual impact of construction activities on roadway capacity and traffic operations would depend on the length of the affected roadway segment, the number of travel lanes that would be available for vehicular flow, and the duration of construction activities on the roadways.

Pipelines. Pipeline construction would occur both within the SFPUC right-of-way and within or adjacent to public roadway right-of-way.[2] Construction across minor roadways and some major roadways would be conducted via the cut-and-cover method, which would require construction activities to occur within the roadway pavement. Impacts on any particular segment of roadway would be limited in duration, as construction of pipelines generally progresses at an average rate of about 120 feet per day in urban and suburban areas, and 160 feet per day in rural areas. In general, multiple crews are expected to work on pipeline construction; therefore, for a particular pipeline project, construction at more than one segment of the pipeline could occur simultaneously. Cut-and-cover construction across some major roadways could result in substantial impacts on traffic flow, and trenchless construction techniques such as the jack-and-bore method may be selected by the contractor or required by local jurisdictions. Construction of pipelines across freeways, some major roadways, and railroads would be completed using the jack-and-bore or similar method, which would not affect operations on these facilities. (See Chapter 3, Section 3.10, for a description of the various proposed construction techniques.)

[2] For purposes of the transportation discussion, "SFPUC right-of-way" implies off-road areas through which the pipeline alignment travels, and "public roadway right-of-way" implies in-road areas. The SFPUC may have easements through the public roadway; however, construction activities in the public roadway right-of-way could encroach on vehicular, pedestrian, and bicycle access and on-street parking, if provided.

Pipeline construction within public roadways would result in greater traffic impacts, as construction activities would require the use of a portion of the roadway for excavation of the pipeline, and additional roadway area would be needed for construction staging, including materials storage and construction vehicle and construction worker parking. If the public roadway right-of-way is narrow (e.g., minor residential streets), then temporary roadway closures could be required.

Tunnels. Since tunnel construction would occur from tunnel portals and shafts within the tunnel alignment, WSIP projects involving new tunnel construction would generally not require the use of parking or travel lanes for construction activities. In some cases, however, haul trucks traveling to a facility site could result in the need to utilize shoulders or parking lanes for staging prior to accessing the construction site. In addition, some temporary roadway closures could be required for tunnel construction activities if they occur adjacent to a public roadway right-of-way.

Other Facilities. Construction of other types of facilities (vaults, valve lots, crossovers, pump stations, treatment facilities, and storage facilities) would generally occur at discrete locations along the alignment, and onsite parking would be provided within the designated construction staging area. Any travel lane closures would be of limited duration. At some urban locations, where the size of staging areas could be limited, construction worker parking demand might need to be accommodated on adjacent public streets.

San Joaquin Region

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	LS

The SJPL System project's (SJ-3) 6-mile eastern pipeline segment and crossover location west of Oakdale Portal would be sited in an undeveloped area, where the potential for traffic impacts would be low. The 10-mile western pipeline segment east of Tesla Portal would extend through a primarily agricultural area that contains a cluster of residences and a golf course.

Most construction on the SJPL System project (SJ-3) would occur within the SFPUC right-of-way, but this right-of-way would cross a number of local roadways, highways, and freeways as well as a railroad. Construction of the new pipeline across freeways (Highway 33, Highway 99, I-5, and I-580) and railroad tracks would be conducted using the jack-and-bore method, and disruption to traffic flow would be minimal. Construction across other roadways would be conducted primarily using the cut-and-cover method; however, since most roadways serving the project site are rural roadways with low volumes of traffic, disruption of traffic flow would also be minimal. Potential traffic impacts associated with the SJPL System project would be evaluated as part of separate, project-level CEQA review for this project. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a is expected to be adequate to reduce any *potentially significant* traffic impacts to a less-than-significant level.

The SJPL Rehabilitation project (SJ-4) involves reconditioning of 48 miles of the existing San Joaquin Pipelines. While the eastern and western portions of the pipeline run through undeveloped and agricultural areas, where the potential for traffic impacts would be low, the central portion of the pipeline runs through the cities of Modesto and Riverbank, and largely through developed residential areas. Any construction through Modesto and Riverbank would be conducted using both the jack-and-bore and cut-and-cover methods and could result in temporary lane closures. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a is expected to reduce any *potentially significant* traffic impacts to a less-than-significant level. When project elements and locations of the SJPL Rehabilitation project are defined, it would be subject to separate, project-level CEQA review.

Other WSIP projects could be located in the Tesla Portal vicinity (under Advanced Disinfection, SJ-1, and Tesla Portal Disinfection, SJ-5) or at the Thomas Shaft (under Lawrence Livermore, SJ-2) and would involve construction of new treatment facilities within the SFPUC right-of-way. No construction within public roadways is anticipated. Construction activities associated with these facilities would not result in a reduction in the number of travel lanes on roadways in the vicinity of the site. Therefore, traffic impacts are expected to be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plans).

Sunol Valley Region

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	PSM

All WSIP projects in this region would be constructed within the SFPUC right-of-way. The Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), New Irvington Tunnel (SV-4), and Treated Water Reservoirs (SV-5) projects would not require construction within or across public roadways, and therefore would not affect the number of travel lanes in the vicinities of these projects. With implementation of SFPUC Construction Measure #5 (traffic control plan), this impact would be *less than significant* for these projects.

The SABUP project (SV-6) would require crossing of Calaveras Road, a temporary but *potentially significant* impact on Calaveras Road. With implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures as part of Measure 4.8-1a, this impact would be reduced to a less-than-significant level.

Construction of Calaveras Dam (SV-2) would require temporary closure of a segment of Calaveras Road (between Geary and Felter Roads) to through-traffic during the two- to three-year construction period. Through-traffic using Calaveras Road would be required to find an alternate route for the duration of the construction period and would likely use I-680. Construction-related traffic impacts associated with Calaveras Dam would be evaluated as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures (including detour plans) as part of Measure 4.8-1a is expected to reduce the *potentially significant* impacts of the roadway closure to a less-than-significant level.

Bay Division Region

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Within the Bay Division Region, the BDPL Reliability Upgrade (BD-1) project would primarily involve construction activities within the SFPUC pipeline right-of-way. However, since this project is located in an urbanized area, it may require construction across multiple roadways, highways, and freeways. Construction across roadways could potentially affect the number of available travel lanes as well as traffic flow on these roadways. The jack-and-bore method of construction is proposed to be used for crossing I-880 and Highway 101, while the cut-and-cover method would be employed to cross all other roadways. Use of cut-and-cover method for construction across a number of multiple-lane arterials, particularly in Fremont (e.g., Mission Boulevard, Paseo Padre Parkway, and Fremont Boulevard), could result in significant impacts on traffic operations. The impacts could be compounded if construction occurs simultaneously on more than one major arterial, and/or if the arterial is used as a haul route for other projects in the region. The BDPL Reliability Upgrade (BD-1) project would also require construction under the commuter and freight rail tracks at a number of locations; however, train movements would not be affected because the jack-and-bore method would be used. A more detailed traffic impact analysis for the BDPL Reliability Upgrade (BD-1) project would be completed as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan), additional traffic control measures identified in Measure 4.8-1a, and coordination of individual traffic control plans (Measure 4.8-1b) are expected to reduce *potentially significant* traffic impacts of the BDPL Reliability Upgrade (BD-1) project to a less-than-significant level.

BDPL 3 and 4 Crossovers (BD-2) would involve construction of new valve and vault structures and would not require construction within public roadways; therefore, potential traffic impacts on nearby roadways would be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plan).

BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) includes a replacement pipeline between the new isolation valves**,** and would likely include work within public roadways. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a are expected to reduce any *potentially significant* traffic impacts to a less-than-significant level.

Peninsula Region

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

Within this region, the Baden and San Pedro Valve Lots (PN-1) and HTWTP Long-Term (PN-3) projects would be constructed at discrete locations within the SFPUC pipeline and tunnel alignments and would not require construction within public roadways. With implementation of SFPUC Construction Measure #5 (traffic control plan), this impact would be *less than significant* for these projects.

CS/SA Transmission (PN-2) facilities would be located on SFPUC property, except for repair work proposed on the Upper Crystal Springs Dam culverts under Highway 92. The Pulgas Balancing Reservoir project (PN-5) would include enlargement of the channel that crosses under Cañada Road. Both of these projects could require temporary closure of traffic lanes. Since these projects cross under public roadways, the potential for traffic disruption would be limited to the crossing location. For both of these projects, implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a are expected to reduce any *potentially significant* traffic impacts to a less-than-significant level. The CS/SA Transmission project would be evaluated as part of separate, project-level CEQA review and a more detailed traffic analysis would be completed at that time.

Lower Crystal Springs Dam (PN-4) would require temporary closure of San Mateo County's Skyline Boulevard Bridge, which was built across the top of the dam. This section of Skyline Boulevard would be closed during the one-year construction period and would be reopened upon completion of the project. Implementation of SFPUC Construction Measure #5 (traffic control plan) and detour plans for the closure of Skyline Boulevard Bridge (Measure 4.8-1a) is expected to reduce *potentially significant* impacts of the roadway closure to a less-than-significant level. Potential traffic impacts associated with this project would be evaluated in more detail as part of separate, project-level CEQA review.

San Francisco Region

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

Within this region, the SAPL 3 Installation, (SF-1) project would have the greatest potential to affect roadway capacity as well as traffic and transit operations. The pipeline alignment would travel through densely populated areas, and pipelines would be located within public roadways. Pipeline replacement would necessitate partial or full temporary lane closures and could include closure of parking and/or travel lanes. Implementation of SFPUC Construction Measure #5 (traffic control plan), additional traffic control measures identified in Measure 4.8-1a, and coordination of individual traffic control plans (Measure 4.8-1b) is expected to reduce *potentially significant* impacts of this project to a less-than-significant level. Potential traffic impacts would be evaluated in more detail as part of separate, project-level CEQA review.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could also require construction within or across local roadways, which could affect traffic operations. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a is expected to reduce *potentially significant* impacts of each project to a less-than-significant level. Potential traffic impacts would be evaluated in more detail as part of separate, project-level CEQA review for both of these projects.

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips.

Construction-related vehicles trips would include construction workers traveling to and from the project site, haul truck trips associated with excavation materials transfer and disposal, and materials and equipment deliveries. The number of construction-related vehicles traveling to and from WSIP project sites would vary on a daily basis, depending on the type of project, construction phase, planned activity, and material needs. The greatest number of construction-generated vehicle trips would generally occur during the excavation, concrete pouring, and backfilling stages of construction. Truck operations, including haul trucks and materials delivery trucks, would occur mostly during daytime hours, but could extend beyond these hours (see Section 4.10, Noise and Vibration for more discussion of construction hours).

Construction traffic could result in short-term increases in traffic volumes on roadways in the immediate vicinity of WSIP project sites and along haul routes. The addition of construction vehicle traffic to the existing roadway volumes, without increasing the capacity of the roadway, could result in increased congestion and delay for vehicles, including transit. The reduction in capacity of roadways through temporary lane closures could further increase congestion and delays for vehicles using the roadway. The presence of construction truck traffic could also temporarily reduce roadway capacities due to the slower travel speeds and larger turning radii of trucks. The actual impact of construction vehicle traffic on local and regional facilities would depend on the number and type of construction-related vehicles, the number of travel lanes on the roadways used as haul routes, existing traffic volumes on these roadways, as well as the terrain and other factors. Impacts of construction traffic would be most noticeable in the immediate vicinity of the WSIP projects, and less noticeable farther away and on regional facilities.

Haul routes for offsite disposal of excavated materials, and deliveries of concrete and other materials would include a combination of regional highways, local arterials, and residential and rural streets, depending on the geographic locations of WSIP projects. Offsite disposal of excavated materials would depend of the type of material to be disposed of, and could occur at any of the 17 active landfills located in Stanislaus, San Joaquin, Alameda, San Mateo, and Santa Clara counties. Depending on project location, regional freeways such as Highway 92, I-280, I-580, and I-680 would be used to access these facilities.

Due to the proximity of WSIP projects to each other, the use of common haul routes, and overlapping schedules, the number of daily truck trips on roadways serving as haul routes could increase substantially over existing conditions. The effect of such combined or collective increases in construction vehicle traffic, and particularly truck traffic, on roadways would be increased delays due to the trucks' slower travel speeds and larger turning radii. The impact of combined construction vehicle traffic increases on roadway operations would depend on a number of factors, including the number of daily and peak-period truck volumes, the duration of the overlapping phases of the construction projects, and the characteristics of the haul route (e.g., the number of travel lanes in each direction, existing traffic volumes, and terrain). Combined or collective traffic impacts are discussed in Section 4.16, Impact 4.16-7, Localized Collective Impacts.

Pipelines. Construction-vehicle activity associated with pipeline construction includes excavation, disposal of excavated materials, and materials delivery. Pipeline construction would proceed at an average rate of approximately 120 feet per day in urban and suburban areas, and 160 feet per day in rural areas; the haul routes would vary depending on the location of the segment of pipeline being constructed. At a minimum, there would be 20 truck trips (round-trips) per day, with a maximum of 10 truck trips per hour during the a.m. and p.m. peak hours. In addition, there would be approximately 30 to 40 workers per crew traveling to and from the site each day. Construction activities could occur six days per week and would generally occur between 7:00 a.m. and 5:00 p.m., although construction could extend beyond these hours.

Tunnels. Construction-vehicle activity associated with tunnel construction would include construction of the tunnel shaft, removal of excavated materials, and materials delivery. Construction staging and materials removal would occur at the tunnel entry and exit shafts or portals, and construction at the tunnel would typically be conducted 24 hours per day, seven days a week. Excavated materials would be disposed of onsite, or stored onsite and then disposed offsite. Offsite disposal of excavated materials would result in greater traffic impacts. If excavated materials were disposed of offsite on a daily basis, the number of haul trucks would be based on the amount of material that could be excavated per day. Typical tunnel excavation could result in between 20 and 40 truck trips (round-trips) per day. If excavation materials were stored onsite prior to offsite disposal, the number of truck trips would be limited to the amount of available staging area and could exceed the 20 to 40 truck trips per day. Truck activity associated with offsite disposal would occur on weekdays during the designated construction hours and, assuming between 20 and 40 truck trips per day, would result in a maximum of 10 truck trips during the a.m. or p.m. peak hours. Since tunnel activities would be conducted 24 hours a day, there would be three shifts of 10 construction workers per crew on a daily basis traveling to and from the project site.

Other Facilities. The number of construction vehicles associated with other types of WSIP projects would depend on the facility, and whether new facilities would be constructed or existing facilities upgraded. New treatment and storage facilities would generate the greatest number of construction vehicles, as these facilities would involve excavation and construction of new structures. The number of vehicle trips would depend on the amount of excavated materials;

however, during the a.m. and p.m. peak hours up to 180 truck trips could be expected. Construction of the new treatment and storage facilities would involve an average of 30 to 50 onsite construction workers per day. Other facilities such as valve vaults and pump stations would have substantially fewer construction vehicles and workers onsite per day. Construction activities could occur six days per week and would generally occur between 7:00 a.m. and 5:00 p.m., although construction could extend beyond these hours.

San Joaquin Region

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

Of the five projects in the San Joaquin Region, pipeline construction associated with the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would generate the greatest amount of construction traffic associated with construction crews and materials deliveries. Construction of the eastern pipeline segment of the SJPL System project (SJ-3) would increase traffic volumes on local highways, such as Highways 120 and 128, as well as on rural, two-lane roadways. Construction of the western pipeline segment of SJ-3 would increase traffic volumes on I-580, Vernalis Road (Highway 132), and Highway 33 as well as on rural, two-lane roadways. The traffic impacts of the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would be evaluated in more detail during separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan), additional traffic control measures as part of Measure 4.8-1a, and coordination of individual traffic control plans for projects in the Tesla Portal vicinity (Measure 4.8-1b) would reduce this *potentially significant* impact to a less-than-significant level.

Since the project elements and location of the SJPL Rehabilitation project (SJ-4) have not been defined, the potential exists that construction could occur at multiple locations along the existing 48-mile pipeline. Construction within Modesto could result in more than one construction project utilizing the same residential streets as haul routes and in partial or full closure of local streets, which could cause significant traffic impacts. Implementation of SFPUC Construction Measure #5 (traffic control plan for each individual project), additional traffic control measures identified in Measure 4.8-1a, and coordination of individual traffic control plans for nearby projects (Measure 4.8-1b) would reduce this *potentially significant* impact to a less-than-significant level.

Access routes for Tesla Portal (Advanced Disinfection, SJ-1, and Tesla Portal Disinfection, SJ-5) would include I-580, Chrisman Road, and Vernalis Road, while access routes for Thomas Shaft (Lawrence Livermore, SJ-2) would include I-580, Corral Hollow Road, and a dirt access road. The amount of activity associated with construction of these facilities has not yet been determined. With implementation of SFPUC Construction Measure #5 (traffic control plan) for these projects and additional traffic control measures identified in Measure 4.8-1a, *potentially significant* impacts of project-related increases in traffic would be reduced to a less-than-significant level.

Sunol Valley Region

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

Within this region, construction of the Calaveras Dam (SV-2) and Treated Water Reservoirs (SV-5) projects would require an extensive amount of excavation for dam replacement and construction of the new storage reservoirs at the Sunol Valley WTP. Of the six projects in the Sunol Valley Region, these projects would result in the greatest number of construction vehicles traveling to and from project sites. These trips would include disposal of excavated materials, and delivery of construction and filter materials. In addition, each project would have between 50 and 190 construction workers traveling to and from the site each day. The Calaveras Dam project would close Calaveras Road to through-traffic between Geary Road and Felter Road, requiring through-traffic using this section of Calaveras Road to divert to I-680. The traffic impacts associated with the Calaveras Dam and Treated Water Reservoirs projects would be evaluated in more detail as part of separate, project-level CEQA review.

The haul route for the New Irvington Tunnel (SV-4) exit portal would be via a new access road that would extend through a residential neighborhood and would connect the portal with Mission Boulevard (Highway 238) and the I-680 freeway. Due to the possible overlap in the construction schedules of the New Irvington Tunnel and BDPL Reliability Upgrade (BD-1) projects, there could be substantial increases in haul and delivery truck traffic in this area, which could substantially affect the operating conditions on Mission Boulevard. Combined or collective impacts associated with this overlap are discussed in Section 4.16, Impact 4.16-7.

For the six projects in the Sunol Valley Region, including Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), and SABUP (SV-6), implementation of SFPUC Construction Measure #5 (traffic control plans) and additional traffic control measures identified in Measure 4.8-1a are expected to reduce any *potentially significant* traffic impacts to a less-than-significant level.

Bay Division Region

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Of the three projects in the Bay Division Region, the pipeline construction projects (BDPL Reliability, BD-1, and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would generate the greatest amount of construction traffic associated with construction crews, disposal of excavated materials, and materials deliveries. Haul routes would be along highways and freeways such as I-680, I-880, I-280, Highway 101, and Highway 238 (Mission Boulevard), major arterials such as El Camino Real, Paseo Padre Parkway, and

Edgewood Drive, as well as local commercial and residential streets. Potential construction traffic impacts would be evaluated in more detail as part of separate, project-level CEQA review for the BDPL Reliability Upgrade and BDPL 3 and 4 Seismic Upgrade at Hayward Fault projects. For the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects, it is expected that SFPUC Construction Measure #5 (traffic control plans) and additional traffic control measures (Measure 4.8-1a) would be adequate to reduce any *potentially significant* traffic impacts to a less-than-significant level.

However, for the BDPL Reliability project, significant traffic impacts could result from construction across major roadways as well as from multiple construction crews in this region using the same haul routes. Implementation of SFPUC Construction Measure #5 (traffic control plan), additional traffic control measures (Measure 4.8-1a), and coordination of individual traffic control plans (Measure 4.8-1b) would reduce *potentially significant* impacts to a less-than-significant level.

Construction of WSIP projects in the Bay Division Region is not expected to substantially overlap with other projects in this region or in other regions. In addition, due to the geographic distribution of the projects, construction traffic in this region would be dispersed over a number of roadways and freeways. The exception is the BDPL Reliability Upgrade and New Irvington Tunnel (SV-4) projects in the Sunol Valley Region as mentioned above.

Peninsula Region

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

Of the five projects in the Peninsula Region, the Lower Crystal Springs Dam (PN-4) project would generate the greatest amount of construction traffic associated with construction crews, disposal of excavated materials, and materials deliveries. Offsite disposal of excavated materials associated with the Lower Crystal Springs Dam project would result in increases in traffic volumes on Crystal Springs Road, I-280, Highway 92, and possibly Highway 101, depending on the disposal site. Haul routes for the Lower Crystal Springs Dam project would include Crystal Springs Road, Skyline Boulevard, and I-280. Crystal Springs Road and Skyline Boulevard are recreational facilities, and increases in construction traffic on these two-lane roadways could affect pedestrian and bicycle circulation. The CS/SA Transmission (PN 2) and HTWTP Long-Term (PN-3) projects would also use Crystal Springs Road and Skyline Boulevard as access routes. Implementation of SFPUC Construction Measure #5 (traffic control plan), additional traffic control measures (Measure 4.8-1a), and coordination of individual traffic control plans (Measure 4.8-1b) for the CS/SA Transmission, HTWTP Long-Term, and Lower Crystal Springs Dam projects would be adequate to reduce *potentially significant* traffic impacts to a less-than-significant level.

It is expected that construction vehicles associated with the Baden and San Pedro Valve Lots (PN-1) project would be dispersed among numerous roadways in the Peninsula Region, so potential impacts are expected to be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plan).

The number of construction vehicles associated with the Pulgas Balancing Reservoir project (PN-5) has not yet been determined. However, improvements associated with this project are expected to occur over an extended period of time (about four years of construction occurring from 2007 to 2008 and 2010 to 2013), and trips to and from the facility would occur south of other SFPUC construction projects in the region. Implementation SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a would be adequate to reduce any *potentially significant* traffic impacts to a less-than-significant level.

San Francisco Region

Impact 4.8-2: Short-term traffic increases on roadways due to construction-related vehicle trips		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	PSM

Of the three projects in the San Francisco Region, the SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3) projects would generate the greatest amount of construction vehicles. Haul routes would include Highway 1, Highway 101, and I-280 as well as numerous local arterials. Potential impacts associated with increased traffic volumes on roadways would be evaluated as part of separate, project-level CEQA review. For these two projects, implementation of SFPUC Construction Measure #5 (traffic control plans), additional traffic control measures identified in Measure 4.8-1a, and coordination of individual traffic control plans (Measure 4.8-1b) are expected to reduce any *potentially significant* impacts of construction-related traffic volume increases to a less-than-significant level.

The number of construction vehicles associated with Groundwater Projects (SF-2) has not yet been determined. However, improvements associated with these projects are expected to occur over an extended period of time, and trips to and from the facilities would likely be dispersed among numerous roadways in the San Francisco Region. Construction vehicles are not expected to substantially increase traffic volumes on the access routes to these facilities, and therefore potential impacts are expected to be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plan).

Impact 4.8-3: Impaired access to adjacent roadways and land uses for both general and emergency response traffic as well as for bicycles and pedestrians.

Pipelines. Pipeline construction would be conducted within the SFPUC right-of-way or within public roadways. Trenching and paving activities within or across public roadways could result in a temporary reduction in parking and travel lanes or temporary road closures, could impede or block vehicular, pedestrian, and bicycle circulation and access to adjacent land uses, and could increase hazards. In addition, temporary road closures could affect access to adjacent land uses by emergency service providers. These impacts would occur mostly during the day when construction is ongoing, as vehicle access would be restored at the end of each workday through the use of steel trench plates or trench backfilling.

Pipeline construction could result in temporary full street closures if the required width of the construction zone would prevent maintenance of, at a minimum, alternate one-way traffic flow adjacent to the work zone. These road closures would be an inconvenience for motorists, bicyclists, and pedestrians, who would be required to detour onto other roadways.

Tunnels. Tunnel construction would occur from tunnel shafts or portals and adjacent staging areas. Impacts on access to adjacent uses would be limited, and would occur only if temporary access roads or staging areas would be required to gain access to public roads. If truck staging for access to construction sites occurs on public roadways, bicycle and pedestrian circulation could be impeded.

Treatment and Storage Facilities. Construction activities would occur at facility sites, and impacts on access to adjacent uses would be limited. Access impacts could occur if temporary access roads or staging areas are constructed across private land to gain access to public roads.

Other Facilities. The impact of other WSIP projects (such as installation of valves, vaults, standby power equipment, and monitoring equipment) on access to adjacent land uses and streets would vary depending on the type of project. Most projects would be at discrete locations along the pipeline alignments and would not require construction within roadways or other activities that could affect access to adjacent land uses or impede emergency access.

San Joaquin Region

Impact 4.8-3: Impaired access to adjacent roadways and land uses		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	LS

Construction of the treatment facilities (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) would occur at Tesla Portal and Thomas Shaft, and use of public roadways for construction staging and equipment parking would be minimal. Existing roadways would be used for construction worker and construction vehicle access. As a result, impacts on pedestrian and bicycle circulation and access to nearby land uses would be *less than significant* for these projects with implementation of SFPUC Construction Measure #5 (traffic control plans).

Pipeline construction associated with the SJPL System project (SJ-3) and SJPL Rehabilitation project (SJ-4) would occur primarily within the SFPUC right-of-way, and impacts on access to nearby land uses would be minimal. However, in some locations, the SFPUC right-of-way crosses agricultural lands, and access to some fields could be affected. In addition, in some locations, temporary construction access routes would cross private property, and construction access would need to be negotiated with local landowners. Some of the temporary construction access roads crossing private property could affect access to the uses, depending on the location of the access route. In addition, the SJPL System project would require crossing of local roadways and freeways, and construction activities associated with the roadway crossings (staging, parking for equipment and construction workers) could affect access to adjacent land uses as well as pedestrian and bicycle circulation. In addition, construction associated with the SJPL Rehabilitation project improvements along the existing pipeline through largely developed residential areas of Modesto and Riverbank could require crossing of local residential streets.

The SJPL System project (SJ-3) would be evaluated as part of separate, project-level CEQA review. When project elements of the SJPL Rehabilitation project (SJ-4) are defined, this project would also be subject to separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a would be adequate to ensure acceptable levels of traffic, pedestrian, and bicycle flow and to reduce any *potentially significant* circulation and access impacts to a less-than-significant level.

Sunol Valley Region

Impact 4.8-3: Impaired access to adjacent roadways and land uses		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

Construction of WSIP facilities in this region would occur on existing facility sites, and impacts on access to nearby land uses and on pedestrian and bicycle circulation would be minimal and generally *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plans) for all WSIP projects in this region except Calaveras Dam (SV-2). Existing roadways would be used for construction worker and construction vehicle access.

Construction of Calaveras Dam (SV-2) would require temporary closure of Calaveras Road between Geary Road and Felter Road to through-traffic during the two- to three-year construction period. Through-traffic using Calaveras Road would be required to find an alternate route for the duration of the construction period and would likely use I-680. Access to the East Bay Regional Park District's (EBRPD) Sunol Regional Wilderness would still be provided via Calaveras Road and Geary Road from the north, and emergency vehicles would continue to have access to temporarily closed roads. Direct access to the EBRPD Ohlone Wilderness Regional Trail may be restricted, including access to the Bay Area Ridge Trail connection from the west. There are no private residences or commercial uses on this segment of Calaveras Road. This project would be evaluated as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a would be adequate to ensure acceptable levels of traffic, pedestrian, and bicycle flow and to reduce any *potentially significant* circulation and access impacts to a less-than-significant level.

Bay Division Region

Impact 4.8-3: Impaired access to adjacent roadways and land uses		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

All WSIP projects in this region would involve construction activities within the SFPUC right-of-way or construction at discrete locations along the alignments. However, within this region, the pipeline alignments traverse urbanized areas, cross numerous arterials and freeways, and extend along residential streets. Depending on the constraints associated with construction across roadways, construction activities could affect access to residences and local businesses as well as pedestrian and bicycle circulation. Of the three projects in the Bay Division Region, construction of the BDPL Reliability Upgrade (BD-1) project would have the greatest potential for impacts. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control identified in Measure 4.8-1a, would be adequate to ensure acceptable levels of traffic, pedestrian, and bicycle flow and to reduce any *potentially significant* circulation and access impacts associated with all three projects in this region to a less-than-significant level.

Peninsula Region

Impact 4.8-3: Impaired access to adjacent roadways and land uses		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	LS

All WSIP projects within the Peninsula Region would involve construction activities along the SFPUC right-of-way or construction at discrete locations along the pipeline alignments. Therefore, impacts on pedestrian and bicycle circulation and access to adjacent roadways and land uses would be minimal. With implementation of SFPUC Construction Measure #5 (traffic control plan), this impact would be *less than significant* for the Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), HTWTP Long-Term (PN-3), and Pulgas Balancing Reservoir (PN-5) projects.

The Lower Crystal Springs Dam project (PN-4) would likely affect access to, and parking areas for, Sawyer Camp Trail near the intersection of Skyline Boulevard and Crystal Springs Road, in the vicinity of the dam. This project would require reconstruction of San Mateo County's Skyline Boulevard Bridge, which was built across the top of the dam. This section of Skyline Boulevard would be closed during construction of this project and would be reopened upon completion of the project. The Lower Crystal Springs Dam project would be evaluated as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a would be adequate to ensure acceptable levels of traffic, pedestrian, and bicycle flow and to reduce any *potentially significant* circulation and access impacts to a less-than-significant level.

San Francisco Region

Impact 4.8-3: Impaired access to adjacent roadways and land uses		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

All WSIP projects in this region (SAPL 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) would have the potential to result in impacts on adjacent land uses and on pedestrian and bicycle circulation. These projects would be constructed within densely populated areas, and pipeline construction would occur within public roadways, many of which are narrow residential streets. Construction staging would likely necessitate the use of the on-street parking lane, which could temporarily restrict access to adjacent land uses. For these projects, impacts on local access would be evaluated as part of separate, project-level CEQA review.

Implementation SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a would be adequate to ensure acceptable levels of traffic, pedestrian, and bicycle flow and to reduce any *potentially significant* circulation and access impacts to a less-than-significant level for all projects in this region.

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways.

Pipelines. Construction of pipelines would be conducted within the SFPUC right-of-way and within or adjacent to public roadways. Work within public roadways would temporarily displace on-street parking, if provided, along affected roadways. Pipeline construction would generally involve crews of 30 to 40 workers, who would park their vehicles in the identified parking areas within the designated construction zone. Temporary parking impacts on any particular segment of roadway would not be long in duration, since pipeline construction would generally proceed at an average rate of 120 feet per day in urban and suburban areas, and 160 feet per day in rural areas.

Other Facilities. Construction of other types of facilities (tunnels, vaults, valve lots, crossovers, pump stations, treatment facilities, and storage facilities) would occur at discrete locations along the alignment, and onsite parking would be provided within the designated construction staging area. At some urban locations, where the size of staging areas could be limited, construction worker parking demand might need to be accommodated on public streets. The number of construction workers would vary by facility type, and would range from 1 or 2 workers for minor repair work to up to 190 workers for dam replacement and water reservoirs.

San Joaquin Region

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	LS

Of the five projects in this region, construction of the SJPL System project (SJ-3) and SJPL Rehabilitation project (SJ-4) would have the greatest potential to result in parking impacts. However, most of the pipeline construction would occur within the SFPUC right-of-way, and it is expected that construction vehicles and equipment would park within the construction zone, along access roads, and in offsite staging areas. Pipeline construction would cross roadway and freeway segments, which could result in the need for on-street parking of construction worker vehicles and equipment. For the SJPL System project (SJ-3), the majority of the roadways that would be affected are adjacent to agricultural uses that have limited on-street parking demand. With implementation of SFPUC Construction Measure #5 (traffic control plan), parking impacts would be *less than significant*.

Program elements and locations of the SJPL Rehabilitation project (SJ-4) have not yet been defined, and rehabilitation of the San Joaquin Pipeline through Modesto and Riverbank could affect local streets in developed residential areas. With implementation of SFPUC Construction Measure #5 (traffic control plan) and additional parking measures identified in Measure 4.8-1a, *potentially significant* parking impacts would be reduced to less-than-significant levels.

Other WSIP projects in this region would be located at Tesla Portal (Advanced Disinfection, SJ-1, and Tesla Portal Disinfection, SJ-5) and at Thomas Shaft (Lawrence Livermore, SJ-2). Construction staging areas that would accommodate construction worker vehicles and equipment would be provided onsite, and it is expected that parking impacts associated with these projects would be *less than significant* with implementation SFPUC Construction Measure #5 (traffic control plan).

Sunol Valley Region

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

WSIP projects in this region would include onsite construction staging areas that would accommodate construction worker vehicles and equipment. Therefore, parking impacts for all projects within the Sunol Valley Region are expected to be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plans).

Bay Division Region

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Within this region, construction of the BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) would have the greatest potential to result in parking impacts. Most of the construction activity would occur within the SFPUC right-of-way, and construction vehicles and equipment are expected to be able to park within the construction zone; however, some segments of pipeline would be located within the public roadway right-of-way. In addition, pipeline construction would cross numerous local arterials and residential streets as well as I-680, which could result in the need for on-street parking of construction worker vehicles and equipment. The majority of the roadways that would be affected are urbanized and adjacent to commercial and residential land uses. These projects would be evaluated as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plans) and additional parking measures identified in Measure 4.8-1a for these projects would be adequate to reduce any *potentially significant* parking impacts to a less-than-significant level.

The BDPL 3 and 4 Crossovers project (BD-2) would be located at discrete locations within the SFPUC right-of-way, with construction staging areas that would accommodate construction worker vehicles and equipment, as appropriate. Parking impacts associated with this project are therefore expected to be *less than significant* with implementation of SFPUC Construction Measure # 5 (traffic control plan).

Peninsula Region

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

Within this region, all of the projects would be constructed at discrete locations within the SFPUC tunnel and pipeline alignments. It is anticipated that all projects in this region would include construction staging areas that would accommodate construction worker vehicles and equipment. For the Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), and HTWTP Long-Term (PN-3) projects, staging areas are expected to be provided onsite, and therefore parking impacts are expected to be *less than significant* with implementation of SFPUC Construction Measure # 5 (traffic control plans).

The Lower Crystal Springs Dam project (PN-4) would likely affect the roadside parking areas used by visitors to Sawyer Camp Trail on Skyline Boulevard near the intersection with Crystal Springs Road. Pulgas Balancing Reservoir (PN-5) could affect parking used by visitors at the Pulgas Water Temple. Displacement of parking to public recreational areas where other nearby parking is not available could result in hazardous parking situations in the vicinity. These projects would be evaluated as part of separate, project-level CEQA review to ensure safe accommodation of visitor parking demand. Implementation of SFPUC Construction Measure # 5 (traffic control plan), additional parking measures identified in Measure 4.8-1a, and accommodation of displaced public parking supply for recreational visitors (Measure 4.8-4) would reduce any *potentially significant* parking impacts of these two projects to a less-than-significant level.

San Francisco Region

Impact 4.8-4: Temporary displacement of on-street parking at some locations due to increased parking demand or construction within roadways		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

Within this region, the SAPL 3 Installation project (SF-1) would have the greatest potential to result in parking impacts. The pipeline alignment would travel through densely populated areas, and the pipeline would be located within roadways. Pipeline replacement would likely necessitate the use of the on-street parking lanes for construction staging of equipment and materials and for construction worker parking. Potentially significant parking impacts would be evaluated as part of separate, project-level CEQA review. With implementation of SFPUC Construction Measure #5 (traffic control plan) and additional parking measures identified in Measure 4.8-1a, *potentially significant* parking impacts associated with this project would be reduced to a less-than-significant level.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) projects could require construction within or across local roadways and could require on-street staging of equipment and materials, and parking for construction workers. The Groundwater and Recycled Water Projects would be evaluated as part of separate, project-level CEQA review. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional parking measures identified in Measure 4.8-1a is expected to reduce *potentially significant* parking impacts of these projects to a less-than-significant level.

Impact 4.8-5: Increased potential traffic safety hazards for vehicles, bicyclists, and pedestrians on public roadways during construction.

Since construction activities temporarily suspend the normal function of roadways, the potential exists for an increase in traffic safety hazards during construction of the WSIP projects. This increase in safety hazards would be due to the increased potential for:

- Conflicts between construction vehicles (with slower speeds and wider turning radii than autos) and vehicles, bicyclists, or pedestrians using the roadways
- Conflicts between the movement of traffic and the construction activities, particularly where traffic is routed into the travel lane adjacent to the work zone
- Confusion of drivers during one-lane, two-way traffic operation

- Confusion of bicyclists and pedestrians due to temporary alterations in bicycle and pedestrian circulation and on-street parking supply
- Distraction of drivers related to construction activities and nighttime lighting (at tunnel portals or shaft locations)

All Regions

Construction activities associated with the WSIP projects in all regions would increase the potential for safety hazards, which would be a *potentially significant* impact. In general, construction contractors for any projects affecting public rights-of-way (e.g., roadways, sidewalks, and walkways) are required to provide for continuity of traffic, pedestrians, and bicyclists; reduce the potential for traffic accidents; and ensure worker safety in construction zones. In addition, as part of project development, haul routes would be established to minimize truck traffic near schools, especially prior to school start times and following dismissal times, when students are on the roads traveling to and from schools. Implementation of SFPUC Construction Measure #5 (traffic control plan) and additional traffic control measures identified in Measure 4.8-1a (stipulating actions required of contractors) would reduce traffic safety impacts to a less-than-significant level for all WSIP projects.

It should be noted that, prior to construction of some WSIP projects, some roadways used to access the project sites could be improved to meet current safety standards, which would be a beneficial impact. For example, construction of the Treated Water Reservoirs project (SV-6) would bring a portion of Calaveras Road adjacent to the turnoff for the Sunol Valley WTP up to current Alameda County standards for safety both during and after construction.

Operational Impacts

Long-Term Traffic Increases

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance.

Operation of some of the WSIP facilities could result in an increase in the number of vehicles traveling to and from the facility site. The primary increase in vehicle trips would result from increases in the number of employees at an existing facility, increases in the number of deliveries to the facility, and new trips associated with operations, monitoring, inspection, and maintenance activities at new facilities. In most cases, there would be minimal increases over existing trips to the facility, and these vehicle trips would not result in a noticeable increase in traffic on adjacent streets.

Pipelines, Tunnels, and Crossovers. Operation of pipelines, tunnels, and crossovers would not result in new long-term trips. These facilities would be located underground and would not generate new vehicle trips.

Vaults, Valves, and Standby Power Facilities. Operation of these facilities would not result in a substantial number of new daily trips. These facilities require routine inspection and maintenance, but would not generate significant levels of new vehicle trips.

Storage Facilities, Treatment Facilities, and Pump Stations. Storage facilities include reservoirs and basins, and treatment facilities include basins, filters, and drains. These facilities could generate long-term vehicle trips associated with ongoing operations and monitoring of the facilities, and routine inspection and maintenance.

San Joaquin Region

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Operation of WSIP facilities in the San Joaquin Region would result in minimal increases in long-term vehicle trips to these facilities. The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) facilities at Tesla Portal and the Lawrence Livermore (SJ-2) facility at Thomas Shaft would be unmanned facilities and would require a daily visit to the site by an operations representative. The SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) pipelines would not in themselves result in an increase in vehicle trips, but would require occasional visits by operations representatives during flow rate changes. Overall, the vehicle trips generated by these facilities would not result in a noticeable increase in traffic on adjacent streets, and operational impacts are expected to be *less than significant*.

Sunol Valley Region

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	N/A
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	N/A

The proposed treatment facilities at the Sunol Valley WTP (40-mgd Treated Water, SV-3, and Treated Water Reservoirs, SV-5) would result in an increased frequency of chemical deliveries to this facility. Overall, the increase in traffic volumes generated by operation of these facilities would not result in a noticeable increase in traffic on adjacent streets, and operational impacts are expected to be *less than significant*.

All remaining WSIP projects in this region (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; New Irvington Tunnel, SV-4; and SABUP, SV-6) would involve upgrades to or replacement of existing facilities as well as construction of new tunnels and pipelines. At these facilities, the number of employees would remain the same as under existing conditions; therefore, the number of vehicle trips to and from the facilities is not expected to increase, and operational traffic impacts would not occur *(not applicable).* The tunnels and pipelines would not result in new employees or deliveries to facility sites.

Bay Division Region

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

All WSIP projects in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would include pipelines, tunnels, and crossovers, which would not generate any long-term vehicle trips. However, these projects would include existing and new vaults and valves, which would require periodic operations review and maintenance. Overall, any increase in traffic generated by operation and maintenance of these facilities would be minimal and would not result in a noticeable increase in traffic on adjacent streets, and operational impacts are expected to be *less than significant*.

Peninsula Region

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

WSIP projects in this region include repair, upgrades, and improvements to existing valves, vaults, and reservoirs (Baden and San Pedro Valve Lots, PN-1; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5) and improvements to an existing water treatment plant (HTWTP Long-Term, PN-3). Only the HTWTP Long-Term project is expected to increase the number of employees (although not specified), and could require an increased frequency of chemical deliveries to the facility. Overall, long-term increases in traffic generated by operation of these facilities would be minimal and would not result in a noticeable increase in traffic on adjacent streets, and operational impacts are expected to be *less than significant*.

San Francisco Region

Impact 4.8-6: Increases in vehicle trips to and from the facility sites for operation and maintenance		
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

New pipelines installed as part of the SAPL 3 Installation project (SF-1) would not result in any new employees or delivery trips to the facilities. Therefore, operational traffic impacts would not occur *(not applicable)*.

The Groundwater Projects (SF-2) include three projects in San Francisco and San Mateo, which would require an operations and maintenance check every day or two on average, as well as some increased chemical deliveries. These increases in trips would not result in a noticeable increase in traffic on adjacent streets. The Recycled Water Projects (SF-3) include recycled water projects at two locations in San Francisco, which would result in an increase of up to six employees as well as increased chemical deliveries to the site. Overall, the traffic generated by operation of these facilities would be minimal and would not result in a noticeable increase in traffic on adjacent streets, and operational impacts are expected to be *less than significant*.

4.8.3 References – Traffic, Transportation, and Circulation

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4.9 Air Quality

4.9 Air Quality

4.9.1 Air Pollutant Properties, Effects, and Sources

Air quality conditions in the WSIP study area are indicated by six criteria air pollutants, as described below (BAAQMD, 1999; SJVAPCD, 2002a).

Ozone. Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and nitrogen oxide (NO_x). The main sources of NO_x and ROG, often referred to as ozone precursors, are combustion processes (including motor vehicle engines) and the evaporation of solvents, paints, and fuels. In the Bay Area, automobiles are the single largest source of ozone precursors. In San Joaquin Valley, primary sources of ozone precursors are mobile sources, solvents, farming operations, area sources (e.g., consumer products, fuel combustion, landscape maintenance equipment, etc.), and oil/gas production. Ozone is a regional air pollutant because its precursors are transported and diffused by wind concurrently with ozone production through the photochemical reaction process. Ozone causes eye irritation, airway constriction, and shortness of breath and can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema.

Carbon Monoxide (CO). CO is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The single largest source of CO is motor vehicles; the highest emissions occur during low travel speeds, stop-and-go driving, cold starts, and hard acceleration. Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and can cause dizziness and fatigue, impair central nervous system function, and induce angina in persons with serious heart disease.

Suspended Particulates (PM_{10} and $PM_{2.5}$). Particulate matter is a class of air pollutants that consists of solid and liquid airborne particles in an extremely small size range. Particulate matter is measured in two size ranges: PM_{10} for particles less than 10 microns in diameter, and $PM_{2.5}$ for particles less than 2.5 microns in diameter. In San Joaquin Valley, $PM_{2.5}$ sources tend to be combustion sources such as vehicles, power generation, industrial processes, and wood burning; PM_{10} sources include these same sources in addition to farming operations (23.2 percent) and road dust (36.6 percent). In the Bay Area, motor vehicles generate about half of the air basin's particulates, through tailpipe emissions as well as brake pad and tire wear. Wood burning in fireplaces and stoves, industrial facilities, and ground-disturbing activities such as construction are other sources of fine particulates in the Bay Area. Fine particulates are small enough to be inhaled into the deepest parts of the human lung can cause adverse health effects. Among the criteria pollutants that are regulated, particulates appear to represent the most serious overall health hazard. Studies have shown that elevated particulate levels contribute to the death of approximately 200 to 500 people per year in the Bay Area. High levels of particulates have also been known to exacerbate chronic respiratory ailments, such as bronchitis and asthma, and have been associated with increased emergency room visits and hospital admissions.

Diesel exhaust is a growing concern throughout California. The California Air Resources Board (CARB) identified diesel engine particulate matter as a toxic air contaminant. The exhaust from diesel engines includes hundreds of different gaseous and particulate components, many of which are toxic. Many of these toxic compounds adhere to the diesel particles, which are very small and can penetrate deeply into the lungs. Diesel engine particulate matter has been identified as a human carcinogen. Mobile sources such as trucks, buses, and automobiles are some of the primary sources of diesel emissions. Studies show that diesel particulate matter concentrations are much higher near heavily traveled highways and intersections. The cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other toxic air pollutant routinely measured in the region. Diesel exhaust contains both pulmonary irritants and hazardous compounds that could affect sensitive receptors such as young children, senior citizens, or those susceptible to chronic respiratory disease such as asthma, bronchitis, and emphysema.

In 2001, the California Health Interview Survey (CHIS) found that California's lifetime asthma prevalence, at 11.5 percent of the population, is higher than the national lifetime asthma prevalence of 10.1 percent (UCLA Center for Health Policy Research, 2007).[1] When asthma symptom prevalence in 2001 is sorted by county, the CHIS found that people who live in rural areas have more frequent asthma symptoms. Asthma symptom prevalence by region ranged from 10.4 to 13.8 percent for all ages. The highest rates occurred in Northern California, Sierra, and Sacramento area counties (13.8 percent). The San Joaquin region had a rate of 12.9 percent, while the Bay Area region had a rate of 12.2 percent. These data indicate that asthma is a regional (not localized) problem. However, these regional statistics mask the fact that asthma rates are higher among African-Americans (16.2 percent) than among the rest of the population (7.0 to 13.1 percent), suggesting there may be asthma "hot spots" in some communities that are not well characterized by regional averages.

Nitrogen Dioxide (NO_2). NO_2 is a reddish brown gas that is a byproduct of combustion processes. Automobiles and industrial operations are the main sources of NO_2. Aside from its contribution to ozone formation, NO_2 can increase the risk of acute and chronic respiratory disease and reduce visibility. NO_2 may be visible as a coloring component on high pollution days, especially in conjunction with high ozone levels.

Sulfur Dioxide (SO_2). SO_2 is a colorless acidic gas with a strong odor. It is produced by the combustion of sulfur-containing fuels such as oil, coal, and diesel. SO_2 has the potential to damage materials and can cause health effects at high concentrations. It can irritate lung tissue and increase the risk of acute and chronic respiratory disease (BAAQMD, 1999).

Greenhouse Gases. Gases that trap heat in the atmosphere are often called greenhouse gases (GHGs). Both natural processes and human activities emit GHGs. The accumulation of GHGs in the atmosphere regulates the earth's temperature; however, emissions from human activities such as electricity production and vehicles have elevated the concentration of these gases in the atmosphere. This accumulation of GHGs has contributed to an increase in the temperature of the

1 "Lifetime asthma prevalence" includes people diagnosed with asthma at some point in their lives, while "asthma symptom prevalence" includes those who experience asthma symptoms at least once per year.

earth's atmosphere and contributed to climate change. The principal greenhouse gases are carbon dioxide, methane, nitrous oxide, ozone, and water vapor. Carbon dioxide is the reference gas for climate change.

4.9.2 Setting

The CARB has divided California into regional air basins according to topographic air drainage features. The WSIP study area spans two of these regional air basins: San Joaquin Valley Air Basin (SJVAB) and San Francisco Bay Area Air Basin (SFBAAB). The SJVAB, the second largest air basin in the state, is defined by the Sierra Nevada mountains to the east, the Coast Range mountains to the west, and the Tehachapi Mountains to the south. The SJVAB is a "bowl" that opens to the north at the Carquinez Strait, where the San Joaquin–Sacramento Delta empties into San Francisco Bay (SJVAPCD, 2002a). The SFBAAB lies west of the Coast Range. In the Bay Area, the Coast Range splits into western and eastern ranges, and San Francisco Bay lies between the two ranges. Air flows into the SFBAAB from the west at the Golden Gate and then flows out of the SFBAAB to the east at the Carquinez Strait (where it enters the SJVAB).

San Joaquin Valley Air Basin

Meteorology

The SJVAB has an "inland Mediterranean" climate averaging over 260 sunny days per year. The valley floor is characterized by warm, dry summers and cooler winters. Summer high temperatures often exceed 100 degrees Fahrenheit (ºF), averaging in the low 90s during summer. Winter highs average in the 50s, but highs in the 30s and 40s can occur on days with persistent fog and low clouds. Wind speed and direction data indicate that summer winds typically originate at the north end of the valley and flow in a south-southeasterly direction. Winter winds occasionally originate from the south end of the valley and flow in a north-northwesterly direction. During the winter months, the valley experiences light, variable winds of less than 10 miles per hour (mph).

The potential for high pollutant concentrations depends on two primary factors: (1) the quantity of pollutant emissions in the surrounding area and upwind of the area, and (2) topographic and climatological factors (e.g., winds, inversion potential, terrain, stability/vertical mixing, and solar radiation). San Joaquin Valley's "bowl" topography induces persistent temperature inversions. Persistent inversions combined with high summer temperatures and low wind speeds during the winter result in a high year-round potential for air pollution.

Ambient Air Quality

The San Joaquin Valley Air Pollution Control District (SJVAPCD) operates a regional monitoring network that measures the ambient concentrations of six criteria air pollutants: ozone, CO, PM_{10}, $PM_{2.5}$, NO_2, and SO_2. Existing air quality in the WSIP study area can generally be inferred from basinwide ambient air quality measurements. **Table 4.9-1** provides a five-year summary of monitoring data (2001–2005) compiled by the CARB and compares measured pollutant concentrations with the most stringent applicable standard.

TABLE 4.9-1
SAN JOAQUIN VALLEY AIR BASIN AMBIENT AIR QUALITY MONITORING SUMMARY (2001–2005)

Pollutant	Most Stringent Applicable Standard	Number of Days Standards were Exceeded and Maximum Concentrations Measured				
		2001	2002	2003	2004	2005
Ozone (ROG)						
- Days 1-hour Std. Exceeded	>0.09 ppm[a]	123	127	137	106	83
- Max. 1-hour Conc. (ppm)[b]		**0.149**	**0.164**	**0.156**	**0.155**	**0.134**
- Days 8-hour Std. Exceeded	>0.08 ppm[b]	109	125	134	109	72
- Max. 8-hour Conc. (ppm)[b]		**0.120**	**0.132**	**0.127**	**0.126**	**0.113**
Carbon Monoxide (CO)						
- Days 1-hour Std. Exceeded	>20 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)		8.4	6.1	5.8	4.6	4.3
- Days 8-hour Std. Exceeded	>9 ppm[a]	0	0	0	0	0
- Max. 8-hour Conc. (ppm)		6.0	4.5	4.1	3.0	3.0
Suspended Particulates (PM_{10})						
- Days 24-hour Std. Exceeded[c]	>50 µg/m^3 [a]	168	256	167	113	146
- Max. 24-hour Conc. (µg/m^3)		**221**	**194**	**150**	**219**	**137**
Suspended Particulates ($PM_{2.5}$)						
- Days 24-hour Std. Exceeded	>65 µg/m^3 [b, d]	19	14	1	3	10
- Max. 24-hour Conc. (µg/m^3)		**154.7**	**104.3**	**84.5**	**77.0**	**102.0**
- Annual Average (µg/m^3)	>12 µg/m^3 [a]	**20.8**	**24.1**	**24.8**	**18.2**	**22.4**
Nitrogen Dioxide (NO_2)						
- Days 1-hour Std. Exceeded	>0.25 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)[b]		0.115	0.107	0.092	0.083	0.087
Sulfur Dioxide (SO_2)						
- Days 1-hour Std. Exceeded	>0.25 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)[b]		0.03	N/A	0.019	N/A	N/A

NOTES: **Bold** values are in excess of applicable standard. "N/A" indicates that data are not available.
conc. = concentration; ppm = parts per million; µg/m^3 = micrograms per cubic meter

[a] State standard, not to be exceeded.
[b] Federal standard, not to be exceeded.
[c] The first number represents measured exceedances but not all exceedances since PM_{10} is not sampled every day. The second number is the calculated days exceeding the standard, which is an estimate of days expected to exceed the standard if there was sampling every day. This estimate could be low if insufficient samples are collected.
[d] Sample days exceeding the standard, which would not represent all possible exceedances since not all days were sampled.

SOURCE: CARB, 2006a.

Ozone

Table 4.9-1 shows that, according to published data, the most stringent applicable ozone standards (the state 1-hour standard of 0.09 parts per million [ppm] and the federal 8-hour standard of 0.08 ppm) were exceeded approximately 20 to 40 percent of each year in the SJVAB between 2001 and 2005.

Carbon Monoxide

As shown in the table, no exceedances of state CO standards were recorded between 2001 and 2005. Measurements of CO indicate hourly maximums ranging between 20 and 40 percent of the more stringent state standard. Similarly, maximum 8-hour CO levels range between 35 and 65 percent of the allowable 8-hour standard.

Suspended Particulates (PM_{10} and $PM_{2.5}$)

Table 4.9-1 shows that exceedances of the state PM_{10} standard occur relatively frequently in the SJVAB. It is estimated that the state 24-hour PM_{10} standard was exceeded between 113 and 256 days per year between 2001 and 2005.

In 1997, the U.S. Environmental Protection Agency (U.S. EPA) adopted a standard for $PM_{2.5}$, the fine fraction of particulate matter (Table 4.9-1). California's standard went into effect in 2003. It is estimated that the federal 24-hour $PM_{2.5}$ standard was exceeded on 1 to 19 sample days per year between 2001 and 2005. The state annual average standard was exceeded every year between 2001 and 2005.

Other Criteria Air Pollutants

Table 4.9-1 shows that the standards for NO_2 and SO_2 are being met in the SJVAB, and pollutant trends suggest that the air basin will continue to meet these standards for the foreseeable future.

Greenhouse Gases

The SJVAPCD's emissions inventory identifies sources of criteria air pollutants but does not include GHGs, pollutants contributing to climate change. Sources of GHG emissions in the San Joaquin Valley include mobile sources (on-road motor vehicles, off-highway mobile sources, and aircraft) as well as stationary sources associated with agricultural, industrial, and commercial operations.

Sensitive Receptors

Land uses such as schools, children's daycare centers, hospitals, and convalescent homes are considered to be more sensitive than the general public to poor air quality because the population groups associated with these uses have increased susceptibility to respiratory distress. Persons engaged in strenuous work or exercise also have increased sensitivity to poor air quality. Residential areas are considered more sensitive to air quality conditions than commercial and industrial areas, because people generally spend longer periods of time at their residences, resulting in greater exposure to ambient air quality conditions. Recreational uses or parks are also considered sensitive due to the greater exposure to ambient air quality conditions, and because the presence of pollution detracts from the recreational experience.

Most of the areas adjacent to WSIP facilities in the SJVAB are undeveloped or used for agriculture. The city of Modesto, located in the center of the San Joaquin Region, includes residential, commercial, school, and park uses. There are also rural residential uses located south of Riverbank. In the western margin of this region (in the Tesla Portal vicinity), there is a private golf course (Tracy Golf and Country Club) and residential development.

San Francisco Bay Area Air Basin

Meteorology

Temperatures in the San Francisco Bay Area average 58 ºF annually, with summer highs in the mid-80s and winter lows in the mid-30s. However, since land tends to heat up and cool off more quickly than water, summer temperatures at the coast can be as much as 35 ºF cooler than temperatures 15 to 20 miles inland. At night, this contrast usually decreases to less than 10 ºF. During the winter, the relationship of minimum and maximum temperatures is reversed, with a small temperature contrast between the coast and inland areas during the day and a large temperature contrast at night.

Summer winds generally flow from the northwest through the Golden Gate, and, when they meet the East Bay Hills, split off to the northwest toward Richmond and to the southwest toward San Jose. In the late morning or early afternoon, air begins to flow onshore (from the coast to the Central Valley), increasing in depth and velocity while spreading inland. The depth of the onshore flow depends in large part on the height and strength of the inversion. During winter, the Bay Area frequently experiences stormy conditions with moderate to strong winds as well as periods of stagnation with very light winds. Winter stagnation episodes are characterized by nighttime drainage flows in coastal valleys. Drainage is a reversal of the usual daytime air-flow patterns; air moves from the Central Valley toward the coast and back down toward the Bay from the smaller valleys within the Bay Area.

The SFBAAB is divided into 11 climatological regions, and WSIP facilities would be located in four of these regions: Livermore Valley, West Alameda, Santa Clara Valley, and Peninsula. The air pollution potential in these areas is highest in the Livermore Valley and Santa Clara Valley, where high summer temperatures, stable air, and the surrounding mountains combine to promote ozone formation. There are also many emissions sources within and upwind of these areas. Although coastal areas of the Peninsula have a lower potential for air pollution due to the marine influence, the southeastern Peninsula area has a high air pollution potential because it is protected from the winds and fog associated with the marine layer. West Alameda has more of a marine influence than the inland valleys, but it also has a relatively high potential for air pollution during the summer and fall.

Ambient Air Quality

The Bay Area Air Quality Management District (BAAQMD) operates a regional monitoring network that measures the ambient concentrations of six criteria air pollutants: ozone, CO, PM_{10}, $PM_{2.5}$, NO_2, and SO_2. Existing air quality in the WSIP study area can be generally inferred from basinwide ambient air quality measurements. **Table 4.9-2** provides a five-year summary of monitoring data (2001–2005) compiled by the CARB and compares measured pollutant concentrations with the most stringent applicable standard.

TABLE 4.9-2
BAY AREA AIR BASIN AMBIENT AIR QUALITY MONITORING SUMMARY (2001–2005)

Pollutant	Most Stringent Applicable Standard	Number of Days Standards were Exceeded and Maximum Concentrations Measured				
		2001	2002	2003	2004	2005
Ozone (ROG)						
- Days 1-hour Std. Exceeded	>0.09 ppm[a]	15	16	19	7	9
- Max. 1-hour Conc. (ppm)[b]		**0.134**	**0.160**	**0.128**	**0.113**	**0.120**
- Days 8-hour Std. Exceeded	>0.08 ppm[b]	7	7	7	0	1
- Max. 8-hour Conc. (ppm)[b]		**0.102**	**0.106**	**0.101**	**0.084**	**0.090**
Carbon Monoxide (CO)						
- Days 1-hour Std. Exceeded	>20 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)		7.6	7.7	8.6	4.8	4.5
- Days 8-hour Std. Exceeded	>9 ppm[a]	0	0	0	0	0
- Max. 8-hour Conc. (ppm)		5.1	5.1	4.4	3.4	3.1
Suspended Particulates (PM_{10})						
- Days 24-hour Std. Exceeded[c]	>50 µg/m^3 [a]	48	24	18	25	23
- Max. 24-hour Conc. (µg/m^3)		**113.9**	**83.5**	**59.5**	**65.0**	**80.8**
Suspended Particulates ($PM_{2.5}$)						
- Days 24-hour Std. Exceeded	>65 µg/m^3 [b, d]	4	4	0	1	0
- Max. 24-hour Conc. (µg/m^3)		**107.5**	**84.5**	56.1	**73.7**	54.6
- Annual Average (µg/m^3)	>12 µg/m^3 [a]	**12.9**	**14.0**	11.7	11.6	11.8
Nitrogen Dioxide (NO_2)						
- Days 1-hour Std. Exceeded	>0.25 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)[b]		0.108	0.080	0.081	0.073	0.074
Sulfur Dioxide (SO_2)						
- Days 1-hour Std. Exceeded	>0.25 ppm[a]	0	0	0	0	0
- Max. 1-hour Conc. (ppm)[b]		0.104	0.111	0.134	0.090	0.038

NOTES: **Bold** values are in excess of applicable standard. "N/A" indicates that data is not available.
conc. = concentration; ppm = parts per million; µg/m^3 = micrograms per cubic meter

a State standard, not to be exceeded.
b Federal standard, not to be exceeded.
c The first number represents measured exceedances but not all exceedances since PM_{10} is not sampled every day. The second number is the calculated days exceeding the standard, which is an estimate of days expected to exceed the standard if there was sampling every day. This estimate could be low if insufficient samples are collected.
d Sample days exceeding the standard, which would not represent all possible exceedances since not all days were sampled.

SOURCE: CARB, 2006a.

Ozone

Table 4.9-2 shows that, according to published data, the most stringent applicable standards (state 1-hour standard of 0.09 ppm and the federal 8-hour standard of 0.08 ppm) are exceeded in the SFBAAB approximately 2 to 5 percent of every year.

Carbon Monoxide

As shown in the table, no exceedances of state CO standards were recorded between 2001 and 2005. Measurements of CO indicate hourly maximums ranging between 20 and 40 percent of the more stringent state standard. Similarly, maximum 8-hour CO levels range between 30 and 60 percent of the allowable 8-hour standard.

Suspended Particulates (PM_{10} and $PM_{2.5}$)

Table 4.9-2 shows that exceedances of the state PM_{10} standard have occurred in the SFBAAB. It is estimated that the state 24-hour PM_{10} standard was exceeded between 18 and 48 days per year between 2001 and 2005.

The BAAQMD began monitoring $PM_{2.5}$ concentrations in 1999. The federal 24-hour $PM_{2.5}$ standard was exceeded on 1 to 4 days each year, for a total of 9 sample days between 2001 and 2005 (not exceeded in 2003 and 2005). The state annual average standard was exceeded in 2001 and 2002.

In 2004, the BAAQMD initiated the Community Air Risk Evaluation program, with the goal of sampling ambient levels of diesel particulate matter; however, the results are not yet available.

Other Criteria Air Pollutants

Table 4.9-2 shows that the standards for NO_2 and SO_2 are being met in the Bay Area, and pollutant trends suggest that the air basin will continue to meet these standards for the foreseeable future.

Greenhouse Gases

The BAAQMD has prepared an emissions inventory of GHGs, pollutants contributing to climate change. Fossil fuel consumption in the transportation sector (on-road motor vehicles, off-highway mobile sources, and aircraft) is the single largest source of Bay Area GHG emissions, accounting for approximately half of the Bay Area's GHG emissions in 2002. Industrial and commercial sources were the second largest contributors of GHG emissions (with about one-fourth of total emissions), while power plants contribute approximately seven percent of total emissions (BAAQMD, 2006a).

Sensitive Receptors

Land uses considered most sensitive to air quality include residential uses, recreational/park uses, schools, children's daycare centers, hospitals, and convalescent homes. All of these uses are present in the vicinity of WSIP facilities within the SFBAAB. Since the area surrounding WSIP facilities in the Sunol Valley contains only one residence, this region has the lowest sensitivity. WSIP facilities in the Bay Division Region would be located near residential, park, school, childcare, and convalescent/nursing home uses. WSIP facilities in the Peninsula Region would be located near residential, park, school, and hospital uses. Sensitive receptors near WSIP facilities in the San Francisco Region include residential and school uses.

Regulatory and Planning Framework

Federal Standards

The 1970 Clean Air Act (last amended in 1990, 42 United States Code 7401 et seq.) required that regional planning and air pollution control agencies prepare a regional air quality plan to outline the measures by which both stationary and mobile sources of pollutants will be controlled in order to achieve all standards by the deadlines specified in the Clean Air Act. The ambient air quality standards are intended to protect the public health and welfare, and they specify the concentration of pollutants (with an adequate margin of safety) to which the public can be exposed without adverse health effects. They are designed to protect those segments of the public most susceptible to respiratory distress, known as sensitive receptors, including asthmatics, the very young, the elderly, people weak from other illness or disease, or persons engaged in strenuous work or exercise. Healthy adults can tolerate occasional exposure to air pollution levels that are somewhat above the ambient air quality standards before adverse health effects are observed.

San Joaquin Valley Air Basin

The SJVAB includes the counties of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare, in addition to the valley portion of Kern County. For each nonattainment criteria pollutant (ozone and PM_{10}), the SJVAPCD is responsible for preparing attainment plans, which establish the strategies that the District will use to attain the federal standards. The SJVAB's current attainment status with respect to federal standards is summarized in **Table 4.9-3**. The SJVAB is currently not in compliance with federal ozone and PM_{10} standards and is designated as "severe nonattainment" for the federal ozone standard and "serious nonattainment" for the federal PM_{10} and $PM_{2.5}$ standards.

The SJVAPCD adopted the *Amended 2002 and 2005 Rate of Progress Plan for San Joaquin Valley Ozone* in December 2002. This ozone plan contains emission control strategies for various mobile and stationary sources, none of which pertain to construction projects. In response to the U.S. EPA's nonattainment designation of the 1-hour ozone standard, the *2004 Extreme Ozone Attainment Demonstration Plan* was prepared for this air basin and submitted to the U.S. EPA in November 2004. The plan set forth emissions reductions for attaining this standard by November 15, 2010. Because this standard (including associated designations and classifications) was revoked in June 2005, the U.S. EPA never approved the plan. However, preliminary work has begun on developing the *Eight-Hour Ozone Attainment Demonstration Plan* (OADP) for San Joaquin Valley. The OADP, which will be part of the State Implementation Plan, must demonstrate attainment of the new federal 8-hour ozone standard by 2013; it must also be adopted by the local air districts and the CARB, and be submitted to the U.S. EPA by June 15, 2007 (SJVAPCD, 2007a).

The SJVAPCD adopted the *2003 PM_{10} Plan* (PM_{10} Plan) in response to the SJVAB's nonattainment status for PM_{10}. The plan is designed to meet the requirements of the federal Clean Air Act and contains new control strategies for stationary, area, and mobile sources needed to attain the federal PM_{10} standards at the earliest possible date. The PM_{10} Plan does have control strategies related to construction projects. This plan became part of the State Implementation Plan for San Joaquin Valley when it was adopted by the CARB in August 2003. The U.S. EPA approved this plan in June 2004. In February 2006, the SJVAPCD adopted the *2006 PM_{10} Plan* and this plan is undergoing review by the CARB. The *2006 PM_{10} Plan* is due to the EPA by March 31, 2006. The *2006 PM_{10} Plan* is a continuation of the SJVAPCD's strategy for attaining federal PM_{10} standards.

TABLE 4.9-3
STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS AND ATTAINMENT STATUS

		(State) SAAQS[a]			(Federal) NAAQS[b]		
Pollutant	**Averaging Time**	**Standard**	**San Joaquin Attainment Status**	**Bay Area Attainment Status**	**Standard**	**San Joaquin Attainment Status**	**Bay Area Attainment Status**
Ozone (O_3)	1 hour	0.09 ppm	**N/Severe**	**N**	NA	See Note (c)	See Note (c)
	8 hour	0.07 ppm	See Note (d)	See Note (d)	0.08 ppm	**N/Serious**	**N/Marginal**
Carbon Monoxide (CO)	1 hour	20 ppm	A	A	35 ppm	U/A	A
	8 hour	9 ppm	A	A	9 ppm	U/A	A
Nitrogen Dioxide (NO_2)	1 hour	0.25 ppm	A	A	NA	NA	NA
	Annual	NA	NA	NA	0.053 ppm	U/A	A
Sulfur Dioxide (SO_2)	1 hour	0.25 ppm	A	A	NA	U	NA
	24 hour	0.04 ppm	A	A	0.14 ppm	U	A
	Annual	NA	NA	NA	0.03 ppm	U	A
Particulate Matter (PM_{10})	24 hour	50 µg/m^3	**N**	**N**	150 µg/m^3	**N/Serious**	U
	Annual[e]	20 µg/m^3 [f]	**N**	**N**	50 µg/m^3	**N/Serious**	A
Fine Particulate Matter ($PM_{2.5}$)	24 hour	NA	NA	NA	65 µg/m^3	**N/Serious**	A
	Annual	12 µg/m^3 [f]	**N**	**N**	15 µg/m^3	**N/Serious**	A
Sulfates	24 hour	25 µg/m^3	A	A	NA	NA	NA
Lead	30 day	1.5 µg/m^3	A	A	NA	NA	NA
	Quarter	NA	NA	NA	1.5 µg/m^3	ND	A
Hydrogen Sulfide	1 hour	0.03 ppm	U	U	NA	NA	NA
Visibility-Reducing Particles	8 hour	See Note (g)	U	A	NA	NA	NA

NOTES: A = Attainment; **N** = Nonattainment; U = Unclassified; NA = Not Applicable, no applicable standard; ND = no designation; ppm = parts per million; µg/m^3 = micrograms per cubic meter.

[a] SAAQS = state ambient air quality standards (California). SAAQS for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, particulate matter, and visibility-reducing particles are values that are not to be exceeded. All other state standards shown are values not to be equaled or exceeded.
[b] NAAQS = national ambient air quality standards. NAAQS, other than ozone and particulates, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The 8-hour ozone standard is attained when the three-year average of the fourth highest daily concentration is 0.08 ppm or less. The 24-hour PM_{10} standard is attained when the three-year average of the 99th percentile of monitored concentrations is less than the standard. The 24-hour $PM_{2.5}$ standard is attained when the three-year average of the 98th percentile is less than the standard.
[c] The U.S. EPA revoked the national 1-hour ozone standard on June 15, 2005.
[d] This state 8-hour ozone standard was approved in April 2005 and became effective in May 2006. Attainment status in both districts is Unclassified.
[e] State standard = annual geometric mean; national standard = annual arithmetic mean.
[f] In June 2002, CARB established new annual standards for $PM_{2.5}$ and PM_{10}.
[g] Statewide visibility-reducing particle standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

SOURCES: BAAQMD and SJVAPCD standards, and attainment status as of February 2007 (BAAQMD 2007; SJVAPCD 2007b).

The U.S. EPA is currently developing implementation guidance for fine particulate matter ($PM_{2.5}$). Air districts will be designated as attainment or nonattainment for this new standard in the near future. The SJAPCD has been designated as nonattainment for the $PM_{2.5}$ standard, and the *$PM_{2.5}$ Plan* is due to the U.S. EPA in April 2008. Air districts that are designated as nonattainment will be subject to more stringent air quality planning requirements.

San Francisco Bay Area Air Basin

The SFBAAB's current attainment status with respect to federal standards is summarized in Table 4.9-3. In general, the Bay Area experiences low concentrations of most pollutants when compared to federal standards, except for ozone and particulate matter (PM_{10} and $PM_{2.5}$), for which standards are exceeded periodically. The Bay Area's attainment status for ozone has changed several times over the past decade, first from "nonattainment" to "attainment" in 1995, then back to "unclassified nonattainment" in 1998 for the 1-hour federal ozone standard. In June 2004, the Bay Area was designated as "marginal nonattainment" for the 8-hour ozone standard. In 1998, after many years without violations of any CO standards, the attainment status for CO was upgraded to "attainment."

The BAAQMD's *Clean Air Plan* (CAP), last adopted in 2000, applies control measures to stationary and mobile sources and outlines transportation control measures. Although the 2000 CAP is an ozone plan, it includes PM_{10} attainment planning as an informational item. The 1997 CAP and 2000 CAP included 19 transportation control measures, many of which were partially implemented between 1998 and 2000. The 2000 CAP continues to implement and expand key mobile-source programs included in the 1997 CAP.

In response to the U.S. EPA redesignation of the basin for the 1-hour federal ozone standard to nonattainment, the BAAQMD, Association of Bay Area Governments (ABAG), and Metropolitan Transportation Commission (MTC) were required to develop an ozone attainment plan to meet this standard. The *1999 Ozone Attainment Plan* (OAP) was prepared and adopted by these agencies in June 1999. However, in March 2001, the U.S. EPA proposed and took final action to approve portions of the 1999 OAP and disapprove other portions, while also making the finding that the Bay Area had not attained the national 1-hour ozone standard. As a result, a revised OAP was prepared and adopted in October 2001. The 2001 OAP amends and supplements the 1999 OAP. The 2001 OAP contains control strategies for stationary and mobile sources. The adopted mobile-source control program was estimated to significantly reduce volatile organic compound and NOx emissions between 2000 and 2006, reducing emissions from on- and off-road diesel engines (including construction equipment). In addition to emission reduction requirements for engines and fuels, the OAP identified 28 transportation control measures to reduce automobile emissions, including improved transit service and transit coordination, new carpool lanes, signal timing, freeway incident management, and increased state gas tax and bridge tolls. In June 2005, the U.S. EPA revoked the federal 1-hour ozone standard, although the 8-hour standard is still in effect. The attainment deadline for "marginal nonattainment" areas for the 8-hour federal ozone standard is June 2007.

State Standards

The Clean Air Act Amendments of 1970 established national ambient air quality standards, and individual states retained the option to adopt more stringent standards and to include other pollution sources. California had already established its own air quality standards when federal standards were established, and because of the unique meteorological problems in California, there is considerable diversity between the state and national ambient air quality standards, as shown in Table 4.9-3. California ambient standards tend to be at least as protective as national ambient standards and are often more stringent. Currently, there are no federal or state ambient air quality standards for any of the six greenhouse gases.[2]

In 1988, California passed the California Clean Air Act (California Health and Safety Code Sections 39600 et seq.), which, like its federal counterpart, called for the designation of areas as attainment or nonattainment, but based on state ambient air quality standards rather than the federal standards.

In 2005, in recognition of California's vulnerability to the effects of climate change, Governor Schwarzenegger established Executive Order S-3-05, which sets forth a series of target dates by which statewide emission of GHG would be progressively reduced, as follows:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

In 2006, California passed the California Global Warming Solutions Act of 2006 (Assembly Bill No. 32; California Health and Safety Code Division 25.5, Sections 38500, et seq., or AB 32), which requires the CARB to design and implement emission limits, regulations, and other measures, such that feasible and cost-effective statewide GHG emissions are reduced to 1990 levels by 2020 (representing a 25 percent reduction in emissions).

California Air Resources Board

The CARB is the state agency responsible for regulating air quality. The CARB's responsibilities include establishing state ambient air quality standards, emissions standards, and regulations for mobile emissions sources (e.g., autos, trucks, etc.), as well as overseeing the efforts of countywide and multi-county air pollution control districts, which have primary responsibility over stationary sources. The emission standards most relevant to proposed WSIP facilities are those related to automobiles and on- and off-road heavy-duty diesel engines. The CARB also regulates vehicle fuels with the intent to reduce emissions; it has set emission reduction performance requirements for gasoline (California reformulated gasoline) and limited the sulfur and aromatic content of diesel fuel to make it burn cleaner. The CARB also sets the standards used to pass or fail vehicles in smog check and heavy-duty truck inspection programs.

2 The six GHGs are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF6).

Diesel Idling Limits. In 2005, the CARB approved a regulatory measure to reduce emissions of toxic and criteria pollutants by limiting the idling of new heavy-duty diesel vehicles, which altered five sections of Title 13 of the California Code of Regulations. The relevant changes with respect to the WSIP are Sections 2480 and 2485. The pertinent requirements of Section 2480, Airborne Toxic Control Measure to Limit School Bus Idling and Idling at Schools, include the following:

> (c)(2) A driver of a commercial motor vehicle:
>
> (A) must turn off the bus or vehicle engine upon stopping at a school and must not turn the bus or vehicle engine on more than 30 seconds before beginning to depart from a school; and
>
> (B) must not cause or allow a bus or vehicle to idle at any location within 100 feet of, but not at, a school for:
>
> (i) more than five consecutive minutes; or
> (ii) a period or periods aggregating more than five minutes in any one hour.
>
> (c)(4) A motor carrier of a commercial motor vehicle must ensure that:
>
> (A) the bus or vehicle driver, upon employment and at least once per year thereafter, is informed of the requirements in (c)(2), and of the consequences, under this section and the motor carrier's terms of employment, of not complying with those requirements;
>
> (B) all complaints of non-compliance with, and enforcement actions related to, the requirements of (c)(2) are reviewed and remedial action is taken as necessary; and
>
> (C) records of (4) (A) and (B) are kept for at least three years and made available or accessible to enforcement personnel as defined in subsection (g) within three business days of their request.

Pertinent requirements of Section 2485, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling, include the following:

> (c) The driver of any vehicle subject to this section:
>
> (1) shall not idle the vehicle's primary diesel engine for greater than five minutes at any location, except as noted in subsection (d); and
>
> (2) shall not operate a diesel-fueled auxiliary power system (APS) to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than five minutes at any location when within 100 feet of a restricted area, except as noted in subsection (d).

"Restricted area" means any real property zoned for individual or multifamily housing units that has one or more such units. There are 12 exceptions to this requirement (e.g., emergency situations, military, adverse weather conditions, etc.), including: when a vehicle's power takeoff is being used to run pumps, blowers, or other equipment; when a vehicle is stuck in traffic, stopped at a light, or under direction of a police officer; when a vehicle is queuing beyond 100 feet from any restricted area; or when an engine is being tested, serviced, or repaired.

Greenhouse Gas Emissions Limits. The California Global Warming Solutions Act of 2006 establishes a timetable for the CARB to adopt emission limits, rules, and regulations designed to achieve the intent of the Act, as follows (CARB, 2006b):

- Publish a list of discrete early action GHG emission reduction measures by June 30, 2007.
- Establish a statewide GHG emissions cap for 2020, equivalent to the 1990 emissions level by January 1, 2008.
- Adopt mandatory reporting rules for significant sources of GHGs by January 1, 2008.
- Adopt a scoping plan by January 1, 2009, indicating how GHG emission reductions will be achieved from significant GHG sources via regulations, market-based compliance mechanisms and other actions, including the recommendation of a *de minimus* threshold for GHG emissions, below which emission reduction requirements would not apply.
- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in GHGs, including provisions for using both market-based and alternative compliance mechanisms.
- Establish January 1, 2012 as the date by which all regulations adopted prior to January 1, 2010 are to become operative (enforceable).

The CARB is proposing “Early Action Measures” in three groups; together, these measures will make a substantial contribution to the overall 2020 statewide GHG emission reduction goal of approximately 174 million metric tons of carbon dioxide equivalent gases (CARB, 2007). (The term “carbon dioxide equivalent” is used to account for the differences in global warming potential [GWP] among the six greenhouse gases.) These measures are summarized as follows:

> *Group 1*: Three new GHG-only regulations are proposed to meet the narrow legal definition of “discrete early action GHG reduction measures”: a low-carbon fuel standard, reduction of refrigerant losses from motor vehicle air conditioning system maintenance, and increased methane capture from landfills. These regulations are expected to take effect by January 1, 2010.
>
> *Group 2*: The CARB is initiating work on 23 other GHG emission-reducing measures in the 2007 to 2009 time period with rulemaking to occur as soon as possible, where applicable. These GHG measures relate to the following sectors: agriculture, commercial, education, energy efficiency, fire suppression, forestry, oil and gas, and transportation.
>
> *Group 3*: The CARB is initiating work on 10 conventional air pollution controls aimed at criteria and toxic air pollutants, but with concurrent climate co-benefits through reductions in carbon dioxide or non-Kyoto pollutants (i.e., diesel particulate matter, other light-absorbing compounds, and/or ozone precursors) that contribute to global warming.

With the exception of the low-carbon fuel standard,[3] none of the Group 1 measures specifically relate to construction or operation of water infrastructure projects, such as the WSIP facility

[3] Feasiblity of this measure is currently unknown depending on availability and suitability of low-carbon fuel for construction equipment and proximity to construction site.

improvement projects. Proposed Groups 2 and 3 measures that could become effective during implementation of the WSIP and could pertain to construction-related equipment operations or specific WSIP facility design include the following actions:

- Measure 2-6, Education: Guidance/protocols for local governments to facilitate GHG emission reductions
- Measure 2-9, Energy Efficiency: Light-covered paving, cool roofs and shade trees
- Measures 2-14, 3-2, 3-4, Transportation: emission reductions for heavy-duty vehicles, on-road diesel trucks, and off-road diesel equipment (non-agricultural); efficiency improvements
- Measure 2-20, Transportation: Tire inflation program
- Measure 3-10, Fuels: Evaporative standards for aboveground tanks

Some proposed measures will require new legislation to implement, some will require subsidies, some have already been developed, and some will require additional effort to evaluate and quantify. Applicable early action measures that are ultimately adopted from Groups 2 and 3 will become effective during implementation of the WSIP and some WSIP facility projects might be subject to these requirements, depending on their timing.

In consultation with the CARB and California Public Utilities Commission, the California Energy Commission (CEC) is currently establishing a GHGs emission performance standard for local, public-owned electric utilities (pursuant to Senate Bill No. 1368). This standard will limit the rate of GHGs emissions to a level that is no higher than the rate of emissions of GHGs for combined-cycle natural gas baseload generation. The rulemaking shall consider, but not necessarily be limited to, establishing a GHGs emission performance standard for baseload generation facilities by June 30, 2007, a process for calculating the emissions of GHGs from baseload facilities and enforcing the standard, and a process for reevaluating and revising as necessary the GHGs emission performance standard. This standard must take into consideration the effect of the standard on rates, reliability, and financial resources, while recognizing the Legislature’s intent to encourage use of renewable resources and its goal of environmental improvement.

San Joaquin Valley Air Basin

The SJVAPCD is the regional agency responsible for air quality regulation within the SJVAB. The SJVAPCD regulates air quality through its control of stationary sources of pollution such as industrial processes and equipment, but also implements indirect source control programs to reduce mobile-source emissions (including transportation control measures). The SJVAB also provides the CARB with local strategies for sources under its jurisdiction for inclusion in the State Implementation Plan. (See the discussion above under Federal Standards for the SJVAB.)

Table 4.9-3 presents a summary of the SJVAB’s attainment status with respect to state standards. As indicated in the table, the SJVAB is designated as “severe nonattainment” for the state ozone standard and “nonattainment” for the state PM_{10} and $PM_{2.5}$ standards. The SJVAB is designated as “attainment” for all other criteria pollutants listed in Table 4.9-3.

San Francisco Bay Area Air Basin

The BAAQMD is the regional agency responsible for air quality regulation within the SFBAAB. The BAAQMD regulates air quality through its planning and review activities. The BAAQMD has permit authority over most types of stationary emission sources and can require stationary sources to obtain permits; it can also impose emission limits, set fuel or material specifications, or establish operational limits to reduce air emissions. The BAAQMD regulates new or expanding stationary sources of toxic air contaminants.

In September 2005, the BAAQMD, in cooperation with the MTC and ABAG, prepared the draft *Bay Area 2005 Ozone Strategy*. The Ozone Strategy is a roadmap showing how the San Francisco Bay Area will achieve compliance with the state 1-hour ozone standard as expeditiously as practicable, and how the region will reduce transport of ozone and ozone precursors to neighboring air basins. The control strategy includes stationary-source control measures to be implemented through BAAQMD regulations; mobile-source control measures to be implemented through incentive programs and other activities; and transportation control measures to be implemented through transportation programs in cooperation with the MTC, local governments, transit agencies, and others.

Table 4.9-3 presents a summary of the BAAQMD's attainment status with respect to state standards. As indicated in the table, the SFBAAB is designated as "nonattainment" for state ozone, PM10, and PM2.5 standards. The SFBAAB is designated as "attainment" for all other criteria pollutants listed in the table.

Climate Action Plan for San Francisco. In February 2002, the San Francisco Board of Supervisors passed the *Greenhouse Gas Emissions Reduction Resolution* (Number 158-02) committing the City and County of San Francisco to a greenhouse gas (GHG) emissions reductions goal of 20 percent below 1990 levels by the year 2012. The resolution also directs the San Francisco Department of the Environment, the SFPUC, and other appropriate City agencies to complete and coordinate an analysis and planning of a local action plan targeting GHG emission reduction activities. In September 2004, the San Francisco Department of the Environment and the SFPUC published the *Climate Action Plan for San Francisco: Local Actions to Reduce Greenhouse Emissions* (Plan) (SFDE and SFPUC, 2004). Although the San Francisco Board of Supervisors has not formally committed the City to perform the actions addressed in the Plan, and many of the actions require further development and commitment of resources, it serves as a blueprint for GHG emission reductions, and several actions are now in progress.

The Plan presents estimates of San Francisco's baseline GHG inventory and reduction targets. It states that burning fossil fuels in vehicles and for energy use in buildings and facilities are the major contributors to San Francisco's GHG emissions; in 1990, these activities produced approximately 9.1 million tons of carbon dioxide (CO_2). The Plan also describes recommended emissions reduction actions in the key target sectors – transportation, energy efficiency, renewable energy, and solid waste management – to meet stated goals by 2012.

The Plan presents proposals to reduce annual carbon dioxide emissions by 2.5 million tons by 2012, a 20 percent reduction below 1990 emissions, such as greening vehicle fleets, increasing energy efficiency in public and private buildings, developing renewable energy technologies like solar, wind, fuel cells and tidal power, and expanding residential and commercial recycling programs. The roadmap to achieving these goals requires the cooperation of a number of City, regional and State agencies as well as private sector partners.

Greenhouse Gas Reduction Ordinance

In May 2008, San Francisco adopted an ordinance amending its Environment Code to establish greenhouse gas emission targets and action plans, to authorize the Department of the Environment to coordinate efforts to meet these targets, and to make environmental findings (CCSF, 2008). The ordinance establishes the following greenhouse gas emission reduction limits for San Francisco and the target dates to achieve them:

- Determine 1990 City greenhouse gas emissions by 2008, the baseline level with reference to which target reductions are set;
- Reduce greenhouse gas emissions by 25 percent below 1990 levels by 2017;
- Reduce greenhouse gas emissions by 40 percent below 1990 levels by 2025; and
- Reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050.

The ordinance also specifies requirements for City departments to prepare Climate Action Plans that assess and report GHG emissions and prepare recommendations to reduce emissions. As part of this, the San Francisco Planning Department is required to: (1) update and amend the City's applicable General Plan elements to include the emissions reduction limits set forth in this ordinance and policies to achieve those targets; (2) consider a project's impact on the City's GHG reduction limits specified in this ordinance as part of its review under CEQA; and (3) work with other City departments to enhance the "transit first" policy to encourage a shift to sustainable modes of transportation thereby reducing emissions and helping to achieve the targets set forth by this ordinance.

Existing CCSF GHG Reduction Actions. The City is already implementing a wide range of actions related to the reduction of GHG emissions. Some of these actions are described below (SFDE and SFPUC, 2004) and additional actions are described in the Plan.

***Transportation*.** The San Francisco Board of Supervisors passed a Resolution No. 728-97 supporting increased Corporate Average Fuel Economy (CAFE) standards in the early 1990s. In 1999, the Board adopted the Healthy Air and Smog Prevention Act, which became Chapter 4 of the City's Environment Code. This ordinance requires that all new purchases or leases of passenger vehicles and light duty trucks must either be rated as ultralow emission vehicle (ULEV) or zero emission vehicles (ZEV) (at least 10 percent were to be ZEV by July 1, 2000). Requirements were also set forth for medium and heavy-duty vehicles and motorized equipment, and for phasing out all highly polluting vehicles and equipment (SFDE and SFPUC, 2004).

The City has also contributed grant funds towards the development of three alternate fueling facilities. It continues to seek funds to expand alternate fueling infrastructure and has also been successful in developing a number of electric vehicle charging stations both in San Francisco and throughout the Bay Area. In addition, the City encourages car sharing. Several car sharing organizations in the City provide a community-wide solution to vehicle fleets. By providing a network of vehicles in locations around the city, available for reservation on an as-needed basis, residents can utilize small, fuel-efficient and electric vehicles and reduce car ownership. Car sharing is also available for use by businesses and public entities. The City requires the provision of car share parking spaces in large new residential buildings (City Planning Code Section 166). The City also limits the amount of parking allowed in new downtown residential developments (City Planning Code Section 151.1).

***Solar and Energy Efficiency*.** San Francisco elected officials and voters have expressed strong support for renewable energy in several ways. The City funds municipal energy efficiency programs through a combination of the SFPUC's Hetch Hetchy Water and Power revenues, state grants and loans, and the City’s General Fund at approximately $5.5 million annually. Alternative renewable energy funding mechanisms, which can take advantage of private investor incentives including the 30 percent federal tax credit and accelerated depreciation through acquisition of renewable power from Power Purchase Agreements, are currently being explored. In 2001, the City’s Department of Environment received $7.8 million of state funds to manage an energy efficient lighting retrofit program for small businesses in San Francisco. Also in 2001, the voters approved Proposition B and H. Proposition B authorized $100 million in revenue bonds to develop solar, wind and energy efficiency projects in City facilities and Proposition H authorized the City to issue revenue bonds for private sector as well as municipal projects.

City ordinances include the Green Building Ordinance for City Buildings, and Residential Energy Conservation Ordinance (RECO); and City energy policies include those such as set forth in the Energy Policy of the City's General Plan, the 1997 Sustainability Plan, and the 2002 Electricity Resource Plan. One of the goals of the Electricity Resource Plan is to maximize energy efficiency in San Francisco. The Plan recommends that the City "periodically review and set annual targets for increasing the efficiency of electricity use and the amount of electricity produced by renewable sources of energy so that ultimately all of San Francisco's electricity needs are met with zero GHG emissions and minimal impacts on the environment." Increased energy efficiency goals included in the Climate Action Plan include 107 megawatts of electric demand reduction and 759 gigawatt-hours of energy efficiency by 2012.

The San Francisco Department of Environment (SF Environment) is developing streamlined permitting and public information systems to pave the way for accelerated construction of solar in San Francisco for both hot water heating and electricity. Permit fees are being reduced and requirements standardized (SFDE and SFPUC, 2004).

SF Environment is also promoting the integration of solar into the construction of new City facilities through its Green Building program. The SFPUC and SF Environment are cooperating to implement the Generation Solar program to facilitate the installation of solar electric systems on residential and commercial rooftops in San Francisco SFPUC provides overall oversight of the program, technical assistance, and contractor screening. SF Environment has responsibility for program marketing and proposing changes to building and planning codes, procedures, permitting and fees. See below for additional SFPUC-specific GHG emissions reduction measures (SFDE and SFPUC, 2004).

Existing SFPUC-Specific GHG Reduction Actions. As stated throughout this PEIR, the SFPUC owns and operates a gravity-driven water system. The SFPUC is also developing and energy-efficiency and renewable generation projects. To date, several renewable generation projects have been constructed and many more are in the planning, design or construction phases. For instance, in 2002, the SFPUC installed a small reciprocating engine to use biogas recovered from the Oceanside Water Treatment Control Plant. In 2003, a 2 megawatt biogas plant began operation at the Southeast Water Treatment Control Plant. Both of these plants use sewage-produced methane gas that would otherwise be flared-off. In addition, the SFPUC has completed several solar electric projects for City facilities. The first project, a 675-kilowatt solar electric photovoltaic (PV) system is located on the Moscone Convention Center's roof. This project generates 826,000 kilowatt-hours of electricity per year and provides a solar showplace for visitors. Additional solar PV projects in operation include a 255-kilowatt project that the Southeast Water Pollution Control Plant and a 245-kilowatt project at Pier 96, the Norcal recycling facility. Five other solar PV projects are currently under construction. The SFPUC has also installed pyranometers at 19 sites on City buildings and schools to collect data about the availability of sunlight, as well as instruments to measure wind speed and ambient temperature. The variability in solar incidence is based on microclimate and geography, and when used in conjunction with availability of appropriate space suggests potential future solar PV project sites.

The SFPUC also manages and implements energy efficiency projects in municipal buildings and facilities. SFPUC provides energy efficiency services such as energy audits, design, and construction management. Energy retrofit technologies include installing energy efficient equipment such as lighting, HVAC, motors, controls and energy management systems.

Municipal energy efficiency and renewable generation projects are funded by Hetch Hetchy power sales net revenue as well as state grants and loans, among other funding mechanisms. Funds that the SFPUC designates for energy projects are appropriated in a project account called The Mayor's Energy Conservation Account (MECA). MECA provides a financing mechanism whereby a loan can be made by the SFPUC to a department for the purpose of funding an energy project. For energy efficiency projects, loans can be paid back though City departments' energy savings. As of 2007, the SFPUC has invested $24 million in energy efficiency projects and estimates that it has reduced peak demand by approximately 3,800 kW and CO_2 emissions by approximately 11,000 tons/year. Municipal solar PV projects have been funded by SFPUC Power Enterprise such that client departments pay the same rate for solar power as they would normally pay for that power from Hetch Hetchy generation. To date, 2 megawatts of municipal solar plants have been installed or are under construction for an investment (before rebates) of about $20 million.

Municipal energy efficiency projects recently completed or underway include: lighting retrofits at Moscone Convention Center (North and South), San Francisco General Hospital, Mental Health Clinics, City parking garages, Golden Gate Park and West Portal Library; Department of Parking and Traffic LED traffic signal conversions; efficient refrigerators at Housing Authority facilities; motor replacements at the Southeast Wastewater Treatment Plant; and efficient lighting, HVAC, building shell, and energy management controls upgrades at the new Moscone West Convention Center (SFDE and SFPUC, 2004).

The SFPUC is also looking at several sites around the Bay Area for wind power development. The SFPUC has installed wind monitoring equipment at five sites in and around the City and additional data are being obtained for City property in the Sierra foothills.

SFPUC GHG Reduction Actions as Part of the WSIP. In addition to the actions set forth above, the SFPUC is committed to the following GHG reduction actions as part of the WSIP program.

A. The SFPUC will include the first two measures in all WSIP contractor specifications and will implement the third during project planning and design, which in addition to having other environmental benefits, would also help reduce GHG emissions.

    1. The SFPUC will require that all contractors maintain tire inflation to the manufacturers' inflation specifications.
    2. The SFPUC will implement a construction worker education program for all WSIP projects.
    3. WSIP projects that include construction of new buildings will consult with the SFPUC Power Enterprise's Energy Efficiency Group to incorporate all applicable energy efficiency measures into project design. Projects with buildings components will

attempt to maximize energy efficiency by exceeding Title 24 minimum requirements by at least 20 percent. Projects with buildings components will attempt to meet or exceed LEED Silver certification as required by the City's Green Building Ordinance.

B. Chapter 6 presents mitigation measures that would be implemented as part of the WSIP and some of these measures would also help reduce GHG emissions. They include exhaust controls (Measures 4.9-1b, 4.9-1d and 4.16-7a), waste reduction measures (Measure 4.11-2) and energy efficiency measures (Measure 4.15-2). In addition, CARB regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485), which limit idling of diesel-fueled commercial motor vehicles, would help to limit greenhouse gas emissions associated with WSIP-related construction vehicles.

4.9.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to air quality, but generally considers that implementation of the proposed program would have a significant air quality impact if it were to:

- Conflict with or obstruct implementation of the applicable air quality plan (Evaluated in this section)
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation (Evaluated in this section)
- Conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32, California Global Warming Solutions Act of 2006, such that the project's GHG emissions would result in a substantial contribution to global climate change (Evaluated in this section).
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors) (Evaluated in this section and Section 4.16, Collective WSIP Impacts; cumulative increases are evaluated in Section 4.17, Cumulative WSIP Impacts)
- Expose sensitive receptors to substantial pollutant concentrations (Evaluated in this section)
- Create objectionable odors affecting a substantial number of people (Evaluated in this section)

Approach to Analysis

The air quality impact analysis considers construction and operational impacts associated with the proposed WSIP. Construction air emissions are evaluated in accordance with the SJVAPCD and BAAQMD guidelines for assessing and mitigating air quality impacts (SJVAPCD, 2002b; BAAQMD, 1999). Both the SJVAPCD and BAAQMD guidelines indicate that the significance of a project's impact should be evaluated based on the effectiveness of proposed measures to reduce construction-related emissions (e.g., whether control measures are implemented as part of construction). If appropriate mitigation measures are implemented for each project to control

PM_{10} emissions, both air districts consider the potentially significant project-related and cumulative impacts to be less than significant.

Both the SJVAPCD and BAAQMD guidelines also provide significance thresholds for criteria pollutant emissions associated with project operation. However, water storage, transmission, and treatment facilities are not typically a source of “traditional” air pollution emissions. Therefore, direct and secondary emissions associated with operation of the WSIP facilities are discussed qualitatively. The significance of the WSIP’s cumulative operational impacts is determined based on the consistency of the WSIP with pertinent air quality plans.

Impact Summary by Region

Table 4.9-4 provides a summary of the air quality impacts associated with implementation of the WSIP.

Construction Impacts

Short-Term Increases in Pollutant Emissions

Impact 4.9-1: Construction emissions of criteria pollutants.

Construction of all WSIP facilities would generate fugitive dust[4] (including PM_{10} and $PM_{2.5}$) and other criteria pollutants, primarily as a result of a variety of construction activities, including excavation, grading, demolition, vehicle travel on paved and unpaved surfaces, and vehicle exhaust. With respect to construction-related emissions, PM_{10} is the pollutant of greatest concern to the SJVAPCD and BAAQMD. Construction-related emissions could cause substantial increases in localized concentrations of PM_{10} and could affect PM_{10} compliance with ambient air quality standards on a regional basis. Particulate emissions from construction activities could also lead to adverse health effects and nuisance concerns (e.g., reduced visibility and soiling of exposed surfaces).

Combustion emissions from construction equipment and vehicles (i.e., heavy equipment and delivery/haul trucks, worker commute vehicles, air compressors, and generators) would be generated during project construction. Emissions from construction worker commute trips would be minor compared to the emissions generated by construction equipment. Criteria pollutant emissions of ROG and NO_x from these emission sources would incrementally add to regional atmospheric loading of ozone precursors during project construction. The *BAAQMD CEQA Guidelines* recognize that construction equipment emits ozone precursors, but indicate that such emissions are included in the emission inventory that is the basis for regional air quality plans, and that construction emissions are not expected to impede the attainment or maintenance of ozone standards in the Bay Area (BAAQMD, 1999). However, the SJVAPCD indicates that

4 “Fugitive” emissions generally refer to those emissions that are released to the atmosphere by some means other than through a stack or tailpipe.

TABLE 4.9-4
POTENTIAL IMPACTS AND SIGNIFICANCE – AIR QUALITY

Projects	Project Number	Impact 4.9-1: Construction emissions of criteria pollutants	Impact 4.9-2: Exposure to diesel particulate matter during construction	Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling	Impact 4.9-4: Air pollutant emissions during project operation	Impact 4.9-5: Odors generated during project operation	Impact 4.9-6: Secondary emissions at power plants	Impact 4.9-7: Conflict with implementation of applicable regional air quality plans and state goals to limit GHG emissions
San Joaquin Region								
Advanced Disinfection	SJ-1	PSM	LS	N/A	LS	LS	LS	LS
Lawrence Livermore Supply Improvements	SJ-2	PSM	N/A	N/A	LS	LS	LS	LS
San Joaquin Pipeline System	SJ-3	PSM	LS	PSM	LS	N/A	LS	LS
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	PSM	LS	PSM	LS	N/A	LS	LS
Tesla Portal Disinfection Station	SJ-5	PSM	LS	N/A	LS	LS	LS	LS
Sunol Valley Region								
Alameda Creek Fishery Enhancement	SV-1	PSM	LS	LS	LS	N/A	LS	LS
Calaveras Dam Replacement	SV-2	PSM	PSM	N/A	LS	N/A	LS	LS
Additional 40-mgd Treated Water Supply	SV-3	PSM	LS	LS	LS	LS	LS	LS
New Irvington Tunnel	SV-4	PSM	LS	PSM	LS	N/A	LS	LS
SVWTP – Treated Water Reservoirs	SV-5	PSM	PSM	N/A	LS	LS	LS	LS
San Antonio Backup Pipeline	SV-6	PSM	LS	LS	N/A	N/A	LS	LS
Bay Division Region								
Bay Division Pipeline Reliability Upgrade	BD-1	PSM	PSM	PSM	LS	N/A	LS	LS
BDPL Nos. 3 and 4 Crossovers	BD-2	PSM	LS	N/A	LS	N/A	LS	LS
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	PSM	LS	PSM	N/A	N/A	LS	LS
Peninsula Region								
Baden and San Pedro Valve Lots Improvements	PN-1	LS	LS	N/A	LS	N/A	LS	LS
Crystal Springs/San Andreas Transmission Upgrade	PN-2	LS	LS	PSM	LS	N/A	LS	LS
HTWTP Long-Term Improvements	PN-3	LS	LS	N/A	LS	LS	LS	LS
Lower Crystal Springs Dam Improvements	PN-4	LS	LS	N/A	LS	N/A	LS	LS
Pulgas Balancing Reservoir Rehabilitation	PN-5	LS	LS	N/A	LS	N/A	LS	LS
San Francisco Region								
San Andreas Pipeline No. 3 Installation	SF-1	LS	LS	PSM	LS	LS	LS	LS
Groundwater Projects	SF-2	LS	LS	PSM	LS	LS	LS	LS
Recycled Water Projects	SF-3	LS	LS	PSM	LS	LS	LS	LS

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

construction projects lasting for many months in the SJVAB could exceed the air district's annual threshold for NOx emissions. In addition, sensitive receptors could be subject to elevated levels of diesel particulate matter (DPM). These impacts would be temporary but would span the duration of construction for each project, mostly one to four years depending on the project. Construction emissions associated with implementation of all the WSIP projects would span seven or eight years (approximately 2008 to 2014). Due to the long overall duration of WSIP-related construction activities and the regional extent of WSIP facilities, this PEIR quantifies construction-phase emissions by region to demonstrate the combined or collective construction impact in each region that could result from WSIP implementation.

Air pollutant emissions were estimated for each region, as shown in **Table 4.9-5**. While much of the estimated emissions are attributable to the largest WSIP projects: SJPL System (SJ-3), Calaveras Dam (SV-2), and BDPL Reliability Upgrade (BD-1), other WSIP projects would incrementally contribute to emissions listed in this table. For purposes of a worst-case analysis, simultaneous construction of all WSIP projects (listed in Table 3.10) were assumed to occur during any given year, which is unlikely to occur.

Given the length of time that construction-related emissions would occur, this PEIR compares estimated exhaust emissions to the SJVAPCD's operational significance criteria (10 tons/year, equivalent to 55 pounds per day, for ROG and NOx; 9 ppm averaged over 8 hours and 20 ppm over 1 hour for CO) and the BAAQMD's operational significance criteria (80 pounds/day for ROG, NOx, and PM_{10}; 550 pounds/day for CO).

San Joaquin Region

Impact 4.9-1: Construction emissions of criteria pollutants		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

Construction activities associated with all projects in the San Joaquin Region would result in short-term increases in suspended particulates and other criteria pollutants. This would be a *potentially significant* impact.

Table 4.9-5 shows the estimated average daily earthmoving quantities and correlating fugitive PM_{10} and equipment exhaust emissions that could occur on any given day in the San Joaquin Region. Most of the estimated construction-related air pollutant emissions in this region are attributable to the SJPL System project (SJ-3), since the majority of the surface disturbance/ excavation in this region would be associated with this project. The SJPL Rehabilitation project (SJ-4) also could contribute substantial additional emissions, but the amount cannot be quantified at this time because the extent of disturbance has not yet been determined. Emissions associated with haul truck traffic for both of these projects would add to estimated emissions (including DPM). Although the SJVAPCD has no construction significance criteria, these estimates indicate the SJVAPCD's annual threshold for NOx could be exceeded, primarily due to the long construction duration (almost three years) for the SJPL System project. Construction of the SJPL Rehabilitation project would further increase estimated emissions and the potential for exceedance of the NOx threshold. Potential air quality impacts associated with these projects

TABLE 4.9-5
WSIP CONSTRUCTION-RELATED AIR POLLUTANT EMISSIONS

Region	Average Daily Area of Disturbance (acres/day)	Average Daily Fugitive PM10 Emissions [a] (pounds/day)	Average Daily Excavation/ Spoils Volume (cubic yards)	Average Daily Equipment Emissions Associated with Earthmoving Equipment (pounds per day)[b]					
				PM10[c]	Carbon Monoxide	Reactive Organic Gases[d]	Nitrogen Oxides[e]	Sulfur Oxides	Carbon Dioxide Equiv[f]
San Joaquin Valley Air Basin									
San Joaquin Region[g]	4.1	208	1,212	6	369	25	**113**	12	7,250
SJVAPCD Significance Thresholds[h]	NA	NA	NA	NA	NA	55	55	NA	NA
San Francisco Bay Area Air Basin									
Sunol Valley Region	6.7	**342**	10,809	52	**3,288**	**219**	**1,010**	110	64,640
Bay Division Region[i]	2.3	**119**	950	5	289	19	**89**	10	5,680
Peninsula Region	0.1	3	105	1	32	2	10	1	630
San Francisco Region[j]	0.4	22	177	1	54	4	17	2	1,060
SFBAAB TOTAL	NA	**486**	NA	57	**3,663**	**244**	**1,126**	119	72,010
BAAQMD Significance Thresholds	NA	80	NA	80	550	80	80	NA	NA

NOTE: **Bold** values are in excess of SJVAPD or BAAQMD significance thresholds. Fugitive PM10 emissions are estimated using the CARB's construction-related emission factor of 51 pounds/acre/day of PM10, as presented by the BAAQMD (1999). Equipment emissions represent a composite fleet of heavy- and light-duty construction equipment in the Bay Area, and estimates are based on BAAQMD emissions factors (1999). NA = not applicable or not available.

[a] Fugitive particulate matter (PM10) emissions for all regions (except the Sunol Valley and Peninsula Regions) are based on typical trench dimensions of pipeline projects and average length of pipeline that can be constructed in one day. Since a larger construction area would result in surface disturbance (and fugitive dust) along segments that are unpaved, additional disturbance area was included for pipelines in the San Joaquin and Bay Division Regions. For the Sunol Valley and Peninsula Regions, fugitive PM10 emissions are estimated based on the maximum total excavation/spoils volume (see Table 3.12 in Chapter 3) that could occur on any given day due to overlapping construction schedules.

[b] Equipment emissions for all regions are based on the maximum total excavation/spoils volume that could occur on any given day due to overlapping construction schedules, averaged over each project's estimated construction duration (see Table 4.16-1). Since these estimates are daily emissions averaged over the entire construction period, actual emissions on any given day could be higher or lower than these estimates.

[c] Equipment PM10 exhaust emissions estimates include DPM, but do not include emissions associated with haul truck traffic.

[d] Does not include methane which is a greenhouse gas.

[e] Does not include nitrous oxide which is a greenhouse gas.

[f] Carbon dioxide equivalent greenhouse gas emissions. The calculation assumes that each cubic yard of cut and fill requires the expenditure of 0.27 gallons of diesel fuel, and that each gallon of diesel fuel combustion produces 22.15 pounds of CO2-equivalent emissions (CO2 + CH4 [GWP=21] + N2O [GWP=310]) based upon Tables C.3 and C.4 of the California Climate Action Registry. GWP is "global warming potential" which recognizes that each GHG differs in its ability to absorb heat in the atmosphere. Methane traps 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 310 times more heat per molecule. All GHG emissions have been quantified and weighted according to their GWP to create a CO_2-equivalent emission rate.

[g] Estimated emissions are based on the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects only, because these projects represent most of this region's emissions. It is assumed that two construction crews would work on SJ-3 and one construction crew would work on SJ-4 simultaneously.

[h] As noted previously, there are no established standards or thresholds applicable to GHG emissions.

[i] Estimated emissions are based on the BDPL Reliability Upgrade project (BD-1) only, because this project represents most of this region's emissions. It is assumed that four construction crews would work simultaneously.

[j] Estimated emissions are based on construction of the SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3), because these projects represent most of this region's emissions. It is assumed that four construction crews would work simultaneously. It is possible that construction activities associated with these two projects could overlap in 2010.

would be evaluated during separate, project-level CEQA review. SFPUC Construction Measure #3, which requires preparation of a dust control plan and implementation of several dust control measures, would reduce these potentially significant impacts. However, the SJVAPCD considers construction-related emissions from all projects in this region to be mitigated to a less-than-significant level if SJVAPCD-recommended PM_{10} fugitive dust rules (collectively called Regulation VIII and included as Measure 4.9-1a) and equipment exhaust emission controls (outlined in Measure 4.9-1b) are implemented. Therefore, implementation of SFPUC Construction Measure #3 for air quality in addition to applicable SJVAPCD dust and exhaust control measures (Measures 4.9-1a and 4.9-1b) would reduce potential air quality impacts to a less-than-significant level.

Sunol Valley Region

Impact 4.9-1: Construction emissions of criteria pollutants		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

Construction activities associated with all projects in the Sunol Valley Region would result in short-term increases in suspended particulates and other criteria pollutants. This would be a *potentially significant* impact.

Table 4.9-5 shows the estimated average daily earthmoving quantities and correlating fugitive PM_{10} and equipment exhaust emissions that could occur between approximately 2009 and 2010 during simultaneous construction of six WSIP projects in the Sunol Valley Region (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; New Irvington Tunnel, SV-4; Treated Water Reservoirs, SV-5; and SABUP, SV-6). Most of the estimated construction-related air pollutant emissions in this region are attributable to the Calaveras Dam project, since the majority of the surface disturbance/excavation in this region would be associated with this project. Emissions associated with haul truck traffic would add to estimated emissions (including DPM; see Impact 4.9-2). Although the BAAQMD has no construction significance criteria, these estimates indicate the BAAQMD's operational thresholds for ROG, NO_x, PM_{10}, and CO could be exceeded. Potential air quality impacts associated with the Calaveras Dam project would be evaluated in more detail in a separate, project-level EIR. SFPUC Construction Measure #3, which requires preparation of a dust control plan and implementation of several dust control measures, would reduce these potentially significant impacts. However, the BAAQMD considers construction-related emissions from all projects in this region to be mitigated to a less-than-significant level if BAAQMD-recommended dust and equipment exhaust emission controls (outlined in Measures 4.9-1c and 4.9-1d) are implemented. Therefore, it is expected that implementation of SFPUC Construction Measure #3 for air quality in addition to applicable BAAQMD dust and exhaust control measures (Measures 4.9-1c and 4.9-1d) would reduce potential air quality impacts to a less-than-significant level.

Bay Division Region

Impact 4.9-1: Construction emissions of criteria pollutants		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Construction activities associated with all projects in the Bay Division Region would result in short-term increases in suspended particulates and other criteria pollutants. This would be a *potentially significant* impact.

Table 4.9-5 shows the estimated average daily earthmoving quantities and correlating fugitive PM_{10} and equipment exhaust emissions that could occur on any given day in the Bay Division Region. Most of the estimated construction-related air pollutant emissions in this region are attributable to the BDPL Reliability Upgrade project (BD-1), since the majority of the surface disturbance/excavation in this region would be associated with this project. Emissions associated with haul truck traffic would add to estimated emissions (including DPM; see Impact 4.9-2). These estimates indicate the BAAQMD's operational thresholds for PM_{10}, CO, and NOx could be exceeded. Potential air quality impacts associated with the BDPL Reliability Upgrade project would be evaluated in more detail in a separate, project-level EIR. SFPUC Construction Measure #3, which requires preparation of a dust control plan and implementation of several dust control measures, would reduce these potentially significant impacts. However, the BAAQMD considers construction-related emissions from all projects in this region to be mitigated to a less-than-significant level if BAAQMD-recommended dust and equipment exhaust emission controls (outlined in Measures 4.9-1c and 4.9-1d) are implemented. Therefore, it is expected that implementation of SFPUC Construction Measure #3 for air quality in addition to applicable BAAQMD dust and exhaust control measures (Measures 4.9-1c and 4.9-1d) would reduce potential air quality impacts to a less-than-significant level.

Peninsula Region

Impact 4.9-1: Construction emissions of criteria pollutants		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Construction activities associated with all projects in the Peninsula Region would result in short-term increases in suspended particulates and other criteria pollutants.

Table 4.9-5 shows the estimated average daily earthmoving quantities and correlating fugitive PM_{10} and equipment exhaust emissions that could occur on any given day within the Peninsula Region. Construction activities associated with WSIP projects in this region as well as emissions associated with haul truck traffic would contribute air pollutant emissions (including DPM; see Impact 4.9-2). SFPUC Construction Measure #3, which requires preparation of a dust control plan and implementation of several dust control measures, would reduce emission of criteria pollutants. These estimates indicate the BAAQMD's operational thresholds for ROG, NO_X, PM_{10}, and CO would not likely be exceeded in this region, and impacts would therefore be *less than significant*. However, it should be noted that construction of these five projects would add to the WSIP's combined or collective emissions contributions to the SFBAAB (see Section 4.16, Collective WSIP Impacts, for more discussion).

San Francisco Region

Impact 4.9-1: Construction emissions of criteria pollutants		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Construction activities associated with all projects in the San Francisco Region would result in short-term increases in suspended particulates and other criteria pollutants.

Table 4.9-5 shows the estimated average daily earthmoving quantities and correlating fugitive PM_{10} and equipment exhaust emissions that could occur on any given day within the San Francisco Region. Most of the estimated construction-related air pollutant emissions in this region are attributable to simultaneous construction of the SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3). Construction activities associated with the Groundwater Projects (SF-2) as well as emissions associated with haul truck traffic (see Impact 4.9-2) would contribute additional air pollutant emissions. SFPUC Construction Measure #3, which requires preparation of a dust control plan and implementation of several dust control measures, would reduce emission of criteria pollutants. These estimates indicate the BAAQMD's operational thresholds for ROG, NO_x, PM_{10}, and CO would not likely be exceeded in this region, and impacts would therefore be *less than significant*. However, it should be noted that construction of these three projects would add to the WSIP's combined or collective emissions contributions to the SFBAAB (see Section 4.16, Collective WSIP Impacts, for more discussion).

Impact 4.9-2: Exposure to diesel particulate matter (DPM) during construction.

Combustion emissions from construction equipment and vehicles (i.e., heavy equipment and delivery/haul trucks, worker commute vehicles, air compressors, and generators) would be generated during project construction. Onsite construction emissions are evaluated above under Impact 4.9-1. Offsite emissions would include those generated by worker vehicles as well as by diesel haul/delivery trucks used during construction, particularly trucks used to transport excavated materials from WSIP facility sites. Emissions from construction worker commute trips would be minor compared to the emissions generated by construction equipment and haul/delivery trucks. Construction emissions would result in an increase in $PM_{2.5}$ emissions in addition to PM_{10} and ozone precursors. $PM_{2.5}$ emissions of concern would be associated primarily with DPM, since particulates generated by excavation, grading, and other soil-disturbance activities are normally outside the $PM_{2.5}$-size range. Diesel exhaust particulates contain substances that are suspected carcinogens. Diesel exhaust contains both pulmonary irritants and hazardous compounds that could affect sensitive receptors such as young children, senior citizens, or those susceptible to chronic respiratory disease such as asthma, bronchitis, and emphysema.

In 2000, the CARB approved a comprehensive *Diesel Risk Reduction Plan* to reduce diesel emissions from both new and existing diesel-fueled engines. The plan focuses on reducing emissions from diesel-fueled engines (through new standards and retrofitting) and reducing the sulfur content of diesel fuel to enable the use of advanced DPM emission controls. The plan's goals are to achieve a 75 percent reduction in DPM by 2010 and an 85 percent reduction by 2020 (from the 2000 baseline). While many of the new regulations are source-based controls, in 2005 the CARB approved a regulatory measure (Section 2485 of the California Health and Safety Code) to reduce emissions of toxic and criteria pollutants by limiting the idling of new heavy-duty diesel vehicles. Idling limits are specified in Measure 4.9-1d, and WSIP projects would be required to comply with these requirements.

The SJVAPCD and BAAQMD do not have methodologies for estimating impacts from diesel exhaust or determining the significance of a project's contribution. However, a DPM air monitoring study was conducted during another water treatment facility construction project in the Bay Area (URS Corporation, 2004). This study found the average downwind exposure during the hauling of 41 loads of material (82 one-way trips) to be 1.44 micrograms per cubic meter (µg/m^3) of DPM. The upwind concentration was 0.92 µg/m^3. Therefore, 41 loads of material (82 trips) are estimated to increase the DPM exposure by 0.52 µg/m^3 over an eight-hour period. To convert this to a daily exposure, it would be approximately one-third of this value. The accumulated health risk to children and residents can be calculated as follows under a number of conservative assumptions:

RISK = (0.52 / 3) * 300 in a million * (loads/day / 41) * (days of hauling / 25,550 days in 70 years)
| | | |
= DPM * Cancer Risk * daily hauling * lifetime fraction over which risk applies

A risk of 1 in a million is considered insignificant by the BAAQMD, while a risk of 10 in a million would be significant.[5] For purposes of this PEIR, a risk between 1 and 10 in a million is conservatively considered to be potentially significant. The number of loads that would cause these thresholds to be exceeded over the hauling lifetime would be as follows:

1 in a million – 20,000 loads (40,000 trips)

10 in a million – 200,000 loads (400,000 trips)

These estimates are based on very conservative assumptions, including the following:

- The receptor remains outside their home for eight hours per day for every day of hauling.
- The receptor location is downwind of and adjacent to the haul route.
- Emissions from the haul truck fleet remain at 2004 emission rates, and no cleaner, lower emission trucks are ever added to the fleet; this assumption results in very conservative estimates since DPM emission rates are estimated to decrease by nearly 50 percent between 2004 and 2012.

5 The BAAQMD's Regulation 2, Rule 5, *New Source Review of Toxic Air Contaminants*, specifies that a cancer risk of 1 in a million or less over a 70-year-lifetime exposure period is an insignificant risk, and no further review of health-related impacts is required. If a project has a risk greater than 1 in a million, it must be further evaluated in order to determine acceptability. Factors that affect acceptability include the presence of controls on the rate of emissions, the location of the site in relation to residential areas and schools, and contaminant reductions in other media such as water. In general, projects with risks greater than 1 in a million, but less than 10 in a million, are approved if other determining factors are acceptable. Projects with risks greater than 10 in a million are generally not approved. Projects that are not approved may be reevaluated if emissions are reduced, thus reducing their risks.

Table 4.9-6 presents a range of truck trips for each WSIP project that could be associated with the hauling of excavated spoils to offsite locations for reuse or disposal. Development of the above hauling thresholds serves as a basis for this program-level analysis, and also provides guidance for a project-level assessment of impacts related to truck hauling. These thresholds clearly include a high degree of conservatism (large margin of safety). Nevertheless, there could be unique, site-specific project features (e.g., proximity to sensitive receptor(s), a combination of onsite equipment emissions and haul trucks, or high levels of other air toxics creating cumulative exposure issues) that would prompt the need for a project-level health risk assessment, even if the above thresholds were not exceeded.

TABLE 4.9-6
OFFSITE DIESEL PARTICULATE MATTER EMISSIONS

Project Number	Project Name	Excavation/ Spoils Volume (cubic yards)	Total Truck Trips (if 80% Hauled Offsite)	Exceeds 10 in a Million Threshold?	Total Truck Trips (if 50% Hauled Offsite)	Exceeds 10 in a Million Threshold?
San Joaquin Region						
SJ-1	Advanced Disinfection	TBD	TBD	TBD	TBD	TBD
SJ-2	Lawrence Livermore Supply Improvements	TBD	TBD	TBD	TBD	TBD
SJ-3	San Joaquin Pipeline System	424,000 cy	56,533	No, but exceeds the 1 in a million threshold	35,333	No
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	Disposal of excavation spoils not expected	TBD	TBD	TBD	TBD
SJ-5	Tesla Portal Disinfection Station	TBD	TBD	TBD	TBD	TBD
	Total Truck Trips for San Joaquin Region		56,533+	No, but exceeds the 1 in a million threshold	35,333+	No
Sunol Valley Region						
SV-1	Alameda Creek Fishery Enhancement	TBD	TBD	TBD	TBD	TBD
SV-2	Calaveras Dam Replacement	6,300,000 cy total excavation and 4,000,000 cy spoil	533,333+	**Yes**	**333,333**	No
SV-3	Additional 40-mgd Treated Water Supply	100,000 cy	13,333	No	8,333	No
SV-4	New Irvington Tunnel	186,175 cy	24,823	No	15,515	No
SV-5	SVWTP – Treated Water Reservoirs	300,000 cy	40,000	No, but meets the 1 in a million threshold	25,000	No
SV-6	San Antonio Backup Pipeline	51,000 cy total excavation and 37,000 cy spoil	4,933	No	3,083	No
	Total Truck Trips for Sunol Valley Region		616,423+	**Yes**	385,265+	No

TABLE 4.9-6 (Continued)
OFFSITE DIESEL PARTICULATE MATTER EMISSIONS

Project Number	Project Name	Excavation/ Spoils Volume (cubic yards)	Total Truck Trips (if 80% Hauled Offsite)	Exceeds 10 in a Million Threshold?	Total Truck Trips (if 50% Hauled Offsite)	Exceeds 10 in a Million Threshold?
Bay Division Region						
BD-1	Bay Division Pipeline Reliability Upgrade	434,000 cy	57,867	No, but exceeds the 1 in a million threshold	36,167	No
	Bay Tunnel Segment	355,000 cy	47,333	No, but exceeds the 1 in a million threshold	29,583	No
BD-2	BDPL Nos. 3 and 4 Crossovers	43,500 cy	5,800	No	3,625	No
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Phase B – 55,300 cy	7,373	No	4,608	No
Total Truck Trips for Bay Division Region			118,373	No	73,983	No
Peninsula Region						
PN-1	Baden and San Pedro Valve Lots Improvements	5,000	667	No	417	No
PN-2	Crystal Springs/ San Andreas Transmission Upgrade	Not Specified (estimated to be up to 9,000 cy)	1,200	No	750	No
PN-3	HTWTP Long-Term Improvements	Not Specified	TBD	TBD	TBD	TBD
PN-4	Lower Crystal Springs Dam Improvements	21,000 cy	2,800	No	1,750	No
PN-5	Pulgas Balancing Reservoir Rehabilitation	TBD	TBD	TBD	TBD	TBD
Total Truck Trips for Peninsula Region			4,700+	No	2,900+	No
San Francisco Region						
SF-1	San Andreas Pipeline No. 3 Installation	44,170 cy	5,889	No	3,681	No
SF-2	Groundwater Projects – Local & Regional	TBD	TBD	TBD	TBD	TBD
SF-3	Recycled Water Projects	47,200 cy	6,293	No	3,933	No
Total Truck Trips for San Francisco Region			12,183+	No	7,614+	No

NOTE: Estimated truck trips assume each haul truck would accommodate 12 cubic yards, and 50 to 80 percent of excavation spoils would be hauled offsite for reuse or disposal. See Sections 4.16 and 4.17 for discussion of collective and cumulative DPM impacts associated with total truck trips and overlapping impacts in each region.

Air pollution studies indicate a high correlation between traffic emissions and health impacts within 1,000 feet, with the strongest association within 300 to 500 feet. Studies also show that concentrations of traffic emissions decline with distance from the road, with a dramatic decrease in the first 300 to 500 feet (up to a 70 percent decrease in one study). Based on these studies, the CARB and BAAQMD recommend that new sensitive land uses not be located within 500 feet of freeways, urban roads carrying 100,000 vehicles/day, or rural roads carrying 50,000vehicles/day (Cal-EPA and CARB, 2005). Therefore, if sensitive receptors are located more than 500 feet from a haul route, potential health effects associated with elevated DPM are considered less than significant.

San Joaquin Region

Impact 4.9-2: Exposure to DPM during construction		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Within the San Joaquin Region, access to most of the WSIP facility sites would be provided by rural roadways, highways, or freeways. As shown in Table 4.9-6, total DPM emissions generated by haul truck traffic associated with the SJPL System project (SJ-3) as a whole would be potentially significant, since the total truck trips for the whole project indicate excess cancer risk would be greater than 1 in a million but less than 10 in a million. However, health risks associated with DPM exposure would be *less than significant*, because haul trucks would use different haul routes along the pipeline alignment and only a portion of the total number of truck trips listed in Table 4.9-6 would occur along the same route. Since DPM emissions would be dispersed along the pipeline alignment (approximately one-third along the eastern pipeline segment and two-thirds on the western pipeline segment), it is expected that the excess cancer risk at any specific receptor would be less than 1 in a million (i.e., less than 40,000 truck trips would occur over the entire construction period at a specific receptor).

The SJPL Rehabilitation project (SJ-4) would not generate significant DPM levels along haul routes since disposal of excavation spoils is not expected to be required. Potential DPM emissions associated with the Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects are expected to be *less than significant* due to the limited surface disturbance associated with these projects (approximately two acres of surface disturbance is expected at each site).

The Lawrence Livermore project (SJ-2) would be located near Thomas Shaft, and there are no residential uses or other sensitive receptors in the area. Therefore, this impact would *not apply* to this project.

Sunol Valley Region

Impact 4.9-2: Exposure to DPM during construction		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	LS

As indicated in Table 4.9-6, DPM emissions generated by haul truck traffic would be *less than significant* (excess cancer risk would be less than 1 in a million) for all WSIP projects in this region,[6] except for the Calaveras Dam project (SV-2) and possibly for the Treated Water Reservoirs project (SV-5). Since most of the excavation spoils associated with the Calaveras Dam project would be hauled to disposal sites in the dam vicinity or the Sunol Valley, all haul truck trips would not necessarily use the entire length of Calaveras Road in the Sunol Valley. If 50 percent of the spoils were hauled offsite via the lower section of Calaveras Road, DPM emissions would remain below the significant "10 in a million" threshold but would exceed the potentially significant "1 in a million" threshold. If 80 percent of the excavation spoils were hauled offsite under the Treated Water Reservoirs project, the excess cancer risk would exceed the potentially significant "1 in a million" threshold.

DPM emissions from haul trucks would be considered *potentially significant* for the Calaveras Dam (SV-2) and Treated Water Reservoirs (SV-5) projects. However, these DPM emissions must also be evaluated at the project level to determine whether sensitive receptors could be affected by increased DPM emissions. The primary haul route for all projects in this region would be Calaveras Road in the Sunol Valley. There is one residential receptor located approximately 2,000 feet west of Calaveras Road; at this distance, potential health risks associated with DPM would be less than significant. However, there are two SFPUC Land Managers' residences, one near Calaveras Dam and the other near Alameda East Portal. Occupants of these residences could include children or the elderly, which are considered sensitive receptors. Therefore, DPM impacts from the individual and combined truck traffic associated with the Calaveras Dam and Treated Water Reservoirs projects would be *potentially significant* at these two residences. A health risk assessment would need to be completed or the residences vacated during construction of these two projects (Measure 4.9-2b) to reduce this impact to a less-than-significant level.

Bay Division Region

Impact 4.9-2: Exposure to DPM during construction		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

Since the majority of this region is urbanized and many of the WSIP projects are located in or near residential neighborhoods and schools, there is a high potential for sensitive receptors to be exposed to increased DPM levels from truck traffic on haul routes associated with all three WSIP projects in this region. As indicated

6 Although an excavation/spoils volume is not specified for the Alameda Creek Fishery project, the size of this project would indicate preliminary that DPM emissions generated by haul truck traffic would not likely exceed cancer risk of 1 in a million.

in Table 4.9-6, DPM emissions generated by haul truck traffic would be *less than significant* (excess cancer risk would be less than 1 in a million) for the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects.

As indicated in Table 4.9-6, total DPM emissions generated by haul truck traffic associated with the pipeline and tunnel components of the BDPL Reliability Upgrade project (BD-1) would be potentially significant, since excess cancer risk would be greater than the "1 in a million" threshold but less than the "10 in a million" threshold. For the pipeline portion of this project, health risks associated with DPM exposure would be less than significant, because haul trucks would use different haul routes along the pipeline alignment and only a portion of the total number of truck trips listed in Table 4.9-6 would occur along the same route. However, truck traffic associated with the tunnel component would generate DPM emissions in the tunnel portal vicinities over the entire construction period, affecting the same sensitive receptors. Therefore, DPM emissions associated with the tunnel component of this project would be *potentially significant*, and use of soot filters on haul trucks (Measure 4.9-2a) could be required for this component (depending on the proportion of excavation spoils that would be hauled offsite) to reduce impacts to a less-than-significant level.

Peninsula Region

Impact 4.9-2: Exposure to DPM during construction		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Table 4.9-6 indicates that DPM emissions generated by haul truck traffic would be *less than significant* (excess cancer risk would be less than 1 in a million) for the CS/SA Transmission (PN-2) and Lower Crystal Springs Dam (PN-4) projects. Although the volume of excavation spoils has not been determined for the other three projects in this region (Baden and San Pedro Valve Lots, PN-1; HTWTP Long-Term, PN-3; and Pulgas Balancing Reservoir, PN-5), potential DPM emissions associated with each of these projects are expected to be *less than significant* (excess cancer risk would be less than 1 in a million or 40,000 total truck trips) due to the limited surface disturbance generally associated with these types of facilities. In addition, the Pulgas Balancing Reservoir project would be located on the west side of Interstate 280 (I-280), so possible haul routes to the I-280 freeway for this project would be more than 500 feet from residential receptors to the east of the freeway.

San Francisco Region

Impact 4.9-2: Exposure to DPM during construction		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

All of the WSIP projects in this region would be located near or adjacent to sensitive receptors, and DPM increases associated with haul and delivery truck traffic could adversely affect sensitive receptors along these routes. However, as indicated in Table 4.9-6, DPM emissions generated by haul truck traffic would be *less than significant* (excess cancer risk would be less than 1 in a million) for the SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3) projects, and it is expected that the volume of excavation spoils for the Groundwater Projects (SF-2) would not be greater than estimated volumes for SF-1 or SF-3.

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling.

Methane and hydrogen sulfide gases could be encountered during proposed tunneling. These gases are generated during the decomposition of organic material. Because methane is odorless, it is not expected to generate nuisance odor problems. However, if hydrogen sulfide gas is encountered, it could cause nuisance odor problems at nearby receptors. Diesel exhaust would be generated by tunnel boring equipment and the muck removal system (if muck trains are used), and diesel exhaust odors would be released into the atmosphere through the tunnel ventilation system. The potential for exposure of any nearby sensitive receptors would depend on the proximity of receptors to tunnel shafts or portals and their ventilation exhaust systems. If gases were present, Occupational Health and Safety Administration standards would require the tunnel ventilation system to reduce gas levels within the tunnel to protect workers. Residential receptors would be exposed to even lower levels of these gases, since dispersion into the atmosphere would reduce levels in the tunnel by more than tenfold, ensuring that residential exposure would be well below exposure within the tunnel. Therefore, impacts related to the exposure of nearby residential receptors to tunnel gases is expected to be less than significant.

If ultramafic rock deposits are encountered during tunneling, there would be a potential for asbestos (chrysotile) emissions from the tunnel ventilation system. If tunnel ventilation systems are required in jack-and-bore pits used in pipeline crossings (where pipelines cross under freeways, major roadways, railroads, waterways) and ultramafic rock occurs along this pipeline segment, there also would be a potential for asbestos (chrysotile) emissions from the ventilation system. Geologic mapping indicates a low potential for encountering such rock along various WSIP facility alignments (see Section 4.14, Hazards, Impact 4.14-2 for more discussion). Wherever demolition is proposed as part of WSIP implementation, asbestos could be released if any asbestos-containing building materials are present. Airborne asbestos fibers could pose a serious health threat if adequate control techniques are not carried out when the material is disturbed (see Section 4.14, Impact 4.14-5 for more discussion of this potential impact).

San Joaquin Region

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling		
Advanced Disinfection	SJ-1	N/A
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	N/A

The Advanced Disinfection (SJ-1), Lawrence Livermore (SJ-2), and Tesla Portal Disinfection (SJ-5) projects would not involve any tunneling or jack-and-bore construction techniques. Therefore, this impact is *not applicable* to these projects.

Construction of the SJPL System project (SJ-3) would employ jack-and-bore or microtunneling techniques where the pipeline would cross under major facilities such as freeways and aqueducts, and potentially where the pipeline would cross wetlands. Pipeline rehabilitation work under the SJPL Rehabilitation project (SJ-4) could also require the use of jack-and-bore or microtunneling techniques. If a tunnel ventilation exhaust system is required in jack-and-bore pits and is located near any residential receptors, they could be exposed to nuisance odors associated with tunnel gases or diesel exhaust. Although impacts related to health risk would be less than significant (as described above), nuisance odors (if they occur) would be *potentially significant*, but could be mitigated to a less-than-significant level through the use of water scrubbers on the tunnel ventilation system (Measure 4.9-3). No other tunneling activities would occur under the WSIP projects in this region.

Sunol Valley Region

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	LS

The Calaveras Dam (SV-2) and Treated Water Reservoirs (SV-5) would not involve any tunneling or jack-and-bore construction techniques. Therefore, this impact is *not applicable* to these projects.

Construction of the New Irvington Tunnel project (SV-4) would require the use of a tunnel ventilation exhaust system at both tunnel portals in the Sunol Valley and Fremont. The Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), and SABUP (SV-6) projects could require jack-and-bore techniques where any pipelines cross creeks or roads. In the Sunol Valley, there is one residential receptor (located west of Alameda Creek and south of the Alameda West Portal). Impacts related to health risk would be less than significant (as described above) for this receptor; it is also unlikely that tunnel-related nuisance odors associated with jack-and-bore crossings related to any of these projects would affect this receptor since there would be adequate area to provide sufficient setbacks, so this impact would be *less than significant*. However, nuisance odors associated with the New Irvington Tunnel project (if they occur) could affect this receptor. If they occur, nuisance odors would be *potentially significant*, but could be mitigated to a less-than-significant level through implementation of tunnel gas odor control measures (Measure 4.9-3). No other tunneling activities would occur under the WSIP projects in this region.

Bay Division Region

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Construction of the BDPL Reliability Upgrade project (BD-1) would require use of a tunnel ventilation exhaust system at both tunnel shafts in Newark and east of East Palo Alto. Tunnel ventilation systems could also be required for the BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3), wherever jack-and-bore or microtunneling techniques are employed for major roadway and creek crossings. Residential receptors located near or adjacent to these facilities could be exposed to nuisance odors associated with tunnel gases or diesel exhaust. Impacts related to health risk would be less than significant (as described above), and nuisance odors associated with these two projects (if they occur) would be *potentially significant*, but could be mitigated to a less-than-significant level through implementation of tunnel gas odor control measures (Measure 4.9-3).

No tunneling activities would occur under the BDPL 3 and 4 Crossovers (BD-2) project, so this impact is *not applicable*.

Peninsula Region

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	N/A

Except for the CS/SA Transmission project (PN-2), no tunneling activities would occur under any other WSIP projects in this region, so this impact is *not applicable* to these projects. If jack-and-bore or microtunneling techniques are used where only pipeline facilities associated with the CS/SA Transmission project cross roadways or waterways and they are located near any sensitive receptors, they could be exposed to nuisance odors associated with tunnel gases or diesel exhaust. Implementation of gas odor control measures (Measure 4.9-3) as necessary would reduce nuisance odor impacts to a less-than-significant level.

San Francisco Region

Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

Pipeline construction under the SAPL 3 Installation project (SF-1) would employ jack-and-bore or microtunneling techniques where pipelines cross under major roadways or creeks. If a tunnel ventilation exhaust system is required in jack-and-bore pits and is located near any sensitive receptors, they could be exposed to nuisance odors associated with tunnel gases or diesel exhaust. In addition, it is possible that pipelines proposed under the Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could require the use of jack-and-bore construction. Impacts related to health risk would be less than significant (as described above), and nuisance odors (if they occur) would be *potentially significant*, but could be mitigated to a less-than-significant level through implementation of tunnel gas odor control measures (Measure 4.9-3).

Operational Impacts

Facility Emissions

Impact 4.9-4: Air pollutant emissions during project operation.

Long-term operation of the WSIP facilities would result in minimal increases in air emissions, including criteria pollutants. Most of the power provided to WSIP projects by the SFPUC would be hydroelectric power. Since all proposed facilities would be connected to grid power, emission sources during project operations would be limited to emergency generators, use of refrigerants, and minor increases in traffic due to project operation and maintenance. Operation of emergency generators at WSIP facilities would result in an incremental short-term increase in criteria air pollutants, but only infrequently during power outages and when equipment is tested.

San Joaquin Region

Impact 4.9-4: Air pollutant emissions during project operation		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Proposed treatment and pipeline facilities in this region would be enclosed, and the potential for increases in criteria pollutants during project operations would be *less than significant*. Three of the WSIP facilities in this region (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) would be unmanned facilities (continuously monitored by the SCADA System), but would require a daily visit to the site by an operations representative. The SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would require occasional visits by operations representatives during flow rate changes, and associated air pollutant emissions would be *less than significant*.

Sunol Valley Region

Impact 4.9-4: Air pollutant emissions during project operation		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	N/A

Except for WSIP facilities at the Sunol Valley WTP, operation of all proposed WSIP facilities in this region (associated with Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; New Irvington Tunnel, SV-4; and Treated Water Reservoirs, SV-5) would use grid power; therefore, potential increases in criteria pollutants during project operations would be *less than significant.* No system changes would occur under the SABUP project, so potential changes in emissions during project operation would *not apply* to this project.

Operation of proposed facilities in this region would generate minor increases in maintenance-related and chemical delivery traffic; however, such minor increases in traffic would result in *less-than-significant* increases in criteria air pollutant emissions.

Bay Division Region

Impact 4.9-4: Air pollutant emissions during project operation		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

Proposed WSIP facilities in this region under the BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Crossovers (BD-2) projects would use grid power as necessary, so potential increases in criteria pollutants during project operations would be *less than significant.* However, propane-powered emergency generators would be used to power actuators at isolation valves along the BDPL Reliability Upgrade pipeline alignment in the event that valves need to be operated during a power failure (e.g., after a major earthquake event). As stationary point sources, the emergency generators proposed under this project would require authority to construct permits and permits to operate from the BAAQMD. The permit review process would ensure that air emissions associated with these generators comply with applicable air quality standards; therefore, potential increases in criteria pollutants during project operations would be *less than significant.*

Since the overall increase in maintenance-related traffic at proposed WSIP facilities would be minimal, WSIP-related increases in criteria air pollutant emissions in this region would be *less than significant.*

The BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) would not result in criteria air pollutant emissions because this project involves construction of enclosed pipelines; therefore, this impact is *not applicable*.

Peninsula Region

Impact 4.9-4: Air pollutant emissions during project operation		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Proposed WSIP facilities in this region (Baden and San Pedro Valve Lots, PN-1; CS/SA Transmission, PN-2; HTWTP Long-Term, PN-3; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5) would use grid power as necessary and thus would not directly emit criteria air pollutants. During power outages, short-term increases in criteria pollutants would result from existing diesel-powered emergency generators at the Harry Tracy WTP (PN-3). The CS/SA Transmission project (PN-2) would also include use of an existing emergency generator in the event of a power outage. As stationary point sources, the existing emergency generators at the Harry Tracy WTP (under PN-3) and Crystal Springs Pump Station (under PN-2) already have permits to operate from the BAAQMD, and these permits would ensure that air emissions associated with these generators are *less than significant*.

Since the overall increase in maintenance-related traffic at proposed WSIP facilities in this region would be minimal, WSIP-related increases in criteria air pollutant emissions in this region would be *less than significant*.

San Francisco Region

Impact 4.9-4: Air pollutant emissions during project operation		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Proposed WSIP storage, pipeline, and well facilities in this region (SAPL 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) would use grid power as necessary and thus would not directly emit criteria air pollutants. During power outages, short-term increases in criteria pollutants would result from operation of an emergency generator at the Recycled Water treatment facility (SF-3). As a stationary point source, this generator would require an authority to construct permit and permit to operate from the BAAQMD. The permit review process would ensure that air emissions associated with this facility comply with applicable air quality standards; therefore, potential increases in criteria pollutants during project operations would be *less than significant.*

Since the overall increase in maintenance-related traffic at proposed WSIP facilities in this region would be minimal, WSIP-related increases in criteria air pollutant emissions in this region would be *less than significant*.

Odors

Impact 4.9-5: Odors generated during project operation.

Nuisance odor problems are not expected to result from operation of WSIP facilities due to the low biological content (and consequent anaerobic activity) of the water as well as the enclosed nature of most proposed facilities. With the exception of filters and some basins at water treatment facilities, existing treatment, conveyance, and storage facilities are enclosed.

Filters at water treatment facilities are not typically a source of odors; odors associated with anaerobic activity do not occur since the water is aerated. However, open basins associated with backwash water processing can sometimes be sources of odor. Odors can derive from organic material suspended in the water, from outgassing of dissolved gases used for disinfection, or from sludge that has been removed from the water during treatment.

Two BAAQMD regulations prohibit the creation of an odor nuisance. Rule 1-301 prohibits the discharge of any contaminants that causes annoyance for a considerable number of people of normal sensitivity. Regulation 7 specifies odor limits for public exposure and identifies specific dilution levels that must be achieved as a function of odor emission strength. If odors were generated during the operation of any WSIP facility, enforcement of these regulations would be adequate to protect the public from impacts related to odorous emissions.

San Joaquin Region

Impact 4.9-5: Odors generated during project operation		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	N/A
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	LS

Proposed WSIP treatment facilities in this region (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) would be enclosed, and the odor potential would be *less than significant*. Enclosed pipelines, such as those under the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects, are not a source of odors, and this impact is *not applicable*.

Sunol Valley Region

Impact 4.9-5: Odors generated during project operation		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	N/A
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	N/A

Except for WSIP facilities at the Sunol Valley WTP, all proposed WSIP facilities in this region would have a low potential for odor generation. These projects involve storage (Calaveras Dam, SV-2) or transmission facilities (Alameda Creek Fishery, SV-1; New Irvington Tunnel, SV-4; and SABUP, SV-6), which are not typically associated with odor generation (due to the low biological content of the water or the enclosed nature of the facility). Therefore, this impact is *not applicable* to these projects.

Proposed backwash system improvements at the Sunol Valley WTP (40-mgd Treated Water, SV-3, and Treated Water Reservoirs, SV-5) could be a source of odor, depending on the design of these facilities. However, if any odors were generated by the backwash system, they would have a *less-than-significant* impact given the absence of nearby sensitive receptors (the closest and only receptor is a residence located 1.6 miles to the north).

Bay Division Region

Impact 4.9-5: Odors generated during project operation		
BDPL Reliability Upgrade	BD-1	N/A
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

Proposed WSIP facilities in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would involve pipelines and valves and would be enclosed. Therefore, there is no odor potential in this region, and this impact is *not applicable* to these projects.

Peninsula Region

Impact 4.9-5: Odors generated during project operation		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	N/A
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	N/A

Except at the Harry Tracy WTP, all proposed WSIP facilities in this region would have a low potential for odor generation. These projects involve valve upgrades (Baden and San Pedro Valve Lots, PN-1), pipelines/tunnels (CS/SA Transmission, PN-2), or storage upgrades (Lower Crystal Springs Dam, PN-4; Pulgas Balancing Reservoir, PN-5), which are not typically associated with odor generation (due to the low biological content of the water or the enclosed nature of the facility). This impact is *not applicable* to these projects.

The Harry Tracy WTP does not currently generate odors, but proposed sludge-handling facility improvements at the plant under the HTWTP Long-Term project (PN-3) could be a source of odor, depending on the design of these facilities. The odor potential of proposed facilities would be assessed as part of subsequent, project-level CEQA review when project design has been completed. With compliance with BAAQMD odor control regulations (Rule 1-301 and Regulation 7), this potential impact would be *less than significant*.

San Francisco Region

Impact 4.9-5: Odors generated during project operation		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Proposed WSIP storage, pipeline, and well facilities in this region (SAPL 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) would be enclosed, and the odor potential would be *less than significant*. No odor problems are expected at proposed Recycled Water treatment facilities (SF-3) due to the low biological content of treated/recycled water. However, if the emergency generator at this treatment facility were diesel-powered, there would be a potential for short-term nuisance diesel odors at the adjacent San Francisco Zoo during a power outage. With compliance with BAAQMD odor control regulations (Rule 1-301 and Regulation 7), this potential impact would be *less than significant*.

Secondary Emissions from Increased Electricity Demand

Impact 4.9-6: Secondary emissions at power plants.

Operation of new and expanded WSIP facilities could result in secondary emissions associated with electricity generation. Electricity is supplied by SFPUC Power Enterprise, which operates 400 megawatts of hydroelectric power generation plants. Pacific Gas and Electric Company provides transmission and distribution services. Energy production varies by season and by year, depending on hydrologic conditions. SFPUC Power Enterprise purchases power as necessary to ensure reliable electricity supply.

At present, SFPUC Power Enterprise is working with WSIP staff to identify energy efficiency in two areas: pumping energy optimization and efficient pump station design. Pumping energy optimization is aimed at designing pumping systems that reduce on-peak energy requirements for water pumping operations. With optimized pumping, pumping would shift to the off-peak and part-peak periods of each day to reduce on-peak energy consumption, while at the same time maintaining uninterrupted water delivery to end-users. This measure is projected to reduce on-peak electricity demand by 6 megawatts. Efficient pump station design focuses on incorporating efficient motors, pumps, lighting, and ventilation systems. SFPUC Power Enterprise is developing energy efficiency design guidelines to be used by WSIP staff in designing energy-efficient buildings and pump stations. Energy savings resulting from this measure are determined based on these guidelines.

All Regions

Operation of WSIP facilities proposed in all five regions would increase demand for electricity. Power is generated primarily from hydroelectric sources, although purchased power is derived from a variety of sources (hydroelectric, alternative energy, and fossil fuels). With respect to purchased power, power generation is regional in nature and could occur outside the air basin or outside California; therefore, the WSIP's incremental increase in power demand during project operations (the portion that is not from hydroelectric or alternative energy sources) is not expected to create a significant secondary air quality impact on criteria air pollutant levels specifically within the SJVAB or SFBAAB, a *less-than-significant* impact for each WSIP facility project.

Regional Air Quality Plans and Goals

Impact 4.9-7: Conflict with implementation of applicable regional air quality plans addressing criteria air pollutants and state goals for reducing GHG emissions.

Air quality planning is accomplished through regional air quality plans that address measures to reduce criteria air pollutants. Air quality planning efforts by the SJAPCD and BAAQMD would pertain to construction and operation of the WSIP. Potential increases in criteria air pollutants during construction and operation of the WSIP are quantified and consistency with state and federal standards for criteria pollutants are evaluated under Impacts 4.9-1 and 4.9-2. While construction-related emissions were determined to be potentially significant in some regions when compared to air district thresholds of significance, criteria pollutant emissions associated with operation of the WSIP were determined to be less than significant. Consistency of the WSIP with regional air quality planning efforts is discussed below by region.

State planning efforts to reduce GHG emissions (pursuant to the California Global Warming Solutions Act of 2006) would also pertain to construction and operation of the WSIP, as discussed below.

GHG Emissions During Project Construction. The WSIP's incremental increases in GHG emissions associated with construction-related traffic and off-road construction equipment would contribute to regional increases in GHG emissions and associated climate change effects (see Table 4.9-5 for GHG emission estimates by region). However, no state or regional air quality agency has adopted a methodology or quantitative threshold that can be applied to a specific development or construction project to evaluate the significance of an individual project's contribution to GHG emissions, such as the ones that exist for priority pollutants. Therefore, this analysis considers the quantity of GHGs that would be emitted with WSIP implementation in relation to the total GHG emissions in the Bay Area and the state. It also considers steps that the State intends to take to reduce GHG emissions and the actions that the CCSF and SFPUC are actively taking steps to reduce GHG emissions, such that implementation of the WSIP would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020.

The *Bay Area Greenhouse Gas Emission Inventory Projections* (BAAQMD, 2006a) indicates that construction and mining equipment emissions currently account for approximately 4 percent of total mobile-source emissions and will continue to account for about the same proportion into the future (projected to 2016). The WSIP's combined GHG emissions from simultaneous construction projects in the San Joaquin Valley and the Bay Area Air Basins identified above would generate approximately 79,260 pounds of CO_2-equivalent GHG each work day during the construction period. For an assumed 260 work days per year, this translates into approximately 9,400 metric tons per year. The current statewide annual GHG inventory is estimated at 427,000,000 metric tons (California Energy Commission, 2006). Peak project construction activities would represent 0.0022 percent of the statewide total during the time these peak construction activities are carried out. This amount reflects peak GHG emissions from all of the WSIP projects; it is evident that GHG emissions from individual project would be extremely small.

Existing CARB regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485), which limit idling of diesel-fueled commercial motor vehicles, would help to limit GHG emissions associated with WSIP-related construction vehicles. In addition, CARB's proposed Early Action Measures (pursuant to the California Global Warming Solutions Act of 2006) include other emission reduction measures for diesel trucks and diesel off-road equipment. The CARB will review and adopt Early Action Measures by January 1, 2010, and equipment used for construction of WSIP facility improvement projects after 2010 could be subject to these requirements. Once such measures go into effect, SFPUC and construction contractors on SFPUC projects would be subject to these requirements, and the SFPUC will implement these measures are required; emissions from SFPUC construction activities would be reduced accordingly. Given the small amount of GHGs that would be emitted from individual WSIP projects during construction, continuing implementation of GHG reduction actions by the CCSF and SFPUC and additional GHG reductions actions that SFPUC would implement as part of the WSIP (see above under "Existing Setting"), the WSIP projects would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020.

As stated above, as part of implementation of the WSIP, the SFPUC will also be required to implement mitigation measures related to exhaust controls (Measures 4.9-1b, 4.9-1d and 4.16-7a) to address criteria pollutant emissions, waste reduction (Measure 4.11-2) to address solid waste disposal, and energy efficiency (Measure 4.15-2) to address energy use, which would further reduce GHG emissions from SFPUC construction activities.

GHG Emissions During Project Operation. Operation of WSIP facilities could result in a minor increase in the use of refrigerants and number of employee trips and chemical deliveries to facility sites and these actions could result in a minor increase in GHG emissions over current levels. These new activities and sources of GHGs would be minimal, however, because most of the WSIP facility projects involve improvements to existing operations and not entirely new operations. No state or regional air quality agency has adopted a methodology or quantitative threshold that can be applied to evaluate the significance of an individual project's contribution to GHG emissions, such as the ones that exist for priority pollutants. The increase in GHG emissions at individual WSIP facilities during long-term operation occasioned by a small increase in vehicle trips would be a fraction of the statewide total inventory, and well below the estimated 0.0022 percent represented by construction emissions. Therefore, it is expected that increased GHG emissions from each WSIP facility operation would generally be minimal in nature.

The CARB will review and adopt Early Action Measures (pursuant to the California Global Warming Solutions Act of 2006) by January 1, 2010, and equipment used during operation of WSIP facility improvement projects after 2010 would be subject to these requirements. For example, future WSIP-related truck or vehicle operation will be required to comply with any future emissions reduction measures adopted by CARB as part of the California Global Warming Solutions Act of 2006, which would reduce the WSIP's contribution to GHG emissions. As CARB's Early Action Measures become effective, the SFPUC will implement them as required to reduce GHG emissions from the WSIP project operations. It is also expected that actions that the CCSF and SFPUC are taking to reduce GHG emissions may reduce GHG emissions associated with SFPUC operations and offset the minimal increases in GHG emissions associated with new operations.

Given the minimal increase in the amount of GHGs that could be emitted from the operation of individual WSIP projects, continuing implementation of GHG reduction actions by the CCSF and SFPUC, and additional GHG reductions actions that SFPUC will take as part of the WSIP project (see above under "Existing Setting"), the WSIP projects would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020.

As stated above, as part of implementation of the WSIP, the SFPUC will also be required to implement mitigation measures related to energy efficiency (Measure 4.15-2) to address energy use, which would further reduce GHG emissions from operation of WSIP facilities.

Secondary GHG Emissions at Power Plants. Implementation of the WSIP would also result in secondary operational increases in GHG emissions as a result of electricity generated to meet the WSIP's increase in energy demand. Although electricity for the WSIP projects would be derived primarily from hydroelectric sources, power would need to be purchased from the grid or other sources by customers of the SFPUC Power Enterprise from a variety of nonrenewable sources when less hydroelectric power is available, particularly during the summer and fall months. Electricity in the Bay Area occurs mainly at natural-gas-fired power plants, which produce about 7 percent of total GHG emissions in the Bay Area (BAAQMD, 2006a). However, since California imports about 20 to 30 percent of its total electricity (mainly from the northwestern and southwestern states), GHG emissions associated with electricity generation also occur outside the SJVAB or SFBAAB or outside of California. Therefore, the WSIP's incremental increase in power demand during project operations (the portion that is not from hydroelectric or renewable energy sources) would indirectly serve to sustain rather than reduce current GHG emissions from these emission sources.

The additional annual energy demand for all proposed WSIP projects is estimated at 39,000 megawatt-hours (MWH; see Impact 4.16-13 in Section 4.16, Collective Impacts, for more discussion). Although there would be an overall increase in demand associated the WSIP implementation, it should be noted that many individual WSIP projects would result in no increase in energy demand. The hydroelectric generating capacity of the SFPUC Power Enterprise is approximately 400 MW. The total increase in energy demand for all of the proposed WSIP projects would be met in approximately 98 hours of hydroelectric generation annually at full capacity. Except in the summer and fall when water is being stored and not being replenished, WSIP projects would be more than adequately supplied by the system. However, the 39,000 MWH used by WSIP projects would no longer be available to provide GHG-free electricity to California users. The "lost" 39,000 MWH would be offset by increased generation from fossil-fueled resources and other sources, such as hydroelectric power generated by Modesto and Turlock Irrigation Districts.

Tables C.1 and C.2 of the California Climate Action Registry (CCAR) Protocol document (CCAR, 2007) show that California power plants create approximately 806 pounds of CO_2-equivalent GHG emissions per MWH of power generated. For simplicity, it was assumed that the WSIP-diverted power would be generated somewhere within California at the above GHG-generation rate. The WSIP projects at completion are estimated to result in approximately 14,260 metric tons of CO_2-equivalent emissions by consuming hydroelectric power that is no longer available to current users. Compared to the current annual inventory of 427,000,000 metric tons in California (California Energy Commission, 2006), this represents 0.0033 percent of that inventory. Planned increases in water distribution and treatment system efficiencies will offset a limited portion of the increased power demand, but not enough to eliminate the increase in GHG emissions that would result from WSIP-diverted electrical power. Nevertheless, the total increased power demand associated with the operation of the WSIP projects is a small fraction of total state demand.

As stated above, no state or regional air quality agency has adopted a methodology or quantitative threshold that can be applied to evaluate the significance of an individual project's contribution to GHG emissions, such as the ones that exist for priority pollutants. However, it is apparent from the above analysis that the indirect effect of increased GHG emissions from power generation associated with operation of all of the proposed WSIP facilities would be minimal. It is apparent that the individual facility impacts would be even less.

As the CARB's Early Action Measures and CEC's greenhouse gases emission performance standard for local, public-owned electric utilities become effective (see discussion under Regulatory Framework, Greenhouse Gas Emissions Limits), the SFPUC will implement them as required to reduce GHG emissions from the WSIP project operations. With continuing implementation of GHG reduction actions by the CCSF and SFPUC and additional GHG reductions actions that SFPUC will take as part of the WSIP project (see above under "Existing Setting"), the WSIP projects would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020.

As part of implementation of the WSIP, the SFPUC will also be required to implement feasible energy efficiency measures in applicable WSIP projects to address energy impacts, consistent with the *Energy Action Plan II* priorities for reducing energy usage (as specified in Measure 4.15-2).

San Joaquin Region

Although the WSIP includes facility improvement projects located in the San Joaquin Valley, operation of the WSIP would not serve future growth in the San Joaquin Valley since it is outside the SFPUC service area. Projected growth assumptions in the SFPUC service area would not be relevant to regional air quality planning efforts in the San Joaquin Valley. Therefore, consistency with SJVAPCD air quality plans related to criteria pollutants would be not applicable to this project.

Given the small amount of GHGs that would be emitted from WSIP projects in this region during construction and operation, continuing implementation of GHG reduction actions by the CCSF and SFPUC and additional GHG reductions actions that SFPUC would implement as part of the WSIP (see above under "Existing Setting"), the WSIP projects in this region would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020 (*less than significant*).

Sunol Valley, Bay Division, Peninsula, and San Francisco Regions

The WSIP would be consistent with the BAAQMD's *Bay Area 2005 Ozone Strategy* (BAOS) (BAAQMD, 2006b), the most recently adopted regional air quality plan that pertains to the WSIP.[7] The consistency of the WSIP with the BAOS was determined by comparing the WSIP's growth assumptions with BAOS growth assumptions, which are based on ABAG population projections. Since the population growth assumed in the WSIP demand projections is generally

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7 Although the WSIP includes projects located in the San Joaquin Valley, operation of the WSIP would serve future Bay Area growth, not growth in the San Joaquin Valley. Therefore, long-term operation of the WSIP would have no direct or indirect effects on air quality planning efforts in the San Joaquin Valley.

consistent[8] with the 2030 population projections for the SFPUC service area in ABAG's *Projections 2005*, the WSIP would also be consistent with the BAOS (see Chapter 7, Growth Inducement Potential and Indirect Effects of Growth, for more discussion on the comparison of WSIP growth assumptions with ABAG projections). Therefore, the WSIP would have a *less-than-significant* impact on regional air quality planning efforts related to criteria pollutants in the Bay Area.

Given the small amount of GHGs that would be emitted from WSIP projects in these regions during construction and operation, continuing implementation of GHG reduction actions by the CCSF and SFPUC and additional GHG reductions actions that SFPUC would implement as part of the WSIP (see above under "Existing Setting"), the WSIP projects in this region would not conflict with the State's goals of reducing GHG emissions to 1990 levels by 2020 (*less than significant*).

4.9.4 References – Air Quality

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4.10 Noise and Vibration

4.10 Noise and Vibration

4.10.1 Noise Descriptors

dB, dBA

Sound is characterized by various parameters that describe the rate of oscillation of sound waves, the distance between successive troughs or crests, the speed of, and the pressure level or energy content of a given sound. The sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound, and the decibel (dB) scale is used to quantify sound intensity. Because sound can vary in intensity by over 1 million times within the range of human hearing, a logarithmic loudness scale is used to keep sound intensity numbers at a convenient and manageable level. Since the human ear is not equally sensitive to all sound frequencies within the entire spectrum, human response is factored into sound descriptions in a process called “A-weighting,” expressed as “dBA.” The dBA, or A-weighted decibel, refers to a scale of noise measurement that approximates the range of sensitivity of the human ear to sounds of different frequencies. On this scale, the normal range of human hearing extends from about 0 dBA to about 140 dBA. A 10-dBA increase in the level of a continuous noise represents a perceived doubling of loudness. The noise levels presented herein are expressed in terms of dBA, unless otherwise indicated. **Table 4.10-1** shows some representative noise sources and their corresponding noise levels in dBA.

Planning for acceptable noise exposure must take into account the types of activities and corresponding noise sensitivity in a specified location for a generalized land use type. Some general guidelines (U.S. EPA, 1974) are as follows: sleep disturbance can occur at levels above 35 dBA; interference with human speech begins at about 60 dBA; and hearing damage can result from prolonged exposure to noise levels in excess of 85 to 90 dBA.

Leq, CNEL, Ldn

Time variations in noise exposure are typically expressed in terms of a steady-state energy level (called Leq) that represents the acoustical energy of a given measurement. Leq (24) is the steady-state energy level measured over a 24-hour period. Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law requires that, for planning purposes, an artificial dBA increment be added to “quiet time” noise levels to form a 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL). CNEL adds a 5-dBA “penalty” during the evening hours (7:00 p.m. to 10:00 p.m.) and a 10-dBA penalty during the night hours (10:00 p.m. to 7:00 a.m.). Another 24-hour noise descriptor, called the day-night noise level (Ldn), is similar to CNEL. While both add a 10-dBA penalty to all nighttime noise events between 10:00 p.m. and 7:00 a.m., Ldn does not add the evening 5-dBA penalty. In practice, Ldn and CNEL usually differ by less than 1 dBA at any given location for transportation noise sources.

TABLE 4.10-1
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT

Examples of Common, Easily Recognized Sounds	Decibels (dBA)	Subjective Evaluations
Near Jet Engine	140	Deafening
Threshold of Pain	130	
Threshold of Feeling – Hard Rock Band	120	
Accelerating Motorcycle (at a few feet away)	110	
Loud Horn (at 10 feet away)	100	Very Loud
Noisy Urban Street	90	
Noisy Factory	85[a]	
School Cafeteria with Untreated Surfaces	80	Loud
Stenographic Room	70[b]	
Near Freeway Auto Traffic	60[b]	Moderate
Average Office	50[b]	
Soft Radio Music in Apartment	40	Faint
Average Residence Without Stereo Playing	30	
Average Whisper	20	Very Faint
Rustle of Leaves in Wind	10	
Human Breathing	5	
Threshold of Audibility	0	

[a] Continuous exposure above 85 dBA is likely to degrade the hearing of most people.
[b] Range of speech is 50 to 70 dBA.

SOURCE: U.S. Department of Housing and Urban Development, Office of Community Planning and Development, 1985.

Vibration

Vibrations caused by construction activities can be interpreted as energy transmitted in waves through the soil mass. These energy waves generally dissipate with distance from the vibration source (e.g., pile driving or sheetpile driving). Since energy is lost during the transfer of energy from one particle to another, vibration that is distant from a source is usually less perceptible than vibration closer to the source. However, actual human and structure response to different vibration levels is influenced by a combination of factors, including soil type, distance between source and receptor, duration, and the number of perceived events.

If great enough, the energy transmitted through the ground as vibration can result in structural damage. To assess the potential for structural damage associated with vibration, the vibratory ground motion in the vicinity of the affected structure is measured in terms of peak particle velocity (PPV) in the vertical and horizontal directions (vector sum), typically in units of inches per second (in/sec). A freight train passing at 100 feet can cause vibrations of 0.1 in/sec PPV, while a strong earthquake can produce vibrations in the range of 10 in/sec PPV. In general, cosmetic or threshold damage to residential buildings can occur at peak particle velocities over 0.5 in/sec. The term “threshold damage vibration” is defined as the highest vibration amplitude at which no cosmetic, minor, or major damage occurs, which includes “threshold cracks” or “hair-sized” cracks in room walls that occur at the lowest vibration amplitudes. Field data suggest a probability of 5 percent for cosmetic damage or threshold damage at 0.5 in/sec PPV, with the probability falling to 0 percent for vibration below 0.5 in/sec PPV (Wilson Ihrig & Associates, 2005).

An active family may produce strains in walls and ceilings that are comparable to those produced by blast vibration at 0.1 to 0.5 in/sec PPV. However, vibrations of 0.012 in/sec PPV can cause residential annoyance (Wilson Ihrig & Associates, 2005). Monitoring data for an unrelated tunnel/pipeline project in San Francisco indicated that the associated vibration was below the level of annoyance for most residents when vibration levels were maintained at 0.1 in/sec PPV or less (i.e., no complaints were received) (ESA, 1997).

Vibration thresholds vary depending on the nature of the vibration and frequency range. Controlled detonations do not generate structural damage if they produce vibrations of less than 0.5 in/sec PPV (measured at the residential building setback line at the ground surface). This level is consistent with the U.S. Bureau of Mines’ threshold cracking criteria of 0.5 in/sec PPV for low frequencies and 2.0 in/sec PPV for high frequencies. Continuous vibration caused by vibratory pile drivers, impact pile drivers, and large vibratory rollers/compactors can cause annoyance but do not cause structural damage if the continuous vibration is less than 0.2 in/sec PPV. This criterion is less than the controlled detonation vibration limit, reflecting the longer exposure time and the potential effect of structural resonances. Vibratory mechanical equipment may be operated over many minutes several times per day, and the associated response of structures can build up over several seconds due to resonance of the structure, especially during startup and shutdown of vibratory compactors. Impact pile driving, while impulsive in nature, involves repeated impacts of several hundred per day, much more than occurs for controlled detonations. Thus, the vibration limit for impact pile driving is the same as the threshold for continuous vibration (0.2 in/sec PPV) (Wilson Ihrig & Associates, 2005).

4.10.2 Setting

Existing Noise Environment and Sensitive Receptors

Human response to noise varies from individual to individual and depends on the ambient environment in which the noise is perceived. The same noise that would be highly intrusive to a sleeping person or in a quiet park might be barely perceptible at an athletic event or in the middle of a freeway at rush hour. Effects of noise at various levels can include interference with sleep, concentration, and communication; physiological and psychological stress; and hearing loss. Given these effects, some land uses are considered more sensitive to ambient noise levels than others. In general, residences and schools are among the uses considered to be the most sensitive to noise.

Certain land uses, such as residences, schools, childcare centers, churches, hospitals, and nursing homes, are considered to be sensitive receptors. The proximity of such receptors to WSIP facilities would vary with each project.

San Joaquin Region

The primary sources of noise in the vicinity of SFPUC facilities in the San Joaquin Region include traffic on state highways and major county roadways, railroad operations, airport operations, and farm equipment associated with agricultural activities. Noise levels in this region were measured to be in the range of 37 to 60 dBA (Ldn), with quieter areas located away from these noise sources (Stanislaus County, 1994).

Most of the areas adjacent to WSIP facilities in this region are undeveloped or are used for agriculture. The city of Modesto, located in the center of this region, has mainly residential, commercial, school, and park uses. There are also rural residential uses located south of Riverbank. In the western margin of this region (in the Tesla Portal vicinity), there is a private golf course (Tracy Golf and Country Club) and residential development. These residential areas as well as school uses in Modesto are considered sensitive noise receptors.

Sunol Valley Region

The southern portion of Sunol Valley and the area surrounding Calaveras Reservoir are mostly undeveloped, with a relatively quiet noise environment typical of rural areas. However, the northern portion of Sunol Valley is subject to higher noise levels due to traffic on regional roads as well as the presence of commercial nurseries and aggregate quarries. The primary sources of noise in Sunol Valley include traffic on I-680, Highway 84, and Calaveras Road, commercial nurseries along Calaveras Road, and aggregate quarries located south of I-680. Other minor sources of noise within this valley include the SFPUC's existing San Antonio Pump Station and Sunol Valley WTP. In general, noise levels exceed 75 dBA (CNEL) within approximately 200 feet of the I-680 freeway and 65 dBA (CNEL) within approximately 200 feet of Highway 84 (Alameda County, 1996).

There are no sensitive receptors in Sunol Valley, except for one residence located about a quarter mile southeast of the existing Alameda West Portal. In addition, there are rural residential uses scattered through the hills between Sunol Valley and Fremont. Residential uses on the east side of Mission Boulevard (Highway 238) are adjacent to the westernmost existing SFPUC facilities (Irvington Tunnel Portal) located in this region.

Bay Division Region

Most SFPUC facilities in the Bay Division Region are located in urbanized areas of the East Bay, South Bay, and Peninsula. The primary sources of noise in this region include traffic on freeways and local roads, aircraft, railroad operations, and stationary (industrial) sources. Major freeways that traverse this region include I-680, I-880, I-280, Highway 84 (Dumbarton Bridge), and Highway 101. There are major arterials located throughout this region. In general, noise levels adjacent to the freeways exceed 70 dBA (Ldn), while noise levels adjacent to major local roadways are generally between 60 and 70 dBA (Ldn) (City of Newark, 1992).

SFPUC facilities also cross the southern portion of San Francisco Bay and San Francisco National Wildlife Refuge. Some special-status species that use the refuge are considered to be noise-sensitive receptors during nesting or breeding season. Sensitive receptors near SFPUC facilities in this region include residential uses, schools, childcare centers, churches, and nursing homes.

Peninsula Region

The Peninsula Region spans the urbanized areas located between the Bay and I-280, but also includes the SFPUC Peninsula watershed, which is the area surrounding the Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoirs. The watershed area is undeveloped, and ambient noise levels are relatively low. The primary sources of noise in this region include traffic on freeways and local roads, aircraft, railroad operations, and stationary (industrial) sources. Major freeways and highways that traverse this region include I-280, Highway 101, Highway 92, Highway 84 (Dumbarton Bridge/Woodside Road), Highway 35 (Skyline Boulevard), and Highway 82 (El Camino Real). There are major arterials throughout this region. The San Mateo County General Plan (San Mateo County, 1986) includes a Community Noise Map, which indicates noise levels exceed 60 dBA (CNEL) in areas adjacent to I-280, Highway 92, Highway 35 (Skyline Boulevard), and Edgewood Road. Sensitive receptors near existing SFPUC facilities in this region include residential uses, schools, churches, and hospitals.

San Francisco Region

Most SFPUC facilities in the San Francisco Region are located in urbanized areas of the west and south sides of the city. Proposed WSIP facilities are located as far north as Golden Gate Park, as far south as Lake Merced. The ambient noise environment within the city is dominated by traffic on freeways and local roads. A city-wide noise map prepared by the San Francisco Department of Public Health (2006) indicate that noise levels generally exceed 60 dBA (Ldn) in areas adjacent to or near major roadways such as I-280, Highway 101, Highway 1 (19th Avenue), and various arterial roadways extending through the city. While many areas in the northeastern part of the city are subject to noise levels over 60 dBA (Ldn), residential neighborhoods in the western and southern portions of the city (away from arterials and freeways) generally experience noise levels of less than 60 dBA (Ldn). Sensitive receptors near WSIP facilities in this region include residential uses, schools, and churches.

Of the proposed WSIP facilities south of San Francisco (in northern San Mateo County), there is one WSIP facility (Baden Valve Lot, SF-1) near the San Francisco International Airport and airport noise contours indicate that this site would be located near the 65-dBA CNEL noise contour (San Francisco Aircraft Noise Abatement Office, 2007).

Regulatory Framework

Local noise issues are addressed through implementation of general plan policies, including noise and land use compatibility guidelines, and through enforcement of noise ordinance standards. General plan policies provide guidelines for determining whether a noise environment is appropriate for a proposed or planned land use. Noise ordinances regulate noise sources, such as mechanical equipment and amplified sounds, as well as prescribe hours of heavy equipment operation. In most cases, noise ordinances are part of local building and zoning ordinances of other jurisdictions; these building and zoning ordinances do not apply to SFPUC projects (see Section 4.2, Plans and Policies). However, time and noise limits prescribed in local noise ordinances are used in this PEIR as criteria to determine the significance of project impacts under CEQA.

WSIP facilities (including alternative sites) would be located 7 counties and 27 cities. Noise ordinance standards that are relevant to the construction of WSIP facilities are incorporated into the significance criteria and summarized in **Table 4.10-2**.

Construction and Operational Time and Noise Limits

San Joaquin Region

WSIP projects in the San Joaquin Region would be located in unincorporated areas of Tuolumne, Stanislaus, and San Joaquin Counties, and incorporated areas of Riverbank and Modesto. Tuolumne and Stanislaus Counties do not have a noise ordinance and do not enforce any noise limits or time restrictions for construction activities. San Joaquin County limits construction activities to specific hours of the day. As shown in Table 4.10-2, noise ordinances for these counties specify noise limits for operation of stationary equipment.

Sunol Valley Region

WSIP projects in the Sunol Valley Region would be located mostly in unincorporated areas of Alameda County, but portions of two facilities would be located in Santa Clara County and the City of Fremont. As shown in Table 4.10-2, noise ordinances for these counties and cities specify time limits for construction activities and noise limits for operation of stationary equipment in or near residential zones.

Bay Division Region

WSIP projects in the Bay Division Region would be located in unincorporated areas of San Mateo County. Project facilities in this region would also be located within the following incorporated areas: Fremont, Newark, San Jose, Santa Clara, Palo Alto, East Palo Alto, Menlo Park, Atherton, Redwood City, and San Carlos. Alternative sites for some of these facilities would be located in the following incorporated areas: Milpitas, Sunnyvale, Mountain View, Los Altos, Redwood City, and Woodside. As shown in Table 4.10-2, noise ordinances for these counties and cities specify time limits for construction activities and noise limits for operation of stationary equipment in or near residential zones.

TABLE 4.10-2
PERTINENT ORDINANCE TIME LIMITS AND NOISE STANDARDS

Jurisdiction	Construction Time Limits			Ordinance Noise Limits for Various Activities in Residential Zones (dBA)[a]	
	Weekdays	Saturdays	Sundays	Day (Leq) 7 a.m. to 10 p.m.	Night (Leq) 10 p.m. to 7 a.m.
Tuolumne and Stanislaus Counties[b]	–	–	–	50	45
San Joaquin County[c]	6 a.m. to 9 p.m.	6 a.m. to 9 p.m.	6 a.m. to 9 p.m.	50	45
Alameda County[d]	7 a.m. to 7 p.m.	8 a.m. to 5 p.m.	8 a.m. to 5 p.m.	58	53
Santa Clara County[e]	7 a.m. to 7 p.m.	7 a.m. to 7 p.m.	Prohibited	60	50
San Mateo County[f]	7 a.m. to 6 p.m.	9 a.m. to 5 p.m.	Prohibited	63	58
City of Riverbank[g]	6 a.m. to 6:30 p.m.	8 a.m. to 5 p.m.	8 a.m. to 5 p.m.	50	45
City of Modesto[h]	7 a.m. to 9 p.m.	9 a.m. to 9 p.m.	9 a.m. to 9 p.m.	–	–
City of Fremont[i]	7 a.m. to 7 p.m.	9 a.m. to 6 p.m.	Prohibited	60 (Ldn)	
City of Newark[j]	7 a.m. to 6 p.m.	–	–	75 or 80 (Lmax) at 50 feet depending on equipment type; 95 (Lmax) at 50 feet for pile drivers	
City of Milpitas[k]	7 a.m. to 7 p.m.	7 a.m. to 7 p.m.	7 a.m. to 7 p.m.	–	–
City of San Jose[l]	7 a.m. to 7 p.m.	Prohibited	Prohibited	55	55
City of Santa Clara[m]	7 a.m. to 6 p.m.	9 a.m. to 6 p.m.	Prohibited	55	50
City of Sunnyvale[n]	7 a.m. to 6 p.m.	8 a.m. to 5 p.m.	Prohibited	60	45/50
City of Mountain View[o]	7 a.m. to 6 p.m.	Prohibited	Prohibited	55	50
City of Los Altos[p]	7 a.m. to 5:30 p.m.	9 a.m. to 3 p.m.	Prohibited	55	45/50
City of Palo Alto[q]	8 a.m. to 6 p.m.	9 a.m. to 6 p.m.	Prohibited	–	–
City of East Palo Alto[r]	7 a.m. to 8 p.m.	7 a.m. to 8 p.m.	7 a.m. to 8 p.m.	63	58
City of Menlo Park[s]	8 a.m. to 6 p.m.	Prohibited	Prohibited	60	50
Town of Atherton[t]	8 a.m. to 6 p.m.	Prohibited	Prohibited	60	50
City of Redwood City[u]	7 a.m. to 8 p.m.	Prohibited	Prohibited	–	–
City of San Carlos[v]	7 a.m. to 6 p.m.	9 a.m. to 5 p.m.	9 a.m. to 5 p.m.	10 dBA above ambient	
City of San Mateo[w]	7 a.m. to 7 p.m.	8 a.m. to 5 p.m.	12 p.m. to 4 p.m.	60	50 or 55
Town of Woodside[x]	7:30 a.m. to 5:30 p.m.	8 a.m. to 1 p.m.	Prohibited	55 (Ldn)	
Town of Hillsborough[y]	8 a.m. to 5 p.m.	10 a.m. to 5 p.m.	Prohibited	70 at 25 feet	–
City of Burlingame[z]	8 a.m. to 7 p.m.	8 a.m. to 7 p.m.	10 a.m. to 6 p.m.	–	–
City of Millbrae[aa]	7:30 a.m. to 7 p.m.	8 a.m. to 6 p.m.	8 a.m. to 6 p.m.	–	–
City of San Bruno[bb]	7 a.m. to 10 p.m. (85 dBA limit at 100 feet) 10 p.m. to 7 a.m. (60 dBA limit at 100 feet)			60	45
City of South San Francisco[cc]	8 a.m. to 8 p.m.	9 a.m. to 8 p.m.	10 a.m. to 6 p.m.	60	50
City of Colma[dd]	–	–	–	–	–
City of Brisbane[ee]	7 a.m. to 7 p.m.	9 a.m. to 7 p.m.	9 a.m. to 7 p.m.		
City of Daly City[ff]	6 a.m. to 10 p.m.	6 a.m. to 10 p.m.	6 a.m. to 10 p.m.	–	–
City/County of San Francisco[gg]	7 a.m. to 8 p.m. (80 dBA limit at 100 feet)			55 or 60	50 or 55

TABLE 4.10-2 (Continued)
PERTINENT ORDINANCE TIME LIMITS AND NOISE STANDARDS

– not specified
[a] In addition to residential zones, these limits could apply to school, hospital, church, or public library uses depending on the jurisdiction. These limits generally apply to operation of stationary noise sources except in the cities of Newark, Hayward, and San Bruno, where limits apply to construction noise.
[b] Noise limits specified in Tuolumne County Noise Element (Table 5.4) and Stanislaus County General Plan Noise Element (Policy Two, Table II) and apply to stationary noise sources. These counties do not have construction time limits.
[c] Section 1025.9(c)(3) of the San Joaquin County Title 9 Development Title specifies hourly limits for construction. Section 1025.9(b)(2) of the San Joaquin County Development Title specifies Leq limits for stationary noise sources.
[d] Alameda County Municipal Code, Title 6, Health and Safety, Chapter 6.60, Section 6.60.070(E) specifies hourly limits for construction. Noise limits are based on specified noise, duration, and timing limits in Section 6.60.040.
[e] Santa Clara County Code Chapter VII, Section B11-154(b)(6), Noise/Demolition.
[f] Noise limits are based on specified noise, duration, and timing limits in San Mateo County Code, Title 4, Chapter 4.88, Section 4.88.330, Exterior Noise Standards*.* Time limits are specified in San Mateo County Code, Title 4, Chapter 4.88, Section 4.88.360(e), Exemptions.
[g] Time and noise limits specified in Riverbank Municipal Code, Title IX, Chapter 93, Section 93.07(C).
[h] Modesto Municipal Code, Title 4, Chapter 9, Article 4-9.103. Although the code does not contain noise limits, the Environmental Resources Element of the Modesto General Plan specifies a maximum outdoor noise level of 60 dBA (CNEL or Ldn) in single-family residential areas or 65 dBA in multifamily residential areas.
[i] Fremont Municipal Code, Section 8-2205 specifies the above time limits for construction activities within 500 feet of residences, lodging facilities, nursing homes, or inpatient hospitals. Beyond 500 feet of these uses, construction hours are extended to 6 a.m. to 10 p.m. on weekdays and 8 a.m. to 8 p.m. on weekends. When a project is located in a right-of-way or easement or on public-owned property, these hours can be modified by the City, on balance, to minimize disruption to the community as a whole, such as to facilitate orderly flow of traffic or to reduce negative impacts on commercial or residential activity.
[j] The Noise Element of the City of Newark's General Plan serves as the City's noise ordinance, which includes peak noise (Lmax) limits for specific types of construction equipment, but no time restrictions for construction activities. However, the City limits construction to the above weekday hours for most projects requiring permits, although exceptions can be granted by the City (Fujikawa, 2006).
[k] Time limits are specified in the Milpitas Municipal Code, Title V, Chapter 213, Section V-213-3(b), Site Construction Regulations, but no noise limits are specified.
[l] Time limits specified by the San Jose Municipal Code (Chapter 20.100, Section 20.100.450) apply to any construction activity on a site located within 500 feet of a residential unit. Specified noise limit is the performance standard for residential zoning districts (Section 20.30.700).
[m] Time and noise limits specified in Santa Clara City Code, Title 9, Chapter 9.10.
[n] Time and noise limits specified in the Sunnyvale Municipal Code, Sections 16.08.110 and 19.42.030.
[o] Mountain View City Code specifies time limits in Chapter 8, Article I, Section 8.23, and noise limits for stationary equipment in Chapter 21, Article I, Section 21.26.
[p] Los Altos Municipal Code specifies time limits in Title 6, Chapter 6.16, Section 6.16.070, and exterior noise limits in Section 6.16.050. Section 6.16.070 specifies construction maximum noise levels of 75 or 80 dBA (7 a.m. to 7 p.m.) and 50 or 55 dBA (7 p.m. and 7 a.m.), depending on the residential zoning district noise limits.
[q] Construction time limits apply to residential properties and are specified in Title 9, Chapter 9.10 of the Palo Alto Municipal Code. This ordinance also limits noise from any individual piece of equipment to 110 dBA at 25 feet or outside the property plane.
[r] Time and noise limits specified in East Palo Alto Municipal Code, Title 8, Chapter 8.52.
[s] Time and noise limits specified in Menlo Park Municipal Code, Title 8, Section 8.06.030.
[t] Time and noise limits specified in Atherton Municipal Code*,* Title 8, Section 8.16.
[u] Time and noise limits specified in Redwood City Municipal Code, Chapter 24, Article II. Noise levels generated by construction activities (including demolition, alteration, repair, or remodeling) shall not exceed 110 dBA on any adjacent residential property or at 25 feet.
[v] Time and noise limits specified in the San Carlos Municipal Code, Chapter 9.3, Sections 9.30.030 and 9.30.070.
[w] Time and noise limits specified in San Mateo Municipal Code, Title VII, Chapter 7.30, Sections 7.30.040 and 7.30.060. Noise levels generated by construction activities (including demolition, alteration, repair, or remodeling) shall not exceed 90 dBA at 25 feet or outside the property plane.
[x] Time limits specified in Woodside Code of Ordinances, Chapter 151, Section 151.55. Noise limits specified in Town of Woodside General Plan Noise Element.
[y] Time limits specified in Section 8.32.040 of Hillsborough Municipal Code. This code limits construction equipment noise to 100 dBA at a distance of 25 feet from the source, and noise levels from all sources shall not exceed 100 dBA at 25 feet outside the property line plane. On Saturdays, the combined noise level from all construction activity is limited to 70 dBA at 25 feet outside the property line plane. The code limits general noise levels to 70 dBA outside the property plane on weekdays, 7 a.m. to 5 p.m.
[z] Burlingame Municipal Code, Title 10, Chapter 10.40, Section 10.40.037. Although the code does not contain noise limits, the Noise Element of the Burlingame General Plan specifies a maximum outdoor noise level of 60 dBA (CNEL) in residential areas.
[aa] Time limits specified in Millbrae Municipal Code, Title 6, Chapter 6.25, Section 6.25.050(F)(9).
[bb] San Bruno Municipal Code, Title 6, Chapter 6.16, Section 6.16.030 for noise limits in residential zone and Section 6.16.070 for construction limits.
[cc] Time and noise limits specified in South San Francisco Municipal Code, Chapter 8.32, Sections 8.32.030 and 8.32.050. Construction activities allowed during these hours if each piece of equipment produces a noise level of 90 dBA or less at 25 feet or outside of the property plane.
[dd] There is no noise ordinance for the Town of Colma. Instead, it uses the California Penal Code Section 415, "Disturbing the Peace," which prohibits any person from maliciously and willfully disturbing another person by loud and unreasonable noise.
[ee] Brisbane Municipal Code, Title 8, Chapter 8.28, Section 8.28.060 specifies time limits, and no piece of equipment shall produce a noise level of more than 83 dBA or more at 25 feet or 86 dBA outside of the property plane.
[ff] Time limits specified in Daly City Municipal Code, Title 9, Chapter 9.22, Section 9.22.030.
[gg] Time and noise limits specified in San Francisco Police Code, Article 29, Sections 2907 through 2909. Except for impact tools and equipment, powered construction equipment cannot generate noise levels in excess of 80 dBA at 100 feet. Noise limits are for fixed noise sources, with the lower limit applying to R-1 and R-2 residential zoning districts and the higher limit applying to all other residential zoning districts.

Peninsula Region

WSIP projects in the Peninsula Region would mainly be located in unincorporated areas of San Mateo County. Project facilities in this region would also be located within the following incorporated areas: South San Francisco and Daly City. Although most of these facilities would be located in unincorporated areas, a number of them would be sited adjacent to or near the cities of San Mateo, Hillsborough, Burlingame, Millbrae, and San Bruno. As shown in Table 4.10-2, noise ordinances for these counties and cities specify time limits for construction activities and noise limits for operation of stationary equipment in or near residential zones.

San Francisco Region

Most WSIP projects in the San Francisco Region would be located in San Francisco. However, two projects would have facilities located in unincorporated areas of northern San Mateo County as well as in the following incorporated areas on the Peninsula: Burlingame, Millbrae, San Bruno, South San Francisco, Colma, Brisbane, and Daly City. As shown in Table 4.10-2, noise ordinances for these counties and cities specify time limits for construction activities and noise limits for operation of stationary equipment in or near residential zones.

4.10.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to noise, but generally considers that implementation of the proposed program would have a significant noise impact if it were to:

- Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies (Evaluated in this section)
- Expose people to or generate excessive groundborne vibration or groundborne noise levels (Evaluated in this section)
- Create a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project (Evaluated in this section)
- Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project (Evaluated in this section)
- For a project located within an area covered by an airport land use plan (or, where such a plan has not been adopted, within two miles of a public airport or public use airport), expose people residing or working in the project area to excessive noise levels (Not evaluated in this section, see Appendix B)
- For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels (Not evaluated in this section, see Appendix B)
- Be substantially affected by existing noise levels (Not evaluated in this section, see Appendix B)

Approach to Analysis

This program-level analysis presents a screening-level analysis to determine areas of potential noise impacts based on two factors: (1) the proximity of sensitive receptors in the site vicinities; and (2) the potential for proposed activities to occur during the more sensitive nighttime hours. Both of these factors are used to define the potential for impact and the need for or feasibility of mitigation. For construction noise, the potential for impact is defined by the proximity of sensitive receptors, typical noise levels associated with construction equipment, the potential for construction noise levels to interfere with daytime and nighttime activities, and whether construction noise audible to nearby receptors will occur outside of construction time limits specified in local ordinances. For operational noise, the potential for impact is defined by the proximity of sensitive receptors to a proposed facility, and the potential for operational noise to remain within noise ordinance limits at the nearest receptors.

This section focuses on the program-level impacts that would be associated with the various types of facilities as well as each WSIP project. The final construction scheduling of specific WSIP projects could lead to combined or collective impacts resulting from construction of more than one facility. This potential effect is assessed in Section 4.16, Collective Impacts.

Another relevant factor to consider in assessing whether a noise impact is significant or not is the frequency with which noise levels associated with project construction might exceed the established standards. If exceedance of a noise standard might happen only very rarely and/or briefly, this may not constitute a significant impact. This factor of noise frequency is not considered as part of this program-level impact analysis of the WSIP projects since there is not yet enough detailed information about the construction scenario for each project to assess the potential frequency of project noise levels that might established standards. This factor will be considered as part of the separate project-level impact analysis to be conducted as appropriate for each WSIP project. Based on more detailed information about project construction activities and schedule, and site-specific information on the proximity of sensitive receptors, project-level analysis may determine that impacts considered to be potential significant and unavoidable at this program-level of review are instead significant but mitigable or less than significant.

Impact Summary by Region

Table 4.10-3 provides a summary of the noise and vibration impacts associated with implementation of the WSIP.

Construction Impacts

Short-Term Noise Increases

Impact 4.10-1: Disturbance from temporary construction-related noise increases.

Construction activities associated with implementation of the WSIP would result in temporary noise increases at sensitive receptors near facility sites. Construction noise levels would fluctuate at any given receptor depending on the type of project, construction phasing, equipment

TABLE 4.10-3
POTENTIAL IMPACTS AND SIGNIFICANCE – NOISE AND VIBRATION

Projects	Project Number	Impact 4.10-1: Disturbance from temporary construction-related noise increases	Impact 4.10-2: Temporary noise disturbance along construction haul routes	Impact 4.10-3: Disturbance due to construction-related vibration	Impact 4.10-4: Disturbance due to long-term noise increases
San Joaquin Region					
Advanced Disinfection	SJ-1	PSU	PSU	LS	LS
Lawrence Livermore Supply Improvements	SJ-2	PSU	N/A	LS	LS
San Joaquin Pipeline System	SJ-3	PSU	PSU	PSU	LS
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	PSU	PSU	PSU	N/A
Tesla Portal Disinfection Station	SJ-5	PSU	PSU	LS	LS
Sunol Valley Region					
Alameda Creek Fishery Enhancement	SV-1	PSU	LS	LS	LS
Calaveras Dam Replacement	SV-2	PSU	LS	LS	N/A
Additional 40-mgd Treated Water Supply	SV-3	PSU	LS	PSU	LS
New Irvington Tunnel	SV-4	PSU	PSM	PSM	LS
SVWTP – Treated Water Reservoirs	SV-5	PSU	LS	LS	LS
San Antonio Backup Pipeline	SV-6	PSU	LS	LS	N/A
Bay Division Region					
Bay Division Pipeline Reliability Upgrade	BD-1	PSU	PSU	PSU	LS
BDPL Nos. 3 and 4 Crossovers	BD-2	PSU	PSU	PSU	N/A
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	PSU	PSU	PSU	N/A
Peninsula Region					
Baden and San Pedro Valve Lots Improvements	PN-1	PSU	PSU	PSU	LS
Crystal Springs/San Andreas Transmission Upgrade	PN-2	PSU	LS	LS	LS
HTWTP Long-Term Improvements	PN-3	PSU	PSU	LS	LS
Lower Crystal Springs Dam Improvements	PN-4	PSU	LS	LS	N/A
Pulgas Balancing Reservoir Rehabilitation	PN-5	PSU	LS	LS	LS
San Francisco Region					
San Andreas Pipeline No. 3 Installation	SF-1	PSU	PSU	PSU	N/A
Groundwater Projects	SF-2	PSU	PSU	PSU	LS
Recycled Water Projects	SF-3	PSU	PSU	PSU	LS

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant Unavoidable impact
N/A = Not Applicable

type/duration of use, distance between the noise source and receptor, and the presence or absence of barriers between the noise source and receptor. Typical construction equipment generates maximum noise levels ranging from about 76 to 88 dBA at a distance of 50 feet from the source, with slightly higher levels of about 88 to 91 dBA for certain types of earthmoving and impact equipment. The rate of attenuation (i.e., reduction) is about 6 dBA for every doubling of distance from a point source. Noise levels from pile drivers can generate noise peaks of approximately 101 dBA at 50 feet. **Table 4.10-4** indicates noise levels at 25, 50, and 100 feet from the noise source for typical construction equipment.

TABLE 4.10-4
NOISE LEVELS AND ABATEMENT POTENTIAL OF CONSTRUCTION EQUIPMENT NOISE AT 25, 50, AND 100 FEET (IN DBA)

	Noise Level at 25 Feet		Noise Level at 50 Feet		Noise Level at 100 Feet	
Equipment	**Without Controls[a]**	**With Controls[a]**	**Without Controls[a]**	**With Control[a]**	**Without Controls[a]**	**With Controls[a]**
Earthmoving						
Front Loaders	85	81	79	75	73	69
Backhoes	86	81	80	75	74	69
Dozers	86	81	80	75	74	69
Tractors	86	81	80	75	74	69
Graders	91	81	85	75	79	69
Trucks	97	81	91	75	85	69
Materials Handling						
Concrete Mixers	91	81	85	75	79	69
Concrete Pumps	88	81	82	75	76	69
Crane, Mobile	89	81	83	75	77	69
Crane, Derrick	94	81	88	75	82	69
Stationary						
Pumps	82	81	76	75	70	69
Generators	84	81	78	75	72	69
Compressors	87	81	81	75	75	69
Impact						
Pile Drivers	107	101	101	95	95	89
Rock Drills	104	86	98	80	92	74
Jack Hammers	94	81	88	75	82	69
Pneumatic Tools	92	86	86	80	80	74
Other						
Saws	84	81	78	75	72	69
Vibrators	82	81	76	75	70	69

[a] Estimated levels can be obtained by selecting quieter procedures or machines and implementing noise-control features that do not require major redesign or extreme cost (e.g., improved mufflers, equipment redesign, use of silencers, shields, shrouds, ducts, and engine enclosures).

SOURCE: U.S. Environmental Protection Agency, 1971; U.S. Department of Transportation, Federal Transit Administration, 1995.

As stated in the first significance criterion above, a noise impact is considered significant if noise levels are in excess of the standards established in local noise ordinances. However, WSIP projects are located in over 20 different jurisdictions, each with its own limits. Some jurisdictions have noise limits but do not have time limits. Others have time limits but no construction noise limits. Given the variation in time and noise limits among jurisdictions, combined with the undetermined nature of construction hours and specific construction activities for the WSIP projects, it is not possible at the program level to accurately determine whether each WSIP project would generate noise in excess of local noise ordinance standards. This project-specific analysis will be undertaken as part of separate, project-level CEQA review.

For construction noise, a “substantial” noise increase (as stated in the fourth significance criterion) can be defined as interference with activities during the day and night. One indicator that construction noise could interfere with daytime activities would be speech interference, and an indicator that construction noise could interfere with nighttime activities would be sleep interference. This analysis uses the following criteria to define the significance of potential noise impacts:

- *Speech Interference*. Speech interference is an indicator of impact on typical daytime and evening activities. A speech interference criterion, in the context of impact duration and time of day, is used to identify substantial increases in noise from temporary construction activities. Noise peaks generated by construction equipment could result in speech interference in adjacent buildings if the noise level in the interior of the building exceeds 45 to 60 dBA.[1] A typical building can reduce noise levels by 25 dBA with the windows closed (U.S. EPA, 1974). This noise reduction could be maintained only on a temporary basis in some cases, since it assumes windows must remain closed at all times. Assuming a 25-dBA reduction with the windows closed, an exterior noise level of 70 dBA (Leq) at receptors would maintain an acceptable interior noise environment of 45 dBA. It should be noted that such noise levels would be sporadic rather than continuous in nature, because different types of construction equipment would be used throughout the construction process.

- *Sleep Interference*. Based on available sleep criteria data, an interior nighttime level of 35 dBA is considered acceptable (U.S. EPA, 1974). Assuming a 25-dBA reduction with the windows closed, an exterior noise level of 60 dBA at receptors would maintain an acceptable interior noise environment of 35 dBA. Since a 15-dBA reduction would occur with windows open, an exterior noise level of 50 dBA (Leq) would be required to maintain an acceptable interior noise environment of 35 dBA.

In general, most construction noise would exceed the speech interference criterion when heavy equipment is operated within approximately 500 feet of a sensitive receptor (distance ranges between 150 and 500 feet depending on the type of equipment operated). The sleep interference criterion would be exceeded at distances closer than approximately 3,000 feet with windows open or 900 feet with the windows closed (with operation of most types of construction equipment; greater setback distances would be required if trucks and impact equipment were to be operated at night).[2] If feasible noise controls are implemented (see Mitigation Measure 4.10-1a), most construction noise levels could be reduced to below the speech interference criterion, except when receptors are approximately 75 feet or less from construction equipment. For nighttime construction, implementation of noise controls would reduce most construction noise to below the sleep interference criterion except when construction equipment were operated within 300 feet (windows closed) or 900 feet (windows open) of sensitive receptors or when impact equipment were operated within 600 feet (windows closed) or 1,700 feet (windows open) of sensitive receptors. Estimates of typical construction noise levels at these distances (mitigated and unmitigated) are included in Appendix F and they are compared to the speech and sleep interference criteria.

1 For indoor noise environments, the highest noise level that permits relaxed conversation with 100 percent intelligibility throughout the room is 45 dBA. Speech interference is considered to become intolerable when normal conversation is precluded at 3 feet, which occurs when background noise levels exceed 60 dBA. For outdoor environments, the highest noise level that permits normal conversation at 3 feet with 95 percent sentence intelligibility is 66 dBA (U.S. EPA, 1974).

2 Whether windows can remain closed at night would depend on local climate conditions as well as duration of nighttime construction.

The construction impacts identified below for each type of facility have been developed to allow a general assessment of the nature and magnitude of potential impacts associated with the WSIP.

Pipelines. For pipelines, sensitive receptors tend to be located closer to construction activities than at facility sites (as close as 25 to 50 feet of proposed alignments in urbanized areas), and construction noise levels would exceed the speech interference criterion at distances closer than 100 feet, with or without feasible noise controls. However, because pipeline construction progresses along an alignment (rather than persisting at one location) at an average rate of approximately 120 to 160 feet per day, any given sensitive receptor would typically be subject to construction noise for about two weeks and not for the entire duration of the construction schedule. In some cases, the limited duration of exposure at a given sensitive receptor could reduce the adverse effects of these temporary noise increases to a less-than-significant level, even if noise controls cannot reduce estimated noise levels to below the speech interference criterion. However, if pipeline construction were prolonged at any one location, localized impacts could be potentially significant and unavoidable. While it is expected that most pipeline construction activities would occur during daytime hours (generally within with applicable noise ordinance time limits), the SFPUC has indicated that nighttime construction could occur at specific locations due to special construction requirements (e.g., water service must be temporarily discontinued when proposed facilities are connected to existing facilities).

Construction of jack-and-bore pits for pipeline crossings of railroads, freeways, and streets that are more than four lanes wide would pose additional noise impacts if tunnel ventilation fans, dewatering pumps, and generators are required. If any sensitive receptors are located near these pits, they could be subject to construction-related noise increases for longer durations as well as nighttime noise increases if fans, pumps, and generators are required to be operated 24 hours per day. Twenty-four-hour operation of ventilation fans, generators, and/or pumps could exceed ordinance time or noise limits, and noise controls would be required to minimize speech interference and sleep disturbance effects.

Tunnels. Noise impacts associated with tunnel construction would primarily occur at tunnel entry and exit shafts or portals, where construction staging would occur. Since tunnel construction might have to occur 24 hours per day, seven days per week, activities at these shafts/portals would often involve nighttime activities. If nighttime activities occur in tunnel portal vicinities, it could be appropriate to apply ordinance noise limits (listed in Table 4.10-2) in addition to the sleep interference criterion to evaluate the potential significance of construction noise increases. In addition to activities at tunnel shafts/portals, noise increases could occur along haul routes, since tunnel construction would entail off-hauling of materials excavated from tunnels (tunnel spoils), as well as equipment and material (e.g., tunnel lining) deliveries.

Within tunnels, the primary noise sources are typically the tunnel boring machine and tunnel muck removal system (conveyor belt and rail cars), but these sources would not be audible at the surface. However, these underground tunnel-related activities could generate groundborne noise within any overlying structures, which could result in sleep disturbance.

The primary sources of airborne noise associated with tunnel construction would be activities at tunnel shafts or portals, which could include the following with a tunnel shaft design:

- Excavation of the tunnel entry and exit shafts, which could include pile driving
- Handling and removal of excavated materials (shaft and tunnel spoils) at the tunnel entry shaft, which could include operation of a crane at the surface and a skip hoist system that moves muck from the bottom of the shaft to the surface, and front loaders that load muck into haul trucks
- Operation of a crane to lower tunnel support segments into the shaft
- Continuous operation of a ventilation fan (which could be located at the bottom of the shaft or at the surface) and dewatering pumps (at the bottom of the shaft) at the entry shaft site (24 hours per day, seven days per week)
- Continuous operation of ventilation equipment and a grout batching plant at the exit shaft (24 hours per day, seven days per week during the tunnel lining phase only)
- Operation of compressors or generators at night at the entry and exit shafts
- Possible controlled detonations during shaft construction

Potential tunnel-related noise impacts would depend on the tunnel design (below-ground shaft or surface portal), the type of tunneling and muck removal system ultimately used (dictated by whether the tunnel is gassy or potentially gassy), the extent of nighttime surface activities in the vicinity of tunnel portals/shafts (e.g., equipment repair, heavy equipment operation associated with muck removal), and the proximity of the shaft or portal (including ventilation fans, dewatering pumps, and/or generators) to sensitive receptors. Outside of the tunnel portal/shaft vicinities, the primary source of noise during tunnel construction would be haul trucks and material delivery trucks.

Other Facilities. Compared to pipeline construction noise, noise impacts associated with construction of other types of water facilities (vault, valve lot, crossover, pump station, treatment, and storage facilities) would generally affect fewer receptors because such construction would occur at discrete locations (involving smaller areas than pipelines), and many of these facilities would be located within or adjacent to existing SFPUC water facilities. Construction at some existing facilities could involve fewer earthmoving activities, limiting the potential for noise impacts associated with operation of heavy equipment and off-hauling of excavated material. The exception would be dam replacement/reconstruction projects, which could involve extensive earthmoving activities. The potential for temporary construction noise impacts would depend on the proximity of sensitive receptors, construction duration, time of day construction occurs, and extent of earthmoving activities (excavation, shoring, stockpiling of excavated materials). Installation of any above-ground facilities could also involve temporary noise increases.

San Joaquin Region

Impact 4.10-1: Disturbance from temporary construction-related noise increases		
Advanced Disinfection	SJ-1	PSU
Lawrence Livermore	SJ-2	PSU
SJPL System	SJ-3	PSU
SJPL Rehabilitation	SJ-4	PSU
Tesla Portal Disinfection	SJ-5	PSU

Within this region, construction of the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would have the potential to result in significant, short-term noise impacts. The SJPL System project's six-mile eastern pipeline segment (west of Oakdale Portal) and eastern crossover would be located in an undeveloped area, where the potential for noise impacts would be low. However, the 9.7-mile western pipeline segment located east of Tesla Portal would extend through a residential area and golf course (Tracy Golf and Country Club). These residences are located west of I-580, and the golf course spans the freeway. Residences could be within 50 feet of the pipeline alignment, depending on the pipeline location within the existing SFPUC right-of-way. (Golf course users are not considered noise-sensitive receptors.) Construction noise impacts could also occur at crossover facility sites proposed as part of this project, depending on their locations and proximity to noise-sensitive receptors.

Potential construction-related noise impacts associated with the SJPL System project would be potentially significant and evaluated in greater detail in a separate, project-level EIR. At most locations along the pipeline alignment where construction would be short in duration (two weeks or less at any given receptor), construction noise impacts could be reduced to a less-than-significant level by limiting construction activities to the daytime hours or reducing construction noise levels to meet ordinance nighttime noise limits (Measure 4.10-1a). However, because sensitive receptors could be within 50 feet of a pipeline alignment, it is possible that construction noise impacts could not be reduced to a less-than-significant level if the construction duration along this segment of the pipeline alignment lasted for longer than two weeks or occurred during nighttime hours adjacent to a residential receptor (e.g., crossover facilities, jack and bore pits). If this occurs, construction noise would be temporary but *potentially significant and unavoidable*.

Similar construction-related noise impacts could result during rehabilitation of the existing San Joaquin pipelines (SJ-4). In Modesto and Riverbank, segments of the existing pipelines are located within 25 feet of existing homes. If the pipeline segments being rehabilitated were within 25 feet of residences and the construction duration were prolonged or occurred during the nighttime hours at any such locations, it is possible that construction noise levels could not be reduced to a less-than-significant level. Therefore, this project would result in temporary but potentially significant construction noise impacts. At locations where construction would be short in duration (two weeks or less at any given receptor), daytime construction noise impacts could be reduced to a less-than-significant level by implementing noise controls to meet the speech interference criterion (Measure 4.10-1a). However, if construction activities would occur within 25 feet of a receptor for a prolonged period (over two weeks at any given receptor) or construction occurred during the nighttime hours, noise impacts would be temporary but *potentially significant and unavoidable*. When project elements and locations are defined, this project would be subject to separate, project-level CEQA review to analyze potential construction noise impacts for specific facility locations and determine if impacts could be mitigated to a less-than-significant level.

Other WSIP facilities within this region would be located at Tesla Portal (under Advanced Disinfection, SJ-1, and Tesla Portal Disinfection, SJ-5) or at Thomas Shaft (under Lawrence Livermore, SJ-2). There are no sensitive receptors located in the vicinity of Thomas Shaft and therefore, construction noise levels would result in less than significant noise impacts. The closest receptors to Tesla Portal include the SFPUC caretaker's residence at Tesla Portal and private residences located approximately 3,500 feet to the south. Since the caretaker's residence would be located adjacent to both these projects, occupants of this residence would be subject to construction noise levels in excess of speech and sleep interference criteria. Vacating this residence (Measure 4.10-1b) would reduce potentially significant noise impacts to a less-than-significant level. At private residences located at least 3,500 feet to the south, construction noise from most types of equipment would not exceed speech or sleep interference criteria. However, nighttime construction noise could still exceed the San Joaquin County nighttime ordinance limit of 45 dBA, a potentially significant impact for the Advanced Disinfection and Tesla Portal Disinfection projects. Given the distance to the nearest receptors, it is possible that this impact could be reduced to a less-than-significant level (avoiding sleep disturbance effects or reducing noise to ordinance noise limits) with implementation of noise controls (Measure 4.10-1a).

At this stage of program planning, proposed construction hours have not been determined for each WSIP project in this region, and it is possible that construction noise (audible to nearby receptors) associated with any WSIP project in this region could extend beyond the typical daytime hours (i.e., could occur during the evening or nighttime hours on weekends as well as weekdays). Therefore, the PEIR errs on the conservative side and identifies *potentially significant and unavoidable* noise impacts for any WSIP project in this region that will generate construction noise audible to nearby receptors beyond the hours specified in local noise ordinances or that cannot meet local noise limits for these hours. However, when construction hours and activities are defined for each WSIP project, separate, project-level CEQA review will be conducted to determine potential construction noise impacts for specific facility locations and whether impacts can be mitigated to a less-than-significant level.

Sunol Valley Region

Impact 4.10-1: Disturbance from temporary construction-related noise increases		
Alameda Creek Fishery	SV-1	PSU
Calaveras Dam	SV-2	PSU
40-mgd Treated Water	SV-3	PSU
New Irvington Tunnel	SV-4	PSU
Treated Water Reservoirs	SV-5	PSU
SABUP	SV-6	PSU

Most of the projects in this region would be located in Sunol Valley, which contains one private residence, two SFPUC Land Manager's residences (one adjacent to Alameda East Portal and one adjacent to Calaveras Dam), various water facilities, commercial nurseries, and quarries. The private residence is about 1,200 feet or more from the existing Alameda West Portal, and 2,000 feet from Calaveras Road.

Since the proposed New Irvington Tunnel (SV-4) entrance portal would be located closer to the private residence than the existing Alameda West Portal, there is a potential that noise impacts could occur at this residence. Depending on the type of equipment that would be operated at the tunnel portal, construction activities within 1,000 to 3,000 feet of this residence could result in potentially significant noise impacts at this residence. Although it is possible to limit nighttime use of certain types of equipment as well as require use of engine controls and sound barriers around the tunnel portal area (Measure 4.10-1a) so that construction noise levels do not cause sleep disturbance, the effectiveness of such measures cannot be determined until portal and equipment design details are determined and therefore, this impact is conservatively considered to be *potentially significant and unavoidable* in this PEIR. The SFPUC Land Manager's residence would be approximately 3,000 feet from the tunnel portal area, and this setback distance would allow construction noise levels generated beyond the time limits to be reduced by noise controls (Measure 4.10-1a) to meet ordinance nighttime noise limits (ensuring that sleep disturbance effects do not occur), reducing impacts to a less-than-significant level. The potential for noise impacts on the private residence and the SFPUC Land Manager's residence, as well as the need for noise controls would be evaluated in more detail in a separate, project-level EIR.

The New Irvington Tunnel (SV-4) exit portal would be located outside of Sunol Valley. The western exit portal of this tunnel in Fremont has the potential to cause noise impacts because it could be located near sensitive receptors. Tunnel-related noise impacts, as described above, would be associated with this project. Due to the proximity of sensitive receptors to the exit portal (less than 500 feet) and possibility of nighttime construction, it is possible that construction noise could result in sleep disturbance effects and possibly exceed the Fremont Noise Ordinance nighttime noise limit of 60 dBA (Ldn) at the closest receptors. This impact would be temporary but *potentially significant and unavoidable*. The New Irvington Tunnel project would be evaluated in a separate, project-level EIR, which would identify potential construction noise impacts at the tunnel exit portal and determine if impacts could be mitigated to a less-than-significant level.

Other WSIP projects in this region with components that could be located within 500 feet of the private residence in Sunol Valley include the pipeline proposed to extend from the Sunol Valley WTP to the Irvington Tunnel or Alameda Siphons as part of the 40-mgd Treated Water project (SV-3). If this pipeline passed closer than 500 feet from this residence, pipeline-related construction noise impacts could occur, as described above. It is also possible that facilities associated with the Alameda Creek Fishery project (SV-1) could extend through the area within 500 feet east of the residence. The potential for significant construction noise impacts on this residence due to these projects would depend on the proximity of these facilities to this residence and construction hours, and therefore, is conservatively considered potentially significant in this PEIR. Since there appears to be available space to provide sufficient setbacks from this residence, implementation of appropriate noise controls (Measure 4.10-1a) would likely reduce potentially significant noise impacts to a less-than-significant level. If nighttime construction occurs, this potentially significant impact could be reduced to a less-than-significant level by providing adequate setbacks and implementing feasible noise controls so as to reduce any construction noise levels below the sleep disturbance criterion (Measure 4.10-1a).

The Calaveras Dam project (SV-2) is located at the south end of Sunol Valley and extends southward into Calaveras Valley, where one borrow area is located at the south end of Calaveras Reservoir. There are private residences located more than 2,000 feet from the southernmost borrow area and the SFPUC Land Manager's residence is located adjacent to the Calaveras Dam. Nighttime construction activities over a two-year period would pose potentially significant noise impacts on these residential receptors. The SFPUC Land Manager's residence is proposed to be vacated, avoiding noise impacts on this receptor. Given the residential setback distances of more than 2,000 feet from project facilities, implementation of noise controls (Measure 4.10-1a) would likely be adequate to reduce potentially significant noise impacts to a less-than-significant level (avoiding sleep disturbance effects or reducing noise to meet ordinance limits). However, it should be noted that mitigated construction noise could, at times, still be noticeable to some of the closest residential receptors during the nighttime hours because ambient noise levels are so low in this area and ordinance limits are higher than ambient noise levels.

The Treated Water Reservoirs (SV-5) and SABUP (SV-6) projects are located more than 500 feet from the private residence in Sunol Valley and 300 feet from the SFPUC Land Manager's residence near Alameda East Portal. At such distances, construction noise impacts associated with this project would be potentially significant, but it is possible that these impacts could be reduced to a less-than-significant level (avoiding sleep disturbance effects or reducing noise to ordinance noise limits) with implementation of noise controls (Measure 4.10-1a).

At this stage of program planning, proposed construction hours have not been determined for each WSIP project in this region, and it is possible that construction noise (audible to nearby receptors) associated with any WSIP project in this region could extend beyond the typical daytime hours (i.e., could occur during the evening or nighttime hours on weekends as well as weekdays). Therefore, the PEIR errs on the conservative side and identifies *potentially significant and unavoidable* noise impacts for any WSIP project in this region that will generate construction noise audible to nearby receptors beyond the hours specified in local noise ordinances or that cannot meet local noise limits for these hours. However, when construction hours and activities are defined for each WSIP project, separate, project-level CEQA review will be conducted to determine potential construction noise impacts for specific facility locations and whether impacts can be mitigated to a less-than-significant level.

Bay Division Region

Impact 4.10-1: Disturbance from temporary construction-related noise increases		
BDPL Reliability Upgrade	BD-1	PSU
BDPL 3 and 4 Crossovers	BD-2	PSU
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSU

All of the WSIP projects in this region would involve construction activities along existing pipeline alignments or construction at discrete locations along these alignments. Pipeline-related noise impacts, as described above, would be associated with the BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects. At receptor locations along pipeline alignments where construction would be short in duration (two weeks or less at any given receptor), construction noise impacts could likely be reduced to a less-than-significant level by implementing applicable noise controls (Measure 4.10-1a). However, because sensitive receptors would be less than 75 feet from the BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) pipeline alignments, it is possible that construction noise impacts could not be reduced to a less-than-significant level if the construction duration along the pipeline alignment lasted for longer than two weeks at any one location (e.g., jack-and-bore pits) or if nighttime construction occurs. Such effects would be temporary but *potentially significant and unavoidable*. With setbacks of less than 75 feet, noise controls (Measure 4.10-1a) would not reduce nighttime construction noise to below the sleep interference criterion or ordinance nighttime noise limits.

Tunnel-related noise impacts would also occur at tunnel shafts proposed as part of the BDPL Reliability Upgrade (BD-1) in Newark and East Palo Alto. Tunnel shafts would be located 900 feet or more from the closest residential receptors; with such setbacks, it is expected that sleep disturbance effects from nighttime tunnel construction noise levels near the shafts could be reduced to a less-than-significant level by limiting equipment/truck operations or erecting sound barriers (Measure 4.10-1a) to meet nighttime ordinance noise limits at the closest receptors. However, the effectiveness of such measures cannot be determined until portal and equipment design details are determined and therefore, this impact is conservatively considered to be *potentially significant and unavoidable* in this PEIR.

Under the BDPL 3 and 4 Crossovers (BD-2) project, construction would occur at discrete locations along the pipeline alignments. Since most of the Bay Division Region is urbanized, it is possible that noise impacts could adversely affect adjacent school or residential receptors. The SFPUC has indicated that construction hours could extend beyond the daytime hours. If facilities are located within 75 feet of noise-sensitive receptors, any prolonged construction activities (longer than two weeks) and/or any nighttime construction activities would result in *potentially significant and unavoidable* noise impacts. With setbacks of less than 75 feet, noise controls (Measure 4.10-1a) would not reduce construction noise to below the sleep interference criterion or ordinance nighttime noise limits.

At this stage of program planning, proposed construction hours have not been determined for each WSIP project in this region, and it is possible that construction noise (audible to nearby receptors) associated with any WSIP project in this region could extend beyond the typical daytime hours (i.e., could occur during the evening or nighttime hours on weekends as well as weekdays). Therefore, the PEIR errs on the conservative side and identifies *potentially significant and unavoidable* noise impacts for any WSIP project in this region that will generate construction noise audible to nearby receptors beyond the hours specified in local noise ordinances or that cannot meet local noise limits for these hours. However, when construction hours and activities are defined for each WSIP project, separate, project-level CEQA review will be conducted to determine potential construction noise impacts for specific facility locations and whether impacts can be mitigated to a less-than-significant level.

Peninsula Region

Impact 4.10-1: Disturbance from temporary construction-related noise increases		
Baden and San Pedro Valve Lots	PN-1	PSU
CS/SA Transmission	PN-2	PSU
HTWTP Long-Term	PN-3	PSU
Lower Crystal Springs Dam	PN-4	PSU
Pulgas Balancing Reservoir	PN-5	PSU

The Baden and San Pedro Valve Lots project (PN-1) would be located at existing valve lots in South San Francisco and Daly City. There are residential receptors adjacent to the Baden Valve Lot in South San Francisco (PN-1), but no residential receptors in the vicinity of the San Pedro Valve Lot in Daly City (PN-1). Sensitive receptors could be less than 100 feet from proposed construction in Baden Valve Lot. While daytime construction could be mitigated to less than significant with implementation of noise controls (Measure 4.10-1a), any nighttime construction activities could result in *potentially significant and unavoidable* noise impacts if they occur within 75 feet of noise-sensitive receptors. With setbacks of less than 75 feet, noise controls (Measure 4.10-1a) would not reduce construction noise to below the sleep interference criterion (and ordinance nighttime noise limits) at the closest receptors.

One WSIP project in the Peninsula Region would be located at the Harry Tracy WTP (PN-3). The closest residential receptors are approximately 500 feet east and southeast of existing WTP facilities and 300 feet to the south. If construction activities occurred within 500 feet of existing residences, construction-related noise impacts would be potentially significant. However, implementation of appropriate noise controls (Measure 4.10-1a) would be adequate to reduce construction noise impacts to a less-than-significant level. With setbacks of 300 to 500 feet or more from these residences, it is possible that construction noise could be reduced to a less-than-significant level (reducing noise to below the sleep interference criterion or ordinance nighttime noise limits) with implementation of noise controls (Measure 4.10-1a).

Two WSIP projects in this region (CS/SA Transmission, PN-2, and Lower Crystal Springs Dam, PN-4) would be located in the vicinity of the Crystal Springs Reservoirs, west of and across I-280 from the westernmost residential neighborhoods in Belmont, Hillsborough, and Millbrae as well as unincorporated areas of San Mateo County. Residential receptors would be over 1,000 feet east of these two projects (and across a freeway), but a few residences are located approximately 500 feet to the northeast of the Crystal Springs Pump Station, at the base of Lower Crystal Springs Dam. Construction activities in this vicinity could occur under these two projects, and could extend beyond the daytime hours. With minimum residential setback distances of approximately 500 feet from these two projects, potentially significant noise impacts could be reduced to a less-than-significant level (reducing noise to below the sleep interference criterion or ordinance nighttime noise limits) with implementation of noise controls (Measure 4.10-1a).

The Pulgas Balancing Reservoir project (PN-5) would be over 6,000 feet from the closest residential receptors to the east. Given such large residential setback distances, potential noise impacts would be less than significant. However, project construction could adversely affect scheduled activities (e.g., weddings, etc.) at the nearby Pulgas Water Temple, a potentially significant impact. If the SFPUC chooses to schedule activities during project construction, appropriate noise controls (Measure 4.10-1a) could be required to reduce noise impacts to a less-than-significant level. However, this potential impact could be avoided if no Temple activities were scheduled during construction hours.

At this stage of program planning, proposed construction hours have not been determined for each WSIP project in this region, and it is possible that construction noise (audible to any nearby receptors) associated with any WSIP project in this region could extend beyond the typical daytime hours (i.e., could occur during the evening or nighttime hours on weekends as well as weekdays). Therefore, the PEIR errs on the conservative side and identifies *potentially significant and unavoidable* noise impacts for any WSIP project in this region that will generate construction noise audible to nearby receptors beyond the hours specified in local noise ordinances or that cannot meet local noise limits for these hours. However, when construction hours and activities are defined for each WSIP project, separate, project-level CEQA review will be conducted to determine potential construction noise impacts for specific facility locations and whether impacts can be mitigated to a less-than-significant level.

San Francisco Region

Impact 4.10-1: Disturbance from temporary construction-related noise increases		
SAPL 3 Installation	SF-1	PSU
Groundwater Projects	SF-2	PSU
Recycled Water Projects	SF-3	PSU

Pipeline-related noise impacts, as described above, would be associated with the SAPL 3 Installation (SF-1) project. At receptor locations along the pipeline alignment where construction would be short in duration (two weeks or less at any given receptor), construction noise impacts could likely be reduced to a less-than-significant level by implementing applicable noise controls (Measure 4.10-1a). However, because sensitive receptors would be less than 25 feet on some residential streets, it is possible that construction noise impacts could not be reduced to a less-than-significant level if the construction duration along the pipeline alignment lasted for longer than two weeks at any one location (e.g., jack-and-bore pits) or if construction occurred during the night. Such effects would be temporary but *potentially significant and unavoidable*. With setbacks of less than 75 feet, noise controls (Measure 4.10-1a) would not reduce construction noise to below the sleep interference criterion at the closest receptors.

The primary construction noise issue associated with the local and regional Groundwater Projects (SF-2) would be 24-hour drilling required as part of proposed well construction. Continuous operation of drilling equipment could exceed the sleep interference criterion (with windows closed) if sensitive receptors were located within approximately 900 feet of well sites. At setback distances of 300 feet or more, implementation of noise controls (Measure 4.10-1a) could reduce drilling noise to less than significant. However, if setbacks are less than 300 feet, sleep disturbance could still occur (with Measure 4.10-1a) and this impact, although temporary, would be *potentially significant and unavoidable*. The Groundwater Projects would be evaluated in more detail as part of separate, project-level CEQA review, which would determine if construction noise impacts could be mitigated to a less-than-significant level.

Both pipeline and facility construction noise impacts, as described above, would be associated with the Recycled Water Projects (SF-3). Sensitive receptors are located near or adjacent to proposed treatment facilities and pipelines, and therefore, construction noise impacts on these receptors would be potentially significant. If facilities are located within 75 feet of noise-sensitive receptors, construction noise (occurring for longer than two weeks or at night) could be a *potentially significant and unavoidable* impact. With setbacks of less than 75 feet, noise controls (Measure 4.10-1a) would not reduce construction noise to below the sleep interference criterion at the closest receptors.

At this stage of program planning, proposed construction hours have not been determined for each WSIP project in this region, and it is possible that construction activities and construction noise associated with any WSIP project in this region could extend beyond the typical daytime hours (i.e., could occur during the evening or nighttime hours on weekends as well as weekdays). Therefore, the PEIR errs on the conservative side and identifies *potentially significant and unavoidable* noise impacts for any WSIP project in this region that will generate construction noise audible to nearby receptors beyond the hours specified in local noise ordinances or that cannot meet local noise limits for these hours. However, when construction hours and activities are defined for each WSIP project, separate, project-level CEQA review will be conducted to determine potential construction noise impacts for specific facility locations and whether impacts can be mitigated to a less-than-significant level.

Impact 4.10-2: Temporary noise disturbance along construction haul routes.

Truck noise levels depend on vehicle speed, load, terrain, and other factors. The effects of construction-related truck traffic would depend on the level of background noise already occurring at a particular receptor site. In quiet noise environments (Leq averaging 50 dBA), one truck per hour would be noticeable, even though such a low volume would not measurably increase noise levels. In slightly noisier environments (Leq averaging 60 dBA), the threshold level is higher, and it would take 10 trucks per hour to noticeably increase the noise exposure. In moderately noisy environments (Leq averaging 70 dBA), a noise increase would be perceptible with the addition of 100 trucks per hour (Caltrans, 1998).

In quiet environments or during quieter times of the day, truck noise is mainly a single-event disturbance because, although the hourly average associated with short, single events is not very high, individual noise peaks of 80 to 85 dBA at 50 feet are common during a truck passage. In noisy environments or during less noise-sensitive hours, truck noise would be perceived as a part of the total noise environment rather than as an individual disturbance. It is important to note that haul truck volumes associated with the WSIP projects would vary from day to day, with the highest volumes generally occurring during the excavation, concrete placement, and backfilling stages of construction. When haul truck noise is considered on an hourly basis rather than as a single noise event, noise levels generated by hourly truck volumes of 80 trucks per hour or more would exceed the 70-dBA speech interference criterion at 50 feet. Any truck volume greater than 1 truck per hour would exceed the 50-dBA sleep interference criterion at 50 feet. At greater distances, higher hourly truck volumes could occur without exceeding these criteria. For example, hourly truck volumes of up to approximately 10 trucks per hour could occur at distances of approximately 200 feet or more from a receptor while not exceeding the 50-dBA sleep interference criterion.

The hours for hauling excavated materials and for deliveries have not yet been specified for several of the WSIP projects that are still under development; however, the SFPUC has indicated that truck operations could occur beyond noise ordinance time limits.

San Joaquin Region

Impact 4.10-2: Temporary noise disturbance along construction haul routes		
Advanced Disinfection	SJ-1	PSU
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSU
SJPL Rehabilitation	SJ-4	PSU
Tesla Portal Disinfection	SJ-5	PSU

Within the San Joaquin Region, access to most of the WSIP facility sites is provided by rural roadways, highways, or freeways. Depending on where pipeline rehabilitation would occur along the existing pipeline alignment, haul trucks associated with the SJPL Rehabilitation project (SJ-4) might have to use residential streets in Modesto or Riverbank to access the pipeline. For the Advanced Disinfection (SJ-1), SJPL System (SJ-3), SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5) projects, haul trucks would use Chrisman and Vernalis Roads to access Tesla Portal from I-580, and residential receptors along this route could be subject to noise increases from haul truck and delivery traffic. Potential haul truck noise impacts would be evaluated in more detail as part of separate, project-level CEQA review these projects. In general, if residences could be set back 50 feet or less along haul routes and any nighttime truck operations exceeded 1 truck per hour, truck noise levels could exceed the sleep interference criterion. It is possible that limiting hourly truck volumes to the daytime hours (Measure 4.10-2a) and restricting nighttime truck operations (Measure 4.10-2b) could reduce this impact to a less-than-significant level. However, since haul routes, truck volumes, and hours of truck operations are undetermined for these projects, potential noise impacts on any residential receptors located along haul routes for these four projects are conservatively considered to be *potentially significant and unavoidable*.

Haul routes to and from the Lawrence Livermore (SJ-2) project site are not located near sensitive receptors, so this impact would *not apply*.

Sunol Valley Region

Impact 4.10-2: Temporary noise disturbance along construction haul routes		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

The haul routes for most of the projects in this region would be Calaveras Road and I-680 in Sunol Valley. There is one private residence (located approximately 2,000 feet from Calaveras Road and possibly as close as 1,000 feet from the proposed tunnel portal associated with the New Irvington Tunnel project, SV-4). There is also one SFPUC Land

Manager's residence that is located approximately 200 feet from Calaveras Road, but its location uphill of this road allows topography to provide additional noise attenuation. To the south of the Sunol Valley, there are a few private residences located in Calaveras Valley at the south end of Calaveras Reservoir, more than approximately 3,000 feet from possible haul routes. With such large setback distances and expected average hourly volumes of up to 12 trucks per hour for each project, it is unlikely that noise generated by haul and delivery trucks along Calaveras Road would exceed speech or sleep interference criteria at these receptors. Therefore, this impact would be *less than significant* for all projects in this region: Alameda Creek Fishery (SV-1), Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), Treated Water Reservoirs (SV-5), and SABUP (SV-6).

The Irvington Tunnel project (SV-4) would generate substantially higher haul and delivery truck volumes than other WSIP projects in this region. Expected average hourly volumes of up to 36 trucks per hour would generate noise levels along the access road and Calaveras Road that would not exceed the speech interference criterion, but could exceed the sleep interference criterion at the SFPUC Land Manager's residence, a *potentially significant* impact. Implementation of Measure 4.10-2c, requiring this residence to be vacated during construction of this project, would reduce this impact to a less-than-significant level. Truck-related noise levels along these two roads is not expected to exceed the 50-dBA sleep interference criterion at the private residence to the south, but truck noise could increase ambient noise levels in the vicinity of this residence, which would be noticeable.

Bay Division Region

Impact 4.10-2: Temporary noise disturbance along construction haul routes		
BDPL Reliability Upgrade	BD-1	PSU
BDPL 3 and 4 Crossovers	BD-2	PSU
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSU

Since the majority of this region is urbanized and many of the WSIP projects are located in or near residential neighborhoods and schools, haul routes for most WSIP projects in this region could adversely affect sensitive receptors. Construction of the BDPL Reliability Upgrade project (BD-1) would expose the greatest number of residential and school receptors to noticeable noise increases due to haul truck traffic; these increases could be potentially significant if residential streets were used as haul routes. Haul routes for the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault projects could also affect residential streets. Potential haul truck noise impacts would be evaluated in more detail as part of separate, project-level CEQA review for all projects in this region. In general, residences are set back less than 50 feet from most residential streets in this region, and any nighttime truck operations greater than 1 truck per hour could exceed the sleep interference criterion. It is possible that limiting hourly truck volumes during the day (Measure 4.10-2a) and restricting nighttime truck operations (Measure 4.10-2b) could reduce this impact to a less-than-significant level. However, since haul routes, truck volumes, and hours of truck operations are undetermined for these projects, potential noise impacts on any residential receptors located along haul routes for all projects in this region are conservatively considered to be *potentially significant and unavoidable*.

Peninsula Region

Impact 4.10-2: Temporary noise disturbance along construction haul routes		
Baden and San Pedro Valve Lots	PN-1	PSU
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	PSU
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Three of the five WSIP projects in this region would be located primarily on the west side of I-280 (CS/SA Transmission, PN-2; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5), so haul routes to the I-280 freeway would likely be more than 225 feet from the closest residential receptors. With such large setback distances, it is unlikely that noise generated by haul and delivery trucks along haul routes would exceed speech or sleep interference criteria at the closest receptors, and noise impacts would be *less than significant*.

The remaining two projects in this region (Baden and San Pedro Valve Lots, PN-1 and HTWTP Long-Term, PN-3) would involve construction sites located in or near residential neighborhoods or schools. Noise increases associated with haul and delivery truck traffic could adversely affect sensitive receptors along these routes. In general, residences are set back less than 50 feet from most residential streets in these two neighborhoods, and any nighttime truck operations greater than 1 truck per hour could exceed the sleep interference criterion. It is possible that limiting hourly truck volumes during the day (Measure 4.10-2a) and restricting nighttime truck operations (Measure 4.10-2b) could reduce this impact to a less-than-significant level. However, since haul routes, truck volumes, and hours of truck operations are undetermined for these projects, potential noise impacts on any residential receptors located along haul routes for these two projects are conservatively considered to be *potentially significant and unavoidable*.

San Francisco Region

Impact 4.10-2: Temporary noise disturbance along construction haul routes		
SAPL 3 Installation	SF-1	PSU
Groundwater Projects	SF-2	PSU
Recycled Water Projects	SF-3	PSU

All of the WSIP projects in this region would be located near or adjacent to noise-sensitive receptors, and noise increases associated with haul and delivery truck traffic could adversely affect sensitive receptors along haul truck routes. In general, residences along most streets where project facilities would be located are set back less than 50 feet, and any nighttime truck operations greater than 1 truck per hour could exceed the sleep interference criterion. It is possible that limiting hourly truck volumes during the day (Measure 4.10-2a) and restricting nighttime truck operations (Measure 4.10-2b) could reduce this impact to a less-than-significant level. However, since haul routes, truck volumes, and hours of truck operations are undetermined for these projects, potential noise impacts on any residential receptors located along haul routes for these two projects are conservatively considered to be *potentially significant and unavoidable*.

Impact 4.10-3: Disturbance due to construction-related vibration.

Construction of WSIP facilities could cause vibration that could disturb local residents and cause cosmetic damage to buildings and structures. The second significance criterion above identifies "excessive groundborne vibration" as a significance impact. For this programmatic analysis, the following criteria were used to determine the significance of construction-related vibration effects:

- The potential for building damage, including cosmetic damage
- The exposure of people to vibration in terms of sleep disturbance or interruption of normal living activity

In general, cosmetic or threshold damage to residential buildings can occur at vibrations over 0.5 in/sec PPV, and controlled detonations would not generate structural damage if they produce vibrations of less than 0.5 in/sec PPV (measured at the residential building setback line at the ground surface). This level is consistent with the U.S. Bureau of Mines' threshold cracking criteria of 0.5 in/sec PPV for low frequencies and 2.0 in/sec PPV for high frequencies (Wilson, Ihrig & Associates, 2005). Continuous vibration caused by vibratory pile drivers and large vibratory rollers/compactors may cause annoyance, but would not cause structural damage if the continuous vibration were less than 0.2 in/sec PPV (Wilson, Ihrig & Associates, 2005). This level is consistent with the Federal Transit Administration's (U.S. Department of Transportation, Federal Transit Administration, 1995) recommended vibration threshold criterion of 0.2 in/sec for fragile buildings.

Much lower vibration levels (levels exceeding 0.012 in/sec PPV) can cause disturbance or annoyance and this threshold is typically applied to construction activities that occur during the more sensitive nighttime hours. Exceedance of this annoyance threshold during the nighttime hours could result in sleep disturbance, depending on proximity to the receptor.

Based on these criteria, vibration exceeding the following limits would be considered significant:

- Controlled detonations: 0.5 in/sec PPV
- Vibratory equipment and impact pile drivers: 0.2 in/sec PPV
- Activities causing annoyance (pertains to nighttime construction only): 0.012 in/sec PPV

Pipelines and Other Facilities. Table 4.10-5 presents vibration levels that could be expected at distances of 25, 50, and 100 feet from vibration sources and assumes typical construction activities and normal propagation conditions.

A threshold of 0.2 in/sec PPV is appropriate to apply to any construction activities occurring during the daytime hours. Both San Francisco and FTA measurement data presented in Table 4.10-5 demonstrate that vibration levels generated by most types of construction equipment would not exceed the 0.2 in/sec PPV threshold for continuous vibration at a distance of 25 feet, while pile-driving activities could exceed this threshold within approximately 50 feet. Impact pile-driving activities could exceed this threshold if it occurs closer than 100 feet from a receptor.

TABLE 4.10-5
VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT AT 25, 50, AND 100 FEET

	Peak Particle Velocity (PPV)		
Equipment[a]	**PPV at 25 Feet (in/sec)**	**PPV at 50 Feet (in/sec)**	**PPV at 100 Feet (in/sec)**
Pile Driver (Impact) – Upper Range	1.518	0.537	0.190
Pile Driver (Impact) – Typical	0.644	0.228	0.081
Pile Driver (Sonic) – Upper Range	0.734	0.260	0.092
Pile Driver (Sonic) – Typical	0.170	0.060	0.021
Clam Shovel Drop (Slurry Wall)	0.202	0.071	0.025
Large Bulldozer	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Jackhammer	0.035	0.012	0.004
Small Bulldozer	0.003	0.001	0.000

NOTES: Vibration levels for construction equipment at 25 feet are based on measured data near various types of equipment and assume normal propagation conditions. The following propagation adjustment was applied to estimate vibration levels at 50 and 100 feet:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

where:
PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance
PPV (ref) is the reference vibration levels in in/sec at 25 feet as listed above
D is the distance from the equipment to the receiver.

It should be noted that vibration propagation characteristics would depend on a number of factors, including the type and condition of geologic materials, depth of construction, and type of construction equipment and activity.

SOURCE: U.S. Department of Transportation Federal Transit Administration, 1995.

For any nighttime construction activities, it is more appropriate to apply the annoyance threshold of 0.012 in/sec PPV. Table 4.10-5 indicates that operation of most types of construction equipment at distances within 50 to 100 feet from a receptor could exceed the annoyance threshold.

Excavation activities associated with facility construction (including clearwells at treatment plants, reservoirs, and pipelines) could require sheetpile driving for shoring, which could generate perceptible vibration levels. Although vibration potential from sheetpile driving as well as other construction activities would depend on soil type and proximity to receptors, the measurements presented in Table 4.10-5 demonstrate that construction equipment can generate a wide range of vibration levels (0.003 to 1.518 in/sec, PPV at 25 feet) and can be operated in a manner that minimizes the potential for structural damage at the closest residential receptors. Measurements collected during various excavation-related construction activities (including pavement breaking, vibratory sheetpile driving, sheetpile driving by an excavator shovel, vibratory soil compaction, and earth excavation) at an unrelated project in San Francisco determined that vibration levels ranged between 0.03 to 0.38 in/sec PPV at 30 to 35 feet (ESA, 1997). When compared to vibration data presented in this table, vibration levels for sheetpile driving would be less than for pile driving (impact or sonic), but greater than levels generated by other types of construction equipment such as bulldozers, trucks, and jackhammers.

It is possible that vibration would be perceptible and could temporarily annoy the closest residents during construction of some of the WSIP projects, particularly if impact pile driving or sheetpile driving occurs. In many of the jurisdictions where WSIP projects are located, code requirements would limit vibration levels at the property line to the vibration perception threshold. Although it might not be feasible to maintain vibration levels below the perception threshold level at all receptors (even with mitigation measures), the limited duration of exposure at a given sensitive receptor[3] and restriction of construction activities to the daytime hours could help reduce such vibration annoyance effects to a less-than-significant level.

Tunnels. The primary sources of vibration associated with tunnel construction would include heavy construction equipment (e.g., bulldozers, vibratory compaction equipment, impact breakers) and mining equipment (e.g., a roadheader or a tunnel boring machine), tunnel train operations, and controlled detonations. Measurements for an unrelated tunnel project indicate that a roadheader can produce vibration levels of 0.0015 to 0.0022 in/sec PPV at 100 feet, while a tunnel train (operating at an estimated 10 miles per hour) can produce vibration levels of 0.0004 to 0.0008 in/sec PPV at 100 feet (ESA, 2003). Since tunnel construction would occur 24 hours per day, there would be a potential for annoyance, particularly during the nighttime hours. So, the lower 0.012 in/sec PPV annoyance threshold is applied as a significance threshold for tunnel construction. The potential for annoyance due to vibration would depend on the strength of rock encountered and the depth of the tunnel below ground. If receptors are located 100 feet or more from the proposed tunnel, vibration levels associated with operating tunneling equipment would likely remain below the 0.012 in/sec PPV threshold level for noticeability or annoyance.

Controlled detonations, which are produced by blasting techniques involving explosives, can be more noticeable to the public than mechanical excavation because of the intermittent, higher level noise and vibrations caused by blasting activities. Controlled detonation is performed by drilling holes in the rock face of a tunnel excavation and packing the holes with small amounts of explosive and primer. The explosives are detonated in one hole at a time, using a time delay between successive detonations; delay periods often range from 10 to 100 milliseconds, with the entire detonation event lasting no more than a few seconds. Detonations typically occur infrequently (once or twice per day), and the vibration produced by such detonations can be controlled by the delay time and the charge per delay (the amount of explosive per delay in each hole) so that cosmetic or structural damage does not occur. With vibration controls (Measures 4.10-3a and 4.10-1a), vibration levels generated by controlled detonations would be restricted so as not to cause cosmetic or structural damage, while the hours when controlled detonations could occur would be limited to the daytime hours.

[3] It is anticipated that pipeline construction would progress along an alignment (rather than persisting at one location) at a rate of approximately 120 to 160 feet per day, so that any given sensitive receptor would typically be subject to construction vibration for about two weeks.

San Joaquin Region

Impact 4.10-3: Disturbance due to construction-related vibration		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSU
SJPL Rehabilitation	SJ-4	PSU
Tesla Portal Disinfection	SJ-5	LS

Pipeline construction for the SJPL System project (SJ-3) would require sheetpile driving to shore the pipeline trench, and pipeline-related vibration effects, as described above, could occur at residences located along the western pipeline segment near Tesla Portal or near crossover facilities. It is possible that rehabilitation of the existing San Joaquin Pipeline under the SJPL Rehabilitation project (SJ-4) would also require sheetpile driving for shoring. Since residences could be located as close as approximately 50 feet from the SJPL System alignment and 25 feet from the SJPL Rehabilitation project (depending on what pipeline segments were rehabilitated), vibration associated with sheetpile driving would be potentially significant. Implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce this potential impact to a less-than-significant level. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. The potential for vibration effects would be evaluated in more detail as part of separate, project-level CEQA review for these projects.

Vibration could result if sheetpile driving is required to shore any excavations associated with proposed facilities at Tesla Portal for the Advanced Disinfection and Tesla Portal Disinfection projects (SJ-1 and SJ-5) or at Thomas Shaft for the Lawrence Livermore project (SJ-2); however, there are no sensitive receptors adjacent to these locations. Therefore, vibrations effects associated with construction of these projects would be *less than significant*.

Sunol Valley Region

Impact 4.10-3: Disturbance due to construction-related vibration		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	PSU
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

There is one private residence and one SFPUC Land Manager’s residence in the Sunol Valley Region, and construction activities associated with all but one of the WSIP projects in this region would be located more than 300 feet from these residences (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; SVWTP – Treated Water Reservoirs, SV-5; and SABUP, SV-6). At distances over 100 feet, construction-related vibration effects would be *less than significant*. The only WSIP component in this region that could be implemented within 300 feet of the Sunol Valley residence is the pipeline proposed to extend from the Sunol Valley WTP to the Irvington Tunnel or Alameda Siphons under the 40-mgd Treated Water project (SV-3). If this pipeline passed within 100 feet of this residence, pipeline-related construction vibration impacts, as described above, could occur at this residence. However, it is unlikely that this pipeline alignment would pass that close to the residence. While vibration effects on this residence are expected to be less than significant if located more than 100 feet from this residence, for purposes of this analysis, this impact is considered potentially significant (since distance is currently undetermined), but could be reduced to a less-than-significant level with vibration controls (Measures 4.10-3a and 4.10-3b). However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of this residence, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. The potential for vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review for the 40-mgd Treated Water project, once the specific pipeline location has been determined.

The New Irvington Tunnel project (SV-4) exit portal would be located near residential receptors in Fremont, and tunnel-related construction activities would be located as close as approximately 200 to 300 feet from the nearest receptors, depending on location of staging areas, etc. At distances of 100 feet or greater, potential tunnel-related vibration effects would likely remain below the annoyance threshold and therefore, would be less than significant. Potential vibration and noise disturbance associated with tunnel-related controlled detonation activities would be *potentially significant* but reduced to a less-than-significant level by restricting these activities to the daytime hours (Measure 4.10-1a) and limiting charges to ensure that vibration does not cause cosmetic or structural damage (Measure 4.10-3a). However, potential vibration effects associated with this project would be evaluated in more detail as part of separate, project-level CEQA review to identify potential vibration impacts and ensure that impacts are adequately mitigated.

Bay Division Region

Impact 4.10-3: Disturbance due to construction-related vibration		
BDPL Reliability Upgrade	BD-1	PSU
BDPL 3 and 4 Crossovers	BD-2	PSU
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSU

Pipeline construction for the BDPL Reliability Upgrade project (BD-1) would require sheetpile driving to shore the pipeline trench, and pipeline-related vibration effects, as described above, could occur at residences and other structures located within 100 feet of the pipeline alignment; some residences are located as close as 10 to 25 feet from pipeline construction. Tunnel-related vibration could also occur if pile driving is required, although the proposed setbacks of 900 feet or more from the closest residential structures would minimize the potential for tunnel-related vibration impacts. Implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce this potential impact to a less-than-significant level. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. Potential vibration and noise disturbance associated with tunnel-related controlled detonation activities would be potentially significant but reduced to a less-than-significant level by restricting these activities to the daytime hours (Measure 4.10-3c) and limiting charges to ensure that vibration does not cause cosmetic or structural damage

(Measure 4.10-3a). Potential vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review.

Vibration could also result if sheetpile driving is required to shore any excavations associated with the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects. Adverse vibration effects could result if sensitive receptors are located within 100 feet of construction. Implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce potentially significant vibration effects to a less-than-significant level at adjacent or nearby sensitive receptors. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that sleep disturbance or annoyance could occur and therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. Potential vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review.

Peninsula Region

Impact 4.10-3: Disturbance due to construction-related vibration		
Baden and San Pedro Valve Lots	PN-1	PSU
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

The Baden and San Pedro Valve Lots project (PN-1) would be located at the existing Baden and San Pedro Valve Lots in South San Francisco and Daly City, and proposed facilities would be located in proximity to existing adjacent structures. Vibration impacts could result if sheetpile driving is required within 100 feet of an existing sensitive receptor to shore any excavations associated with these projects. Implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce this potential impact to a less-than-significant level. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. Potential vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review.

Improvements at the Harry Tracy WTP (HTWTP Long-Term, PN-3) could generate vibration if sheetpile driving is required to shore any excavations associated with this project. However, sensitive receptors are located 300 to 500 feet from the closest receptors, which reduces the potential for annoyance due to vibration. At this distance, vibration effects would be *less than significant*.

The remaining three WSIP projects in this region (CS/SA Transmission, PN-2; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5) would be located in the vicinity of the Crystal Springs Reservoirs, west of and across I-280 from the westernmost residential neighborhoods in Belmont, Hillsborough, Millbrae, and unincorporated areas of San Mateo County. Since the closest residential receptors would be located over 1,000 feet east of these three projects (and across a freeway), potential vibration impacts would be *less than significant*.

San Francisco Region

Impact 4.10-3: Disturbance due to construction-related vibration		
SAPL 3 Installation	SF-1	PSU
Groundwater Projects	SF-2	PSU
Recycled Water Projects	SF-3	PSU

Pipeline construction for the SAPL 3 Installation project (SF-1) could require sheetpile driving to shore the pipeline trenches or pipeline-related facilities (e.g., jack-and-bore pits), and pipeline-related vibration effects, as described above, could occur at residences and other structures located along the pipeline alignment. Due to the close proximity of sensitive receptors to sections of this pipeline alignment (potentially less than 25 feet on some residential streets), vibration effects could be perceptible and therefore potentially significant. Implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce this potential impact to a less-than-significant level. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. Potential vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review.

Vibration could also result if sheetpile driving is required to shore any excavations associated with the Groundwater Projects (SF-2) and Recycled Water Projects (SF-3). Potentially significant vibration effects could result if there are any sensitive receptors located within 100 feet of proposed facilities, and implementation of vibration controls (Measures 4.10-3a and 4.10-3b) would reduce this potential impact to a less-than-significant level. However, if any construction activities were to generate vibration during the nighttime hours and within 100 feet of a receptor, it is possible that these measures could not reduce vibration levels sufficiently and sleep disturbance or annoyance could occur; therefore, this analysis conservatively considers this impact to be *potentially significant and unavoidable*. Potential vibration impacts would be evaluated in more detail as part of separate, project-level CEQA review.

Operational Impacts

Long-Term Noise Increases

Impact 4.10-4: Disturbance due to long-term noise increases associated with operation of project facilities.

Operation of some of the WSIP facilities would result in long-term noise increases. The primary sources of noise associated with facility operation are pumps and electrical facilities (substations, transformers, and emergency generators). Such noise sources are most often associated with water treatment plants and pumping plants. The degree of impact would vary with each project and would depend on pump sizes, transformer sizes, proximity to sensitive receptors, and the extent of noise attenuation incorporated into the facility design.

For operational noise, a substantial noise increase (as stated in the first significance criterion) can be defined by whether operational noise levels are within local ordinance noise limits (see Table 4.10-2). Operational noise levels would be estimated as part of separate, project-level CEQA review for those facilities, and the potential for operational noise impacts would be assessed at that time. Potential impacts would depend on existing ambient noise levels in the project vicinities, proposed facility design, and pertinent ordinance noise limits.

Pump Stations. Operation of some WSIP facilities would include new pump stations or upgrades of existing pump stations. The primary sources of noise associated with pump stations are pumps and electrical facilities (substations, transformers, and emergency generators). As indicated in Table 4.10-4, a pump (not enclosed) typically generates noise levels of 76 dBA at 50 feet. Noise levels associated with pump stations would depend on four factors: (1) characteristics of the noise source (e.g., technology type, rated horsepower, revolutions per minute, presence or absence of pure tones, directional characteristics of the noise source, presence or absence of acoustical design features); (2) the number of noise sources clustered together; (3) the type and effectiveness of the building enclosure; and (4) operational characteristics (steady 24-hour operation, intermittent operation, variable settings at different times, etc.). Typical noise levels associated with pump stations are as follows:

- Pumps (enclosed with baffled vents): 45 to 60 dBA (Leq) at 50 feet, depending on the number and sizes of pumps (based on noise measurements collected at various pump stations)
- Transformers: 50 to 70 dBA at 50 feet, depending on the size and number (NEMA, 1994)

Treatment Facilities. Treatment facilities typically include basins, filters, and drains, which would not be major sources of noise. Noise generated by water flowing through pipes or drains would be limited to areas in the vicinity of openings or vents; since noise levels from flowing water would generally be less than ambient noise levels, these facilities would not increase noise levels beyond the treatment plant boundaries. Chemical feed systems typically operate with very small pumps and are enclosed; therefore, they typically do not affect ambient noise levels. However, if pumping facilities are located within the treatment facility, noise from pumping facilities would be a principal source of operational noise.

Storage Facilities. Storage facilities include reservoirs or basins, which are typically located entirely or partially below grade. These facilities are sometimes filled by gravity flow, although pumping facilities can be required to fill basins or reservoirs. For the WSIP, major pumping systems are considered separately when they are located at different locations (e.g., the San Antonio Pump Station is considered separate from Calaveras Dam or Sunol Valley WTP). Noise sources within these facilities could include internal pumping systems, filters, chemical feed systems, piping, valves, and electrical and instrumentation facilities. Since this equipment is typically enclosed within the facility, it does not contribute significantly to the surrounding ambient noise environment.

Pipelines, Tunnels, and Crossovers. Operation of pipelines, tunnels, crossovers, or storage facilities would not generate noise. Pipelines, tunnels, and crossovers would be located underground and/or enclosed, and these facilities generally do not include any noise-generating equipment. While there could be electrical facilities associated with some of these facilities, they are generally housed within control buildings, and these enclosed facilities are not a major source of noise.

Vaults and Valve Lots. Vaults are structures (typically concrete) that are normally partially underground and enclosed either by hatch covers or valve house buildings. Various piping and valves are located within these vaults, and the valves allow operators to control water flows through the system. Since valves are typically electric-powered, standby power must be provided so they remain operational at all times, even during power outages. Other than emergency generators, there are no major noise sources (e.g., motors, pumps, transformers) associated with these facilities.

Standby Power. WSIP implementation would include provision of standby power (propane- or diesel-fueled emergency generators) at a number of existing, proposed, and upgraded facilities to keep facilities operating during power outages, thereby reducing the potential for interruption of supply to customers. Standby power, which could be provided by permanent or portable emergency generators, is proposed at various treatment facilities, pump stations, wells, vaults, and valve lots. Emergency generators typically generate noise levels of 85 dBA at 50 feet (see Table 4.10-4). An enclosure with baffled vents for permanent standby generators could reduce generator noise by 25 to 30 dBA. These generators would be used infrequently (only during power outages and for periodic testing during the day).

San Joaquin Region

Impact 4.10-4: Disturbance due to long-term noise increases		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	LS

Primary sources of operational noise within this region would be standby power facilities associated with the SJPL System project (SJ-3, if required for valve house, crossovers, or possible pump station) and the Tesla Portal Disinfection project (SJ-5). Transformers or substations for power generation would also be a source of operational noise associated with the Advanced Disinfection project (SJ-1). The degree of impact would depend on the locations and designs of these facilities (e.g., proximity of sensitive receptors, use of enclosures or sound barriers). Given the rural or undeveloped nature of the areas surrounding these facility sites and the distance to the closest sensitive receptors, it is expected that operational noise could be maintained at acceptable levels (within local ordinance limits) through appropriate location and design (enclosure if necessary). Standby power facilities would be operated infrequently (only during power outages and for periodic testing during the day), limiting the potential for significant noise impacts. Enclosure of these facilities typically reduces potential impacts to a less-than-significant level. With implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible), potential noise impacts on any affected residential receptors would be *less than significant* for these three projects. However, it should be noted that the location of power facilities for the SJPL System project have not been determined, potential operational noise impacts would be evaluated in more detail as part of separate, project-level CEQA review for this project to define design measures needed to ensure operational noise levels are maintained at acceptable levels.

The Lawrence Livermore project (SJ-2) is not located near any noise sensitive land uses; therefore, noise associated with any Lawrence Livermore facilities would be *less than significant*. No facilities under the SJPL Rehabilitation project (SJ-4) would generate noise; therefore, this impact would *not apply* to this project.

Sunol Valley Region

Impact 4.10-4: Disturbance due to long-term noise increases		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	N/A

Potential increases in operational noise in the Sunol Valley Region could occur as a result of new pumping facilities possibly associated with the Alameda Creek Fishery project (SV-1); new pumping facilities at the Sunol Valley WTP for filter backwashing, chemical feed, etc. proposed under the 40-mgd Treated Water and Treated Water Reservoirs projects (SV-3 and SV-5); and electrical supply upgrades associated with the 40-mgd Treated Water project (SV-3). The possible provision of additional standby power facilities at a new Alameda East Portal (under New Irvington Tunnel, SV-4) would also introduce a new source of noise (emergency generators) during periodic daytime testing and power outages. The SFPUC Land Manager's residence is located approximately 300 feet north of the Alameda East Portal, while a private residence is located about a half mile to the west. With implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible), potential noise impacts on these residential receptors would be *less than significant.* Given the distance between noise sources and residential receptors, it is expected that operational noise could be maintained at acceptable levels (within local ordinance limits) through appropriate location and design (including enclosure, if necessary).

The Calaveras Dam (SV-2) and SABUP (SV-5) projects would essentially have no operational noise, and this impact would *not apply*.

Bay Division Region

Impact 4.10-4: Disturbance due to long-term noise increases		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

Operational noise increases within this region would be associated with standby power for the BDPL Reliability Upgrade project (BD-1). Since these facilities could be located near noise-sensitive receptors, there would be a potential for operational noise impacts. However, operational noise sources would be limited to backup power systems, including emergency generators, which would operate only during power outages and for periodic daytime testing. With implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible), potential noise impacts would be *less than significant,* given the limited noise sources associated with operation of this project. Potential operational noise impacts would be evaluated in more detail as part of separate, project-level CEQA review for the BDPL Reliability Upgrade project to define design measures needed to minimize noise levels during emergency and testing conditions.

The BDPL 3 and 4 Crossovers project (BD-2) would consist of crossovers and valves, partially underground and enclosed; these facilities would not generate noise. Similarly, the BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) project, as a pipeline project, would not generate operational noise. Therefore, this impact would *not apply* to these two projects.

Peninsula Region

Impact 4.10-4: Disturbance due to long-term noise increases		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission Upgrade	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	LS

Primary sources of operational noise within this region would be upgrades to existing pumping facilities (CS/SA Transmission, PN-2, and HTWTP Long-Term, PN-3), and possible electrical upgrades at the Harry Tracy WTP. The Baden and San Pedro Valve Lots project (PN-1) would consist of valves located partially underground and enclosed. Residential or school receptors are located near the HTWTP Long-Term (PN-3) and Baden Valve Lot projects. Proposed facilities at the Baden Valve Lot would also have a limited potential for noise impacts since the facilities would be enclosed. With implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible), potential noise impacts on these residential receptors would be *less than significant,* given the setback distances between sources and receptors or the limited noise potential associated with operation of proposed facilities. Potential operational noise impacts would be evaluated in more detail as part of separate, project-level CEQA review for these three projects to define design measures needed to ensure operational noise levels are maintained at acceptable levels.

Potential operational noise increases resulting from the provision of new chemical feed systems at the Pulgas Balancing Reservoir (PN-5) would be *less than significant* due to the absence of sensitive receptors in this vicinity and the small size of pumps that are typically associated with such facilities.

The Lower Crystal Springs Dam (PN-4) project would not generate operational noise, and operational noise impacts are *not applicable* to this project.

San Francisco Region

Impact 4.10-4: Disturbance due to long-term noise increases		
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Potential increases in operational noise in the San Francisco Region would be associated with wells for the Groundwater Projects (SF-2), the pumping facility for the Recycled Water Projects (SF-3), and standby power (under both the Groundwater and Recycled Water Projects). Potential impacts associated with standby power would be limited, since emergency generators would only operate during periodic daytime testing and power outages. Enclosure of these facilities typically reduces potential impacts to a less-than-significant level. With implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible), potential noise impacts would be *less than significant*. However, it should be noted that the location of these facilities have not yet been determined, and potential operational noise impacts would be evaluated in more detail as part of separate, project-level CEQA review for both the Groundwater and Recycled Water Projects to define design measures needed to ensure operational noise levels are maintained at acceptable levels.

Pipelines under the SAPL 3 Installation (SF-1) project would not generate operational noise. This impact would *not apply* to this project.

4.10.4 References – Noise and Vibration

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4.11 Public Services and Utilities

4.11 Public Services and Utilities

This section addresses potential impacts on public services and utilities that could occur as a result of implementation of the WSIP projects. This analysis is conducted on a program level, and each WSIP project would be subject to separate, project-level CEQA review. Public utilities discussed in this section include water, natural gas, and electricity conveyance facilities. Public services addressed in this section include law enforcement services, fire protection services, and solid waste disposal. Potential impacts on emergency response or access (i.e., disruption of emergency services due to access restrictions) are addressed in Section 4.8, Traffic, Transportation, and Circulation, and potential energy and power issues are addressed in Section 4.15, Energy Resources. Projects implemented under the WSIP that would affect school facilities are addressed in Section 4.3, Land Use and Visual Quality.

This section discusses the county and city jurisdictions where WSIP project construction would occur, or those within close proximity. Potential secondary or indirect impacts on utilities and public services that could occur as a result of population growth attributed to the WSIP projects are presented in Chapter 7.

4.11.1 Setting

The SFPUC regional water system consists of a network of facilities covering a geographic range of approximately 170 miles across central California, from the Sierra Nevada on the east to San Francisco on the west. WSIP projects are proposed within or in close proximity to the jurisdictional boundaries of the following seven counties: Alameda, San Francisco, San Joaquin, San Mateo, Santa Clara, Stanislaus, and Tuolumne. Project construction would occur in 27 cities within these counties. A detailed description of the SFPUC regional system, including facilities, locations, and operations, is provided in Chapter 3.

Water Service

The SFPUC provides water delivery services to retail and wholesale customers, primarily in San Francisco, San Mateo, Santa Clara, and Alameda Counties. The SFPUC serves about one-third of its water supplies directly to retail customers in San Francisco, and about two-thirds of its water supplies to 27 wholesale customers by contractual agreement. The wholesale customers consist of 25 cities and water districts and two private utilities in San Mateo, Santa Clara, and Alameda Counties, represented by the Bay Area Water Supply and Conservation Agency (BAWSCA). Some of these customers have sources of water in addition to what they receive from the SFPUC regional system. The SFPUC also provides service to some isolated regional retail customers along the water system, including customers in Tuolumne County. Chapter 3 provides detailed information regarding the SFPUC's overall water supply service.

Table 4.11-1 lists the major regional system customers and indicates the wholesale customers that have available water supplies from sources other than the SFPUC.

TABLE 4.11-1
SFPUC REGIONAL WATER SYSTEM CUSTOMERS

Wholesale Regional Customers[a] (BAWSCA Members)		
Peninsula	**South Bay**	**Other Major Customers**
California Water Service Company (South San Francisco* and Mid-Peninsula)	Alameda County Water District*	City and County of San Francisco
City of Brisbane	Mid-Peninsula Water District	Presidio Trust*
Guadalupe Valley Municipal Improvement District	California Water Service Company (Bear Gulch)*	San Francisco County Jail (San Bruno)
City of Burlingame	City of Hayward	San Francisco International Airport (San Mateo County)
City of Daly City*	City of Menlo Park*	Lawrence Livermore National Laboratory (Site 200/300)
City of Millbrae	City of Milpitas*	National Aeronautics and Space Administration (Santa Clara County)
City of San Bruno*	City of Mountain View*	Town of Sunol (Alameda County)
Coastside County Water District*	City of Palo Alto*	Groveland Community Services District (Tuolumne County)
Estero Municipal Improvement District (Foster City)	City Redwood City*	
North Coast County Water District	City of San Jose (North San Jose Service Area)*	
Town of Hillsborough	City of Sunnyvale*	
Westborough County Water District	City of Santa Clara*	
	City of East Palo Alto	
	Purissima Hills Water District	
	Skyline County Water District	
	Stanford University*	

* Indicates customers that currently receive additional water supplies from sources other than the SFPUC.

[a] Not shown on the table because they are not a BAWSCA member, the Cordilleras Mutual Water Association is also a wholesale customer receiving water from the SFPUC. It is a small water association serving 18 single-family homes located in San Mateo County.

SOURCES: CDM, 2005; URS, 2004a.

Natural Gas

Natural gas customers in California, including the WSIP study area, are served by a network of regional natural gas pipelines that traverse the state, crossing the state line to the southeast via San Bernardino and Riverside Counties, or to the north via Modoc County. Within northern California, natural gas pipelines are primarily owned by Pacific Gas and Electric Company (PG&E). Additional natural gas pipelines in the state are owned by Southern California Gas, San Diego Gas and Electric Company (SDG&E), Kern/Mojave, and other utility providers. Regional pipelines generally range from 2 to 42 inches in diameter. Large natural gas pipelines (33 to 42 inches in diameter), of which there are four, travel through much of the state.

PG&E owns the regional natural gas pipelines in the WSIP study area. PG&E operates natural gas and electrical transmission lines in two corridors west of the Calaveras Reservoir, and three high-pressure natural gas transmission lines in the San Antonio Valley, which is located along the Diablo Range in eastern Santa Clara County on the border of Alameda and Stanislaus Counties (SFPUC, 2001). The diameters of regional pipelines within proximity or traveling through proposed WSIP construction areas vary widely, from 2 and 42 inches (California Energy Commission, 2007a).

Petroleum

California is a major refining center for petroleum markets on the West Coast, with a combined crude oil distillation capacity of more than 1.9 million barrels per day, ranking the state third highest in the nation. California petroleum refineries are located in the San Francisco Bay Area, the Los Angeles area, and the Central Valley. A large network of crude oil pipelines connects producing areas with the major ports in Northern and Southern California. These ports receive Alaska North Slope and foreign crude oil for processing in many of the state's 21 refineries (California Energy Commission, 2007b).

The Chevron Pipeline Company operates a pipeline in the WSIP study area for the transport of refined petroleum products. The pipeline travels through the San Antonio Reservoir watershed, which is within the Alameda Creek watershed, and then crosses Alameda Creek in the Sunol Valley, for a distance of about eight miles within the Alameda watershed (SFPUC, 2001).

Electricity

A number of regional electricity transmission lines with varying levels of capacity serve the state's electricity demand. Most of California's electricity transmission lines, not including distribution lines, are owned by PG&E (approximately 58 percent of the state's transmission line mileage). Other transmission line owners in the state include Southern California Edison, SDG&E, municipal utilities, and the Western Area Power Administration.

Generally, PG&E provides electricity in the WSIP study area and also operates electrical transmission lines in two corridors west of Calaveras Reservoir (SFPUC, 2001). The Modesto and Turlock Irrigation Districts also serve Stanislaus County, while some customers choose to maintain contracts with independent power generators. Through the seven counties where WSIP project construction could occur, regional electricity transmission lines have capacities of 110 to 161 kilovolts, and 220 to 287 kilovolts (California Energy Commission, 2007a).

Law Enforcement Services

Law enforcement services in the WSIP study area are provided by a combination of county sheriff departments as well as citywide police departments (see **Table 4.11-2**). Sheriff departments typically provide law enforcement and jail services within their respective counties. In addition to law enforcement jurisdiction over unincorporated county areas, some sheriff departments, including the Stanislaus, San Joaquin, Alameda, and San Mateo County Sheriff Departments, also provide law enforcement services to certain cities within the county on a contract basis.

**TABLE 4.11-2
LAW ENFORCEMENT AND FIRE PROTECTION SERVICE PROVIDERS
WITHIN THE WSIP STUDY AREA**

Jurisdiction	Law Enforcement Agencies	Fire Protection Service Agencies
Alameda County		
Unincorporated areas including, San Lorenzo and Castro Valley	Alameda County Sheriff's Department	Alameda County Fire Department
	East Bay Regional Park District Police Department	East Bay Regional Park District Fire Department
Newark	Newark Police Department	Newark Fire Department
Fremont	Fremont Police Department	Fremont Fire Department
San Francisco City and County	San Francisco Sheriff's Department and Police Department	San Francisco Fire Department
San Joaquin County		
Unincorporated areas	San Joaquin County Sheriff's Department	Various Fire Districts
Riverbank	Stanislaus County Sheriff's Department	Stanislaus Consolidated Fire Protection District
Modesto	Modesto Police Department	Modesto Fire Department
San Mateo County		
Unincorporated areas	San Mateo County Sheriff's Department	San Mateo County Fire Department
East Palo Alto	East Palo Alto Police Department	Menlo Park Fire District
Menlo Park	Menlo Park Police Department	Menlo Park Fire District
Atherton	Atherton Police Department	Menlo Park Fire District
Redwood City	Redwood City Police Department	Redwood City Fire Department
San Carlos	San Carlos Police Department	Belmont-San Carlos Fire Department
Woodside	Contracted with the San Mateo County Sheriff's Department	Woodside Fire Protection District
San Mateo	San Mateo Police Department	San Mateo Fire Department
Hillsborough	Hillsborough Police Department	Central County Fire Department
Burlingame	Burlingame Police Department	Central County Fire Department
Millbrae	Millbrae Police Department	Millbrae Police Department
San Bruno	San Bruno Police Department	San Bruno Fire Department
South San Francisco	South San Francisco Police Department	South San Francisco Fire Department
Colma	Colma Police Department	Colma Fire Department
Brisbane	Brisbane Police Department	North County Fire Authority
Daly City	Daly City Police Department	North County Fire Authority
Santa Clara County		
Unincorporated areas	Santa Clara County Sheriff's Department	Santa Clara County Fire District
Milpitas	City of Milpitas Police Department	City of Milpitas Fire Department
San Jose	City of San Jose Police Department	City of San Jose Fire Department
Santa Clara	City of Santa Clara Police Department	City of Santa Clara Fire Department
Sunnyvale	Sunnyvale Department of Public Safety	Sunnyvale Department of Public Safety
Mountain View	Mountain View Police Department	Mountain View Fire Department
Los Altos	Los Altos Police Department	Santa Clara County Fire District
Palo Alto	Palo Alto Police Department	Palo Alto Fire Department
Stanislaus County		
Unincorporated areas	Stanislaus County Sheriff's Department	Various Fire Districts
Tuolumne County		
Unincorporated areas	Tuolumne County Sheriff's Department	Tuolumne County Fire Department

SOURCES: See the reference list provided at the end of this section.

Fire Protection Services

Fire protection services in the WSIP study area are provided by a number of agencies, including county fire departments, city fire departments, and fire districts (see Table 4.11-2). A number of the counties also have volunteer fire departments. The California Department of Forestry and Fire Protection (CDF) provides fire protection services for both wildland and residential/commercial areas, in addition to responding to other types of emergencies, ranging from automobile accidents to lost hikers to earthquakes. The CDF is responsible for the protection of over 31 million acres of California's privately owned wildlands and provides emergency services within 36 of California's 58 counties through local government contracts. Within the counties that would be affected by WSIP projects, the CDF has three units: the San Mateo/Santa Cruz Unit, the Santa Clara Unit, and the Tuolumne/Calaveras Unit.

Solid Waste Management

With the exception of San Francisco and Tuolumne Counties, each of the counties within the WSIP study area has active landfills. Active landfills by county include: Alameda County with two landfills (Altamont Landfill and Resource Recovery, and Vasco Road Sanitary Landfill); San Joaquin County with three landfills (Foothill Sanitary Landfill, Forward Landfill, Inc., and North County Landfill); San Mateo County with one landfill (Ox Mountain Sanitary Landfill); Santa Clara County with seven landfills (City of Palo Alto Refuse Disposal Site, Guadalupe Sanitary Landfill, Kirby Canyon Recycling and Disposal Facility, Newby Island Sanitary Landfill, Zanker Material Processing Facility, and Zanker Road Resource Recovery Operations Landfill); and Stanislaus County with two landfills (Bonzi Sanitary Landfill and Fink Road Landfill). The California Integrated Waste Management Board (CIWMB) maintains facility information and waste stream profiles for all counties and jurisdictions in the state (see Table **4.11-3**). The CIWMB, the state entity that administers the California Integrated Waste Management Act (described below), found that these jurisdictions achieved the 50 percent goal or approved their good faith effort to achieve the 50 percent goal[1] for 2002 (CIWMB, 2007a). Jurisdictions within the WSIP study area have prepared and adopted the necessary planning documents to implement the act.

Regulatory Framework

California Public Utilities Commission

The California Constitution vests the California Public Utilities Commission (CPUC) with exclusive power and sole authority to regulate privately owned and investor-owned public utilities. This exclusive power extends to all aspects of the location, design, construction, maintenance, and operation of regulated utility facilities. The CPUC has provisions that require regulated utilities to work closely with local governments and to give due consideration to their concerns.

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1 The California Integrated Waste Management Act of 1989 is discussed under Regulatory Framework.

TABLE 4.11-3
ACTIVE LANDFILLS WITHIN THE WSIP STUDY AREA

Jurisdiction	Total Estimated Permitted Capacity[a] (cubic yards)	Total Estimated Capacity Used[b] (cubic yards)	% Used[b]	Remaining Estimated Capacity[a] (cubic yards)	Remaining Capacity Date[c]	% Remaining Capacity[b]	Closure Date[a]	Waste Types Accepted/Permitted
Alameda County								
Altamont Landfill and Resource Recovery	124,400,000	0	0%	124,400,000	As of 04/12/05	100%	1/1/2025	Asbestos, asbestos friable, ash, construction/demolition, contaminated soil, green materials, industrial, mixed municipal, other designated, tires, shreds
Vasco Road Sanitary Landfill	31,942,205	19,662,340	62%	12,279,865	As of 06/11/01	38%	1/1/2015	Construction/demolition, contaminated soil, green materials, industrial, mixed municipal, other designated
San Francisco City and County								
None								
San Joaquin County								
Foothill Sanitary Landfill	102,000,000	4,100,000	4%	97,900,000	As of 06/01/05	96%	1/1/2054	Agricultural, construction/demolition, industrial, mixed municipal, tires, wood waste
Forward Landfill, Inc	51,040,000	11,008,942	22%	40,031,058	As of 01/01/02	78%	1/1/2020	Agricultural, asbestos, asbestos friable, ash, construction/demolition, contaminated soil, green materials, industrial, mixed municipal, sludge (biosolids), tires, shreds
North County Landfill	17,300,000	4,060,968	23%	13,239,032	As of 09/01/04	77%	1/1/2035	Agricultural, construction/demolition, industrial, metals, mixed municipal, other designated, tires, wood waste
San Mateo County								
Ox Mountain Sanitary Landfill	37,900,000	6,746,148	18%	31,153,852	As of 01/01/00	82%	1/1/2018	Asbestos, construction/demolition, mixed municipal, other designated, sludge (biosolids), tires
Santa Clara County								
City of Palo Alto Refuse Disposal Site	7,758,854	6,969,672	90%	789,182	As of 05/01/05	10%	12/30/2011	Construction/demolition, industrial, mixed municipal
Guadalupe Sanitary Landfill	16,500,000	3,837,211	23%	12,662,789	As of 06/11/01	77%	1/1/2010	Construction/demolition, green materials, industrial, mixed municipal
Kirby Canyon Recycling and Disposal Facility	36,400,000	20,871,507	57%	15,528,493	As of 06/11/01	43%	12/31/2022	Construction/demolition, industrial, tires, green materials, mixed municipal

TABLE 4.11-3 (Continued)
ACTIVE LANDFILLS WITHIN THE WSIP STUDY AREA

Jurisdiction	Total Estimated Permitted Capacity[a] (cubic yards)	Total Estimated Capacity Used[b] (cubic yards)	% Used[b]	Remaining Estimated Capacity[a] (cubic yards)	Remaining Capacity Date[c]	% Remaining Capacity[b]	Closure Date[a]	Waste Types Accepted/Permitted
Santa Clara County (cont.)								
Newby Island Landfill	50,800,000	35,821,454	71%	14,978,546	As of 12/31/01	29%	12/31/2020	Construction/demolition, contaminated soil, green materials, industrial, mixed municipal, sludge (biosolids), tires
Zanker Material Processing Facility	540,100	41,100	8%	499,000	As of 04/01/04	92%	12/31/2018	Construction/demolition, other designated
Zanker Road Resource Recovery Operations Landfill	1,300,000	823,000	63%	477,000	As of 08/16/05	37%	01/01/2029	Construction/demolition, green materials, industrial, tires
Stanislaus County								
Bonzi Sanitary Landfill	4,171,000	3,879,876	93%	291,124	As of 05/01/05	7%	12/31/2019	Construction/demolition industrial
Fink Road Landfill	14,500,000	4,500,000	31%	10,000,000	As of 02/01/04	69%	1/1/2011	Agricultural, ash, construction/demolition, industrial, mixed municipal, sludge (biosolids), tires
Tuolumne County								
None								

[a] Capacity information from 2000 (CIWMB, 2007b). The remaining capacity of landfills in the WSIP study area that were recently closed, or that will be closed in the near future, were not included in this analysis. They are: Tri-Cities Recycling and Disposal Facility (Alameda County), Hillside Class III Disposal Site (San Mateo County), and NORCAL Waste Systems Pacheco Pass (Santa Clara County).
[b] Calculated using CIWMB 2007 data.
[c] Remaining capacity date provided by the CIWMB or local landfill operator.

California Integrated Waste Management Act of 1989

The California Integrated Waste Management Act of 1989 (Public Resources Code [PRC], Division 30), enacted through Assembly Bill (AB) 939 and modified by subsequent legislation, requires all California cities and counties to implement programs to reduce, recycle, and compost at least 50 percent of wastes by the year 2000 (PRC Section 41780). The state determines compliance with this mandate to divert 50 percent of generated waste (which includes both disposed and diverted waste) through a complex formula. This formula requires cities and counties to conduct empirical studies to establish a "base year" waste generation rate against which future diversion is measured. The actual determination of the diversion rate in subsequent years is arrived at through deduction, not direct measurement: instead of counting the amount of material recycled and composted, the city or county tracks the amount of material disposed at landfills, then subtracts the disposed amount from the base-year amount. The difference is assumed to be diverted (PRC Section 41780.2).

In the original determination of their base-year generation rate, cities and counties may not count certain diverted materials, including agricultural wastes, scrap metals, discarded major appliances, or inert solids such as rock, concrete, brick, sand, soil, fines, asphalt, and unsorted construction and demolition waste, unless the city or county can demonstrate that these materials had previously been disposed in a landfill and were now being diverted through a specific action of the city or county (PRC Section 41781.2). In subsequent years, these materials only have an impact on a city's or county's attainment of the diversion mandate if the materials are disposed in landfills. If they continue to be diverted, they are never accounted for.

Regulations Governing Utility Safety and Service at Construction Sites

Excavation activities are regulated through the California Occupational Health and Safety Administration Trench Construction Safety Orders. In addition, California Department of Health Services (DHS) standards require: (1) a 10-foot horizontal separation between parallel sewer and water mains; (2) a 1-foot vertical separation between perpendicular water and sewer line crossings; and (3) encasement of sewer mains in protective sleeves where a new water line crosses under or over an existing wastewater main. In the event that separation requirements cannot be maintained, the SFPUC or its contractors would obtain a DHS variance by providing sewer encasement or other measure deemed suitable by the DHS.

4.11.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to public services and utilities, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Result in substantial adverse physical impacts associated with the provision of, or the need for, new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any public services such as fire protection, police protection, schools, parks, or other services (Not evaluated in this section, see Appendix B)

- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board (Not evaluated in this section, see Appendix B)

- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects (Evaluated in this section)

- Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects (Not evaluated in this section, see Appendix B)

- Not have sufficient water supply available to serve the project from existing entitlements and resources, or require new or expanded water supply resources or entitlements (Evaluated in this section)

- Result in a determination by the wastewater treatment provider that would serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments (Not evaluated in this section, see Appendix B)

- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs (Evaluated in this section)

- Be out of compliance with federal, state, and local statutes and regulations related to solid waste (Evaluated in this section)

Impacts from construction of new water facilities are discussed by impact topic throughout Chapter 4. The provision of adequate water supply is discussed in Chapters 3 and 5. Storm water drainage issues as they relate to effects on hydrology are addressed in Section 4.5, Hydrology and Water Quality.

This section specifically addresses impacts on public utilities and landfills. Due to the nature of the proposed program, this PEIR also applies the following additional criteria and considers implementation of WSIP to have a significant effect on services and utilities if it were to:

- Disrupt operation of or require relocation of regional or local utilities (Evaluated in this section)

Approach to Analysis

For this program-level analysis, one area of focus is the temporary construction-related impacts on utility services. In general, implementation of the WSIP projects would not have direct, long-term impacts on the demand for public utilities, with the exception of water supply service (discussed in Chapter 3) and electricity (discussed in Section 4.15, Energy Resources). Long-term electricity use would increase as needed to power new or expanded facilities. Short-term, temporary disruption of service could occur if existing utilities required relocation. The presence of existing utility systems in the vicinity of proposed WSIP projects is used as an indicator of potential impact on utilities.

The second focus of analysis is the potentially adverse temporary impact on landfill capacity due to the disposal of WSIP construction waste. The largest potential source of solid waste would be excavated soil. While it is expected that most clean soil would be recycled, reused offsite, or stockpiled and reused as backfill, this analysis assumes that a portion of soil would be disposed in landfills. The analysis includes an estimate of the available capacity of landfills in the counties within the WSIP study area and expected construction waste quantities.

Impact Summary by Region

Table 4.11-4 presents a summary of potential impacts on utilities and landfills associated with the WSIP projects. For each impact, the summary presents the expected level of significance of each potential impact for each WSIP project.

Construction Impacts

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities.

Implementation of the WSIP projects would result in new construction of or improvements to pipelines, tunnels, vaults, valve lots, crossovers, treatment facilities, and storage facilities. Construction activities associated with the WSIP projects could result in unintentional utility service disruptions, including water, sewer, storm drain, and natural gas pipelines, and electricity, telephone, and television cable service. Construction activities that could affect utilities are addressed by facility type below.

Pipelines. The open-cut or cut-and-cover construction methods for pipeline installation, repair, or replacement would have the greatest potential for disrupting existing utility services. Depending on the location of the proposed pipeline and associated staging areas, construction activities could disrupt utility services.

Regional utility lines as well as local utility connections of varying sizes traverse the WSIP study area. Given that utility corridors generally include multiple utility lines (i.e., natural gas, water, and sewer lines), construction of pipelines could interfere with existing utility services. If the specific locations of existing utilities are not identified prior to construction activities, damage to utility lines and temporary disruption of utility services could occur.

TABLE 4.11-4
SUMMARY OF IMPACTS AND SIGNIFICANCE – PUBLIC SERVICES AND UTILITIES

Projects	Project Number	Impact 4.11-1:Potential temporary damage to or disruption of existing regional or local public utilities	Impact 4.11-2 : Temporary adverse effects on solid waste landfill capacity	Impact 4.11-3: Impacts related to compliance with statutes and regulations related to solid waste	Impact 4.11-4: Impacts related to the relocation of utilities
San Joaquin Region					
Advanced Disinfection	SJ-1	LS	PSM	PSM	PSM
Lawrence Livermore Supply Improvements	SJ-2	LS	PSM	PSM	PSM
San Joaquin Pipeline System	SJ-3	PSM	PSM	PSM	PSM
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	LS	PSM	PSM	PSM
Tesla Portal Disinfection Station	SJ-5	LS	PSM	PSM	PSM
Sunol Valley Region					
Alameda Creek Fishery Enhancement	SV-1	PSM	PSM	PSM	PSM
Calaveras Dam Replacement	SV-2	PSM	PSM	PSM	PSM
Additional 40-mgd Treated Water Supply	SV-3	PSM	PSM	PSM	PSM
New Irvington Tunnel	SV-4	PSM	PSM	PSM	PSM
SVWTP – Treated Water Reservoirs	SV-5	LS	PSM	PSM	PSM
San Antonio Backup Pipeline	SV-6	PSM	PSM	PSM	PSM
Bay Division Region					
Bay Division Pipeline Reliability Upgrade	BD-1	PSM	PSM	PSM	PSM
BDPL Nos. 3 and 4 Crossovers	BD-2	PSM	PSM	PSM	PSM
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	PSM	PSM	PSM	PSM
Peninsula Region					
Baden and San Pedro Valve Lots Improvements	PN-1	LS	PSM	PSM	PSM
Crystal Springs/San Andreas Transmission Upgrade	PN-2	PSM	PSM	PSM	PSM
HTWTP Long-Term Improvements	PN-3	LS	PSM	PSM	PSM
Lower Crystal Springs Dam Improvements	PN-4	PSM	PSM	PSM	PSM
Pulgas Balancing Reservoir Rehabilitation	PN-5	LS	PSM	PSM	PSM
San Francisco Region					
San Andreas Pipeline No. 3 Installation	SF-1	PSM	PSM	PSM	PSM
Groundwater Projects	SF-2	PSM	PSM	PSM	PSM
Recycled Water Projects	SF-3	PSM	PSM	PSM	PSM

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant

All utility lines that could be disrupted during pipeline construction would be identified during the project design phase. As a condition of approval for either a utility excavation permit or an encroachment permit, the SFPUC would prepare a detailed engineering and construction plan that identifies construction techniques and protective measures to minimize impacts on utilities.

Tunnels. Unlike pipeline projects, tunnel projects are generally not expected to interfere with utility services, since new tunnels would not be constructed within utility corridors. However, potential impacts on utilities associated with tunnel construction could occur at the tunnel entry and exit portal locations, which would serve as the construction staging areas. Utilities could be adversely affected if portals were located within existing utility corridors.

Vaults, Valve Lots, and Crossover Facilities. The WSIP includes the construction of vaults, valve lots, and crossover facilities at isolated locations near existing SFPUC facilities. These new facilities would be partially or completely buried. Impacts on utilities could occur during project construction, as subsurface activity has the potential to interfere with existing utilities and could result in interruptions in service.

Pump Stations. The WSIP projects would include the construction of new pump stations and upgrades to existing pump stations. New pump stations could result in an adverse effect on the provision of utilities if construction interfered with established utility lines and interrupted services. Typically, construction would be scheduled such that service to customers could be maintained without interruption.

Treatment Facilities. The WSIP would upgrade and expand treatment facilities at two existing treatment plants as well as at the system's primary disinfection facility, in addition to constructing a new secondary disinfection facility. Upgrades at existing treatment plants would occur within the property boundaries and would not affect offsite utility services. Potential impacts associated with the provision of utilities would depend on site locations in relation to established utility lines. Typically, construction would be scheduled such that service to customers could be maintained without interruption.

Storage Facilities. WSIP projects related to water storage facilities include improvements to reservoirs and dams. For most reservoirs, construction activities would be limited to the installation of new pumping and electrical equipment; however, for the Pulgas Balancing Reservoir project (PN-5), rehabilitation work would include replacing the Pulgas Channel. Dam improvement projects include raising the dam parapet wall at Lower Crystal Springs Dam (PN-4) and replacing Calaveras Dam (SV-2). During construction at storage facilities, interruptions in water service to SFPUC customers are not expected, as the SFPUC would plan for alternative water service during project planning and construction phasing, as necessary. Also, construction would be scheduled such that service to customers could be maintained without interruption. Thus, the level of service during a planned outage would remain unchanged from existing conditions.

San Joaquin Region

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Of the projects in this region, the SJPL System project (SJ-3) would have the greatest potential to result in temporary adverse impacts on utility services. The SJPL System project would entail construction of a new pipeline and two crossover facilities. Pipeline construction (and associated staging areas) could temporarily interrupt the provision of utility services, resulting in *potentially significant* impacts. Potential impacts on services and utilities would be evaluated in more detail as part of separate, project-level CEQA review for this project. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce this impact to a less-than-significant level.

The proposed water treatment projects (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) and SJPL Rehabilitation project (SJ-4), would replace existing facilities with new facilities to increase system reliability and improve the supply of water to SFPUC retail and wholesale customers. These facilities would be constructed within the SFPUC's existing right-of-way on sites that already have power connections. The SFPUC would phase construction to ensure that operations would not be interrupted during construction. With implementation of SFPUC Construction Measure #1 (neighborhood noticing), potential impacts on existing regional and local public utilities from these four projects would be *less than significant*.

Sunol Valley Region

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	PSM

Four of the five WSIP projects in the Sunol Valley Region (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; the pipeline portion of the 40-mgd Treated Water project, SV-3; New Irvington Tunnel, SV-4; and SABUP, SV-6) could conflict with existing local and regional utilities. Although these water improvement projects also have the potential to disrupt water services delivered to SFPUC customers, appropriate measures would be incorporated into these projects to ensure that construction activities would not result in service interruption. While these projects have various components, the pipeline component would have the greatest potential to conflict with existing utilities. Underground utility lines in this region include the Chevron pipeline, which transports refined petroleum products, and PG&E natural gas and underground electrical transmission lines.

Construction of these four WSIP projects could cause temporary service disruptions of these water and utility lines (as described above) or potential safety hazards, resulting in *potentially significant* impacts. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce these impacts to a less-than-significant level.

The Treated Water Reservoirs project (SV-5) would be constructed in a previously undisturbed area adjacent to the Sunol Valley Water Treatment Plant, and this project is not expected to result in water or utility service interruptions. With implementation of SFPUC Construction Measure #1 (neighborhood noticing), potential impacts on existing regional and local public utilities would be *less than significant*.

Bay Division Region

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

Construction in this region associated with pipelines, tunnels, and valve lots or vaults (as described above) would result in potential impacts on utility service. Although most construction would occur within SFPUC rights-of-way or within existing SFPUC facilities, all of the projects in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) have the potential to traverse or encroach on existing utility corridors because much of this area is urbanized. The project could result in *potentially significant* (although temporary) service disruptions where such conflicts occur. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce these impacts to a less-than-significant level.

Peninsula Region

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	LS

The CS/SA Transmission (PN-2) and Lower Crystal Springs Dam (PN-4) projects could cause temporary utility disruptions, a *potentially significant* impact. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce this impact to a less-than-significant level.

The other projects in this region (Baden and San Pedro Valve Lots, PN-1; HTWTP Long-Term, PN-3; and Pulgas Balancing Reservoir, PN-5) would involve repair, improvement, or expansion of existing water facilities and would occur in areas that are already developed with SFPUC water facilities. Therefore, these projects are not expected to cause impacts on offsite utility systems. With implementation of SFPUC Construction Measure #1 (neighborhood noticing), potential impacts on existing regional and local public utilities from these three projects would be *less than significant*.

San Francisco Region

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

All three projects in this region (SAPL 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) have the potential to result in temporary adverse impacts on utility services. Some components of the Groundwater and Recycled Water Projects, such as wells, storage facilities, etc., would be located in developed areas, where the potential exists for encroachment on existing utilities. Project construction (and associated staging areas) could temporarily disrupt utility services, resulting in *potentially significant* impacts. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce these impacts to a less-than-significant level.

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity.

Construction of the WSIP projects could result in the generation of a large volume of waste materials; if the total amount were disposed of in local landfills, these materials could potentially exceed the daily tonnage limit of these landfills and/or adversely affect landfill capacity. These waste materials include construction debris, demolition materials, and excavated spoils. The largest potential source of solid waste would be excavated soil. Every landfill listed in Table 4.11-3 is permitted to accept construction/demolition waste, including clean soil. Four landfills (Newby Island Landfill in Santa Clara County, Altamont Landfill and Resource Recovery and Vasco Road Sanitary Landfill in Alameda County, and Forward Landfill, Inc. in San Joaquin County) are permitted to accept contaminated soil. The specific quantity and quality of solid waste to be disposed would be determined during a condition assessment for each project. Due to the economic value of clean excavated soil and the cost of landfill disposal, this analysis assumes at least 50 percent of excavation/spoils would be diverted from landfills and reused as landfill or agricultural cover, backfilled onsite, or recycled.[2]

[2] This rate of diversion from landfills would be consistent with the California Integrated Waste Management Act of 1989, which requires all California cities and counties to implement programs to reduce, recycle, and compost at least 50 percent of wastes by the year 2000 and divert at least 75 percent by 2010. These are general guidelines, and percentages would vary depending on waste types, etc. Also, diversion rates for the WSIP projects could vary substantially, since some projects, like Calaveras Dam (SV-2), provide for onsite disposal of most of their own spoils.

Table 4.11-5 indicates the estimated amount of excavated soils in cubic yards (whether or not demolition would be required for each project) and provides additional information on disposal. Assuming a 50 percent diversion rate, the estimated total volume of excavated material to be disposed of offsite for all WSIP projects combined would be approximately 2,903,157 cubic yards. There would be approximately 374,229,941 cubic yards of remaining capacity in nearby landfills, as identified in Table 4.11-3. The proposed volume of excavated material under the WSIP is less than approximately 1 percent of the total existing landfill capacity in the WSIP study area. Furthermore, when the estimated disposal amount for the Central Valley projects is compared to the available capacity of landfills in San Joaquin and Stanislaus Counties, these projects would account for 1 to 2 percent of capacity. The WSIP projects in the four Bay Area counties would similarly account for 1 to 2 percent of the landfill capacity in the Bay Area. However, since the exact quantity and quality of disposed material and the daily disposal rates have not yet been determined for each project, the impacts on permitted landfill capacity are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

San Joaquin Region

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

Of the projects in this region, the SJPL System project (SJ-3) has the greatest potential to result in temporary adverse impacts on landfill capacity. This project would create approximately 424,000 cubic yards of excavation/spoils. Assuming a 50 percent diversion rate, the SJPL Rehabilitation project (SJ-4) could generate approximately 100,000 cubic yards. Due to the economic value of clean excavated soil, the cost of landfill disposal, and the availability of alternative receptor sites such as agricultural fields, this analysis assumes at least 50 percent of excavation/spoils generated in the San Joaquin Region would be reused onsite or used by nearby agricultural industries. This analysis also assumes that any solid waste disposal necessitated by the projects within this region would utilize nearby landfills, while spoils in other regions would use landfills in the Bay Area.

The estimated 262,000 cubic yards of solid waste generated in the San Joaquin Region would only use 1 to 2 percent of the existing regional landfill capacity in San Joaquin and Stanislaus Counties. However, since the exact quantity and quality of disposed material and daily disposal rates have not yet been determined, the impacts on permitted landfill capacity from all of the projects in the San Joaquin Region are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

TABLE 4.11-5
WSIP SPOIL ESTIMATES AND DISPOSAL SITE INFORMATION

Project No.	Project Name	Excavation/ Spoils (cubic yards)[a]	Demolition Required[a]	Disposal Information[a,b]	Offsite Disposal Estimate (cubic yards)[c]
SJ-1	Advanced Disinfection	TBD	TBD	No additional borrow or disposal sites.	Part or all of the spoils to be disposed onsite or used in nearby agricultural operations.
SJ-2	Lawrence Livermore Supply Improvements	TBD	TBD	TBD	Part or all of spoils to be disposed onsite or used in nearby agricultural operations.
SJ-3	San Joaquin Pipeline System	424,000	TBD	Clean spoils might be stockpiled on right-of-way, and adjacent owners could be allowed to move spoils to adjacent agricultural uses.	Part or all of spoils to be disposed onsite or used in nearby agricultural operations. Estimate for analysis: 50% disposed offsite = 212,000 cubic yards
SJ-4	San Joaquin Pipeline Rehabilitation	100,000	None	No additional borrow or disposal sites.	Part or all of spoils to be disposed onsite or used in nearby agricultural operations. Estimate for analysis: 50% disposed offsite = 50,000 cubic yards
SJ-5	Tesla Portal Disinfection Station	TBD	TBD	TBD	Part or all of spoils to be disposed onsite or used in nearby agricultural operations.
SV-1	Alameda Creek Fishery Enhancement	TBD	TBD	TBD	—
SV-2	Calaveras Dam Replacement	4,000,000	Yes	Seven borrow areas (totaling over 222 acres).	Most or all of spoils to be disposed of onsite. Estimate for analysis: 50% disposed offsite = 2,000,000 cubic yards
SV-3	Additional 40-mgd Treated Water Supply	100,000	No	TBD	Estimate for analysis: 50% disposed offsite = 50,000 cubic yards
SV-4	New Irvington Tunnel	186,175	Yes	Up to four spoils disposal areas are proposed. Spoils could be transported to one of these areas by conveyor belt.	Most or all of spoils to be disposed of onsite. Estimate for analysis: 50% disposed offsite = 93,087 cubic yards
SV-5	SVWTP – Treated Water Reservoirs	300,000	No	TBD	Estimate for analysis: 50% disposed offsite = 150,000 cubic yards
SV-6	San Antonio Backup Pipeline	37,000	No	Borrow/disposal sites could be located on undeveloped SFPUC land.	Estimate for analysis: 50% disposed offsite = 18,500 cubic yards

TABLE 4.11-5 (Continued)
WSIP SPOIL ESTIMATES AND DISPOSAL SITE INFORMATION

Project No.	Project Name	Excavation/ Spoils (cubic yards)[a]	Demolition Required[a]	Disposal Information[a,b]	Offsite Disposal Estimate (cubic yards)[c]
BD-1	Bay Division Pipeline Reliability Upgrade	434,000	Yes	Portions of the section of Bay Division Pipeline No. 1 between Edgewood Valve Lot and Pulgas Valve Lot would be removed. Potential disposal sites for tunnel muck include salt ponds near Dumbarton Strait and South Bay Salt Pond Restoration Project and nearby landfills.	Estimate for analysis: 50% disposed offsite = 217,000 cubic yards
BD-2	BDPL Nos. 3 and 4 Crossovers	43,500	TBD	TBD	Estimate for analysis: 50% disposed offsite = 21,750 cubic yards
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	55,300	No	No additional borrow or disposal sites.	Estimate for analysis: 50% disposed offsite = 27,650 cubic yards
PN-1	Baden and San Pedro Valve Lots Improvements	4,970	Yes	TBD	Estimate for analysis: 50% disposed offsite = 2,485 cubic yards
PN-2	Crystal Springs/San Andreas Transmission Upgrade	Up to 9,000 cubic yards	TBD	TBD	Estimate for analysis: 50% disposed offsite = 4,500 cubic yards
PN-3	HTWTP Long-Term Improvements	Not specified	Not specified	TBD	Unknown
PN-4	Lower Crystal Springs Dam Improvements	21,000	Yes	TBD	Estimate for analysis: 50% disposed offsite = 10,500 cubic yards
PN-5	Pulgas Balancing Reservoir Rehabilitation	TBD	TBD	N/A	Unknown
SF-1	San Andreas Pipeline No. 3 Installation	44,170	Yes	N/A	Estimate for analysis: 50% disposed offsite = 22,085 cubic yards
SF-2	Groundwater Projects	TBD	TBD	N/A	Unknown
SF-3	Recycled Water Projects	47,200	TBD	TBD	Estimate for analysis: 50% disposed offsite = 23,600 cubic yards
TOTAL					**2,903,157 cubic yards**

TBD = To be determined; N/A = Not Available or Not Applicable

a Information from Table C.4 in Appendix C.
b Information from Table C.1 in Appendix C.
c For this analysis, a conservative estimate was made that 50 percent of the excavated soil would be disposed of in landfills.

SOURCES: SFPUC, 2006; ESA, 2006.

Sunol Valley Region

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

The construction of a number of the WSIP projects within the Sunol Valley Region (Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; New Irvington Tunnel, SV-4; and Treated Water Reservoirs, SV-5; SABUP, SV-6) would require offsite disposal in nearby landfills. Due to the economic value of clean excavated soil and the cost of landfill disposal, the following estimates assume at least 50 percent of excavation/spoils would be diverted from landfills to be reused as landfill cover, backfill, or recycled for further use.

The Calaveras Dam project (SV-2) would generate approximately 4,000,000 cubic yards of excavation/spoils. Although most of the spoils are proposed for onsite disposal in the dam vicinity, this analysis conservatively assumes up to 2,000,000 cubic yards could be disposed of in a nearby landfill. The 40-mgd Treated Water project (SV-3) would create approximately 100,000 cubic yards of excavation/spoils, of which up to 50,000 cubic yards could be disposed of in a nearby landfill. The New Irvington Tunnel project (SV-4) would create approximately 186,175 cubic yards of excavation/spoils, of which up to 93,087 cubic yards could be disposed in a nearby landfill. The Treated Water Reservoirs (SV-5) would create approximately 300,000 cubic yards of excavation/spoils, of which up to 150,000 cubic yards could be disposed in a nearby landfill. The SABUP project (SV-6) would create approximately 37,000 cubic yards of excavation/spoils, of which up to 18,500 cubic yards could be disposed in a nearby landfill. Individual landfill disposal requirements and potential impacts of these projects would be evaluated in more detail as part of separate, project-level CEQA review. More detailed project design information would be necessary to determine the expected excavation/spoils quantities and disposal information for the Alameda Creek Fishery project (SV-1).

The estimated 2.3 million cubic yards of solid waste that would be generated from the Sunol Valley Region projects would use approximately 1 to 2 percent of the existing landfill capacity in the four Bay Area counties. However, since the exact quantity and quality of disposed material and daily disposal rates have not yet been determined, the impacts on permitted landfill capacity are conservatively considered to be *potentially significant*. However, development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

Bay Division Region

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

The construction of all three WSIP projects within the Bay Division Region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would require offsite disposal in nearby landfills. Due to the economic value of clean excavated soil and the cost of landfill disposal, the following estimates assume at least 50 percent of excavation/spoils would be diverted from landfills to be reused as landfill cover, backfill, or recycled for further use.

The BDPL Reliability Upgrade project (BD-1) would create approximately 434,000 cubic yards of excavation/spoils, of which up to 217,000 cubic yards could be disposed of in a nearby landfill. The BDPL 3 and 4 Crossovers project (BD-2) would create approximately 43,500 cubic yards of excavation/spoils, of which up to 21,750 cubic yards could be disposed of in a nearby landfill. The BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would create approximately 55,300 cubic yards of excavation/spoils, of which up to 27,650 cubic yards could be disposed of in a nearby landfill. Individual landfill disposal requirements and potential impacts of these projects would be evaluated in more detail as part of separate, project-level CEQA review for each project.

The estimated 266,400 cubic yards of solid waste generated from the Bay Division Region projects would use only 1 to 2 percent of the existing landfill capacity in the four Bay Area counties. However, since the exact quantity and quality of disposed material and daily disposal rates have not yet been determined, the impacts on permitted landfill capacity are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

Peninsula Region

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity		
Baden and San Pedro Valve Lots	PN-1	PSM
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

The construction of three WSIP projects in the Peninsula Region (Baden and San Pedro Valve Lots, PN-1; CS/SA Transmission, PN-2; and Lower Crystal Springs Dam, PN-4) would require offsite disposal in nearby landfills. Due to the economic value of clean excavated soil and the cost of landfill disposal, the following estimates assume at least 50 percent of excavation/spoils would be diverted from landfills to be reused as landfill cover, backfill, or recycled for further use.

The Baden and San Pedro Valve Lots project would create approximately 4,970 cubic yards of excavation/spoils, of which approximately 2,485 cubic yards could be disposed of in a nearby landfill. The CS/SA Transmission project would create up to 9,000 cubic yards of excavation/spoils, of which up to 4,500 cubic yards could be disposed of in a nearby landfill. The Lower Crystal Springs Dam project would create approximately 21,000 cubic yards of excavation/spoils, of which up to 10,500 cubic yards could be disposed of in a nearby landfill. Individual landfill disposal requirements and potential impacts of these projects would be evaluated in more detail as part of separate, project-level CEQA review. More detailed project design information is necessary to determine the expected excavation/spoils quantities and disposal information for the HTWTP Long-Term (PN-3) and Pulgas Balancing Reservoir (PN-5) projects.

The estimated 15,000 cubic yards of solid waste generated from the Peninsula Region projects would use only 1 to 2 percent of the existing landfill capacity in the Bay Area. However, since the exact quantity and quality of disposed material and daily disposal rates have not yet been determined, the impacts on permitted landfill capacity are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

San Francisco Region

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

Two projects in the San Francisco Region (SAPL 3 Installation, SF-1, and Recycled Water Projects, SF-3) would require offsite disposal in nearby landfills. Due to the economic value of clean excavated soil and the cost of landfill disposal, the following estimates assume at least 50 percent of excavation/spoils would be diverted from landfills to be reused as landfill cover, backfill, or recycled for further use.

The SAPL 3 Installation project would create up to 44,170 cubic yards of excavation/spoils, of which up to 22,085 cubic yards could be disposed of in a nearby landfill. The Recycled Water Projects would create approximately 47,200 cubic yards of excavation/spoils, of which up to 23,600 cubic yards could be disposed of in a nearby landfill. Individual landfill disposal requirements and potential impacts of these projects would be evaluated in more detail as part of separate, project-level CEQA review. More detailed project design information is necessary to determine the expected excavation/spoils quantities and disposal information for the Groundwater Projects (SF-2).

The estimated 45,685 cubic yards of solid waste generated from the San Francisco Region projects would use only 1 to 2 percent of the existing regional landfill capacity. However, since the exact quantity and quality of disposed material and daily disposal rates have not yet been determined, the impacts on permitted landfill capacity are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

Impact 4.11-3: Impacts related to compliance with federal, state, and local statutes and regulations related to solid waste.

All Regions

The CIWMB found that the jurisdictions within the WSIP study area achieved or nearly achieved the 50 percent solid waste diversion goal for 2002 (CIWMB, 2007a). Construction of the WSIP projects would result in the generation of a large volume of waste materials; if the total amount were disposed of in local landfills, these materials could potentially exceed the daily tonnage limit of these landfills or lower diversion rates for the purpose of calculating compliance with the California Integrated Waste Management Act. The exact quantity of waste materials to be disposed of in nearby landfills (which includes construction debris, demolition materials, and excavation spoils) would not be known until each project undergoes a detailed evaluation as part of separate, project-level CEQA review. In the absence of exact disposal quantities, WSIP compliance with local plans, policies, programs, and ordinances regarding solid waste management cannot be determined. Therefore, impacts related to compliance with federal, state, and local statutes are conservatively considered to be *potentially significant*. Development of a waste management or recycling plan (Measure 4.11-2) would reduce this impact to a less-than-significant level.

Siting Impacts

Need for Relocation

Impact 4.11-4: Impacts related to the relocation of utilities.

Implementation of the WSIP would result in new construction or improvements to existing pipelines, tunnels, vaults, valve lots, crossovers, and water treatment and storage facilities. Many of these projects would occur at existing SFPUC facility sites or within SFPUC rights-of-way. Construction activities associated with the WSIP projects could affect utility infrastructure by requiring the relocation of existing facilities. The relocation of facilities could result in adverse effects related to the following environmental resource topics: hydrology, biological resources, cultural resources, traffic, and air quality, among others. All subsurface and aboveground utility lines and cables requiring relocation during construction of the WSIP projects would be identified during the predesign and permitting stages for each project.

Pipelines. Of the WSIP project types, pipeline projects have the greatest potential to require the relocation of utility lines, since construction activity would encroach on existing utility corridors. Utility corridors generally include multiple utility lines (i.e., water, sewer, storm drain, and natural gas pipelines, and electricity, telephone, and television cables). All utility lines that require relocation as a result of WSIP construction would be identified during project design.

Tunnels. Tunnel projects could require the relocation of utility lines near the tunnel entry and exit shaft/portal locations, which would serve as construction staging areas.

Vaults, Valve Lots, and Crossover Facilities. The construction of vaults, valve lots, and crossover would occur at isolated locations near existing SFPUC facilities. These facilities could require the relocation of utility lines, depending on project siting.

Other Facilities. The WSIP projects that would occur at discrete locations include pump stations, treatment facilities, and storage facilities. Upgrades at existing facilities are not expected to require the relocation of offsite utilities, since the projects would be located at existing facility sites or within the SFPUC right-of-way. These sites already include development and utility connections. For new project siting, potential impacts could result if utility lines needed to be relocated.

All Regions

All of the WSIP projects have the potential to require the relocation of subsurface or aboveground utilities and cables during construction. The extent of utility relocation cannot be determined until that time, but would be identified during the predesign and permitting stages for each project. The impact associated with the relocation of utilities could be temporary or permanent, thereby resulting in *potentially significant* impacts. Implementation of SFPUC Construction Measure #1 (neighborhood noticing) and identification of public utility lines prior to commencing construction (Measures 4.11-1a through 4.11-1h) would reduce this impact to a less-than-significant level.

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